FLORA MALESIANA

BEING
AN ILLUSTRATED SYSTEMATIC ACCOUNT OF THE MALAYSIAN FLORA, INCLUDING KEYS FOR DETERMINATION, DIAGNOSTIC DESCRIPTIONS, REFERENCES TO THE LITERATURE, SYNONYMY, AND DISTRIBUTION, AND NOTES ON THE ECOLOGY OF ITS WILD AND COMMONLY CULTIVATED PLANTS

PUBLISHED

PREPARED
ON AN INTERNATIONAL CO-OPERATIVE BASIS UNDER THE SUPERVISION OF SEVERAL DIRECTORS OF BOTANIC GARDENS, KEEPERS OF HERBARIA AND VARIOUS PROMINENT BOTANISTS

FOR THE PROMOTION OF BOTANICAL SCIENCE AND THE CULTURAL ADVANCEMENT OF THE PEOPLES OF SOUTH-EASTERN ASIA TO THE SOUTHWEST PACIFIC REGION

SERIES I
SPERMATOPHYTA

VOLUME 4
PART 1

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FOR SALE ONLY, NOT FOR EXCHANGE

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Flora Malesiana is designed to represent a concise flora of the Malaysian region. The present part is the first published. It contains the 1st instalment of vol. 4 of series I.

The following independent series are planned:

Series I. Spermatophyta (flowering plants) .................................................. ca 15 volumes
Series II. Pteridophyta (ferns and fern allies) ............................................. ca 3 volumes
Series III. Bryophyta (mosses and hepatics) .............................................. ca 5 volumes
Series IV. Fungi & Lichenes (fungi and lichens) ........................................... ca 3 volumes
Series V. Algae (algae) .................................................................................. ca 3 volumes

At the present moment preparations have been made necessary for the start of series I only. As soon as possible the other series will be commenced and directed by special general editors.—The area covered by Flora Malesiana is indicated on the accompanying map by the hatched area.

**PLAN FOR THE PUBLICATION OF SERIES I SPERMATOPHYTA**

Volume 1. *Cyclopaedia of Malaysian botanical collectors and collections*, by Mrs M. J. van Steenis-Kruseman.

This is a cyclopaedia of Malaysian collections of Phanerogams and Pteridophytes. It contains over 3000 names of collectors, with short biographies, carefully excerpted itineraries, and literature pertaining to the collections.
Indispensable when localizing herbarium sheets of Malaysian plants and interpreting the scant notes on the labels of older collections. Contains also chapters on methods of collecting in the tropics, hints for travellers, notes on erroneously localized Malaysian collections, &c. — Ready for the press, probably available by the end of 1949. Appr. 600 printed pages. Sample treatment at the end of this copy.

This is a second edition, much enlarged, of ‘Maleische Vegetatieschetsen’ (1935) by the same author. It deals with all vegetation types known in Malaysia, as far as described in literature and reports, or known to the author by personally acquired field knowledge, their status and interpretation, their relations, origin, distribution within Malaysia, and importance to mankind. Biological phenomena, both explained or yet unexplained will be briefly touched on. This book will be copiously illustrated. The MS. can be expected to be finished in 1950. Appr. 500 printed pages. Sample treatment at the end of this copy.

This volume consists of two parts. Part one deals with floristic plant geography and contains tables showing the distribution of the ca 2200 recognized indigenous genera of Malaysian phanerogams, compiled from literature and from the Herbarium. Further there are chapters on the history of phytogeographical theories and discussions, a provisional list of the genera with their synonymy, an attempt to divide the Archipelago into phytogeographical districts based on the hitherto known facts of generic distribution, and a discussion of the phytogeographical character of the islands or island groups separately. The MS. is far advanced but not yet ready for the press. Sample treatment at the end of this copy.

Part two will deal with the historical plant geography of the Malaysian region. This is only in the initial stage.

Volume 4. Flora Malesiana proper. Onwards of vol. 4 the revisions of the families will be printed in the sequence in which they are finished, irrespective of the alliance of the groups concerned. Vol. 4 will be opened by an introductory essay containing chapters on the importance of variability in Malaysian plants, special aberrations with which the Malaysian botanist is confronted in the field and with which he must be acquainted to judge their importance in the often scanty specimens available in the herbaria. A chapter is added on the history of Malaysian phytography. An annotated list of existing revisions concludes the introduction.

PROPOSED CONTENTS OF VOLUME 4

1. Preface.
2. Introduction.
3. General considerations.
4. History of descriptive Malaysian botany (by Dr H. C. D. de Wit).
5. General plan of revisions and hints to collaborators.
7. Annotated list of former revisions.
8. Photographs of principal botanical contributors to Malaysian botany.
9. Systematic revisions of families of Phanerogams, incl. Bignoniaceae, Podo-stemonaceae, Droseraceae, Umbelliferae, Convolvulaceae, Dioscoreaceae, Plumbaginaceae, etc. etc.
Flora Malesiana will not be available for purposes of exchange; it is for sale only. Co-operating and collaborating institutions can obtain this flora at a reduced price. For subscribers to a complete series the price will be reduced. For substantial collaborators a special reduction will be fixed individually. General volumes 1—3 will also be sold separately to a limited extent.

APPLICATIONS TO BE DIRECTED TO

N.V. Erven P. Noordhoff, N.V. Noordhoff-Kolff,
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Groningen, Holland. Batavia-C., Java.

and in the Americas to:

The Chronica Botanica Co.,
Book Department
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SCIENTIFIC COMMUNICATIONS

concerning Flora Malesiana should be addressed to Dr C. G. G. J. van Steenis,
c/o Rijksherbarium, Nonnensteeg 1, Leiden, Holland.

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MEMORIAE
EORUM QUI SE FLORAE MALESIANAE PERSCRUTANDAE DEDERUNT
ET NOBIS DUCES ET EXEMPLA FUERUNT
GRATO ANIMO
HOC OPUS DEDICANT
AUCTORES
There are only a few things left in common to the displaced and disjointed inhabitants of this Earth; they are the things spiritual.

Among those treasures of the mind natural science has come to the fore only in the last three centuries, as a lofty and impartial principle that tends to join people instead of disrupting them. Through war, famine and pestilence the undying fire of science has remained a steady beacon.

At the inception of a great work, which shall be the demonstration of the united effort of many workers, it seems meet to remember the function of Science, apart from its benificial or detrimental applications. In these days the adjectives ‘pure’ and ‘applied’ have lost much of their meaning, and the Masters amongst us were the least concerned with this classification. Nevertheless, as long as sentiment, politics, greed and bigotry rule this world, a purely scientific endeavour may become a binding force between individual groups, and maybe, even between nations. At the beginning of this great project we therefore see already a dark shadow cast by this unfortunate era, but rather than to dwell on darker thought let us invoke the light that is cast by those that lived and worked in these regions before us, and let us consider this work as an apotheosis of the ideals formulated by Melchior Treub who, half a century ago, became the initiator of co-ordinated scientific effort in the tropics.

His ideals are still ours.

To the General Editor, Dr C. G. G. J. van Steenis, we all want to express our gratitude for his initiative, for his boundless energy and, especially, for his faith in this project.

To discuss the project of the Flora Malesiana from the technical side would be simply borrowing materials from the scientific collaborators.

Rather than to plagiarize it seems fit to leave these matters to the specialist. But as Director of the Scientific Institutes, called ‘s-Lands Plantentuin’ I may express the satisfaction that our Government, almost a century after the foundation of our Herbarium, after 130 years of effort of these institutes, after the publication of innumerable, chiefly disjointed contributions, has decided to further a unified effort. Amongst the many accusations that our workers have suffered in the last years, some at least have some foundation. We have plowed too deep, we were too few, we did not seek enough contact. But the greatest blight of tropical science has been the lack of continuity. Now we may plow deep, but with many to help. Now we may proceed together and, let us hope, with continuity guaranteed.

The great ‘Horn of Plenty’, the cornucopia of our Malaysian Flora, which was opened by van Rheede and by Rumphius shall still flow for a long time. I wish great joy to those that shall have the privilege to examine its contents.

(L. G. M. BAAS BECKING)

Director of ’s-Lands Plantentuin
1. *Systematicae* plantas suas disponit verus Botanicus; 
   Nec absque ordine easdem enumerat.
2. *Fructificationis* principium in theoretica dispositione agnoscit; 
   Nec dispositionem secundum Herbam immutat.
3. *Genera* naturalia assumit; 
   Nec Erronea ob speciei notam aberrantem conficit.
4. *Species* distinctas tradit; 
   Nec e Varietatibus falsas fingit.
5. *Varietates* ad species reducit; 
   Nec eas, pari passu, cum speciebus obambulare sinit.
6. *Synonyma* praestantissima indagat et Selectit; 
   Nec acquiescit in quacunque obvia nomenclatura.
7. *Differentias* characteristicas inquirit; 
   Nec inania nomina specifica praeponit veris.
8. *Plantas* vagas ad Genera amandare studet; 
   Nec rariores obvias fugitivis oculis adspicit.
9. *Descriptiones* complectentes differentias essentiales, compendiose sistit; 
   Nec naturalissimam structuram oratorio sermone ebuccinat.
10. *Minimas* partes attente scrutatur; 
   Nec ea, quae maxime illustrant, flocci facit.
11. *Observationibus* ubique plantas illustrat; 
    Nec in vago nomine acquiescit.
12. *Oculis* propriis quae singularia sunt observat; 
    Nec sua solum, ex Auctoribus, compilat.

*Linnaeus, Philosophia botanica*
INTRODUCTION

After the appearance of Rumphius’s *Herbarium Amboinense*, the result of lifelong research into the botanical treasures of the Malaysian Archipelago, the first comprehensive work on the flora of these islands was begun by C. L. Blume, the second Director of the Botanic Gardens at Buitenzorg. His *Bijdragen tot de Flora van Nederlandsch Indië* (Contributions to the Flora of the Netherlands Indies) consisted of numerous brief botanical diagnoses mostly, however, of Javan species. Shortly after followed his *Flora Javae* and later *Rumphia*. None of these books represent a ‘flora’; neither completeness was aimed at nor keys were given.

The first design for a flora of the whole of Malaysia seems to have been drafted by the Swiss botanists H. Zollinger and his teacher, A. Moritz.¹ H. Zollinger and his teacher, A. Moritz.¹ ¹ have not succeeded in tracing any further results of their plans.

Since the publication² of the *Flora van Nederlandsch Indië or Flora Indiae Batavae* by F. A. W. Miquel (5 vols, 1854–’60)—which was no ‘flora’ in the present meaning of the word, keys being almost absent—no work has been conceived with the object of covering the Malaysian region. Miquel’s work³ may be considered as a more or less critical compilation of descriptions, mostly copied or extracted.⁴

Miquel must have realized that by his Flora the proper work was only started. This may be concluded from the series of revisions which Miquel, together with some specialists, published in 4 volumes *Annales musei botanici Lugduno batavi* (1863–69),⁵ *Choix des plantes rares ou nouvelles* (1863), to which was added his posthumous *Illustrations de la Flore de l’Archipel Indien* (1870–’71) by his successor at Leyden, University, W. F. R. Suringar.

Unfortunately, Miquel had few pupils⁶ which caused a serious shortage of well-trained systematists during half a century of botanical endeavour in the East Indies. The only Dutch scientists studying the Malaysian flora were:

P. de Boer, who wrote his doctor’s thesis on the subject *De Coniferis archipelagi indici* (1866), and later became a professor of Pharmacology at Groningen University, and

R. H. C. C. Scheffer, an extremely able botanist whose thesis was entitled *De Myrsinaceae archipelagi indici* (1867).

Scheffer was subsequently appointed as the (fourth) Director of the Botanic Gardens, Buitenzorg, and ardently promoted the study of the Malaysian Flora, notwithstanding his feeble health. In his term of office he published several important papers, most on *Annonaceae⁷* and *Palmaceae⁸*.

De Boer had one pupil in systematic botany, Th. Valeton, who obtained his doctor’s degree on a monographic study of the *Olaceae⁹*. He eventually was employed as a bacteriologist in the Sugar Experiment Station in Java but, soon after, joined the staff of the Botanic Gardens, Buitenzorg (1892).

After the appointment of Dr M. Treub as the fifth Director of the Gardens in 1880, interest in the promotion of knowledge of the Malaysian flora revived, but Treub was badly handicapped by the absence of trained Dutch systematists. Treub—a contemporary of Hooker, Eichler, Bentham, and Harvey & Sonder, the editors of respectively the *Flora of British India*, the *Flora Brasiliensis*, the *Flora Australiensis*, and the *Flora of tropical Africa*—was well aware that systematic botany in the Netherlands Empire was on the verge of falling behind that in other tropical countries. He judged the advancement of systematics of preeminent importance.

He engaged W. Burck, a pupil of Suringar’s at Leyden, later a teacher of botany at Buitenzorg, as a subdirector of the Gardens (1883) and charged him with critical research into *Sapotaceae* (getah-pertja family),¹⁰ *Mucuna¹¹* the *Erythroxylaceae* (coca-family),¹² and *Dipterocarpaceae¹³* mostly families of economic importance.

Treub, who tried continuously to raise a worldwide interest in the Gardens and its botanical institutions, considered the compilation of a new Malaysian Flora to be premature. Collections were inadequate and of the vegetation of the surrounding regions little was known.

He advanced, therefore, the idea of composing a local flora of the surroundings of Buitenzorg, covering the region from the mangrove of Tandjong Priok to the summit of Mt Gedeh at 3000 m. All altitudinal zones would thus be represented.

This *Flore de Buitenzorg* would serve as a guide to botanically interested visitors of the Gardens and be equally acceptable to residents of Java. Dr J. G. Boerlage, then conservator of Leyden Herbarium, during a visit to Buitenzorg as a stipendiary of the Dutch Buitenzorg Fund, had already made collections for the new flora (1889) and published an article on the grasses.¹⁴

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¹ Zollinger, Observationes plantographicae etc. Natuur- & Geneesk. Arch. 1 (1845) 375; cf. also J. K. Hasskarl, Flora 30 (1847) 299.
² Made possible by a grant of the Ministry for the Colonies.
⁵ Dates of publication of the several parts of Nakai, Journ. Arn. Arbor. 6 (1925) 211–213.
⁸ Ibid. vol. 1 (1876) 103–164; O. Beccari, Reliq. Scheff. ibid. 2 (1885) 77–171.
⁹ Critisch overzicht der Olaceae (1886).
¹¹ Ibid. 11 (1893) 183–190.
¹² Ibid. 11 (1893) 190–194.
¹³ Ibid. 6 (1887) 145–249.
Treub, however, found it difficult to rally workers to this local flora and so most of it was assigned to foreign visitors who sometimes were temporarily employed at the Gardens. Six volumes appeared viz the Myxomycetes by O. Penzig (1898), Ferns and Fern Allies by M. Rachborski (1898), Hepaties by V. Schiefner (1900), Algae by E. de Wildeman (1900), and Mosses by M. Fleischer (1900–22, 4 vols). The 6th and only volume on Phanerogams was written by J. J. Smith (Orchidaceae 1905, atlas 1908–14).

None of the volumes of the Flore de Buitenzorg bears the character of a local flora; the majority dealt with the whole of Java. Fleischer’s Musei even expanded to a standard work on the world’s mosses.

Of the flowering plants apart from the Orchidaceae, much material was collected by Burck and H. Hallier who planned to elaborate a 7th volume of the Flore de Buitenzorg. A list of the species to be included is kept at Buitenzorg, but nothing ever appeared in print.

During this period important revisions of families were published abroad by O. Beccari in his 3-volume Malesia. Several monographs appeared in the 4th tomes of the Annals of the Royal Botanic Gardens, Calcutta, on the genus Ficus, the oaks and chestnuts, the bamboos, etc.

Local floras of other parts of Malaysia were the 3rd edition of Blanco’s Flore de Filipinas (1877–83) by Navas & F-Villar, Schumann & Hollrung’s Flore von Kaiser Wilhelmsland (1889), and Schumann & Lauterbach’s Flore der Deutschen Schutzgebiete in der Südsee (1901) with the Nachträge (1905). These eastern floras resembled enumerations and were mainly indices of materials collected on expeditions.

In 1890 Boerlage previously having published two critical studies of Malaysian plants, viz the genus Astrylantes and the genera of Araliaceae, started a work of quite another nature in the compilation Handeling tot de kennis der flora van Nederlandsch Indië. This comprised a description of the families and genera of Malaysian phanerogams. The species were—especially in the last parts—only briefly enumerated. He added to a few families keys to the genera. The generic descriptions were mostly critically copied from Bentham & Hooker’s Genera Plantarum, and occasionally emended. Phylogenetically Boerlage’s Handeling brought hardly anything new, but now a comprehensive review in the Dutch language of families and genera came within reach of interested persons in the colonies. However, as will be demonstrated later, this interest was and is still more directed towards species than genera.

Boerlage’s work was more intended as a prelude to a general flora than as a final work.

He accepted (1896) the post of subdirector of the Botanic Gardens and Head of its first Division (Herbarium and Botanical Museum), as a successor to Burck and began a monograph of the Acanthaceae. Unfortunately he soon (1900) fell a victim to a tropical disease while on a tour in the Moluccas attempting to re-collect the plants mentioned by Rumphius in his Herbarium Ambonense.

Another flora was started, at Treub’s instigation, of trees growing in the island of Java. This was to be based mainly on the collections made by Forest officer S. H. Koorders who gathered in the field notes on each species (occurrence, value, uses, etc.). Scientific descriptions and keys were by Th. Valeton. This work is Bijdragen tot de kennis der Boomsoorten van Java (Additamenta ad cognitionem Florae Javanicae, pars I, Arbores). Thirteen volumes compose this standard work, the 12th volume is by J. J. Smith, the concluding 13th by Smith and Valeton. The work was begun in 1894, and finished in 1913. Later illustrations were edited by Koorders in his unfinished Atlas der Baumarten von Java (4 vols, 1913–18). The Bijdragen is an excellent work with critical descriptions and notes, and still very useful though, of course, now antiquated. The descriptions of the species and genera are both in Dutch and Latin.

During Treub’s directorate many collections, specially of the Outer Provinces, were brought together. Hallier made an important one in West Borneo, Koorders in Java and North Celebes, the Sarasins collected in Celebes, Forbes and Koorders in Sumatra, Forbes in Timor, while Wurburg’s, Schlechter’s, and Beccari’s great collections equalled those of Teysmann’s and extended over the whole archipelago. These collections were partly inaccessible though together they could have served to a large measure as a reliable basis for a Flora Malesiana.

Lack of trained taxonomists induced Treub to engage J. J. Smith, formerly an assistant curator of the Gardens, for taxonomic work. His revisions of Javan Euphorbiaceae, Urticaceae, Urticaceae, and Orchidaceae proved his ability, and Smith spent his life in describing Malaysian Orchids, Ericaceae, and Epacridaceae. Unfortunately, he did hardly any monographical work.

For the same reasons Treub selected C. A. Backer, a teacher in a primary school at Batavia who possessed already a thorough and critical knowledge of the local flora. Backer intended to fill the still existing lacunae in the phanerogamic part of the Flore de Buitenzorg, which resulted in the publication of one volume of a Flora van Batavia (1907). This was followed by a preliminary schoolflora and later by the Schoolflora (1911).

(1) On the dates of publication see Merrill, Philip. J. Sc. 12 (1917) Bot. 113–117.
(4) In total 5 parts appeared, the last posthumously (1890–1903, 3 vols). The publication was made possible by a grant of the Ministry for the Colonies.
(6) That was: Netherlands Indian territory outside the islands of Java and Madoera.
(7) Voorlooper eener Schoolflora van Java (Precursory Schoolflora of Java). Batavia (1908).
The latter excellent work contained only $\pm 25\%$ of the Javan flora (Chorpetalae). He later devoted all his time to the Javan flora, wrote (together with van SLOOTEN) a weed flora of tea plantations (1924), 3 instalments of a Handboek voor de Flora van Java (1924–28), a weed flora of sugar plantations (1928–34; vol. II (atlas) not yet completed), and is now engaged in completing the Flora of Java.

An ill-advised enterprise was a flora of Java by S. H. KOORDERS who, when charged by the N.I. Government to write a flora of the Javan mountains, abandoned this concept and hurriedly compiled an Exkursionsflora von Java (Jena, 1911–12, 3 vols) which did more harm than good and is scarcely of any value to a student of the Javan flora.

The flora of the Malay Peninsula was originally included in the Flora of British India, but as the account remained very incomplete KING & GAMBLE, and RIDLEY, started to work on it, publishing a true model of a critical local flora (2). This was later followed by RIDLEY’S decidedly uncritical Flora of the Malay Peninsula (5 vols, 1922–25).

On the Flora of Borneo a most helpful Bibliographic enumeration of Bornean plants was prepared by Dr E. D. MERRILL (3).

In the Philippines MERRILL, after 1902, energetically undertook the research of the Philippine flora, this first resulting in an excellent local Flora of Manila (1912), in a large number of papers dealing with several aspects of the Philippine flora, and crowned by his Enumeration of Philippine flowering plants (1923–26).

The results of frequent expeditions into the Dutch and German territories of New Guinea were published by Dr A. A. PULLE and others in the serial Nova Guinea (vols, 8, 12, 14, and 18), and by C. LAUTERBACH and others (4), and in recent years those of Dutch and British parts by MERRILL and other collaborators (5).

The undesirability of compiling, at this stage, local floras in Malaysia. The studies of the materials of various separate regions persuaded some leading Dutch botanists in the first quarter of our century—for some reasons they doubted the feasibility of a Malaysian flora as a whole—to propose several local floras e.g. one of Java, of Borneo, Sumatra, Celebes, etc. This caused the appointment of HALLIER at Leyden to write a Flora of Borneo resulting in a small preliminary paper (6).

It is clear that this was a wrong policy, born from either ignorance of the taxonomic position and the technique of writing revisions, or from the wish for dodging obstacles; the difficulties should be faced directly. Only temporary profit may be gained from making local floras, and both valuable time and money are wasted by the enormous duplication which is unavoidable when the goal of a flora of a plant-geographical unit is to be reached along this tortuous road.

The natural sequence is to start with the large flora, eventually followed later by local floras, a procedure followed in the great floras of South America, tropical Africa, India, and Australia. The unnatural sequence of starting with the local flora has led, both in North America and Europe, to a most regrettable state of affairs.

The absence of a general flora is also one of the causes that the flora of Java which BACKER has studied close on forty years is only now more or less to be completed. It contains several families which cannot be critically treated (Lauraceae, Araceae, Zingiberaceae, etc.) lacking revisions of these families in the whole Malaysian region.

General Flora. A general flora was and is needed and prospects at the end of the first World War seemed favourable. The Forest Research Institute and the Museum for Economic Botany (7) at Buitenzorg requested much service and urged the Herbarium of the Botanic Gardens to produce speedy results. This induced the Government to add to the staff of the Herbarium R. C. BAKHUIZEN VAN DEN BRINK (1917)—he was originally a plantation assistant—Dr D. F. VAN SLOOTEN and Dr H. J. LAM, the first pupils of PULLE at Utrecht (1919). In 1921 Dr H. C. CAMMERLOHER, a German biologist, was appointed, and a professional collector engaged, H. A. B. BÜNNEMEIJER.

At the same time a scheme was made for critical revisions. These were to be published in the Bulletin du Jardin Botanique, Buitenzorg (8) under the heading: Contributions à l’étude de la Flora des Indes Néerlandaises. Economically important families had priority. The method of treatment stood below that of KING & GAMBLE’S Materials in so far that descriptions were only admitted if species were new or critical. This was believed to save time. On the other hand extensive lists of herbarium numbers had to be compiled. If the latter had been left out and instead a concise characteristic of the occurrence of the species given, besides a good diagnostic description of each species, the Contributions would have made a most satisfactory foundation. Though the later Contributions are far more complete than the earlier, the manner of treatment and publication is so laborious and slow that at this rate the Flora Malesiana will never be completed. Till the present 34 Contributions have appeared, comprising 2000 species.

Due to the post-war economic depression of 1921–22 the Staff of the Buitenzorg Herbarium (7) Head of this Museum was the late K. HEYNE, author of the standard work on useful plants of Indonésia (1927).

were reduced, and though towards 1930 there were a few constructive moments, a protracted slump set in after that year and the Staff at Buitenzorg were reduced to the barest minimum. Shortly before the Pacific War the Staff again increased but the circumstances limited advancement of the Flora to planning.

I have always felt it as a shortcoming, and not in accordance with the standing of the great work at hand, that the contributions appeared in a periodical as scattered articles and not as a separate publication.

The work was undertaken on full official authority but being printed in an irregularly interrupted series of articles in many volumes of a technical journal, it was practically inaccessible to a wider non-professional public. A standard work of this scope and weight meant to be used by future generations and worthy of the wonders of nature in this great land ought to have commanded considerable interest in and beyond the tropics, specially so in neighbouring countries. It would not have made a difference in expenditure to issue this work as a separate publication thus materially augmenting its practical importance, its intrinsic value remaining, of course, the same.

This seemingly trivial technical-editorial point had very undesirable consequences. If the Government had once for all decided to order a standard work on the Malaysian flora to be written with all possible expediency and to be used many years afterwards, the halting and haphazard progress in the decade preceding the Pacific War would never have occurred.

It is a gratifying thought that the turbulent times of the present could not prevent the Government now to put the Flora Malesiana in an advantageous and satisfactory position both as regards effective publication, and national and international collaboration of systematists. Co-operation with foreign colleagues, whose help is invited and whose help is needed in order to finish the work within a reasonable time, will now, presumably, more easily be obtained. Evidently, it is far more attractive and stimulating to be entrusted with an individual part of a standard work than with writing an article in a journal.

Prospect and scope of the Flora Malesiana. A general flora of Malaysia must result from a careful study of all previous publications, blending them into a harmonious whole, and so founding Malaysian botany on a secure base of historical fact, observation, and accurate description. This is, however, the labour of a lifetime, and although I may be privileged in witnessing the laying of the foundations and the issue of a number of volumes, I cannot hope to bring it to a conclusion; progress, moreover, will depend entirely upon circumstances at present beyond control. I have no doubt that when I will be called to abandon this endeavour the historical necessity for the completion of this work will compel someone to continue this task and, eventually, to finish it.

It would, however, be wrong were I to convey the impression that this arduous undertaking had entirely originated with myself; on the contrary during many years the conviction has grown among plant taxonomists that the ample collections accumulating in this country warranted the preparation and publication of a Flora Malesiana. The collections are undeniably extensive having been gathered over a wide extent of country. As I am anxious to render each portion of the work in itself as complete as possible, and desirous of enlisting those of our fellow-botanists as may be willing to take care of those families or groups they are most familiar with, the Flora Malesiana, when terminated will probably consist of a series of local-monographs. For these reasons it seems inadvisable and most inconvenient to arrange the families in the mode of sequence usually adopted in systematic works.

I consider it important that the Flora Malesiana should embrace as wide an area as possible, being firmly convinced that no species can be properly defined, until it has been examined in all variations induced by the differences in climate, locality, and soil, which an extensive area affords. Also, the flora of an area cannot be worked out thoroughly without a knowledge of the botany of the surrounding countries (these have many plants in common), and so the greater the area encompassed, the better it will illustrate habits, forms, and variations of the species comprised within it. For this reason we have extended the limits of our Flora from Sumatra to New Guinea and from Luzon to Christmas Island, Timor and New Guinea.

The use of the Flora Malesiana. In the preceding pages I have mentioned several times the public and the government. Both have a right to a clear understanding of the use of a flora of the scope and character of that now contemplated.

Although it is difficult to explain theoretically the 'use', i.e. the material benefit of purely scientific standard works, many anecdotes and instances concerning scientists entirely possessed by their inventions, instruments, and desire for research, told in biographies and popular literature, exemplify the eminently practical results based on seemingly impractical and abstract study.

The same can be said about this Flora. Botany is not a cherished source of pleasure and interest to naturalists only; and I have but vague ideas of

(1) Collections have increased enormously. From 1917 on, the Forest Research Station at Buitenzorg accumulated materials of arboreous plants from the islands outside Java (more than 30,000 numbers): The Museum for Economic Botany furnished by its own collectors another 6000 numbers of those islands. The collectors of the Buitenzorg Herbarium in the past 30 years added to the collections more than 125,000 numbers. A similar increase of Malaysian collections in these last decades is due to the activities at Manila and Singapore; besides, private collectors substantially augmented the collections of New Guinea. A conservative estimate of the collections at Buitenzorg alone runs to about 400,000 numbers of Malaysian plants.
possible advantage and ultimate gain for the community and practice by means of this registration of the Malaysian flora.

I could refer, of course, to the fact that all other civilized nations have already made considerable progress in the task of making common knowledge of their vegetable resources.

Actually the disentangling of confused species, the description of new or the rehabilitation of obsolete genera, the dissection of dried flowers and, in general, the establishment of law and order in 'the hay lofts', and the publication of the results have less appeal to the lay public than the segregation of a new promising variety of rice or sugarcane, or devising a method to suppress a pest of coffee or of coconut plantations.

The Flora of Malaysia contains besides highly interesting and even unique plant forms, instructive vegetation types, and peculiar ecological and phytogeographical problems, numerous important industrial plants and economic products which, in their manifold kinds, add to human comfort and social prosperity, while, in their ranks, many treasures still await discovery, the latest acquisitions being pectin and mannan producing plants. Their value has come as a surprise both to taxonomists and economists.

Nearly a century ago, one of the foremost of British botanists, Sir Joseph Dalton Hooker¹ wrote an introductory essay to the Flora of British India, one of the most instructive general essays ever written on tropical botany. This nearly one century old exposition of facts and thought meets the present state of knowledge of the Malaysian flora admirably. Its excellence induced me to copy the following from it:

"With regard to economic botany, it is obviously impossible to do more than briefly enumerate, under their respective species, the various products which have been used in the arts: for detailed accounts of their value, we must refer our readers to the many excellent works on those subjects, which have been published by Indian botanists."

"Our work is intended to facilitate the progress of economists, by supplying their great desideratum, a critical description of the plants which yield the products they seek. We have had a considerable experience both in medical and economic botany and we announce boldly our conviction, that, so far as India is concerned, these departments are at a standstill, for want of an accurate scientific guide to the flora of that country. Hundreds of valuable products are quite unknown to science, while of most of the others the plants are known only to the professed botanists. The mass must indeed always remain so: just as the refinements of the laboratory and the calculations of the mathematician must ever be mysteries to the majority of manufacturers and navigators, whose operations are based on the sciences in question. It is a mistake to suppose that it can be otherwise; or that those who are engaged in forwarding a science so extensive and abstruse as philosophical botany, can command the time to become so familiar with the details of the commercial value of vegetable products, as to be safe referees on these subjects. On the other hand, it is equally a mistake to suppose that those who devote themselves to the collection of economic products, can possess the experience and botanical knowledge necessary to render their identifications of tropical plants trustworthy in the eyes of men of science. It is therefore as a strictly scientific work that we offer this commencement of the Flora Indica to the public, but though the advancement of abstract science is indeed its primary object, yet as we yield to none in our estimate of the value of economic botany, we confidently trust that . . . our labours will be found of material service."

"Had it been possible to take up the economic plants of India by themselves, and to present a history of them to the English reader, we should at once have devoted ourselves to the task, with the certainty of obtaining an amount of encouragement which a so-called paying work is sure to command, but which one of a more scientific nature is not thought worthy of receiving. We should, however, only be deceiving the public, were we to propose a scheme which, in the present deplorably backward state of scientific Indian botany on the one hand, and the confusion of Indian economic botany on the other, is literally impracticable: the difficulties have increased fourfold, from scientific botany not having advanced pari passu with the economic branch; and so long as plants themselves remain undescribed, it is obviously impossible to recognize what are useful, or so to define them that they shall be known by characters that contrast with those of the useless. Our principal aim, however, being purely botanical, the most insignificant and useless weed is as much the object of our attention as the Teak, Sal, and tea: in the vegetable kingdom, and in the great scheme of nature, all have equal claims on our notice, and no one can predicate of any, its uselessness in an economic point of view."

"Every one who has studied Indian plants, whether for economic purposes or for those of abstract science, must have felt the want of a general work which should include the labours of all Indian botanists, to be a very serious inconvenience. Our own experience in India has convinced us of this: for we found it often impossible to determine the names of many of the most ordinary, and, in an economic point of view, often most valuable forms; and every day's additional experience in the preparation of this volume has served to show more and more clearly, that whilst such a work is wanting satisfactory progress is impossible. At present the student has to search in general systematic works, for the descriptions of species; and as all of these are imperfect, a multitude of scattered papers must be consulted for the additions which have from time to time been made. These too have unfortunately so often been published without reference to preceding works of a similar nature, that the same plant has been described as new by

¹ Hooker & Thomson, Flora Indica (1855) I–280, specially p. 3 et seq.
many successive botanists, ignorant or neglectful of the labours of their predecessors." So far Hooker.

To emphasize our inability to foresee practical results of taxonomic work I intend to mention a few recent instances in Malaysia showing that plants which seem useless at the present may stand in the focus of attention at a future date.

Twenty years ago it would have seemed the whim of a botanist to work on the species of a genus of foetid aroids, scientifically known as Amorphophallus. Few years later, however, the tubers of some species of this genus were found to be important commercially and industrially. The basic work on the distinction of the species, the notes on their distribution, their habitat and structure proved to be most useful for agricultural purposes.

The same holds for a genus of leguminous plants, Derris. The roots were found to contain a very valuable resin-like substance, rotenon, poison to fish and numerous insects but harmless to larger animals, also to man. As soon as its commercial value was recognized a sudden large demand for Derris rose. It soon appeared that not every species was valuable and so the original studies of Derris offered hold for a first segregation of promising material whereas the systematist was questioned about the characters by which the species could be recognized.

The absence of any reliable taxonomic information of the genus Metroxylon prevents at present well-founded research on the economic possibilities of the sago-producing species which supply a basic food to the whole population of East Malaysia and Melanesia.

Invariably it is the duty of the taxonomic botanist to supply basic data to research in directed (= applied) botany.

In all cases the name of the species, and eventually its varieties, is the alpha of knowledge, as it represents the key to existing literature embodying earlier work on habits, life-history, on distribution geographical and altitudinal, ecology and growth habit, current native names if any, etc. and Flora Malesiana must serve for this purpose.

In the past e.g. tropical plant-breeding in some cases followed a wrong direction and might have achieved better results more rapidly when the aid of taxonomists had been available or requested.

From the discussion of some selected topics above it will be clear that the taxonomic botanist in composing the Flora Malesiana will be able to offer critical knowledge of numerous forest products, plants containing vegetable oils, fats, and resins, rattan, timber, guns, fruits, spices, insecticides, fibres, dyes, and medicines, or species which may serve for afforestation, for ornamental use, as new green manures, fodder plants, or possibly, species withstanding drought or being resistant to fire or inundation, suitable for combating erosion, and other economic aspects.

In addition to taxonomical information, the Flora Malesiana will contain ecological data. In anthropogenic areas and eroded lands biological control of necessity will seek guidance in its comprehensive survey of facts. Large amounts of money and energy have been wasted in the absence of professional planning, through negligence of fundamentals. I remember attempts, as expensive as they were fruitless, of planting mangroves to protect the coastal area of a tropical harbour, a waste which would have been avoided when the ecological potentialities of mangrove forest had been duly considered.1

In (re-)afforestation, the choice of trees has to rely partly on previous experience, but instructions can be given by field-taxonomists and by means of general rules of tolerance capacities. Native trees occupy in our forest-types fitting ecological niches, but it should not be assumed that they grow always under optimal conditions. An example is probably found in swamp forest trees which have roots tolerant of a very low aeration of the soil, a virtue not practically utilized, as far as I know, when planting on very poorly aerated soils.

The ecological misunderstanding that all plants grow in nature under optimal conditions for their growth led to 'forest plantations' of quinine by Junghuhn. The Cinchona-crop was saved thanks to TEYSMANN who maintained that the plant should be grown in the open. Much trouble and still much more money could have been saved if this ecological principle had been better known.

The Flora Malesiana is, therefore, of first interest to practice and may direct new research: it must give data as to where the plant occurs, in what quantity, under what life-conditions, and with what life-cycle. It ought to contain ecological and biological data, and a critical extract of the notes made by the collectors. None of us can predict the industrial future of a neglected plant species, but we should be prepared for any coming rush on the botanical wealth of this vast archipelago, linking the Asiatic and Australian continents.

The aim of the Flora Malesiana is to compile a critical knowledge and a botanical standardization of the Malaysian flora of basic importance both to pure and to economic botany.

How much of the flora is known? Often it is assumed—the majority of botanists being acquainted with the state of knowledge in Europe or North America—that the flora of these islands is sufficiently known, and the actual facts cause astonishment.

For instance, not even the number of species is known otherwise than by very approximate calculation: 25,000 to 30,000 species of flowering plants is a conservative estimate. The Orchidaceae alone claim about 5000 species. Java possesses more than 500 species of ferns. The number of different species of trees in Malaysia is about 3000. The total number of genera is near 2400. The largest genera are found among the Orchids, Dendrobium with ca 1110 and Bulbophyllum with about 933 recognized species.

This is indeed astonishing if compared with the flora of Holland where the whole native flora

amounts to little more than 1000 flowering plants. Counting all trustworthy and up to date revisions together, about 5000 out of a total of 25,000–30,000 species are now more or less critically known. It appears that the bulk of the work remains still to be done.

The area covered by the Flora Malesiana will besides Indonesia also include the Malay Peninsula, Sarawak, Brunei & British North Borneo, the Philippines, Christmas Island, Portuguese Timor, and the whole of New Guinea (fig. 1).

![Fig. 1. Delimitation and main divisions of the flora of Malaysia.](image)

It may be asked whether this is not an unnecessary extension of the task to include foreign border countries. To explain this it ought to be realized that the demarcation lines of natural units seldom coincide with political boundaries.

As much as possible, however, the demarcation of a Flora should be based on scientific, that is, plant geographical limits.

Plant geographically the natural demarcation lines of the Malaysian flora pass through the isthmus of Kra, between the Philippines and Formosa, and through Torres Straits, and include the Louisiades and the Bismarck Archipelago. An extensive geographical survey of the distribution of the Malaysian flora will be published in the 3rd volume of this work. The outcome is wholly in confirmation with the suggested demarcation lines which were drawn first, as I have mentioned, about a century ago by Zollinger.

In the NW quite a number of typical Malaysian genera of forest plants fail to occur any further in the Indo-Chinese Peninsula, e.g. Rafflesia, Rhizanthes, camphorwood (Dryobalanops), benzoin (Styrax benzoin), kauri or copal (Agathis), true ironwood (Eusideroxylon), menggaris (Koompassia), etc.

The Philippines possess an essentially Malaysian flora, in contrast to Formosa’s Japono-Chinese floral character which was definitely demonstrated by Merrill.

The flora of New Guinea was formerly assumed to be essentially Australian in character. This interpretation was mostly based on zoological arguments and on the occurrence of few but very striking examples of plants which later appeared to be also spread westwards in the Moluccas and Celebes. O. Warburg, in 1891, on account of important statistics, already showed the essential Malaysian character of the Papuan flora.

Technically the botanist must in each case—whether the Flora Malesiana is limited to a political or to a natural demarcation—study and compare critically all species of the natural phyto-geographical unit. Plants described hitherto only from East New Guinea almost certainly occur also in West New Guinea, numerous species originally described from the Philippines occur in Celebes, the Moluccas and New Guinea, and the same holds for the Malay Peninsula, where the flora is intimately allied to that of Sumatra and Borneo. In identifying plants of Malaysia in the narrow sense, that is, limited to the Netherlands Indian boundaries the botanist is always obliged to revise or critically to take into consideration the species described from the border areas. This will cost him about the same time and labour as when admitting them into the final work.

If these species are omitted, the Flora Malesiana will doubtless be out of date early and unnecessarily.

**Bibliographic advantage of the Flora Malesiana.** The absence of any definitely indicated centre of publication for Malaysian plants has led to a rather chaotic taxonomic literature. At the present moment revisions of Malaysian plants are published more or less frequently in about 10 important periodicals scattered all over the world, and occasional publications are found in some 50 others. An annotated list of former revisions will be presented in this volume to facilitate future study. No single individual can be supposed to own these journals and it is thus more or less private knowledge to those, who have access to a well-stocked library. In Malaysia there are only two libraries where they are nearly all represented, viz at Buitenzorg and Singapore.

This is of course a rather unsatisfactory situation to naturalists, foresters, agriculturists, phytochemists, veterinarians, pharmacologists, and interested private persons desirous to study the flora according to the best available data. The Flora Malesiana will put students of systematic botany generally in possession of the essence of literature.

**Sequence of publication.** It is commonly understood that in a flora the sequence of publication ought to be in agreement with the ‘natural system’. This has been—I feel sure—a serious obstacle mentally and practically to all those who, previously, have considered the project of this flora.

Arguments against this sequence are in the first

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place the existence of several 'natural systems'; it is tacitly agreed that the last word in 'the natural system' will probably never be spoken.

A system now adopted may be obsolete when this flora is finished.

A choice seems, therefore, difficult, as most of the systems are advanced by leading botanists who among themselves, may claim little priority of preference.

It would be possible that the editors of the Flora Malesiana advance a system of their own. However, this falls beyond the scope of this Flora which is solely intended as a practical work.

This technical difficulty, which was already mentioned on p. viii, in connection with the adoption of a system is a serious obstacle to the progress of the work.

Clearly not at every moment a specialist is available for every family of flowering plants. This is more or less a matter of chance. Rapid and regular publication is most desirable and so every opportunity should be made use of. A 'natural system' consequently involves the 'waiting' of some manuscripts for many years because it is not yet their turn to be printed, and several volumes will be set up in one part but can be continued only at a remote period because for the 'following' family no specialist was available. The real disadvantage can be observed in works like the Flora of North America, in course of publication, of which, in 1941, were published 2 complete volumes and 55 loose parts belonging to 17 of the remaining 32 planned volumes. The same has been the case with the Flore Générale de l'Indo-Chine where most volumes ranged over a period of about 30 years before they were completed and could be bound. In the meantime consultation was very difficult because the indexes appeared naturally in the final instalment. The handling of the loose parts is undesirable both from a bibliographical and a practical standpoint.

In the newly started Flore de Madagascar the families are numbered according to the natural system and are separately published and paged. The idea is that after completion the subscribers can arrange them into sequence and bind them accordingly. We must be aware, however, that this will hardly bring any advantage as the number of families in the Malaysian flora is 211, and that among them 70 families are represented by less than about 10 species, so that also in this case one has to handle a large amount of small unbound fascicles.

A long time is needed to complete the Flora Malesiana, about 25 years at least. This is certainly not overestimated if compared with floras of similar magnitude as Flora Brasiliensis (1840–1906), Flora of Tropical Africa (1868–hodie), Flora Capensis (1894–1933), Flora of British India (1855–1897), Flore générale de l'Indo-Chine (1907–hodie), Flora Australiensis (1863–1878).

The exact duration cannot be calculated, this depends largely on opportunity and facilities, and the joining of forces. The editors are fortunate in having received the promise of much co-operation, and they hope to be able to extend their resources still more. Moreover a considerable amount of recent publications exists which may easily be adapted to the flora.

The here adopted scheme of 'opportunity sequence' in the production of family revisions will remove any delay caused by the 'natural system'. The addition of an up to date index to the contents of prior parts on the cover of each new appearing instalment will serve to verify in a moment if a desired group has already been revised.

The size of the families is of course widely different ranging from 1–5000 species.

At least one figure illustrating characteristics will be added to each family and large genus.

The volumes will not exceed 500–600 printed pages. They must be easy in the hand, agreeable to work with, and bound in covers which may not be attacked by tropical insects, as we hope that numerous subscribers will be found in the Old World tropics outside the official institutions.

Completeness of the Flora. No perfection can ever be attained in any tropical flora. Always novelties and new localities will have to be recorded. No squadron of botanists can ever comb a tropical area engirdling 1 ° of the equator.

Although completeness is a first aim set for this work, its future value will depend mainly on the amount of critical original study which it contains. The Floras of British India and Australia are now definitely incomplete, but they remain first class sources of information. Backer's Schoofflora voor Java, of 1911, still meets present demands nearly as well as at the time of its appearance. If we can keep our flora to so high a standard it will become the keystone to future Malaysian systematic botany.

The Flora Malesiana will be started with the flowering plants (Series I).

Series II will comprise the ferns and fern allies and is estimated to occupy 3 volumes.

Series III will be devoted to mosses and hepatics. These will take about 5 volumes.

Series IV will treat the fungi and lichens. The number of volumes can as yet not be estimated.

Series V is intended for the algae and other groups of unicellular cryptogams.

For the series II–V special editors will be appointed. The general method of treatment may possibly deviate somewhat from the first and largest series but the needs of these can hardly be estimated at the moment.

C. G. G. J. van Steenis

Buitenzorg /The Hague, Sept. '44/July '47.

(2) Dr K. Biswas calculated that to the 'Flora of British India' consisting of ca 14000 species, ca 2000 have been added since its publication, a surprisingly low number in relation to its vast surface and variety of vegetation types (Proc. 30th I.S.C. pt II, sect. V, Bot., Pres. addr. p. 109).
GENERAL CONSIDERATIONS

We should endeavour to determine how few, not how many species are comprised in the Malaysian flora.

In writing the following chapters I have kept in mind the exemplary 'Introductory Essay' of J. D. Hooker in his 'Flora Indica' (1855), the precursor of the 'Flora of British India'.

For the same reasons that moved Hooker, I felt obliged to introduce the Flora Malesiana properly by some general considerations especially intended for co-operators less fortunate than I have been in acquiring an experience of long standing in the field. I may add that field experience often is invaluable when studying dried, always fragmentary, materials in the Herbarium.

Some of the subjects Hooker treated are now too large to be included in one essay and, therefore, the survey of the Malaysian collections, the physiognomy of the vegetation, and the genetic and floristic plant geography occupy the (introductory) volumes 1-3 of this work.

The present essay will be entirely devoted to topics directly bearing on the study of systematic botany. Some of them I have previously discussed, or touched on, in my study of the origin of the Malaysian mountain flora.

As my intention is further to study the Malaysian botany, I shall discuss only points of which a clear understanding is essential to the Malaysian naturalist. I will try to illustrate each case by reference to plants of this region.

These points are: individual variation and racial segregation, variation caused by the environment, the problem of speciation and specific centres, hybridization, views on the status of the species and subspecies, migration and adaptation, and the way to interpret these concepts.

These theoretical points are inseparable from a philosophical study of plants, and I believe it to be essential for systematists to explain the principles which have guided them in the execution and design of their work.

Hooker's general instructions have guided me in my work, and I am convinced that in the flux of botanical conceptions in general aspects the words of the Master still hold their own. I desire to express here my admiration for this classic work by quoting literal imitation some passages of his essay.

"It may seem almost chimerical to look forward to a time when all the species of the vegetable world shall have been classified upon philosophical principles, and accurately defined; and it must be confessed that the present state of descriptive botany does not hold out much prospect of the realization of so very desirable an object. This, we think, is in a great measure due, not to any want of students willing and anxious to take up the subject, but rather to a gradually increasing misapprehension of the true aim and paramount importance of systematic botany, and of the proper mode of pursuing the study of the laws that govern the affinities of plants. We are therefore desirous, at the outset of a work which is devoted to these subjects, of explaining our views on them; and as we trust that our work will fall into the hands of many beginners who are anxious to devote themselves usefully to the furtherance of botanical science, but who have not an opportunity of acquiring in any other way its fundamental principles, we shall make no excuse for dwelling at some length on the subject. We are also anxious to refute the too common opinion (which has been productive of much injury to the progress of botany) that the study of systems presents no difficulties, and that descriptive botany may be undertaken by any one who has acquired a tolerable familiarity with the use of terms."

"There can be no doubt that any observant person may readily acquire such a knowledge of external characters, as will in a short time enable him to refer a considerable number of plants to their natural orders; though even for this first step more knowledge of principles is required, than to make an equal advance in the animal kingdom: but to go beyond this,—to develop the principles of classification, to refer new and obscure forms to their proper places in the system, to define natural groups and even species on philosophical grounds, and to express their relations by characters of real value and with a proper degree of precision, demands a knowledge of morphology and anatomy and often of physiology, which must be completely at command, so as to be brought to bear, when necessary, upon each individual organ of every species in the group under consideration. To follow the laws that regulate the growth of all parts of the plant, especially the structure of stems, the functions of leaves, the development and arrest of floral organs, and the form, position, and minute anatomy of the pollen and ovule, and to trace the whole progress of the ovule and its integuments to their perfect state in the seed, ought all to be familiar processes to the systematic botanist who proceeds upon safe principles; but no progress can be made by him who confines his attention chiefly to the modification of these organs in individual or natural orders."—So far Hooker.

Variability in characters of minor importance and description of extreme forms have led to a rather confused state of affairs. I believe that among the scores of species described many microspecies should be reduced to a much smaller number of true species, with a normal area of distribution and a normal variability in characters typical for Linnean populations which are intermediate between the species of extreme 'splitters' and extreme 'lumpers'. Much 'splitting' has been caused by describing single extreme forms not exactly agreeing with the type or type-description; for practical purposes it is sometimes required to describe such forms as new species and to recognize them provisionally as new 'entities'; the author's conscience and eagerness to finish his task are thus temporarily satisfied. This method has proved a failure and a serious handicap to the progress of tropical plant knowledge.
There are three methods of handling new collections, all being equally unsatisfactory. Firstly, provisional rapid identification of the material as to genus, or to species as far as is possible, and its insertion in the herbarium; collectors in general do not favour this method as only few final names can be provided on a cursory examination. Secondly, a collection may be worked through by rough comparisons to named specimens and with standard literature. This second method is rapid but all extreme forms and forms belonging to large genera or to difficult families which cannot be identified from the available literature, are described as new (specimen description). By this method collectors get immediate results but science is burdened with a host of 'endemic' species which, as experience has shown, disappear by the score when a thorough monograph is made. Thirdly, a collection may be thoroughly studied, delaying results, as the identification of extremes means in nearly every genus a preliminary revision.

Hooker continues (l.c.)—"A knowledge of the relative importance of characters can only be acquired by long study; and without a due appreciation of their value, no natural group can be defined. Hence many of the new genera which are daily added to our lists rest upon trivial characters, and have no equality with those already in existence. A proneness to imitation leads to a gradual increase in their numbers, without a corresponding increase of sectional groups. Indeed, even when the sectional groups are well defined, and the genera in themselves natural, a too great increase in the number of genera is detrimental, by keeping out of view those higher divisions which are of greater importance. The modern system of elevating every minor group, however trifling the characters by which it is distinguished, to the rank of a genus, evinces, we think, a want of appreciation of the true value of classification. The genus is the group which, in consequence of our system of nomenclature, is kept most prominently before the mind, and which has therefore most importance attached to it."  

(1) "We may make our meaning more clear by a few examples. The genus *Ficus* is surely more natural than the subgenera *Pogonotrophe*, *Covellia*, *Urostigma*, &c, into which it has been subdivided. So with the genera *Anemone*, *Hedyotis*, *Erica*, *Andromeda*, and others which have been split into many by modern systematists." R. BROWN, G. BENTHAM, J. D. HOOKER and others, in all their works, laboured to keep this important principle in view, and to impress it upon others; they have, however, failed to check the prevalent tendency to the multiplication of genera.

I add here other examples of genera occurring in Malaysia which are separated by trifling characters: *Voandzeia* differs from *Vigna* only in fruit biology, viz its globular pods ripening subterraneously. In *Urena* and *Pavonia* now only one fruit character remains the decisive distinction, *Dillenia* and *Wormia* are distinguished only in their fruit biology, *Berberis* and *Mahonia* are distinct solely in the foliage, *Kibessia* and *Pterandra* differ only in unimportant characters of the calyx tube, &c. The separating characters are far less important than those which, in other genera, serve to divide sections or subgenera.

The more species are described the more differences originally accepted as of generic rank tend to disappear. A redefinition of the generic characters is often delayed, and the attitude in 'local monographs' is mostly to keep at all costs the old delimitation in order to avoid laborious monographic work. Suggestive casual remarks are often made in local works, but decisions deferred.

(2) In entomology this has led to an intolerable chaos (cf. The New Systematics 1940, p. 475-491). The same holds for several large groups of the Fungi.
and when attempted without access to authentic specimens, leads to inextricable confusion, and its evil effects are not confined to specific botany, but extend to all departments."

"The pages of our Indian Flora will supply numerous illustrations of these remarks, and we would direct the attention of those commencing the study to the lesson to be derived from these instructive errors; for where the first botanists of the day have failed, beginners cannot be expected to succeed. It cannot be too strongly impressed upon all students of botany, that it is only after much preliminary study, and with the aids of a complete library, and an herbarium containing authentic specimens of a very large proportion of known species, that descriptive botany can be effectively carried out; and it would be well for science if this were fully understood and acted upon."

"The prevailing tendency on the part of students of all branches of natural history, to exaggerate the number of species, and to separate accidental forms by trifling characters, is, we think, clearly traceable to the want of early training in accurate observation, and of proper instruction in the objects and aim of natural science. Students are not taught to systematize on broad grounds and sound principles, though this is one of the most difficult processes, requiring great judgement and caution; or, what is worse, they are led by the example if not by the precepts of their teachers, to regard generic and specific distinctions as things of little importance, to be fixed by arbitrary characters, or according to accidental circumstances. As a consequence, the study of systematic botany is gradually taking a lower and lower place in our schools; and, being abandoned by many of those who are best qualified to do it justice, it falls into the hands of a class of naturalists, whose ideas seldom rise above species, and who, by what has well been called hair-splitting, tend to bring the study of these into disrepute."

"We therefore earnestly recommend to the Indian botanist the detailed study of individuals and their organs with the view of determining their limits of variation."

WIGHT and ARNOTT1 formulated their warning to beginners as follows:—

"We shall perhaps be severely censured for cutting down species. We have all along considered it as trifling with nature to separate species on slight or variable grounds, nor could we ever understand the 'cui bono' for which so much ingenuity in splitting hairs has been wasted. Before we determined what was a species, we examined with care numerous specimens from the same and different localities; and so far we have had an advantage over many other of the European botanists who have described Indian plants, they having only seen one or two isolated specimens. Numerous observations too were made in the plants in their natural situation, the result of which went to prove, what we have frequently endeavoured to enforce by examples throughout the present volume, that no precise shape of leaf or quantity of pubescence is of any value, although both of these seem in each species to be limited within certain variations. With regard to varieties, we have seldom distinguished any unless well marked and tolerably constant; we are aware, indeed, that these correspond to what some naturalists call species, but our own observations have convinced us, that varieties and forms, as well as species, may be constant in similar situations, and even in widely different situations, for many years, if raised from seeds either obtained from the original locality or from cultivated plants; the cultivated cerealia and garden vegetables ought to lead to such an hypothesis without any additional proof."

HOOKER continues:—

"In relative size especially, the observer will find immense variation; for, unlike the animal creation, proportional dimensions are of small moment in the vegetable kingdom. This fact, so familiar to the botanist of experience, is always a puzzle to the zoologist, who fancies he perceives a vagueness and want of exactness in all botanical writings (except in those of the too numerous class that make a parade of measuring to lines organs that vary inches), that contrasts unfavourably with descriptive zoology. Symmetry is again only a relative term amongst plants, for even such leaves as grow in pairs are never alike, and often differ much in form, texture, and colour; whilst the various sepals, petals, etc., of an individual flower, never so exactly correspond as the relative members of an animal do; and there are still greater differences between these organs, when taken from different flowers."

"It is hardly necessary to allude to the desirability of studying the various forms induced by artificial causes: the browsing of cattle on shrubs, for instance, which is almost invariably followed, by an abnormal state of foliage on the subsequently developed shoots, has been a prolific source of bad species; while there is scarcely an operation of man that does not tend to produce change in the vegetation surrounding him."

"It will generally be found that botanists who confine their attention to the vegetation of a circumscribed area, take a much more contracted view of the limits of species, than those who extend their investigations over the whole surface of the globe. This is partly, no doubt, owing to the force of bad example; and partly to the fact that the student who takes up the study of the flora of his native country, finds that the species are all tolerably well known, and that no novelty is to be discovered. There is therefore a natural tendency to make use of trifling differences, from the scope which they afford for minute observation and critical disquisition; whilst the more close comparison of the few species which come under his investigation, leads the local botanist to attach undue importance to differences which the experienced observer knows may be safely attributed to local circumstances. To this tendency there can be no limit, when the philosophy of system is not understood; the distinctions which appeared trifling to

botanists a quarter of a century ago, are at the present day so magnified by this class of observers, that they constantly discover novelties in regions which have been thoroughly well explored; considering as such, forms with which our predecessors were well acquainted, and which they rightly regarded as varieties.

"Another result of the depreciated state of systematic botany is, that intelligent students, being repelled by the puerilities which they everywhere encounter, and which impede their progress, turn their attention to physiology before they have acquired even the rudiments of classification, or an elementary practical acquaintance with the characters of the natural orders of plants. Unfortunately, in botany, as in every other branch of natural science, no progress can be made in the study of the vital phenomena except the observer have a previous accurate acquaintance with the various modifications under which the individual organs of plants appear in the different natural orders, and such an appreciation of the comparative value, structural and morphological of these modifications, as can only be obtained by a careful study of the affinities of their genera and species. Ignorance of these general laws leads to misinterpretation of the phenomena investigated by the physiologist, and to that confusion of ideas which is so conspicuous in the writing of some of the astute physiological observers of the day."

"The modern system of botanical instruction attempts far too much in a very limited space of time, and sends the student forth so insufficiently grounded in any branch of the science, that he is unprepared for the difficulties which he encounters, let his desire to progress be ever so great. The history of botanical discovery, and the philosophy of its advance, form instructive chapters for the student in any department of natural science."

"We owe to Linnaeus the establishment of the doctrine of the sexuality of plants; and we find by the writings of the same great naturalist, that besides foreseeing many physiological discoveries, he preceded Goethe in the discovery of morphology, a doctrine which, more than any other, has tended to advance scientific botany. A third great discovery, that of the nature of the ovule, and the relation of the pollen tube to the ovary, received its principal illustration at the hands of Brown, our chief English systematist, and of Brongniart, also a practised botanist."

"It should not be forgotten, that the relative importance of physiology is very different in the animal and vegetable kingdoms. In the former, structure and function operate so directly upon one another, that the great groups are, to a certain extent, defined by well-marked external characters, which are at once recognizable by the student, and are familiar, or at least intelligible, to those even who have paid no attention to natural history. In the vegetable kingdom this is by no means the case: the processes of assimilation and secretion present but little of that complication which renders the study of animal physiology so important; they are, on the contrary, uniform almost throughout its whole extent, and moreover so simple in their modus operandi, that this very simplicity prevents their being rightly understood. In consequence, even the two great classes of Monocotyledons and Dicotyledons are not distinguishable without considerable practice and study; and were we dependent upon actual inspection of the organs whence the essential characters of these groups are drawn, for the means of recognizing, Systematic Botany would be an impracticable study."

"Herein lies one great obstacle which meets the beginner on the very threshold of his botanical studies: he sees the great divisions of the animal kingdom to be recognizable by mere inspection, and that familiar characters are also natural, and available for purposes of classification: the very names of the groups convey definite information, and to a great extent give exact ideas. Birds, fishes, reptiles, etc. are all as natural as they are popular divisions; but what have we in the vegetable kingdom to guide the student through the two hundred and fifty natural orders of flowering-plants? As with a new language, he must begin from the very beginning, and also avail himself of artificial means to procure as much superficial knowledge of structure and affinity as shall enable him to see that there is a way through the maze. Hence the obvious necessity of an artificial system of some sort to the beginner, who has, at the same time, to master a terminology, which, if not so complex as that of zoology, is more difficult at the outset, from the want of standards of comparison between the organs of plants and those he is familiar with in himself as a member of the sister kingdom. Applying these remarks to practice, the botanical student finds that he has much to unlearn at the very outset; in many cases he has misapplied the terms root, stem, leaf, etc., and contracted most erroneous ideas of their structure and functions; while he is startled to find that the popular divisions of plants into trees, shrubs, and herbs, —leafy and leafless, water and land, erect, climbing, or creeping,—are valueless even as guides to the elements of the science."

"It is not however to be supposed, because pure physiology is of secondary importance to the right understanding of the affinities of plants, that botany is therefore a less noble or philosophical study than zoology; since we find anatomy, development, and morphology, occupying a very far higher rank in proportion. Being deprived, as he is in most cases, of all technical aids to the determination even of the commoner exotic natural families, the systematist is compelled to commence with the knife and microscope, and can never relinquish these implements. Systematic Botany is indeed based upon development; and no one can peruse, however carelessly, the most terse diagnosis of a natural order or genus of plants, without being

(1) "Many of the species which have been revived in modern times were indicated by Haller, Ray, Tournefort, and other ancient botanists, but were reduced to the rank of varieties, when the science was reformed by Linnaeus."
struck with the variety and extent of knowledge embodied as essential to its definition and recognition. Not only are the situation and form, division or multiplication, relative arrest or growth, of the individual organs exactly defined, in strictly scientific and scrupulously accurate language, but the development of each is recorded from an early stage: the vernation and stipulation of the leaves; the aestivation of the young calyx and corolla, and their duration relatively to other organs; the development and cohesion of the stamens; the position and insertion of the anther; its pollen; the cohesion or separation of the carpels, and the stages of their development from the bud to the mature fruit, and from the ovule to the ripe seed, are all essential points; all however minute, must in many cases be actually inspected before the position of a doubtful genus can be ascertained in the Natural System; and this is not the exception, but the rule."

"The necessity for acquiring so extensive and detailed a knowledge indicates a power of variation in those organs from which the natural characters are drawn, that defeats any attempt to render one, or a few of them only, available for the purposes of classification; and hence it is that the study of morphology or the homologies of the organs, becomes indispensable to the systematist; by this he reduces all anomalies to a common type, tests the value of characters, and develops new affinities. The number, form, and relative positions of organs may supply technical characters, by which observers of experience recognize those natural orders under which a great number of plants arrange themselves; but a knowledge of structure and anatomy alone enable the botanist to progress beyond this, and to define rigidly: whilst the study of development affords him safe principles upon which to systematize and detect affinities, and morphology supplies the means of testing the value of the results, and reveals the harmony that reigns throughout the whole vegetable world."

"Physiology, again, is a branch of botany very much apart from these: its aim is the noblest of all, being the elucidation of the laws that regulate the vital functions of plants. The botanical student of the present day, however, is too often taught to think that getting up the obscure and disputed speculative details of physiology, is the most useful elementary information he can obtain during the short period that is given him to devote to botany; and that, if to this he adds the scrutiny of a few of the points under a microscope, he has made real progress as an observer. This, we maintain, is no more botany, than performing chemical experiments is chemistry, or star-gazing astronomy. A sound elementary knowledge of vegetable physiology is essential to the naturalist, and should indeed be a branch of general education, as it requires nothing but fair powers of observation and an ordinary memory to acquire it. For the student to confine his attention to this knowledge of the vegetable world, and to try and improve upon it by crude experiments of his own, undertaken in ignorance of the branches of pure botany we have enumerated, is a very rational amusement, but nothing more."

"The students are indeed, in too many cases, perfectly ignorant of the elements of natural science, and require some practical acquaintance with plants and their organs, before they can appreciate the relations of the different branches of botany to one another, or discriminate between what is essential to understand first, and what is better acquired afterwards. Were the elements of science taught at schools, this would not be so: we should then have the student presenting himself at the botanical lectures fully prepared for the more difficult branches of science, and for making that progress in them for which the professor's aid is indispensable. A sound practical knowledge of system we hold to be an essential preliminary to the study of the physiology of plants—a study which requires also a practical acquaintance with organic chemistry, consummate skill in handling the dissecting knife, and command over the microscope, a good eye, a steady hand, untiring perseverance, and above all, a discriminating judgment to check both eye, hand and instrument. A combination of these rare qualities makes the accomplished vegetable physiologist, and their indispensability gives physiology its pre-eminence in practice."

"It has been with no desire of obstructing our views upon our readers that we have ventured to discuss these obscure subjects with relation to Indian plants, but from a conviction, that in the present unsatisfactory state of systematic botany it is the duty of each systematist to explain the principles upon which he proceeds; and we do it not so much with the intention of arguing the subject, as of pointing out to students the many fundamental questions it involves, and the means of elucidating them."

"To every one who looks at all beneath the surface of descriptive botany, it cannot but be evident that the word species must have a totally different signification in the opinion of different naturalists; but what that signification is, seldom appears except inferentially. After having devoted much labour in attempting to unravel the so-called species of some descriptive botanist, we have sometimes been told that the author considers all species as arbitrary creations, that he has limited the forms he has called species by arbitrary characters, and that he considers it of no moment how many or how few he makes. So long as this opinion is founded on conviction, we can urge no reasonable objection against its adoption; but it is absolutely necessary that the principle should be avowed, and that those who think the contrary should not have to waste time in seeking for nature's laws in the works of naturalists who seek to bind nature by arbitrary laws. So again with regard to specific centres; except we are agreed with an author as to whether the same species has been created in one or more localities, and at one or more times, we shall be at cross purposes when discussing points and principles relating to identity of species and geographical distribution."

"Great differences of opinion have from the
earliest days of science always existed on the nature of species. The prevalent opinion has undoubtedly at all times been, that a species is a distinct creation, distinguishable from all others by certain permanent characters. Many eminent philosophers, however, have taken a contrary view; of these the best known have been LAMARCK, and more recently the anonymous author of the ‘Vestiges of Creation’.

—So far Hooker.

Modern biological science has progressed rapidly in the last decades through the results of experimental genetics. Though it is far from easy to weld the often contradictory opinions into a satisfactory whole, views relating to matters of variation have much gained. In the following pages I will try to discuss on this new basis the value to be attributed to characters of less than specific importance and a number of considerations which may lead to increased accuracy in judging specific delimitation.

Trifling characters, such as peloric and cleistogamous flowers, have led to the creation of worthless new genera; galls, insect bites, and parasitic fungi have been mis-interpreted and caused the publication of new species of Phanerogams. Individual variations, either intrinsic or extrinsic have, in a similar way, induced systematists working on tropical plants to distinguish more species than Nature intended.

It is not our intention to limit phytography to a merely administrative function in the study of botany, but to treat it as an essential of natural philosophy. The systematist ought to keep pace with cytogenetics, physiology and morphology, phytochemistry, phytogeography, ecology, genetics, i.e. experimental taxonomy.

Inadequate material and information are the chief causes which prevent the phyto-systematist from applying the results obtained by these branches of botanical science.

The systematist is seldom favourably regarded by the layman or student of directed botany. They are opposed to changes in nomenclature, being unable to gauge the force of the arguments for a 'new' name for a familiar plant and so rarely accept the judgment of taxonomists. When, on the other hand taxonomic problems are tackled by applied scientists nomenclature and specific distinction become chaotic; entomology, mycology, forestry, agriculture and horticulture supply many examples. A wish for simplification, impatience, or even personal vanity or the desire for pecuniary gain have caused hosts of 'species' to be added to our lists by applied workers. Not long ago a forestry officer made a study of Agathis in Malaysia in which 13 species and 2 doubtful ones, that is 15 entities, were distinguished. In the same material the late Dr. DANSER, whose judgment and experience cannot be doubted, distinguished only 3 divergent species with a number of local geographic variations. He found it very difficult to define the latter. Additional material showed that the keys and distinctions presented for the 13 species did not hold to the satisfaction of the Forest Research Station, from which this work emanated. In plant families of economic importance particularly in Gramineae, Rutaceae, and Leguminosae, similar work has resulted in multitudes of microspecies provided with binomials; by such a proceeding nothing is gained and much lost.

An example of the difficulties arising between taxonomy and an applied science when a good revision is absent, is the following:—a Clausena of unknown origin was cultivated for economic purposes at Buitenzorg. I referred it to Clausena anisum-olens (BLECHNER), but the phytochemist was dissatisfied, the properties of the oil did not tally with data recorded from the same species in the Philippines. I then sent ample material with full notes to Dr. TANAKA, Dr. SWINGLE, and to the Kew and Paris Herbaria, for identification. The answers were all different and the phytochemist was, of course, disgusted with the practical results of taxonomy, because now he had the choice among 5 names for his plant. By way of comfort I expressed the hope that a systematist would some day make a satisfactory monograph of the genus. In order not to raise his hopes too high I remarked that even then some research from him would be needed to establish the assumed constancy of the oil properties as a specific character. I also informed him that taxonomy has sometimes scored by predicting phytochemical facts, e.g. when HALLIER supposed the presence of valerianic acid in Viburium on phylogenetic grounds only.

In the following two chapters general information on variation as a source of superfluous binomials is collected for the benefit of those with no field experience of the Malaysian flora. I distinguish variations induced by the environment from those belonging to the genetic composition of populations, and I have tried to illustrate them by examples in Malaysian phytography.

Often the number of examples is too small, and chapters overlap, but in the course of time every student of Malaysian botany will meet with other equally telling cases. May they stimulate the wish to avoid lapses of this character by conscientious treatment of the revisions in Flora Malesiana.

(1) For the value of wood anatomy in taxonomy, see Den BERGER, in Handel. 4e N.I. Natuurwet. Congres (1926) 397.

(2) Cf. WIGHT, in a letter to Griffith, dated April 15, 1842:—"How people can work on dry plants I cannot imagine. I am daily convinced of the poverty of the study from such materials, unless a man has seen much of living structure." MIQUEL ignored this remark, and on sterile and inadequate material based a host of species from Sumatra which even at present are not wholly elucidated.


(4) Compare R. WIGHT in a letter to Griffith, dated March 30, 1841:—"as you say Botany is difficult, and increasingly so, but Botanists are to blame for this. No remedy will be so effectual as the publication of Monographs."

VARIATIONS MOSTLY INDUCED BY THE ENVIRONMENT
(Phenotypic modifications)

Phenotypic modification is the response to environmental conditions, such as climate, soil, exposure, altitude, temperature, wind, fire and living organisms. The genetic qualities govern the character of the plant, but the environment in which the plant develops determines the actual and final appearance of the individual. The changes or differences from the 'normal plant' are called modifications. Such changed characters are not themselves inherited, however, though the manner in which a plant reacts to environmental conditions is. In some cases an external change may be reversed by a change in the environment during the development of the individual but in other cases, when factors act in the seedling stage only, the effects in the individual are irreversible.

It is necessary to agree about the concept 'normal plant'. This is far from easy, as each specimen grows under a different combination of CEB-factors (Climatic, Edaphic, Biotic). We might approach the idea by saying that "the normal plant results from a genetically average individual under average natural environmental conditions", average to be understood in the sense of optimal. This 'normal' individual is never a reality but remains an abstraction.

Though the difference between phenotypic and genotypic variation is clear, the field botanist—and still more the herbarium botanist—is not always able to recognize it. Only experiments may furnish proof. For instance a dwarf shrub in an area subject to fire or browsing animals may assume this stunted form through these CEB-factors but it is also possible that the stunted form is a specialized race adapted to these conditions and thus selected by nature itself from the specific population. Experimental breeding must decide its constancy.

I have arranged the phenotypic modifications under several headings—which partly overlap and interlock—in the following sequence:

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Ontogeno-morphosis

1. Juvenile forms

Juvenile forms often differ widely from the mature plant. Seedlings of many Leguminosae differ greatly from the adult in foliage and other characters. The youth form of Cassia javanica L. possesses large metamorphosed twigs acting as thorns (1). Thorny juvenile specimens are also found in Alangium.

In general, flowering twigs have smaller leaves than sterile branches; this often gives rise to difficulty in identifying non-flowering material and some of the pitfalls if new species are based on sterile material. An example is Campnosperma acutauris Boerrl. & Koord. (Anacardiaceae) described on sterile juvenile material from Sumatra. The leaves are large and conspicuously auriculate-amplicaulous. A similar juvenile form was later found in West Java, together with mature trees. These possessed much smaller non-auriculate leaves (fig. 2). The plant appeared to represent a species of Tristania (Myrtaceae)(2); its specific identity will probably remain obscure, however, as several species produce similar juvenile forms.
Youth forms of *Myrica longifolia* T. & B. differ strongly from mature specimens in possessing distinct stipules and incised larger leaves.

Incised leaves of seedlings occur in a score of arborescent plants, e.g. many *Bignoniaceae*, *Proteaceae*, *Gmelina*, *Lonicera*, *Aleurites*, *Vitex*, &c. Leaves of young trees of *Pangium edule* REINW.

![Fig. 2. Large leaf of a juvenile specimen, small leaves of a mature tree of *Tristania* sp. (Myrt.) in W. Java, ½.](image)

are 3-lobed whereas the leaves of mature trees are entire.

The growth of different parts of the plant is often very disproportionate. In some *Symlocos* species I found the leaf teeth were mature and large in young leaves but inconspicuous in mature foliage: they possibly have some (excretive) function during youth only. Backer (3) found the leaf tip earlier developed than the blade in some species of *Dioscorea*; it disappears also sooner. A peculiar development occurs in the growing leaves of some *Meliaceae*, e.g. *Chisocheton* (fig. 3).

Very peculiar juvenile forms greatly differing from the later normal foliage, have been described in various climbing plants such as some *spp. of Adenia*, *Medinilla*, *Macrozanonia*, *Piper*, *Araceae*, *Ficus*, &c. Juvenile specimens of these trunk climbers are always sterile. Their foliage is mostly broader than that of mature plants, and is appressed to rocks or tree trunks. The similarity in their appearance may cause considerable confusion as *e.g.* is shown by the type specimen of *Ficus peltata* Bl., which was recently proved to represent a juvenile specimen of some climbing species of *Piper*.

In several *Malvaceae*, *Leguminosae*, *Sterculiaceae*, *Tiliaceae*, juvenile leaves are often different from mature ones (fig. 4). *Sterculia polyphylla* R. Br. is a juvenile stage of *St. foetida* L.; young trees often possess leaves having 10–15 narrow leaflets, mature trees have mostly 5–9-foliolate leaves with broader segments. Young *Lasia spinosa* Thw. is very different from the mature plant. *Ficus basidentula* Miq. is merely the juvenile form of *F. callosa* Willd.; it is quite common in the hedges at Buitenzorg. The polymorphy in the habit and foliage of *Ficus quercifolia* Roxb. and *F. heterophylla* L.f. is unbelievable.

In juvenile forms of *Nepenthes* the shape of the pitchers may considerably differ from that in mature plants; as a result juvenile *Nepenthes* cannot with certainty be identified.

In *Carallia lucida* Roxb. leaves of mature trees are oblong to obovate with very shallowly serrate to entire margins; saplings, however, have oblong to lanceolate leaves distinctly serrate (4).

Other cases of old mature plants differing from young ones are found among lianas in which the shape of the stem may change considerably: *Cissus tuberculata* Bl. has terete tuberculate stems but they later become flat and, in older stems, up to 60 cm broad looking like gigantic ribbons! The latter were described as a separate species, *Vitis lanceolaria* Wall., but the two forms are merely two stages of one species. The stems of lianas generally change greatly with age, through the development of corky warts and wings, together with secondary wood not present in young flowering twigs. Spines sometimes disappear in lianas and trees with age; in some cases, on the other hand, they enlarge considerably. A peculiar case is represented in two undescribed Cucurbitaceous lianas from the Lesser Sunda Islands, both having a...
swollen base; in Gynostemma sp. this 'podagric' base is smooth, in Alsomitra sp. it is spiny (5).

Habit also sometimes changes with age: Ancistrocladus is sometimes a shrub in youth whereas later it becomes distinctly scandent. Climbers which have no support may sometimes grow into semi-erect shrubs; this I once observed in a plant of Smilax modesta DC. in a grass field on Mt Dieng.

Spotted leaves often occur only or predominantly in juvenile specimens. Strobilanthes pica Koord. was a new species proposed on account of silvery spots on the leaves. However, it is a juvenile stage of Str. cerinms Bl. Similar cases are known in Begonia, Cissus, and other genera in which a number of those spots may disappear with age. In greenhouses these juvenile forms are preferred for ornamental purposes.

Juvenile forms of plants with pinnate leaves sometimes have a much larger number of pinnae e.g. Campsis pandorana (ANDR.) STEEN. c.n. (6).

An example of a new species based on a juvenile plant is found in Daecydidum: the type specimens of Daecydidum junghuwanum Miq. from Sumatra consist of juvenile specimens of D. elatum WALL. with long loosely set needles.

In the herbarium flowers sometimes open during drying and create the impression of being mature. This is specially the case with flowers having valvate terete corollas e.g. Symplacos § Cordylolabaste, Styrax, Polysosma, Proteaceae, Loranthaceae, &c.

MIQUEL described a new species of Lonicera from Sumatra L. sumatrana Miq. In his description short corollas are mentioned; owing to this mistake the species was subsequently placed in the wrong section and described twice again, once from Burma and once from Sumatra (7). The examination of MIQUEL's type specimen revealed that he described immature flowers, in fact buds which had opened in the herbarium. Immature woody capsules or strobili of Myrtaceae, Theaceae, Coniferae, Casuarina, &c. also tend to open after drying.

There is often a great similarity in the leaves of watersprouts of mature trees with those of saplings: large size, deeper incised teeth, thinner texture, e.g. in Symplacos, Ficus, Sapotaceae, Dipterocarpaceae, etc.

A still unsolved case is that of Evonymus japonicus THUNB. of which a sterile slender climbing and rooting form is frequently found in the Javan mountain forests. I originally took it for a juvenile shade form (8). Not until 1941 did I succeed in finding it flowering and fruiting on the open summit of Mt Jang. It is unknown whether the shade conditions in the juvenile stage determine the later morphology.


2. Precocious flowering (paedogenesis)

In several Malaysian plants precocious flowering is observed. Costerus (1) recorded flowering seedlings in Melia arguta DC. (fig. 5). Backer found them in Melia azedarach L. and J. J. Smith described (2) the same phenomenon in Muraya paniculata L. In Cocos nucifera L. precocious flowering is often seen. The late Dr A. RANT observed flowering seedlings in Cinnamomum zeylanicum THW. (oral comm.). Other plants in Malaysia in which precocious flowering has been observed are Swietenia mahogani JACQ., Coffea robusta, Citrus decumana L., Nicotiana tabacum L., Sesbania sericea DC., Vigna sinensis ENDL., Teramnus labialis SPRENG., Tectona grandis L.f., Kalanchoe pinnata Pers., and Ailanthus sp.

In plants which flower strictly periodically precocious flowering is sometimes controlled by the date of sowing. If sown too late they flower together with full-grown plants sown earlier. This is a fact well-known to agriculturists (in Java e.g. in Hibiscus spp.).

Precocious flowering may also be caused by poor soil or some
methods of pruning. An example of the former is Osbeckia pusilla Zoll., which is a flowering dwarf of *O. chinensis* L. on poor soils.

Sometimes dwarfed plants flower when very small and represent distinct varieties or strains, e.g. the dwarf of Canangium odoratum Baill. *f.* pumila (3) grown in pots in Malaysia (introduced

and several species are known to form spores in dwarf or juvenile specimens which have sometimes been described as distinct species. It has been assumed that pygmy species in *Antrophyum* may possibly represent neotenous stages of other species. Copeland described in 1939 (5) a dwarf fern from Borneo as *Holttuania*, but it is Dr Donk’s contention that this fern is a precocious stage of a *Tae- nites*. In the genera *Teratophyllum*, *Stenochlaena* and *Lomariopsis*, *Holttuima* (6) was able to demonstrate that a great deal of confusion is caused by the description of juvenile stages; being familiar with the living plants in the field he clarified the true status and affinities of a number of obscure species.

Diels (7) compiled an instructive book on juvenile forms, giving instances where the juvenile foliage persists in the mature flowering plant, a course of development comparable to neotenous forms in zoology. Australian and New Zealand botanists have written a great deal about this phenomenon of heteroblasty which in those floras has apparently an important bearing on speciation (8). I cannot remember a Malaysian plant suspected to represent such a case. Yet such strange plants as *Monophyllaea* (fig. 6) and allied genera of the Gesneriaceae living on the enlarged cotyledons might be examples.


### 3. Dimorphous foliage

It was observed by F. W. Went (1) that in trees generally the foliage of the lower branches is larger than that of the upper twigs. He ascribes this to the amount of water available to different shoots (internal water-conducting capacity); so, in mature trees the upper foliage would be insufficiently provided with water. The leaves of water sprouts, on the other hand, are mostly exceedingly large as their water supply is abundant. Leaves of these shoots are mostly hardly recognizable in the herbarium, as they may reach disproportionate dimensions. Foliage for description in the herbarium ought therefore to be comparable and preferably that of flowering twigs.

The dimorphy of the foliage is mostly linked up with a difference between flowering and non-flowering parts of the plant, similar to that found in *Hedera*. It is conspicuous in several climbing *Ficus*, *Piper*, *Araceae*, and in some *Coniferae*. A striking example of plagirotropically flowering twigs is that of *Abroma angusta* L.f.

A good illustration is also *Luvunga sarmentosa* (BL.) Kurz (*Rutaceae*). The stem shoots of this

Fig. 6. *Monophyllaea horsfieldii* R.BR. (Gesn.), adult plant, one cotyl large and leafy, the other (in front) bract-like, soon disappearing (W. Java, Kalapa Noenggal), × 2/s.
liana possess large straight axillary thorns and 1-foliolate leaves. The climbing shoots, however, possess conspicuously curved thorns and 3-foliolate leaves and the flowering parts of these are often unarmed. *L. eleutherandra* Dalz. was based on a type different from Blume's but is actually the same species, as was found by Kurz (2).

Fig. 7. Heterophylly in *Ficus deltoidea* Jack (= *F. diversifolia* Bl.) (Morac.), Mt Gedeh, W. Java, × 3/4.

Putting into practice what he had read of *Hedera helix* in a botanical manual, Mr Bolt made a remarkable application of the dimorphism of *Piper cubeba* L. Near Semarang, instead of cultivating it as a climber he took cuttings of the flowering twigs, and got shrublets which, though small, produced abundantly 'tail pepper'.

Plants with dimorphous foliage are very numerous in Malaysia and species are frequently named after this peculiarity. *Ficus deltoidea* Jack (= *Ficus diversifolia* Bl., fig. 7) is one of them; *L. van der Pijl* (3) could not find any regularity in its heterophylly. In *Faradaya dimorpha* Pulle from New Guinea there are two kinds of twigs, with decussate and with 3-whorled leaves of different shape. *Phytocrene macrophylla* Bl. has both entire and 3-lobed leaves on one individual, as have *Broussonetia sumatrana* Miq., *Knema heterophylla* Warb., several species of *Gmelina* and *Sterculiaceae*, *Tiliaceae*, *Artocarpus varians* Miq. A good case is also *Uraria picta* Desv. (fig. 8). Heterophylly is common in ferns.

Polyomorphy in leaf shape among different individuals of a population is a subject which ought to have a separate heading. It is of universal occurrence in the Malaysian flora, and has (*e.g.* in *Cucurbitaceae*) given rise to a multiplication of names. In *Coelinaea*, Miq. (4) distinguished two species, one with incised leaves and one with angular entire leaves; according to Backer they are identical, the incised leaves mostly belong to juve-

Fig. 8. *Uraria picta* Desv. (Legum.), with heterophyllous foliage, Kangean Island, moist *Imperata* fields at low alt., × 1/5.
nile specimens. In Gymnopetalum cochinchinense (Lour.) Kurz there is even more confusion: specimens with incised leaves have been described as G. septemlobum Miq., G. quinquelobum Miq. and G. quinquelobatum Cogn., those with angular or entire leaves as G. piperifolia Miq. and G. horsfieldii Miq. There is probably a host of other names L. etc. In the Oleaceae, Nyctanthes dentata Bl. is only a dentate-leaved form of N. arbor-tristis L.

In some Pteridophytes heterophyllous leaves are well known. The most striking examples occur in the genera Teraphyllum, Stenochlaena and Lomariopsis where according to Holtum (5) heterophyll has caused much taxonomic confusion. An other striking case is that of the plant which is mostly cited as Lindsaya repens (Bory) Bedd. as demonstrated by W. Troll (6).


4. Dimorphous seeds and fruits

Of heterocarpy (1) only few examples are known in the Malaysian flora. In some Compositae the marginal fruits are sometimes strikingly different from those produced by the central tubular flowers, as was described for Synedrella nodiflora Gaertn. by A. Ernst (2). It is also known that in Tragia volubilis L. normal and 2-hooked one-seeded fruits may occur together.

In Umbelliferae normal fruits and fruits with one half reduced may sometimes be observed.

In Leguminosae also different types of fruit are sometimes found on one plant. In Desmodium heterocarpm DC. the lower pods are 1-seeded, the upper 5-7-seeded.

Dimorphous fruits and seeds are known in Aeschynomene spp. and in the genus Jussieuana.

One of the most curious cases of dimorphous fruits is that detected by Backer (3) in the common Acalypha indica L. in Java where the tip of the male spikelets is crowned by a single female flower developing into a T-shaped fruit with a central fertile and 2 lateral sterile cells; the central cell seems to be sunken in the tip of the axis of the rachis. The normal capsule consists of 3 equal cocci.

A special case is that of macrobiocarpy (4) when not all fruits dehisce at the end of the season but a number remain closed on the plant and grow for years larger and woody. Sometimes fruits of 3–4 seasons are found on one twig, which thus keeps a reserve of seeds. Macrobiocarpy seems to be mainly restricted to the semi-arid climates and is of definite advantage in fire-swept areas. It is very common in some genera of capsular Myrtaceae (fig. 9), viz. Leptospermum, Eucalyptus, Melaleuca, Agonis, Metrosideros, Syncarpia. It possibly also occurs in some Proteaceae, Coniferae, Casuarina, and some Rubiaceae.

The woody structure, large size and modified shape of the fruits formed in previous seasons must be allowed for in identifying the species. Inadequate material may cause considerable confusion.

5. Dimorphous flowers

A most peculiar case of flower dimorphy occurs in some Orchidaceae viz. in Remanthera lowii Rchb. f. (1) and Grammatophyllum speciosum Bl. (2). The shape and colour of the lower flowers in a raceme are very much different from those of the upper ones. In these Orchids the occurrence of aberrant lower flowers is a normal phenomenon. It seems also to occur in some species of Arachnis and less obviously in some species of Bulbophyllum.

In Oberonia imbricata Lindl. the upper flowers of the spike are abnormal and their gynaeicum is reduced.

Dimorphous flowers are also frequently found in dioecious and polygamous plants. Male and female flowers are sometimes very different in shape and size, e.g. in Mangifera, Brucea, Hevea, &c.

In thysroid inflorescences the marginal flowers are often different from the central ones, or sometimes the central ones are reduced or deformed. A conspicuous instance is Mussaenda where some flowers of the inflorescences have one calyx lobe large and leafy. Other cases are found in Hydrangea, Sambucus javanica Reînâw., some Umbelliferae, some Araliaceae, e.g. Boerlagiodendron, and some Mimosaceae.


6. Cleistogamous flowers

Cleistogamous flowers occur frequently in the Malaysian flora. A general survey has hitherto not been compiled. They were described in Clitoria by Harms (1) and Rant (2) where they are sometimes more frequent than normal flowers. The description of specimens with cleistogamous flowers has led here to a phytographical confusion: the American genus Martia Leand. Sacr. was based on a cleistogamous leguminous plant which is, actually, according to Bentham and Harms (i.e.) nothing but the cleistogamous state of Clitoria.

Cleistogamy also occurs in Malaysian species of Viola. It is stated by Beccari (3) to occur in several Bornean Annonaceae.

A very typical example is described in Commelina Benghalensis L. by J. van Welzen (4); cleistogamous flowers are present on subterranean shoots.

Another well known case in a common plant is Ruellia tuberosa L. mentioned by van Welzen (5) and A. F. G. Kerr (6).

Cleistogamous (better: cleistopetalous) flowers are common in Orchidaceae as J. J. Smith and R. Schlechter both frequently mentioned. The former gives a list of cases known to him in connection with his experience on autogamy (8); the latter studied the occurrence of cleistogamy especially in New Guinea (7) and found it in several genera, and both in the lowland and in the mountains. Sometimes in several specimens all the flowers are cleistogamous, e.g. in Eria rugosa Lindl. and Dendrobium gemellum Lindl. Smith even found species which are only known in the cleistogamous state (8, p. 138), or of which normal flowers have only occasionally been found.

Smith suggests that cleistogamy is more common in the rainy season, and he mentions that R. Schlechter also got the impression that cleistogamy was common in very wet places in Sumatra and in the mossy forests of New Guinea more frequent in the rainy season than in the dry period. The same phenomenon has been observed by C. A. Backer (9) for cleistogamy in Dichlipera canescens Nees (Acanth.) in Java; in moist countries or during wet periods in the dry season this plant produces minute white cleistogamous flowers the corollas of which drop in the early morning.

It is certainly noteworthy that a single trivial character like cleistogamy can so upset taxonomical judgment that a new genus has been based on this abnormal state of a plant; this character changes the whole floral development, and suppresses the manifestation of numerous genon tendencies in the mature plant. Physiologically this can only be explained by some break in the physiologic chain reactions in an early stage of the development of the flower. The field observations mentioned above may show how this problem may be studied experimentally.


Teratologo-morphosis

7. Teratological forms

Malaysia can boast of a series of good articles by J. J. Smith & J. C. Costerus (1) dealing with teratological phenomena in plants.

Though several of these teratological forms are due to some hereditary factor, others are apparently caused by external factors. Some are possibly the result of a fungus's attack though no fungus has been found.

Pometia pinnata Forst. almost always has peculiar large brown structures like witches' brooms by which the tree can easily be recognized in the riverine forest: they suggest inflorescences.

Invrescentia are quite a common phenomenon in several Compositae (fig. 10); the fact that they are often found together in colonies in several different species suggests that they may be due to some virus (?).

Monstrous flowers occur rather frequently in Orchidaceae and have often confused systematists.
J. J. Smith (2) has given an interesting account of them. The absence of a rostellum is closely connected with autogamy. As a result the flowers often hardly open, do not develop well, and their colour is paler than normal e.g. in Phajus tankervilliae Bl.

Fig. 10. Invirescence of Emilia sonchifolia DC. (Comp.) from Mt Abang, Bali, sandy riverbed, ca 1000 m, × 1/2.

Sumatran specimens are apparently more normal than Javan. Of quite a number of these abnormal Orchidaceae no normal specimen is as yet known.

Another abnormality is a variation in the number of anthers, which, in Dilochia pentandra Rchb. f., is five; this ‘species’ is, however, a mere form of D. wallichii Lindl. In other cases the third stigmatic lobe is changed into a rostellum and the rostellum has become a stigmatic lobe.

J. J. Smith remarks that the phenomenon of peloria occurs in different degrees. Mostly the peculiarities of the labellum disappear, sometimes the tepals show some characteristics of the labellum. As peloria is for the most part inherited these forms are treated in more detail in the following chapter, paragraph 2.

Teratological aberrations frequently cause such large changes in the structure of flowers that they strongly suggest some taxonomic novelty. An additional example is: an interesting 3-seeded coconut (3). De Wit & Posthumus collected at Buitenzorg, Sept. 1944, a specimen of Cassia minumoides L. of which each flower possessed 2 ovaries. This character is considered to be primitive or ancient in the Leguminosae; it has been reported to occur in several Caesalpiniaeae, e.g. in African Schaerziana (6) and Indian Caesalpinia (7). In Archidendron, a genus of Mimosaceae centred in New Guinea, it is a generic character.

Monstrous forms occur frequently in ferns where the plasticity seems greater than in Spermatophyta. Forked, lobed, and crisped leaves occur in many genera. Sometimes these monstrosities seem to be inherited and of racial rank (4). Even precocious spore formation may be partly inherited.

Teratological aberrations merge gradually into individual variations. It is questionable whether an individual of Cassia minumoides L. with two ovaries is to be classed as a teratological or individual variation.

I will mention only a few examples of individual variation. Melchior found (5) some flowers in Aphantha masakapu Melch. with free anthers. Backer found individuals of Alystcarpus rugosus DC. with 2-3-foliolate leaves. The leaves of Cissampelos pareira L. are sometimes both peltate and non-peltate in one plant. Some specimens of Amaranthus spinosus L. are unarmed.

There is no end to this kind of individual variation which sometimes affects typically structural characters. Experiments are needed to ascertain whether these aberrant plants are sports of the genome and hereditary or not.


8. Phenotypic effect of altitude

G. Bonnier, and later F. E. Clements, experimented on the effect of altitude on plants. Bonnier even assumed that species might change under prolonged exposure to different conditions into other species but it seems that his experiments are untrustworthy (1).

In the Malaysian mountains where collectors are often compelled to follow ridges, plants from exposed situations are frequently brought home. Their foliage is often reduced, the leaves roundish, margins recurved, texture coriaceous, venation prominent, petioles reduced, habit compact. It is
not always certain that these characters are a 'normal feature' of the species. It is, therefore, of the greatest importance to try to collect such species from less exposed habitats (light, wind, poor soil), i.e. from the more fertile, sheltered, though less accessible slopes. Extensive notes and large collections may show that such variability exists and serve to define the position of transitional specimens. The same species may be a crooked gnarled shrub when growing on a ridge and a moderately tall tree 50 m lower on the slope.

The dwarfing of trees towards the summits of mountains and ridges is chiefly due to the gradual disappearance of the bole with increasing altitude. This is partly a consequence of the development of the young plants under a gradually increasing light intensity which stimulates branching close to the base. I observed a striking example in the field of dwarfing in *Casuarina junghuhuiana* Miq. on Mt Soeket, Idjen volcano, E. Java. Herbs too are generally dwarfed at high altitude, e.g. *Erigeron linifolius* Willd.

I studied an instructive case of variation induced by altitude combined with poor rocky soil in the grass *Isachne pangerangensis* Z.M. (fig. 11). A large series of transitions from tall to dwarfed specimens were represented.

An example of a 'hypselo-morphosis' which has been described as a local-endemic species is that of the fern *Histiopteris alte-alpina* v. A. v. R. (fig. 12) from the summit of Mt Kerintji, West-Central Sumatra, which is found at ca 3700 m alt., on a barren rocky ridge. This is certainly only a form of the common volcanophile *H. incisa* J. Sm.

It is difficult, however, to single out the various factors associated with increasing altitude viz more wind, sudden and large changes of temperature, strong insolation, poorer soils, lower atmospheric
pressure, different fluctuations of atmospheric humidity, greater difference between day and night temperatures, &c. In the absence of experiments one can only make some suggestion, in many cases based on observation in the field only.

I know of only few species which are hairier in the mountains than in the lowland, e.g. Hydrocotyle sibthorpioides Lamk, of which Blume described the hairy form as *H. hirsuta* Bl. nonal. However, glabrous forms of this species also occur on the mountains! An other example is that of *Dodonaea viscosa* (L.) Jacq.

Kurz (2) in his 'Sketch of the Vegetation of the Nicobar Islands' has remarked on the apparent absence of any general relation between hairiness and environment.

There is no general rule that flowers are brighter coloured in the mountains. *Ageratum houstonianum* Mill. has larger capitules and brighter blue flowers in the mountains than at low altitude but on Mt Pakiwang, S. Sumatra, I found the reverse (3), *Scutellaria javanica* Jungh. var. *sumatranas* Backer having here blue flowers at the base of the peak but white ones towards the summit.

Of *Dendrobium jacobsonii* J. J. S. (*§ Pedilium*) from the *Casuarina* forests 2400–2900 m alt. in East Java, J. J. Smith says that at Bandoeng at 700 m alt. cultivated specimens had smaller and paler coloured flowers with a slightly different flower shape: mentum not bent and differences in the labellum; the inflorescences were, moreover, sometimes 2-flowered (4).

Fruiting and flowering are also strongly influenced by altitude, as I demonstrated elsewhere (5).

Experiments on the influence of altitude, the morphological and physiological behaviour of Malaysian plants have been scarcely made. Trysmann made some observations in his pioneer work on Mt Gedeh in West Java but did not comment; Coster (6) wrote a note on the beech specimen planted by the former.

In the Malay Peninsula Ridley (7) made some notes on the acclimatization of plants and the ways in which they can be accommodated at low altitude.


Photo-morphosis

9. Epiphytes

It is sometimes wrongly assumed that epiphytism is confined to specific plants which are restricted to this mode of life. The amount of light appears to be the main factor. On the floor of closed forest the shade prevents epiphytes from making use of patches of bare soil, which in primary forest are always present. Exposed places, such as rocks, lava streams, landslides, poor silicious soils, mud streams and *solfatara*, however, offer conditions suitable for their growth, and are indeed often the places where many epiphytes are assembled, i.e. selected from the neighbouring forest. Though epiphytes may withstand dry conditions well, they mostly need a rather high atmospheric humidity which, in these exposed places, becomes a limiting factor. Most astonishingly rich communities of epiphytes I found on the often misty slopes of Mt Telong in S. Sumatra which from 1800 m upwards is like a rock garden carpeted with normally epiphytic orchids amidst luxuriant dripping cushions of hepatics and mosses with some isolated dwarf *Rhododendrons*. It is sometimes contended that these terrestrial epiphytes are *epilithes* but I have

Fig. 13. *Vaccinium laurifolium* Mtq. (*Eric.*) as a hemi-epiphyte, height ca 5 m, along a road above Tretès, 1500 m, N. slope of Mt Ardjoeno, E. Java.
also found them in deep humic soil between the rocks. I did not succeed in detecting any essential differences in habit between terrestrial and epiphytic specimens.

In other species, though, the terrestrial speci-

mens may differ considerably in habit from epiphytic; they become more rigid and condensed, often fastigiate. Vaccinium lucidum (Bl.) Miq., as an epiphyte is a loosely and irregularly branched shrublet with a tuberous woody base. Terrestrial specimens on ridges are mostly cupressus-shaped miniature trees without the woody tuberous base. Similar differences are found in Ficus deltoidea Jack of which the epiphytic and terrestrial specimens may differ considerably in habit.

It goes without saying that a proposal by Nakai (2) to distinguish the Ericaceous Agapetes and Vaccinium by a terrestrial habit in the latter and an epiphytic habit in the former did not meet with the approval of Sleumer.

Some species begin their life as epiphytes but, when their roots subsequently reach the soil, they may grow into trees and sometimes show no sign of their early history. Such is found e.g. in Ficus, Fagraea, Scheflera, Wightia (1), and I even found it once in Vaccinium laurifolium Miq. (fig. 13). Many, however, are equally able to germinate ter-

restrially and grow normally to trees. This is, in Wightia, even more common than the hemi-epiphytic habit. As a small tree it is gregarious on the sunbaked lava streams of Mt Idjen in East Java, but on the forested outer slopes of the same moun-

tain it is a semi-epiphyte.


10. Shade forms

Shade forms are found both in the lowland and the mountains. In general they possess larger, thinner leaves, longer internodes, &c. Shade and nor-

mal leaves may occur in one individual. A very good example is Gentiana laxicalis Z.M. de-

scribed from Java, which appears to be a shade form of G. quadrifaria Bl. Sometimes compact tussocks of the latter bear on one side shoots of ‘laxicalis’ in one individual plant (fig. 14).

Slender modifications of herbs can be observed in tall grass fields, comparable with those in temperate corn fields. These weeds growing in the damp dark micro-climate between the closely set culms of Saccharum spontaneum L., Andropogon ambio-

nicus (L.) Merr., etc. strive for light. They show reduced leaves and inflorescences in relation to their lank habit. All herbs unable to emerge from the tops of the grasses show a similar habit, a kind of etiolated growth combined with some degree of nanism.

For the effect of light on the habit of forest trees see the paragraph on savannah trees.

Hygro-morphosis

11. Influence of drought

Hardly anything is known of the influence of drought, and the changes induced by it in the morphology and physiology of Malaysian plants. In Gerbera jamesonii Bolus I observed in the dry year 1945 at Buitenzorg an astonishing reduction in length of the peduncles in relation to leaf length. The size of the leaves was very much reduced during the same period in Turnera subulata Sm. (T. trioniflora Ait.).

Similar behaviour is mentioned by Backer (1) in Jatropha gossypifolia L. var. elegans M.A., a plant which is thoroughly naturalized in the dry regions of Java and the Lesser Sunda Islands; dur-

ing the driest period of the dry season only minute, short-petiolate dark-brown leaves are produced. Flowering of some trees, e.g. Dipterocarpaceae, and probably bamboo coincides with unusually dry years. Higher fungi fructify after a dry spell.

Cited literature: (1) Onkruidflora Jav. Suiker. (1930) 411.

Hora-morphosis

12. Seasonal variation

Seasonal variation as described in Europe (1) I have not found recorded from Malaysia. In the cultivated Hibiscus subdariiflora L. I have seen fruiting specimens flowering a second time; these flowers, however, were only half the normal size and, also, paler in colour. Field botanists should search for ‘autumn forms’ in periodically dry regions.
Seeds of seasonal plants germinating in the wrong season may sometimes grow into dwarfs. I observed such forms also in Hibiscus sabdariffa L. at Buitenzorg. These dwarfs were 10-15 cm high and of some leguminous trees which produce leaves in flushes; the latter consist of pale or white or even pink-coloured limply hanging leaves which only slowly get their normal texture (Manihot).

The distinction between annuals, biennials and perennials causes many difficulties in species growing both inside and outside the tropics, specially when the duration of life is used as a character to establish taxonomic limits. I assume e.g. Centroplepis to be annual in N. Sumatra, though its perenniality in S. temperate regions is used as a distinctive generic character against allied genera. In some Gramineae species may be similarly variable, specially in tropical localities, and thus deviate from temperate representatives of the same species in a character which is, in grasses, generally assumed to be of importance for the delimitation of species if it runs parallel with other morphological differential characters. It is puzzling me how it is possible to interpret from herbarium specimens the duration of life of perennials flowering during their first year and collected in that state. The use of the duration of life as a character in keying out species must be limited to very clear cases based on wide experience.


Anemo-morphosis

13. Windforms

A peculiar aberrant habit in shrubs and trees can be caused by constant winds. I have described this from Noesa Penida and Bali (1) in Terminalia catappa L., Barringtonia asiatica (L.) Kurz, Calophyllum inophyllum L., Bischofia javanica Bl., Ficus sp., and Tamarindus indica L. (fig. 15). Other more recent examples are Dodonaea viscosa Jacq., near the Wijnkoops Bay, S. Java, and plants from Padaung Bolak in N. Sumatra described by M. van der Voort (2). These plants possess sometimes a peculiar oblique condensed one-sided habit and always show a decreased leaf size apparently owing to desiccation of the buds. They are found both on seashores and inland.


Edapho-morphosis

14. Fumarole plants

I have described (1) very aberrant modifications from some mountain summits viz Mt Ardjoeno in East Java (2) and Mt Agoeng in Bali (3) at 2900–3000 m alt. Some common lowland weeds, have through chance dispersal by wandering pilgrims and/or by deer established themselves in the immediate neighbourhood of fumaroles. Owing to the heat and moisture emitted by the fumaroles they are able to grow at these high altitudes. They are very much reduced in size and in habit very condensed, and their leaves are very small (fig. 16). Without
flowers their identification would be difficult. They live in what may be called 'open air hothouses' in the subalpine zone, and the altitude, insolation, &c. are doubtless the factors which have induced their

aberrant mode of growth and resulted in what seems to be an 'alpine habit'.


15. Rock plants; calcareous and silicious soils

Both rocks and silicious soils may bring about rather conspicuous changes of habit in some plants, apparently owing to the small amount of nutrients available. These modifications can occur either at low or high altitude.

Mr. C. N. A. DE VOOGD collected dwarf specimens of *Pemphis acidula* Forst. (fig. 17) on the rocky coast of SW. Java resembling subalpine 'Spa-

liersträucher'; normally this littoral species is a bush or small tree (fig. 18).

On the so-called 'padangs', the gravelly or sandy flats of various geological history which sometimes occupy large areas in Sumatra and Borneo, many species are dwarfed: *Leptospernum flavescens* Sm. when growing under optimal conditions is a medium sized cedar-like tree (fig. 20); here it is a dwarf, 10–20 cm high, which flowers and fruits abundantly (fig. 19). Many other species behave similarly. If herbarium specimens are not provided with good field notes, a botanist who has never visited the tropics is of course confronted with a puzzle. He may even find some other slight charac-

Fig. 17. Dwarf of *Pemphis acidula* Forst. (*Lythr.*) in flower and fruit, seashore of Oedjoeng Koelon, W. Java, × 2/5.

Fig. 18. Full-grown specimen of *Pemphis acidula* Forst., NE. coast of P. Tioman, Mal. Peninsula. (Corner)

Fig. 19. Flowering and fruiting dwarf of *Lepto-
spernum flavescens* J.Sm. (*Myrt.*) on dry sterile sands of Toba highlands, Central Sumatra, in a heath-like vegetation, × 1/2.
ter not known to occur in the normal population and may think that they represent a different species: in this way another ‘paper species’ is created. Residents in the tropics ought to experiment with seeds gathered from dwarf individuals. Abandoned mining grounds in Banka, Billiton and Borneo are rich in dwarf forms of the most diverse species, which flower precociously as very small individuals (1).

Flowers, an unusual character in the species (2). Though no experiments have been made it is likely to be an edaphical form only.

Scores of dwarfed species, mostly of shrubs or small trees but also of herbs (e.g. Dianella nemorosa Lamk. f. nana Schlitt. from Camarines and f. monophylla Schlitt. from New Guinea) occur in the Philippine Islands, and especially in New Guinea on ridges in the mossy forest and the sub-

Fig. 20. Full-grown specimens of Leptospermum flavescens J.Sm. (Myr.) on the slopes of Mt Bonthain, SW. Celebes. (L. van der Pijl)

On poor unweathered volcanic ash on the slopes of mountains the vegetation as a whole is dwarfed, e.g. on the slopes of the easily accessible Mt Lamongan, E. Java. Here the black gravel and sand is continually rejuvenated and gradually runs down. On these ash slopes all the common Javan mid-mountain trees and shrubs are dwarfed but flower and fruit profusely e.g. Radermachera gigantea (Bl.) Miq., Parasponia parviflora Miq., and Weimannia blumei (Bl.) Planch., &c. flower and fruit on 1–2 m high shrubs. This observation induces me to suspect that Radermachera brachybotrys Merr. from Leyte merely represents a dwarf specimen of some other species; Korthals found a similar specimen in the padangs of Borneo.

I have also found dwarfs on wooded limestone cliffs in NW. Bali at 100–200 m mostly of herbaceous species. One of them was so aberrant that I described it as a new variety, Anisomeles indica (L.) O.K. var. biflora Steen.; this had solitary alpine zone. No experiments have been done and the ‘normal’ habit of these plants is thus unknown.

On rock cones, e.g. Mt Idjen, E. Java (fig. 21) and Mt Agoeng, Bali, I found Casuarina (fig. 22), Vaccinium, Rhododenron as extremely small shrubs and ascribed this to the very poor soil, though on these cones the influence of climate and soil are not readily separable.

W. Troll found precocious spore formation in Gleichenia vulcanica Bl. on Mt Gedeh. This was certainly not caused by altitude but by the locally poor rocky soil. In cracks of rock on the summit Argapoera, of Mt Jang, E. Java, I have collected microphyllous specimens of a Polygonum which I originally took for P. chinense L. but which Danser afterwards identified as an aberrant form of P. runcinatum Don (fig 23). On Mt Kerintji were found minute fruiting specimens of Aralia ferox Bl. which I have distinguished as f. nana (3).
16. Solfatara plants

Specimens collected in craters are often of a surprisingly dwarfed habit even when old. SCHROTER (1) figured a dwarf plant of Vaccinium varingifolium Miq. of East Java which was probably 50 years old and had the appearance of some alpine 'Spalierstrauch'. At a short distance from these strongly insolated, edaphically dry and often wind-swept barren rocky places on slopes or summits, the same species occurs in hollows or other sheltered places as well-developed shrubs or small trees. The dwarf shrubs of craters are often wholly appressed to the soil (with rooting branches!), with a matted and prostrate habit. Owing to the poisonous gases emitted by the solfatara or effect of the wind on ridges, their surfaces are flat and look as if clipped or pruned (2) (fig. 21, 24). The solfatara may shift its outlet and so release these plants from its influence: I found some partly grown into a fresh bush, proving that the plant had recently escaped from the reach of the gases, the prostrate section being the oldest part. The reverse may also occur; erect shrubs may be affected later by crater gases (3) which makes them one-sided (fig. 25).

Fig. 21. Vaccinium varingifolium Miq. (Eric.) as poor prostrate shrubs ('Spaliersträucher') near Kawah Idjen, E. Java, ca 2000 m alt. Exceedingly poor, eroded, very young volcanic soil. This species also grows in the mountain forest on the ridge behind in ca 3-6 m tall trees.

Fig. 22. Casuarina junghuhniiana Miq. (Casuar.). Old dwarf from the summit of Mt Agoeng, Bali Island, 3100 m, on a rocky windswept cone, × 1/2.

Solfatara plants thus represent forms different in habit, and herbarium botanists must handle these materials cautiously. In a general sense the 'poor soil'-conditions cause nanism.

In Malaysia adaptability to habitat and variability in habit under extreme conditions is far greater than the average herbarium botanist suspects. It is difficult to interpret aberrant specimens from remote regions without a thorough field knowledge. Unfortunately this has led to the description of many 'paper species' which may seem specifically distinct but, when studied under various natural environments appear gradually to merge in the range of modifications existing in many Linnean populations.

17. Water- and swamp plants

Phenotypic variations comparable to those known in Europe are also known in the Malaysian flora. Jussieua repens L., when growing on muddy soil through the lowering of the water level, changes into a conspicuously different land form with minute hairy leaves and very condensed habit; it takes some time to recognize this land form (1). Land forms are also known in Potamogeton, e.g. from Sumatra, and in Utricularia.

Of Neptunia plena Bth, a land form is known. Backer suggests that the endemic N. javanica Miq., a terrestrial endemic species in Java, is merely a land form of the common N. oleracea Lour. (2).

Limnophila sessiliflora Bl. and L. indica (L.) Druce, in shallow water, have deeply divided leaves below the surface with gradual transitions to lobed and toothed upper leaves above the water level. In very deep water pinnatifid leaves predominate, but in marshy grass fields only pinnatisect to dentate leaves are present.

The amount of aerenchyma is closely related to the depth of the water.

Many swamp plants fail to flower in deep water, but come rapidly into bloom when the water recedes (Lemma, Blyxa, Pistia, Azolla, Salvinia, Marsilea, &c.).

Swamp forest trees are also affected by the amount of water in the soil. A conical base to the trunk, so well known in Taxodium, is found frequently in other swamp species e.g. in Gluta renghas L., Alstonia spatulata Bl., &c. but, in non-inundated soils, the swollen base of the trunk is not or scarcely developed.

The same is true of aerial roots at the base of the trunk. In deep swamps they may resemble the stilt roots of mangrove. Such roots may not develop in the same species when it is growing on dry land e.g. Acmena (Eugenia) operculata (Roxb.) Merr. & Perry. Root production in these cases is doubtless a direct response to the habitat.

Cited literature: (1) De Trop. Natuur 2 (1913) 83, fig. 3. (2) Schoolflora voor Java (1911) 428.

Fig. 23. Polygonum runcinatum Don. (Polygon.). Below: apex of a normal plant. Above: a very uncommon form of Mt Argapoera (Jang massif, E. Java) from clefts in rocks (St. 10960), × 2½.

Fig. 24. Sketches of prostrate clipped habit of shrubs in the crater of Mt Papandajan, W. Java, ca 2000 m, through the combined action of wind and sulphurous vapours from solfatara. Above: Vaccinium varingifolium Miq., below: Rhododendron retusum (Bl.) Benn. (Eric.) (drawn after photographs).

Fig. 25. Oblique growth of Vaccinium varingifolium Miq. caused by sulphurous gases of the crater of Mt Papandajan, W. Java, ca 2000 m alt., ca 1 m high.
Phyto-morphosis

18. Fungus and bacterial diseases, and symbiosis

Malformations caused by fungi have led to some errors in identifying Malaysian plants. *Loranthus maculatus* Bl. is, according to Danser, the common *Dendrophthoe pentandra* Miq. with a fungus on the leaves causing black spots (1).

In specimens of *Cassyythila filiformis* L. from New Guinea Dr Hatusima found some tetramerous flowers with a central column marked by little pits. The slender inflorescence was glabrous and the rest of the plant hairy. It was evidently a malformation caused by a Peziza-like Ascomycete.

Root deformities caused by *Cyanophyceae* are found in *Cycas, Gunnera*, &c.

Structures like witches' broom are often found in bamboos, and often regarded as immature flowering parts. These pseudo-flowers are galls caused by a fungus (fig. 26).

A curious malformation in *Pilea trinervia* Wight consisting of conspicuous swellings of the internodes was described by Mrs Weber van Bosse (2) and is caused by a parasitic alga: *Phytophyta treubii* W. v. B.

In Pavetta, bacteria cause dark often thickened spots in the leaves. According to Breemkamp the symbiosis is mostly restricted to particular species. Similar bacteria are found in species of *Psychotria, Ardisia*, the tips of the leaves of *Smilax*, &c. The presence of absence of bacterial nodules is used in the identification of *Rubiaceae*, a rather singular method.


Zoo-morphosis

19. Ant plants (myrmeco-morphosis)

Several Malaysian plants are inhabited by ants. Treub (1) proved that the cavities in which the ants live in the tubers of *Myrmecodia* and *Hydnophyllum* are also formed in the absence of ants.

In other instances, however, ants presumably bite their way into internodes and remove and carry away the pith. This was shown to occur in *Endospermum moluccanum* T. & B. (*E. formicarum* Becc.) by Docters van Leeuwen (2); I am able to confirm this. Docters van Leeuwen also found some specimens uninhabited by ants. In *Endospermum*, therefore, whether the internodes are hollow or not is certainly not a good specific distinction, hough used by Pax in his key to the species of

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Fig. 26. Pseudo-flowering of bamboo; galls caused by *Epichloe treubii* (*Fungi*). Bot. Gardens, Buitenzorg, Java.

Fig. 27. Above: *Kibessia sessilis* Bl. (*Melast.*). being based on a galled swollen fruit of *K. azurea* Bl. (W. Java). Below: peculiar galls of *Styrax benzoin* Dryand. (*Styrac.* from Sumatra, × 2/3.)
Endospermum subg. Capellenia (3). Moreover, as the other character used by Pax, viz. the number of coccii in the fruit, varies from 3–5, through ignorance of data on points the collector ought to have noted on the label, the whole key breaks down.

In Wightia borneensis Hook. f., some individuals are attacked by ants which remove the pith from the upper internodes. The withdrawal of the inner tissue causes the hollow internodes to assume a cigar-like shape.


20. **Galls deceptive to phytographers (cecidio-morphosis)**

Cecidia caused by animals have sometimes deceived botanists when describing plants. An example is Ceratostachys arborea Bl., a genus based on a galled fruit of Nyssa javanica (Bl.) WANG. Kibessia sessilis Bl. is merely the galled and enlarged fruit of K. azurea Bl. (fig. 27).

According to Ridley (1) Apteron lanceolatum Kurz, described as a distinct genus, is identical with Ventilago kurzii Ridl.; Kurz mistook some insect galls for the ripe fruit.

Miquel described (2) an abnormal tree from Sumatra which was actually a species of Styrax, a genus in which most peculiar galls (fig. 27) are very common.

**Otoptetum micranthum** Miq. is an Apocynaceae described from Java. According to Boerlage (3) the plant was referred to the wrong tribe because Miquel erroneously took galled flowers for 1-seeded berries; the former author suspects that it is related to Microchites.

Insects (mostly cicads and larvae of Hemiptera) cause a singular malformation of the flowers in some species of the genus Sterculia. H. C. Cammerloher (5) observed that they are attracted to so-called 'sugar hairs' which occur on the inside of the perianth. The insects injure both the hairs and the outer tissue in an early stage of development of the flower. The calyx becomes enlarged, thicker and tough, and opens hardly in anthesis; its lobes remain short and triangular, and the tube is relatively large. These flowers are conspicuously different from the normal 'uninhabited' flowers and, according to Adelbert (6), ought not to be used when describing or identifying plants.

Backer (7) described in Hibiscus schizopetalus (Mast.) Hook. f.: malformations of the vegetative parts and of the flowers caused by plant lice.

The Philippine species *Euphoria malaanonan* was described by Blanco and by him referred to Sapindaceae but Merrill stated (8) that it is merely based on specimens of the eichinate galls of Shorea guiso Bl. of the Dipterocarpaceae.

W. M. Docters van Leeuwen has published (4) an illustrated book on zoceecidia of Indonesia.

**Cited literature:** (1) Flora of the Malay Peninsula 5 (1925) 300. (2) Linnaea 26 (1853) 285. (3) Hand- leiding Fl. Ned. Ind. 2 (1899) 380. (4) The Zooe- cicdia of the Netherlands Indies, Batavia 1926;


21. **Influence of browsing animals (pasceo-morphosis)**

In some parts of Malaysia browsing cattle and deer (1) can induce changes in the morphology of plants which might be termed pasceo-morphosis. In

Fig. 28. *Casuarina junghuhniana* Miq. (Casuar.) on Mt Jang, E. Java; crown trimmed below by deer.

the deepark of the Buitenzorg Palace, deer regularly feed on the pendent air roots of *Ficus* and prevent them from reaching the soil. The trees therefore remain single-stemmed and do not form thickets of pillar-like roots.

A similar effect is caused by deer on Mt Jang, in East Java, where deer eat the hanging branches of *Casuarina junghuhniana* Miq. as high as they can reach (fig. 28). The trees look as if clipped (2) at the undersides of the crown like those on the lawns at Buitenzorg. Much the same was observed on Mt Rindjani, Lombok Island (3). The broom-like appearance of the grass *Pogonatherum panicum* Hack. on Mt Dieng was ascribed to grazing cattle by the late Mr Loogen (4), an excellent amateur field botanist.

Browsing of animals has in general the same effect on the vegetation as frequent burning: the plants acquire a low habit and flower at an early age (pseudo-nanism). This occurs very commonly on the closely cropped fields of fine grass of Mt
Jang. It is only in hedges, on steep slopes or somewhere out of reach of deer that plants grow to normal dimensions.

In Central and East Java, and the Lesser Sunda Islands pseudo-morphosis is due to browsing of cattle in the dry season; it is known in Zizyphus jujuba L., Streblus asper L. and other shrubs. These assume a fastigate habit as high as the browsing animals can reach: above about 2 m the twigs are again spreading and form a globular crown.

A transition to anthropo-morphosis is the clipping and pruning of plants which can sometimes produce an aberrant habit. According to Backer (5) repeated cutting of plants along roadsides produced a peculiar table-shaped densely branched form in Sida retusa L. near Batavia. In the Lesser Sunda Islands cattle are sometimes fed in the dry season with leaves of trees, as is done in Africa. For this purpose the people lop the lower branches of trees in order that cattle may reach the foliage. This causes a tendency to umbrella-shaped trees. Deer may cause the same change of habit.


**Anthropo-morphosis**

22. Influence of fire (pyro-morphosis)

The changes in habit and structural characters induced by fire were named pyro-morphosis by Perrier de la Bâthie who made observations in the island of Madagascar. In Malaysia there are few reliable data. One of the changes induced by regular burning of the vegetation is that plants are stunted, and flower when small.

Owing to the damage done to the surface part of the plant the underground parts thicken, and the upper portion of the rootsystem and lower portion of the stem form gradually a thickened half-subterranean 'lignotuber', which sprouts after fires have swept the plains. I made some observations in the Indramajoe plains (W. Java), where species of Grewia, Butea, Dillenia, Morinda, Phyllanthus emblica, Zizyphus, &c. sprouted from these thickened bases (1) (fig. 29).

Some instances of phytographical importance have come to my knowledge. Rant found (2, 3) that Psidium cujavillus Burm. f. can originate spon-
taneously from root shoots of *Ps. guajava* L. It is distinguished from *Ps. guajava* L. mostly by differences of size. *Ps. cujavilla* BURM. f. must, therefore, be reduced to a sport of *Ps. guajava*.

Fire-resistant trees are often crippled beyond recognition. Plants described from semi-arid (4) regions where fires occur annually are sometimes known only in this crippled state, e.g. *Fordia fruticosa* CRAB., from N. Siam, described (5) as a shrublet 40 cm tall. The late A. F. G. KERR, a most able and experienced field botanist, stressed in a note made in the field that the plant was growing in an area subject to fire; this may explain such a habit in this otherwise arboreal genus. The normal plant will, in all probability, prove to be a tree.


23. Pioneer plants

In the preceding paragraphs 9, 14-16, and 22, several examples have already been given of pioneer plants. I am decidedly of the opinion that this term should not be restricted to plants peculiar to landslides and other bare soils. Trees settling in savannahs or devastated areas, epiphytes settling on rocks, &c. are just as well 'pioneer plants'. They constitute seral vegetation types. In the initial stages of revegetation forest trees may appear as pioneer shrubs, flowering and fruiting early. It is rather baffling to find *Schima noronhae* REINW. flowering and fruiting as a lax shrub 2 m tall, when one is familiar with the gigantic full grown tree in the forest (height sometimes over 50 m, columnar bole over 1 m diam.). Backer found (1) near Batavia flowering specimens 15 cm tall of *Grewia microcos* L., usually a tree up to 17 m high. The same phenomenon can occur in *Adinandra*, various *Urticaceae*, *Leguminosae*, *Ulmaceae*, &c. In New Guinea some endemic species were originally described as tall trees but Mr BRASS has recently found them as gregarious pioneer shrubs in different seral vegetation types.

A promising shade plant, *Albizia sumatrana* STEEN., described from the Westcoast of Sumatra, was found to be a forest tree. In the plantations it is a weed tree flowering and fruiting at a very early age. In the forest, its native habitat, flowering is apparently suppressed by the deep shade, the seedlings grow into pole trees, slender and tall with a minute crown and real growth only starts when the crownlet emerges from the canopy. The behaviour and appearance of forest trees when growing in the open cannot be predicted. The adaptive capabilities of most Malaysian forest trees are unknown, though data on these points would be of great importance for practical forestry. See also chap. 2 on precocious flowering, a phenomenon frequently observed in pioneer plants.

*Cited literature:* (1) Flora van Batavia (1907) 196.

24. Savannah trees

Trees of the savannah generally differ in habit from trees of the closed forest in their short bole and spherical crown (fig. 30). If young forest trees

Fig. 31. *Altingia excelsa* Nor. (Hamam.) at Tjibodas, W. Java, *ca* 1450 m. Left: forest-grown tree, clear bole *ca* 25 m. Right: planted on the lawns of the mountain garden, at *ca* 200 m distance.
in deforested areas become exposed, or when they are planted as roadside trees, they acquire this shape: a striking example is *Altingia excelsa* Nor., a forest giant of the West Java midmountain forest between 600-1600 m. The clear bole is usually a characteristic feature of the tree; it is columnar, up to 1½ m in diameter, and up to 20-30 m from the ground unbranched (fig. 31). Specimens 50 years old, however, planted on the lawns at Tjibodas mountain garden, have grown into low spreading trees with hardly any bole at all (fig. 31). Descriptions of the habit of trees and shrubs taken from specimens grown in private and botanic gardens, will therefore generally not agree with those taken from specimens in the forest. THORENAAR made similar observations in Javan oaks, and other trees such as *Podocarpus imbricata* Bl., *Quercus*, etc. The habit of trees grown in open gardens resembles the shape of trees of the savannahs where the rounded crowns on a short bole often characterize the phisognomy of the open savannah forest. Physiologically this tree form is in all probability determined by the high amount of light present during the juvenile stages of growth. The crowns of mature forest giants exposed after deforestation also tend to become rounded.

### Variations Bound to the Genotype

(***Genotypic variation***)

1. General remarks 
2. Peloric flowers 
3. Other teratological or deviating forms 
4. Distribution of the sexes. 
5. Geographical segregation of Malaysian specific populations. 
   
   (a) Ecological 
   
   (b) Regional 
   
   (c) Topographical 
6. The problem of speciation 
7. The effect of isolation 
8. Centres of speciation in the Malaysian flora 
9. Centres of generic development in Malaysia 
10. Local-endemic species and genera 
11. Parallel or homologous variation 
12. Reticulate affinities. 
14. Adaptation and migration 
15. Hybrids in the Malaysian flora 
16. Polyembryony, parthenogenesis and apogamy 
17. The origin of native aliens 
18. The origin of Malaysian cultigens 
19. Extinct plant groups in Malaysia.

Variation bound to the genotype is intimately related to the species concept and to geographical distribution. The ideas advanced by J. D. HOOKER in his introductory essay to the *Flora Indica* (1855) have gained in 'philosophical' importance through the progress of basic research in experimental taxonomy in the last decades in Europe and the United States, in particular by E. BAUR, F. V. WETTSTEIN, N. H. NILSSON, G. TURESSON, A. MÜNTZING, Ö. WINGE, G. D. KARPECHENKO, B. H. DANSEY, W. B. TURRILL, J. CLAUSEN, J. P. LOTSZY, H. DE VRIES, N. I. VAVILOV, and many others. This work is summarized in several useful symposia and textbooks such as 'The New Systematics' edited by J. HUXLEY, CAIN'S 'Foundations of Plant Geography' and CLAUSEN'S *et al.*, 'Experimental Studies on the Nature of Species' (1945).

It lies outside the scope of this essay to consider the various view points on these subjects. Some of them I have already touched on in a study of Malaysian mountain plants.¹

Now I will try to explain briefly some current views, including my own, and will illustrate them by examples taken from Malaysian botany.

### 1. General remarks

Scientific names of species rest on the 'International Rules of Nomenclature' and depend on the identity of the 'type specimen'. This need not imply that only studies in which all type specimens have been examined, full synonymy is given, in which nomenclature is in accordance with the Rules, and in which new species or other *taxa* have been described by careful Latin descriptions, are sound and durable. I know some excellent works in which nomenclature is neglected and synonymy is obsolete, but in which botanical distinction and description are superb, and specific delimitation is carefully drawn. Such books give the impression that the author is master of his art.

I become more and more convinced that in the past two decades the care for outward appearance has come to take a too predominant share of the attention of some botanists who wrongly assumed that the examination of type specimens is the last word in real taxonomical research. It is sometimes not realized that type specimens often are only deficient, poor and miserably dried single plants chosen at random from billions of specimens growing in Nature in the past, the present and the future, which, together, according to the Linnean principle, compose the specific population. Very often these type specimens by no means represent the 'average' or 'most common type' of the population. The 'z-typicum'-distinction, therefore, has only nomenclatural, i.e. administrative but no botanical value.

It needs no comment that an up to date nomenclature is a *conditio sine qua non* for any taxonomic work, and it will be tried to reach a high standard in this Flora. At the same time, however, is is hoped that the contributors will not be satisfied when writing formally correct revisions, but also carefully consider the status of both genera and

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species and the structural differences distinguishing them, not merely limiting themselves to the distinction of *taxa* for reasons of convenience.

Inadequacy of material and lack of field knowledge are both sources for the provisional distinction of 'species of convenience', which mark, in tropical floras, as a rule the initial stage of exploration.

Whilst the inadequacy of material is an immovable obstacle, and not every revisor will have the privilege to acquire field knowledge, a large fund of experience has been collected on the subject of variation in tropical plants.

The following pages contain a discussion, valuation, and illustration of variation in Malaysian plants.

In general the new systematics, based on modern experimental taxonomy holds that a narrow species concept is not in accordance with the structure of nature.

Modern insight offers no support to so-called 'splitters', one of whom declared to me as his 'principle' that he felt obliged to distinguish the smallest distinguishable entities and to assign to these a binomium. On the average the standard of the specific concept proposed by LINNAEUS in his works and rules cannot be questioned and for binomiums the Linnean canon has priority of conception. I fail to understand how that conscientious splitter who in matters of nomenclature adheres strictly to priority and applies the binomial system of LINNAEUS can simultaneously call wide-spread polymorphic populations 'collective species'. To do so is intentionally to depreciate the time-honoured and scientifically sound Linnean standards.

The difficulties confronting the systematist are manifold; no clue exists to the causes of polymorphy. Systematists are still far from being able to explain why some species are polymorphic and variable and why others show a narrow amplitude of divergency. This is a fundamental barrier to the methods of 'weighing and measuring', a common basis in the natural sciences generally. Polymorphy is apparently not related to speciation, as monospecific units such as *Homo sapiens, Cocos nucifera,* &c. are very variable and species of large genera are sometimes not very polymorphic, though it will be observed that in most genera at least one species is widely distributed and rather polymorphic.

Ignorant of the laws underlying his taxonomic distinctions, the systematist should be aware that he deals with *inequal* entities, though we may try to shape them as consistently as possible.

A basic research in this connection is the work of the late E. BAUR, the geneticist, who made unsurpassed long-range efforts in the combined fields of taxonomy, field-work and experiments, to disen- tangle the genus *Antirrhinum sect. Antirrhinastrum* (1). This section had some dozens of local species described from the West Mediterranean distinguished by characters which were the despair of taxonomists. BAUR proved that the population of the section falls apart in numerous 'colonies' or 'partial populations' which are isolated and cross mutually (*convivia, sensu DANSER*). Each colony has its own type, the larger the colony the wider the local diversity (fig. 33c). All these local types can be freely intercrossed with fertile offspring, and there is no doubt that, if not isolated in nature, they would together merge into a still more diverse population with transitions and intermediates. BAUR, moreover, obtained experimentally many forms not realized in nature (*i.e.* p. 289), showing that the potential variability (2) or polymorphy (3), *i.e.* the total number of possible forms (genetic capabilities) is not exhaustively represented. There is a great reserve of possible combinations, and the genus manifests itself to us at present under a limited number of combinations.

Hardly any plant species is evenly spread within its area, and many occur in aggregates or colonies. BAUR's findings are thus of the utmost value for the Malaysian archipelago where isolation is a normal factor in specific populations, in the lowland owing to the insular discontinuous nature of this region and in the mountains still more accentuated by the often long distances between the summits. We cannot expect that the whole plant world will be subjected to accurate and thorough experimental research like BAUR's *Antirrhinum*-studies, but, judging from his results, it appears that geographical distribution is an important argument when determining the status of taxa. Well-defined allied species possess in general overlapping areas of distribution proving the independence of the populations. If, however, several allied species exclude each other geographically one must be on the alert, and check the differential characters again because the specific population may well be differentiated into a number of races, subspecies, or ecotypes.

Especially along the frontier—horizontal and altitudinal—of the area, a species population has a different *facies* from that at its centre. KERNER (4) showed that in *Cytisus sect. Tubocystis* aberrant forms occurred along the border of the area (fig. 33e). Migrating plant individuals (seeds, spores, fruits, root-stocks, &c.) carry only a part of the potential polymorphy of the genus, and their offspring will possess a special facies. Hence, along the frontiers, combinations can be expected which are not realized within the centre of the population. According to VAVILOV such pioneer aggregates are found to be recessive homozygous; this is of great practical importance.

It is worthy of note, as was pointed out by E. C. ANDREWS (5) that BENTHAM realized long ago that the geographical station of a 'waif' or colonist imposes variations upon it almost from the moment of its arrival. ANDREWS adds, that Eucalypts planted in New Zealand, California, *etc.* present marked differences in general appearance from the same species in Australia.

Stimulated apparently by HOOKER (6), HUGO DE VRIES (7), the Master of experimental taxonomic botany, remarked that the initial stages of new species will be found most easily in luxuriant alien vegetations. His classic example, *Oenothera,* showed these 'mutations'—which they indeed are if the
TAXONOMIC REVISIONS
ACERACEAE\(^1\) (S. Bloembergen, Buitenzorg)

I. ACER

LINNÉ, Sp.Pl. (1753) 1054; PAX, Pfl.R. 8 (1901) 1; K. & V. Bijdr. 9 (1903) 252.

Trees or shrubs, buds with many perules. *Leaves* decussate, petiolate, entire, palmate or pinnate, appearing simultaneously with the flowers or later, exstipulate. Inflorescence racemose, corymbose or spicate, terminal with 2–4 leaves, or rarely terminal or axillary without leaves. Monoecious or dioecious. *flowers* actinomorphic, \(\sigma\) and \(\varphi\). ovary in the \(\sigma\) fls more reduced than stamens in \(\varphi\) fls. Calyx and corolla 4–5-merous. Stamens 4–10, mostly 8, hypogynous or perigynous. Disc extramural or intrastaminal. Ovary superior, 2-celled, laterally flattened, each cell with 2 ovules. *Fruit* a samara, splitting into 2, rarely 3, winged usually 1-seeded parts. Seed without endosperm, radicle elongate, cotyledons foliaceous, or thickened, plicate, involute or flat.

Distr. *Ca 200 spp.* in the N. hemisphere, only in Malaysia crossing the equator.

Notes. By BLUME, BENTHAM & HOOKER, MIQUEL, \&c. this genus was included in the Sapindaceae. In Malaysia only one species.

\(1\) In Malaysia only one genus.


\(\frac{3}{8}\) mm (in \(\varphi\) slightly smaller and not dehiscent). Disc flat, glabrous to woolly. Ovary 2 mm broad, densely woolly, in \(\sigma\) (with the styles) usually strongly reduced. Styles 2, \(\frac{1}{2}\) mm long. Wings of *fruit* 4–7 by \(\frac{1}{2}\)–\(\frac{3}{4}\) mm, asymmetric and obovate, inside narrowed or straight, hairy; mericarp proper 8–13 mm long, ovate.

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Fig. 1. *Acer niveum* Bl. \(\times \frac{1}{3}\), flower enlarged.
Distr. Cf. fig. 2; in the Malay Peninsula recently collected in the hills near Cameron Highlands (CF. 27181, 27344, 36281, 37745, 45489), in W. Borneo once near Simpang at 27 m (bb 13518) and once in Sarawak (HAVILAND 2092), in the other islands many localities.

Fig. 2. Distribution of Acer niveum Bl.; in Borneo and the Malay Peninsula it is very rare.

Ecol. In primary, rarely in secondary or devastated, forests, often common but scattered, 900–2550 m, in Flores descending to 750 m, in Sumatra to 630 m, in Celebes to 450 m, and at only 27 m near Simpang, Borneo. Fls in April–Aug., fr. July–Nov. In Casuarina forest saplings have been found. When flowering the leafless crown swarms with Hymenoptera collecting honey. Trees are easily located in the forest by the fallen leaves which are glaucous and fine-reticulate-veined underneath.

Vern. Some dozens of native names have been recorded, none of these fixed (HEYNE, l.c.).

Uses. Timber unimportant, no distinct heart-wood is present; used for building purposes, fit for boxes.

Notes. PAX inserted A. niveum in his sect. Integrifolia in which the inflor. is terminal on short leafy twigs. I could examine this character in A. oblongum Wall. (Wall. 1222 A), A. laevigatum Wall. (THOMSON s.n.) and ‘A. niveum’ (HELPER s.n.) from India. A. niveum Bl. with its axillary leafless inflorescences is, however, possibly related to PAX’s sect. Lithocarpa and does not belong in sect. Integrifolia.

Excluded

Acer javanicum BURM. f. Fl. Ind. (1768) 221 = Actinophora fragrans R.BR. sec. BACKER in Herb. Bog.; according to BURRET it is Colona javanica, both Tiliaceae.
PHILYDRACEAE (C. Skottsb, Göteborg)


Distr. Centering in Australia, comprises 4 genera with 5 species.

KEY TO THE GENERA
1. Outer tepals free. Anthers spirally twisted. Ovary 1-locular
1. Outer tepals united at the base. Anthers straight. Ovary 3-locular

1. PHILYDRUM


Outer tepals free, inner ones more or less united at the base with the filament. Anther spirally twisted. Pollen grains in tetrads. Ovary 1-locular. Capsule loculicid. Testa spirally striate.

Distr. Monotypic, E.-SE. Asia, and Australia, rare in Malaysia.


Perennial caespitose herb, caudex short. Leaves densely rosulate, isolateral monofacial, glabrous, thick and of soft texture, 40-80 cm long incl. the sheath; sheath 14-30 by 1-11/2 cm and 2-4 mm thick. Scape 1 m high or more, slender, terete, glabrate below, villous towards the woolly inflor., with few cauline leaves gradually passing into the alternate bracts. Inflor. a terminal spike, simple or paniculate. Bracts ovate, clasping, abruptly acuminate and subulate, 2-7 by 3/4-1 cm enclosing the buds, reflexed in anthesis, again embracing the fruit. Flowers sessile, yellow. Perianth thin, outer tepals 12-15 by up to 10 mm, acute, ~-nerved, long-villous outside, margins inflexed, the posterior with 2 stronger veins and bidentate; inner petals united below 1–2 mm with the filaments, 8 by 2 mm 3-nerved, spatulate, base hairy outside. Stamen 8-9 mm, glabrous; anther ± spherical, 11/2 mm across. Ovary 6-7 by 2-3 mm, densely long-woolly; style 3-4 mm, glabrous; stigma broad-triangular long-papillos. Capsule triangular-oblong, 9-10 by 4-5 mm. Seeds ~, dark-reddish, bulb-shaped, 0.8-0.9 by 0.3-0.4 mm.

Distr. E. to SE. Asia (Riu Kiu Isl., Formosa, Kwantung, Hongkong, Indo-China, Siam, Burma, Andaman Isl.) and NE. Australia, in Malaysia: only in the Malay Peninsula, and in SE. New Guinea, to be expected locally elsewhere.

Ecol. In ponds, marshes, and rice-fields at low altitude, in New Guinea in sedge swamps and moist savannahs.

Notes. According to Merril (1915) the Cuming specimen credited to the Philippines came from the Malay Peninsula; the Hillebrand specimen is certainly erroneously believed to occur wild in Java.

2. HELMHOLTZIA


Tepals united to form a short cupular tube, the inner connate to half their length with the filament. Anther straight. Pollen grains single. Ovary 3-locular. Berry leathery, (apparently) indehiscent. Seed with long funicle, outer testa lengthwise striate and not spirally so.

Distr. 2 species, one in Australia, the other in E. Malaysia.
Fig. 1. *Philydrum lanuginosum* Banks, $\times \frac{2}{5}$ (after Banks & Solander).

Perennial herb. Rhizome stout, ascending to erect, woody, covered with leaf sheaths, up to 35 by 1–11/2 cm; roots coarse, shoots flat, fan-shaped. *Leaves* densely roslulate, ensiform, 75–150 by 3–41/2 cm; sheath 20–30 cm long, inside with scanty very long thin arachnoideous hairs, linear, acute, glabrous, of firm texture, a bundle veins on each side forms a prominent costa dissolving to the apex, with short oblique transverse veins; blade monofacial arched or horizontal, with secondary upper and lower surface. Scape terminal 25–50 cm, erect, obtuse-angular, upwards covered with a dense light-grey wool, leafless in its lower half, thence carrying 5–10 reduced ensiform leaves or spathe’s passing into bifacial alternate bracts. Branches of 1st order of the panicle supported by a spathe, the largest 10–40 by 111/2–3 cm, 2–3 lowermost with few branchlets of 2nd order 2–8 cm long. Bracts linear subulate 1–2 by 1/4–11/2 cm, 1–3-nerved, base woolly convolute enclosing the bud. *Flowers* sessile, white, glabrous except the 2–21/2 mm high tube. Outer tepals narrow-triangular, convolute with filiform apex, posterior one bicarinate-bicuspidate, with inflexed margins, 9–121/2 by 4–5 mm, anterior one 8–11 by 21/2–31/2 mm. Inner tepals and filament adnate to the tube, small, 1-nerved, 4–5 mm long, irregularly 3-dentate, free portion 11/2–21/2 by 3/4–11/2 mm. Free part of the stamen 31/4–33/4 mm; anther 2–21/2 by 1–11/2 mm. Ovary 2 by 1 mm densely grey-woolly. Style 3-sulcate, 21/4–41/2 mm long, stigma small triangular. *Berry* white, slightly 3-sulcate, 7–8 by 6 mm, pericarp tough leathery. Seeds ∞, 2–21/4 by 11/2 mm, cylindrical-flattened, often slightly curved, dark-brown with a transparent striate outer testa prolonged at both ends.

**Distr.** *Malaysia*: Moluccas (Ambon, Boeroe, Ceram) and New Guinea, 600–1500 m.

**Ecol.** In groups in muddy or moist, humic open spots in rain forests, and along ponds and margins of lakes. *Fl. & fr.* throughout the year.

**Notes.** Closely allied to *H. acorifolia* F. v. M. from E. Australia, which has an almost glabrous scape, a more robust habit, a trifle smaller flowers, outer petals hairy on the back, style 5–61/2 mm long, seeds mostly a little less than 2 mm.
ANCISTROCLADACEAE (C. G. G. J. van Steenis, Buitenzorg)

ANCISTROCLADUS


Scendent shrubs (often erect in youth), without resin; branches sympodial with a series of circinate woody hooks in one plane. Leaves spread, simple, entire, often rosette-crowded, cuneiform, penninervous, reticulate-veined, glabrous, both surfaces minutely pitted, each pit with a peltate small hair secreting a wax-like substance; petiole articulated, scar on the twigs often saddle-shaped; stipules absent. Flowers $\xi$, actinomorphic small. Inflo. few or several times dichotomous or spike-like, often provided with said hooks and single reduced bract-like leaves, branches often recurved. Pedicels articulated. Bracts with a glandular-thickened base, margin fimbriate-membranous. Calyx tube short, at length adnate to the base of the ovary; lobes 5 inequal imbricate, enlarged and wing-like in fruit. Petals 5, united at the base, slightly contorted in bud. Stamens mostly 10, rarely 5, the episperalous slightly longer. Filaments with broadened base; anthers basifixed, $\pm$ intorse to $\pm$ latrorse, 2-celled, opening lengthwise. Ovary for the greater part inferior, consisting of 3 carpels, 1-celled, protruding into a nipple-shaped elongation bearing 3 articulated erect styles with a punctiform or horse-shoe-shaped stigmatic apex; nipple enlarging in fruit. Ovule 1, basal, ascending, with 2 integuments. Nut not dehiscent, crowned by the enlarged calyx. Seed roundish with tests intruding between the cerebral-like folds of the endosperm. Exocarp leathery. Embryo straight, erect, obliquely placed; cotyledons diverging; hypocotyl rather thick.

Distr. Disjunct, ca 3 spp. in trop. W. Africa, and 9 in SE. Asia, from the Deccan to Burma, Indo-china, Hainan, S. China, the Malay Peninsula, Borneo and Sumatra (cf. fig. 2).

Uses. Except for some local information nothing is known (cf. Burkhill).

Ecol. In mixed rain forests, but most common on silicious soil in so-called ‘padang-scrub’, from the lowland to the hills. Kerr noted of A. wallichii (his no 7006) that all specimens grew erect, and it is reported by Gagnepain to be erect in youth. Ridley also found it on the ground as a bush, or ascending trees, and this is also observed in specimens from Sumatra and Borneo. In the open padang-scrub it is either erect or trailing.

Notes. This monogenic family has been subsequently been referred to several families; it is now mostly placed next to the Dipterocarpaceae but differs by the 1-celled ovary, basal ovule, peculiar endosperm, climbing habit, sympodial structure, absence of stipules, and presence of hooks. Hallier f. brought it to the Linaceae-Hugoniaceae, suggested already by Miquel. The bark of the twigs shows a peculiar cracking $viz$ lengthwise superficial splitting of the thin grey corky outer bark and further by deeper transverse cracks. In A. extensus I found peculiar rather large crateriform glands on the base of the bracts of the inflo. Similar glands I found on 2–3 or all 5 sepals, distinctly elevated, 1–3 together. I have not found any stipules, neither in A. extensus nor in abundant living material of A. hamatus (Vahl) Gilg; there are rather large bracts leaving scars amidst the leaf-tuffs but these belong apparently to the leaf-spiral. Gagnepain (Fl. Gen. I. C. 1 (1910) 393) mentions 3–5 styles, but I found only 3. Hutchinson (Fam. Fl. Pl. 1 (1926) 178) apparently assumes the style to be represented by the nipple-shaped extension of the ovary above the calyx on tip of which 3 free stigmas are articulated, but the tip of the latter I found distinctly ‘stigmatic papillose’ so that I assume the styles to be articulated with the ovary. The stigmatic surface is punctiform or horse-shoe-shaped. The nipple enlarges in fruit and forms a distinct part of it. All authors assume the presence of a ruminating endosperm, but Hutchinson
denies its presence and assumes the embryo to be constituted of remarkably 'folded cotyledons'. I had no seedlings at my disposal but an examination of the seeds did not confirm Hutchinson's statement. The embryo is lying loose in the endosperm.

The flowers are mostly deficient or absent in our rather rich material and when drying shrink to poor and brittle remnants. However, in *A. extensus* I found laterally slit anthers and not introrse cells, contrary to Gagnepain's statements. Boerlage mentions slits which are turned somewhat towards the inner surface.

The size of the leaves varies much both in shape and dimensions in one specimen, specially between sterile and fertile twigs. In cultivated *A. hamatus* I found leaves of flowering twigs 6–9 by 2–2½ cm, and those of sterile twigs 35–40 by 4½–5½ cm. Notwithstanding the scanty flowering material I am perfectly satisfied that only one species occurs in Malaysia.


Leaves crowded mostly immediately above the 2nd hook, variable in size and shape, sessile, mostly obovate-oblong, tapering towards the base, apex obtuse, rounded, acute or even acuminate, blade 9–30 by 3–10 cm; nerves 4–8 on either side, spreading, connected by a slightly looped intramarginal vein and a 2nd feebler outer one, rather straight, numerous secondary veins often becoming as strong as the main nerves and parallel. Inflor. between the crowded leaves, very rarely lateral in the place of a 'tendril' on the main shoot, repeatedly dichotomous, branches divaricate, 8–15 cm long. Flowers rather crowded at their tips. Calyx lobes inequal, oval, thin-margined, glabrous except the short ciliate rounded apex, some or all lobes provided with 1–3 conspicuous crateriform prominent glands, mostly shorter than the corolla, 1½–2½ mm long, soon enlarging. Petals oblique-oval, one margin often involute, acute, 3–3½ by 1½ mm. Styles erect, nearly as long as the nipple-shaped ovary-

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**Fig. 1. Ancistrocladus tectorius** (Lour.) Merr., from Borneo, × 2/5.

**Fig. 2. Localities of Ancistrocladus tectorius** Merr.
top, both $\frac{1}{2}$ mm high, stigma punctiform. Stamens alternately unequal; filament broadened at the base; cells free, acute, more or less latrorse. Fruit with spreading calyx wings slightly decurrent on the obconical sub-5-angular smooth tube, oblong-cuneate to spatulate, unequal, often oblique, apex blunt to rounded, with 3 larger nerves and numerous smaller densely reticulate ones, overlapping at the base, smallest mature ones measured $2\frac{1}{2}$ by $1\frac{1}{2}$ cm, largest 5 by $1\frac{3}{4}$ cm: nipple broad-obcampanulate, $\pm$ 3 mm high protruding, solid, not filled with part of the seed. Seed obconical with flat apex, ca 5 mm high, mostly consisting of a ruminate endosperm; germ ca 2–2$\frac{1}{2}$ mm high, erect, straight, obliquely inserted.

**Distr.** Burma, Siam, the Andamans, and Indo-China to S. China and Hainan, in *Malaysia*: Malay Peninsula, Riouw & Lingga Arch., Anambas Isl., W. Dutch Borneo, Karimata, Banka, Billiton, once collected in S. Sumatra (fig. 2).

**Ecol.** Low altitude, often near the sea, sometimes on the margin of the beach, mostly on silicious soils, both in mixed forest and padang scrub fr. fl. March-Aug.

**Vern.** *akar* (be)boeloes, beloeloes, meloeloes (Banka), mendjoeloeng (Lepar), troeng boeloes (Billiton).

**Notes.** I agree with Burkill that no differences of importance can be found between *A. extensus* and *A. pinangianus*. I have tentatively accepted Merrill’s name, though Moore stated that the type in the Br. Mus. is inadequate for specific identification. It was collected in the classical locality but I am not satisfied that no other species grows there; in tropical regions the identification ‘by exclusion’ is a somewhat dangerous procedure.

**Excluded**

*Ancistrocladus sagittatus* WALL. = *Tetramerista glabra* MIQ. (Theac.).
APONOGETONACEAE (C. G. G. J. van Steenis, Buitenzorg)

I. APONOGETON

LINNÉ f. Suppl. (1781) 32; ENGL. & KRAUSE, Pfl. R. 24 (1906).

Perennial laticiferous freshwater herbs, rhizome short tuberous with fibrous roots. Leaves radical, submerged or floating, base sheathing, oblong to linear, entire or crisped, often long-petiolate; nerves lengthwise parallel, connected by numerous oblique transverse veins. Spike emerging from the water, simple or 2-8-forked, without bracts, subtended by a mostly caducous basal sheath (spathe). Flowers bisexual (rarely by abortion unisexual), small, spicate-scopose, white, rose, purple, yellow or yellowish-green. Perianth segments 2 (1-3, or absent), equal or unequal, usually persistent. Stamens in 2 rows, 6 (or more), free, hypogynous, persistent; filament filiform; anthers extrorse, small, 2-celled. Pollen subglobose or ellipsoid. Gynaecium superior, apocarpous; carpels 3-6, sessile, each with a simple style. Ovules 1-8 (or more), anatropous. Mature carpels inflated, opening along the back. Seeds without endosperm; outer testa often loose; embryo straight, elongate.

Distr. About 40 spp. described, Africa, Madagascar, Ceylon, SE. Asia, through Malaysia (very rare) to N. Australia, centering in Africa and Madagascar.

Ecol. The few Malaysian specimens were collected in lowland stony streams both on calcareous and other rock. The testa contains in some spp. air between the two coats and float on the water; it soon decays and the embryo sinks to the bottom. Uses. The starchy tuberous rootstock is said to be edible in some spp.

Notes. Monogeneric family. Next to the single indigenous species, A. fenestralis with its unique fenestral-leaved foliage is cultivated in the Bot. Gard. Buitenzorg, and may be found in private gardens as a curiosity.


Submerged; rootstock roundish 1/2-1 1/2 cm. Leaves green or brown, distinctly petiolate (2-15 cm), blade linear-spathulate, 10-35 by 1-4 cm, mostly gradually tapering into the petiole, base narrow-cuneate, apex rather broadly cuneate and ± blunt, primary nerves 2 on both sides and a marginal vein; parenchyma opaque dotted brown-punctate; margin slightly undulate-crisped to ± flat. Scape 5-40 cm. Spathe 1/2-1 1/2 cm long, ovate-acute, lengthwise nerves, persistent, decaying gradually from the apex towards the base, green, concave, subamplexicaulous, apex mucronulate. Flowers greenish-yellow, the lower ones over 2-3 cm densely set and

Fig. 1. Aponogeton loriae Martelli. Plant × 1/2, flower, tepal with stamen, stamen, and fruit enlarged (after Martelli).
with developing fruits, stamens about equaling the tepals on 2 mm long filaments, the upper ones rather abruptly as it seems male with 3 mm long stamens, very small ovaries and flowers set laxly to remote. Spikes 1 1/2-7 elongating in flower up to 18-20 cm. Tepals obovate ca 1 1/2-1 3/4 by 1-1 1/4 mm, concave, apex broadly rounded. Stamens 6; anthers roundish oval, no dehisced ones observed by me. Carpels 3, ca 2 1/2 mm long, ovate, ± bluntly trigonous, rather abruptly beaked by a distinct recurved rostrate style about 1/2 mm long. Seeds (in TEYSMANN 12792) 1-6 with a delicate loose outer coat 6-winged or -ribbed, transparently brown-reticulate-netted-celled, 2 by 2/3 mm. Inner testal coat oblong, opaque, darkbrown, smooth, 1 1/4 by 1/2 mm, closely enveloping the straight embryo, easily splitting on slight pressure, rounded at both sides.


Ecol. In shallow stony streams in forests and savannahs, 100-600 m.

Notes. There is a remarkable yet unexplained dimorphy in the flowers of the spike, the lower ones setting fruit only and differing in length of anthers.
BURMANNIACEAE (F. P. Jonker, Utrecht)

Annual or perennial, saprophytic or autotrophic herbs; the saprophytic species often colourless. Leaves usually spread or alternate, entire, simple, without stipules; non-saprophytic species with a radical rosette of linear leaves; stem leaves often reduced to small scales; sometimes the basal part of the stem provided with many decurrent, grass-like leaves. Flowers ♀, usually actinomorphic, solitary or in capitulate or cymose inflorescences. Perianth corolline; limb consisting of 2 whorls; tube sometimes 3-winged. Anthers 3, subseissile in the perianth throat and dehiscing laterally with horizontal slits, or 6, hanging down in the perianth tube and dehiscing with longitudinal slits. Connective large, often appendiculate. Style filiform or shortly cylindrical or conical. Stigmas 3, sometimes connate. Ovary inferior, 1-celled with parietal placentation, or 3-celled with axile placentation. Ovules ∞, anatropous, with 2 integuments; funicles often rather long. Fruit usually capsular, sometimes fleshy, crowned by the persistent perianth tube and the style, or by a thickened persistent basal ring of the perianth tube, dehiscing irregularly or with transverse slits at the top. Seeds ∞, small, subglobose to linear, sometimes with loose, reticulate testa, with endosperm.

Distr. About 125 species, widely distributed in the tropics of both hemispheres, also in subtropical America, Chinese area, Moçambique, Southern China, Japan, Southern Australia, New Zealand and Tasmania. As many species are rare, it is possible that only a part of their area is known. Most of them are found in moist regions. Among the autotrophic Malaysian Burmanniaceae there are 3 rather common species which are widely spread, viz Burmannia coelestis, B. disticha and B. longifolia. The latter two are absent from Java and the Lesser Sunda Islands, the former occurs in Java proper only in its western part. Of the saprophytic Malaysian species only 3 have been often collected, viz Burmannia championii, B. lutescens, and Gymnosiphon affinis.

Ecol. The autotrophic species provided with green leaves occur in grass-fields, along road sides and river-banks, among brush-wood and in forests or on moist swampy soil, up to about 3000 m alt. The saprophytic species usually occur in dense primary or secondary forests on soils rich in humic matter by decaying wood and leaves, up to ca 1500 m alt. They are also found sometimes in bamboo bushes and parks.


In collecting Burmanniaceae it is necessary to collect plants with complete flowers, as the limb with the stigmas and stamens is often caducous. The fruits are also important. The colour of the flowers, stems and leaves must be noted. Preservation of collections in 60% spirits is recommended.

In the field the saprophytic species are often found in colonies together with other saprophytic plants belonging to the Orchidaceae, Triuridaceae, and Gentianaceae. From the extreme rarity of a number of species it may be assumed that by further collecting these tiny plants several novelties will be found.

KEY TO THE GENERA

1. Perianth tube cylindrical or trigonous, persistent on the capsule. Style of equal length as the tube. Anthers 3, subseissile in the perianth throat. Thecae dehiscing laterally with transverse slits

**TRIBE Burmannieae Miers**

2. Ovary and capsule 3-celled with axile placentation. Perianth as a whole persistent on the capsule. Ovary without glands. Capsule mostly dehiscing irregularly

3. Inner perianth lobes free, or converging at their tops or connate to a mitre with 3 holes, the latter without appendages at the apex

4. Mitre crowned by 3 erect, thick, filiform appendages, clavately swollen at their tops

5. Scaphiophora
1. BURMANNIA

Linné, Sp. Pl. ed. 1 (1753) 287; Jonker, Monogr. (1938) 18, 57.

Annual or perennial, saprophytic and colourless or chlorophyllose. Flowers often 3-winged. Perianth limb usually consisting of 6 lobes; the outer ones being much larger; inner 3 often minute, sometimes lacking. Perianth tube cylindrical to trigonous. Anthers 3; connective sometimes with 2 apical crests and/or a hanging, median, basal spur. Style filiform, branching into 3 short branches, each bearing a stigma, or 3 sessile stigmas at the apex of the style. Ovary trigonous. Fruit capsular, mostly dehiscing irregularly. Seeds many, oblong or ellipsoid.

Distr. 57 species, tropics of both hemispheres, also in the S. United States, S. part of S. America Moçambique, S. China, Japan and S. Australia.

**Key to the Species**

1. Perennial, leafy green herbs. Greater part of the stem beset with grass-like, linear or ensiform, decurrent, imbricate leaves. Inflorescence usually many-flowered. Flowers hanging, very narrowly 3-winged in the basal part. (Sect. Foliosa Jonk.). 1. B. longifolia

2. Non-saprophytic, chlorophyllose herbs with a rosette of green leaves at the base; rosette often consisting of only 1–3 leaves.

3. Flower wings narrower than the perianth tube or reduced to ribs.

4. Basal rosetulate leaves few. Stem bearing 1–2 flowers at its apex. Connective with 2 apical crests, basal spur lacking. Ovary as long as the perianth or longer. 2. B. geelvinkiana

5. Basal rosette well developed. Stem bearing at its apex a usually bifid inflorescence. Connective provided with 2 apical crests and a basal, hanging spur. Ovary shorter than the perianth.

3. B. bancana

6. Robust herbs with a well-developed rosette of grass-like, up to 15 cm long leaves. Inflorescence usually a bifid, many-flowered cyme.

7. Flowers wingless, 3- or 6-costate.

8. Stem scales many, imbricate in the lower part of the stem. Ovary as long as the perianth or longer. 7. B. sphagnoides

9. Stem scales not imbricate. Ovary shorter than the perianth.

10. Inflorescence usually capitate. Inner perianth lobes spathulate, sometimes slightly papillose. Connective mucronate at the apex, obtuse at the base.

11. Inner perianth lobes absent.


14. Secondary plants, often many-flowered. Inner perianth lobes minute, orbicular. Flower wings variable, linear to half cuneate or quadrangular.

15. B. malasica
1. **Burmannia longifolia** BECC. Malesia 1 (1877) 244; JONKER, Monogr. (1938) 20, 59.—B. leucantha SCHLTR. Bot. Jahrb. 49 (1913) 107.—Fig. 8.

Perennial. 12-50 cm. Stem usually simple, forked at the top into the bifid inflorescence or bearing a simple cincinnus. Leaves linear, sometimes keeled, decurrent, stem-clasping, acute, sometimes subulate, parallel-veined but midrib more prominent, growing smaller towards the top, 4-20 cm by 2-9 mm. Upper part of stem beset with appressed, scattered, lanceolate, acute scales, 5-33 mm. Basal part of stem with brownish, dried leaves. Inflorescence 32-1-flowered, branches up to 4 cm. Bracts scale-like, linear-lanceolate, 5-10 mm. Flowers subsessile, hanging, white, often with pale-violet or bluish limb, 8-16 mm. Outer perianth lobes deltoid, acute, 2-41/2 mm; margin fleshy at the base. Inner ones broad-ovoid to orbiculate, entire and rounded, or retuse, or bilobate, 11/2-2 mm. Perianth tube cylindrical, sometimes swollen in the upper part, 3-5 mm; lower part of tube and ovary very narrowly 3-winged. Stamens inserted just below the inner perianth lobes. Connective broad, oblong, crowned by two, rather wide crests. Filaments short, broad. Style thick, branching into 3 very short branches, each bearing a curved funnel-shaped stigma. Ovary obovoid, 4-7 mm. Capsule obovoid, dehiscing transversely, irregularly. Seeds obovoid to scobiform, appended at both sides; testa loose, reticulate.

Distr. All over Malaysia, except Java and the Lesser Sunda Islands.

Ecol. In mountain forests, brushwood, along mossy trails, often on ridges, scattered, ascending to 2800 m alt.

2. **Burmannia geelvinkiana** BECC. Malesia 1 (1877) 244; JONKER, Monogr. (1938) 111.

Annual, 7-12 cm. Stem filiform, simple, bearing 1 or, sometimes, 2 flowers. Rosulate leaves 2-5, linear, subulate, 3-nerved, 3-5 mm by 1 mm. Stem leaves scale-like, appressed, linear-lanceolate, acuminate to subulate, up to 3 mm. Bracts ovate-lanceolate, long-acuminate, 3-nerved, 11/2 mm. Flowers bluish, very narrowly 3-winged, 7 mm. Outer perianth lobes triangular to broad-ovate, apiculate, about 11/2 mm. Inner ones linear, obtuse, 1/2-1 mm. Connective thick, triangular, obtuse at the base, bearing two divergent, slightly papillose crests at the apex. Style rather short and thick, bearing 3 sessile, funnel-shaped stigmas; style with stigmas about 11/2 mm. Ovary ellipsoid to narrowly obovoid, about 4 mm. Flower wings linear, about 51/2 mm by 1/4 mm. Capsule obovoid, dehiscing with transverse slits. Seeds ovoid, bright yellow.

Distr. **Malaysia**: West New Guinea (Wadammen Peninsula, Geelvink Bay), once collected.


Annual, 20-37 cm. Stem simple, terete, forked into the inflorescence. Rosette distinct; leaves many, linear to lanceolate, subulate, parallel-veined, 21/2-7 cm by 6 mm. Stem leaves few, scale-like, appressed, lanceolate, subulate, 1-3 cm. One rosette sometimes bearing 2 or 3 stems. Inflorescence a double cincinnus, 3-5-flowered; branches up to 3 cm. Flowers blue or purplish, narrowly winged, 6-13 mm. Outer perianth lobes lanceolate-triangular, acute, with 3 prominent, fleshy nerves inside, up to 3 mm. Inner ones linear-lanceolate, obtuse, up to 21/2 mm; midrib prominent, fleshy. Perianth tube cylindrical-trigonal, up to 41/2 mm. Connective oblong, provided with a basal, hanging, obtuse spur and 2 apical, divergent obtuse styles. Style filiform, branching into 3 short branches, each bearing a slightly curved, funnel-shaped stigma. Ovary truncate-ellipsoid, 3-7 mm. Flower wings linear, 11 by 1/2-1 mm. Capsule ellipsoid to obovoid. Tests of the seeds elongate.

Distr. **Malaysia**: Sumatra, Banka, Billiton, Borneo.

Ecol. Wet places, along streams, &c.

Vern. *Roempoet taroem, oemboet oemboet* (Billiton).


Robust annual, up to 75 cm. Stem usually simple, forked into the inflorescence. Rosette distinct; leaves linear or lanceolate, acute, up to 15 cm by 13 mm. Stem leaves reduced to appressed, lanceolate, acute or acuminate scales, up to 7 cm by 7 mm, imbricate in the lower part of stem; upper part of stem often leafless. Inflorescence branches up to 8 cm. Bracts lanceolate, acute, about 5-12 mm. Flowers sessile or shortly pedicellate, blue or purplish, often with yellow-tipped, greenish lobes, rarely yellow, 10-20 mm. Outer perianth lobes triangular, acute, 21/2 mm; margin thick, double in the basal part. Inner lobes linear-lanceolate, fleshy, obtuse, 1-11/2 mm. Perianth tube cylindrical-trigonal, 3-41/2 mm. Connective broad, provided with 2 distinct, acute apical crests and a broad, obtuse to almost truncate, basal, hanging spur. Style thick-filiform, bearing 3 sessile, funnel-shaped stigmas; style with stigmas about 3 mm. Ovary ellipsoid to obovoid, truncate, attenuate towards the base, up to 1 cm. Flower wings elliptical, 10-18 by 11/2-21/2 mm, continuing as crests on the back of the outer perianth lobes, decurrent along the short pedicel. Capsule obovoid, truncate, irregularly dehiscing with transverse slits.

Distr. Widely distributed in the tropics of Asia and Australia: Ceylon, India, Siam, Indo-China, China, through Malaysia to Australia, in *Malaysia* hitherto not found in Java, the Lesser Sunda Islands, Moluccas, and Philippines.

Ecol. A species with a large ecological amplitude. It has been collected in brushwood, swamps and bogs among *Sphagna*, moist hollows, open grasslands, mountain meadows, marshy plateaus, on bare rocks, and has even been recorded as growing in water; ascending to ca 3500 m alt.

Vern. *Si goeroe goeroe* (Sumatra).

Autotrophic annual, up to 30 cm. Stem simple or, sometimes, branched, bearing a single flower or a cluster of few flowers. Rosulate leaves linear or lanceolate, acute or acuminate, 3-nerved, about 1 cm by 1½-3 mm. Stem leaves appressed, imbricate in the basal part, linear-lanceolate, subulate, rather long, up to 2 cm. Bracts lanceolate, acute, 4 by 1 mm. Flowers prominently 3-winged, blue, purplish or white, often with yellow lobes, about 11½ mm. Outer perianth lobes ovate, apiculate, with double margin, about 1½ mm. Inner ones lanceolate, apiculate, with double margin, about ½ mm. Tube cylindrical-trigonous, about 5 mm. Connective provided with 1 apical, divergent, obtuse to truncate crests and a basal hanging, rather long, obtuse spur. Style thick-filiform, bearing 3 sessile, funnel-shaped stigmas with swollen margin. Style with stigmas about 4 mm. Ovary ellipsoid to obovoid, truncate, attenuate towards the base, about 5 mm. Flower wings half elliptical to half obovate, about 10 by 2½ mm. Capsule obovoid, truncate, transversely dehiscing.

Distr. Widely spread in tropical Asia: India, Siam, Indo-China, S. China, and the Caroline Islands, in Malaysia throughout the Archipelago, in Java only in the W. part, once collected in the S. part of Madoera Island, and once in Bali, otherwise absent from the Lesser Sunda Islands.

Ecol. Grass-fields, among alang-alang (Imperata), in mountain meadows, parks and plantations, ascending to ca 1700 m alt.


Autotrophic annual, 15-30 cm. Stem simple, bearing 1-3, shortly pedicellate flowers. Rosulate leaves few, linear, acute or acuminate, 1-nerved, 4-8 by 1 mm. Stem leaves scale-like, appressed, linear, acute, 2-5 mm. Bracts linear-lanceolate, acute, 1½ mm. Flowers prominently 3-winged, 6-8 mm. Outer perianth lobes acute, with involute margin, 1 mm. Inner ones broadly ovate, obtuse, nearly ½ mm long. Perianth tube cylindrical, 3 mm. Connective rather broad, provided with 2 apical, divergent, obtuse crests. Thecae bright yellow, appressed against the connective and connate below the basal connective margin. Basal hanging spur lacking. Style as long as the tube, bearing 3 short branches, each bearing a petaloid, disk-shaped stigma. Ovary ellipsoid to obconical, 2½-4 mm. Flower wings half obovate, decurrent along the pedicle, 8 by 2 mm. Capsule ellipsoid, dehiscing with transverse slits, 4-6 mm. Seeds scobiform, yellow.

Distr. Malaysia: Sumatra, Eastcoast Residency (Kota Pinang, Soengei Kana).


Saprophyte, 4½-12 cm. Stem simple, thick, beset with many lanceolate, acute, in the lower part imbricate, 3-6 mm long, scale-like leaves and bearing 2-5 subsessile flowers at the apex. Bracts broad-lanceolate to ovate, acute, 3-6 mm. Flowers 6-costate, white, about 8½ mm. Outer perianth lobes broadly triangular, with swollen margin, about 8½ mm. Inner ones fleshy, obtuse to rounded, papillose, almost 1 mm. Perianth tube cylindrical, about 2 mm. Connective oblong, acute at the base crowned by 2 divergent, obtuse crests. Style thick-filiform, bearing 3 sessile, obconical stigmas. Ovary large, broadly ellipsoid to subglobose, 4-5 mm.

Distr. Malaysia: Malay Peninsula, Sumatra (Eastcoast Res.), and Borneo (Sarawak).

Ecol. A rare species, occurring in decaying matter in forests.


—Fig. 1.

Saprophyte, 5-13 cm. Stem simple or branched, beset with scale-like, ovate to lanceolate, 1-nerved, sometimes distichous, up to 5 mm long leaves and bearing 1 flower or branching into a bifid, up to 9-flowered cyme. Flowers shortly pedicellate, 6-costate, white or somewhat purplish, 9-13 mm. Limb fleshy. Outer perianth lobes triangular, obtuse, with involute, crenate margin, 1½-2 mm. Inner ones ovate to orbicular, 1½-4½ mm. Perianth tube cylindrical-trigonous, 2½-5 mm. Connective obtriangular, crowned by 2 divergent, papillose crests. Style thick-filiform, branching into 3 short branches, each bearing a somewhat funnel-shaped stigma with a broad, rotundate, membranous, hanging appendage. Style with stigmas 4½-6½ mm. Ovary ellipsoid, 3-6 mm. Seeds ovoid, brown. Flower wings reduced to narrow, linear ribs.

Distr. Malaysia: West Java (vicinity of Buitenzorg) and Enggano Island (off SW. Sumatra).

Ecol. Among decaying leaves in forests, ascending to 1000 m alt.


Saprophyte, 2-18 cm. Rhizome tuberous or elongate, covered with hair-like roots, producing small, adventitious tubers. Stem simple, beset with lanceolate, acute, appressed, scale-like, 1½-4 mm long leaves. Bracts lanceolate, acute, about 3 mm. Flowers subsessile in a capitate inflorescence at the top of the stem, 3-costate, white, 5-12 mm. Outer perianth lobes triangular, acute, with involute margin in the upper part, 1-2½ mm. Inner ones spatulate, rounded, slightly papillose at the margin, about ½ mm. Connective broadly oblong, obtuse at the base, crowned by 2 indistinct, divergent, obtuse crests and provided with a median small
point at the apex, usually directed inwards and then hardly perceptible. Style thick-filiform, bearing 3 subsessile funnel-shaped stigmas; style with stigmas 3 mm. Ovary ellipsoid to obovoid, 2–3 mm.

about 2 mm, in the upper part provided with small, rounded, crenate lateral lobes. Inner ones broadly obovate, rounded, papilllose at the margin, 1/2 mm. Perianth tube cylindrical, about 3 mm. Connective oblong, acute at the base, crowned by 2 divergent, acute crests. Style thick-filiform, branching at the apex into 3 very short branches, each bearing a funnel-shaped stigma with 2 small, apical points. Style with stigmas about 3 mm. Ovary ellipsoid, truncate, about 2 1/2 mm.

**Distr.** _Malaysia_: New Guinea only.

11. **Burmannia tridentata** Becc. _Malesia_ 1 (1877) 246; _Jonker, Monogr._ (1938) 141.

Saprophyte, 6–14 cm. Stem simple or branched, beset with appressed, lanceolate, acute, 1-veined, slightly keeled, scale-like, 1 1/2–2 mm long leaves. Bracts ovate-lanceolate, acuminate, 1-veined, about 1 1/2 mm. Stem or branches bearing 1–3, prominently winged, 2–7 mm long flowers. Outer perianth lobes triangular to ovate, obtuse, swollen to the margin, 1–1 1/2 mm. Inner lobes absent. Perianth tube cylindrical, about 2 mm. Connective quadrangular with a broad, swollen, obtuse, hanging, basal spur, and an apical, erect, papilllose, obtuse crest. Style as long as the tube, bearing 3 subsessile, funnel-shaped stigmas. Ovary subglobose, about 2 mm. Flower wings elliptical to half-ellipticulate, about 4 by 2 mm. **Capsule** subglobose, about 2 1/2 mm. Seeds scoriiform.

**Distr.** _Malaysia_: Borneo, Sarawak (Mt Mantang), once collected.


Saprophyte, 7–15 cm. Stem simple or branched, bearing 1–2 flowers, beset with appressed, ovate to lanceolate, obtuse, scale-like, about 1 1/2 mm long leaves. Below the flower 2 lanceolate, scale-like bracts, 2 1/2 mm. **Flowers** white, sometimes with yellow limb, 8–10 mm. Outer perianth lobes bifid, obtuse, about 1 1/2 mm, papilllose in the upper half at the margin, in the lower half with 2 yellow bags inside, provided with 2 involute, narrow triangular lateral lobes. Inner ones absent. Tube conical, 4–4 1/2 mm long. Connective oblong, yellow, without crests or spur. Style thick-filiform, bearing at the apex 3 sessile, funnel-shaped curved stigmas. Style with stigmas about 4 1/2 mm. Ovary subglobose, 2 1/2–4 mm. Flower wings obovate, truncate, white, 5–7 1/2 by 3–4 mm.

**Distr.** _Hainan, Indo-China and Malaysia_: Malay Peninsula, N. Sumatra (Atjeh and Eastcoast Res.).

**Ecol.** On forested rocks or loamy soil in dense jungle or forest, ascending to 1300 m.

13. **Burmannia steenisii** _Jonker, Monogr._ (1938) 158.

Delicate saprophyte, 2–6 cm. Stem simple or branched, bearing 1–2 flowers, beset with lanceolate, acute, scale-like, 1/2–1 1/2 mm long leaves. Below each flower 1 or 2 lanceolate, 1-veined, acute bracts, about 1 1/2 mm. **Flowers** pure white with yellow
limb, prominently 3-winged, 3–7 mm. Outer perianth lobes triangular, subobtuse, with swollen margin, about 1 mm. Inner ones orbiculate, minute. Perianth tube cylindrical-trigonoous to conical-trigonoous, about 2½ mm. Connective quadrangular, with a broad, obtuse, basal hanging spur and crowned by 2 short, thick, straight, obtuse, divergent crests. Style thick-filiform, bearing 3 sessile, slightly curved, bilabiate, funnel-shaped stigmas. Ovary subglobose, about 2 mm. Flower wings half elliptical to half-quadrangular, pure white, about 4½ by 1½ mm. Capsule subglobose, dehiscing with transverse slits. Seeds scrobiform.

**Distr.** Malaysia: E. Java, Pasoeroean Residence (Mt Lamongan).

Ecot. Collected on the SW. slope of Mt Lamongan on coarse, volcanic sandy soil in brushwood, ca 600 m alt. It is the only species of the family hitherto reported from East Java.


Saprophyte, up to 23 cm. Stem thickly filiform to robust, simple or branched, 1-flowered or forked into the inflorescence. Leaves lanceolate to ovate, acute, 1½-3½ mm. Bracts lanceolate to ovate, often keeled and carinate. Cincinni bifid, up to 11-flowered; branches up to 3 cm. Flowers pedicellate, white, sometimes with yellow limb, seldom bluish, about 8½ mm. Outer perianth lobes ovate or triangular, apiculate, about 1½ mm; margin fleshy. Inner lobes minute, fleshy, orbiculate. Perianth tube trigonous, 2½-5 mm. Connective truncate, rounded at the base, slightly 2-lobed at the apex into 2 very short, papillose crests. Basal spur absent. Style thick, bearing 3 sub sessile, funnel-shaped to bowl-shaped stigmas. Style with stigmas as long as the tube. Ovary subglobose to truncate-globose, 3–5 mm. Flower wings various, linear, or elliptical, or rather broad, half-cuneate or quadrangular, running from the base of the limb to the middle or the base of the ovary. Capsule sub globose, dehiscing with large horizontal slits.

**Distr.** Malaysia: Sumatra, Malay Peninsula, Borneo, Java, New Guinea, and New Ireland.

Ecot. Usually in the humus of shady moist forests, up to 1500 m.

**Notes.** Specimens with narrow perianth wings have been described as *B. lutescens*, *B. novae-iber niae*, *B. gjellerupit*, with elliptical ones as *Goni anthes candida*, and rather broad-winged speci mens as *B. gracilis*. They all belong to one species variable in that respect. In Java the species was often called *B. candida* (BL.) ENGL. but this is a later homonym; *B. candida* Griff. ex Hook. f. is an allied species, occurring in Burma, Siam and the Langkawi Islands.

### 15. Burmannia malasica Jonker, Monogr. (1938) 152.—Burmannia lutescens (non Becc.) Winkler, Bot. Jahrb. 48 (1913) 96.

Saprophyte, 5½–8 cm. Stem simple, 1-flowered, seldom 2-flowered, beset with few appressed, lanceolate, subacute, 1-veined, slightly keeled, 1½-2 mm long, scale-like leaves. Bracts elliptical, acuminate, 1-veined, 1½ mm. Flowers purple or white with yellow limb, prominently winged, about 5 mm. Outer perianth lobes triangular with swollen margin, acuminate to apiculate, about 1 mm. Inner lobes erect, lanceolate-ovate, obtuse, about 1½ mm. Perianth tube cylindrical, 1½ mm. Connective obtriangular, obtuse at the base, provided with 2 short, divergent crests at the apex. Style cylindrical, bearing 3 sessile, funnel-shaped stigmas. Ovary subglobose to ellipsoid, 2½ by 2 mm. Flower wings half-orbiculate to half-elliptical, about 4 by 2 mm. Capsule ellipsoid to obovoid, dehiscing with a transverse slit. Seeds scrobiform to fusiform.

**Distr.** S. Iам and **Malaysia**: SE. Borneo.

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**Fig. 10. Burmannia lutescens Becc., Mt Salak, W. Java.** Form with narrow perianth wings, × 2½.
2. GYMNOSIPHON


Saprophytic annuals, without chlorophyll. Leaves scale-like. Perianth limb consisting of 6 lobes, the 3 outer being much larger and slightly 3-lobed. Anthers 3, sessile in the throat. Thecae bursting horizontally. Ovary ovoid to globose, 1-celled with 3 parietal placentas, each placenta provided with a large, globose gland at both sides of the top. Style filiform, branching into 3 short branches, each bearing a stigma. Perianth limb, stamens and the upper part of style with the stigmas caducous after flowering. Capsule crowned by the persistent perianth tube. Seeds ovoid to globose, reticulate.

Distr. 29 species, tropics of both hemispheres, not in Australia.

Notes. In Asia, and Malaysia, this genus is represented by the section Eugymnosiphon URBAN only, characterized by the reticulate-perforated capsule dehiscing at the top.

KEY TO THE SPECIES

1. Anthers inserted above the middle of the perianth.
2. Flowers pedicellate, in loose, many-flowered cincinni or bifid cincinni
   3. Capsule ± globose. Margin lobes of the outer perianth lobes crenate
   4. Anthers inserted in or below the middle of the perianth.
   5. Flowers sessile or subsessile in loose cincinni or bifid cincinni
   6. Outer perianth lobes deltoid, short, a fifth of the whole perianth. Stigmas without crest. Inflorescence 1-3-flowered

1. Gymnosiphon aphyllus BLUME, Enum. Pl. Jav. 1 (1827) 29; JONKER, Monogr. (1938) 30, 170.—G. borneense BECC. Malesia 1 (1877) 241.—G. pedicellatum SCHLTR. Bot. Jahrb. 49 (1913) 105.—Fig. 7.

   Stem up to 17 cm, forked into a bifid cincinnus or bearing a single cincinnus. Leaves acute, often keeled, appressed, 1–2½ mm. Bracts ovate, obtuse, scale-like. Pedicels 1–5 mm. Inflorescence often loose and many-flowered. Perianth white or lilac; tubular part up to 4 mm; limb about 2½ mm. Outer perianth lobes ovate, obtuse, provided with a narrow, crenate lateral lobe at both sides. Inner ones linear-lanceolate, minute. Stigmas curved, funnel-shaped, inappendiculate. Capsule about 3 mm.

   Distr. S. Siam, throughout Malaysia.

   Ecol. On humus or decaying wood or leaves in the shade of moist forests, below 1500 m alt.


   Stem tender, simple or branched, 4–9½ cm, 1- or 2-flowered. Leaves and bracts minute, to 1 mm, keeled and appressed. Pedicels up to 3 mm. Flowers white to bluish lilac, up to 5 mm. Outer perianth lobes triangular, subobtuse, provided with crenate lateral lobes. Inner ones small, cuneate, obtuse to truncate. Stigmas auriculate, soup-plate-shaped.


Ecol. In forests, 450 m alt.


   Stem usually simple, 2–5-flowered, 7–12 cm. Leaves acute, appressed, up to 1 mm. Bracts more or less obtuse, keeled. Pedicels 1–3 mm. Perianth white with bluish limb. Outer perianth lobes obtuse; lateral lobes entire. Inner ones lanceolate. Perianth limb deciduous above the anthers. Stigmas quadrangular, truncate at the apex, apiculate at the base.

Distr. Malaysia: N. Celebes (Minahasa), once collected.

Ecol. In humic soil, 800 m alt.


   Stem 7–13 cm, simple or branched, white, lilac or rose-coloured, forked into a bifid cincinnus or bearing a simple cincinnus of 1–3 flowers. Leaves ovate, acuminate, 1–2 mm. Bracts to 3 mm. Pedicels 1–4 mm. Perianth white, limb 2½ mm, tube 1½ mm. Outer perianth lobes ovate, obtuse; lateral lobes crenate. Inner ones small, rather broad,
obovate, obtuse. Tube swollen at the insertion of the stamens. Connective quadrangular, acute-apiculate at the apex. Stigmas rather large, soup-plate-shaped. Ovary obconical, swollen in the upper part, about 1½ mm. Capsule thick-ellipsoid, about 3-3½ mm, crowned by the short, cylindrical to conical, 2 mm long, persistent part of the tube. Seeds brownish, fusiform, reticulate.


Stem simple or branched, 4-14 cm, colourless, bearing rather loose simple or bifid cymes of 3-many subsessile flowers. Leaves acuminate, up to 2½ cm. Bracts up to 3½ mm. Perianth whitish-purplish; limb about 1½ mm; tube up to 4½ mm. Outer perianth lobes ovate, triangular, obtuse; lateral lobes entire, involute. Inner ones small, linear. Connective deltoid, at the top 3-lobed, provided with a forked thickening. Stigmas rather large, soup-plate-shaped, obtuse, cordate, auriculate at the base. Ovary ovoid, about 1½ mm. Capsule obovoid to truncate-subglobose, 2½-5 mm long; crowned by the 2-2½ mm long, cylindrical persistent part of the tube.


Ecol. Moist forests, ascending to ca 500 m alt.

6. Gymnosiphon neglectus Jonker, Monogr. (1938) 175.

Stem simple or branched, 7½-11 cm, bearing 1 or few flowers or a capitate inflorescence, consisting of contracted cymes. Leaves lanceolate-ovate, acuminate, keeled, 1-2½ mm. Bracts to 5 mm. Flowers subsessile. Perianth dirty white; tube about 2 mm; limb about 2 mm. Outer perianth lobes ovate, acuminate; lateral lobes crenate. Inner ones small, linear, acute. Stigmas funnel-shaped, curved, dorsally ciliate. Ovary ovoid, about 2 mm. Capsule nearly globose, crowned by the 2½ mm long persistent part of the tube.

Distr. Malaysia: Java (Preanger Regencies and Semarang).

Ecol. Moist forests, ascending to 1000 m alt.


Stem simple, colourless, 2½-9½ cm, bearing 1-3 sessile or subsessile flowers. Leaves ovate, acuminate, 1-1½ mm. Bracts to 3 mm. Perianth whitish to purplish; tube about 4 mm; limb very short. Outer perianth lobes ovate, acute, about 1-1½ mm; lateral lobes entire. Inner ones minute. Connective not apiculate, forked at the top. Style branches rather long, each bearing an ovoid, in transverse section somewhat triangular, stigma. Ovary obovoid, about 2 mm. Capsule ovoid, to 3½ mm; persistent part of the tube 1½-2½ mm.


3. THISMIA


Saprophytic, fleshy herbs. Underground part in the Malaysian species coralliform or vermiciform and creeping. Stems usually short, seldom branched. Leaves small, scale-like. Below the flowers 1 or more bracts, sometimes forming an involucre. Flowers actinomorphic or, sometimes, zygomorphic, urceolate to campanulate. Perianth lobes 6, occasionally free and of equal length and size, or inner ones larger, sometimes inner lobes connivent at the apex or connate in the apical part, then forming an erect mitre with 3 holes, in that case outer lobes very small. Stamens 3, free or, usually, stuck together to an anther tube, hanging at an annulus in the perianth throat. Filaments short, ribbon-shaped. Style thick, short, cylindrical or conical, persistent, bearing at its apex 3 simple or bilabiate stigmas. Ovary obconical or obovoid; the 3 placentas inserted at the bottom or parietally in the basal part of the ovary. Fruit fleshy, cup-shaped, crowned by the persistent, fleshy, basal ring of the perianth tube and the style with the stigmas.

Distr. 24 species, in tropical America (Sect. Myostoma and Ophiomeris), tropical Asia (Sect. Euthis-mia and Sarcostiphon), Chicago area, New Zealand and Tasmania (Sect. Rodwaya).

Stem usually simple and 1-flowered, about 15 cm. Leaves and bracts linear-lanceolate, acute more or less imbricate, up to 4 mm. Perianth tube genulate; part below knee c. 3 mm, pink with longitudinal striae; the c. 5 mm long, upper part and limb chocolate-brown; perianth mouth yellow. Perianth lobes lanceolate, about 7 mm, tapering to filiform tentacles. Annulus prominent, slightly 6-lobed. Anthers quadrangular, provided with a thick hair on both sides of the free, apical margin and a broad, wing-like appendage, inserted on the midline of the connective. Stigmas oblong, bifid. Fruit stalk elongate.

Distr. *Malaysia*: Malay Peninsula (Malacca, Mt Ophir), once collected.


Stems several, occasionally branched. Leaves linear, acuminate. Flowers 4–6 in a raceme; pedicels 1–1 1/2 cm long. Perianth lobes short, triangular-ovate, blunt. Annulus prominent. Tube cylindrical, about 6 mm long.

Distr. *Malaysia*: Malay Peninsula (Pahang), once collected.


Stem simple, 1-flowered, 3 cm, provided with 2 basal, opposite, scale-like lanceolate leaves, about 5 mm, and 2 apical bracts, of the same shape and size as the basal leaves; both leaves and bracts beset with stiff, terete, blunt processes on the back. Perianth urceolate; tube pink with longitudinal striae, 8 mm. Lobes patent, ovate-triangular in the basal part, tapering at the apex to filiform tentacles. Annulus prominent. Anthers not or scarcely stuck together, provided with 2 lateral teeth at the free apical margin and a wing-like appendage inserted at the middle of the connective. Stigmas lanceolate, bifid, acute, papillose. Ovary about 4 mm, obovoid, truncate.

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**KEY TO THE SPECIES**

1. Inner perianth lobes free, spreading or erect. Underground part vermiform, creeping

2. **Thismia chrysops**

3. **Thismia racemosa**

4. Stems several, flowers 4–6 in a raceme

5. Leaves and bracts beset with distinct, prominent, blunt processes

6. Perianth lobes lanceolate, acute to acuminate, flat


8. Anthers provided with 3 thick-filiform appendages at the free apical margin. Perianth yellowish in the basal part, bright orange-yellow in the upper part and limb. Tentacles bright orange-red at the base. Perianth lobes with tentacles up to 10 mm

9. Perianth very zygomorphic, bilabiate. Upper lip fleshy, bent over the opening of the tube

10. Inner perianth lobes simple. Tube with prominent horizontal bars inside.

11. Anthers with 3 distinct teeth at the free apical margin, each tooth bearing a stiff hair. Outer perianth lobes broadly ovate, obtuse, erect

12. Inner perianth lobes linear, connate at the tips, forming a mitre with large holes. Anthers ciliate in the basal part, toothed at the apex.

13. Apical margin of the anthers provided with 2 teeth, each bearing a stiff hair. Anthers slightly constricted in the middle, below the thecae

14. **Thismia grandiflora**
Distr. Malaysia: Malay Peninsula (Johore),

once collected.

(1890) 338; Jonker, Monogr. (1938) 240.

Stem slender, conspicuous, unbranched, about
10 cm, bearing 1-2 flowers. Leaves very small, ap-
pressed, lanceolate, acute. Flowers up to 1 cm.
Perianth lobes lanceolate, acute, greenish-grey,
constricted above the ovary and broadened below
the limb, white with pink stripes. Annuless pro-
mminent. Ovary obconical. Capsule cup-shaped, rib-
bed and scabrid, crowned by the crenulate, basal
ring of the perianth.

Distr. Malaysia: Malay Peninsula (Singapore
and Selangor).

5. Thismia aseroe Becc. Malesia 1 (1877) 252;
Jonker, Monogr. (1938) 240.—Fig. 3.

Stem simple or, sometimes, branched, 1- or 2-
flowered, up to 8\(\frac{1}{2}\) cm high. Leaves few, lanceolate,
obtuse, to 4 mm long. At the base of the flowers an
involucre, consisting of lanceolate bracts. Peri-
anth obconic-campanulate, dirty-yellow in the
basal part, bright orange-yellow in the upper part
and in the limb. Perianth tube about 11 mm; the
basal 5 mm inside with transverse bars. Lobes tri-
angular, 3 mm long, ending in bright orange
tentacles, red at the base, 6 mm long. Annuless
prominent. Anthers with 3 short thick-filiform
appendages at the free apical margin; in the lower
part of the anther, inserted at the middle of the
connective, a broad, dorsal, quadrangular wing, wider
than the anther. Thecae oblong, in the basal
part of the anther; in the apical part 2 nectaries on
the line of junction of one connective with the
next. Ovary obovoid, 3 mm. Stigmas narrow-lan-
celate, rather long, acute. Capsule ribbed, about
5 mm. Fruit stalk lengthening about 5-7 mm above
the involucre. Seeds ellipsoid, ribbed.

Distr. Malaysia: Malay Peninsula (Singapore
and Perak).

6. Thismia alba Holttum, ms.

A Th. aseroe differt antheris singulris munitis una
tantum appendice mediana crassi-filiformi, porro
marginie apicali libera instructa dentibus 2 lat-
eralibus brevibus. Perianthium album signatum striis
6 longitudinalibus ochraceo-brunnes; perianthii
lobis tentaculis \(\pm 2\) cm longis praeditis.

Stem simple, 1- to 3-flowered, up to 10 cm. Leaves
few, 3-4\(\frac{1}{2}\) mm long, lanceolate, acute or
acuminate. At the base of the flowers an involucre,
consisting of lanceolate, acute bracts. Perianth
obconic-campanulate, white with 6 thin ochraceous-
brown streaks, leading down from each perianth
lobe, alternating with 6 thin yellow lines. Perianth
tube about 10 mm, the basal part with transverse
bars inside. Lobes triangular, 3-4 mm long, pale-
yellow at the base, terminated by white, tentacles
about 15 mm long. Annuless prominent, bright
yellow. Anthers with 1 thick-filiform, median ap-
pendage and 2 lateral short teeth at the free apical
margin; in the lower part of the anther, inserted
at the middle of the connective, a broad, dorsal,
quadranuglular wing, wider than the anther. The-
cae oblong, in the basal part of the anther; in the
apical part 2 nectaries on the line of junction of
one connective with the next. Ovary semi-globose,
about 2 mm. Stigmas lanceolate, retuse, papillose.
Capsule obconical, about 6 mm.

Distr. Malaysia: Malay Peninsula (Pahang).

7. Thismia ophiurus Becc. Malesia I (1877) 252;
Jonker, Monogr. (1938) 242.

Stem 2-6 mm, simple or branched, 1- or 2-flow-
ered. Leaves lanceolate, obtuse, to 4 mm long.
Below the flowers an involucre of several, lanc-
cele, 3-4 mm long and 1 mm wide bracts. Perianth
urceolate, yellowish brown. Tube about 9 mm;
lobes triangular, terminated by long, filiform ten-
tacles, about 13 mm. Annuless broad and thick.
Insertion of the stamens broad, then narrowed into
a ribbon-shaped filament and again broadened into
the quadrangular anthers. Apical free margin of
the anthers provided with 2 teeth, each with a
globose body at the top. Ovary ovoid, about 5 mm.
Style bearing 3 sessile, funnel-shaped, circumval-
lated stigmas. Capsule ribbed; seeds oblong with
longitudinal ribs; funicules about the same length
as the seeds.

Distr. Malaysia: Borneo (Sarawak & Br. N.
Borneo).

9 (1927) 220; Jonker, Monogr. (1938) 44, 243.

Stem simple, 22 mm long. Leaves ovate, acute,
appressed, 1\(\frac{1}{2}\) mm. Flowers with an involucre of 3
ovate-lanceolate, acute, 5\(\frac{1}{2}\) mm long bracts. Peri-
anth urceolate in the basal part, bilabiatus-zygo-
morphous in the upper part. Outer perianth lobes
2\(\frac{1}{2}\) mm, broad-ovate at the base, rounded, with
a subulate appendage inserted below the top. Inner
lobes linear to filiform, subulate, 5 mm. A thick,
fleshy upper lip bent over the perianth mouth;
on the back of the upper lip 1 inner and 2 outer peri-
anth lobes. The other 2 inner lobes between the 2
lips. The third outer lobe inserted on the middle
of the lower lip. Stamens rounded and ciliate at the
free, apical margin; thecae elongate; outer side of
the stamen provided with scattered hairs. The 3
stigmas connate to a capitulate, 3-lobed stigma.
Ovary obconical.

Distr. Malaysia: Sumatra (Eastcoast Res.)

once collected.

(1910) 32; Jonker, Monogr. (1938) 245.—Fig. 11.

Stem simple or branched, up to 12 cm, 1- to 5-
flowered. Leaves ovate or lanceolate-ovate, obtuse,
3 mm. At the base of a flower an involucre of 3
bracts. Perianth tube 7 mm, urceolate, whitish with
12 longitudinal, orange stripes, inside with longi-
tudinal bars connected by many transverse bars.
Outer perianth lobes obtuse, ovate; inner ones
triangular, terminated in up to 3 cm long, filiform
tentacles. Anthers 3-toothed at the free apical
margin; each tooth terminating in a hair. On the outer
side of the anther, inserted in the middle, a qua-
drangular appendage, wider than the stamen. Margin of the appendage striose. Style orange-coloured; stigmas sessile, ovate, truncate. Ovary obovoid, 3 mm. Capsule orange-coloured, about 6 mm. Seeds ellipsoid.

Fig. 11. *Thismia javanica* J. J. Soengoes Iwoel, × 3/2. (LIEFTINCK)

**Distr. Malaysia:** Sumatra and W. Java.
**Ecol.** Shade of forests, on humus, below 1000 m alt.
**Vern.** Angkrek rambut (Java).

**Notes.** Perhaps conspecific with the following species.


Stem simple, 1-7½ cm, bearing 1-3 flowers. Leaves few, lanceolate, acute, about 5 mm. At the base of the flowers an involucre, consisting of ovate-lanceolate, acute, 5-7 mm long bracts. Perianth urceolate to obconical, about 8 mm long, inside with longitudinal bars, connected by many transverse bars; tube transparent, white with 6, vertical, red streaks in the apical part. Perianth lobes pale red. Outer lobes very short, about ½ mm, car-shaped; inner ones triangular, about 1 mm, terminating in up to 3 cm long, thin, filiform tentacles. Annulus prominent, yellow. Anthers slightly 3-toothed at the apical free margin, the lateral teeth somewhat larger than the median one, each tooth terminating in an indistinct, very thin, fragile hair. On the outer side of the anther, inserted in the middle, a quadrangular striose appendage, wider than the stamen. Style thick, conical; stigmas lanceolate, obtuse. Fruit stalk lengthening above the involucre.

**Distr. Malaysia:** Malay Peninsula (Perak & Pahang).

**Note.** Closely related to the preceding species, perhaps conspecific.


Stem 4-25 mm, simple, 1-flowered, beset with few, lanceolate, acute, about 3 mm long leaves. At the base of the flower an involucre of 3 lanceolate, acute, 4-6 mm long bracts. Perianth tube urceolate, with 6 longitudinal stripes, 6 mm. Outer perianth lobes simple, recurved, filiform with triangular base, 4½ mm. Inner ones erect, about 15 mm, consisting of an erect, short, basal part; a transverse part with hamate base and a broadened, rounded apex and, inserted on the apex of the transverse part, an erect, long, awl-shaped part. Annulus prominent. Anther quadrangular, 3-toothed at the free apical margin. Stigmas lanceolate, acute. Ovary obovoid, truncate, 1½ mm.

**Distr. Malaysia:** Borneo (Sarawak, Mt Mattang), once collected.


Stem up to 5 cm, 1-2-flowered. Leaves appressed, acuminate, to 5 mm. At the base of the flower 3 bracts. Perianth tube urceolate, about 2½ mm, greenish-grey, with 12 longitudinal, brownish-black stripes. Outer perianth lobes almost absent, inner ones connate to a 2½ mm long, acuminate mitre. Annulus prominent, 6-lobed. Margin of the filaments and upper part of the anthers with short hairs. Thecae oblong, inserted on the margins of the anthers. Free apical margin of the anthers with 2 teeth, tapering to stiff hairs. Inserted on the midline a large, wing-like appendage, provided with bundles of hairs on the angles. Stigmas ovate, bilobate, papillose, whitish. Ovary obovoid, about 3 mm. Funicle about the same length as the ovules. Capsule papillose, about 5 mm.

**Distr. Malaysia:** W. Java.
**Ecol.** In humus of forests, ascending to ca 1000 m alt.

13. *Thismia episcopalis* (BECC.) F. v. MUELL. Pap. & Proc. R. Soc. Tasm. for 1890 (1891) 235; Jonker, Monogr. (1938) 46, 253.—*Geonitra episcopalis* BECC. Malesia I (1877) 250.—*Bagnisia episcopalis* ENGL. Fl. Pfl. Fam. 2, 6 (1889) 48.—*Sarcosiphon episcopalis* SCHTR. Notizbl. 8 (1921) 38.—Fig. 4.

Stem simple or branched, 1-8 flowered, up to 19 cm. Leaves appressed, ovate, acute, 2-5 mm. Perianth tube urceolate, yellow with black stripes, 6-9 mm. Outer perianth lobes almost lacking; inner connate to a slightly acuminate, about 5 mm long mitre. Filaments constricted. Theca divergent. Margin of the anthers and the winglike appendage hairy, apical part of the anther, below the insertion of the appendage, darker coloured; free apical margin 3-toothed, each tooth terminated by a stiff hair. Stigmas bilobate. Ovary obovoid, 3 mm. Funicles about as long as the ovules. Capsule ribbed, about 3 mm. Fruit stalk lengthened.
Distr. Malaysia: Borneo (Sarawak, Br. N. Borneo).

Ecol. In humus of forests, ascending to ca 1700 m alt.


—Baguisia crocea BECC. Malesia 1 (1877) 249.—Thismia verssteegii J.S. Nova Guinea 8,1 (1909) 193.—Sarcosiphon croceus SCHLTR. Notizbl. 8 (1921) 38.—Sarcosiphon verssteegii SCHLTR. Notizbl. 8 (1921) 38.

Stem simple, 1-3-flowered, about 6 cm. Leaves appressed in the basal part, lanceolate, acute, to 6 mm. At the base of the flowers 3 ovate lanceolate, acute bracts. Perianth tube urceolate, ribbed, redish-brown in the upper part, yellowish-orange in the middle and white at the base, about 6 mm. Anthers quadrangular, not hairy; thecae oblong, parallel; inserted in the apical part of the anther a broad appendage with curled margins. Stigmas ovate, obtuse, papillose. Ovary light reddish-brown, about 2 mm. Funicles as long as the ovules. Fruit ribbed, obovoid. Fruit stalk thickened and lengthened after flowering to 16 mm above the bracts.


Notes. In Perak (Malay Peninsula), Ridley observed a Thsminia, described by him in Mat. Fl. Mal. Pen. 2 (1907) 75, as Baguisia crocea var. brunnea. This specimen was apparently not preserved; it is highly improbable that it belongs to T. crocea.

4. GEOMITRA

BECCARI, Malesia 1 (1877) 250; Jonker, Monogr. (1938) 46, 254.

Underground part unknown. Stem beset with scale-like leaves. Flowers rather large, with an involucre at the base. Tubular part of the perianth urceolate. Outer perianth lobes free, very small. Inner ones connate at the top to an erect mitre with 3 holes, crowned by 3 apical, long, thick-filiform, erect, clavately swollen appendages. Basal ring of the perianth tube thickened, persistent on the fruit. throat margin of the perianth thickened to a 6-lobed annulus. Stamens 6, hanging at the annulus; anthers stuck together to a tube. Style short, cylindrical, fleshy, bearing 3 erect stigmas. Ovary with 3 stalked placentas; funicles short. Capsule cup-shaped, crowned by the persistent, basal perianth ring and the style.

Distr. One species, known only from Borneo (Sarawak).


Stem simple, up to 12 cm, bearing about 3 flowers. Leaves lanceolate, acuminated or acute, 2-6 mm. Bracts lanceolate, acuminate, 6-7 mm. Perianth tube about 9 mm. Outer perianth lobes erect, broadly triangular, about 1 mm. Mitre about 3-5 mm, hooked at the apex. Filiform appendages 8-12 mm long. Anthers quadrangular; free apical margin with 3 teeth, each bearing a stiff, transparent hair. Anther tube about 4 mm. Stigmas lanceolate, bilobate; lobes acute. Ovary obovoid, truncate, about 3 mm.

Distr. Malaysia: Borneo (Sarawak), once collected.

5. SCAPHIOPHORA

SCHLTR. Notizbl. 8 (1921) 39; Jonker, Monogr. (1938) 46, 256.

Roots coriaceous. Stem provided with scale-like leaves; at the base of the flower an involucre. Perianth tube urceolate. Outer perianth lobes small; inner ones narrow in the basal part, broadened at the apical part, connate to an erect mitre with 3 holes in the basal part. Mitre crowned by a long, stiff column, bearing at the top 3 lobes. Stamens 6, hanging, inserted at an annulus in the perianth throat. Filaments ribbon-shaped. Anthers stuck together to an anther tube; each anther provided with a wing-like appendage, inserted in the middle and broader than the anther. Placentas stalked; stalks inserted peripherically at the bottom of the ovary. Basal perianth ring and style persistent on the fruit.

Distr. Two species, one in New Guinea, the other in the Philippines.
—
Flora Malesiana

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KEY TO THE SPECIES
1.

1.

Flowers 3-6'/2 cm long (without column). Column l'/2-6 cm long, at the apex broadened to 3 fleshy,
1. S. gigantea
connate lobes
long, bearing at the apex 3 cup-shaped
Flowers 1 cm long (without column). Column 5

mm

bodies
1.

2. S.

Scaphiophora gigantea JoNKER, Monogr. (1938)

257.— Fig. 2.
Stem 4-10';'2 cm,

partly subterranean. Leaves
lanceolate, acute,
mm, the lower ones keeled.
Bracts ovate, lanceolate, acute, about 1 8 mm. Peri-

2^

anth tube

1

5-21

mm, pale rose-coloured with yellow

below the inner perianth lobes.
Outer perianth lobes ear-shaped. Mitre 5-9 mm
long, orange to yolk-yellow. Stamens about
7 mm. Anthers prominently nerved; free apical
margin provided with 3 median and 2 lateral teeth;
each bearing a stiff, transparent hair. Appendix
of the anther greenish-blue; lateral margins bearing
3 bundles of short hairs; apical margin pilose.
Thecae divergent, ovate. Style truncate-conical.
Stigmas sessile, obovate, 2-lobed, papillose outside
and in the upper part inside. Fruit cup-shaped.
Placentas connate at the apex, stalked stalks about
veins, reticulate

;

the

same length

as the placentas.

Distr. Malaysia:
collected.

Philippines

(Luzon),

twice

appendiculata

Scaphiophora appendiculata (Schltr.) Schltr.
Notizbl. 8 (1921) 39; Jonker, Monogr. (1938) 259.

2.

(1918)202.
Stem 15-20

mm

high, partly subterranean, usu-

Leaves ovate to lanceolate, 2-3 mm.
Bracts lanceolate, acute, about 5 mm. Perianth
tube 6 mm, yellowish white in the lower part.
Outer perianth lobes small, ear-shaped. Mitre
3-6 mm, orange-coloured. At the base of each perianth lobe, on the inner side, a glandular, bowl-shaped
body. Column ± broadened towards the apex,
bearing 3 thick, fleshy, cup-shaped bodies. Stamens
about 3 mm. Appendage of the anther crenulate
at the apical margin. Thecae divergent. Style truncate-conical, l'/2 mm. Stigmas sessile, obovate, 2ally 1-flowered.

3'/2 mm. Placentas stalked,
part suddenly narrowed again
into a filiform, apical appendage. Placentas attached to the bottom of the ovary by the stalks and
to the roof by the apical appendages.

lobed,

1

mm. Ovary

above the

fertile

Distr. Malaysia: Northeast
collected.

New Guinea,

once


Sphenocleaceae (H. K. Airy Shaw, Kew)

Mart. ex Lindl. Nat. Syst. ed. 2 (1836) 238; DC. Prod. 8 (1939) 548; Wight, Ill. Ind. Bot. 2 (1850) 115; Miq. Fl. Ind. Bat. 2 (1857) 569; Boiss. Fl. Or. 3 (1875) 963.

Annual (?) laticiferous herbs, with the habit of Phytolacca. Stem erect, somewhat succulent. Leaves spirally arranged, simple, entire, exstipulate. Inflorescences terminal, densely spicate, acropetal. Flowers subtended by a bract and two bracteoles, bisexual, actinomorphic. Calyx tube adnate to the ovary; segments 5, united below, imbricate, connivent, persistent. Corolla campanulate-urceolate, perigynous; lobes 5, imbricate. Stamens 5, epipetalous, alternating with the corolla lobes; filaments short; anthers rounded, 2-locular, dehiscing longitudinally. Ovary semi-inferior, 2-locular; style short, stigma capitate; ovules ~, attached to large spongy stipitate axile placentas. Capsule cuneate-obconic, 2-locular, membranous, circumsessile; seeds ~ minute, oblong, rugose-costate, albumen very scanty or none (?); embryo axile, straight, subterete.

Distr. Mono-generic, almost pantropical.

Ecol. Uses, Vern., see below under S. zeylanica.

Notes. The maintenance of Sphenocleaceae as a separate family is abundantly justified; there is no evidence of affinity with Campanulaceae, with which it has hitherto been associated. The habit resembles that of Phytolacca, and the anatomy shows several significant features occurring in members of the Phytolaccaeae and related families. Other characters suggest Primulaceae, and provisionally it is suggested that the family represents a ‘half-way house’ between the families mentioned. From the Centrospermae it deviates in the semi-inferior ovary, gamopetalous corolla and straight embryo, and from the Primulaceae principally in the alternipetalous stamens. A separate note on the classification will be published in the Kew Bulletin.

I. SPHENOCLEA

Gaertn. Fruct. 1 (1788) 113, t. 24, f. 5; Miq. Fl. Ind. Bat. 2 (1857) 569; B. & H. Gen. Pl. 2 (1876) 560; Baill. Hist. Pl. 8 (1886) 327, 362, f. 158-161; Schönland, in E. & P. 4, 5 (1889) 60; Boerl. Handl. 2, 1 (1891) 257. For characters see family description.

Distr. Two species, one pantropical, one endemic in W. Africa.


Roots long, cord-like. Stem hollow, 7-150 cm. Leaves oblong to lanceolate-oblong, attenuate at both ends, acute or obtuse, glabrous, 2½-12½ by ½-5 cm; petiole 3-30 mm. Spikes ½-7½ cm long, cylindric; peduncle 1-8 cm. Bracts and bracteoles ± spatulate, the green apices arched over the calyx before and after anthesis. Flowers crowded, rhomboid or hexagonal by compression, sessile, wedge-shaped below, attached longitudinally to the rachis by a linear base. Calyx segments deltoid-semicircular, obtuse, ultimately accrescent and convoluted. Corolla whitish, 2½-4 mm long, caducous, segments ovate-triangular, obtuse or acute, united slightly more than half-way, connivent. Stamens inserted half-way up tube of corolla, filaments slightly dilated at base. Ovary obvoid, 2½ mm long, apex broad, free, truncate. Capsule 4-5 mm in diam., dehiscing below the calyx segments which fall with the lid, leaving the scarious persistent base. Seeds yellowish-brown, ± ½ mm long.


Ecol. A weedy annual occurring in almost any kind of damp ground at low alt. up to 350 m; river banks and dry riverbeds, damp marshy or periodically inundated depressions, seasonal swamps, sides of ponds, ditches, and stagnant water generally, especially rice-fields, both in continuously rainy and in seasonal climates. Almost every flower on
every inflor. sets fruit; only one or two flowers are open at once on any one head. In Malaysia never gregarious, nor growing on mud of tidal creeks, as in Africa.

Uses. In Java young plants and tips of older plants are steamed and eaten with rice; they have a slightly bitter taste; leaves are sold under the name goenda padi.

Vern. Java: goenda, M, J, Sd, g. rawah, g. lalab, g. padi, g. sapi, Sd, goendha, Md, gondo, J; Bali: gonda; Celebes: gangang karaeng, Mk., goura, Mk, Bg; Philippines: mais-mais (Panay, Bisaya), silisi-lihan (Tagalog); the Javanese names are also applied to the superficially similar Hydrophyllaceous Hydrolea zeylanica (L.) VAHL.

Notes. The plant is described as laticiferous but Metcalfe reports that 'typical laticiferous canals are absent from the phloem, although occasional elongated cells have been observed in this tissue with granular contents which may represent coagulated latex'. Miss M. C. Vreeke, Anatomist in the Treub Lab., Buitenzorg, Java, reported, July 6, 1948, that in fresh material she could find neither milky juice nor laticiferous elements.

Fig. 1. Sphenoclea zeylanica GAERTN. × 1/4. A rich-flowering individual.
NYSSACEAE! (J. Wasscher, Groningen)

1. NYassa


Dioecious trees or shrubs. Leaves simple, scattered. Stipules 0. Flowers unisexual, often in heads, in the axils of a bract and with 2 bracteoles. φ: in axillary heads or short racemes; calyx entire or 5-toothed; petals 5, imbricate, often small, alternate with the calyx; stamens 8–16 in 2 alternating whorls; anthers small, dorsiﬁxed with lateral lengthwise slits; disk pulvinate; style rudimentary. ψ: solitary, axillary or in 2–10-flowered heads; ovary inferior, 1-locular, connate with the 5-toothed or entire calyx; petals 5–8 often minute; stamens of inner whorl partly sterile, both petals and anthers soon dropping; style with 2 appressed later divergent often torulose branches stigmatose on their inside, brittle, often deﬁcient in the herbarium. Ovule 1, hanging from the apex of the cell, anatropous with 2 integuments. Fruit drupaceous ovoid to oblong.

Distr. Ca 6 spp., in Atlantic N. America, 1 in China, 1 from India to W. Malaysia.

Ecol. The American spp. mostly in swamp forests, the Asiatic one not so.

Notes. The flowers are often deﬁcient in the herbarium. The polymorphy of N. javanica suggests that perhaps more than one species is present in Malaysia.


Dioecious tree up to 40 m, 30–100 cm diam., clear bole 13–23 m, buttresses mostly absent. Twigs tomentose, glabrescent. Leaves rather dense set, oblong-lanceolate to obovate, rarely subovate, base acute, apex abruptly acuminate, coriaceous, entire, sparsely hairy to tomentose on midrib and nerves beneath, further glabrous, 5–23 by 2½–8 cm; in seedlings the 1st pair of leaves is opposite; nerves 8–11 pairs; petiole 1–3½ cm long, flat or slightly sulcate, hairy or glabrous. Flowers pallid, in pedunculate nearly globose axillary heads 12–18 mm diameter; pedicels flattened towards the apex ¾–5 cm long, their apex 2–5 mm broad, glabrous or hairy, ca halfway with 1–2 sessile small acute bracts 3–4 by 1 mm. Receptacle globose to ellipsoid, flattened, 2–3 and 4–5 mm. Flowers enveloped by 1 bract and 2 half-way connate bracteoles, all broad-ovate, sericeous-ciliate, 2–2½ by 1½–3 mm, in φ persistent.—ψ: Flowers 20–40 capitate, 1½–4 mm pedicellate; calyx teeth 4–5 rounded, 1½–2½ by 1–1½ mm, outside appressed-hairy, ciliate; petals 4–5 free, ovate with broad base, curled back, 3–5 by 1½–3 mm, both sides very short spreading hairy; stamens 8–10, those of outer whorl 3–5 of inner 2–4 mm long; anthers elliptic 1½ by 1 mm, outer loculi often larger than inner ones; disk ½–1 by 1–2 mm, 8–10 lobed.—φ: Flowers usually 3–8 rarely up to 18, sessile; calyx campanulate 2–3 by 1½ mm, densely appressed-sericeous; lobes 4–5 irregular, rounded, ½–1 by 2½ mm or almost absent; petals 4–5 as in φ but smaller 3–4 by 2½–3 mm; stamens 8–10, probably of inner whorl at least sterile, smaller than in φ; style 1½–2 by 1½–1 mm, with 2 divergent (in bud one branch longer and incurved over the other), or curled branches 1–2 mm long. Fruit ellipsoid, little flattened, 1½–2½ by 4–1½ mm, 3½–1½ cm thick, crowned by the disk & calyx limb 1 by 2 mm, immature yellow, ripe purple. Exocarp coriaceous glabrescent, mesocarp spongy-fleshy. Stone flattened obovate, acute 1–2 by 1½–2½ cm, 2–6 mm thick, on one side with 5 length-grooves, the other side with few tubercles above the middle and a length-keel.

Distr. SE Asia and Malaysia: Sumatra, Mal. Peninsula, Borneo, Java, 600–1600 m alt. (in Siam and Sumatra once at 100 m, in the Himalaya ascending to 2400 m acc. to Hook. f.).

Ecol. Common or scarce, never gregarious, in mixed evergreen mountain forests both in ever-wet and periodically dry regions (E. Java), not in sec-

(1) The family consists of 3 genera, 2 of which are endemic in Central Asia. Nyssa occurs from Malaysia to Asia and N. America. Formerly the family was included in the Cornaceae sens. ampl.
Fig. 1. *Nyssa javanica* (BL.) WANG. Twig, × 2/3, a. male flower, × 6, b–d. female flowers, × 6, e. galled fruits, × 2/3, f. fruit, × 2/3, g. seed, × 2/3.

Vern. Malay names in Sumatra mostly ‘me-dang’ with some additional name (also common for Laur.), in Java hiroeng, or kiroeng, Sd; Javanese names very variable.

Uses: Rather heavy dense wood not highly estimated. Bark grey, smooth, dingy yellow in section. Fruits are said to be edible and have a sweet odour, but a bitter acid taste.

Notes. The fruits are often deformed to a gall on which Blume based his Ceratostachys arborea. The variability in the flowering parts, their early dropping, and the brittleness of the flowers in the herbarium have caused many discrepancies in literature.

Excluded

SARCOSPERMACEAE (H. J. Lam, Leyden)

1. SARCOSPERMA

Hook. f. in B. & H. Gen. Pl. 2 (1876) 655; RIDL. Fl. Mal. Pen. 2 (1923) 260; H. J. Lam, Bull. J. B. B. III, 7 (1925) 248; l.c. 8 (1926) 18; Philip. J. Sc. 49 (1932) 143; Blumea 3 (1938) 183; l.c. 3 (1939) 261; l.c. 4 (1941) 322.—Bracea King, J. As. Soc. Beng. 64, II (1896) 101.—Apoia Merr. Philip. J. Sc. 17 (1920) 605.

Trees or shrubs, at least two spp. laticiferous. Leaves simple, entire, subopposite or opposite, rarely subverticillate; often with some alternate ones between, pinnerved; petiole sometimes with auricles at the top; blade often with glandular pits in the axils of the secondary nerves or scattered on the undersurface; tertiary nerves slender but conspicuous, transverse and usually crowded, more or less perpendicular to the midrib. Stipules small, caducous. Flowers bisexual, in small fascicles or solitary, placed along racemose or more or less broadly paniculate axillary shoots; bracts minute deltoid. Sepals 5, quincuncially imbricate, two inner ones with scarious margins. Corolla infundibuliform, tube short, slightly thickened; lobes spreading, imbricate in bud. Staminodes 5, alternipetalous, inserted in the throat. Stamens 5, epipetalous; filaments short, connate with the base of the petals; anthers basifixed, slightly extrorse, 2-celled, longitudinally dehiscent. Ovary superior, 1–2-celled, glabrous, contracted into a short stout style; cells with 1 apotropous, ascending ovule, attached to the basis of the central axis; stigma truncate, capitate or faintly 2-lobed. Fruit drupaceous, 1–(2)-seeded, ovoid to oblong; pericarp thin. Seeds with a thin-crustaceous pale dull testa. Hilum small, round, basal; albumen absent; cotyledons thick; radicle inferior.

Distr. 6 spp. of this mono-generic family occur in SE. Asia and Malaysia.

Ecol. Scattered in mixed forests from the lowland up to ± 1100 m.

Uses. The wood of the moderate-sized S. paniculatum is rather soft and not durable; in Sumatra it is used as timber (Heyne, Nutt. Pl. (1927)1245); Marco described it in detail anatomically (Trop. Woods 5 (1933)).

Notes. The genus is closely allied to the Sapotaceae; its wood anatomy is only slightly different. Herbarium specimens are often not recognized and confused with other families.

KEY TO THE SPECIES

1. Apex of the petiole with distinct auricles. Leaves oblong to elliptic, 6–28, by 3½–10 cm, dark brown s.s.; glandular pits scattered on undersurface; secondary nerves 6–11. Ovary 2-celled

1. S. paniculatum

1. Auricles absent. Leaves rather broad, 11–36 by 3–13 cm, slightly pubescent below, light brown s.s.; glandular pits absent; secondary nerves 7–16. Ovary 1-celled . . . . . . . 2. S. utitenii

1. Sarcosperma paniculatum (King) Stapf & King, l.c. Pl. 7 (1901) t. 2690; Lam, l.c.c.—Bracea paniculata King, l.c.—Discocalyx macrocarpa Elmer, Leafl. 8 (1915) 2781.—Apoia macrocarpa Merr. l.c.—Sarco sperma breviracemosum H. J. Lam, Bull. J. B. B. III, 8 (1926) 21.

Laticiferous tree, 12–27 m, unbranched bole 6–17 m, 20–50 cm diam., crown spreading. Leaves glabrous, opposite or scattered, oblong to elliptic, base acute to ± acuminate, apex gradually bluntly acuminate, 6–28 by 3½–10 cm, auricles acute ½–2 mm long; petiole 1–2½ cm. Stipules subulate, glabrous, ca 4 mm long. Inflo. glabrous or slightly tomentose, either paniculate, 1–14 cm long with branches 2–9 cm, or hardly branched 8–16 mm long; bracts glabrous, acute, 1 mm long. Flowers thickish, waxy yellow to pale greenish white, fascicled or solitary; pedicels 1–1½ mm. Sepals roundish or broadly acute 2 mm through. Corolla tube 1 mm, lobes ovate 3 by 2 mm. Stamens acute 1 mm. Stamens ovoid 1 mm through. Ovary 2 by 1 mm; style 1 mm. Fruit ovoid, 17–20 by 15–15 mm, 1–(rarely 2) seeded, 3 mm stalked; hilum 3 by 4 mm.


Ecol. Scattered in dense or open mixed rainforests, rarely in forest borders, among bamboos, or in secondary jungle, in the Malay Peninsula below 250 m, elsewhere ascending to 1100 m. Fl. and fr. irregularly.
Fig. 1. *Sarcosperma uittenii* H. J. L. a. flowering branch, $\times \frac{1}{2}$, b. bud, c. flower diagram, d. part of the corolla and calyx within, e. ovary in longitudinal and cross-section.
Vern. Not constant, few noted.

Notes. It is probable that more specimens are hidden among indeterminates in several families.

2. Sarcosperma uittienii H. J. Lam, Bull. J. B. B. III, 8 (1926) 19, f. 1, &c.—S. sumatranum Uitt. ex Lam, l.c.—Fig. 1.

?Tree. Leaves fairly opposite, oblong-elliptic to ovate or obovate, both base and apex acuminate, glabrous above glabrescent below; petiole 12–20 mm. Inflor. densely minutely tomentose, generally broadly and laxly paniculate, sometimes almost unbranched, 3¹/₄–13¹/₄ cm long, branches 1¹/₂–6¹/₄ cm long; bracts tomentose, deltoid 1–2 mm long. Flowers fascicled or solitary only known in bud; pedicels 2–4 mm. Calyx densely tomentose, 2¹/₂ by 2 mm. Corolla tube ¹/₂ mm long, lobes obovate, 2–2¹/₂ mm. Staminodes deltoid ¹/₂ by ¹/₃ mm. Stamens ovoid, 1 mm through. Ovary glabrous, 2¹/₂ by 1¹/₂ mm. Style 1 mm. Fr. unknown.

Distr. Malaysia: only known from Sumatra (Eastcoast Res.).


Vern. Only once noted.

Notes. Inadequately known. Closely related to S. kachinense (King & Prain) Exell from Burma & China, and to S. arboreum Hook. f. from India to China.

Excluded

Sarcospermum petasites Reinw. ex de Vriese, Reinwardt's reize (1858) 576 = Gunnera macrophylla Bl. (Halorrh.).
STACKHOUSSIACEAE (F. I. Brouwer, Groningen)

STACKHOUSSIA


Annual, or perennial herbs with a rhizome. Leaves scattered, entire. Stipules 0 or very small. Racemes terminal. Flowers bisexual, regular, 5-merous, in groups in the axils of bracts. Sepals usually more or less connate, rarely free. Corolla perigynous or almost hypogynous, petals long-clawed, rarely entirely free, usually free at the base, connate in the upper portion of the claws, lobes imbricate spreading. Stamens 5, inserted on the margin of the calyx tube, free, usually unequal (2 shortest), included in the corolla tube. Ovary (2–)3(–5) celled, lobed, each cell with 1 erect ovule. Style with (2–)3(–5) stigmatic lobes, partly sunk in the ovary. Fruit with (2–)3(–5) one-seeded cocci and a columella.

Distr. Ca 19 spp. in Australia, 4 in Tasmania, 1 in New Zealand and 1 in Malaysia, Australia and Micronesia (Palau, Jap).

Notes. The family consists next to the genus Stackhousia, the single one by which it is represented in Malaysia, of 2 other monotypic genera, and is practically confined to Australia. It is not directly allied to any other family and has been compared with e.g. Euphorbiaceae, Celastraceae, Sapindales, &c.


—S. mucicata (non Lindl.) duet. plur. quoad Philip.

—St. vininea (non J. Sm.) Volkens, Bot. Jahrb. 31 (1902) 467; id. var. micrantha Lautb. Nachtr. Fl. Deut. Sch. Geb. Süds. (1905) 305.—St. tenissima var. ramosa Steen. Nova Guinea 14 (1927) 307.—Fig. 1—2.

Erect, glabrous annual, 6–50 cm long. Root fusiform, up to 5 cm long, 1/2 mm diam. at the base, attenuate, with fibrous ramifications. Stem gradually attenuate to the almost filiform angular apex, little branched and leafy below, terete, striate, internodes 1/2–3 cm long. Leaves linear, sessile, base attenuate, 7/1–20 by 1/5–2 mm, lower obtuse, upper acute to mucronate, nervation absent or midrib visible. Racemes 1–20 cm long. Flowers minute yellow, upper groups 1–3 fls and 2 bracteoles, lower groups with more bracteoles and up to 5 fls. Bracts roundish ovate, strongly acuminate, fimbriate, dentate, 3/4–1 by 1/2 mm, membranous except the midrib. Bracteoles like the bracts but more dentate and less acuminate. Pedicels 3/4–1 1/4 mm. Calyx-tube 1/2 mm high, lobes ovate-acuminate, 1/2 mm long, irregularly fimbriate-dentate, margin membranous. Corolla inserted on the margin of the calyx-tube, sympetalous, hypocrateriformous, tube cylindrical, 2 by 1/2 mm, divided into 5 petals in the lower portion over 1/4 mm, lobes ovate-oblong, strongly acuminate, ca 3/4 mm long. Filaments filiform, 2 shorter ones reaching the middle, 3 longer ones the margin of the corolla-tube; anthers oblong, very obtuse and emarginate at base and apex, 0.6 by 0.3 mm, intorse, dithecic, 4-lo-}

cular. Ovary subglobose, 0.3–0.4 mm diam. 3-lobate, 3-celled. Style straight, 0.4 mm long, with 3 linear stigmas. Coeci 3, roundish ovate, 1 1/2 by 1 mm, reticulate.

Distr. Australia, Micronesia, and Malaysia: Sumatra (Toba-Batak Lands), N. Celebes, Philippines (Luzon, Culion, Guimaras), Moluccas (Boeroe, Amron, Savaroa), New Guinea, 10–100–300–600–1500 m alt.—Fig. 1.

Fig. 1. Localities of Stackhousia intermedia Bailey in Malaysia.

Ecol. Lank herb mostly in grassfields, savannahs and abandoned fields, in both wet and dry spots, in Sumatra at 600–1400, but in E. Malaysia & Micronesia below 300 m, in the Philippines ascending to 1500 m. Fl. mostly in April–May together with the grasses.

Notes. St. tenissima, virgata, aphylla and micranthu Pamp. l.c. are most probably all identical with this species.
Fig. 2. _Stackhousia intermedia_ BAILEY, × ½, fruits and flowers enlarged.
ACTINIDIACEAE (C. G. G. J. van Steenis, Buitenzorg)

1. ACTINIDIA


Trailing shrubs or lianas without special organs for climbing, branches rarely flexuose; stem with wide vessels, raphides in the flowering parts; bark often with short linear lengthwise lenticels. Growth in flushes from terminal and axillary buds. Indumentum of stellate or simple hairs. Stipules minute, obsolete, or absent. Leaves simple, scattered, petiolate, serrate or callous-dentate, penninervous, midrib sulcate, veins in cross-bars, veinlets reticulate. Inflor. lateral, often on a common peduncle forked at the apex. Cymose, often pseudo-umbellate; bracts 2, at the apex of the pedicule. Flowers mostly white, dioecious (or polygamous), 5–(4–)merous. Sepals distinctly imbricate (rarely valvate), free or subconnate at the base. Persistent. Stamens (10–)∞, in ♀ flowers with short filaments and small sterile anthers; filaments thin, anthers versatile, base divaricate, attached in the middle, reflexed in bud, dehiscing lengthwise. Disc absent. Ovary free, superior, tomentose (or glabrous), (5–)∞-celled; ovules attached on the central axis. Styles free, (5–)∞, persistent, elongating after flowering in ♀, ±clavate, spreading, in ♂ ovary small, with minute styles. Berry glabrous (or hairy), often spotted by lenticels, oblong. Seeds ∞, small, biconvex, oblong, immersed in pulp; testa cartilagineous, reticulate-pitted, dark when dry; albumen copious; integuments 1; embryo cylindrical, straight, cotyledons short.

Distr. Ca 30 spp. from W. Malaysia & Himalaya to Sachalin, Japan and Formosa, centering in China and Japan.

Notes. Both Malaysian species appear to be strictly dioecious; the number of ♂ and ♀ sheets in A. callosa is about equally large; on Mt Kinabalu only ♀ have been found of A. latifolia. The total number of specimens examined is considerable; the species are either rare or little collected being inconspicuous. The genus Actinidia is often included in Theaceae, Dilleniaceae, or even Ericaceae, and it is closely related to Saururaceae from which it differs in its trailing or climbing habit, absence of scale-like emergences (except in A. strigosa), mostly dioecious fls, ebracteate pedicels, lengthwise dehiscing anthers, numerous styles, and a multilocular ovary. I wish to express my sincere thanks to Mr H. K. AIRY SHAW and to Mr M. R. HENDERSON for verifying the MS. of this contribution with the materials preserved at London and Singapore respectively.

KEY TO THE SPECIES

1. Leaves either glabrous or subglabrous, or provided with simple pluri-celled hairs. Petals glabrous.
   Inflorescences short ........................................ 1. A. callosa
   2. Leaves glabrous or subglabrous ........................................ 2. A. latifolia
   2. Leaves rather distinctly subtomentose beneath ........................................ var. pubescens
   1. Leaves subtomentose beneath. Petals pubescent on the back. Inflorescences often well-developed.
      Pedicule 1½–8 cm ........................................ 1. Actinidia callosa


Rambling or trailing shrub or liana up to 30 m, twig-lenticels distinct, wood and inner bark orange. Petiole red s.v., 1–4 cm, blade rather variable in shape ovate-elliptic or obovate, acuminate, midrib red s.v., 5–10½ by 2½–6 cm, sidesinerves ca 5–6 pairs rather steeply ascending and substraight, insertion decurrent, margin distinctly serrate or dentate, teeth erect at the end of a vein, apex acuminate, base rounded to subacute. Indumentum meagre or absent, consisting of short often somewhat crisped pluri-celled simple hairs. Peduncle, pedicels and calyx thin-tomentose. Pedicule 1½–1½ cm, pedicels 1½–1¼ cm, all thin. Dioecious, flowers white, anthers yellow. Sepals ovate-orbicular, ca 6 by 5 mm. Petals oblique-broad-spathulate, sub-
Fig. 1. Actinidia latifolia (GARDN. & CHAMP.) MERR., habit × $\frac{1}{2}$ (after KING).
fleshy, margin ± irregular, ca 10 by 7 mm. Stamens ∞ in ca 2 rows, filaments subequal, ca 6 mm (in φ very short); anthers 1½ by 1 mm, apex subapiculate (in φ sterile, hardly dehiscing); φ ills unknown to me. Ovary stout cylindric, styles ca 2 mm (in φ very small, reduced). Berry grey-green, spotted grey or brown, entire syncarp, oboval to broad-elliptic, often oblique, apex often concave, 17–27 by 14–18 mm, base rounded, sepals recurved. Seeds elliptic, 3 by 1½ mm.

Distr. SE. Asia, China, Formosa, in Malaysia: Sumatra, Java.

Notes. Young shoots edible. Leaves sometimes with raspberry-coloured zoceccida consisting of crowded-hairy portions. In Java a juvenile shoot was collected with subordinate subglabrous leaves resembling in shape those of *A. latifolia*. A rather variable species; some of the forms distinguished by Dunn are now taken up as species, wrongly it seems. *A. indochinensis* Merr. apparently belongs here.


Distr. Assam, in Malaysia: Malay Peninsula (Henderson 23436), Sumatra (Korthals, Forbes).

Notes. Apparently rare, may be confused with *A. latifolia*. The Sumatra specimen has glabrous twigs, the others hairy ones. The indumentum seems partly caducous. I assume Korthals’s specimens came from Sumatra, not from Java.


Rambles shrub or liana to 20 m long, twigs dark-coloured s.s., innovations, inflor. and under-surface of the leaves thinly cinnamon- (s.v. rusty-red)-stellate-tomentose. Petiole 2–4 cm; blade broad-ovate, oboval to suborbicular, 5½–11 by 3–9 cm, base reniform-cordate to rounded or cuneate, apex acuminate, margin subentire with small callous teeth, veins rusty in distinct cross-bars, reticulations below hidden by a pale closed indumentum, upper surface puberulous. Peduncle rather stout, ± remote from the petiole, 1½–8 cm long, apex forked, ± pseudo-umbellate, rich-flowered, pedicels in fr. apparently enlarging. Flowers velvety, light-brown, yellow inside, stamens yellow (*ex coll.*). Only seen φ buds, these depressed-globose. Sepals tomentose outside. Petals pubescent outside, apex imbricating, basal parts free, blunt, rather roundish, pale green in bud apparently smaller than in *A. callosa*. Anthers numerous ± 1 mm long, on ½–3½ mm long filaments, sterile hardly dehiscing. Ovary depressed-globose, densely pilose, 1½ mm high. Styles ∞, ± 2 mm long, slender-clavate, overtopping flatly the anther clump. Berry acorn-shaped, 3–4 by 2 cm, brown, spotted pale. Seeds broad-elliptic, ± 1½–2 by more than 1 mm.

Distr. China, Indochinese Peninsula, Hong-kong, ?Formosa, Hainan, in Malaysia; Malay Peninsula, Sumatra, Borneo.


Vern. Once noted, S. Sumatra, *wait boerah*.

Notes. There is some variability in the size of the inflor. *A. formosana* Hayata probably belongs here. Expected to occur in the Philippines.
FLORA MALESIANA
CERATOPHYLLACEAE (C. G. G. J. van Steenis, Buitenzorg)

I. CERATOPHYLLUM


Submerged, rootless, monoecious freshwater plants. Leaves verticillate, 2–4 times forked, segments linear dentate. Flowers actinomorphic, solitary, axillary, unisexual. Perianth valvate, segments 9–12, persistent, narrow. φ: stamens 8–24; anthers nearly sessile rather broad, connective pointed, the 2 cells mostly crowned by a minute bristle; ovary rudiment absent. Ψ: ovary superior, sessile, 1-celled with 1 ovule; style persistent, subulate, sulcate towards the apex; stamen rudiments absent. Fruit oblong, compressed, warty, not dehiscent, near the base with 2 straight or curved soft spines, or unarmed.

Distr. Ca 2 spp., both ubiquitous.

Ecol. In stagnant pools, small slow streams, shallow parts of lakes and ditches, in ponds, often gregarious. The specimens are frequently rough by incrustations of lime. They 'collect' mud on their surface and contribute to the clearing of water as do Hydrilla, Blyxa, &c. The stems die at their distal end and grow at the top. They propagate easily vegetatively but remain often sterile; near Batavia they are locally rather frequently found flowering in shallow water. The leaves are slack though in C. demersum slightly stiffer than in C. submersum. On extracting material from the water the leaves join brush-like.

Key to the species

1. Leaves mostly 3–4 times forked, segments 7–12. Fruit with 1 apical spine only


Plant often much branched up to 3 m long, stems mostly red, internodes 1–3 cm. Leaves in whorls of 7–10, dark green when adult, 1–4 cm long, base gradually or abruptly thickened above the middle. Pedicel 3½–1½ mm. Perianth segments 9–12, linear, transparent greenish-white with numerous short brown lines, near the apex with few bristles, 1½–2 mm long. φ: stamens 8 or more. Ψ: ripe fruit black, 4–5 mm long, with 3 spines, apical spine (style) 11–12 mm long, soft, 2 basal ones straight (in Mal. material), patent to slightly recurved, 9–11 mm long.

Distr. Throughout Malaysia, not yet known from the Malay Peninsula, ascending to over 1500 m.

Ecol. See above. The 'internodes' of the leaves are sometimes inflated and imitate an articulated structure.

Vern. Kantiil, M, ganggeng, Sd., ganggong, J, hoornblad (Dutch); the Indonesian names are also used for other waterplants.

Fig. 1. Ceratophyllum demersum L. Habit, detached leaves, × 3½, fruit enlarged.
Much like the preceding sp., up to 1 m long, leaves in whorls of 6–8, adult ones 1\(\frac{3}{4}\)–2 cm long, bright green. Flowers not yet found in Malaysia. ♀: ripe fruit black, ± 4 mm long, only the style thickened into an apical soft spine, basal spines absent.

**Distr.** In *Malaysia* rather rare: N. Sumatra, Java, Celebes, and New Guinea, at low altitudes.

**Ecol.** In places as the prec. sp., the New Guinean specimens were found massed in open water in *Melaleuca leucadendron* swamp forest, plant brown (BRASS).
HYDROCARYACEAE (C. G. G. J. van Steenis, Buitenzorg)

I. TRAPA


Floating aquatic herbs with dimorphic leaves, submerged ones opposite pinnatifid rootlike, apical ones in a rosette, rhomboid, dentate, with spongy often inflated petiole, arranged in leaf-mosaic; stipules 4-8, minute. Flowers bisexual, small, solitary, axillary, short-pedicelled, 4-merous, white or lilac. Petals imbricate. Disk present. Ovary half-inferior with 1 style and 2-4 persistent sepals turning often to thorns or horns. Fruit mostly 1-celled, 1-seeded, shell bone-hard; thorns after withering often set with barbs at the apex. Seed often producing 2-5 free germ-stalks.

Distr. Several species in the Old World, but not known from Australia.

Ecol. Trapa is very rare and was for the first time reported in 1877 in Java. It is surely a component of the old lowland eutrophic swamp flora such as is preserved in the Danoe swamp (Bantam).

Use. The fat-containing kernels of T. bicornis are highly nutritious and are eaten in West Java but not on a scale comparable to that of several parts of Asia, where it is a staple food.

Notes. Sometimes included in the Onagraceae or Haloragaceae. The names are those given by H. GLÜCK in sched. Herb. Bog. There is little agreement about the specific distinctions in the genus Trapa.

KEY TO THE SPECIES

1. Fruit triangular to 4 cm high, 7-8 cm broad with 2 large horns. Leaves green . . 1. T. bicornis

1. Trapa bicornis OSBECK var. cochinchinensis (LOUR.) GLÜCK—OSBECK, Dagb. Ostind. Resa (1757) 191; LINNÉ f. Suppl. (1781) 128; VORDERMAN l.c. 313; MERR. Comm. Lour. (1935) 290; HEYNE, Nutt. Pl. (1927) 1206; OCHSE, l.c. t. 47.—T. cochinchinensis LOUR. Fl. Coch. (1790) 108; BACKER, Ann. J.B.B. Suppl. 3 (1910) 418.—T. chinensis LOUR. l.c.—Fig. ff.

Leaves green, petiole 9-20 cm long, blade 5-7 by 6-9 cm. Flowers white. Horns of the fruit very blunt, straight or subcurved, their lateral surfaces bluntly irregularly ribbed.

Distr. Native of Asia, in Malaysia: introduced probably by the Chinese, cultivated mostly near Batavia by the Chinese. In Batavia markets fruits are offered for sale of variety with black sharpened curved points suggesting buffalo horns often referred to as T. bispinosa ROXB.; these fruits are imported apparently directly from China (Teysm. 4. p. 499; WEBSTER l.c. fig.).

Vern. Lengkat, lengkong, ling, lingkok, chin, kerendan (Batavias), calthrop(s), Chinese water chestnut (Engl.), waternoot (Dutch).


Fig. 1. Trapa maximoviczii KORSH. a. leaf, b. germinating fruit, c, d. fruits.—e. Trapa bispinosa ROXB. (edible, imported fruits on the market at Batavia).—f. Trapa bicornis OSBECK var. cochinchinensis (LOUR.) GLÜCK (edible, cultivated locally), in section, × 1/2.

(1932) 62, 63, f. 9.—T. quadrispinosa auct. non Roxb.; VORDERMAN l.c.; Trop. Natuur 9 (1920) 73, f.; HEYNE l.c. 1207; OCHSE l.c. fig. 48.—Fig. 1.

Leaf blade towards the base black-brown or with 2 dark spots, 2½–4 by 3½–5½ cm, petiole 5–15 cm. Corolla pale lilac, anthers yellow. Fruit tipped by the conical hardened style. Thorns straight or curved often unequal, their apex barbed, surface of the fruit smooth, not ribbed.

Distr. SE. Asia, rare but certainly native in Malaysia: W.-NW. Java (from Indramaju to Bantam, e.g. Danu swamp (ANON. (1877), l.c.; VORDERMAN, l.c.) and S. Sumatra (Palembang Res., Lake Teloko, near Kaju Agung).

Ecol. Swamps and ponds, disappearing under anthropogenic influence.

Vern. Salekat, salaikat, M.

Notes. Possibly one of the forms of T. natans L. s. ampl.
MORINGACEAE (C. G. G. J. van Steenis, Buitenzorg)

1. MORINGA


Small trees, mostly deciduous, bark gummy, wood soft, roots thickened, pungent, trunk often inflated. Leaves spread, imperfectly 2-4-imparipinnate: tissue with myrosin cells; pinnate opposite, provided with stipitate glands at the base of the petiolo1es and pinnate. Leaflets small, opposite, entire, all articulated. Stipules represented by blunt knobs. Flowers bisexual, zygomorphic, white (or yellow streaked red), in axillary panicles. Calyx tube short, as a hypanthium; lobes 5 imbricate, spreading or reflexed, separately dropping. Petals 5 free, anterior one largest and erect, others reflexed, posterior smallest. Disk lining the calyx tube, with a short free margin bearing the androecium. Perfect stamens 5 epipetalous; anthers dorsifixed, 1-celled, oblong, when lengthwise opened broader. Stamnodes 5, subulate, with or without rudimentary anthers. Ovary superior, shortly stalked, 1-celled with 3 parietal placentas. Style filiform, stigma small. Ovules ~, in 2 series on each placenta. Capsule linear, beaked, 3-6-angled; valves thick, spongy, on the inside with pitted cavities in 1 row along the median line. Seeds 3-winged (or exalate), body roundish large. Embryo exaluminous, straight, containing oil.

Distr. Ca 10 spp., confined to the semi-arid countries of Somaliland, Madagascar, SW. Africa, NE. Africa, Asia Minor, 2 spp. in India.

Ecol. Said to be deciduous, but M. oleifera is to my knowledge in Malaysia never wholly so, thriving both under wet and seasonal conditions. As far as is known M. oleifera never runs wild.


Notes. Very different opinions have been advanced on the affinity of Moringa. Dalzell arranged it with the Bignoniaceae; even recently Hallier f. (Rec. Trav. Bot. Néerl. 15 (1918) 60, 99) followed Bentham, Miquel and others in assigning Moringa to the Leguminosae as a syncarpous remote member; Griffith, however, had already predicted (Posth. Pap. 2 (1839) p. xiv, 1849) that polycarpous Leguminosae should be apocarpous (as now described in Archidendron &c.). The genus is now universally adopted as allied to the Capparidaceae. In Malaysia one species occurs, only cultivated.


Rapid-growing often crooked tree 3-10 m, stem 10-30 cm diam., crown thin, bark with coarse fibre. Leaves somewhat crowded towards the twig-ends; twigs lenticellate, with distinct scars; innovations pubescent. Petiole thickened at the base incl. the rachis 25-60 cm, all stalks articulated hence caducous, provided with linear or clavate often curved glands; jugae 8-10. Petiolo1es 1-6 mm, blades ovate, obovate or oblong, 9-20(-30) by 5-12(-18) mm, tip rounded or slightly emarginate, lower surface pale green, nerves obscure not prominent. Panicles erect, 10-30 cm; bracts small. Flowers white with greenish base, fragrant; pedicels 7-11 mm, articulated under their tip. Calyx tube 3-4 mm high, posterior sepal 7-10, anterior 10-14 mm long. Petals hairy towards the base, anterior one 14-17 by 6-8 mm, posterior ones 10-13 by 5-8 mm. Stamen5 and staminodes hairy, directed to the largest petals, apex of the filaments recurved. Gynophore 2-3 mm. Ovary 3-4 mm high, densely hairy; style upwards glabrous with hollow stigma. Capsule pendent, dagger-shaped, subtorulose, 18-45 cm long, valves with 3 strong blunt ribs. Seeds 10 mm diam., wings 25 by 4-7 mm, subsequent ones partly overlapping; testa reticulate.

Distr. Indigenous in NW. India, in Malaysia introduced at an early date, now planted throughout the settled areas in all tropics, not run wild, sometimes found as a culture relic in abandoned places, up to ca 500 m.

Ecol. Flowers throughout the year, fr. mostly Sept.-Nov. Exclusively propagated by cuttings. Germination hypogaeic. Colibrís, and in India honey-suckers, are reported to visit the flowers. Once corallloid twig-galls 10-30 cm diam. were found in W. Java. Damage of the stem by insects causes quick exudation of gum.

Vern. Horse radish tree (Engl.), keler, J, M, Md,
marongghi, Md, marunga (Timor), k(o)lêntang (fruct.), malungay, Tag. Philip., gemunggai, meringgai (Mal. Pen.), and many others.

Uses. Many: flowers, leaves and immature fruits as vegetable. Leaves and bark (specially of the roots) medicinal. Bark-gum and seed-oil not valuable. Treelet sometimes used for living fences or as supporting tree for pepper vines (cf. Rumpfius, Greshoff, Heyne, Burkill, &c.).


Fig. 1. Moringa oleifera Lamk, × 1/5.
SAURURACEAE (C. G. G. J. van Steenis, Buitenzorg)

Rhizomatose, aromatic or pungent, perennial, often stoloniferous herbs. Stem articulated. Leaves simple, entire, scattered (not alternate), often oblique; leaf base mostly reniform-cordate, nervation mostly palmate. Petiole sheathing or an intrapetiolar stipule. Flowers bisexual, actinomorphic, small, in terminal spikes or racemes or opposite the leaves (sympodial), each in the axil of a bract, bract sometimes connate with the pedicel; lowest bracts sometimes petaloid. Perianth absent. Stamens 3, 4, 6 or 8, sometimes partly abortive, free or adnate to the basal part of the ovary or epigynous. Anthers 2-celled, splitting lengthwise laterally or extrorse. Ovary composed of 3–4 connate carpels, or 1-celled with 4–3 parietal placentas. Styles free or connate at the base, often recurved, stigmatose on the inner surface. Fruit capsular opening at the top, or consisting of tubercled indehiscent 1-seeded cocci.

Distr. 4 genera, 2 in E. Asia, 1 in California, and 1 both in Asia and Atlantic N. America; the latter with 2 species, the others monotypic.

Ecot. Mostly in marshy places.

Uses. In China and N. America medicinal with acrid and adstringent properties.

Notes. Formerly sometimes included in Piperaceae. A key to the genera is given in Blumea 6 (1948) 244–245.

KEY TO THE GENERA

1. Short spike of sessile flowers subtended by 4 petaloid bracts. Intrapetiolar stipule distinct
   1. Houttuynia

1. Elongating raceme. No petaloid bracts at the base of the raceme. Petiole sheathing

2. Saururus

1. HOUTTUYNIA


Distr. Monotypic, from India & Indo-China to Japan and Formosa, in Malaysia doubtfully native.

Notes. The generic name Houttuynia Thunb. should be preserved against the older Houttuynia Houtt. and was proposed for the list of Nomina generica conservanda (Fl. Mal. Bull. 3 (1948) 73).


Root-stock copiously branching, up to more than 1 m long. Stems erect or ascending, up to 50 cm long. Leaves broad-ovate, base reniform-cordate, apex acuminate, 3–8½ by 2½–6½ cm; petiole 1–4 cm. Petaloid bracts white, oblong, ½–1½ cm long. Spike 1–2 cm long. Seeds ½–2½ mm long, ellipsoid, testa of dry seed reticulate.

Distr. Under temperate conditions from the Himalaya to E. Asia, also in Formosa, in Malaysia: only once found in W. Java, ca 1250 m alt., questionably native. Might be expected to occur in Luzon or Mindoro.

Ecot. A tenacious and obnoxious weed; crushed leaves with a fishy or fleshy smell, in W. Java found in a tea-plantation and a neighbouring bamboo grove.


Vern. djikut hanjir, Sd, after the peculiar smell which much intrigued the Sundanese workers in the plantation and gave rise to a legend that the plant proceeded from the flesh and blood of a man who was killed by a tiger in the same spot. On account of the smell there was even trouble with Japanese weeders.

2. SAURURUS

Linné, Sp.Pl. (1753) 341.—Spathium LOUR. Fl. Coch. (1790) 217.—Mattuschkia Gmel. Syst. 2 (1791) 589, non al.—Saururopsis TURCZ. Bull. Soc. Nat. Mosc. 21 (1848) 1, 589; BAILL. Adans. 10 (1871) 69.—Saururotus ENGL. E. & P. 3, 1 (1887)

Tall erect herbs up to 1 m or more. Leaf base reniform-cordate. Flowers in the axils of bracts, or pedicels connate with the bracts. Stamens (8–)6, or by abortion only 4, sometimes opposite the carpels, sometimes lateral; filaments ± free. Ovary composed of (3–)4 carpels connate at their base, each with 2(–4) ovules, only one developing. Styles free, recurving. Fruit depressed-globose, said to be subfleshy, parting into (3–)4 tubercled cocci. Testa of roundish seed reticulate.

Distr. 2 species, one in E. Asia, 1 in Atlantic N. America.

Notes. Gymnotheca Decne (S. cavaleriei Lév.) constitutes a distinct genus. The N. American S. cernus L. is apparently distinct through a slightly different leaf-shape, very long filaments and nodding spikes. These differential characters ought to be further studied.

1. Saururus chinensis (Lour.) BAILL. Adans. 10 (1871) 71; Loud. Hort. Brit. (1830) 144, nomen;


Glabrous, except for pedicels & rachis. Stem ribbed, pithy, lower part terete, upper part angular; lower leaves amplexicaulose, leaving annular scars, upper ones half-amplexicaulose, stem somewhat zigzag towards the apex, internodes 1–4 cm; lower petioles 6½2, upper ones 3–1½ cm long. Leaf blade mostly oblique, base reniform-cordate-truncate, apex acute to slightly acuminate, palminervous with 5 larger and 2 feeble nerves, shape ovate-lanceate, 8½2–12½ by 3½–6½ cm. Spikes straight, bracts in bud pine-like imbricating, 5–8 in fruit to 15 cm long; peduncle glabrous, 1–3 cm. Rachis and pedicels pubescent. Flowers white, fragrant. Bracts ovate to roundish, or broad-spathulate, their blade 1–2 by 1–2 mm, ± ciliate, with brown dots (glands) in the parenchyma, connate with the 1½–3 mm long pedicels and winging these; rachis angular by the recurrent pedicels. Anthers 4 behind the carpels, or 6 (in twos lateral of the carpels), or 8. Filaments ± ½3–1½ (½4) mm; anthers ± convex, elliptic, ± ½4–1 mm long, extrorse. Cosei 4, tubercled, ½2 mm long; style recurved ca ½2 mm. Seed ovoid, fine-reticulate, ½6–1 by ½3–½4 mm.

Distr. Indo-China & Hainan to Central China, Japan, Riu Kiu and Formosa, in Malaysia only in Luzon (Ilocos Norte, Bontoc), in swampy places, muddy banks, rice-fields, 50–1100 m.

Notes. It should be studied whether there are several sexual forms showing floral dimorphism.

Uses. Used as a drug in China (Groff i.e.).
STYRACACEAE (C. G. G. J. van Steenis, Buitenzorg)

Evergreen trees or shrubs. Leaves simple, spirally arranged, sometimes pseudo-alternate, margin entire or toothed, mostly with stellate or lepidote indumentum. Stipules 0. Flowers bisexual, actinomorphic, axillary or terminal. Calyx tubular more or less adnate to the ovary; lobes if present valvate. Corolla rarely of free petals, mostly united in a basal tube, 4–7, valvate or imbricate. Stamens equal and alternate, or double the number of the petals, mostly adnate to the tube. Disk absent; anthers 2-celled, introrse, splitting lengthwise. Ovary superior, rarely semi-inferior, 3–5-celled. Style 1; stigma punctiform to 3–5-lobed. Ovules 1–∞ in each cell, axile. Fruit capsular (rarely drupaceous) 1–∞-seeded, dehiscent or not, pericarp often thick and woody or corky, with a persistent calyx. Seeds with copious endosperm and straight or slightly curved embryo.

Distr. Ca 12 genera mostly in the N. hemisphere, absent in Australia and the Central Pacific, richly developed in E. Asia. No Styracacea has yet been found in the Philippines proper, Central & East Java, and the Lesser Sunda Isl.. Sumatra is the richest centre in Malaysia.

Ecol. Styrax represents a northern type in the Malaysian flora but its representatives are found both in the lowland and the mountains up to ca 1600 m alt. Most peculiar galls are found in Styrax, caused by specially adapted Aphids, which surpass the European oak galls in variety (cf. Doct. v. Leeuwen, Bull. J.B.B. III, 4 (1922) 147; Zooce. D.E.I. (1926) 452: Tijd. Entom. 75 (1932) Suppl. 97; Ned. Kruidk. Archief 51 (1941) 217, and J. van der Meer Mohr, Natur & Museum 63 (1933) 163, 6 fig.).

Uses. The wood is little used. Of some Styrax spp. the bark after having been softened by taps yields benjoin resin from incisions made in the bruised portion. This resin contains benzoic or cinnamic acid. Tapping benjoin is a common procedure in Sumatra, mainly Palembang and Tapanul Res.. Benjoin is used as an antiseptic, in cigarettes and ceremonial, and is an important forest product of Sumatra.

Wood anat. See also generic descriptions. The ground tissue by Moll & Janssonius (2 (1920) 472) called fiber tracheids according to Reinders’s definitions (Handl. 3 (ed. 1941) 145) are libriform fibers; checked by C.A.R.-G.

Notes. The genus Symplocos was formerly often included in the Styracaceae or Styracinae, but is accepted to represent a separate family Symplocaceae in this Flora. Styracaceae possess stellate hairs, or scales, not fasciculate stamens, linear anthers, a half or wholly superior ovary, an imperfectly celled fruit, and differ, moreover, anatomically distinctly from the Symplocaceae.

KEY TO THE GENERA

1. Pedicels articulated. Flowers dull-creamy; lobes and stamens free. Ovary glabrous, imperfectly 5-celled. Seeds minute, numerous. Leaf margin serrulate
   1. Bruinsmia  
   2. Styrax

1. BRUINSMIA


Glabrate tree with flattened-angular branchlets through decurrent petioles. Leaves serrat, brownescent. Flowers in (mostly foliate) terminal thyrses. Pedicel with 1 bracteole, articulated at the apex. Buds solid. Calyx broad-campanulate with truncate margin, entire or sub-5-toothed. Corolla-lobes 5(–6), free, imbricate. Stamens 10(–12), 5 longer alternate, 5 shorter epipetalous, or 10 subequal, coherent mutually and with the base of the corolla-lobes. Ovary free for the greater part, imperfectly 5(–6)-locular. Style 5-angular, not grooved. Stigma capitate, sub-5–6-lobed. Ovules ∞. Fruit indehiscent, pear-shaped; style-base mostly persistent. Seeds small, prismatic-4-angular.

Distr. Monotypic, endemic in Malaysia.
1. **Bruinsmia styracoides** Boerl. & Koord. &c. lll. cc.; Steen. J. Am. Arb. 28 (1947) 422.—B. celebica Koord. Med. ’s Lands Pl.T. 19 (1898) 525.—Fig. 1.

Evergreen tree 15–37 m, diam. 30–150 cm (mostly 25 m by 40 cm); clear bole 7–11 m, without buttresses, bark dirty orange in section. Adult leaves oval to oblong, base mostly rounded, apex acute to acuminate, sparsely hairy, 7½/2–19 by 3–10 cm; primary nerves 6–10 pairs; petiole sulcate 1–1½ cm long. Thyrses 10–25 cm. Pedicels 2 mm; bracteole narrow, 1–2½ mm long. Calyx 1½–2 mm high, 5–6½ mm diam. Corolla lobes pubescent on both sides, tip cap-shaped, ovate-oblong, acute, 9–10 by 4–4½ mm. Stamens 5–5½ and 6–6½ mm, sometimes subequal 3½–4 mm; filaments glabrous or short-hairy inside and marginal; cells 1½–3 mm long. Ovary 2–2½ mm high, 3–3½ mm diam. Style 3–5 mm long. Fruit 6 by 9 to 10 by 6 mm; style remnant ½–6 mm long. Seeds 1½ mm long.

**Distr.** Sumatra, W. Java (W of Buitenzorg), Borneo, Celebes, and New Guinea, (400–)700–1600 m alt., expected to occur in the Philippines & Moluccas.

**Ecol.** In primary or partly devastated forests, rather rare; globose leaf-galls ½–1 cm diam. are found in Borneo and New Guinea.

**Vern.** Names local and not trustworthy.

**Uses.** Wood not durable and besides the tree is rare, though dimensions would be sufficient.

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2. **STYRAX**


Shrubs or trees, at least the innovations stellate-hairy, tomentose or lepidote. Leaves mostly tomentose below; petiole sulcate. Calyx campanulate to cup-shaped, free, or the base connate with the ovary, truncate, rarely toothed. Flowers solitary, mostly in racemes or leafy panicles. Corolla lobes 5(–6–7), connate at the base with the annular staminal tube. Stamens (8–9–)10(–11–14), erect, connate at the base; anders split lengthwise. Ovary imperfectly 3-locular, with few ovules per cell, or only 1. Style 3-angular; stigma punctiform or indistinctly 3-lobed. Fruit globose to oblong, dehiscent or not. Seeds 1(–2) attached at its base.

**Distr.** Ca 120 spp. in the tropics and subtropics of Europe, Asia, Malaysia, and America. In Malaysia the genus is richest in Sumatra, but the widest distributed species, St. agrestis, is not found in that island.


**Notes.** In Java St. tonkineus Pierre furnishing Saigon benzoe is recently cultivated by the Forest Service. In the key below it is to be placed nearest to St. ridleyanum but differs distinctly by its narrow buds 7–10 by 2–3 mm.

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**Key to the Species**

1. Undersurface of adult leaves with a closed tomentum, concealing the parenchyma.
   2. Corolla imbricate in bud
   3. Indumentum glaucous without stellate brown hairs or scales in adult leaves
   4. Tomentum thin with appressed stellate scales. Fruit large, globose to ovoid-globose, 2½–3 by 2½–3½ cm. Seed shining brown, base broad, 1½ cm across, hilum 1 cm
   5. St. oliganthes
   6. St. paralleleum
   7. Armes of brown stellate hairs ½ mm long. Leaves large 1½–2½ by 6–12 (rarely 8 by 3) cm.
   8. St. sccrulatum var. mollissimum
   9. St. serrulatus
   10. St. oliganthes
   11. St. paralleleum
   12. St. crotonoides
5. Stellate hairs minute, arms much smaller than 1/2 mm.

7. St. ridleyanum

6. Inflo. mostly shorter than the leaves. Youngest twigs greyish. Pedicels 1½–4 mm. Mature buds 12 by 3 mm. Calyx 4–4½ mm high, 3–3½ mm diam. Petals fleshy, median part inside impression and glabrous. Connective glabrous. Stigma punctiform as thick as the style

3. St. benzoin

1. Adult leaves not with a closed indumentum.

1. St. agrestes

7. Corolla imbricate.

2. St. japonicum

8. Fruit with rounded apex. Calyx tomentose. Flowers mostly in paniculate rich-flowered infl. Pedicels shorter, flowers not drooping

8. St. serrulatum


var. mollissimum

var. rugosum


Fig. 2. Fruits and seeds of Malaysian Styrax. Upper row from left to right: St. serrulatum Roxb. var. mollissimum Steen., St. serrulatum Roxb. var. rugosum Steen., St. oliganthes Steen., St. agrestes (Lour.) G. Don, St. crotonoides Clarke. Second row: two forms of St. paralleleoneurum Perk., with seed. Third row: St. benzoin Dryand., right: a seed of St. benzoin Dryand. var. hilferianum Steen., showing the large hilum, × 3/4.


Shrubb or small tree 3–12 m, up to 5 cm diam. Leaves thin, ovate-oblong to ovate-lanceolate, apex acute to acuminate, 3½–13 by 2–6 cm; nerves 4–9 pairs; petiole 2½–6 cm. Racemes 1½–12½ cm, lowest fls often axillary. Pedicels frequently united in twos, 4–6 mm, in fr. 9 mm. Calyx 3–5 mm across. Corolla tube 2–3½ mm high, lobes oblong to lanceolate, acute, outside hairy. Stamens hairy below, upper part narrowed and glabrous, 7–10 mm; anthers linear, as long as the filaments, not glabrous. Ovary with a 2½–1½ mm long beak. Fruit 1–2-seeded, often oblique, rostrate by a 1–3½ mm long beak. Seed acute at both ends, lengthwise grooved, lepidote, base contracted, 7–13 by 2½–5½ mm.

Distr. From Annam and Hainan through Malaya and the Solomons & Micronesia, in Malaysia: Borneo, Celebes, Moluccas, New Guinea, and Bismarcks, 10–300, rarely to 1000 m alt. in the Solomons and NE. New Guinea.

Fig. 3. St. agrestes (Lour.) G. Don, with fruits and a stem gall intermediate between the coralloid and the alicorniform types, × 1/2.
Ecol. Undergrowth of primary forests, in Bornéo and New Guinea inundated in the wet season, *fl.* and *fr.* mostly simultaneous, March–Nov. From Borneo coralliform twig galls are described.


Notes. A Hainan specimen was distributed as *St. subcrenata* H.M.

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Shrub 2–3 m. *Leaves* on long-branches alternate, ovate to ovate-lanceolate, sparsely stellate-lepidote to subglabrous and often with domatia in the nerve-axils below, 4 1/2–9 1/2 by 2–6 cm; lateral nerves 4–5 pairs; petiole 4–7 mm. Pedicels 1–1 1/4 cm, base densely lepidote, upwards sparsely so, thickened towards the calyx, drooping. *Calyx* campanulate, 4–5 mm high, stellate-lepidote. *Fruit* ellipsoid, apex truncate, mucronate, seed oblong, 3 1/4-sulcate, surface minutely pitted, 10–11 by 5–6 mm.

Distr. Japan, N. China, Riu Kiu and Formosa, in Malaysia: N. Philippines (Camiguin & Batan Isl., N. of Luzon), only twice found, apparently at low alt.


Notes. A distinct northern type, here accepted as a slightly differentiated outlier of the *Styrax* japonicum population with somewhat larger flowers.

3. *Styrax benzoin* Dryand. Phil. Trans. 77 (1787) 11, 308; Perk. Pfl.R. 30 (1907) 59; Steen. Bull. J. B.B. III, 12 (1932) 228; Burk. Dict. (1935) 2105.— *St. benzoe* Bl. Cat. (1823) 6, nomen.— *St. benjoin* Roxb. Fl. Ind. (1832) 415.— *Lithocarpus benzoin* Bl. ex Royle, ill. (1839) 261, in syn.—Plagiospermum benzoin Pierre, Fl. For. 4 (1889) 260.— *St. rauensis* Boerl. *ms.* ex Gresh. l.c.—118.—Fig. 2, 4, 5b.

Tree 8–34 m, trunk 10–100 cm diam., butresses small or absent; bark wine-red in section, 3–7 mm, wood white. *Leaves* ovate to oblanceolate, base rounded, apex acuminate, 8–13 by 2 1/2–5 cm; petiole sulcate 5–13 mm; nerves 7–13 pairs. *Flowers* fragrant, in 6–11 cm long panicles often forming a leafy panicle 13–20 cm long. Buds solid, blunted. Pedicels 1 1/2–4 mm, top-shaped. Corolla lobes 9–12 by 2–3 1/2 mm, tube 1–2 mm high. Staminal tube 2 1/2–4 mm, anthers 5 and 1 1/4 mm long. Ovary 8–12 mm high. *Fruit* depressed-globose 2–2 1/2 by 2 1/4–3 cm, indehiscent; pericarp (3–)4–5 mm diam., subtended by a rarely appressed calyx 7–13 mm diam. Seed (1–2), ca 15 by 19 mm, dull pale brown; hilum 3–6 mm diam., in *var. hiliferum* 10–12 mm diam.

Distr. Malaysia: Sumatra (only the main land), Malay Peninsula and West Java (rare, mostly W of Buitenzorg), 10–1500 (mostly 100–700) m, doubtful from Banka Isl. Erroneously recorded from the Philippines by F.—Vill., Nov. App. (1880) 27.

Ecol. In mixed primary forests, often common, mostly on fertile soils; *fl.* & *fr.* not periodic, Jan.–Dec. Germination preferably in the shadow. Several gall forms are described, all of the saccate type. The fruit is eaten by swine and deer.

Uses. Cultivated in Sumatra (mostly Palembang and Tapanuli Res.), Java (also in monsoon climate) and W. Bornéo, often in clearings; therefore, the tree occurs frequently gregarious in old secondary forests. Sumatrans often soak the fruit before planting, or peel them. Yields red benzoin, mostly consisting of benzoic acid. Resin can be drawn from 7 years old saplings. Wood worthless.

Vern. (*Ke*)menjan, hamindjan or kumajan, with various spelling and with various additional names.

Notes. No specimens are known with certainty from the Indo chinese Peninsula; those recorded belong mostly to *St. benzoides* Craib which differs in the absence of brown-stellate hairs, smaller flowers (lobes 8 by 1 1/2–13/4 mm) and different fruit (1 cm high with 1/2 mm thick 3-valved pericarp). This continental species produces Siam benzoe (cf. Hook. Ic. Pl. t. 2999).

*var. hiliferum* Steen. l.c.—Seed subglobose 17–18 by 20–24 mm. Testa dark-brown. Hilum 10–12 mm diam.—Fig. 2.

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Fig. 4. Bark gall of *St. benzoin* Dryand., × 7/16.

Fig. 5. Brown stellate hairs of a. *St. crotonoides* Clarke, b. *St. benzoin* Dryand., and c. scales of *St. paralleleoneurum* Perk., × 160.
Distr. Malaysia: Malay Peninsula (Pahang) and Sumatra (Tapanuli).

Vern. Kemanjan bukit (Mal. Pen.), hamindjan minjak (Batak, Sum.).

Fig. 6. *Styrax crotonoides* Clarke, × 1/3, flower, nat. size, bunch of sack-galls, × 1/3.


Tree 13–27 m by 25–50 cm. Leaves oblong to broad-elliptic, rarely subovate, base rounded, margin entire, apex acute-acuminate; nerves (7–)9–11 pairs, connected by transverse veins. Infl. mostly unbranched spike-shaped, rachis stout, straight, bearing fls from the base; fls solitary or in pairs. Pedicels 1/2–3 1/2 mm, rusty tomentose. Calyx 4–5 mm across. Corolla lobes 10 by 2 1/2 mm, tube 1–2 mm high. Staminal tube 2 mm; filaments 1 mm; connective lepidote; anthers 5–6 mm. Style 6–7 mm. Mature fruit rusty tomentose.

Distr. Malaysia: Malay Peninsula, 50–300 m alt.

Ecol. Mixed primary forests on low hills. Umbellate rusty coloured sack-galls are described. As far is known it yields no benzoin.

5. *Styrax oliganthes* Steen. Bull. J.B.B. III, 12 (1932) 241.—Fig. 2.

Tree up to 33 m, trunk 50–60 cm diam. Leaves ovate-oblong, rarely lanceolate, often oblique, base cuneate or rounded, apex blunt-acuminate, margin recurved s.s., 7–9 1/2 by 3–4 cm; primary nerves 7–8 pairs; petiole 3 1/2–8 mm. Flowers unknown. Calyx in fruit 3 1/2–4 by 6 1/2–7 1/2 mm. Fruit obovate not dehiscent, apex broadly rounded, short-mucronate, 10–13 by 8 1/2–9 1/2 mm. Seed ovate, dull dark-brown, without papillae, 9 1/2 by 6 mm; hilum 4 by 3 mm.


Ecol. Primary mixed forest, fr. Febr.

Notes. By its height, non-dehiscent fruit, pauciflorous infl. and not papillose seeds different from *St. tonkinensis* Craib. and *St. benzoides* Craib from continental Asia; the flowers may yield additional characters.

6. *Styrax paralleloneurum* Perk. Bot. Jahrb. 31 (1902) 484; Pfl.R. 30 (1907) 37; Steen. Bull. J.B. B. III, 12 (1932) 243.—St. sumatranus J.J.S. Tect. 10 (1917) 204.—Fig. 2, 5c, 6–8.

Tree, 5–35 m by 23–60 cm; clear bole 6–25 m. Leaves ovate to lanceolate, mostly ovate-oblong,
Flora Malesiana

Fig. 9. Spiral galls of *St. paralleleoneurum* Perk., × 3/4. These twisted galls have essentially the same structure as sack-galls, and contain a cavity.

distinctly acuminated, 6-16 by 2½-6½ cm; tomentum of undersurface thinner than in *St. benzoin* and not woolly, golden-brown lepidote; nerves 6-8 pairs glabrate, with distinct transverse veins, mostly cinnamon-coloured, petiole 7-15 mm. Larger infl. leafy, panicles 2-11 cm long. *Corolla* in mature buds 2-4 × as long as the calyx. Fls violet-scented, drooping, 4-6 mm stalked. Calyx 3-4½ mm high and slightly broader. Corolla 13-15 mm, tube 4-4½ mm; lobes 11-13 by 3-3½ mm. Stamens 12-12½ and 13-14 mm; filaments 9-10 mm; anthers 4-5 mm, margin of the cells lepidote. Fruit-base included by the cupular, fleshy, thickened calyx, shell 5-9 mm diam. hard-fleshy. Seeds 1(-2) ovate-globose, with broad base; testa shining, bony, dark-brown.

Distr. Malaysia: Sumatra (only main land) & Malay Peninsula, 575-1700 m.


Uses. Wood of inferior quality. Tapping yields white benzoin chiefly consisting of cinnamic acid, in Sumatra (Tapanuli Res.) planted in clearings and secondary forests, in Java by the For. Serv.

Vern. (Kemenjan, in different spellings and additional epithets, as in *St. benzoin*).

Notes. Very distinct from *St. benzoin*, and easily recognizable in the sterile state by the transverse veins and appressed scales on the underside of the leaves.

*f. inutilis* Steen, l.c.—Tomentum of leaf undersurface tinged light brown, scales few; upper surface light brown to brown s.s.; benzoin said to be worthless.

Distr. Once found in Tapanuli, said to be removed from plantations.

Vern. Kemenjan bulu (also used for *St. benzoin*).


Tree up to 30 m by 30 cm, buttresses up to 80 cm, clear bole 15 m. Leaves generally alternate, ovate to oblong-ovate, distinctly often abruptly acuminate, 7-17 by 3½-8 cm; nerves 7-9 pairs; petiole ½-1 cm long; axillary buds 3-5 mm long, brown-tomentose. Panicle leafy at the base, 7½-20 cm long. Flowers fragrant. Corolla tube 2 mm high; lobes valvate or slightly induplicate-valvate, margin thickened, 9-10 by 3 mm. Stamens subequal, tube ¾-1 mm high; filaments 1½-2 mm long; anthers 6-6½ mm, connective prominent and broadened above the cells. Style 8 mm. Stigma lobed to truncate or hammer-shaped. Fr. unknown.

Distr. Burma and Malaysia: Sumatra & Malay Peninsula, low alt.

Ecol. Apparently rare in lowland primary mixed forests.
Vern. Kemenjan burong (also for St. benzoin), k. landak (Mal. Pen.).

Notes. The nearest ally of St. benzoin, and only differing in the flowers, though the fruit will probably show additional characters when known. Not known to yield resin.

Fig. 10. Flower galls of St. serrulatum Roxb. var. mollissimum Steen., × 1/2.


No Malaysian specimen agrees entirely with the Indian ones, and I assume that the Malaysian specimens represent distinct varieties. It is a rather variable species and it is closely related to a group of allied species in SE Asia: St. grandiflorum Griff., St. caudatum Wall., St. hookeri Clarke, St. virgatum Kurz, all of them possessing a larger corolla; St. japonicum is distinct by drooping, long, glabrous pedicels and a glabrous calyx. The aestival is variable, being subvalvate or imbricate in bud, even in one flower.


Small to medium tree up to 20 m. Leaves on both surfaces with scattered small stellate hairs, 5–11 by 3–5 cm; nerves 5–6 pairs. Racemes short, terminal on the shoots, or axillary in depauperate raceses or even solitary. Corolla lobes 10–11 by 4 mm. Filaments 5 mm, glabrous towards the apex; anthers 3½–5 mm. Style 11–14 mm. Fruit ovate to obovate-globose, pericarp rugose 2 mm diam. Seed 6–8 mm across; hilum 5 mm long.

Distr. India, Andamans, Mergui, Tenasserim and Malaysia: PenangIsl. and Malay Peninsula (Malacca, once).

Fig. 11. Alcicorniform galls of St. serrulatum var. mollissimum Steen., × 1/3.

Ecol. Mixed primary forests, up to 200 m. Fl. fr. March-May.


Tree 10–30 m by 8–45 cm. Leaves stellate-pubescent to submentose on the lower surface, the parenchyma remaining visible, 7–14 by 3½–7½ cm; nerves 6–8 pairs. Flowers in pyramidal brown-yellow tomentose panicles 5–17 cm long; lobes 7–8½ by 2½–3½ mm, pubescent all over, distinctly imbricate. Anthers 2½ by 3–3½ mm. Style 8–10 mm. Fruit obovate, not dehiscent; pericarp smooth 3½ mm diam. Seed 9½ by 6 mm: hilum 3 mm long.

Distr. Malaysia: Sumatra, 350–1500 m alt.

Uses. Once reported to yield benzoin used as incense.

Fig. 12. Coralloid galls of St. serrulatum var. mollissimum Steen., × 2/3.

Excluded


Styrax ellipticum Jungh. & De Vr. Pl. Nov. Ind. Bat. (1845) 10; MIQ. Fl. Ind. Bat. 1, 2 (1859) 464, Suppl. (1860) 187; GRESH. Schets. (1896) 118; PERK. Bot. Jahrb. 31 (1902) 484; Pfl.R. 30 (1907) 86; Steen. Bull. J.B.B. III, 12 (1932) 253.—I have not succeeded in locating the type specimen. It is certainly not Styraceaeous and possibly belongs to Xanthophyllum or Vatica.

Styrax glabratum (non Schott) Warb. l.c. = Diospyros.

Styrax javanicum BL. Bijdr. 13 (1825) 671 = Alangium.


Styrax villosum BL. Bijdr. l.c. = Alangium.

Styracid. gen. nov.? ZOLL. Syst. Verz. 2 (1854) 136 = Vatica.

Fig. 1. Trigloehin procera R.Br. var. dubia Benth. Habit, × 2/3, flower and juvenile fr. enlarged.
JUNCAGINACEAE (C. G. G. J. van Steenis, Buitenzorg)

1. TRIGOCHIN


Glabrous, annual or perennial herbs. Leaves distichous, radical, entire, linear, with a sheath. Inflorescence terminal, spicate or racemose. Flowers bisexual, actinomorphic, small, inconspicuous, mostly green. Perianth segments 6, conchiform. Stamens 6 (or partly reduced), epi-tepalous. Anthers sessile, extrorse, cells 2. Carpels 6, or less by abortion, free or united, or partly free; ovule 1 per cell, basal, erect; style mostly absent. Pericarp dry. Seed exalbuminous, embryo straight.

Dist. Cosmopolitan, the majority of the ca 15 spp. known from the S. hemisphere. The Malaysian species is the only one of subg. Cycnogeton (Endl.) Buch., distinct by entirely free carpels.

Ecol. Predominantly in marshy localities, or in the water; some spp. in semi-arid countries.

Notes. The family is sometimes called Schaeuchzeriaceae, but Juncaginaceae has priority. It centers in the S. hemisphere, specially in the S. Pacific. Hutchinson (Fam. Fl.Pl. 2 (1934) 36, 38) has removed Schuechzeria from June, to a separate family in a separate order on account of bracteate pedicels.

Only one species is hitherto reported from Malaysia:


Perennial, 30–50 cm long; rhizome short, roots partly thickened and ending in globular tubers 2–3 cm across. Culms terete, solid, sheaths at the base surrounded by the fibrous remains 1–2 cm long of the nerves of former leaves. Leaves ± as long as the culms, 1–3 mm broad. Spike multiramous, rather lax and relatively few-flowered, 1½–2, in fruit up to 7 cm long. Flowers sessile, ebracteate, towards fruiting gradually pedicelled. Stamens 6, distinctly in 2 rows, 1 mm long, very broad, slightly shorter than the erect oblong 1½–2 mm long tepals rounded at the apex. Carpels mostly 3, the slightly curved outwards directed stigmatic apices protruding distinctly above the anthers; stigma large oblong, linear, grooved. Nuts mostly 3, rarely 4, or 1–2, small, 7–9 mm long, linear-oblong mostly subfalcate, 1½–2½ mm pedicelled, erect.

Dist. Australia and Tasmania to SE. Malaysia: Wassi Kussa area in S. New Guinea, at low alt.

Triglochin belongs to a series of (sometimes world-wide) spread genera, both occurring in Australia and Asia but absent or exceedingly scarce in Malaysia, as e.g.: Aldrovanda, Alisma, Anagallis, pumila, Astragalus, Callitriche, Eryngium, Glossostigma, Leptocarpus, Limonium, Oxlaxis, Pariecia, Phylidrum, Plantago, Rothia, Tenagocaris, Tragus, Villarsia, and Zannichellia.

Ecol. Savannah forest, common in streams which contain water only during the wet season, locally massed. Roots partly swollen into edible terminal tubers. Hardly an aquatic plant. Fl. Dec.–Jan.

Notes. The species is more robust than the variety: length ± 1 m, leaves 4–10 mm broad, spikes denser, gynoeceum less reduced. The variety more often occupies a peculiar habitat, and seems to represent an ecotypic radiation. Hutchinson l.c. recognizes Cycnogeton as a separate genus by its free carpels; some other spp. of Triglochin occupy an intermediate position.

Excluded

Schuechzeria palustris Miq. Ill. Fl. Arch. Ind. (1870) 48; Micheli in DC. Mon. Phan. 3 (1881) 95; Buch. Pfl.R. 16 (1903) 15; Steen. Bull. J.B.B. III, 13 (1934) 221.—Sch. asiatica Miq. Fl. Ind. Bat. 3 (1855) 243; Suppl. (1860) 35; Koord. Exk. Fl. Java 1 (1911) 91.—In the Leyden Herbarium is a sheet of which the origin is doubtfully given as ‘Java’, and said to be collected by Korthals. Interchange of labels is probably the cause of this erroneous record.
Fig. 1. *Trigoniastrum hypoleucum* Miq. Flowering twig, ×\( \frac{3}{4} \), a. flower, petals removed, b–c. petals, d. bag-shaped petal, e. the same, frontal view, f. fruiting tip of inflorescence, g. bracts with glands, h. winged partial fruit, i. opened, showing insertion of seed.
TRIGONIACEAE (C. G. G. J. van Steenis, Buitenzorg)

I. TRIGONIASTRUM


Tree, wood vessels mostly solitary. Leaves simple, spread (on lateral branches), penninervous, entire, margin and leaf tip glandular; upper epidermis often double and provided with mucilaginous cells; midrib sulcate above. Stipules caducous. Indumentum of simple hairs. Flowers actinomorphic, bisexual, in axillary and terminal panicles; bracts with glandular margin. Sepals 5, free, nestled as the petals are, unequal, imbricate. Petals 5, free, very unequal, imbricate; posterior saccate with reflexed emarginate limb, lateral spathulate, spreading, anterior oblique, keel-like together, including at their base the genitals; entrance of the sac with one fleshy hairy concave gland (easily breaking into 2 parts). Stamens 6 monadelphous, tube split posteriorly, eventually with some loose minute teeth, minute upper part of filaments free; anthers oval, slightly emarginate at the base, 2-celled, opening with one slit, gaping; exine (judging from boiled fls) reticulate. Ovary hairy, easily falling into 3 parts as does the simple style; stigma small punctiform. Ovule pendulous solitary. Fruit composed of 3 easily detaching samaras. Seeds (n.v.) elongate, shortly hairy, exalbuminous; radicle very short.

Distr. Monotypic, confined to W. Malaysia, wrongly credited to New Guinea by LEMÉE, l.c. WOOL ANAT. HEIMSCH, Lilloa 8 (1941) 132.

Notes. This genus, which is the single representative of the family in Malaysia, was mostly included in the Polygalaeeae, and though differing in several respects from the 2 other neotropical genera of the Trigon. by its spread leaves &c. it seems mostly allied to Trigonia. HALLIER f. suggested in passing¹ affinity with the Rosac.-Chrysobal. (1918) for which indeed some arguments could be advanced. In the herbarium it is sometimes confused with Angelesia which it resembles superficially in vegetative characters. It has also been compared with Dichapetalaceae. The glandular leaf margin, glandular-thickened leaf tip, sulcate midrib, and the indumentum are easy characters for distinction. The gland in the posterior petal could be interpreted both as a disk or as (a) metamorphosed stamen(s).

1. Trigoniastrum hypoleucum Miq. l.c.; BENN. l.c.; CHODAT l.c.; FOXX. Mal. For. Rec. 2 (1922) 216; RIDL. l.c.; BAKER f. J. Bot. (1924/6) Suppl. 7, 143; MERR. PL. Elm. Born. (1929) 132; BURK. Dict. (1935) 2182; incl. var. oliganthum cum var. viride AIRY SHAW, Kew Bull. (1940) 253.—Isopterys penangiana WALL. ex BENN. l.c.—Fig. 1.

Small to moderate-sized tree 6-30 m by 14-50 cm; wood hard, yellowish, fine-grained; bark exuding a yellowish, later turning reddish, gummy juice. Innovations hairy. Leaves oblong with cuneate base, apex acuminate, glandular-thickened, often ± spathulate; petiole 4-7 mm, stout, sulcate; blade 8-18 by 3-6 cm; upper side often with a metallic hue s.s.; lower side whitish by a very thin arachnoid appressed indumentum consisting of twisted hairs, interspersed with sclerenchymatous longer hairs; margin with minute impressed glands; side-nerves ca 5-6, reticulations prominent on both sides. Panicle leafy, 20-40 cm, lower bracts leafy, upper ones linear acute. Flowers white, fragrant; anthers pale yellow. Buds whitish s.s. Sepals ca 21/2 by 11/2 mm, ovate, acute, hairy. Saccate petal-base ca 2 mm, sometimes compressed, reflexed part ca 2 by 21/2 mm; base thickened; laterals unguiculate-spathulate, ca 31/2-4 by 11/2 mm; anteriors 4-5 mm long, oblique-oblong. Staminial tube 1 mm high, filaments over 14 mm free; anthers ca 11/2 mm. Gland ca 3/4 mm diam. Style 11/2 mm glabrous. Ovary 1/2 mm high. Samaras pale or yellow green, connate over 11/2-21/2 cm, with straight inner side 21/4-31/2 cm long and rounded or lozenge-

(1) Med. 's-Rijks Herb. Leiden 37, p. 56.
shaped outer side, 1–1\(\frac{3}{4}\) cm broad. Seed not seen.

Distr. Malaysia: Sumatra, Malay Peninsula (incl. P. Penang), Borneo (incl. P. Laut).

Ecol. Evergreen non-inundated rainforest, scattered up to 1000 m, but mostly below 300 m; at the highest altitude found in sandy rainforest, differing slightly by blunter thicker leaves; fl. fr. Sept.–June.

Uses. The wood is little estimated.

Vern. kikir, mangkudor (SE. Borneo), kaju bras, tinggiran batu (Palemb.), tinga batu (Asahan), marajali, mata pasak, suginara (Mal. Pen.), apparently no fixed name.

Notes. The seedling grows out of the wing; the cotyledons are epigaic; the 1st pair of leaves is opposite.
COCHLOSPERMACIDEAE (C. G. G. J. van Steenis, Buitenzorg)

I. COCHLOSPERMUM


Trees (or shrubs), often deciduous, producing gum and an orange juice. Leaves spread, palmatifoliolobed, often with domatia in the axils of the main ribs; stipules caducous. Flowers actinomorphic, bisexual, showy, mostly golden-yellow, paniculate or racemose. Sepals 5 imbricate. Petals 5, imbricate or contorted, emarginate. Stamens ∞, with free filaments, equal or subequal; anthers 2-celled, linear, basixed, opening by intorose, short, often confluent pore-like slits. Ovary 1-celled with laminal placentas projecting into the cell, or perfectly or imperfectly 3-celled, the upper portion remaining 1-celled; ovules ∞, style simple, stigma punctiform. Capsule 3–5-valved, valves of the endocarp separating from and alternating with those of the pericarp. Seeds covered by woolly hairs, mostly cochlate-reniform; endosperm copious, rich in oil; embryo large, conforming to the shape of the seed; cotyledons broad.

Distr. Ca 15 spp., mostly in trop. and subtropical America, some in trop. Africa and SE. Asia, 3 species in N. Australia, rare in Malaysia; G. gillivrayi is possibly the only native Malaysian species. Lam assumed the genus to belong to the 'antarctic' type (Blumea 1 (1935) 135), but it is manifestly peri-tropical.

Ecol. The species prefer a semi-arid or seasonal climate, and in Malaysia occur only in regions with a dry season. Some African species are fire-resistant through a corky layer on the rhirome.

Notes. The family was formerly often included in Bixaceae; Hallier f. referred it to the Tiliaceae (Med. Rijksherb. 35 (1918) 18). Several authors describe the sepals of Cochlospermum as deciduous; in C. religiosum cultivated at Buitenzorg they are decidedly persistent. Domatia are not yet recorded in the genus but in cultivated C. regium at Buitenzorg they are present in the basal axils of the main ribs as tufts of hairs, and Acari were observed between them. The generic name is preserved against the few years earlier Maximilianea Mart. & Schrank (1819).

KEY TO THE SPECIES

1. Ovary pubescent. Stamens red in the lower half
   2. Ovary perfectly glabrous. Stamens yellow.
   2. Leaves entirely glabrous; lobes 5–7, incised for 5/6–7/8 of the length of the main ribs, 6–7 by 2–3 cm.
      Fls ± 6–9 cm across. Stamens ± 1 cm long with blunt hardly tapering anthers 3–4 mm long, pore rounded-triangular
      2. C. gillivrayi
      2. Leaves pubescent to tomentose beneath, midribs tomentose above. Blade incised to 2/3 of its length into 3–5 lobes, middle lobe ± 5–11 by 4½–9 cm. Fls ± 12–14 cm diam. Stamens 1½–2 cm long, anthers distinctly tapering to the acute apex 6–7 mm long, pore sagitattate.
      3. C. religiosum


Small tree 3–12 m, with red-brown branches. Leaves ± orbiculate, 10–30 cm wide, cordate, glabrous, incised to 2½–3½, lobes 5, acuminate, crenate-serrate, basal axils of main ribs with domatia; petiole 10–25 cm. Flowers in dense panicles at the end of leafless twigs, pedicellate, bright yellow. Sepals 5, tomentose, persistent. Petals obovate, 4–6 cm long. Stamens ca 2 cm, inner ones shortest; anther cells with a terminal pore. Capsule 5-valvate, partly green partly red, obovoid, 4–8 by 4–6 cm, apex depressed, finely velvety pubescent, striate-nerved. Pericarp hard, endocarp cream-coloured, parchment-like. Seeds reniform covered with cotton-like white hairs.

Distr. Native in Central & South America, in Malaysia sometimes cultivated as an ornamental tree.

Wood anat. Vestal, Philip. J. Sc. 64 (1937) 221.

Note. The ovary in C. regium is not 3-locular as is often suggested but imperfectly 5-locular.


Small deciduous tree, 4½–7 m, bark pale-grey,
Flora Malesiana

channelled and scaly (Brass); branches of the panicle, pedicels, and calyx slightly pubescent otherwise glabrous. Leaves 5–11 cm across, on 6–13 cm long petioles; stipules 3–4 cm long, subulate; blade divided to about \( \frac{1}{2} - \frac{3}{4} \) cm from the base; lobes slightly toothed-crenate, 2 outer shortest and very acuminate. Panicles short and loose. Flowers yellow;
pedicels less than 1\( \frac{1}{4} \) cm, lengthening after flowering. Sepals shortly pubescent, glabrous towards the apex, with very thin edges, outer sepals usually smaller than the inner ones. Anthers oblong, curved. Capsule obovoid-oblong, rarely exceeding 7\( \frac{1}{2} \) cm, depressed-truncate. Seeds enveloped in fugacious wool.

**Distr.** N. Australia, N. Queensland, Thursday Island and other islands near N. Australia, in Malaysia: only known from the Port Moresby area, Terr. of Papua, sometimes planted there, also near Boku (Kemp Welch river area).

**Ecol.** Mostly in anthropogenic localities but apparently native, common on dry rocky places along the coast, \( \text{fl. July-Sept.} \)

**Fig. 1.** Cochlospermum religiosum (L.) Alston, after the tree cultivated in the Bot. Gardens, Buitenzorg (type of \( C. \) balicum), \( \times \frac{1}{2} \).


Small rather crooked-branched, more or less deciduous tree. Leaves cordate, 7\( \frac{1}{2} \)–20 cm diam., margin undulate or obscurely crenate, apex of the lobes acuminate with blunt tip; petiole articulated 8–25 cm long. Stipules linear-subulate, 7–8 mm long. Flowers in a simple raceme or a loosely branched panicle, terminal, short-hairy, one flower open at a time on each branch, facing side ways. Pedicels \( \pm 2 \) cm long. Bracts caducous, triangular-acute, short-hairy, 4–5 mm broad at the
base. Corolla yellow, with a distinct odour. Sepals partly purplish, 2-2 1/2 by 1-2 1/4 cm. Petals thickened at the base. Stamens slightly S-curved, unequal. Anthers orange, falcate, 1 mm broad. Ovary globular. Style glabrous 1 1/2-2 cm. Capsule obovate, 5-7 cm long, valves striate-ribbed, 2 1/2-3 cm broad. Seeds reniform to cochleate, brown, 5-6 mm across.

Dist. India, Cambodia, introduced in Siam and Ceylon, in Malaysia: Penang Island and Malacca. E. Java and Bali, doubtless introduced.

Ecol. More or less established in Penang and very conspicuous in cultivated ground round the town, near Dato Kramat growing in a native settlement, in Malacca Griffith noted 'near a stream at the foot of... hill'; in N. Bali near a large pagode (Teysmann) pr. Singaradja. At Buitenzorg flowering throughout the year. In Penang noted as deciduous. All specimens at low alt. It is propagated by cuttings or rather loppings; any branch stuck in the ground will strike in wet weather. Flowers last for 1 1/2 day. If the flower is setting fruit the withered petals remain for a long time (Corner).

Wood anat. By Gamble the wood is defined as 'extremely soft' (Indian Timbers 1902; here also short hand lens description).

Vern. Bebaru (Penang), tjanigarah (Bali), butter-cup tree, yellow cotton-tree, yellow silk cotton-tree (Engl.). The Malay name 'bebaru' is used in confusion with Hibiscus tiliaceus.

Notes. Certainly introduced in Penang, never re-collected in Griffith's spot. Among the MS-plates left by Deschamps no 57 is unmistakably this species, which has never been re-collected in Java after Deschamps figured it (±1793-1802); acc. to his MS. he did not visit Bali Island. The locality near Singaradja was visited by Mr de VooGD in 1936; flowering material was collected near the pagodes. The late Mr Kerr wrote me, Aug. 1936, that 'there is no good evidence that the species is indigenous in Siam; the only place is a small hill crowned by a small deserted temple where it may quite well have been planted'. In India it is often used as a temple plant, and flowers are used in offerings. In Ceylon Trimen found it in the dry districts, but it occurs usually near temples for the sake of its beautiful flowers. For these reasons I am convinced that the species is introduced in Malaysia, that its introduction is due to its religious fame in India, and that it is brought to Bali by the Hindus.

Boerlage described the Balinese specimens erroneously as having subglabrous leaves.
ZYGOPHYLLACEAE (C. G. G. J. van Steenis, Buitenzorg)

1. TRIBULUS


Prostrate hairy herbs. Leaves opposite, paripinnate, mostly anisophyllous; stipules present. Flowers actinomorphic, 5-merous, bisexual, solitary on pseudo-axillary peduncles, white or yellow. Sepals 5, free, imbricate, persistent or caducous. Petals 5, free, patent, imbricate, fugacious. Disk present. Stamens 10, subequal or unequal; anthers dorsifixed. Ovary superior, sessile, hairy, 5–12-lobed, 5–12-celled; style short and thick, with 5–12 deciduous stigmas; cells with 3 or more ovules. Fruit 5-angled or 5-12-winged; cocci partly abortive, spinous or tuberculate, indehiscent with 3–5 superposed seeds separated by septa.

Distr. & Ecol. Ca 20 spp. difficult to delimit, specially developed in the dry regions of Africa and Australia. In S. Africa the spinous fruits adhere to the wool and feet of sheep (‘hoof-burs’) and are a nuisance. The family has about 26 genera, of which 12 monotypic, and ca 250 spp., mostly of warm dry countries. In Malaysia one genus and one species.


Fig. 1. Tribulus cistoides L., on the beach of Nusa Penida, near Bali. (DE VOOGD)

var. moluccensis Bl. Bijdr. l.c.; MIQ. l.c. 682; FORBES, Wand. (1885) 501.—T. moluccanus DECNE, Herb. Tim. Descr. (1835) 118.—T. lanuginosa (non L.) THUNB. l.c.; BLANCO, Fl. Filip. (1837) 350.—T. macranthus HASSK. Flora 48 (1865) 403.—Fig. 1, 2.

Perennial herb, branches decumbent, apex ascending, 30–145 cm long; tap-root very long. Leaves of each pair: one 6–7; the other 4–5-jugate, 2–7½ cm long, midrib ending into a small micro 1½–2 mm long. Leaflets subsessile, base obliquely rounded-cordate, apex blunt to subacute, 6–22 by 2½–9 mm, both surfaces silky. Stipules falcate, acuminate, erect, 3–6 mm long. Flowers inserted laterally of the axil of the smallest leaves, bright yellow, 2½–4 cm diam.; pedicels hairy, 2–4 cm. Sepals narrow-lanceolate, acute, appressed-hairy, 7–11 mm long, caducous. Petals obovate-cuneate, apex broadly rounded-truncate, 1–2 by 1½–3½ cm. Stamens subequal; anthers ± 1 mm long. Disk represented by 5 small erect scales appressed to the hisolute ovary, alternating with its lobes. Cocci 4–5 with sharp stout spines, two lateral largest; pericarp rather thick, corky.

Distr. Circumtropically ubiquitous, in Malaysia: confined to the E. part (fig. 2), avoiding the everwet Sunda Land; in some places, near harbours, probably an alien.

Ecol. In Malaysia exclusively indigenous along sand beaches and coastal dunes, locally often gregarious, fl. March–July.

Notes. Closely allied to T. terrestris L., an annual or biennial with much smaller flowers.

Excluded

Fagonia montana MIQ. olim in sched. Herb. Metz.; MIQ. Fl. Ind. Bat. 1, 2 (1859) 596, in syn.: CLARKE, in Hook. Fl. Br. Ind. 3 (1882) 620; BOERL. Handl. 1 (1890) 147 = Azima sarmentosum. Though MIQUEL mentioned the name in his Flora, the specimen on which it was based is extra-Malaysian.

Fig. 2. Localities of Tribulus cistoides L. in Malaysia; an arrow indicates a presumably introduced occurrence.
PODOSTEMACEAE (C. G. G. J. van Steenis, Buitenzorg)

Mostly annual, rather small, of peculiar habit, often moss-like, gregarious, confined to swift running water in streams and cascades. Tissues with silicium. Roots often thalllose, flat, stem sometimes absent. Leaves mostly alternate, sometimes scattered, decussate or distichous, base often provided with a sheath, and sometimes stipule-like appendages, often dentate or divided. Flowers terminal, often in cymose inflo., mostly Ø, actinomorphic to zygomorphic. Perianth of 3–5 free or subconnate tepals, if reduced to two small, ovate or linear appendages, the bud is enveloped by an originally closed thin ‘spathella’. Stamens hypogyn, 1–∞, often 2 unilateral, frequently monadelphic. Anthers mostly introrse, 2–4–locular, splitting lengthwise. Pollen grains single, or in twos or fours. Ovary superior, ovate to elliptic, mostly 2–, rarely 3–locular with thickened central placenta and thin septa. Ovules ∞; styles as many as carpels, free, rarely 1. Capsule septicid (often) ribbed; seeds ∞, minute, exalbuminous, epidermis mucilaginous.

Distr. Principally confined to the tropics throughout the world, not yet recorded from the Pacific islands and the greater part of Australia, northward as far as S. Japan, in Malaysia apparently very rare. The locality closest to Malaysia is isthmian Siam where Dr A. Keith found Podostemon ?algaeforaris Btrn. in the nineties.

EcoI. All members of this aberrant stream-resistant family are confined to swift not too densely shaded streams with normally clear water. The rather numerous SE. Asiatic members are all tiny to minute plants growing socially and covering the rocks in sheets. During the rainy season they are mostly found only in the sterile thalllose state and submerged. In the dry season the flowers appear and the thallus withers. They occur often very locally, and the plants are easily overlooked. Many additional records may be expected. Local dispersal is certainly effected by water; Cladopus seedlings have been found on rocks, a cemented dike, bamboo and an iron pipe at highwater mark. Dispersal from one river system to another unconnected is still obscure (birds, fishes, insects?). Transplanting experiments which I did with rocks covered by Cladopus from Mt Gedeh on Mt Salak in W. Java, were unsuccessful (1937). So were Ciferri’s in the Dominican Republic (Atti Ist. Bot. G. Briosi e lab. Crittog. Ital. Univ. Pavia V, 7 (1946) 18–21).

Notes. The affinity of the family is still uncertain; opinions are offered of alliance to Saxifragaceae; Engler accepts it to represent a separate Group Podostemales in the neighbourhood of the Urticales.

KEY TO THE GENERA

1. Flowering stems very short, hardly 1 cm. Leaves crowded, scattered, imbricate, digitately lobed
   2. Cladopus

1. Flowering stems elongate, 2½–6½ cm. Leaves distichous, laterally compressed, entire, the upper
   3–(4)-dentate
   2. Torrenticola

1. CLADOPUS


Small, flatly adhering to the substratum. Roots flat, ligulate, without stomata, side-branches mostly opposite, at last concrescent in a crust on the substratum. Leaves of the sterile sessile sprouts (?) roots) partly linear partly digitate with 4–7 segments as are those of the fertile stems. Flowering stems minute, hardly 1 cm in length, densely covered with scattered, imbricate, digitately lobed leaves. Flowers solitary, pedicellate, zygomorphic, before anthesis enclosed in an oblique spathella; spathella oval-acuminate, apex nipple-shaped, mostly irregularly dehiscent, sometimes slit on one side. Tepals 2, narrow triangular to linear, at both sides of the base of the filament. Stamen 1 (rarely 2 ?), anther basifixed, cells divergent at the base, filament curved; pollen grains 2-celled. Ovary smooth, oblique-ellipsoid, as long as the filament, curved towards the anther. Capsule oblique-ellipsoid, smooth, the largest valve persistent.
Distr. S. Japan (Kyushu), Malaysia: Java and SW. Celebes.

Ecol. Swift running streams and cascades, clinging to the rocks, also found on a cemented dike and occasionally young plants on bamboo, 5–1550 m.

Notes. The Japanese species C. japonicus Imamura belongs in my eye doubtless to Cladopus and does not represent a separate genus (Lawiella Koiz.). Specifically it differs in 8–12-lobed leaves.

1. Cladopus nymani H. Möll., ll. cc.—Fig. 1.

Roots dark green often reddish tinged, densely branched at last forming a continuous concrescent sheet exceeding 60 cm diam., branches opposite or alternate, 1/2–3 mm broad, tips with a minute dorsal root cap. Sterile leaves in rosettes, simple or digitate, narrow 2–6 by 1/6–1/3 mm. Fertile stems at the root margins, up to 5 mm long, leaves with 3–7 segments 1/4–1 mm long. Spathella ca. 2 mm. Tepals narrow linear acute, 1 mm long. Stamens 1, rarely 2, anthers 3/4–1 mm long. Ovary 2-locular ca. 1/2 by 1 mm, stigmas 2, oblique, 2/3 mm long. Capsule smooth 1/2–1 1/2 by 1 mm; pedicel 2–3 mm.


Ecol. See under the genus.

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2. Torrenticola


Roots lingulate, sparsely ramified; sprouts very close, erect, mostly simple rarely branched, thin, rigid, densely foliate. Leaves distichous, equitant, base laterally compressed, obtangular, upper ones toothed, minute, thick, 1–2-carinate, decurrent, lowest semi-amplexicaulous, blade ± patent. Flowers single, apical, strongly asymmetric. Spathella sub-oblique, tipped, irregularly circumscissile-dehiscent. Flower shortly stalked. Tepals 2, narrow, small. Stamen 1, articulate with the pedicel, in bud appressed to the ovary, filament broad, anther broad, connective emarginate, cells introrse. Pollen grains 2-celled. Ovary ± globular, smooth, 2-locular with 2 grooves where the dissepiment is attached; stigmas 2, oblong-lanceolate, in bud appressed to the ovary towards the stamen. Fruit slightly oblique, terete, the largest valve persistent, ribs 10, indistinct. Placenta globular, surrounded by a thin narrow membranous dissepiment, caducous. Seeds numerous sub-angular oblong.

Notes. The first specimens were found in Queensland, Johnstone river, by Walter Hill, in 1873; they remained a long time undescribed; Oliver sent the specimens in 1874 to Weddell who recognized the species as new but could not place it. The New Guinean material exactly matches Domin's description. The floral structure is described here for the first time. Though manifestly distinct in the lingulate roots and in phyllotaxis, the closest ally is difficult to find, as there are several genera of which the flower-structure is very similar (Cladopus, Polypleurella) but their vegetative structure differs widely from that of Torrenticola. Vegetatively some Podostemon species from America are similar. Decussate leaves are found in Willisia from the Anamalais, but this genus possesses an androphore with 2 stamens. The tipped spathella Torrenticola has in common with Cladopus. For these reasons it stands more or less isolated and apparently represents a separate genus. Between the pollen grains I found globular bodies 1/10th the length of the grains, measuring about 3 μ. They were sometimes in twos. I accept these to represent sterile pollen grains.

1. Torrenticola queenslandica Domin, l.c.; Engler, l.c.; Steen, l.c.—Podostemon sp. Domin, l.c. nom. altern.—Fig. 2.

Roots ca 1/2–2 mm broad. Stems 21/2–61/2 cm long, densely set, darkgreen. Leaves ridged on the back, ca. 1/2–2 mm long. Spathella sessile, to = 1/2 mm stalked, ± 2 mm long. Pedicle 1/2–11/4 mm in bud, 2 mm in fruit. Tepals ± 1/2 mm long, filament ± 1/2 mm long, thecae ± 3/4 mm, cells slightly unequal, pollen grains ± 30 μ. Ovary 1 1/4 mm diam.; stigmas ± 1/2 mm; seeds ca 1/4–1/3 mm diam.

Distr. Queensland and Malaysia: SE. New Guinea, Roona (Laloki river), c. 200 m alt.

Ecol. On submerged rocks in the river (May 1935, Carr 12445). The stems and leaves were attacked by a fungus forming brown spots.

Excluded


Lemnopsis minor Zoll. ibid. (Zoll. 3334) = Halophila ovata Gaud.


Tristicha bifaria Presl. Rel. Haenk. 1 (1827) 86 is suspected to represent T. hypnoides Spr. and was erroneously recorded from the Philippine Islands acc. to Merrill (Philip. J. Sci. 10 (1915) Bot. 189).

Sp.: d’Albertis, ‘What I did and what I saw’ 2 (1880) 93 mentions a plant which he found June 17, 1876 in the Fly River (Steen, l.c. 1947) which was advanced by Lam (Blumea 2 (1936) 117) as a possible representative of the Pod. in New Guinea; the record will remain doubtful as no material was collected.

Beccari Piant. Sum. 482 in herb. Kew (Steen, 1936, l.c.) = Annea tamariscina Steph. (Hepaticae).
AMARANTHACEAE (C. A. Backer, Heemstede)

Herbs, rarely climbing or clambering shrubs. Leaves opposite or alternate, exstipulate, simple, entire or obsolescently dentate-serrate. Flowers ♀, unisexual, or partly diurnally and neutral, in clusters, heads, racemes, spikes or panicles, solitary or clustered in the axil of persistent bracts, usually bibracteolate. Tepals 3–5, mostly free; bracts, bracteoles and tepals with scarious margins or entirely scarious; bracteoles falling off with the perianth or persistent; perianth usually enclosing the fruit and falling off with it, rarely persistent. Stamens as many as petals and opposed to them, rarely fewer; filaments free, or connate below, or almost entirely united in a cup or tube, with or without interposed dentiform, subulate, linear or short and broad pseudo-staminodes; anthers dorsifixed or inserted in a basal cleft, 1–2-celled (2- or 4-locellate). Ovary superior, 1-celled; ovules 1 or more, basal; funicles short or long. Fruit sometimes baccate or crustaceous, usually membranous, very rarely coryx, circumscissile, indehiscent or bursting irregularly. Seeds 1–∞, often lenticular or subreniform, smooth or verruculose.

Distr. Worldwide, more than 60 genera and ca 850 spp., few in America and Africa, in Australia a big centre of Pilolotus. In Malaysia: mostly represented by widely distributed anthropochorous spp., none endemic, several naturalized.

The floristic areas occupied by the native spp. can be divided into three types viz. wides, Western and Eastern elements. The wides are those of spp. widely distributed in the Old World. Their native country is often unknown.

The Western element (Asiatic or/and African) is represented by: Aerva curtisi, Nothosaerva brachiata (doubtful), Digera muricata, Pupalia lappacea, and is mostly confined to the western half of Malaysia.

It is about as strong as the Eastern (or Australian) element which consists of: Gomphrena canescens, G. tenella, Pilolotus conicus, Deeringia arborescens, Amaranthus lepsothychus & A. interruptus. This eastern element is for the greater part confined to New Guinea, the Moluccas, and the Lesser Sunda Islands.

Ecol. Mainly annuals of open places, in Malaysia: mostly in anthropogenic localities, waste places, road-sides, fields, two aquatic (Centrostachys, Alternanthera philoxeroides), one occasionally so (Alternanthera sessilis), a few almost exclusively in forests.

Uses. Some spp. are used as vegetables, especially Amaranthus. There are some ornaminals (Celosia, Alternanthera, Gomphrena, Iresine, Amaranthus). Several are medicinal. Alternanthera ficoideae var. betzckiana is used against soil wash. Ashes of Achyranthes aspera are rich in alcali.

Notes. Flowers and ripe fruits are necessary for identification. The foliage, in many spp. is very variable and hardly offers constant characters for specific distinction. The species are, apart from the shape of the leaves, not very variable; Amaranthus tricolor and A. lavidus are exceptions. Celosia argentea and some other species have produced varieties in breeding; these are sometimes unstable.

Figs. 2–3, 5–8 courtesy Pasuruan Exp. Station.

(Artificial) Key to the Genera

1. Leaves alternate.

2. Scandent or clambering shrubs, unarmed, green-leaved, at least 2 m tall, often very much larger.
   Flowers singly or clustered along the rachis of simple or panicked racemes or spikes, ♂ or unisexual, glabrous, white, yellowish or greenish, 1½–2½ mm long; filaments at their base united in a cup, without intervening pseudo-staminodes; stigmas 2–4, mostly 3, patent or recurved. Fruit an indehiscent berry falling out of the persistent perianth when ripe ................................................. 1. Deeringia

2. Otherwise.

3. Fruits all or for the greater part 2–∞-seeded. Flowers ♂ in simple or panicked (sometimes coxcomb-like) spikes, glabrous. Stamens 5; filaments at their base united in a cup. Erect, unarmed herbs or undershrubs.
   4. Style 1, rather long; stigma 1, capitulate. Perianth 6–10 mm long. Fruit membranous, circumsciss; seeds 1–9 ................................................................. 2. Celosia
   5. Style very short or absent; stigmas 2–3, linear-clavate. Perianth less than 4 mm long. Fruit baccate, falling out of the persistent perianth when ripe; seeds 10 or more, usually more than 20 1. Deeringia

3. Otherwise. Fruit 1-seeded.

5. No pseudo-staminodes.


7. Flowers in short, dense head-like spikes. Lower flowers not accompanied by 2 palmatifid scales (sterile flowers). Filaments at their base connate in a cup. Stigma 1, entire or faintly 2-lobed. Fruit thin-walled.
8. Tepals distinctly dimorphous: 2 outer ones elliptic, their bases externally with a dense tuft of hairs; 3 inner ones with a narrow cuneate claw and patent ovate-oblong blade. Fruit indehiscent. 12. Ptilotus

8. Tepals subequal. Fruit circumsciss. Seed arillate. 3. Allmania

7. Flowers in spiciform often long racemes, the lower part of the older racemes lax. Lower flowers usually accompanied by 2 palmatifid scales (sterile flowers). Filaments free. Stigmas 2, recurved. Fruit crustaceous, indehiscent. Seed exarillate. 5. Digera

6. Flowers unisexual, in sessile (d) (q) or (d) (2) clusters; these either collected in a spike or panicle or not. Filaments free. Style very short or absent; stigmas 2-4 (often 3), linear. Unarmed or spinous. 4. Amaranthus

5. Filaments alternating with subulate pseudo-staminodes. Flowers ♀ or ♀, in the latter case long-pilose outside. Style very short, stigmas 1-2, minute. 8. Aerva

1. Leaves, at least partly, opposite. 9. Lower flowers not accompanied by fascicled hooks (difformed flowers).

10. Flowers in panicled spikes, minute, in Malaysia exclusively ♀. Perianth ± 1 1/4 mm long, externally at the base with a dense whorl of long white hairs, otherwise subglabrous, nerveless. Stigmas 2, ascending, subulate. 16. Iresine

10. Otherwise.

11. Anthers 2-celled (4-locellate).

12. Filaments 5, alternating with pseudo-staminodes.

13.pseudo-staminodes short, with a broad, truncate or subdentate apex. Flowers glabrous, united in a (finally) long spike, after anthesis widely patent or reflexed. Bracteoles, or one or more tepals, after anthesis with a very acute, often pungent tip. Stigma capitate, entire.


14. Terrestrial. Bracteoles consisting of a rather long spine bearing on either side of its long concave base a much shorter, membranous nerveless wing. Tepals not very unequal, after anthesis spinous or not. 11. Achyranthes

13. Pseudo-staminodes subulate. Flowers either white-pilose or thinly beset with short hairs and then strongly nerved, not pungent. 8. Aerva

12. No pseudo-staminodes. Style at best 1 1/2 mm long. Leaves glabrous. 15. Stamens 1-2. Spikes usually clustered, 1 1/2-1 1/2 cm long. Tepals nerveless, hairy outside 9. Nothosaerva

15. Stamens 5. Spikes solitary or sometimes paired, 1-2 1/2 cm long. Tepals strongly nerved, glabrous. 13. Psilotrichum

11. Anthers 1-celled (2-locellate), or absent and replaced by spurious ovaries.


16. Stigmas 2, erect or spreading, sometimes minute. 15. Gomphrena

9. Flowers racemose or spicate, lower ones accompanied by fascicled hooks (difformed flowers). Hooks hairy at the base, upwards glabrous. Perianth pilose outside. Style 1, stigma capitate. Fruit falling off together with the hooks, by means of these easily adhering to passers-by.

17. Filaments alternating with short, broad pseudo-staminodes. Old flowers deflexed, accompanied by sessile or subsessile fascicles of obliquely erect, 1 1/4-2 1/2 mm long hooks. 6. Cyathula

17. No pseudo-staminodes. Old flowers widely patent with distinctly stalked fascicles of squarroso, 3-4 mm long hooks. 7. Pupalia

1. DEERINGIA

R.Br. Prod. (1810) 413.

Erect herbs or scandent or clambering shrubs, unarmed. Leaves alternate, petioled, ovate to lanceolate, acute, entire. Flowers in axillary and terminal, simple or branched, frequently panicked racemes or spikes, solitary in the axil of a bract, subtended by 2 bracteoles. Tepals 5, rarely 4, oval-oblong, 1-nerved with scarios margins, glabrous. Stamens 5, rarely 4, filaments at the base united in a cup; free parts distant, filiform-subulate; no pseudo-staminodes; anthers 2-celled (4-locellate). Ovary sessile or shortly stalked; ovules few to many; funicles long; stigmas 2-3, rarely 4, linear or ± clavate. Fruit baccate, thin-walled, indehiscent, globose, broadly ellipsoid or obovoid, falling out of persistent perianth when ripe; seeds 0 to many, on long pale funicles, circular or reniform, shining black or brownish black, very finely verruculose or almost smooth.

Distr. About 7 spp. in the palaeotropics from Madagascar to Australia.
Ecol. Unlike most Malaysian Amaranthaceae the species of this genus are not anthropochorous; as a rule they inhabit forests.

Uses. Only one species used by the Malaysians, mainly medicinally.

Notes. This is the only Malaysian Amaranthaceae genus of which the fruits (red or white berries) fall off unopened, leaving behind bracts, bracteoles and perianth.

**KEY TO THE SPECIES**

1. Single flowers sessile or sub sessile. Single spikes consisting of 50 or fewer flowers. Flowers % or (♂) (♀). Tepal s pressed against the ripe living berry. Seeds distinctly verruculose.

2. Flowers in simple or very sparingly branched spikes or sometimes solitary. Perianth 2 1/4-2 1/2 mm long. Free parts of the filaments about as long as the staminal cup or but slightly longer. 

3. Spikes rather less than 1 cm long. Flowers very few, occasionally 1. Ripe berry red. Seeds 1-4. Climber

3. D. tetragnya

2. D. polyperma

1. D. arborescens

1. Single flowers on 2 1/2-2 mm long pedicels, %. Single racemes often consisting of more than 50 flowers. Free parts of the filaments several times longer than the staminal cup. Tepals under the ripe living berry patent or reflexed. Ripe berry bright red. Seeds 0-9, almost smooth . 1. D. amaranthoides

very often divarically branched, 5-35 cm (0-8 cm peduncle included), rather dense or in lower part lax, often more than 50-flowered; highest racemes usually collected in a terminal panicle of 15-75 cm long; racihes of inflorescence finely and not very densely appressed pubescent; bracts narrowly triangular, very acute, ± 1/2 mm; bracteoles ovate, acute, ± 1 mm. Flowers solitary or clustered, malodorous. Pedicels 3-1-2 mm. Tepals during anthesis widely patent or reflexed, under the fruit reflexed as are the stamens, obtuse or rounded, concave, pale green or somewhat yellowish, white-margined, often, especially under the fruit, tinged with red, 1 1/2-2 1/2 mm long. Staminal cup 1/4-1 1/3 mm: free parts of the filaments several times longer

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**Fig. 1. Deeringia amaranthoides (LAMK) MERR. from Java, × 1/5.**

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than the cup, for the rest variable as to length, 1½/2-2½ mm. Stigmas 3, greenish white, 1-1½ mm, recurved on the fruit. Berry globose-obovoid, bright red, 4-7 mm diam. Seeds 0-9, usually no more than 5, circular with emarginate base, 1-1½ mm diam., almost smooth.

Distr. From India to China, southward to Australia, in Malaysia: throughout, not yet reported from the Moluccas & Borneo.

Ecol. In Java, especially in the drier eastern half, 1-1500 m, in teak- and open mixed forest, forest borders, secondary forests, tall brush-wood, hedges, often, though by no means exclusively, on calcareous soil. Sometimes cultivated for its medicinal properties.

Uses. The natives press the root in diluted vinegar and add a piece of onion (Dutch: aijn; Burkill (Dict. 775) mistranslated alum = aluin). The juice so obtained is sniffed up; it looses the mucus and dries the head-ache caused by obstruction of the nasal cavities. The leaves are applied to sores; young cooked sprouts are eaten with rice.

Vern. Bayam besar, bayam pohon, pantjar luhur, tangtang angin.

Notes. The specimens found in native hedges may have been plants of *D. amaranthoides*, *D. baccata*, and *D. celosioides* are considered specifically distinct by Suessenguth (Fedde, Rep. 44 (1938) 39). I cannot agree with this view; the differences mentioned by S. are hardly of any importance and moreover are very inconstant in Malaysian materials.


Erect herb or undershrub, 1-2 m. Young stems, petioles, leaves, rachises of the spikes, bracts and bracteoles frequently clothed with shortish, thickish brown hairs, glabrescent; stem in the higher part obtusangular. Leaves ovate-oblong-lanceolate from a cuneate or slightly contracted base, narrowed upwards or slightly acuminate, acute, herbaceous or slightly fleshy, 3-22 by 1½/2-12 cm; midrib in the living plant slightly prominent beneath; petiole 1½/2-5 cm. Flowers spicate; spikes axillary, single or sometimes paired, erect or more or less patent, simple or sometimes sparingly branched, 3-12 cm long, rather dense or, at an advanced age, rather lax, 4-50-flowered. Flowers quite sessile; bracts broadly ovate, obtuse or rather acute, ± 1½/2 mm long; bracteoles ovate, 1-1½ mm. Perianth 2½/4-2½ mm long. Tepals during anthesis erect or obliquely erect, afterwards appressed to the fruit, very obtuse, green, white-bordered. Staminal cup 1½/4-1 mm high; free parts of the filaments about as long as the cup or slightly longer. Stigmas 2-3, recurved or on the fruit obliquely erect or patent, 1½/3-½ mm long. Berry globose or broadly ellipsoid, white, ± 3 mm diam. Seeds 10-64, usually more than 20, reniform, ± 3/4 mm diam, very finely verruculose.


Ecol. In Java, 5-800 m alt. (in the Philippines ascending to 1800 m, according to Merrill), in thickets and shaded localities, in forests and on forest borders, much rarer than *D. amaranthoides*.

Notes. In a fruiting state conspicuous by its white berries.

3. *Deeringia tetragyna* Roxb. Fl. Ind. ed. CAREY (1832) 683; WIGHT, Jc. 2 (1843) 729; Mмо. Fl. Ind. Bat. I, 1 (1858) 1026. Climbing shrub, entire glabrous; young shoots pendulous. Leaves ovate from a broad, rounded base, slightly contracted into petiole, shortly acuminate, acute, slightly undulate, 3-7 cm by 2-4 cm; petiole 1½/4-1½ cm. Flowers axillary, spicate or sometimes solitary; spikes erect, shortly stalked, rather less than 1 cm long, few-flowered, dense; bracts ovate-oblong, obtuse, ± 1½ mm: bracteoles much shorter than perianth, oblong, obtuse. Tepals 4-5, oval-oblong, obtuse, very concave, 2½/4-2½ mm long. Stamens about equalling perianth; staminal cup rather large; free parts of filaments linear from triangular base, about as long as cup or slightly longer. Ovary subglobose, with 3-4 longitudinal furrows, few-ovuled; styles 3-4, recurved, linear-subclavate. Berry (not seen) subglobose, ± lobed, red, succulent. Seeds 1-4, mostly 1.

Distr. Malaysia: Moluccas (according to Roxburgh).

Notes. This imperfectly known species of which I could examine the type specimen I find to represent a distinct species which is tolerably well figured by Wight. Its native country is said to be the Moluccas on the authority of Roxburgh l.c. who states that it was accidentally introduced from there into the Botanic Gardens, Calcutta. It is strange that it has never been re-collected.

Woody climber, ascending to top of tallest trees (ev. Bth.), glabrous or on young vegetative parts clothed with brown, ± crisped hairs. Leaves oblong or lanceolate from a cuneate or contracted base, obtuse or rather acute, firmly herbaceous, 5–20 by 1½–10 cm; petiole 1½–3½ cm. Flowers (♂) (♀) (male ones pseudo-hermaphrodite), panicled; single panicles 4–15 cm long, axillary and terminal; highest often collected in a terminal, rather large panicle; branches of single panicles widely patent, spiciform, dense or rather lax, 1–3 cm long. Flowers sessile or subsessile, glabrous; bracts and bracteoles thinly membranous, nerveless.—♂: Bracts ovate-ornicular, rounded, ± 1 mm long; bracteoles slightly smaller than the bract, much shorter than the perianth, ± ¾ mm diam; perianth white. Tepals oblong or oblong-obovate, rounded at apex, very convex, nerveless, 1½–2 mm long. Adult stamens slightly exceeding the perianth; filaments thin, finally much longer than the short staminal cup; anthers oblong, yellow. Ovary shortly stalked, conical, glabrous, empty; style very short; stigmas 3, linear-ciliate, short, thick, recurved.—♀: Bracts and bracteoles much shorter than perianth, ± 1 mm long; bracts ovate-triangular, bracteoles oval. Perianth greenish, 1½–1½ mm long, at last appressed against ripe fruit. Staminodes 5, varying from slightly shorter to slightly longer than perianth; filaments at base connate in a comparatively large and wide cup; their free parts slightly longer than cup; their anthers deformed, small, empty. Ovary subglobose, 6–15-ovuled; style short; stigmas 3, recurved, shortly linear, thick. Berry globose, red, with the top excised from the perianth, 3–4 mm diam. Seeds 1–2, reniform, black, densely verruculose, ± 1 mm diam.

Distr. NE. Australia, in Malaysia: collected in Buton Isl. (SE. Celebes), the Tanjimir Isl. (S. Moluccas), and SE. New Guinea (Saibai Island)

2. CELOSIA

Linne, Sp.Pl. 1 (1753) 205.

Erect, entirely glabrous annuals. Stem angular-ribbed. Leaves alternate, petiolated, ovate to linear, entire or subentire, often with small semilunar leaves in the axils. Flowers ♀, in simple or branched, dense or interrupted, sometimes deformed, terminal or axillary spikes, solitary in axil of bract, subtended by 2 bracteoles. Tepals 5, free, during anthesis erecto-patent or spreading, before and after anthesis erect, ovate-oblong, acute, scarious, longitudinally nervèd. Stamens 5; filaments at the base connate in a cup; free parts linear from a triangular base, often alternating with minute, triangular pseudo-stamnodes; anthers oblong-linear, 2-celled (4-locellate). Ovary sessile with broad base; ovules ∞, on short funicles; style 1, filiform, persistent; stigma capitately, faintly 2–3-lobed. Utricle thin-walled, circuitus in or about the middle. Seeds 1–∞, lenticular, shining black.

Distr. About 60 spp. mainly in the subtropical and temperate regions of Africa and America, in Malaysia: no indigenous species.

In Malaysia one wild species, and several more or less deviating forms which are cultivated for ornamental purposes.

1. Celosia argentea


Forma spontanea: Annual, 0.4–1½ m; stem erect, green or red, strongly ribbed, often much branched. Leaves on petioles of ¼–½ cm or highest almost sessile, oblong-lanceolate or lanceolate-linear, rarely ovate-oblong, acute at both ends, herbaceous, often tinged with red, 4–18 by ½–6½ cm; highest often very small; leaf axils often provided with ± falcate small leaves. Spikes solitary or sometimes paired, erect, stalked or partly subsessile, often much lengthening during anthesis, at length cylindrical with a conical apex, very dense, throughout their length (when pure-
Flora Malesiana

AMARANTHACEAE (Backer)


—Allmania esculenta R.B. in Wall. I.C. 6892—
Chamissoa browni Steud. nom. ed. 2 (1841) 344.
—Chamissoa javanica Hassk. Fl. Jav. Rar. (1848) 4: 344; Moq. in DC. Prod. 13, 2 (1849) 249—
Chamissoa albida Moq. in DC. Prod. 13, 2 (1849) 248.
—Chamissoa esculenta Moq. I.C. 249—
—Chamissoa pyramidalis Moq. I.C. 248—

Erect or ascending annual 0.1-0.8 m long; taproot long; stem branched from the base or nearly so, solid with thickened nodes, glabrous or obscurely thinly pubescent. Leaves linear, spathulate, oblanceolate or obovate, narrowed into petiole, acute, obtuse, rounded or abruptly shortly acuminate, mucronate, glabrous or pubescent on undersurface thinly pubescent, rather fleshy, 11/2-61/2 by 11/2-21/2 cm; petiole 2-10 mm. Heads terminal or leaf-opposed, at first subglose, afterwards somewhat lengthened, 31/2-2 cm long; their stalk 2-35 mm, rather robust, scantly hairy or glabrous; single cymes sessile, 3-7-flowered; bracts and bracteoles ovate-lanceolate, long acuminate, keeled, 3-5 mm long; midrib green or purple; margins shining white; keel scaberulous outside. Tepals before and after anthesis erect, during anthesis obliquely spreading, with strong, green or purple midrib and pellucid white, shining margins, glabrous or scaberulous on back, 4-5 mm long. Stamens shorter than perianth. Ovary and style glabrous; style during anthesis ± 2 mm, on fruit (conical base included) ± 3 mm; stigma about as high as anthers. Utricle glabrous, ± 31/2 mm; seed shining black, ± 21/2 mm diam.; aril enclosing base of seed, pale pink or pale brown.

Distr. Tropical Asia; in Malaysia: Singapore, Sumatra, Java, Madura, Sumba, Wetar & the Philippines.

Ecol. In Java from the plains up to ± 100 m alt. (very rarely higher), locally often a rather common weed on light especially sandy soils, sandy shores, fields, roadsides and dunes.

Uses. Long ago reported to be eaten at Singapore.

Notes. Often split into 2 species: A. nodiflora with sessile heads and A. pyramidalis with peduncled ones. This difference exists only on paper, not in nature where the two forms pass into each other. I never saw a form with *quite sessile* heads. Schinz (in E. & P. Nat. Pfl. Fam. ed. 2, 16c, p. 33) figures A. nodiflora with clearly peduncled heads but he described them as sessile.

4. AMARANTHUS

Linné, Sp.Pl. 1 (1753) 989.

Annuals, erect or wholly or partly decumbent, unarmed or spinous. Leaves alternate, entire. Flowers (♂ ♂) in sessile, small, dense clusters, clusters axillary or collected in axillary and terminal, solitary or panicled spikes. Flowers solitary in the axil of a bract, sustained by 2 bracteoles; bracts and bracteoles small, scarious. Tepals 3 or 5, rarely 4, erect or obliquely patent, free, subequal, membranous, green, purple, or pellucid with a green or purple median band, after anthesis sometimes indurate at base. Stamens as many as tepals; filaments free, filiform, no pseudostaminodes; anthers 2-celled (4-locellate). Ovary ovate or oblong, ovule 1, sessile, erect; style short or none; stigmas 2-4, often 3, erect or spreading-recurved, linear. Utricle laterally compressed, membranous, circumsciss when ripe or bursting irregularly or falling off unopened together with the perianth; seed erect, lenticular, shining black or brown.

Distr. About 40 spp. allover the world, specially developed outside the tropics, several elsewhere introduced. Most of the Malaysian species are ubiquists; of some the native country is unknown. Of the 7 wild Malaysian species one is frequently also cultivated; the two others are almost exclusively cultivated but occasionally met with as strays from gardens.

Ecol. Weeds of waste places, roadsides, fields and gardens, locally sometimes gregarious.

Uses. Some species serve as vegetables; some are used medicinally or for ornamental purposes.

Vern. In the Malay language all species are called bayam (with various additions).

Notes. Probably several of the Malaysian species have been introduced.

**KEY TO THE SPECIES**

1. Utricles,2 also when adult and quite ripe, indehiscent or at last bursting irregularly, falling off together with the perianth. Tepals very shortly mucronate. Stigmas very short (1/4—1/3 mm), erect or suberect. Bracts and bracteoles shorter than the perianth. Unarmed.

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(1) Not Celosia pyramidalis Burm. f. which is Celosia argentea L.
(2) See footnote next page.
2. Tepals in all flowers 3, exceptionally 4.
3. Ripe utricle very strongly corrugated, seed-containing part entirely included by the perianth, from which only the seedless conical beak emerges

   1. A. gracilis

3. Ripe utricle smooth or faintly rugulose, top of the seed-containing part slightly emerging from the perianth

   2. A. lividus

2. Tepals 5. Ripe utricles in a dried state faintly longitudinally ribbed and ± rugulose

   3. A. interruptus

1. Adult quite ripe utricles 1 circumsciss a little below the middle. Perianth and cup-shaped base of the utricle persisting till after the fall of the lid and the seed. Stigmas 3/4–2 1/2 mm, often recurved when long.

4. Tepals in all or most flowers 5, less often 4, rarely (only in a few flowers) 3, shortly mucronate.
5. Flower clusters for a great part solitary in the higher leaf axils, for the rest collected in spikes or panicles which terminate the main stem and its branches. Bracts not longer than the perianth.
6. Axillary flower-clusters exclusively 5; those of the spikes and panicles for the greater part or almost entirely 5. Midrib of the tepals not much broadened upwards.
7. Style 11/4–11/2 mm long, 5 clusters usually armed with 2 very sharp spines, rarely with 1 spine only or unarmed. Midrib of the tepals green or purple

   5. A. spinosus

7. Style 1/4–1/2 mm long. Flower-clusters unarmed. Midrib of the tepals green. Small plant

   6. A. leptostachyus

6. Terminal spike of the main stem almost entirely 5, other spikes entirely 5, or at their base 5, higher up 5. Midrib of the tepals green, in the lower half very thin, in the upper half (up to quite near the apex) much thickened. Unarmed

   7. A. dubius

5. Flower clusters all collected in terminal and axillary panicles of spikes. Bracts often longer than the perianth.
8. Tepals of 5 flowers not or hardly overlapping, 3/5–1/2 mm wide. Panicles erect, or nodding only in their upper half. Cultivated and occasionally met with as an escape from gardens

   8. A. hybrida

8. Tepals of 5 flowers distinctly overlapping for the greater part of their length, 2 1/2–3/4 mm wide. Panicles (in Malaysian specimens) drooping almost from the very base. Possibly exclusively cultivated.

   9. A. caudatus

4. Tepals in all flowers 3, provided with a long apical awn

   4. A. tricolor


Annual, erect, ascending or rather prostrate, 10–75 cm long, often much branched, unarmed; stem terete-obtusangular, glabrous or thinly pubescent. Leaves (larger ones at least) rather long-petioled, ovate-rhomboid-oblong from obtuse or cuneate, often decurrent base, acute, obtuse, rounded or retuse, glabrous or on stronger nerves sparingly pubescent, green; larger ones 3–9 by 2–6 1/2 cm. Flowers green; lower clusters axillary; upper ones in terminal, rather dense, continuous or interrupted (5) spikes or panicles; bracts and bracteoles ovate, minutely mucronate, shorter than adult perianth; tepals 3 (exceptionally 4), very shortly mucronate with transparent white margins and green median band, glabrous, very convex, in all oblong-linear, ± 1 1/2 mm long, in 5 narrowly oblong-spatulate, during anthesis 2/3–1 mm, when fruiting 1 1/4–1 3/4 mm long; 5 flowers often with rudimentary filiform ovary; ovary in 5 oblong; stigmas 2–3 on conical top of ovary, erect or suberect, 1 1/4–1 1/2 mm. Utricle falling off together with the perianth, about as long as this, only the subconical short beak emerging, very strongly corrugated, ± 1 1/2 mm long, indehiscent or at last bursting irregularly. Seed with a blunt margin, shining brown or black, 1–1 1/4 mm diam.

Distr. Tropical ubiquist, in Malaysia: throughout the Archipelago.

Ecol. In the lower regions, especially below 600 m alt., a very common weed of cultivated areas, also in waste places, locally often abundant. To my knowledge never cultivated in Malaysia.

Uses. In the Moluccas used as a food.

Vern. Besides the general name bayam many local names.

(1) Herbarium specimens have not rarely been collected before the utricles were quite ripe, sometimes when they were still very young. In such cases a normally circumsciss utricle often seems to burst irregularly (by pressure).

Annual, erect ofprostrate, 5-80 cm long, often much branched (frequently from very base), unarmed; stem terete-obtusangular, quite glabrous. Leaves (larger ones at least) rather long petiolated, obovate or ± rhomboid, rarely oblong, from cuneate base, with broadish, usually deeply emarginate mucronate apex, green or more or less suffused or blotched with purple or entirely purple; larger ones 3-6 by 2-4 cm. Lower flower-clusters axillary, higher ones on older vigorous plants always collected in terminal and axillary spikes or panicles; bracts and bracteoles ovate, acute, much shorter than adult perianth. Tepals 3, very shortly mucronate, with transparent margins and green or purple median band, very concave, in Ø oblong, ± 11/14 mm long, in Ø oblong-spathulate, slightly acaceous with age, 11/14-11/4 mm. Filaments equaling the perianth or slightly shorter. Rudimentary ovary in Ø often present, filiform; ovary in Ø oblong; stigmas 2-3, erect or suberect, 11/3-2/3 mm long; adult utricle broadly ovoid, glossy, laterally compressed, slightly exceeding perianth, smooth or faintly rugulose when ripe, 11/2-2 mm long, falling off together with perianth, indehiscent or at last bursting irregularly; seed wit a rather blunt margin, shining black or blackish brown, 1-11/4 mm diam.

Distr. In Malaysia: Sumatra, Java, Celebes & Philippines, probably also elsewhere. Ecol. In Java from the lowlands up to ± 2000 m, a very common weed in cultivated and waste places. Uses. Used by the Indonesians as a food. Vern. Bayam. Moreover, many local names. Notes. This is a very variable species.


Annual, erect or ascending, 40-60 cm long, almost simple or in higher part with (sometimes many) obliquely erect branches, unarmed; stem straight or slightly flexuous, obtusangular, glabrous or very thinly clothed with minute patent hairs. Leaves (larger ones at least) rather long petiolated, oblong from long-cuneate base, much narrowed in upper half, obtuse or slightly emarginate, sharply mucronate, with oblique prominent primary lateral nerves; glabrous; larger leaves 3-6 by 11/4-21/2 cm. Flower-clusters dense; lower ones axillary; higher ones collected in continuous or more or less interrupted spike; terminal spike simple or branched; flowers in upper part of panicle-branches often exclusively Ø, lower down largely or exclusively Ø; bracts and bracteoles shorter than perianth, mucronate on broadly oval transparent base. Flowers green, all of them in the Timor-specimen 5-merous. Tepals of Ø oblong, acute or minutely mucronate, 11/3-11/2 mm long; tepals of Ø narrowly spatulate, very shortly mucronate, slightly acaceous with age, 11/4-11/4 mm long. Styles 2-3, erect 11/2-2 mm. Utricle falling off together with the perianth, broadly ellipsoid, rather thick, in a dried state faintly longitudinally ribbed and rugulose, tipped above the seed with a sharply delimited, broad, obtuse cone (bearing the unaltered styles), indehiscent or in dried materials bursting irregularly. Seed thick, with an obtuse margin, shining brownish black, ± 1 mm diam.

Distr. Eastern Australia in Malaysia: Timor (SPANOGHE) and SE. New Guinea (LAWES; Port Moresby, CHALMERS, TURNER; Rigo distr. MAC-GRoRe). Notes. Sometimes confused with unarmed forms of Amaranthus spinosus L. which may at once be recognized by the much longer (11/4-11/2 mm) styles. It has also been confused with Amaranthus leptostachythus BTH. with differs by the circumsciss smooth utricles.

4. Amaranthus tricolor LINNÉ (sens. ampl.) SP.Pl. (1753) 989; THELUNG in ASCH. & GR. SYN. 5, 1 (1914) 272; MERR. INTERPR. HERB. AMB. (1917) 213; EN. PHILIPP. FL.PL. 2 (1923) 128; HEYNE, NUTT. PL. (1927) 606; BACKER, ONSKR. SUIKR. (1930) 220, ATL. t. 230; OCHSE & BAKH. V. D. BR. VEGET. (1931) 25.—Amaranthus melanochilus LINNÉ, SP.PL. (1753) 989; MOQ. IN DC. PROD. 13, 2 (1849) 262; MIQ. FL. IND. BAT. 1, 1 (1858) 1032.—Amaranthus mangostanus LINNÉ, CENT. PL. 1 (1755) 32; MOQ. IN DC. PROD. 13, 2 (1849) 261; MIQ. FL. IND. BAT. 1, 1 (1858) 1032; HOOK. f. FL. BR. IND. 4 (1885) 720; MERR. INTERPR. HERB. AMB. (1917) 213; EN. BORN. (1921) 245; RIDL. FL. MAL. PEN. 3 (1924) 6; GAGN. IN FL. GEN. I. C. 4 (1936) 1062.—Amaranthus polygamus LINNÉ, CENT. PL. 1 (1755) 32.—Amaranthus gangeticus LINNÉ, SYST. ED. 10, 2 (1759) 1268; MOQ. IN DC. PROD. 13, 2 (1849) 261; MIQ. FL. IND. BAT. 1, 1 (1858) 1032; HOOK. f. FL. BR. IND. 4 (1885) 719; KOORD. EXK. FL. 2 (1912) 196; RIDL. FL. MAL. PEN. 3 (1924) 6; GAGN. IN FL. GEN. I. C. 4 (1936) 1063.—Amaranthus oleraceus (non LINNÉ) BURM. f. FL. IND. (1768) 198 (SPHALMAL. 298); BLUME, BJDR. (1825) 539; DECNE IN NOU. ANN. MUS. 3 (1834) 371; SPAN. IN LINNAEA 15 (1841) 345; MIQ. FL. IND. BAT. 1, 1 (1858) 1033; SUPPL. (1860) 149.—Amaranthus salicifolius HORT. VEITCH ex GARD. CHRON. (1871) 1550, fig. 331; MERR. EN. PHILIPP. FL.PL. 2 (1923) 129.—FIG. 2.

Annual; stem under cultivation erect and often very robust, up to 11/2-21/2 m high, in a wild state usually much smaller, erect or ascending, angular, glabrous or in higher part thinly pubescent. Leaves (larger ones at least) long-petiolated, rhomboid-ovate-oblong-lanceolate from a cuneate or acute, often decurrent base, narrowed in upper part, acute,
obtuse, rounded, retuse or emarginate, glabrous or on larger nerves thinly pubescent, in wild specimens entirely green, in cultivated (for orna-
ment) forms often tinged or blotched with purple or entirely purple, sometimes bright red with yellow; larger leaves 10–25 by 3–12 cm. Flower-clusters dense; lower ones axillary, higher ones often collected in rather thick spike; & & flowers intermixed; bracts and bracteoles long-awned from broad base, as long as adult perianth or shorter. Tepals 3, long-awned from broad base, with broad transparent margins and green or purple median band, in 3½–6 mm long, in s at first 2–3 mm, under the ripe fruit 3–5 mm. Filaments about as long as perianth or shorter, often much shorter; ovary cylindrical or obconical; styles 3, 2–2½ mm long. Utricle flask-shaped, circumsciss somewhat below middle; lid with thickened base and suddenly contracted, conical, obtuse apex. Seed with a rather obtuse margin, shining blackish brown or brown, 1–1¼ mm diam.

Distr. Ubiquist, possibly native in trop. Asia, in Malaysia: throughout the Archipelago.

Ecol. Very frequently cultivated as a pot-herb, often run wild in waste places, in fields, along roadsides, locally often abundant, 1–700 m.

Uses. Cultivated green-leaved forms very frequently eaten by Europeans and non-Europeans as a substitute for spinach. Variegated-leaved forms sometimes kept in gardens as ornamentals.

Vern. Bayam. Moreover, local names.


Annual, erect, often much branched, 15–100 cm high; stem terete or obtusangular, green or more or less suffused with purple, glabrous or slightly pubescent. Leaves (larger ones at least) rather long petioled, ovate-oblong-lanceolate, from acute, often slightly decurrent base, in their upper part gradually narrowed, obtuse, rounded or slightly retuse, often shortly mucronate, glabrous or, when young, slightly pubescent on the nerves; larger ones 3½–11 by 1½–4½ cm. Flower-clusters dense; lower ones axillary; higher ones often collected in axillary and terminal spikes; spikes often branched in their lower part; terminal spike above base usually wholly s, with weak spines or quite unarmed, finally often with a drooping apex; axillary clusters and those on the base of the spike (rarely also the higher ones) usually armed with 2, or sometimes more, obliquely erect or patent. straight, thin, very

Fig. 2. Amaranthus tricolor L. from Java, × ⅔.
sharp, 1/2-2 cm long spines (metamorphosed bracts), sometimes with one spine only, rarely (var. inermis SCHINZ) unarmed; bracts and bracteoles mucronate from a broad base, shorter than the adult perianth or at best as long. Tepals 5, shortly mucronate, very convex, with transparent margins and green or purple median band, in a ovate-oblong, 2-21/2 mm long, in poly obliged, at first 1/4-11/2 mm, under the ripe fruit 13/4-23/4 mm long. Filaments about equalling perianth or slightly longer or shorter. Ovary oblong; styles mostly 3, sometimes 2, when adult recurved and 13/4-11/2 mm long. Utricle oblong, with a 3-lobed apex, circumsciss a little below the middle. Seed with a thin margin, shining black or brownish black, ±1 mm diam. or slightly larger.

Distr. Ubiquist, in Malaysia: throughout the Archipelago.

Ecol. At present throughout Java, from the lowlands up to ±1400 m, a very common weed of waste places, railway-yards, waysides, fields and gardens, often gregarious.

Uses. Used as a diuretic, an emmenagogue and a lactagogue, further for poultices and against gonorrhea.

Vern. Bayam duri (i.e. spinous bayam). Moreover many local names.

Notes. Possibly an introduced species. In Malayasian specimens ripe adult utrices always open circumsciss a little below the middle.

6. Amaranthus leplostachyus BTH. FL. Austr. 5 (1870) 214; Bailey, Queensl. Fl. part 4 (1901) 1220; Domnin, Beitr. Pflanzengeogr. Austr. 1, 2 (1921) 630.

Annual, not or sparingly branched, 71/2-25 mm high; stem obtusangular, glabrous or very sparingly beset with patent minute hairs. Leaves (larger ones at least) long petiolate, ovate-oblong from a cuneate base, in their upper part gradually narrowed to an obtuse or acute, minutely mucronate apex, glabrous or beneath on the nerves with very few scattered, very minute, patent hairs, 1-6 by 1/3-21/2 cm; primary nerves in dried specimens distinctly prominent beneath; petiole 1/4-6 cm. Flower-clusters rather dense; lower ones axillary, consisting almost or entirely of φ flowers; higher clusters collected in axillary and terminal spikes, often forming together a terminal panicle, consisting mainly of φ flowers, in the lower part often intermixed with 0 ones; bracts and bracteoles mucronate, shorter than the perianth. Tepals usually 4-5, sometimes 3, erect or obliquely patent, oblong-spathulate with a distinct mucro, scarious with a conspicuous but rather thin green midrib, 1-21/2 mm long, 1/3-21/2 wide. Stamens in 4-5, not rarely 3. Styles in φ 2-3, erecto-patent or recurved, 1/4-21/2 mm long. Utricle tipped by a thick conical beak, crowned by the styles, not rugulose, circumsciss; upper part falling away, leaving the much shorter cup-shaped persistent base in the perianth. Seed erect, lenticular, shining blackish brown, somewhat less than 1 mm diam.


Notes. Sometimes confused with A. interruptus R. Br. which may be easily recognized by the indescent, in a dry state slightly rugulose utricle and constantly 5-merous flowers. From unarmed forms of A. spinosus L. easily distinguishable by the much shorter styles (in A. spinosus 11/4-11/2 mm).


Annual, erect, 1-2 m high, in its upper part often with many obliquely erect branches, unarmed; stem obtusangular, green, glabrous or very thinly beset with minute patent hairs. Leaves (larger ones at least) long-petioled, ovate-oblong or ovate-elliptic from broadly cuneate base, much narrowed in the upper part, slightly emarginate, minutely mucronate, glabrous; larger leaves 6-20 by 4-10 cm. Flowers-clusters dense, green, lowest axillary; higher ones collected in dense spikes; spikes (especially the terminal ones which frequently reach 10-25 cm in length) in their lower part frequently with few or many obliquely patent branches, often sinuous, either almost entirely 0 or at base φ, higher up 0; terminal spike often entirely 0; larger bracts broad, thinly membranous, oval with a long mucro, totalling ±2 mm. Perianth 11/2-21/2 mm long; that of the φ flowers somewhat increasing with age; tepals 4-5, rarely 3, ovate-oblong; their midrib in lower half very thin, in upper half (up to quite near apex) much thickened, produced into a short (often very short) mucro. Filaments short. Ovary shortly 3-lobed; styles 3, 1-11/4 mm long, often recurved. Utricle ellipsoid, when fully ripe circumsciss in or slightly below middle. Seed with a rather thin margin, brownish black, shining ±11/6 mm diam.

Distr. Native of tropical America, of rather recent introduction in Java; collected for the first time in 1922 and repeatedly afterwards at Buitenzorg, later also at Bandong. Not yet found in any other part of Malaysia.

Ecol. Weed of gardens, road-sides and waste places, abundantly fruiting, may be expected to spread rapidly.


Annual, erect, in higher part often much branched, 0.15-3 m, unarm'd; stem obtusangular, strongly suffused with purple; younger parts more or less...
doubly revolving, evergreen, often with wavy margins, dark green above, strongly tinged with purple beneath; larger ones 10–30 by 3–12 cm; nerves beneath or on both sides more or less densely hairy. *Flower-clusters* crowded, paniculate or in feebly specimens saccate: panicles (spikes) terminal and frequently also in the higher leaf axils, erect or at the top more or less drooping, puberulous, (p); terminal panicle in well-developed specimens 15–40 cm long. *Flowers* dark purple, 5-merous; bracts and bracteoles long-pointed distinctly longer than perianth. Sepals oblong, not or hardly overlapping, with a short or very short micro, 1/3–1/2 mm wide, in 11/34–2 mm long, in p during anthesis (mucro excluded) 11/2–11/2 mm long, afterwards up to 2 mm. Filaments white, equalling perianth or slightly longer. Ovary in p rudimentary, hardly perceptible. In p oblong; styles 3, less often 2, ± recurved, ± 3/4 mm long; *ovule* exceeding perianth, ± urceolate, in the lower half pale, in the upper half purple, circumsciss between the pale and the purple parts. Seed dark brown, shining, 1–11/4 mm diam.

Distr. Native country unknown, introduced into *Malaysia* very long ago; Sumatra, Java, Lesser Sunda Islands.

Ecol. In Java from the lowlands up to ±1300 m cultivated for ornamental purposes and sometimes met with as a stray from gardens, but nowhere firmly established, not truly naturalized.

Uses. in *Malaysia* unknown.

Vern. *Bayam kējong*, J, and a few local names.


Annual, erect, not or sparingly branched, 0.3–1 1/2 m, unarmed; stem obtusangular, usually suffused with purple, thinly beset with patent short hairs. *Leaves* (larger ones at least) long petiolated, rhomboid-ovate-lanceolate from cuneate base, in their upper half gradually narrowed, obtuse, mucronate, green, often bordered with purple; dimensions?; nerves beneath usually pale. *Flower-clusters* very densely saccate; lower panicled; panicle in *Malaysian* specimens borne by a flaccid peduncle, drooping from the very base; terminal spike frequently much longer than the others; bracts and bracteoles broad, with a long apical point; many slightly exceeding the flowers. Perianth 5-merous. *Sepals* in p ovate-oblong, shortly mucronate, in p oblong-obovate-subspathulate, with at least partly overlapping margins, 2–2 1/2 mm (including the often rather long mucro) by 1/3–1/4 mm, purple. Styles 3, ± 1/3 mm long. *Ovary* slightly exceeding perianth, lageniform, circumsciss. Seed 1–1 1/4 mm diam; dark brown, shining.

Distr. Ornamental plant of old, native country not known with certainty, in *Malaysia* but rarely cultivated.

Notes. The only *Malaysian* specimen I have seen had been collected in NE. Sumatra above Sibolangit, ±1350 m); it may have been taken from a cultivated plant.

5. DIGERA

FORSK. Fl. Aeg.–Arab. (1775) 65.

Annual. *Leaves* alternate, petioled, entire or subentire. *Flowers* in axillary peduncled spiciform racemes; lower part of raceme in each axil of persistent bracts with 3 flowers on very short common stalk; central flower of triad perfect, p, 2-bracteolate; tepals 5, almost free; 2 outer ones larger than the 3 other ones and together embracing them. Stamens 5; filaments free, filiform; no pseudo-staminate nodes; anthers oblong, 2-celled (4-locellate). Ovary obovoid, truncate; ovule 1., erect; style filiform, rather long; stigmas 2, recurved, linear, short. Lateral flowers in the axil of bracteoles of the fertile flower, reduced to a stalked palmatifid scale; scales towards the apex of the raceme gradually smaller, in the highest flowers absent. *Utricle* falling off together with the enclosing perianth, bracteoles and scales, rugulose-tuberculat, with keeled sides ending at the top in a small hornlet, crustaceous, indehiscent. Seed erect, exarillate.

Distr. Monotypic; northern Africa through the Orient and S. Asia to *Malaysia*.

Notes. In feebly specimens the sterile lateral flowers are sometimes absent.

Digera muricata Wight, Icon. (1843) t. 732.—Cladostachys muricata Moq. in DC. Prod. 13, 2 (1849) 235.—D. alternifolia Asch. in Schweine, Beitr. Fl. Aeth. (1867) 180; Asch. & Gr. Syn. 5, 1 (1914) 357; Backer, Onkr. Suiker. (1930) 223; Atl. t. 233.—Fig. 3.

Annual, often branched from base; small specimens erect; larger ones prostrate-ascending or with widely patent, prostrate-ascending, often long branches, 0.15–1.6 m long; stem often flexuous, glabrous or slightly pubescent. Leaves ovate or ovate-oblong from a cuneate, obtuse, rounded or subcordate base, with an acute, obtuse or rounded apex, entire or obsoletely crenulate, herbaceous, glabrous, 1½–7½ by ½–5½ cm; petiole ½–5 cm. Racemes solitary, widely patent-ascending, in upper part dense, lower down rather lax, 1–30 cm long (½–7½ cm of peduncle included); glabrous or subglabrous; lowest fruits often falling off before expansion of the highest flowers; bracts widely patent, ovate-lanceolate, concave with a strong midrib and broad scarious margins, glabrous (as are pedicels, bracteoles, scales and perianth), 2½–3 mm long, persistent; pedicels very short; bracteoles appressed against sterile flowers or in the absence of these against the perianth, oblong with scarious margins, 2–2½ mm long. Sterile flowers appressed against the fertile flower, flat, much dilated from a stalk-like base, palmatifid, towards the apex of the raceme gradually smaller, in the highest flowers absent. Tepals during anthesis more or less patent, afterwards erect; 2 outer ones 3½–4½ mm long, concave, 5–7-nerved, green with whitish or pink borders; 3 inner ones shorter, much narrower, thinner, obtuse, pink, 1–2-nerved. Adult filaments much longer than anthers. Style (short stigmas excluded) 2–2½ mm; perianth after anthesis not or hardly accrescent. Fruit compressed-globose, between the apical hornlets slightly depressed, bearing a persistent style-base, 2½–3½ mm diam.

Distr. N. Africa through the Orient to southern Asia, in Malaysia: Java, Madura, Kangean Arch., Celebes, Moluccas, Sumba and Sumbawa.

Ecol. Obviously preferring the drier areas, 1–250 m in fields (especially when sandy), along road-sides, railway-embankments, waste places, usually in scattered specimens.

Vern. Bayam sidit, J.

Notes. The specimen preserved in Burman’s collection (Herb. Delessert, Geneva) named Achyrantes muricata and mentioned in Burm. f. Fl. Ind. (1768) 63 is Amaranthus gracilis Desf. The true Digera muricata lies in Herb. Burman as ‘Blitum, malaice Batan clatek’ (bajam glatik).

6. CYATHULA

Blume, Bijdr. 11 (1825) 548, nom. conserv., non Lour.

Perennial herbs or undershrubs. Leaves opposite, entire. Flowers clustered; clusters either singly along the rachis of a long raceme on short, jointed stalks, deflexed after anthesis, or (not in Malaysia) in dense globose heads; perfect flowers in each cluster 1–3, ⊙, at least partly accompanied by imperfect sterile ones (reduced to
fascicled hooks. *Tepals* of perfect flowers 5, oblong, shortly acuminate, with scarious margins, longitudinally nerved. Stamens 5; filaments at the base connate into a short cup; free parts alternating with shorter, dentate or lacerate pseudo-staminodes; anthers 2-celled (4-locellate). Ovary obovoid; ovule 1, pendulous from a long funicule; style filiform; stigma capitellate. *Utricle* ellipsoid, thin-walled, indehiscent, by means of the hooks easily adhering to passers-by.

Distr. Pantropic, probably two dozen species, centering in Africa, in *Malaysia* only one widely distributed species and an endemic variety.

**KEY TO THE SPECIES**

1. Leaves rhomboid-obovate or rhomboid-oblong; larger ones less than twice as long as broad.

   1. **C. prostrata**

1. Leaves lanceolate or linear-lanceolate; larger ones more than 2½ times as long as broad.

   1. **C. prostrata var. lancifolia**


Perennial herb, ascending or erect from a rooting base, 30–50 cm high; stem obesely quadrangular, thickened above the nodes, often tinged with red, rather densely clothed with fine hairs. *Leaves* rhomboid-obovate or rhomboid-oblong from a contracted or narrowed, rounded, obtuse or acute base and a mostly triangular, acute or rather obtuse apex, entire, ciliate, bordered with red, otherwise green or, especially in a young state, more or less tinged with red, herbaceous, on both surfaces more or less densely patently hairy, 1⅓–1½ by ⅓–⅔ cm; petiole 1–12 mm. *Flowers* racemose; racemes terminal and often also in the highest leaf-axils, erect, straight or ± sinuous, 19–45 cm (including 1–12 cm peduncle); rachis rather densely pubescent; bracts ovate, acuminate very acute, reflexed after anthesis; clusters shortly stalked, in the lower part of the inflorescence more or less distant, in the higher part crowded, at first erect, afterwards patent, at last reflexed; lower clusters composed of 2–3 perfect ♀ flowers and several imperfect sterile ones; imperfect flowers towards the

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**Fig. 4. Cyathula prostrata** (L.) Bl. from Java, × ⅓.
Amaranthaceae

(1858)

flowers

J. worms.

Wand. (1803)

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204; Br.

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1-132, fiUform;

Stamens

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Leaves lanceolate or linear-lanceolate from a narrowed, acute base, towards the apex tapering or slightly acuminate, acute or rather obtuse, apiculate, entire, ciliate, herbaceous, on both surfaces rather thinly clothed with appressed long thin hairs or, barring the nerves, subglabrous beneath, 1/3-7 by 1/3-21/2 cm; petiole 1/4-1/2 cm.


Ecol. Damp forests at low and medium altitudes.

Notes. Except the narrow leaves I can find no differences with the species; there are no transitions. Merrill’s var. stenophylla is apparently a dwarf, characterized by a much slenderer habit and short racemes 5-10 cm long incl. the peduncle.

7. PUPALIA


Herbs, sometimes woody at the base. Leaves opposite, entire. Flowers spicate or racemed; spikes (racemes) terminal and axillary; lower part of spike (raceme) in axis of persistent bracts with a flower-cluster consisting of 2-3 bibracteolate $ flowers accompanied by some rudimentary ones; highest flowers often solitary and $, without rudimentary flowers. Tepals 5, free, with scarious margins, 3-5-nerved, not indurate at base. Stamens 5, at the base connate in a very short cup; no pseudstaminodes; anthers oblong, 2-celled (4-locellate). Ovule 1, pendulous from a long funicle; style filiform; stigma capitulate. Utricle oblong-ovoid, subcompressed; pericarp thin with a sharply delimited somewhat thicker apex, which finally falls off letting out the seed; rudimentary flowers consisting of fascicled squarrose hooks; clusters falling off (with the bracteoles) as a whole, by means of the hooks, readily and firmly adhering to passers-by.

Distr. Few spp., from Africa to India and Malaysia.


Perennial herb, erect or clambering, often much branched, 1/2-2 m high: stem obtusely quadrangular or subterete, thickened above the nodes, finely pubescent. Leaves ovate-oblong from a rounded, obtuse or acute base, contracted into the petiole, acutely acuminate, on both surfaces glabrous or more or less densely clothed with shorter or longer, appressed or obliquely patent, white hairs. 2-12 by 1/4-7 cm; petiole 2-25 mm, finely pubescent. Spikes (racemes) terminal and in the highest leaf axils, erect of obliquely erect,
Flora Malesiana

8. AERVA (Aerva Auctt.)

FORSK. Fl. Aeg.–Arab. (1775) 170, nomen conserv.

Herbs or undershrubs, erect, straggling or clambering. Leaves alternate or opposite, quite entire. Flowers in axillary and terminal spikes, small ☯ or (⊙) (⊙), solitary in the axil of a persistent bract, sustended by 2 bracteoles: the latter either falling off with the perianth or not; rachis of the spike remaining whole after fruiting, or breaking up. Tepals 5, free, thin and tender or rather firm, hairy, 1- or more-nerved. Stamens 5; filaments at base connate in a short cup; free parts subulate, alternating with shorter, subulate, pseudo-staminodes; anthers 2-celled (4-locellate). Ovary compressed, glabrous; ovule 1, pendent from apex of long funicle; style very short, stigmas 1-2. Utricle falling off with the perianth, much compressed, bursting irregularly. Seed vertical, reniform, shining black.

Distr. About 10 spp. in the Old World, centering in Africa.

Notes. Aerva javanica (Burm. f.) Juss. does not occur in Java, nor for that matter elsewhere in Malaysia. It is reduced to the African-Asian Aerva persica (Burm. f.) Merr.

KEY TO THE SPECIES

1. Stigmas 2, very distinct, shortly linear, obliquely spreading. Spikes for the greater part 1/2-2 1/2 cm long, with a usually rounded apex, mostly 2-4 together in the axils of normal leaves, never forming a loosely branched panicle. Tepals 11/4–1 1/2 mm. Leaves 1/2-5 by 1 1/4-3 cm. Erect herb, 10-110 cm high.

1. A. lanata

2. Stigmas 1, entire or very obscurely 2-lobed with broadly rounded lobes. Spikes 3/4-5 cm long, usually with a conical apex, partly in the axils of ordinary leaves, partly in the axils of bracts, often forming a ± paniculate inflorescence. Tepals 2-2 1/2 mm. Leaves 11/4–2 1/2 cm. Erect or more or less clambering, 3/4-2 m high

2. A. sanguinolenta

1. Spikes not very dense. Tepals rather firm, 3-5-nerved, externally thin beset with very short hairs. Bracteoles falling of together with the fruiting perianth. Bract-bearing rachis remaining whole for a long time after the fall of the flowers

3. A. curtisi


Perennial erect herb, 10-110 cm long, often divided from near the base into ascending or erect branches; main branches and upper part of the stem often unbranched for a considerable length, leafy and flowering almost throughout: stems terete, hard, densely clothed with appressed and patent white hairs; internodes usually shorter than 2 cm. Leaves alternate, oval-elliptic-obovate from a cuneate or contracted base, acute or rather obtuse, with a very short mucro, on both surfaces (especially so beneath) rather densely appressed white-pubescent, 6-50 by 3-30 mm; highest leaves often very small; petiole 2-15 mm. Spikes mostly
2-4 together, patent or obliquely erect, cylindric with a usually rounded apex, pure white, 1/2-1 1/2 cm, sometimes up to 2 1/2 cm long; highest often collected into a dense leafless inflorescence, but never forming a loosely branched panicle. Flowers softly membranous; all 5; bracts and bracteoles ovate-oval, mucronate, white, externally hairy, 3/4–1 mm long. Tepals 1 1/3–1 1/2 mm, densely white–woolly outside, oval-oblong, rounded or very obtuse; 2 outer ones with minute mucro, entirely white, 3 others with green midrib. Stamens ± half as long as perianth; style totalling 1/3–1/2 mm, bifid nearly halfway down; arms very distinct, obliquely spreading, shortly linear. Utricle ± 1 mm diam. Seed 5 1/2–3 1/2 mm. Fruiting spike easily breaking up (in a dried state). Graceful plant!

Distr. Africa to Asia, in Malaysia: Sumatra, Banka, Java, Madura, Philippines, Aru Isl., Timor, and New Guinea.

Ecot. Especially in periodically dry areas, in Java 1/2–100 m, in dry localities, along roadsides, on neglected premises, waste places, locally often frequent.

Uses. Leaves steeped in hot water used as a remedy against sudden swellings.

Vern. Katumpangan ayer, M.

Notes. The sheet conserved under the name Achyranthes lanata in Herb. Burman at Geneva is Ae. sanguinolenta (L.) Bl. A second specimen of Ae. sanguinolenta in the Herb. Burman bears the wrong name of Celosia lanata L. (= Aerva javanica Juss.).


Perennial herb, often more or less woody at base, 1/4–2 m high, erect or ± clambering, branched or not; stem terete, its upper part densely clothed with appressed or patent soft white hairs, gradually glabrescent downward; internodes often longer than 3 cm. Leaves opposite or alternate (often on a single specimen), ovate-elliptic, oblong or lanceolate from a cuneate or contracted base, usually acute, mucronate, on both surfaces (especially so beneath) rather densely clothed with appressed white hairs, more or less tinged with purple (type) or green, 15–75 by 6–45 mm; petiole 3–10 mm. Spikes solitary or fascicled, partly in axils of ordinary leaves, partly in those of bracts and then often collected into a lax terminal spike or raceme with a well-developed terminal spike, cylindric, usually with a conical apex, 1/3–5 cm long, more or less tinged with purple or sordidly white, rarely pure white. Flowers softly membranous, 5; bracts and bracteoles ovate, mucronate, externally pilose but not very densely so, rarely glabrous, acute 1–1 1/2 mm long. Tepals oblong, acute, externally pilose but not very densely so, 2–2 1/2 mm long; 2 outer ones minutely mucronate. Stamens slightly more than half as long as perianth. Style totalling 1/3 mm; stigma entire or very slightly 2-lobed with rounded lobes. Fruiting spike very dense and rather thick, not easily

Fig. 5. Aerva lanata (L.) Juss. from Java, × 1/5.
breaking up. Utricle fully 1 mm diam. Seed 3/4—1 mm diam., shining brownish black.

Distr. India to China, in Malaysia: Java (incl. Madura & Kangean), Celebes (incl. Saleier & Muna), Philippines, Moluccas, (Ambon, Timor), Lesser Sunda Isl. (Lombok, Sumbawa, Flores, Timor).

Ecol. Especially in periodically dry areas, in Java 5–200 m, in sunny or moderately shaded dry localities, bushwood, hedges, neglected premises, locally often numerous. The purple-tinged typical form is sometimes cultivated for medicinal purpose.

Uses. The red-leaved form used internally against haematuria and irregular or painful menstruation (doctrine of the signature).

Vern. Ki sambang, sambang tjalak.

Notes. In the Kew-herbarium I found 2 abnormal specimens collected in 1884 by J. G. Fr. Riedel in Timor Laut (=Timbar Archipelago; 131–132° E, 7–8° S), where also normal plants have been gathered. These abnormal specimens had paniculate short spikes of deformed hairy flowers; most of these were asexual and consisted of insufficiently differentiated bracts, bracteoles and tepals. But several flowers were pseudo-bisexual; stamens 5, at the base connate in a short cup; filaments alternating with short subulate pseudo-staminodes; anthers 2-celled (4-locellate); ovary much compressed, glabrous, empty; stigma capitate, entire. Leaves on both surfaces pubescent; inflorescence pubescent. They had been reported to represent Nothosaerva brachiata by Hemsley (Rep. Bot. Chall. Exp. 1, 3 (1884) 183).


Straggling herb, sometimes slightly woody at base, 30 cm of usually much more; stem rather robust, rather thinly pilose. Leaves opposite, oblong-lanceolate or lanceolate from a gradually narrowed acute base, very acute, herbaceous, on both sides (especially beneath) thinly clothed with patent, rather long thin hairs, 5–15 by 2–4 cm; petiole 3/4–2 cm. Frutes terminal or in higher forks of stem, racemed, umbellate or subpaniculate on a 1–2/2 cm common peduncle, erect or patent, 1–4/2 cm long, much less dense than in the 2 other Malaysian species; rachis rather thinly clothed with patent short hairs; bract-bearing rachis thin, not breaking up after fall of flowers or fruits. Flowers 3-furios or in the higher part of the spike bifarious. ♂, bracts persistent after the fall of flowers, patent, ovate, acuminate, acute, glabrous, very dense, often with 1-nerved, thinly membranous, ± 1/4 mm long; bracteoles falling off together with the perianth, ovate, acute, very thin, nerveless, ± 1 mm. Tepals oblong, acute, rather firm, strongly 3-5-nerved, externally thinly clothed with very short hairs, ± 3 mm long. Free parts of filaments subulate from a broad base. Style ± 1/2 mm; stigma subcapitate, entire. Utricles obovoid-oblong.

Distr. Malaysia: Malay Peninsula (Perak).

Ecol. On rocks in forests, 150–1000 m, fr. May.

Notes. This species is distinctly allied to some continental SE. Asiatic species, e.g. Aerva cochinchenensis Gagn.

9. NOTHOASAerva

Wight, Icon. 6 (1853) 1.

Erect annual herb. Leaves opposite. Flowers in axillary, solitary or usually clustered, very dense, short spikes, minute, 3–5-merous, ♂; flowers solitary in the axil of a bract, subtended by 2 bracteoles; bracts and bracteoles minute, very thin, hyaline, persistent till after fall of fruiting perianth; rachis of spike not breaking up after fruiting. Tepals free acute, hyaline, 1-nerved, outside villous. Stamens 1–2, minute, free; no pseudo-staminodes; anthers 2-celled (4-locellate). Ovary oblong, compressed, glabrous; ovule 1, pendulous from the apex of a long funicle; style very short, stigma capitate, entire. Utricle compressed, thin-walled, indehiscent. Seed lenticular.

Distr. Monotypic, distributed through tropical Africa, Mascarenes & Comores to tropical Asia, and possibly Malaysia.


Stem usually much branched, often so from near the base, 0.10–0.60, glabrous. Leaves elliptic or ovate-elliptic from an acute base, obtuse or acute, minutely mucronate, thinly herbaceous, green, quite glabrous, 2–5 by 1/2–2 cm; petiole 4–8 mm. Spikes very numerous, for the greater part in clusters of 3–8, rarely solitary or paired, erect or patent, sessile or shortly stalked, 1/2–1/2 cm long, cylindrical with rounded apex, white; bracts and bracteoles glabrous. in sicco white, patent; bracts ovate acute, ± 1 mm long; bracteoles slightly smaller. Tepals ± 1 1/4 mm long, oblong, acute, nerveless, bluish red (ex Winkler; in the specimens seen by me in sicco white), patently villous outside. Stamens 1–2; filaments very thin, anthers minute, style hardly perceptible. Utricle falling off with the enclosing perianth. Seed shining, brownish black, ± 3/4 mm diam.

Distr. Trop. Africa & Mascarenes to SE. Asia,
10. CENTROSTACHYS

Wall. in Roxb. Fl. Ind. 2 (1824) 497.

Aquatic herb. Leaves opposite, petioled, entire, herbaceous. Flowers 9, spicate; spikes terminal, erect many-flowered, at last elongate; only few flowers open at the same time. Flowers solitary in the axil of a thin bract, subtended by 2 membranous bracteoles, after anthesis deflexed. Tepals 5, spreading during anthesis; before and after anthesis erect, firmly membranous, after anthesis hardened at base; outermost one rigid, pungent, 1-nerved; others distinctly shorter, plurinerved. Stamens 5, much shorter than perianth, at the base connate in a short cup, alternating with short, cuneate pseudo-stamnodes; these dorsally, just below the truncate or subdeterminate top, with a fimbriate scale much surpassing them. Anthers oblong, 2-celled (4-locellate). Ovary glabrous; ovule 1, pendulous from a long funicule; style filiform, short, persistent; stigma capitate. Utricle ovoid, thin-walled, indehiscent; seed erect.

Distr. Monotypic, from trop. Africa to SE. Asia, Java and Norfolk Island (± 168° E, 29° S).


Stem floating or ascending, rooting, terete, thick, striate-ribbed, densely appressed pubescent, medullate, 0.75–1.50 m long. Leaves oblong-lanceolate from an acute base, acuminate, acute, 7/2–15 by 2–3 cm, on both surfaces clothed with appressed long, white hairs; indumentum of young leaves very dense, growing thinner with age; petiole 1–3 cm. Spikes erect, 7/2–45 cm; rachis rather densely appressed pilose; bracts, bracteoles and flowers glabrous; flowers at first crowded, afterwards remote; bracts soon reflexed, ovate, acuminate, 3–4 mm; bracteoles embracing together the foot of the perianth, broadly ovate-orbicular, very concave, 3–31/2 mm diam. Outermost tepal with very narrow transparent margins and a firm, slightly recurved, subulate tip, 6–8 mm long; other ones with broader transparent margin 5–7 mm long. Filaments (staminal cup included) 2–3 mm long; anthers 11/4–11/2 mm. Style 11/2–21/2 mm. Utricle (not seen) rather acute, ± 4 mm long.


Ecot. In Central Java at 450, in E. Java at 20 m, in swampy or inundated localities, locally abundant but, on the whole, very rare.

11. ACHYRANTHES


Erect or ascending terrestrial herbs. Leaves opposite, petioled, entire, herbaceous. Flowers 9 spicate. Spikes terminal or axillary, erect, many-flowered, at last elongate; only few flowers open at the same time; flowers solitary in the axil of an acuminate, acute, membranous, persistent bract, subtended by 2 bracteoles, after anthesis deflexed; bracteoles consisting of a rather long spine bearing on either side of its thick concave base a much shorter, membranous nerveless wing. Tepals 5, spreading during anthesis, before and after anthesis erect, membranous or herbaceous-coriaceous, 1- or more-nerved, very acute, in fruit pungent or not. Stamens 5, much shorter than the perianth; filaments at the base connate in a short cup, alternating with short broad pseudo-staminodes; anthers oblong, 2-celled (4-locellate). Ovary glabrous; ovule 1, pendulous from a long funicule; style filiform, short, persistent; stigma capitate. Utricle falling off together with perianth and bracteoles,
by means of bracteoles or tepals easily adhering to passers-by, ellipsoid with truncate or depressed apex, thin-walled, indehiscent. Seed erect.

Distr. Few spp., mostly in the Old World, often introduced.

Notes. In Malaysia transitions between the 2 species described below have not yet been found.

**KEY TO THE SPECIES**

1. Back of the pseudo-staminodes just below the apex with a long-fringed scale much surpassing the pseudo-staminode itself. Basal wings of the bracteoles (when not damaged) adnate throughout their length to the spine, 1 1/2-2 mm long

   1. A. aspera

2. Back of the pseudostaminodes without a scale. Basal wings of the bracteoles inserted on the thick base of the spine, otherwise free from it, 1 1/2-1 1/4 mm long

   2. A. bidentata


Erect rather stiff herb 1 1/4-1 1/4 m high, usually branched from near the base: branches obliquely erect or ascending; stem angular-rubbed, thickened above the nodes, hard, more or less densely hairy. Leaves ovate-obovate or elliptic-oblong, from an acute or obtuse base, acuminate or not, acute, obtuse or rounded, entire, flat or more or less wavy, more or less densely hairy or, barring the nerves, glabrous or subglabrous, 1 1/2-10 cm by 3 1/2-5 1/4 cm; petiole 1/2-1 1/2 cm. Spikes terminal, erect, 10-75 (1 1/2-15 cm peduncle included); rachis rather robust, stiff, angular-rubbed, more or less densely clothed with appressed or more or less patent, rather long white hairs; bracteoles long-acuminate, not pungent, 2-3 1/2 mm long, before anthesis erect, afterwards spreading, at last quite reflexed as often is the fruiting perianth also, ± silvery; bracteoles appressed against base of perianth. Spines 2 1/4-4 1/2 mm, shining, often tinged with purple, sharp; basal wings almost throughout their length adnate to spine but most easily separating from it, 1 1/4-2 mm long. Tepals ovate-lanceolate, very acute, green with pale margins, with 3 or more rather strong nerves, during anthesis 3 1/2-5 1/2 mm long, afterwards up to 4 1/2-6 1/2 mm, hardening and becoming pungent. Filaments (staminal cup included) 2 1/4-3 1/2 mm; pseudo-staminodes truncate or crenulate, just below the apex with a dorsal long-fringed scale far exceeding the top of the pseudo-staminode itself; ovary turbine; style 1-2 mm. Utricle rounded at the base, 2 1/2-2 1/4 mm long.

Distr. Ubiquist, in **Malaysia**: throughout the Archipelago, possibly not truly indigenous in Malaysia.

Ecol. Sunny dry localities especially in regions with a well-marked dry monsoon: road-sides, waste places, a typical ruderal, 1-2300 m.

Uses. Rubbed on the body of young children against convulsions.

Vern. Djarong, njarong, etc.


Erect or ascending, rather flaccid herb, 3 1/4-1 1/2 m long; stem ± quadrangular with longitudinally furrowed sides, often purple in higher part, thinly or moderately densely clothed with appressed or patent long, fine, white hairs. Leaves elliptic-oblong-lanceolate or ovate-lanceolate from an acute or obtuse base, long acuminate, on both surfaces thinly or moderately densely clothed with appressed or patent longish hairs, 5-20 by 1-8 cm; petiole 1/2-3 1/2 cm. Spikes terminal and in the higher leaf axils, 4-45 cm long (including 1-15 cm peduncle); rachis rather thin and flaccid, often somewhat tortuous, rather densely clothed with appressed of more or less patent long white hairs; bracteoles long-acuminate, not pungent, 3-3 1/2 mm long, before anthesis erect, afterwards patent or reflexed; bracteoles appressed against base of perianth, often slightly recurved at the apex, very variable in length, 2 1/2-5 1/2 mm, basal wings inserted on the thick base of a spine, otherwise free, erect or more or less patent, 1 1/2-1 1/4 mm long. Tepals (midrib excepted) thinly membranous and nervesless, very acute, during anthesis often violet, often distinctly unequal, variable as to length, 4 1/2-7 mm, not becoming pungent. Filaments (staminal cup included) 2-2 1/2 mm long; pseudo-staminodes truncate, entire or mostly irregularly dentate, without dorsal scale. Style 1/2-2 mm. Utricle subtruncate, 2-2 1/2 mm long.

Distr. Tropical Africa and Asia, in **Malaysia**.
Sumatra, Java, Celebes, Philippines, Moluccas, Lombok and New Guinea.

Excl. Throughout Java, 350–2500 m, in forests and well-shaded localities, often abundant along trails under everwet conditions.

Uses. Internally used as an anthelmintic; masti- cated against malignant ulcers of the cavity of the mouth.

Notes. It is remarkable that this species has not yet been collected in the Mal. Peninsula, Borneo and most of the Lesser Sunda Islands. Unlike A. aspera it is certainly indigenous in Malaysia.

**Excluded**

*Achyranthes linearifolia* Sw. in *Wikström*, Vct. Akad. Handl. Stockholm fôr 1825 (1826) 428 (not: 48) is quoted by Ind. Kew. as described from the Moluccas. It came from St Barthélemy, E of Porto Rico, in the West Indies, as I was kindly informed by Dr Florin.

*Achyranthes spiciflora* BURM. f. *Ind. Alt. Herb.* Amb. (1769) 5, *non ibid.* 203; PENNANT, Outl. of the Globe 4 (1800) 257 is based on *Cauda felis agrestis* RUMP. *Herb*. Amb. 4, p. 84. According to MERRILL (J. Arn. Arb. 29 (1948) 188) this is *Acalypha amentacea* ROXB. (*Euph.*).

*Achyranthes hispida* PENNANT, *Lc.* is according to MERRILL, *l.c.*, *Acalypha hispida* BURM. *Fl*. *Ind.* (1768) 303, pl. 61, f. 1 (*Euph.*).

12. **PTILOTUS**

R. BR. Prod. (1810) 415.

Annual herbs. *Leaves* alternate, entire, often narrow. *Flowers* ☂, terminal, in globular conical or cylindrical dense heads or short spikes, solitary in the axil of a bract, subtended by 2 bracteoles; bracts and bracteoles scariosus; *tepals* free or at the base shortly connate, usually dimorphous, after anthesis indurated at the base or not, glabrous or clothed on the back with denticulate, often long hairs, inside glabrous or woolly. Stamens 5; filaments free or connate in short cup, with or without interposed, small, translucent pseudo-staminodes, all perfect or 1–2 sterile. Anthers 2-celled (4-locellate). Ovary sessile or shortly stalked, glabrous or hairy; ovule 1, pendent from basal erect long funicule; style central or slightly excentrical, long, thin; stigma capitulate. *Utricle* enclosed by perianth, indescent. Seed vertical, sometimes arillate.

Dist. If united with *Trichinium*, which is now almost universally done, this large genus is practically confined to Australia and Tasmania, in *Malaysia*: one Australian species.

Ecol. Mainly confined to semi-arid regions.


Stem erect, 40–60 cm high, slender, glabrous, often quite close near the base divided into ascending main-branches, in higher part with erecto-patent branchlets. *Leaves* rather distant, narrowly linear, acute, with *in sice* recurved margins, glabrous, 2–5 cm by 1/2–2½ mm. *Heads* in higher portion of plant loosely paniculate-corymbose, at first globular, ± 3/4 cm diam., growing more cylindrical with age, finally up to 1½ cm long; bracts and bracteoles with short acicular tips, 1-nerved, 2½–3½ mm long, persistent after the fall of perianth; flower-axis articulated above the bracteoles. *Tepals* shortly united at the base, purple, ± 4½ mm long; 2 outer ones elliptic, outside at base with dense tuft of erecto-paten long hairs, otherwise glabrous, 3–4½ mm long; 3 inner ones with an erect, narrowly cuneate, 3-nerved claw and a slightly longer and (at the base) broader, ovate-oblong, 1-nerved, patent blade; claw along either margin densely clothed with intricate, long, thin, dentate hairs. Perfect stamens 5, glabrous, ± 4½ mm, filaments narrowly ligular, at base connate into a short cup; free parts tapering upwards but at 3/4–1 mm below top abruptly broadened into a subcircular disk, above this dilatation much con- tracted, filiform; anthers short; no pseudo-staminodes. Style glabrous, ± 2½ mm. *Utricle* narrowly ovate compressed, ± 2½ mm.

Dist. N. Australia (Gulf of Carpentaria), in *Malaysia*: Lesser Sunda Islands (Flores, Roti, Timor, Wetai), and S. Moluccas (Tanimbar, Key); a distinct Australian element in the Malaysian flora.

Ecol. Apparently confined to open country in periodically dry regions, at low alt., in Timor on calcareous hills.

13. **PSILOTRICUM**

BLUME, Bijdr. (1825) 544.

Dwarf shrubs or herbs. *Leaves* opposite, entire. *Flowers* ☂, terminal or axillary
heads or narrow spikes, solitary in the axil of a bract, subtended by 2 bracteoles. *Tepals* 5, free, narrow, strongly longitudinally plurinerved, membranous, after anthesis indurate or not. Stamens 5, filaments unequal, at the base connate in a short cup; anthers small, 2-celled (4-locellate); no pseudo-staminodes. Ovary ellipsoid or globose; ovule 1, pendulous from a long erect funicle; style thin; stigma capitate. *Fruit* enclosed by the perianth, thin-walled, indehiscent; seed erect, lenticular.

Distr. About 14 spp. in Africa, SE. Asia and Malaysia, centering in Africa.


—Fig. 6.

Annual, erect or ascending, often much branched from near the base, 5–50 cm long, in sunny localities often strongly tinged with purple; stems thin, in the leaf axils and on the young nodes often hairy, otherwise glabrous; pairs of leaves often distant. *Leaves* patent, variable in shape, lanceolate, oblong, elliptic or obovate, minutely mucronate, rather fleshy in a living state, glabrous, 1/4–7/2 by 1/2–2 cm; petiole 3–10 mm. *Spikes* usually terminal or in forking of stem, sometimes also axillary, solitary or rarely paired, sessile or on thin and often rather long peduncles, at first shortly conical, afterwards lengthened, rather acute, dense, 1–2 1/2 cm long; rachis pilose; lowest fruits often falling off before expansion of the highest flowers; bracts and bracteoles thinly membranous; bracts widely patent or subreflexed, ovate-lanceolate, concave, very acute, 1/14–1/2 mm long, persistent; bracteoles ovate-triangular, nerveless, 1/2–3/4 mm long, falling off together with the perianth and the fruit. *Perianth* much longer than the bract and the bracteoles. *Tepals* lanceolate, very acute, throughout their width with 3–5 strong longitudinal nerves, glabrous, 2–2 1/2 mm long, not or hardly indurate after anthesis. Filaments very thin, 1/2–3/4 mm long (cup included). *Style* 1/2–3/5 mm, persistent. *Utricle* ellipsoid, compressed-pellucid but opaque at the apex, 1–1 1/2 mm long. Seed vertical, shining black or blackish brown, ± 1 mm long or slightly longer.

Distr. SE. Asia, in Malaysia: throughout the Archipelago, not yet reported from the Lesser Sunda Islands and the Moluccas.

Ecol. Humid clayey fields, along ditches and trenches, locally often numerous, 5–1200 m, on the whole not a very common species.

Notes. The shape of the leaves is very variable.

Fig. 6. *Psilotrichum ferrugineum* (Roxb.) Moq. from Java, × 1/3.
14. ALTERNANTHERA

FORSK. Fl. Aeg.–Arab. (1775) 28.

Annual or perennial, erect, ascending, trailing, creeping, floating or clambering herbs, often hairy; hairs dentate or smooth. Leaves opposite, entire. Flowers ♂ or by malformation ♀, in axillary or rarely terminal, sessile or peduncled heads or short spikes, solitary in axil of bract, subtended by 2 bracteoles; bracts and bracteoles scarious. Perianth often dorsally compressed. Tepals 5, free, equal or unequal, glabrous or hairy. Stamens normally 2–5, sometimes partly antherous; filaments at the base united in a tube or a short cup; free part short, usually alternating with (sometimes very minute) pseudo-staminodes; anthers small, 1-celled (2-locellate); pseudo-staminodes entire, dentate or laciniate. Ovary compressed or not; ovule 1, pendulous from a long funicle; style short; stigma capitate. Utricle indehiscent, sometimes corky, falling off with the perianth and with or without the bracteoles. Seed vertical.

Distr. Large genus, centering in America, some species in other parts of the World, in Malaysia: 6 species, of which 1 indigenous (one variety endemic); the 5 others introduced from trop. America. Three of these are naturalized and, often on a large scale, locally firmly established. The other two are cultivated.

Uses. The gregarious matted growth of some species is sometimes used for protecting soils from rain-wash. Others are cultivated for ornamental purposes.

Notes. In some species the hairs are, under the microscope, smooth, in others they are minutely but distinctly dentate. This neglected character is of importance for specific delimitation; it proved constant in the Malysian species treated here.

KEY TO THE SPECIES

1. Heads all sessile (after the fall of the lower flowers often seemingly stalked, but in this case the spurious peduncle is at once recognized as the rachis of the head by the presence of bracts). Perianth sessile between the bracteoles. Filaments at the base united in a very short cup.

2. Bracts and tepals not spinaceous.

3. All tepals 1-nerved, or only at the very base obscurely 3-nerved, not with indurate bases. Bracts not or shortly acuminate. Anthers 3, oval or oblong. Pseudo-staminodes minute, entire, perhaps sometimes wanting. Leaves green. Hairs smooth.

4. Leaves variable as to shape but not narrowly linear-filiform, 1/4–15 by 1/4–3 cm

5. A. sessilis var. tenuissima

3. Three outer tepals in their lower 1/3–1/2 distinctly 3-nerved, their bases at last indurate. Bracts rather long-acuminate. Anthers 5, linear, 1–2 of them sometimes shorter than the others. Leaves often coloured. Hairs dentate

2. Bracts and 2 outer tepals with spinaceous tips. Entire head conspicuously prickly. Stems trailing or creeping. Hairs dentate

6. A. porrigens

1. Heads usually borne on a distinct bractless peduncle (if sessile then the perianth is 5–7 mm long!). Filaments united at the base into a distinct tube. Pseudo-staminodes distinct, divided into narrow apical straps.

5. Stems solid, their young parts hairy all round; hairs minutely dentate. Bracts, bracteoles and perianth hairy. Leaves, when not too old, densely appressed-hairy all over the lower surface. Not aquatic.

6. Perianth yellowish-white, placed between the bracteoles on a short but distinct stalk, falling off with this stalk. Top of the bracteoles with a distinct dorsal hairy crest. Bracts with a rather long mucro. Robust plant

5. A. brasiliiana

6. Perianth red, sessile between the bracteoles. Bracteoles not crested. Bracts with a very short mucro or without one

6. A. porrigens

5. Stems in their lower part fusiform. Leaf axils with white smooth hairs, on two opposite sides with a longitudinal hairy groove, otherwise glabrous. Plant of very humid localities, often growing in shallow water

4. A. philoxeroides


Prostrate herb, often rooting; taproot robust; stem terete, hard, on the younger parts densely clothed with appressed, minutely dentate, white hairs, 10–50 cm long. Leaves elliptic-ovate, narrowed into the petiole, with an obtuse or round-edged...
top, on the upper surface glabrous or thinly ap-pressed-pilose, on the lower surface glabrous or on the nerves apressed-pilose, 1/4-4/12 by 1/3-2 cm, in a single pair often of very unequal size; petiole 2–10 mm. Heads 1–3 in the leaf-axils, sessile, globose or oblong, white, 1/2–1/2 cm long; bracts spine-tipped, ± 4 mm (including spine); bracteoles acuminate, very acute but not spinous, 3–4 mm long. Tepals very unequal: 2 abaxial ones much larger than the others, convex, spine-tipped, ± 5 mm long, above base right and left with hair-tuft, in the lower half with 3 upwards confluent nerves, hardening after anthesis; adaxial tepal rather flat, oblong, dentate near tip, mucronate, not spiny, at base right and left with hair-tuft, ± 3½ mm long, two inner tepals much smaller than the others, their lower halves very concave, embracing the ovary and afterwards the fruit, on the middle of their back with a patent hair-tuft. Stamens 5, all perfect; filaments (basal cup included) 1½–3½ mm; anthers oblong, minute; pseudo-staminodes much shorter than filaments, broad, entire, emarginate or irregularly dentate. Style very short. Fruit falling off with perianth and bracteoles, broadly oval, much compressed, truncate or retuse, brown ± 1½ mm long.

Distr. Native of trop. America, introduced in Java, collected there for the first time in 1912, now established in some waste places on and near the northern coast, at low altitude, locally abundant, but on the whole still rare.

Notes. The specimen mentioned by Burman in his Fl. Ind. (1768) 66 as Illecebrum achyranthes, and conserved at Geneva in Herb. Delessert, is Alternanthera sessilis.


Herb, perennial or under unfavourable circum-
stances short-lived, often pluricaulous, 10–100 cm long; taproot robust; stem either erect, ascending or creeping and solid, or, in inundated localities, floating and in the lower part fistular), green or more or less tinged with purple, on 2 opposite sides with a longitudinal row of hairs, across the nodes

with a transverse row of hairs, otherwise glabrous; hairs articulate, smooth. Leaves variable as to shape and size, varying from linear-lanceolate via oblong to oval or obovate, acute at the base, acute, obtuse or rounded at the apex, green, glabrous or thinly and finely pilose, ¾–15 cm by ½–3 cm, in wet localities comparatively large, in dry localities much smaller; petiole 1–5 mm. Heads 1–4 in the axil of present or fallen leaves, sessile but by the fall of lower flowers often spuriously peduncled, at first globose, growing more cylindrical with age, 1½–1½ cm long; rachis densely white-hairy; bracts and bracteoles not or shortly acuminate, glabrous, white, persistent after the fall of the flowers; bracts 2½–3½ mm; bracteoles 1–½½ mm. Tepals shortly acuminate or not, glabrous or on the back with few or several hairs, white or purplish, shining (in a living state), 1-nerved or only at the very base obscurely 3-nerved, after anthesis not hardening in the lower part, 2½–3½ mm long. Filaments 5 of which only 3 antheriferous, ± ¾½ mm long (basal cup included); anthers oval-oblong, ½½–1½½ mm; pseudo-staminodes subulate-filiform, entire, very minute, not exceeding filaments, often shorter. Style during anthesis very short, afterwards slightly

Fig. 7. Alternanthera sessilis (L.) R.Br.
from Java, × ½s.
lengthened. Fruit falling off with the perianth, obreniform, deeply emarginate, corky, dark brown, glabrous, 2-2½ by 2½-3 mm; lobes finally longer than the interposed style.

Distr. Throughout the Old World, in Malaysia: throughout the Archipelago.

Ecol. A common plant, ½-1250 m, in constant or periodically humid or even inundated, open localities: fallow rice-fields, road-sides, gardens, shallow ditches, swamps, tea-plantations. Fruits often floating in great quantities upon the water.

Uses. An infusion of the entire plant is used as a remedy against intestinal cramps and as a cooling hair-wash.

Vern. Daun tolod, M, kremak, J.

Notes. The habit of the species varies exceedingly with the habitat.

var. tenuissima (Suess.) comb. nov.—Alternanthera tenuissima Suessenguth in Bot. Arch. 39 (1939) 382.

Leaves from a narrowed base very narrowly linear or almost filiform, acute, shortly mucronate, with a strongish midrib, when very young sparsely beset with longitudinal white hairs, soon becoming glabrous, 2-6 cm by ½-2 mm. Pseudo-staminodes not found.


Ecol. The only collection known was made in a garden, as a weed, at c. 1800 m alt.

Notes. In contrast to Suessenguth who says that it is not closely allied to any Malaysian species, I find this aberrant form in all essential characters agreeing with A. sessilis from which it differs only by the peculiar shape and width of the leaves. It might be an etiolated or depauperated form.

A specimen closely resembling this variety was figured by Dorni (i.c.) under the name of A. nodiflora R.Br. from Queensland.


Perennial herb, 20-50 cm high; stem erect or at the base for a greater or smaller part decumbent and rooting, often much branched and forming dense tufts, terete in the lower part, quadrangular upwards, on 2 opposite sides with a longitudinal furrow, appressed-pilose at the top and on the nodes. Leaves oblong, oblong-ovate or spatulate from an acute base, acute or obtuse, finely mucronate, often ± crisp, not rarely entirely green, but mostly in different ways variegated with brownish red, bright red, pink or yellow, when young clothed with fine dentate hairs, glabrescent, 1-6 by ½-2 cm; petioles 1-4 cm, ± hairy. Heads terminal and axillary, often in dense clusters of 2-5, globular or oblong, ½-1 cm long; hairs of bracts, bracteoles and floral parts, when present, minutely dentate; rachis hairy; bracts and bracteoles rather long-acuminate, very acute, glabrous or on the back with long hairs; bracts 1½-3 mm; bracteoles 2-2½ mm. Perianth often d - diformed and then consisting of more than 5 tepals; normal tepals white or yellowish, shiny; 3 outer ones in their lower ½-1½ with 3 close-set strong, upwards convergent nerves; their bases finally indurated; 2 abaxial tepals ovate-oblong, 3-4 mm long, concave, in their lower halves rather densely patently pilose on the back; their upper halves acutely acuminate, glabrous; adaxial tepal ovate-oblong, faintly concave or almost flat, sparingly hairy or glabrous, 2½-3½ mm long; 2 inner tepals very concave, narrower and shorter than the others, sparingly hairy of glabrous. Stamens (basal cup included) 1½-2½-3½ mm long; anthers 5, linear; 1-2 often somewhat shorter than the others and sterile; fertile ones ½-1 mm: pseudo-staminodes strap-shaped, reaching up to the middle or the top of the anthers, at the apex cleft into 3-5 very narrow strips. Oval glabrous; style subconical rather thick ± ½ mm. Utricle in Java not developing (in typical A. ficoidea faintly notched).

Distr. Native of Brazil, already long ago introduced into Java, in Malaysia (at least in Sumatra and Java) frequently cultivated as an ornamental plant, or in tea-plantations along the borders of terraces as a protector from rain-wash, for which purpose it is, by its densely tufted growth, eminently adapted, 1-2000 m.

Ecol. In Malaysia fruits are never produced.

Uses. See above.

Vern. Djoekoeot sélón (Ceylon-grass), ketijitjak abang, J.

Notes. A form of A. ficoidea with entire, subulate pseudo-staminodes and shorter petioles has been collected in Banka, probably also in a cultivated state: var. versicolor (Regel) Back.


Perennial herb, ascending from a creeping or floating, rooting base, often much branched and forming dense masses, ½-1 m long; stem fleshy, in the leaf-axils with a transverse row of white, smooth hairs, on 2 opposite sides with a longitudinal hairy groove. Leaves oblong or oblong-ovate from a tapering base, acute or rather obtuse, submucronate, glabrous or ciliate, 2½-3 by ½-2½ cm; petiole 3-6 mm. Heads terminal and ses-
Flora Malesiana [ser. 1, vol. 4]

Flora (1914) phaneras placed corded near-ate-cuneate, narrow mens, (including persistent sile, 5. fruits very bracts solitary, 420. 4 rounding up ovate-lanceolate approximated nodes, or high; theranthera 2-3 glabrescent. ovoid-oblong, often bracteoles short, 279. Ecol. Notes. Alternanthera ACyranthes porrigens (Jacq.) O.K. Rev. Gen. 2 (1891) 538; Asch. & Gr. Syn. 5, 1 (1914) 366.—Achyranthes porrigens Jacq. Hort. Schoenbr. 3 (1798) 54, t. 350.—Telanthera porrigens Moq. in DC. Prod. 13, 2 (1849) 377. Erect or ascending with erecto-patent branches, 1/2—1/4 m high; all hairs minutely dentate; stems thin, firm; young parts densely clothed with apressed acroscopic rather long hairs. Leaves elliptic-oblong from an acute or contracted base, acute, mucronate, 1/2—6/14 by 1/3—3/4 cm, at first on both surfaces densely clothed with appressed long hairs; hairs subpersistent or those of upper surface gradually disappearing; petiole 2—10 mm. Heads terminal and near the tops of the branches also axillary, not very numerous, highest often in lax umbelliform inflorescences, often 2—3 together on a common peduncle and then 1—2 sessile; rest shortly peduncled; peduncle thin, firm, up to 10 cm long but often much shorter; axes of inflorescence and stalks of heads densely clothed with appressed acroscopic hairs; heads at first ovoid, afterwards more cylindrical, 6—15 by 4—6 mm; lowest flowers already fallen before expansion of highest; axis of head densely hairy; bracts acute or very shortly mucronate, ± 2 mm long, bracteoles very acute, densely hairy on back, ± 2/4 mm. Perianth sessile between the bracteoles, red, 3—3/2 mm long. Tepals oblong or ovate-oblong, 1-nerved, in lower half rather densely hairy on the back. Filaments (staminal cup included) 1/4—2 mm; anthers linear, 3/4—1 mm; pseudo-staminodes strap-shaped, about as long as stamens, at top divided into a few narrow strips. Style 1/4—1/2 mm. Fruit broadly oblong, dorsally compressed, 1—1/4 mm long.

Distr. Native of trop. America, introduced into Java more than a century ago, in Malaysia: at present naturalized in a wide circle around Buitenzorg, and also collected in Central Java, as yet not found in other islands.

Ecol. Moist, shaded localities, 200—600 m, steep ravine slopes, stream banks, locally often gregarious.

6. Alternanthera porrigens (Jacq.) O.K. Rev. Gen. 2 (1891) 538; Asch. & Gr. Gr. Syn. 5, 1 (1914) 366.—Achyranthes porrigens Jacq. Hort. Schoenbr. 3 (1798) 54, t. 350.—Telanthera porrigens Moq. in DC. Prod. 13, 2 (1849) 377. Erect or ascending with erecto-patent branches, 1/2—1/4 m high; all hairs minutely dentate; stems thin, firm; young parts densely clothed with appressed acroscopic rather long hairs. Leaves elliptic-oblong from an acute or contracted base, acute, mucronate, 1/2—6/14 by 1/3—3/4 cm, at first on both surfaces densely clothed with appressed long hairs; hairs subpersistent or those of upper surface gradually disappearing; petiole 2—10 mm. Heads terminal and near the tops of the branches also axillary, not very numerous, highest often in lax umbelliform inflorescences, often 2—3 together on a common peduncle and then 1—2 sessile; rest shortly peduncled; peduncle thin, firm, up to 10 cm long but often much shorter; axes of inflorescence and stalks of heads densely clothed with appressed acroscopic hairs; heads at first ovoid, afterwards more cylindrical, 6—15 by 4—6 mm; lowest flowers already fallen before expansion of highest; axis of head densely hairy; bracts acute or very shortly mucronate, ± 2 mm long, bracteoles very acute, densely hairy on back, ± 2/4 mm. Perianth sessile between the bracteoles, red, 3—3/2 mm long. Tepals oblong or ovate-oblong, 1-nerved, in lower half rather densely hairy on the back. Filaments (staminal cup included) 1/4—2 mm; anthers linear, 3/4—1 mm; pseudo-staminodes strap-shaped, about as long as stamens, at top divided into a few narrow strips. Style 1/4—1/2 mm. Fruit broadly oblong, dorsally compressed, 1—1/4 mm long.

Distr. Native of trop. America, introduced into Java more than a century ago, in Malaysia: at present naturalized in a wide circle around Buitenzorg, and also collected in Central Java, as yet not found in other islands.

Ecol. Moist, shaded localities, 200—600 m, steep ravine slopes, stream banks, locally often gregarious.
15. GOMPHRENA

LINNÉ, Sp.Pl. 1 (1753) 224.

Annual, or less often perennial herbs. Leaves opposite, sessile or on short petioles. Flowers ♀, in terminal, solitary, sessile or sub-sessile heads or short spikes; receptacle cylindric or swollen. Flowers solitary in the axil of a persistent bract, subtended by 2 bracteoles; bracts and bracteoles scarious, glabrous; bracteoles erect, navicular, acute, often coloured, with or without dorsal crest, glabrous, falling off with perianth. Tepals 5, erect, free or nearly so, on back long-woolly. Stamens monadelphous; staminal tube long or short, shortly 5-lobed; free parts of filaments with or without intervening pseudo-staminodes, entire, retuse or distinctly 2-lobed; anthers introrse, 1-celled (2-locellate). Ovary compressed, glabrous; ovule pendulous from long erect funicle; style short or long; stigmas 2, erect or spreading, short, sometimes almost inconspicuous. Utricle compressed, indehiscent.

Distr. Large genus, centering in trop. America, some spp. native in Australia and SE. Malaysia, one an introduced ubiquist.

Of the species collected in Malaysia 3 are natives of America and have been introduced. The 2 other species are native both in Australia and in SE. Malaysia, and represent a distinct Australian element in the Malaysian flora.

Notes. The flowers are in this genus ♀, at least in the Malaysian spp. In those of an Australian specimen of G. brownii Moq. I could find no trace of an ovary. SCHINZ in ENGL. & PR. Nat. Pfl. 2e Aufl. 16c (1934) 26 describes this genus as lacking pseudo-staminodes. But on p. 79 of the same volume he figures 2 species with very distinct pseudo-staminodes.

**KEY TO THE SPECIES**

1. Bracteoles with a (sometimes very narrow) dorsal crest.
2. Dorsal crest of the bracteoles well-developed, very distinct, dentate-serrate on the back.
3. Head globose or depressed-globose, 11/4-21/4 cm long when adult. Bracteoles deep purple, pink or white, 2-3/4 mm broad (crest included). Lobes of the staminal tube at least partly obtuse or rounded, not or hardly longer than the unwithered anthers.
   1. G. globosa
3. Heads at first ovoid, afterwards more spiciform, cylindric, 21/2-5 cm long when adult. Bracteoles orange or reddish, 4-5 mm broad (crest included). Lobes of the staminal tube very acute, much longer than the unwithered anthers. Exclusively cultivated.
   3. G. haageana
2. Dorsal crest of the bracteoles very narrow, dorsally entire, not reaching up to the apex of the bracteole. Flowers white.
   2. G. celosioides

1. Bracteoles without a dorsal crest.
4. Adult heads 3-4 cm diam. Perianth much compressed, 12-14 mm long, much longer than the bracteoles. Tepals acute. Staminal tube with long filiform pseudo-staminodes between the filaments, free parts of the latter 5-6 mm long. Style 8-9 mm (spreading stigmas included), exceeding the stamens. Robust herb.
   4. G. canesceens
4. Adult heads 3/4-1 cm diam. Perianth not or hardly compressed, 3 1/2-4 mm long, about equaling the bracteoles or slightly longer. Tepals rather obtuse. Staminal tube without pseudo-staminodes between the filaments, free parts of the latter = 1/2 mm long. Style = 1/2 mm (the erect minute stigmas included), not exceeding the stamens. Small herb.
   5. G. tenella


Flos globosus RUMP. Herb. Amb. 5, 289, t. 100, fig. 2.—Fig. 8.

Annual, erect or at base decumbent and rooting, 15-60 cm high: stem thickened at base of inter-nodes. Often tinged with red, on young parts appressed pilose. Leaves oblong or oblong-ovate from an acute base, obtuse, often ± undulate, thinly pilose on both surfaces, 5-15 by 2-6 cm; petiole 1-1 1/2 cm; 2 topmost leaves sessile or nearly so. Heads sessile or sub-sessile above the topmost pair of leaves. Solitary or sometimes in clusters of 2-4, globose or depressed globose, 13/4-2 1/4 cm diam.; bracts ovate-triangular. acuminate, acute, 3-6 mm; bracteoles with very distinct dentate-serrate dorsal crest, much surpassing the bract, 7-12 mm by 2-3/4 mm (crest included); deep purple,
pink or white. Perianth shorter than the bracteoles, yellowish green, white-woolly outside, 6–6.5 mm long. Staminal tube about equalling the perianth; its lobes at least partly obtuse or rounded, not or hardly longer than unwithered anthers. Style much shorter than staminal tube, bifid. Fruit ovoid, ± 2-2.5 mm; seed reniform, swollen.

Distr. Native of trop. America; long ago introduced into Malaysia: found throughout the Archipelago either cultivated or semi-naturalized.

Ecol. In settled areas in waste places not rarely found as a stray from gardens but nowhere firmly established, and not truly naturalized, 1–± 1300 m.

Fl fr. throughout the year.

Uses. Cultivated in gardens as an ornamental. Cooked leaves may be eaten.

Vern. Bunga knop, M.


Annual, erect or ascending, 10–25 cm long, often branched from the base; stem finely appressed-white-pilose; internode immediately beneath 2 topmost leaves often long. Leaves shortly petioled or subsessile, spatulate or oblong-lanceolate from an acute base, acute or rather obtuse, ending in a short rather hard point, glabrous or sparingly appressed pilose above, thinly or rather densely appressed pilose beneath, 2–4.5 by 1.5–1.5 cm; 2 topmost leaves subsessile. Heads sessile above highest pair of leaves, at first subglobose, ± 1 cm diam., gradually lengthening into a spike, finally up to 4 cm long; receptacle long-white-woolly; bracts ovate, acuminate, very acute, 3–4 mm; bracteoles long-ovate, very acute, white, ± 6 mm, in the higher part with a dorsal crest; crest narrow, abruptly ending below top of the bracteole and there sparingly short, irregularly dentate, otherwise entire. Perianth inserted on a minute knob, pure white, somewhat shorter than the bracteoles, 4–5 by 5–5.5 mm. Sepals narrowly lanceolate, acute, in lower half externally densely clothed with long fine white hairs. Stamens slightly shorter than perianth; filaments nearly entirely connate; apical teeth of the staminal tube varying from rather obtuse to rather acute, not or shortly exceeding unwithered anthers, ± 2 mm. Style much shorter than the staminal tube, bifid somewhat deeper than halfway down, totalling 3/4–1 mm. Ripe fruit not seen.

Distr. Native of trop. America, introduced in trop. and S. Africa, India and Australia, in Malaysia: in Batavia, Manila (Coert no 1400, a. 3.6.36), and Singapore, well on its way to spread over the Old World. The statement of Sandwith l.c. that the plant has run wild all over the Botanic Gardens at Buitenzorg was due to misinformation.

Ecol. Roadside weed, between grass, locally gregarious, tufted in mats (Singapore, harbour-yard, 1926; Batavia, 1946), well adapted to hot, dry, dusty situations at low elevations.


For differentiating characters see the key to the species.

Distr. Native of Mexico, in Malaysia: exclusively and occasionally cultivated.


Erect annual, 60–90 cm high, not or sparingly branched, stem hard, densely clothed with erect appressed long white hairs. Leaves sessile, linear.
or narrowly linear-lanceolate, acute, firmly herbaceous with a strong midrib, on both surfaces densely clothed with appressed long white hairs, 1/2–5 cm by 2–5 mm. Heads subtended by an involucre of 5–9 patent cauline leaves, depressed globose, 3–4 cm diam.; involucral leaves narrowly linear, tapering to a very acute apex, 1-nerved, at the base long-ciliate, on both surfaces densely clothed with appressed long white hairs, 2–3 by 4–6 mm; receptacle densely long-white-woolly; bracts and bracteoles tapering from a broad base, bracts 6–7 mm long; bracteoles very acute ± 8 mm. Flowers between the bracteoles on a very short thick pedicel; perianth strongly compressed, purple, greatly surpassing the bracteoles 12–14 mm long. Tepals nearly free, lanceolate, acute, 1-nerved, in the lowest 1/3–1/2 of the back (especially at the base) clothed with long hairs. Stamens 7–9 mm long, at the base for a length of 2–4 mm conflate into a tube; free parts of filaments flat, glabrous 5–6 mm, alternating with shorter subulate acute antherless pseudo-staminodes. Ovaly glabrous; style glabrous; 8–9 mm, longer than the stamens, shortly bifid; arms spreading. Fruit?

Dist. N. Australia, in Malaysia: Lesser Sunda Isl. (Timor, Spanoghe), Moluccas (Tanimbar, Riedel).

Ecol. Probably in sunny dry localities, in Timor on calcareous rocks, apparently rare, only twice collected.

5. Gomphrena tenella (Moq.) Bth. Fl. Austr. 5 (1870) 256.—Iresine tenella Moq. in DC. Prodr. 13, 2 (1849) 343.

Erect annual, Malaysian specimens only 2 1/2–6 cm high, unbranched; stem thin, hard, in higher part densely woolly. Leaves in 2–4 distant pairs, narrowly linear, glabrous, above, thinly patently pilose beneath, 1/2–3/4 cm long. Heads sessile above the topmost pair of leaves, globose, 3/4–1 cm diam.; receptacle very densely clothed with longish white hairs; bracts ovate, shortly apiculate, ± 2 1/2 mm long, much shorter than the bracteoles; axis of flower densely woolly; bracteoles ovate, acute, ± 3/4 mm long. Tepals nearly free, oblone, rather obtuse, 3/4–4 mm long, in the lower half with an oblong herbaceous central field: this field on the back densely clothed with long, entangled, in dried specimens brownish hairs. Filaments connate up to near apex; staminal tube not shorter than ovary and style together; free parts of filaments ± 1/2 mm long, broad, slightly narrowed upwards, without intervening pseudo-staminodes. Style minute; stigmas 2, erect, subulate; stylus and stigmas together ± 1/2 mm long. Fruit?

Dist. N. Australia, in Malaysia: Moluccas or the Lesser Sunda Islands. The only specimen on which this record is based was collected by Reinwardt in 1821, and is preserved in the Rijksbarium, Leyden. According to an accompanying note by Blume it was collected somewhere in the Moluccas, but it may have been gathered in Flores Island.

Notes. I am not wholly satisfied that my identification of the specimen described above is correct. The dimensions of its vegetative parts are very much smaller than those given by Moquin and Bentham for Australian specimens. However, it is possible that Reinwardt collected the plant in a very sterile or arid locality. I have not examined any other specimen of this species.

16. IRESINE


Erect, ascending or scendent herbs or undershrubs. Leaves opposite, petioled, entire or subentire. Flowers (♂) (♀) or ♀, paniculate; panicles terminal, often also in the highest leaf axils, many-flowered; their ultimate branches spiciform, bearing solitary or clustered, minute flowers; flowers solitary in axil of bract, subtended by 2 bracteoles, membranous, usually shining, subglabrous or woolly. Tepals 5, oblong or ovate-oblong, acute; stamens (in ♀ reduced to very minute staminodes) 5; filaments at the base connate in shallow cup, filiform, with or without interposed pseudo-staminodes; these usually short, broadly triangular, rarely long; anthers oblong, 1-celled (2-locellate); ovary (wanting in ♂) compressed, ovule 1, pendulous from an erect funicule; style very short; stigmas 2, subulate, erect-ascending, short; utricle compressed, orbicular, thin-walled, indehiscent; seed lenticular or reniform, shining.

Dist. Large genus, centering in America, also in the Galapagos Isl., in Malaysia: one Brazilian species cultivated and locally naturalized.

Perennial herb, erect or ascending, often much branched, slightly fleshy; nodes thickened; base of the internodes in dried specimens strongly constricted; young stems pubescent, especially on and near nodes. Leaves broadly ovate-orbicular, broadly oval or broadly obovate, at the frequently slightly unequal base very obtuse, rounded or truncate but shortly contracted into the petiole, with a usually more or less deeply emarginate but sometimes rounded or shortly acuminate and then very acute apex, entire or subentire, concave, thinly fleshy, either shining dark red with lighter coloured bands along the main-nerves or (var. aureo-reticulata Nich.) green with golden yellow bands, on both surfaces very thinly clothed with shining brown or yellowish, partly bifid and appressed hairs, 2¼–8 cm long and wide; petioles 1–5 cm; those of a single pair connected at the base by a transverse row of longish, thickis, harticulate hairs. Panicles terminal and often also in axils of the highest and then small leaves, 5–50 cm long, united in a terminal, erect, 8–60 cm long, often much branched and rich-flowered panicle; primary branches of the panicle erecto-patent, branched from base or nearly so; ultimate branchlets spiciform, rather dense-flowered, 1–4 cm long; rachises of the panicle thin, red, at first rather densely clothed with longish shining hairs; glabrescent. Flowers not concealing the rachis, in Malaysia exclusively ♀; bracts, bracteoles and perianth greenish white or yellowish white; bracts and bracteoles persistent after fall of the perianth, ovate, rather acute, concave, nerveless, glabrous; bracts ± 1 mm long; bracteoles slightly wider, ± 1¼ mm long. Perianth ± 1¼ mm long, at the base externally with a dense whorl of long, very thin, white hairs; tepals dorsally with a few short hairs, otherwise glabrous, oblong, rather acute, nerveless; pseudo-staminodes minute. Ovary suborbicular, much compressed, glabrous; stigmas obliquely patent-ascending, ± 1/2 mm. Fruit never produced in Malaysia.

Distr. Native of Brazil, in Malaysia: exclusively cultivated for ornamental purposes (already before 1894) and locally naturalized in e.g. Java, Celebes, and Ceram.

Ecol. Naturalized in forest borders and along forest paths, 500–1500 m, locally abundant.

Uses. The leaves are squeezed in water in order to obtain a red dye used for colouring agar agar jellies.

Vern. Bayam merah, M.

Notes. In Malaysia exclusively ♀ flowers are found. In none of the many specimens I examined, I have found ♀ flowers nor have I traced any description of them. Fruit is never produced in Malaysia.

Excluded

*Neurolis fuscata* Rafinesque, Autikon Bot. (1840) 150. This new genus was based by Rafinesque on *Celosia virgata* Hort. (*non* Jacq.). Its native origin was cited as: 'Borneo or Moluccas?' I cannot identify this with certainty. It is possible that Merrill (Rafin. p. 119) is right in reducing it to *Celosia*. Rafinesque might have had a specimen belonging to a garden form of Jacquin's species which is native in South America.
CHENOPODIACEAE (C. A. Backer, Heemstede)

Annual or perennial herbs or shrubs, often fleshy, glabrous, papillate or hairy. Leaves opposite or alternate, exstipulate, sometimes seemingly wanting, stalked or sessile, entire, dentate-serrate-lobed or irregularly gashed. Flowers solitary, 2–3-nate or glomerulate, usually sessile, either axillary or in terminal or axillary dense or interrupted spikes or panicles, ♀ or unisexual, monochlamyious, rarely acheny, small; bracts present or absent, usually small, rarely leafy. Perianth herbaceous or sometimes scarious, rarely (in ♀) absent, 3–5-partite with (in bud) imbricate segments, or sometimes almost entirely gamophyllous and then shortly lacerate-dentate or unilaterally cleft, persistent, after anthesis accrescent or not. Stamens often the same number as tepals and opposite to them, sometimes fewer, usually inserted on or near base of perianth; filaments free or shortly connate; anthers dorsifixated or inserted in a basal cleft, 2-celled (4-locellate); cells bursting longitudinally. Ovary free or at the base adnate to the perianth, 1-celled; ovule 1, basal, sessile and erect or suspended from a funicle; styles or stigmas 2–5, linear. Utricle either enclosed by the perianth or not, indehiscent or rarely opeculate; seed erect, oblique or horizontal, usually compressed; endosperm mostly present, peripheral, surrounding the embryo; embryo annular or spirally twisted.

Dist. Species numerous, inhabitants of the temperate and tropical zones of both hemispheres.

Ecol. Often in maritime, saline, or in permanently or periodically dry regions. Many are weeds of cultivation. In Malaysia restricted to maritime and mountainous districts.

Uses. In Malaysia some species are cultivated as vegetables, others as medicinal or ornamental plants, but not for the production of sugar.

(Artificial) key to the genera

1. Apparently leafless; stem spuriously articulate. Leaves decussate; those of each pair connate throughout their length into a tubular fleshy sheath which tightly and entirely encloses the appertaining internode and is widened at the apex into a shallow cup. Flowers spicate; bracts decussate, crowded; flowers in the axil of one bract ± collateral; perianth gamophyllous, scarious, ± flagon-shaped; stamen 1 (sometimes 2?).

2. Floral bracts almost entirely connate into a cup; base of the cup on 2 opposite sides provided with collateral apertures for the protrusion of stamens and stigmas. Apex of perianth laterally split.

5. Arthrocnemum

2. Floral bracts almost free; their margin dilated into a patent semi-orbicular scale, their base without apertures. Apex of perianth shortly dentate-lacerate

4. Tecticornia

1. Leafy in a normal way; leaves alternate.

3. Leaves spine-tipped. Bracts exceeding the perianth. Tepals about the middle with a transverse thickening, above this thickening scarious. 7. Salsola

3. Leaves not spine-tipped. Tepals without a transverse thickening.

4. Leaves sessile, narrowly linear, semi-terete, very succulent. Bracteoles distinct though small, transparent, after anthesis stellately spreading. 6. Suaeda

4. Leaves distinctly petiolated, flat.

5. Flowers (♂) (♀); ♀ flowers in spicate or panicated clusters; ♀ flowers solitary in leaf axils. No bracteoles. In Malaysia exclusively cultivated. 3. Spinacia

5. Flowers all clustered, all or for the greater part ♀; the ♀, when present, in the same cluster as the ♂ ones.

6. Ovary free. Flowers after anthesis not coalescent. No bracteoles

2. Chenopodium

6. Ovary adnate to base of perianth. Flowers coalescent after anthesis. Bracteoles minute. In Malaysia only cultivated

1. Beta

Linné, Sp. Plant (1753) 222.

In Malaysia not wild; 1 species frequently cultivated in the mountainous regions of Java.
2. CHENOPODIUM


Annual or perennial herbs, sometimes strongly smelling; young parts often more or less densely clothed with minute, powdery, white or pink vesicles which, when young, contain a watery liquid but usually soon shrivel and lose their colour. Leaves alternate, petioled, herbaceous, variable as to shape, entire, dentate-serrate or irregularly gashed. Flowers ♂ or by abortion ♂, sessile, clustered; clusters solitary in the leaf axils or in axillary and terminal cymes, spikes or panicles; no bracteoles. Tepals 5 or sometimes 4, free or shortly connate, vaulted, herbaceous, often longitudinally thickened or keeled on the back, in the Malaysian species not fleshy after anthesis. Stamens in ♂ the same number as tepals, inserted on the base of the perianth or free from it, at the base sometimes connate into a fleshy disk. Ovary depressed globose; style short; stigmas 2–5. Fruit often embraced by conniving tepals, thin-walled indehiscent. Seed usually horizontal, sometimes oblique or vertical, shining or dull, smooth or finely tuberculate, lenticular; its margin keeled or not; testa thinly coriaceous; embryo annular, surrounding the usually meaty endosperm.

Distr. Species about 60 in the temperate zones of both hemispheres. A small number naturalized in the mountainous districts of the tropics.

Ecol. For the greater part weeds of cultivation; many prefer a fertile soil.

Uses. A few species cultivated either for their oil-producing fruits, as a substitute for tea, or for ornamental purposes.

Notes. Most species flower and fruit freely. For the determination ripe fruits are of value. The colour of young leaves should be noted by Collectors.

BURMAN (Fl. Ind. (1768) 72) records Chenopodium urbecum L. as having been sent to him from Java. The specimen mentioned by him is conserved at Geneva and has been correctly named. Nevertheless I have omitted the species from my key as I feel not at all convinced that it was really collected in Java; BURMAN was often not careful in his records. Ch. urbecum was never afterwards collected in Malaysia.

KEY TO THE SPECIES

1. Top of ovary and fruit studded with (in vivo yellow) glands; stigmas 2–5; embryo encircling only \(1/2\)–\(2/3\) of the seed. Young vegetative parts and outside of perianth without powdery white or pink vesicles. Undersurface of leaves with (sometimes rather indistinct) yellow glands. Strongly smelling.
   1. Ch. ambrosioides

1. Top of ovary and fruit glandless; stigmas 2; embryo encircling almost the entire seed. Young vegetative parts and outside of perianth with powdery white or pink vesicles. Leaves without any yellow glands. Not or faintly smelling.

2. Segments of perianth after anthesis widely patent, not covering the fruit. Young parts without powdery vesicles, quite glabrous
   2. Ch. polyspermum

2. Segments of perianth after anthesis connivent, covering the fruit. Young, or at least very young, parts with powdery white or red vesicles.

3. Only very young parts with distinct vesicles; these white, very soon shrivelling and losing their colour; old leaves on both surfaces dark green and feebly shining. Seed (after removal of pericarp) dull black, rather obscurely papillate. Panicles small; terminal panicle not much larger than the axillary ones.
   3. Ch. murale

3. Vesicles white or red, not very soon losing their colour; old leaves not dark green on both surfaces.

4. Larger leaves irregularly and rather coarsely serrate-dentate-laciniate or deeply gashed, often longer than 5 cm and wider than 3 cm; undersurface of leaves not very densely and persistently visiculose. Seed after removal of pericarp shining blackish brown, almost smooth
   4. Ch. album
4. Leaves quite entire, small (mostly 2–4 by 1\(\frac{1}{2}\)-3 cm), on the undersurface very densely and persistently vesiculose: hence *in a dried state* very pale beneath; their nerves and margins often reddish. Flower-clusters spicate; higher spikes united in a terminal, small, leafless, paniculate inflorescence; rachises of the inflorescence and outside of the perianth densely clothed with patent, oblong, reddish vesicles.

5. *Ch. acuminatum*


Dec. 1877


Erect or ascending annual, often very much branched; entire plant strongly smelling, without powdery vesicles, 15 cm to 1 m high; stem angular-ribbed, glabrous or finely pubescent. *Leaves* oblong-lanceolate from a narrowed or contracted, acute, often more or less decurrent base, acute or rather obtuse; larger ones coarsely or shallowly serrate-dentate; smaller ones less deeply incised; highest entire, gradually changing into bracts; all leaves herbaceous, bright green, on the undersurface more or less densely studded with *in vivo* yellow (sometimes very inconspicuous) glands, otherwise subglabrous or sparingly beset with short white hairs, 1\(\frac{1}{2}-5\) cm; midrib prominent beneath; other nerves thin; petioles short or medium-sized; those of highest leaves obsolete. *Flower-clusters* small, 3–25-flowered, in the axils of successive, conspicuous, narrow, boat-shaped leaves, united in short or longish, rather lax spikes, forming together a leafy panicle; floral leaves much surpassing the clusters, acute, with a strongish midrib. *Flowers* 5 or partly 5, sometimes partly 4 and then with 4–5 stamens and a rudimentary, densely glandular ovary. *Perianth* light green with a pale base, 1\(\frac{1}{2}-1\) mm long, 4–5-cleft to near the base; segments ovate-triangular, rather acute, very concave, not or indistinctly keeled. Stamens in 5 4–5, rarely 1–3; filaments slightly exceeding the perianth. Ovary depressed globose, on top with many small, in vivo yellow glands; stigmas 2–5, usually 3 or more. Ripe *fruit* entirely concealed by the connivent tepals. *Seeds* horizontal, or a few (rarely many or all) erect, broadly oval-obovoid, shining brownish black, 2–5 mm diam.; embryo encircling 1\(\frac{1}{2}-2\) of the seed.

**Distr.** Native of tropical America, introduced in many other regions: Europe, Asia, Africa. Australia, in *Malaysia*: naturalized throughout the Philippines, in Java and in N. Celebes (Minahasa). At present found in a wild state in the western and the eastern part of Java between 1600 and 2000 m.

**Ecol.** Road-sides, locally often very numerous. In Celebes collected in dry ricefields. *Fl. Jan.–Dec.*

Uses. The slightly poisonous oil distilled from the seeds is used as a remedy against ankylostomiasis. For this purpose the plant has been cultivated in Java, but it cultivation was abandoned as being insufficiently remunerative.

**Notes.** In Java the seeds are all or nearly all horizontal. The Celebian specimen has *vertical* seeds (see also the description by MOQUIN, l.c. p. 73) but in all other respects it completely agrees with the Javan material. It was collected in 1840 by FORSTEN and had as late as 1949 still distinctly retained its peculiar smell.


Annual, erect or ascending, quite glabrous, glandless, without a distinct smell, without powdery vesicles, 4–100 cm (mostly 15–75 cm) long, dull green, rarely shining, in a living state often more or less strongly tinged with purple, frequently much branched (often from quite near the base); branches obliquely erect or the lower widely patent-ascending, not rarely partly prostrate; stem and branches angular. *Leaves* herbaceous, rarely fleshy, entire or the larger ones sometimes with one or a few triangular teeth near the base; lower leaves on rather long petioles, ovate or oval-oblong from a cuneate or obtuse, rarely hastate base, shortly contracted into the petiole, acute or obtuse, rarely subretuse, frequently very shortly mucronate, 4–11 by 1\(\frac{1}{2}-6\) cm; highest leaves much smaller, oblong-lanceolate. *Cymes* very numerous, most variable as to size, dense or rather loose, few- to many-flowered; highest very often collected in a narrow, paniculate inflorescence (reminding of *Amaranthus graciulis*). *Flowers* sessile; tepals oval-obovate or oval-oblong, obtuse, thin, with a very distinct, not-keeled midrib, 1\(\frac{1}{2}-\frac{1}{2}\) mm; after anthesis widely patent, not concealing fruit; stamens 5, on the base of the perianth, = equalling tepals; stigmas 2, erect or suberect, minute, persistent. *Fruit* depressed-globose, \(\frac{1}{2}\) mm diam., very thin-walled. Seed blackish brown, feebly shining, very faintly striolate.

**Distr.** Europe, continental Asia; elsewhere locally introduced.

**Ecol.** Weed of fields and gardens; waste places.

**Notes.** I have seen no Malaysian specimen but MERRILL l.c. records the plant as a casual weed in the Philippines. The species is very variable.

Flora Tecticornia (1913)

Fruit often coarsely oblong angular leaves dery anth, (1929) still black, not very globose, 398; 219; Syn. Fl. 159; Annual, Erect Java Dieng, Kood. Back, Hook./. Bat. DC. Fields and gardens, road-sides, locally very common. Vern. Dieng, J, dieng dempo, J, dieng idjo, J.


Erect annual, often much branched, not marked-smelling, without any yellow glands, 15 cm-11/2 m high; all vegetative parts and outside of perianth, when very young, clothed with white, powdery vesicles, otherwise glabrous; vesicles soon shrivelling up and losing their colour. Stem angular, ribbed, with longitudi-nal dark green or red streaks. Lower leaves long-petioled, ovate-rhomboid, irregularly and rather coarsely dentate-serrate-laciniate or deeply gashed; higher ones gradually shorter-petioled, elliptic-oblong-lanceolate from an acute or contracted base, acute or obtuse, less deeply incised or entire; all leaves herbaceous, 11/2-15 by 1/2-13 cm. Flowers in panicled clusters, 5-merous, var; panicles often collected in a large terminal leafy paniculate inflorescence. Perianth herbaceous, not becoming fleshy after anthesis. Tepals distinctly connate at the base, oval, very concave, obtuse, with a strong, rounded midrib, 11/2-21/4 mm long. Stamens slightly longer than the perianth. Ovary depressed globose; stigmas 2, short. Fruit in the living plant en-

Fig. 1. Tecticornia cinerea (F.V.M.) Bail. from saline coastal flats N of Mt Baluran; drawn after a living specimen by A. Hamzah, Nov. 1941, x1/2.
tirely enclosed by the incurved tepals, depressed-globose, finely papillate. Seed horizontal, lenticular, surrounded by an obtuse keel, shining blackish brown, smooth or nearly so, $1^{1/4}-1^{3/4}$ mm diam.

Distr. Europe, continental Asia, Africa, Australia, America, in Malaysia; in Java introduced already very long ago, naturalized in the eastern part of the island, 800-1800 m.

Ecol. Fields, gardens, locally common.

Vern. Dieng, J. dieng putih, J.

Notes. Extremely polymorphous, buried by fanatical species-splitters under a mountain of unnecessary and useless names.


—Chenopodium amaranthicolor (Coste & Reyn.) Coste & Reyn. in Bull. Soc. Bot. Fr. 54 (1907) 181; Asch. & Gr. Syn. 5, 1 (1913) 66.

Young parts and outside of perianth densely clothed with amaranthine vesicles, retaining their colour during a long time but at last turning pale and shrivelling. Plant up to 2$^{1/2}$ m high. Otherwise like the main species and in a dried state indistinguishable from it. Introduced in Java long ago, at present naturalized in the western and the eastern part between 1200 and 2300 m above sea-level. Roadside, fields, locally often numerous. By the Indonesians sometimes cultivated as a vegetable.

Note. In a living state very conspicuous by the bright amaranthine colour of the young parts. A specimen (LÖRZING 7168) of Ch. album was in 1920 collected in N. Sumatra. I have seen it only in a dried state and it bears no note indicating the colour of the young leaves, so that it is impossible to make out whether it belongs to the typical species or to its **subsp. amaranthicolor**.

5. **Chenopodium acuminatum** Willd. (non Schur) Acta Nat. Cur. 2 (1799) 124, tab. 5, fig. 2; Mook in DC. Prod. 13, 2 (1849) 62; Merr. in Philip. J. Sc. 3 (1908) Bot. 405; En. Philip. Fl. Pl. 2 (1923) 125.

Annual, erect or ascending, 20–30 cm high, branched or not; all young parts, especially under surface of leaves, clothed with oblong, red or white vesicles; stems and branches angular; branches obliquely erect; their vesicles, except on the angles, subpersistent. Leaves entire, in sicco thickish, retaining their indumentum of vesicles during a long time especially on the underside where it is very dense, hence in sicco very pale beneath, often with a reddish margin and a reddish underside of nerves; lower leaves on rather long, reddish vesiculose petioles, ovate from a very obtuse or rounded-subtruncated, shortly contracted base and an obtuse or rounded, very shortly pointed apex, 2–4 by $1^{1/2}$–3 cm; higher leaves on shorter petioles, shorter, narrower, acute, distinctly and finely acuminate. Rachis of inflorescence densely clothed with reddish vesicles. Flower-clusters subglobose, small, dense, spicate, crowded or the lower rather distant; higher spikes united in a terminal, rather small leafless paniculate inflorescence. Flowers sessile, outside densely reddish-vesiculose. Tepals $5$, broadly oval, obtuse or rounded, very concave thin, 1-nerved, $1^{1/2}$–$1^{3/2}$ mm long, before and after anthesis connivent. Stamens $5$, about equaling the perianth; anthers thick: ovary (in our specimens) minute. Style short, 2-armed. Fruit (not seen) finely wrinkled; seed dull black or shining.

Distr. Siberia, China, Japan, Formosa; in Malaysia: Philippines (Batam Isl., between Formosa and Luzon).

Ecol. Waste places.

Note. I could examine only 2 specimens, neither of them collected in Malaysia.

3. **SPINACIA**


In Malaysia not wild; 1 species, the true spinach, occurs but rarely cultivated.

1. **Spinacia oleracea** Linné, Sp. Pl. (1753) 1027, the true spinach, is but very rarely cultivated in Malaysia and only by way of experiment. It is substituted by two quite different species, Amaranthus tricolor L. (Amaranthaceae), bayam, and **Tetragonia expansa** Murr. (Aizoaceae), New-Zealand spinach, kabak, M.

4. **TECTICORNIA**

**Hook.** f. in Bth. & Hook. f. Gen. Pl. 3 (1880) 65.

Only seemingly jointed and leafless, glabrous, softly succulent herb. Leaves decussate; those of each pair connate throughout their length in a tubular fleshy sheath tightly and entirely enclosing the appertaining internode and widened at the apex into a shallow, faintly bilobed cup, which embraces the slightly attenuate base of the next higher sheath. Flowers minute, spicate; spikes terminal and frequently also in highest leaf axils, oblanceolate or shortly cylindrical, very obtuse, bracteate; bracts decussate, densely crowded, almost free, not provided with basal apertures, fleshy; their margin dilated into a semi-orbicular, ± patent, thin-margined scale. Flowers often in threes, sessile, collateral, φ; perianth flask-shaped, very thin, with
a narrow, dentate-lacerate mouth. Stamen 1; filament short; anther exert, oblong-linear. Ovary ovoid-oblong, compressed, narrowed into a longish, shortly bifid style; ovule subsessile. *Utricle* erect, pericarp very thin, hyaline. Seed oblong, compressed, densely papillate; albumen hard; embryo slender, radicle inferior.

Distr. Monotypic, Australia and S. Malaysia.

1. **Tecticornia cinerea** (F.V.M.) BAIL. Queensl. Fl. 4 (1901) 1261; VALET. Bull. Dép. Agr. Ind. Néerl. 10 (1907) 9; KOCH in ZW. Nieuw-Guin. Exp. 1904/5 (1908) 505; PULLE in Nova Guin. 8 (1910) 349.—*Halocnenum cinereum* F.V.M. Fragm. 1 (1858) 140.—*Salicornia cinerea* F.V.M. Fragm. 6 (1868) 251.—Fig. 1.

Perennial (?), much branched, erect or prostrate with erect branches, 15–30 cm long; young stems after removal of leaf-sheaths thinly wiry, tough; old stems rather robust, cylindrical, woody; adult internodes 1–2 cm; whole plant in a dried state greyish. **Spikes** usually 1 terminal and 2–6 in higher axils; the latter spikes opposite, widely patent, 1/2–2 1/4 cm long. **Utricle** brown, 1 1/4–1 3/4 mm long; seed yellowish brown.

Distr. N. Australia, in **Malaysia**: SW. New Guinea, S. coast near Merauke, (long. 140° E, G. M. VERSTEEG 1895; 8.9.07, KOCH s.n.) and coast near Mt Baluran, E. Java (long. 114°25' E, HOOGERWERF s.n. Nov. 1941).

Ecol. Low, clayey, seasonally swampy and again completely desiccating localities, cut up after a prolonged dry period in their upper layers into hard clumps by criss-crossing cracks, locally gregarious. According to KOCH the loamy plain was inundated in the rainy season, and had (had?) probably connection with the mouth of the Digul river; possibly the soil was, therefore, saline. It is also said to have been collected in *Imperata*-fields, but we should bear in mind that non-botanists are apt to confound *Imperata* with other grasses.

Notes. Making an accurate detailed description of this species based on herbarium-specimens is impossible, owing to the extreme shrinking of dried materials and their pappiness after soaking. A new description after the living plant is urgently needed. Though Hooker based his new genus *Tecticornia* on this species only, he did not create the binomial, which is often wrongly ascribed to him.

5. **ARTHROCNEMUM**


Only seemingly jointed and leafless herbs or undershrubs. **Leaves** decussate; those of each pair connate almost throughout their length in a tubular fleshy sheath, tightly and entirely enclosing the appertaining internode and widened at the apex into a rather shallow, faintly 2-lobed cup which embraces the shortly attenuate base of the next higher sheath. **Flowers** minute, spicate; spikes terminal, on often very short lateral branches, bracteate; bracts crowded, decussate, pairwise connate into a very faintly 2-lobed cup, embracing the base of the next higher cup; cups very fleshy at base, gradually thinner upwards, at the base on 2 opposite sides with 3 small collateral apertures for the protrusion of the adult anthers and stigmas (over the margin of the next lower cup); pairs of aperture-triads decussate. **Flower** usually 1 behind each aperture, ♀ or unisexual; bracteoles narrowly linear-spatulate, thinly membranous. Perianth thinly membranous, gamophyllous, at the apex or also deeper unilaterally cleft. Stamen 1 (sometimes 2?); filament short; anther thick. Ovary membranous; stigmas 2. subulate, rather long. **Utricle** (not seen in a ripe state) membranous or hard. Seed compressed; albumen well-developed, one-sided, mealy; embryo comma-shaped.

Distr. Species ± 12, along the Mediterranean coast and in the warmer regions of N. America, Asia and Australia, in the coastal districts and salt-marshes, in **Malaysia** 1 species.

Chenopodiaceae


Rather robust perennial herb, woody beneath, divaricated branched from the base; branches ascending, much divided; young shoots after removal of leaf sheaths very thin, wiry, afterwards growing thick and woody, not breaking up into joints. Leaf sheaths on young branches 7–10 mm long; their widened top with a thin, very minutely dentate upper margin, gradually drying up, long persistent. Spikes erect or erecto-patent, cylindrical, very obtuse, 1 1/2–4 1/2 cm long, distinctly thicker than the branches by which they are born; bracteal cups 12–30, from the narrowed base to the upper margin 2 1/2–3 mm long, at last separating from the thin rachis on which they seem to be strung. Spikes apparently unisexual, but both sexes present on a single plant. Flowers free from each other; perianth obtriangular, more or less deeply split; stamen 1, anther exerted; perianth obliquely flagon-shaped, unilaterally split at the apex, 1 1/2–2 mm long. Utricle compressed, indurate. Seed erect, orbicular; testa membranous.

Distr. Coasts of tropical Africa, Hindustan, Bengal, in Malaysia: Java, Madura, Kangean Archipelago, Sumbawa, Sumba, Timor.

Ecol. Near the sea on salt clayey soils, which may be covered by a thin layer of sand, often more or less gregarious. Fl. Jan.–Dec.

Vern. Kemalalahala (Sumba).

6. SUAEDA


Annual, biennial or perennial herbs, or shrubs, erect, ascending or prostrate; stems not conspicuously articulate. Leaves alternate, sessile, narrowly linear, terete or semiterete, succulent. Flowers small, ? or partly unisexual, sessile, clustered or higher ones solitary; clusters in the axil of a leaf or a bract, 2–∞-flowered, often united in paniculate inflorescences. Flowers 2–3-bracteolate; perianth herbaceous, deeply 5-cleft; segments subequal or 2–3 outer ones swollen on the back into tubercle; rarely all of them winged. Stamens 5, on base of perianth. Ovary free or at the base adnate to the base of the perianth, globose, ovoid or flask-shaped; styles 2–5, subulate or filiform. Fruit enclosed by the enlarged, more or less succulent perianth; pericarp membranous or spongy. Seed horizontal, oblique or erect, smooth; embryo planospiral, often green.

Distr. Few spp., all over the world.


Perennial glabrous herb, 7–45 cm long, at an advanced age often woody at the base, usually divided from the base into obliquely erect or ascending branches, often rooting from the lower joints; old stems tuberculate by scars of fallen leaves. Leaves rather crowded, linear, semiterete, with well-developed aquiferous tissue, glaucous or more or less tinged with purple or entirely purple, 1–4 1/2 cm long, with a saltish taste. Inflorescence usually paniculately branched, 2 1/2–15 cm; flowers in clusters of 2–5 or higher solitary, all ?; lower bracts rather large, foliaceous; higher ones gradually smaller; bracteoles at the base of perianth 2–3, oblong obtuse, transparent, 1/2–1 mm long, persistent, after fall of the fruit ± stellately spreading. Perianth green of more or less suffused with purple; segments at first (?) stage conniving, leaving only at top a small orifice for the protrusion of the stylus, afterwards (d) stage spreading, after anthesis once more convivnt and enclosing the fruit, ovate, obtuse, with ± transparent margins and top; perianth in the (d) stage ± 1 1/4 mm diam., in the (e) stage ± 2 1/2 mm; anthers broad, bilobed at the base, ± 1/2 mm long. Ovary free from perianth, ovoid-conical; styles 2, rarely 3, rather long. Fruiting perianth depressed, without either tubercles or wings, in the living plant 2–2 1/2 mm diam., succulent. Seed usually horizontal, rarely vertical, shining brown; albumen very scanty.

Distr. Europe, N. Africa, Asia, Australia, N. America, in Malaysia: West and East Java, Madura, New Guinea (?).

Ecol. Moist or swampy, clayey, saltish soils near the sea, often gregarious, frequently very conspicuous by its purple colour. Red and green specimens often grow intermixed.

Vern. Alur, J.
Use. Leaves sometimes eaten by the Indonesians as a vegetable.

Notes. Very polymorphous species. The two specimens recorded as Suaeda nudiflora by Koorders l.c. for the Karimon Djawa Isl. belong both to Salsola kali. Zollinger 2909 from Banjwangi (E. Java) is Suaeda maritima; Zollinger (Syst. Verz. (1854) 108) could not place it.

7. SALSOA

LINNÉ, Sp.Pl. (1753) 222.

Herbs or shrubs, glabrous or hairy; stems not conspicuously jointed. Leaves alternate or lowest opposite, sessile, linear or triangular, often spine-tipped. Flowers axillary, solitary or glomerate, sessile, ♂, bibracteolate at the base; bracteoles exceeding perianth. Perianth 5-partite down to the base; segments ovate-oblong, in or below the middle with a transverse thickening, above the thickening scarious, after anthesis completely embracing the fruit; the thickening after anthesis often excrecent into a horizontal wing; basal part of perianth unchanged or slightly indurate. Stamens 5, inserted on annular disk; filaments linear or subulate; anthers short or long; connective either produced into a point or not. Ovary globose-ovoid; style short or long, split into 2 long arms. Fruit falling off together with perianth; pericarp membranous or fleshy. Seed usually horizontal, exalbuminous; embryo coiled in a conical spire, often green.

Distr. Species ± 100, in Europe, Africa and Asia; a few introduced species in America and Australia, in Malaysia only the ubiquitous S. kali L.


Psammophilous, glabrous or slightly pubescent annual, usually branched from the base and forming dense tufts; stems erect, or prostrate beneath, often woody at the base, 30–60 cm long. Lower leaves of young Malaysian specimens narrowly linear, rather flaccid, 2–7½ cm long; higher leaves gradually shorter, proportionally broader; highest tapering from a broad amplexicaulous membranous-margined base, channelled, rigid, recurved, ½–1 cm long; all leaves spine-tipped, fleshy, ± glaucous. Flowers solitary in axil of floral leaves, remote or in small numbers densely crowded on short axillary branchlets and then seemingly in axillary fascicles, which, when fruits are ripe, fall off as a whole; bracteoles recurved, rigid, tapering from a broad base, channelled, pungent, 4–5 mm long; perianth-segments ovate-oblong acute, 3–3½ mm. Filaments linear; anthers short, bilobed at the base, ± 1½ mm; connective not or hardly produced. Style arms far exserted from perianth; base of fruiting perianth campanulate, pergameneous, ± 2 mm high, closely embracing the fruit; wings varying from very short to well-developed, often pink; 3 of them usually much broader than the rest, often emarginate; tips of the perianth-segments conning above the fruit into a cone, thinly scarious. Fruits shortly obconical, truncate, tipped by the style-base, ± 1½ mm diam., at last circumsciss; apical part falling away. Seed horizontal, subglobose, shining black.

Distr. Europe, N. Africa, Asia, Australia, N. America, in Malaysia; Java (said to have been collected in 1828 by BÉLANGER; I saw no Javan specimens), Karimon Djawa Arch., Madura, Bali, Kankean Arch., Celebes, Saleier, Buton, Timor, Key Isl., New-Guinea.

Ecol. Sandy sea-shores, very local. Flowers in dry regions in the rainy season; disappears in the latter half of the dry monsoon.

Vern. Landep, J. sindepan, J.

Note. Very polymorphous plant.

TEYSMANN (in Nat. Tijd. Ned. Ind. 11 (1856) 202) records Salsola for the region between Surabaya and Tuban, but in a manner which suggests that he was mistaken. He says: 'The road crosses coastal swamps in which grow Rhizophora, Avicennia, Salsola, Triandhema and other marsh-plants.' As a matter of fact, Salsola never grows in marshes; TEYSMANN, whose knowledge of plants was ample but superficial, may have confounded it with Suaeda.
PLUMBAGINACEAE (C. G. J. van Steenis, Buitenzorg)


Herbs or undershrubs. Leaves simple. Stipules absent. Flowers bisexual, actinomorphic, often in unilateral inflorescences, or subumbellate. Bracts often sheathing, dry and membranous. Bracteoles 2. Calyx tubular, gamosepalous, often conspicuously ribbed, folded, the membranous folds often hyaline, lobes 5, often scarious. Petals free, but mostly connate at the base, contorted. Disk 0. Stamens 5, epipetalous, and connate with their base. Anthers 2-celled, opening lengthwise. Ovary superior, mostly sessile, often angled, 1-celled with 1 ovule pendulous from a basal funicle; styles 5, free or variously connate; stigma subcapitate. Capsule membranous, mostly included, circumscissile near the thin base, rarely valvate from the base upwards. Seed 1, with or without endosperm, cylindric.

Dist. Throughout the world, ca 10 genera.

Ecol. Mostly in salty steppes, or littoral. Leaves variously reduced to needle-shape, often provided with glands secreting water, mucus, salts or CaCO3.

Uses. Several species are medicinal; see Plumbago.

KEY TO THE GENERA

1. Leaves scattered or alternate on the stems, not rosulate.
   3. Petiole alate throughout, clasping the branch. Blade orbicular
      2. Petiole not so. Blade not orbicular


   3. Armeria
   2. Flowers in wide-branched corymbs, unilateral, spicate. Leaves large, pinnatisect-spathulate
      4. Limonium

I. AEGIALITES

R. Br. Prod. (1810) 426 (not of Trin. 1820); Roxb. Fl. Ind. 2 (1832) 111 (Aegelatis); Boiss. l.c. 621; Griff. Not. 4 (1854) 207 (Aegiatilis); Miq. l.c. 994; B. & H. l.c. 624; Kurz, J. As. Soc. Beng. 46, II (1877) 217; For. Fl. Burma 2 (1877) 96; Clarke, l.c. (Aegianilites); Boerl. l.c. 278; Pax l.c.; Baill. l.c.; Gamble l.c.—Aegialinites Presl, Bot. Bem. (1844) 103.

Simple-stemmed shrub, or undershrubs, 1–3 m tall, branches with pith. Leaves alternate, orbicular, glabrous, coriaceous, entire, smooth, gland-dotted; nerves and veins parallel; petiole long, thick, winged, clasping the stem, leaving annular scars. Glandular inside. Flowers solitary in the axil of a bract, erect, in leafy panicled often fork-branched racemes not much exceeding the leaves. Bracts sheathing, enclosing 2 similar but smaller boat-shaped bracteoles, all persistent, glandular inside. Calyx persistent, wholly or only upwards with 5 prominent ribs, folded between, tubular, lobes short. Corolla white, longer than the calyx. Easily detached circumscissile at the base, lobes elongate-spathulate, subconcaive 3-nerved, mutually connate at the base in a short tube together with the stamens; tube annular or barrel-shaped, after anthesis when pushed out splitting upwards from the base.
Stamens inserted on the apex of the tube, anthers basifix c. as long as the corolla, sagittate at the base; cells ± parallel, halfway free, latrorse; connective a narrow furrow between the cells; pollen 90–120 μ diam. Styles free, articulate at the base; stigma small, punctiform-capitate, reaching just above the stamens. Capsule linear, long-exserted, pentagonal, dehiscing finally along the angles.

**Distr.** 2 spp., SE. Asia to Australia, absent in many districts of **Malaysia** (fig. 1).

**Ecol.** In the open mangrove, according to **Teysmann** and **Brass** also on rocky beaches and exposed shorelines, on sandy soil (**Warburg**), locally in small pure groves. The stembase in **Ae. rotundifolia** is said to be swollen and conical (**Griffith**, **Craib**, **Brandis**). Aerophores are not found (**Warburg**). **Griffith** says that the petioles, bracts, and bracteoles exude a viscoso fluid. This is due to mucilaginous glands which are widely distributed in the family (cf. **Wilson**, Ann. Bot. 4 (1890) 244).

In the Ceram specimens I found sand adhering to calyx and corolla. The exocarp is coriaceous; the mesocarp is swollen and spongy and contains air in the herbarium; and the endocarp is thin. The mesocarp therefore seems to contribute the means by which the fruit can drift. The elongated fruit reminds of viviparous **Rhizophoraceae**, **Aegiceras**, &c. The flowers seem not to be ephemeral; therefore measurements of the ovary (proportion length/diameter) are not constant, as it enlarges during anthesis. The corolla is after anthesis circumsissile at the base and is slowly pushed out, and its basal obconical part enclosing the ovary is partly slit upwards. Field study is urgently needed to clear the life-history and variability of this peculiar genus.

**Notes.** The genus consists of two widely separated populations which show rather unimportant differences in the flower. As no intermediates are known and the ecological behaviour is different I accept them provisionally as two distinct species. The disjunction is similar to that in **Aldrovanda**, **Philydrum lanuginosum**, &c; the absence in the intervening area is unexplained.

**Key to the species**

1. Leaves shining above, reticulations prominent s.s. Flowering parts larger than in next species, longer pedicelled. Calyx 13 mm, lobes hardly imbricating, acute-triangular. Corolla tube (3½–)5 mm high, lobes 12 by 3–4 mm below the apex. Anthers 3 mm; filament inserted in the middle. Ovary 5–10 by 2½–5 mm, little acuminate towards the apex

2. **Ae. rotundifolia**

1. Leaves dull above, reticulations indistinct s.s. Flowering parts smaller than in the prec. species. Flower sessile or up to 5 mm pedicelled. Calyx 7–8 mm, lobes distinctly imbricating, their apex rounded to subtruncate, mucronulate. Corolla tube 1–2 mm high, lobes 9–10 by 1½–2 mm. Anthers 2 mm long, filament inserted at 1/3 of the length. Ovary 3–4 by 1½–2 mm, oval

**1. Ae. annulata**

Stembase swollen, conical. Leaves rotundate to oval, 4–8 by 2½–7 cm. Petiole 3½–8 cm long. Bracts 7–9 by 6 mm, bracteoles 6–8 by 2 mm. Flowers sessile or up to 5 mm pedicelled. Stamens 7–8 mm long. Styles 6–7 mm. Fruit 2 mm diam., first straight, gradually elongating, later falcate up to 5 cm long, but not thickening.

**Distr.** Queensland, NW. Australia, Thursday Isl. and E. **Malaysia**: S. New Guinea, Moluccas (Aru, Ceram) and Lesser Sunda Isl. (Timor, Sema, Alor, Solor, Adonara, E. Flores (Larantuka)).—**Fig. 1.**

**Ecol.** **Brass**’s Papuan specimens were only 30–45 cm tall. Grows in isolated specimens or small colonies in more sandy and rocky places than the following species.


**Leaves** orbicular, base mostly rounded or broad-

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**Fig. 1.** Distribution of **Aegialites**.
Plumbaginaceae

2. PLUMBAGO


Perennial herbs or undershrubs, rarely annual, often straggling or subscandent. Leaves spread, entire, older ones often below pale-lepidote by excreted carbonates, or reduced on the flowering stems; petiole often semi-amplexicaulous-auriculate at the base. Flowers in terminal racemes or spikes, often united in a leafy panicle, blue, rosa, white or violet, ephemeral, not caducous. Calyx tubular, outside often with sessile or stalked glands, teeth erect, not enlarged in fruit. Corolla funnel-shaped, lobes spreading. Stamens free, broadened at the base. Style short, with 5 branches. Capsule included in the persistent calyx and (often twisted) corolla; pericarp thin, hardened above, circumscissile near the base, caducous part often splitting towards the apex with 5 valves.

Distr. About 10 spp. in all tropics, often used as ornamentals.

Ecol. Not limited to saline localities, but preferably under semi-arid conditions. Of _P. indica_ no fruit has ever been found, and _P. aphylia_ and _P. auriculata_ never produce fruit in Java; they are propagated vegetatively. The leaves of the latter are often covered below with greyish scales of excreted CaCO₃.

Uses. Plumbago, leadwort, derives its name from the colour adapted by the skin after the medicinal use of the European _Pl. europeae_, a plant used in historic time for curing _plumbun_, an illness of the eyes. The Indian species too are often used medicinally. The active substance, plumbagin, is known as a narcotic and specially as a vesicatory and anthelmintic. It is specially extracted from the roots; _radix vesicatoria_ was already figured by RUMPHIUS, Herb. Amb. 5, p. 453, t. 168 ( _P. indica_). Several spp. are known as ornamentals, mostly _P. auriculata_. In a strict sense none is native in Malaysia, though _P. zeylanica_ might be accepted as such.

**KEY TO THE SPECIES**

1. Corolla white, tube less than 2½ cm long, limb 12–15 mm diam. Rachis of the raceme or spike with sessile or stalked glands

2. Leaves well-developed on flowering stems, 3–12½ by 2–5 cm. Rachis with sessile glands

   1. _Pl. zeylanica_

   2. _Pl. aphylia_

3. Corolla red or blue, tube 2½–4 cm long, limb 2–3 cm diam. Rachis hairy or glabrous but without glands.

   1. _Pl. auriculata (non Lamk)_

   3. _Pl. auriculata_

   3. _Pl. auriculata_, lobes distinctly mucronate. Calyx red, 8–9 mm long, glandular all over, glabrous

4. _Pl. indica_


   Straggling shrub. Twigs long, not rooting, 1½–2½ m. Young leaves with caducous small auricles. Racemes 6–30 cm, glands green often red-tipped. Calyx glabrous, glandular all over, green. _Corolla_ tube 18–22 mm, lobes obovate 6–7 mm. Anthers blue-purple. Ovary and style glabrous. _Fruit_ oblong, acute with 5 furrows, calyx patent and recurved.

   Distr. Tropics of the Old World to Hawaii, possibly only indigenous in SE. Asia, in _Malaysia_ not yet found in Borneo and the Moluccas, also cultivated.


   Strong taproot producing few-branched, rather...
Fig. 2. Plumbago indica L., \( \times \frac{1}{2} \). (Courtesy Pasuruan Exp. Station)
Plumbaginaceae (v. Steenis) 111


Erect shrub or halfshrub, 1 1/2-1 1/2 m. Leaves oblong to obovate, 1 1/2-5 by 3-2 cm, auricules mostly large. Upper axes with a bundle of leaves. Racemes mostly combined to leafy corymbs; rachis 1-6 cm long, densely puberulous. Calyx green, 10-14 mm long, lower 1 1/2 2/3 puberulous but without glands. Ovary pear-shaped, style base glabrous.

Distr. Native of S. Africa, in Malaysia: a common ornamental, up to 1100 m, does not run wild. Fl. Jan.–Dec.

Vern. Mammentrouw, verliefde luitenaantjes (Dutch).


Branched from the base, stems flaccid, sometimes rooting, 1 1/2-1 1/2 m. Leaves oblong, 5-15 by 2-8 cm, without fascicled leaves in the axils, petiole not auriculate. Calyx red, 8-9 mm high, glabrous, glandular all over. Racemes not corymbiform, rather sparse. Rachis glabrous, 10-30 cm long. Ovary ovate-oblong. Style base short-hairy. Fruit unknown.

Distr. Widely distributed in the Old World tropics, probably native in SE. Asia, certainly not a sport or variety of *Pl. zeylanica*, in Malaysia: not yet recorded from the Malay Peninsula. Borneo, and New Guinea, ascending to 1000 m, also cultivated.

Ecol. Always in anthropogenic localities, locally run wild or semi-spontaneous, often persistent in abandoned cultivations, also in teak-forests. Fl. Jan.–Dec.

Uses. Ornamental, sometimes medicinal as a substitute for *Rauwolfia serpentina* Bth.


3. ARMERIA


Perennial tufted seacope herbs with narrow rosulate leaves and a subterraneous, branched rootstock. Flowers in heads subtended by dry bracts. Bases of the outer ones coalescent into a tubular sheath. Calyx obconical. 5-lobed, lobes mucronate. Petals united at the base. Stamens inserted on top of the tube. Style = free, stigma cylindric. Fruit circumsessile at the base.

Distr. Spp. 10 or 60 depending on the specific concept, cosmopolitan, not native in Australia and Malaysia.


Leaves 1-nerved, slightly puberulous on margins and midrib, 5-7 by 1 mm. Culms 10-20 cm, thin and hard, puberulous, apex hollow. Heads 2-2 1/4 cm diaim., sheath 10-18 mm. Calyx 6 mm high. Petals cuneate-spathulate, emarginate, rosa to red, their base pale, rarely white, 8-10 mm long. Style bases hairy.

4. LIMONIUM


Stiff, erect herbs. Leaves rosetulate, spathulate, entire or lobed, often large. Flowers in widely branched corymb, consisting of unilateral spikes. Bracteoles unequal. Calyx tube narrow, 5-ribbed; limb scarious, coloured, teeth often mucronate. Petals mostly ± free, at the base connate with the stamens. Styles ± free, stigma cylindric, rarely (§ Goniolimon) capitate. Fruit indehiscent or capsular at the apex.

Distr. More than 100 spp., cosmopolitan, not native in Malaysia. This absence is surprising as the genus occurs both in Australia and Asia. This distributional discontinuity is found in several plants, e.g. Philydrum launiginosum, Rothia trifoliata, Samolus valerandi, &c. Some of the plants of this type have occasionally been found in Malaysia, e.g. Ericaulon setaceum, Hydrocotyle peltata, Aldrovanda vesiculosa, Montia, Anagallis pumila, but remain exceedingly scarce.


Robust, 1/2–1 m. Leaves lanceolate-spathulate, deeply pinnatisect, 20–50 by 2½–6 cm (incl. the long petiole), sparsely long-hairy. Peduncle and branches distinctly winged, wings ± crisped, on each fork with 3 erect, leafy, linear, 1–12 mm long appendages. Unilateral spikes dense, stalk between the bracts 3-olate, one wing narrow, the others broadening. Large bracteole folded, short-3-lobed, apex on the back with 2–3 teeth, narrow bracteole needle-tipped. Calyx tube 6 mm long, limb entire, fine-plaited, blue, white or rosa, 6–7 mm long.


Excluded


This species was based on a specimen said to have been collected by LA BILLARDIÈRE in Buru Island (Moluccas) on the expedition of ‘La Recherche et l’Espérance’ which went along the Cape Verde’s to Cape of Good Hope, Australia and Mænesia to the Moluccas, and stayed in Buru from Sept. 18–30 at Kajeli, the principal harbour. A copy kindly sent by Dr BAENHI agrees with BURCHELL 512 at Leyden and is identified as L. equisetinum (BOISS.) DYER var. depauperatum (BOISS.) from the Cape. There are one developed flower and one reduced flower in each spikelet. It is closely allied to L. scabrum (THUNB.) O.K. The occurrence of minute tufts of hairs on the scape is typical. Cf. also WRIGHT, in Fl. Cap. 4, 1 (1909) 422. This is the 2nd instance in which a species of this genus was mislabelled (cf. Kew Bull. 1948, 368).
UMBELLIFERAEE († P. Buwalda, Groningen)

Annual or perennial herbs, never woody shrubs (in Malaysia). Stems often furrowed and with soft pith. Leaves alternate along the stems, often also in rosettes; petiole usually with a sheath, sometimes with stipules at the base; lamina usually much divided, sometimes entire. Flowers polygamous, in simple or compound umbels, sometimes in heads, terminal or leaf-opposed, beneath with or without involucres and involucels. Calyx teeth 5, often obsolete. Petals 5, alternate with the calyx teeth, equal or outer ones of the inflorescence enlarged, entire or more or less divided, often with inflexed tips, inserted below the epigynous disk. Stamens alternate with the petals, similarly inserted. Disk 2-lobed, free from the styles or confluent with their thickened base, forming a stylopodium. Ovary inferior; styles 2. Fruits with 2 one-seeded mericarps, connected by a narrow or broad junction (commissure) in fruit separating, leaving sometimes a persistent axis (carpophore) either entire or splitting into 2 halves; mericarps with 5 longitudinal ribs, 1 dorsal rib at the back of the mericarp, 2 lateral ribs at the commissure; 2 intermediate ribs between the dorsal and the lateral ones; sometimes with secondary ribs between the primary ones, these without fascicular bundles; often vittae in the ridges between the ribs or under the secondary ribs, and in the commissure, seldom under the primary ribs.

Distr. Numerous genera and species, all over the world. The representatives native in Malaysia belong geographically to five types. (1) Ubiquitous genera (Hydrocotyle, Centella, Oenanthe); one species, Hydrocotyle vulgaris, shows a remarkable disjunction, occurring in Europe & N. Africa and also in New Guinea, Australia and the Marshall Islands. (2) Western elements are Sanicula (wide-spread in the N. hemisphere but absent from New Guinea and Australia), Heracleum and Pimpinella; though some spp. are endemic their close relatives are found in SE. Asia. (3) A distinctly N. element is the Japono-Formosan Peucedanum japonicum in the islands N. of Luzon. (4) A distinct Australian element is Trachymene which centers in Australia and occurs also in New Caledonia and Fiji; this genus shows a relatively rich secondary centre in East Malaysia; another Australian alliance is found in ubiquitous Eryngium of which the only native Malaysian species hitherto known is allied to Australian spp. (5) A distinct Subantarctic-distributed genus is Oreomyrrhis which centers in New Guinea by 4 spp.; one of these occurs from Kina- balu to Australia, New Zealand to Andine South America as far as Mexico; a marked instance of the ancient alpine-Papuan South Pacific plant refuge (v. St.).

Ecol. As to altitude both the cultivated and native spp. prefer microtherm localities: Pimpinella, Trachymene, Heracleum, Oreomyrrhis, Eryngium, and Hydrocotyle vulgaris are confined to the montane or subalpine zones, Sanicula descending to the colline subzone. Some Umbelliferae are found in the alpine zone above 4000 m alt., e.g. Hydrocotyle sibthorpioides, and Oreomyrrhis andicola. Several oreophytes show a remarkable reduction of the leaf surface, and some are reduced to cushions (Oreomyrrhis andicola) or true pin-cushions (Trachymene pulvilliforma and Oreomyrrhis azorellacea). There are only very few spp. preferring a shaded locality, e.g. Sanicula europaea, Hydrocotyle javanica, Trachymene erodoides, ? Heracleum sumatranum. Pimpinella javana and P. priatjan are often found in Casuarina forests. Oenanthe javanica, Centella, and the Hydrocotyles decidedly prefer moist or marshy places. In the semi-arid regions of Malaysia Umbelliferae are exceedingly scarce; Hydrocotyle javanica is a typical indicator for everwat conditions. Many spp. show a remarkable adaptive capacity to wide altitudinal limits, e.g. Hydrocotyle sibthorpioides 1–4050 m, H. javanica 1–2900 m, Oenanthe javanica 1–2800 m, Centella asiatica 1–2500 m, Sanicula europaea 500–3060 m (v. St.).

Uses. Quite a number of Umbelliferae are cultivated for the essential oil contained in their fruit and are used as condiments. The leaves of some spp. are eaten as vegetables or for medicinal purposes. Under the several species data are mentioned drafted from Heyne, De Nuttige Planten ed. 2 (1927), Ochse & Bakhuizen van den Brink, Indische Groenten (1931) and Burkill, A dictionary of the economic products of the Malay Peninsula (1935).

Notes. The extensive treatment in my former revision (Blumea 2, 1936) is mostly followed; several novelties are added. Of the genera which are represented only by introduced or cultivated spp. generic characters are not given.

When collecting Umbelliferae it is to be observed that ripe fruits and basal leaves are essential for identification.

PS. The MS. of the present revision was made before the author received the rich New Guinean collections of L. J. Brass, M. S. Clemens, C. E. Carr; on the latter he prepared a separate paper to be

Figures 1 & 5 courtesy Pasuruan Exp. Station, fig. 2-4, 6 & 10 courtesy Blumea.

**KEY TO THE GENERA**

1. Flowers in simple umbels¹ or heads often united in more compound inflorescences, but not in compound umbels.
2. Leaves and involucres prickly. Flowers in heads ......................................................... 5. _Eryngium_
3. Leaves and involucres not prickly. Flowers in umbels.
4. Fruits with uncinate bristles .............................................................. 4. _Sanicula_
5. Fruits without uncinate bristles.
6. Fruit at least twice as long as broad; generally not laterally flattened .... 9. _Oreomyrrhis_
7. Fruit not longer than broad, laterally flattened.
8. _Mericarps_ 7-9-ribbed, with connecting veins between the ribs. Leaves simple, crenate, reniform ........................................ 2. _Centella_
10. Leaves without sheaths but with distinct entire stipules, Corolla valvate 1. _Hydrocotyle_
11. Leaves with sheaths, without or without lacerate stipule-like appendages. Corolla imbricate 2. _Trachymene_

1. Flowers in compound umbels which are sometimes united in more compound inflorescences.
2. Mericarps winged on the margin.
3. Fruit not strongly dorsally flattened, more than twice as long as broad. Leaves tripinnate, ultimate segments nearly filiform ........................................ 19. _Anethum_²
4. Fruit strongly dorsally flattened, at most twice as long as broad. Leaves pinnate to bipinnate, extreme segments not filiform.
5. Leaflets or ultimate leaf-segments cuneate-obovate, only dentate or incised at the broadened apex. _Mericarps_ about twice as long as broad ........................................ 22. _Peucedanum_
6. Leaflets or ultimate leaf-segments not cuneate-obovate, margin serrate or crenate. _Mericarps_ at most 1½ times as long as broad.
7. Ovary hairy. Involutue 6-7. Wing of the _mericarps_ 2½ mm broad. Corolla white or reddish, radiating ........................................ 21. _Heracleum_

7. _Mericarps_ not winged at the margin.
8. Fruit laterally flattened. Leaves simple, roundish ........................................ 1. _Hydrocotyle_
10. Fruit with a sterile neck or a short beak visible on the ovary as a dark green ribbed neck 6. _Chaerefolium_
11. Fruit without a sterile neck or beak.
12. Calyx teeth distinct.
13. Ovary and fruit bristly.
14. Fruit with uncinate bristles; stems and leaves hairy; leaf-segments not very narrow: flowers not radiating ........................................ 7. _Torilis_
15. Fruit with stellate hairs; stems and leaves glabrous; extreme leaf-segments linear to filiform; flowers radiating ........................................ 10. _Cuminum_
16. _Mericarps_ hollow at the ventral side; primary ribs visible as undulate lines, secondary ribs somewhat more prominent; flowers radiating ........................................ 8. _Coriandrum_
17. _Mericarps_ not hollow at the ventral side; marginal ribs thicker than the lateral ones, secondary ribs absent; flowers not radiating ........................................ 17. _Oenanthe_

13. Calyx teeth not distinct.
14. Ovary and fruit entirely glabrous.
15. Leaves ternate; umbels and umbellules few-rayed. ........................................ 14. _Cryptotaenia_
16. Leaves pinnate or bipinnate.
17. Flowers yellow or yellowish green.
18. Involucre many-leaved; leaves 3-4-pinnate with filiform segments 18. _Foeniculum_²
19. Involucre 0-2-leaved; lower leaves 3-pinnate with nearly obovate or cuneate leaflets 19. _Petroselinum_

19. Flowers white or reddish.

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(1) Rarely solitary (1-flowered umbels).
(2) _Foeniculum_ and _Anethum_ are very alike with the exception of their fruits, which in _Anethum_ are very distinctly winged, in _Foeniculum_ not. They may further be distinguished, besides by their characteristic odor, by fine-punctulate stems in _Foeniculum_ which are absent in _Anethum._
21. Ripe fruits 1¼–2 mm through, roundish when seen from the lateral side; carpophore entire or very shortly biitid at the apex. 11. Apium
21. Ripe fruits 4–5 mm long and half as broad; carpophore biitid to nearly ⅔ of its length. 15. Carum

17. Ovary and fruits brisly, hairy, or with scale-like trichomes.
22. Involucres pinnatitid. 22. Involucres not pinnatitid.
23. Leaves simple, or pinnate with simple leaflets: leaves and stems hairy. 16. Pimpinellina
23. Leaves pinnate with divided leaflets: leaves and stems glabrous. 13. Trachyspermum

1. HYDROCOTYLE
LINNÉ, Sp.Pl. 1 (1753) 234; BUW. Blumea 2 (1936) 122 (lit.).
Perennial, stems prostrate or rooting at the nodes, sometimes suberect. Leaves petiolate and stipulate, in outline rhomboid, peltate or cordate, palminerved, entire, lobed or divided. Crenate to crenate-serrate. Umbels simple, sometimes irregularly subcompound. Involucral bracts few or 0. Calyx teeth minute or obsolete. Petals entire, valvate in bud. Disk plane, margin elevated. Styles from the base filiform or with thickened base. Fruit laterally flattened, commissure narrow; vittae 0; mericarps with dorsal ribs, marginate, lateral ribs in the commissure, intermediate ones straight or arcuate.

Distr. About 100 spp. all over the world, mainly in the S. hemisphere.

KEY TO THE SPECIES

1. Leaves peltate 1. Leaves not peltate.
2. Leaves usually less than 3 cm in diam. Stems creeping, sometimes with ascending extremities. Inflorescences single, sessile or short-peduncled, along the creeping stems and the ascending tips. Fruits up to 15 in each inflorescence, yellow to dark-brown when ripe. 2. H. sibthorpioides
2. Leaves usually more than 3 cm in diam. Stem creeping with ascending branches. Inflorescences single or in bundles, sessile to long-peduncled, usually along the ascending branches only. Fruits more than 15 in each inflorescence, blackish brown when ripe. 1. H. javanica


Stems rarely entirely erect, 10–50 cm, terete, glabrous or short-hairy. Stipules 3–8 by 4–6 mm broad-ovate, roundish to acute, membranaceous, entire or the apex fringed. Petioles 2–20 cm, short-hairy; lamina usually 3–8 cm through, rarely only 1⅔ cm. roundish to 5–8-angular in outline, cor. date, 5–8-lobate. Lobes crenate to crenate-serrate, more or less triangular, glabrous, rarely sparsely hairy. Inflorescences single or in groups, opposite to the leaves, sometimes united to an umbel with an involucre of few small bracts, sometimes also terminal. Peduncles 1–7 cm, rarely absent, glabrous or short-hairy. Involucres many around and between the flowers. 1 by 3½ mm, ovate-acute, entire or base with small teeth, outer ones reflexed in fruit. Pedicels 15–50, 0–½ mm, rarely longer. Peals 1 by ½ mm, lanceolate, acute. Mericarps 1–1½ by nearly 3½ mm, glabrous or short hisutre or even with short curved hairs, sometimes red-punctate when young, red-brown to blackish when ripe.

Distr. SE. and E. Asia to the Solomon Islands, Australia, Tasmania, and in tropical Africa, in Malaysia: all over the Archipelago, not yet found in the Lesser Sunda Islands, Madura and Kangean Islands.

Ecol. In shaded and forested places, 1–2900 m, but in the periodically dry parts of Central and E. Java not below 1000 m rarely descending to 700 m near hot springs or along stream banks. decidely avoiding the semi-arid regions.

Uses. Leaves as a fish-poison.

Vern. Pégagah gajah (Mal. Pen.); pegagoh, pe-gagan. manj-mangi (Sum.): dulang sotok, dawm sotok, S; variable in Javanese.

Notes. Small forms from high altitudes are difficult to separate from H. sibthorpioides LAMK. These specimens have at least 15 fruits in the umbellule, and for that reason I refer them to H. javanica. In New Guinea some specimens have very long-pedicelled flowers: there is a series of transitions to subsebsise and sessile flowers.

Stems long-creeping or with ascending extremities, sometimes almost caespitose, terete, thin or almost filiformous, glabrous or sparsely hairy. Stipules 1/2-1 by nearly 11/2 mm, ovate to obovate, acute, entire or fringed. Petioles 1/2-6 cm, or even shorter in the uppermost leaves, more or less hairy; lamina 11/2-21/2 cm through, roundish to 5-angular in outline, deeply cordate, 3-5-lobate to 3-5-partite; segments crenate to serrate, more or less pilose to hirsute. Inflorescences single along the creeping stems; peduncles 0-3 cm, filiformous, glabrous or short hairy; involucres 4-10 around and between the flowers, nearly 1 by 1/2 mm, ovate, lanceolate, acute, base with 2 acute teeth, sometimes filiformous, lower ones reflexed in fruit. Pedicels 10-15; petals greenish white, nearly 3/4 by 11/2 mm, ovate, acute. Mericarps 1-11/4 by 3/4 mm, yellow to brown, glabrous or with short stiff hairs, sometimes red-punctulate.

Distr. Australia, tropical Asia, tropical Africa, S. America (?), in Malaysia: all over the Archipelago.

Ecol. Sunny or slightly shaded, damp, fertile localities, along streambanks, between stones of pathways and alongside walls, from 1-4050 m.

Uses. Raw or steamed eaten with rice; medicinal against skin diseases.

Vern. Kurawet galeng, antanan in several combinations, S. sumud, samangi in several combinations, J. but Javanese names are rather variable; salatun, patekan tjena, Md.

Notes. Very variable as to leaf shape, depth of incisions, and hairiness; the numerous forms are connected by series of transitions.

3. Hydrocotyle vulgaris LINNÉ, Sp. Pl. 1 (1753) 234; Buw. Blumea 2 (1936) 133 (lit.)

Stems thin, creeping. Petioles 1-17 cm, with spreading hairs to the apex; lamina 3/4-31/2 cm through, orbicular, peltate, 8-13-nerved, coarsely crenate to slightly lobed. Inflorescences solitary or few together on the nodes; peduncles 1/2-14 cm, filiformous; with 1-10 whorls of flowers, each flower with an ovate membranous, acute bract. Petals nearly 3/4 mm, ovate, white or reddish. Fruits smooth, 11/2-2 by 3/4-21/2 mm, transversely elliptical.


Ecol. In open marshes, ± 2000 m.

Notes. Description after European and New Guinean materials. In Malaysian specimens the fruits are smooth, not covered with reddish warts as in the European form.

2. CENTELLA


Perennial, sometimes suffruticose, erect, prostrate, or rooting at the nodes. Leaves entire, crenate or lobate, palmatifid; petioles with sheaths. Umbels simple, sessile or sub sessile. Involucres few or 0. Calyx teeth obsolete. Petals entire, imbricate in bud; disk plane, margin elevate; styles from the base filiformous. Fruits laterally flattened, vittae 0; commissure narrow; mericarps with dorsal ribs marginate, lateral and intermediate ribs arcuate, all connected by veins, sometimes with 2-4 secondary ribs.
Umbelliferae (Buwalda)  

13. Umbelliferae


Stems creeping with long stolons, more or less puberulous in the young state. Leaves in rosettes; petioles 1–40 cm, sometimes puberulous; lamina 1–7 cm diam., rounded reniform, crenate or crenate-dentate. Umbels solitary or 2–5 together in the axils of nearly 3 mm long bracts; peduncles 1–5 cm, shorter than the petioles. Flowers usually 3, middle one sessile, lateral ones pedicellate; involucres 2–3 by nearly 1 1/2 mm, ovate. Petals red, 1–1 1/2 by 3/4 mm. Mericarps about 2 by 1/2 mm, subhairy when young.

Distr. Pan tropic, in Malaysia: all over the Archipelago.

Ecol. Sunny or slightly shaded, fertile, damp localities, along streambanks, also between stones of pathways and alongside walls, 1–2500 m.

Uses. Leaves raw or steamed eaten with rice. Medicinal uses many, especially against skin diseases and as a diuretic. Capacity for holding earth against erosion.


3. TRACHYME


Annual or perennial, hirsute to glabrous, sometimes glandular-hairy. Stems erect, procumbent or ascendent, branched, often in a sympodial way. Leaves alternate along the stems, sometimes also in rosettes, roundish cordate to broadly cuneate, ternately divided, or entire, narrow-cuneate to subspathulate; petioles with sheaths. Umbels simple, terminal or opposite the leaves, sometimes in a corymbiform di-monochasium. Involucres linear. Calyx teeth minute, rarely subulate. Petals entire, imbricate in bud. Disk plane. Styles from the base filiform. Fruits laterally flattened, vittae 0; commissure narrow; mericarps with dorsals ribs, marginate, lateral ribs in the commissure, intermediate ribs arcuate, subprominent. Carophore persistent, undivided.

Distr. This genus is chiefly Australian; outside Australia it is spread to New Caledonia and the Fiji Islands, in Malaysia it occurs in New Guinea, Timor, Flores, Celebes, Borneo, and the Philippines.

KEY TO THE SPECIES

1. Plant glandular-hairy.
2. Ovary hairy; ripe fruits roughly tuberculate with glandular hairs; annual, erect, cultivated

16. T. caerulea

11. T. adenodes

I. Plant not glandular-hairy.

2. Ovary glabrous; ripe fruits smooth; wild mountain species

1. Plant glandular-hairy.

3. Leaves nearly triangular and somewhat hastate in outline, tripartite or ternate with the middle segment longer than the lateral ones

6. T. erodioides

3. Leaves never triangular hastate, more roundish or more cuneate in outline, if tripartite or ternate, then the middle segment hardly longer than the lateral ones

4. Leaves about as long as broad, base cuneate.

5. Petiole at least twice as long as the lamina. Prolonged leafy stems absent. Stem not papillose.

2. T. novoguineensis

5. Petiole at most as long as the blade. Leafy branched stems present. Stems, petioles, and peduncle densely papillose

13. T. flabelliformia

4. Leaves broader than long or longer than broad.

6. Leaves longer than broad, all of them cuneate to spathulate.


15. T. pulvilliforma


Dec. 1949]

Perennial, reddish, more or less hirsute to glabrous; caudex with rosettes from which sympodial leafy stems with terminal inflorescences and axillary rosettes, flower-bearing or not. Stems terete, striate. Sheaths 5–10 by 2–3 mm, tapering into the petiole, ciliate; petioles 3–13 cm; lamina 3½–4 by 1–6 cm, roundly reniform to broadly cuneate, trifid to tripartite, even ternate, segments broadly rhomboid or narrower, sometimes divided again, apical part: ultimate segments serrate to lobate. Umbels terminal in the rosettes or on elongated stems opposite the leaves; peduncles 3–29 cm; involucres 7–25, 5–15 by 1–3 mm, lanceolate, acuminate, sometimes dentate, spreading, appressed in fruit; pedicels 5–more than 30, 5–15 mm, inner ones gradually shorter, spreading, incurved in fruit. Calyx teeth ½–2 by 1½–1½ mm, triangular, acute, equally developed or one larger. Petals 2½ by 1½–1½ mm, white to dark pink, ovate to lanceolate; styles ½–1½ mm. Mericarps 1½–3 by 1½ mm, glabrous, reddish purple to purple.

Distr. Australia (N.S. Wales), in Malaysia: Philippines (Mindoro), Br. N. Borneo and E. New Guinea.

Ecol. Open shallow damp places, at the base of rock walls at falls, rock crevices, grasslands, on burnt over ground and in forest glades, 1800–4020 m.

Uses. In Borneo used as Dusan medicine.

Notes. Rather variably as to the length of the stems, hairiness, shape and incision of the lamina.

2. Trachymene novoguineensis (Dom.) Bwv. Blumea 2 (1936) 144. fig. 2a.—Didiscus saniculaciformis var. novoguineensis Dom., Sitz. Ber. Böhm. Ges. Wiss. (1908) 67.—Fig. 2a.

Perennial, often reddish, more or less hirsute to glabrous; caudex with rosettes, bearing again axillary rosettes; dwarf forms only 2–3 cm. Leaf sheaths 2½ by 3 mm, ciliate, tapering in the petiole; petioles 1–13 cm; lamina (3)–7–30 by (2½)–5–17 mm, cuneate, triflabiate or trifid, apical part: segments with 2–3 subacuminate teeth. Peduncles (1½)–3½–3½–37 mm, terete, striate or subplane; involucres 7–13, 8–12 by 1½–1½ mm, lanceolate, acute, glabrous or margin ciliate, spreading, appressed in fruit; pedicels 12–30, to 5 mm, inner ones gradually shorter, spreading, to 14 mm and incurved in fruit, glabrous. Calyx teeth ½–1½ mm,
Fig. 2.  a. *Trachymene novoguineensis* (DOMIN) BUW.,  b. *Trachymene arfakensis* (GIBBS) BUW., × 2/3.
narrow or broad-triangular, somewhat enlarged in fruit. Petals c. 1 1/2 by 3/4 mm, creamy white, white or violet, elliptical. Styles to 3/4 mm. Mericarps to 3 by 1 1/2 mm, glabrous, brown-yellow or tinged with red to dark violet.


Ecol. Open, stony localities, brook banks, marshy grasslands, 2700–3720 m.

3. Trachymene kobrensis (Gibbs) Buw. Blumea 2 (1936) 146, fig. 1a.—Didiscus kobrensis Gibbs, Contr. Arfak Mts (1917) 165.—Fig. 3a.

Perennial, entirely glabrous. Stems to 40 cm, erect or prostrate, sometimes finely papillose, with leaves over the whole length and rosettes in the leaf axils, densely set with swollen petiole-bases in the basal part and below the rosettes, with branches from the axillary rosettes, again with rosettes in the leaf axils. Sheaths nearly 2 by 3 mm, tapering into the petiole; petiole 1–2 cm, canaliculate above; lamina 1–2 by 1 1/2–1 cm, cuneate, tapering into the petiole, apex with 3–5 triangular, acute teeth. Peduncle 6/2–8/1 cm, terete, striate; involucres 5–13, nearly 6 by 1 1/2 mm, lanceolate, acute; pedicels 15–30, to 5 mm, the inner ones shorter, spreading, somewhat incurved in fruit. Calyx teeth 3/4–1 1/2 mm, narrowly triangular or subulate, sometimes unequally developed. Petals nearly 1 1/2 by 3/4 mm, obovate, white or white with purple tinge; styles nearly 1 1/4 mm. Mericarps to 2/1 by 1 1/2 mm, tuberculate or smooth.


Ecol. Open burnt localities and sterile limestone slopes, 2400–3225 m.


Perennial, entirely glabrous; branched caudex with rosettes from which sympodial leafy stems with terminal inflorescences and axillary few-leaved rosettes from which stems branched in the same mode. Stems procumbent, angulate, sulcate, at the nodes inerseate. Sheaths 1–3 mm long and broad with subulate thick coriaceous to 3 mm long appendages; petioles 2 by 0.1 mm, difficult to distinguish from the lamina; leaves with petiole 2–9 cm; lamina 4–7 mm broad, thick and stiff-coriaceous, narrow-cuneate-spatulate, apex with 1–5, mostly 3, obtuse, triangular teeth 3 by 1–2 mm; margin entire, subcurved. Peduncles 5/2–11 cm, 1 1/2–1 1/2 mm thick, angulate, sulcate; involucres 10–12, 5–10 by 1/2–1 1/2 mm, lanceolate, acute or subobtuse; pedicels 20 or more, 2–4 mm, somewhat spreading, erect in fruit. Calyx teeth 1 1/4–3/4 mm, obtuse, persistent. Petals 1 1/2–2 by 1 mm, oblong-ovate, inside white; styles 1 1/2–2 mm. Mericarps to 3 by 2/1 mm, dark violet or brownish.


Ecol. Open localities, 3000 m.

5. Trachymene acrotricha Buw. Blumea 2 (1936) 148, fig. 1e–f.—Fig. 3e–f.

Perennial; caudex at the top densely set with in-crassate leaf rudiments. Stems to 13 cm, prostrate, sulcate, densely-hirsute towards the tip, hairs divericate, to 1/2 mm. Leaves sparse, rosettes absent; sheaths 4 by 2 mm, tapering into the petiole, margin long-ciliate, hairs to 3 mm; petiole to 7 cm, canaliculate, densely long-hirsute, hairs to 2 mm; lamina to 7 by 10–15 mm, of the lower leaves reniform, of the upper leaves rhomboid in outline, tripartite or trifid with cuneate segments, apical portion broad-dentate, teeth ending in an apical hair, subcoriaceous, involute when dried up, palminerved, glabrous above, beneath sparsely hirsute on the nerves. Umbels opposite the leaves in the upper portion of the stem; peduncles 1/2–2 cm, densely hirsute; involucres 8–10, 4 mm, lanceolate, acute, canaliculate, glabrous with hairy teeth and tip; pedicels 10–20, to 4 mm, the inner ones shorter, glabrous, somewhat dilatate at the tip. Calyx teeth 1 1/2 by 1 mm, elliptical, triangular, acute. Petals c. 1 1/2 by 1 mm, apiculate. Styles to 3/4 mm. Mericarps 2/1–3 by 1 1/2–2 mm, glabrous, ribs indistinct.


Ecol. Stony localities, mountain heaths, 3100 m.


Small; stems creeping, terete, subincrassate at the nodes, hirsute or subhirsute, with hairs to 2 mm. Leaves single and in few-leaved axillary rosettes; sheaths ca 2 by 1 mm, tapering into the petiole, outside densely hirsute, hairs 1–5 mm; petioles 1 1/2–4 cm, canaliculate, pilose with divaricate crisp hairs; lamina 1/2–2 1/2 by 1–2 cm, in outline ovate-triangular, somewhat hastate, tripartite or ternate, terminal segment 1–2 by 1/2–1 1/2 cm, triangular-rhomboid, lateral segments 5–12 by 5–7 mm, ovate, all segments pinnaflated at the base, crenate towards the apex with short acuminate tips. Umbels terminal or from the axillary rosettes; peduncles 2/1–3/2 mm, ascendent, slender, terete, striate, densely hairy, hairs 1–2 mm, crisp; involucres 5–6, 3–5 mm, lanceolate, glabrous or subciliate; pedicels 12–15, to 7 mm, inner ones shorter, glabrous. Calyx teeth to 1/4 mm or absent (on the fruits). Styles ± 1/2 mm. Mericarps 2/1–3 by nearly 2 mm, glabrous, equal or subequal.


Ecol. Stony localities in mossy forest, 2700 m.


Perennial; caudex with rosettes from which flower-bearing stems and lateral rosettes, sessile or on short stolons from the upper leaf axils. Stems 20–50 cm, erect or ascending, nearly terete, more or less ribbed, densely hirsute to subhirsute, little branched and few-leaved beneath, terminated by a corymbiform inflorescence of umbels. Sheaths of the rosette leaves 2 by 3/4–1 1/2 cm, outside glabrous, towards the apex hirsute and ciliate, hairs 2–4 mm; petioles 5–15 cm, hirsute; lamina

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Fig. 3. a. Trachymene koebrensis (Gibbs) Buw., b–d. Trachymene rigida Buw., e–f. Trachymene acrotricha Buw., g–h. Trachymene erodioides Buw. (plants × 2/3, fruits × 4).
5–13 by 7–14 cm, in outline roundish, deeply cordate, 3–7-palmatifid, segments obovate, 3-lobed, biserrate, densely hirsute; cauleine leaves and inflorescence bracts gradually smaller and shorter petioled, uppermost ones subsessile with less numerous and narrower segments and smaller sheaths. Peduncles 21/2–6 cm, upper ones shorter; involucres numerous, nearly 10 mm, narrowly lanceolate, long-acuminate, appressed; pedicels more than 50, up to 17 mm, inner ones shorter, spreading, incurved in fruit. Calyx teeth small, acute, persistent. Petals white, nearly 2½ by 1½ mm, elliptic, acute. Styles nearly 3 mm, persistent. Mericarps nearly 4 by 3 mm, red.


Ecol. Open, stony localities, 2300–3000 m.

Uses. Roots (raw) as medicine against stomach-ache.

Vern. Kriongo, djahé merah.


Perennial; caulex with rosettes from which flower-bearing stems and lateral rosettes, sessile or on short stolons from the upper leaf axis. Stems erect, 30–40 cm, terete, striate, sparingly hirsute, more densely at the nodes. Leaves nearly all in a rosette; sheaths 3–6 by 5–8 mm, at the back and the margin with 1–2 mm long hairs, abruptly contrac-
tected into the petiole; petiole 6–8 cm, hirsute, more densely towards the lamina; lamina 4–4½ by 6–7 cm, roundish in outline, deeply cordate, ter-
nate, the central leaflet nearly 4 by 3½ mm. tripar-
tite, lateral leaflets hardly smaller, obliquely trifid, all ultimate segments 2–3-lobed, coarsely serrate, rather sparingly appressedly hirsute; cauleine leaves smaller, shorter petioled, bracts of the dichasyum nearly sessile. Peduncles 3–4 cm, terete, striate, shortly hirsute; involucres numerous, 7–10 by 1½ mm, narrowly lanceolate, acuminate with few hairs at the margin and on the midrib, spreading, appressed in fruit; pedicels 7–11 mm, spreading, suberect in fruit. Calyx teeth nearly 2½ mm, subulate. Petals 2–2½ by 1 mm, ovate, white. Styles nearly 2 mm. Mericarps nearly 4½ by 3½ mm, entirely glabrous.


Ecol. Probably open, stony localities, 1100 m.


Stems 20–45 cm, erect and terete in the lower portion, terete or subangular in the upper part, with spreading branches, the whole densely velvety hairy with yellowish brown indumentum, glabrescent; glabrous in the young state. Leaves rather densely set in the basal part, more remote upwards, hirsute to glabrous; petioles of the lower leaves to 13½ cm, gradually shorter upwards, in the upper leaves nearly absent, all of them slightly sheathing at the base, hairy like the stems; lamina palmatifid to ternate, segments rhomboid to obo-
vate, the middle one 3-lobate to trifid, besides, all biserrate with acuminate teeth; lamina of the upper leaves smaller and more cuneate. Umbels opposite the leaves; peduncles 1–5 cm, to 7 cm in fruit, terete, grooved, hairy like the stems; involucres 7–10, to 3 mm broad, shorter as or as long as the pedicels, lanceolate, hairy like the leaves; pedicels 25–40, to 7 mm, to 15 mm in fruit, inner ones shorter. Calyx teeth to 1½ mm, acute or obtuse. Petals to 2 by 1 mm, cream to pink, elliptical, acute. Styles nearly 1½ mm to 1½ mm in fruit. Mericarps to 6 by 4 mm, equal.

Distr. Malaysia: Lesser Sunda Islands (Timor, Flores), SE. Celebes.

Ecol. In mountain forests, damp places, 1800–2600 m.

Notes. The specimens from Celebes differ from those from the Lesser Sunda Islands by stronger developed leaf sheaths, by broader involucres which enclose the flower when young, and by pink to purple flowers.

10. Trachymene arfakensis Buw. Blumea 2 (1936), 154, fig. 2b.—Didiscus arfakensis Gibbs, Contr. Arfak Mts (1917) 166.—Fig. 2b.

Stems to 60 cm, erect or suberect, glabrous, slender, base thickened with scars and remnants of leaf sheaths, unbranched in the lower portion, terete, striate to subulate, several times dichoto-
mously branched in the upper part, branches spreading and sympodial. Sheath 2–7 by 1½–
4 mm, tapering into the petiole, ciliate with hairs to 2 mm; petioles 2–7 cm in the lower leaves, gradu-
ally shorter upwards, canaliculate, glabrous or towards the lamina with few to 2 mm long hairs; lamina 2½–7 by 4–8 cm, roundish-cordate, ternate, leaflets with petiololes to 1½ cm, 2–3-fid to 2–3-
partite, segments 3-lobed and coarsely serrate, teeth acuminate and apiculate, upper surface sub-
glabrous, beneath sparingly hirsute, especially on the nerves, base long-ciliate. Umbels opposite to each other leaf: peduncles 1½–7 cm, terete to sul-
cate, involucres 5–10, 5–10 mm, linear to filiform, broadest ones with few filiform teeth; pedicels
20–30, 5–8 mm, 10–15 mm in fruit, spreading, inner ones shorter. Calyx teeth hardly any. Petals 1–1½ by 3½–1 mm, white, ovate, acute. Styles 1–1½ mm, Mericarps to 5 by 3 mm.

Distr. Malaysia: Celebes, W. New Guinea (Mt Arfak).

Ecol. Marshy, muddy localities, often in groups, 1500–2400 m.

11. Trachymene adenodes Buw. Blumea 2 (1936) 155, fig. 4a–b.—Fig. 4a–b.

Stems to 50 cm and more, terete, striate, lower portion ascendent with rosettes at the base, glabrous, unbranched, upper portion dichoto-
mously later sympodially branched, densely hirsute, hairs to 2 mm. Leaves rather densely in the lower portion, upwards more remote; sheaths 5–8 by 3–5 mm, semi-amplexicaluous, tapering into the petiole, glabrous, margin long-ciliate with partly glandular hairs to 3 mm; petioles 7–20 cm, up-
wards gradually shorter, uppermost ones nearly
Fig. 4. a–b. *Trachymene adenodes* Buw., c. *Trachymene papillosa* Buw. (plants × 2/3, b. glandular hair of the petiole × 16, d. × 4.)
absent, towards the lamina densely hirsute with glandular hairs to 3 mm; lamina of the rosette leaves and lower leaves 4½/2 by 7½/2 cm, roundish-cordate to subreniform, 3–5-partite to ternate, segments rhomboid-ovate, middle ones trilobed with 2–3-lobate parts, all segments moreover serrate with broad, subacuminate to subapiculate teeth, sparsely pilose with partly glandular appressed hairs, to 2 cm especially towards the margin and in the incisions. Umbels opposite the leaves and in the bifurcations; peduncles to 10 cm, shorter towards the end of the stems, towards the top with glandular hairs; involucres 6–8, 7–10 by 1–1½/2 mm, lanceolate, acute, glabrous or long-ciliate; pedicels ± 30, 7–9 mm, inner ones shorter, glabrous. Calyx teeth nearly 1/4 mm, broad-triangular. Petals 1½/2–2 by 1½–2½/2 mm, obovate. Styles ± 1½/2 mm. Mericarps (unripe) 2 by 3½/4 mm, glabrous. 


Notes. When more material will come to hand this species might possibly appear to be referable to *T. arfakensis* which it resembles in leaf shape but from which it differs by its longer petioles, longer peduncles and the glandular indumentum of the petioles, stems and peduncles. As yet I have seen no transitional forms.


Stems 20–40 cm, probably ascendent, terete, densely papillose and densely hirsute with 1 mm long, stiff hairs, branched in the upper part. Leaves sparse; sheaths 2–3 by 2 mm, semiamplexicaul, tapering into the petiole, papillose like the stem, above long-ciliate, hairs 1–2 mm; petioles 1½–2½/2 cm, hirsute and papillose like the stems; lamina 1–2 by 3–4 cm, orbicular-reniform in outline, ternate; leaflets 1–2 by 1½–2½/2 cm, attenuate towards the base, 2–3-fid or 2–3-partite, terminal segments often biserate, at the base papillose to glabrous, on both sides sparsely hirsute to glabrous. Umbels terminal, often opposite the leaves; peduncles 3–8½/2 cm, terete, striate, hirsute and papillose like the stem or glabrous; involucres 6–12, 4–5 by 1½–1 mm, linear-lanceolate, acute, glabrous or long-ciliate; pedicels 30–50, to 5 mm, inner ones shorter, glabrous, spreading, erect to reflexed in fruit. Calyx teeth 1½–2½ mm long and broad, triangular, equal. Petals circa 1½/2 mm, reddish white, ovate, acute. Style 1½–2½ mm. Mericarps to 2 mm long and broad, equal, black, with tuberculiform scales, especially between the intermediate ribs and the commissure, to entirely smooth.

Distr. Malaysia: SW. New Guinea (Central Range). Ecol. Grassy, deforested slopes, on sandy soil, also forest edges, 1600–3500 m.

13. *Trachymene flabellifolia* n. sp.

Species nova ad Tr. papillosam Buw. accedens tamen foliis cuneatis flabelliformibus distinguenda. Perennial herb. Rhizome 7–12 mm thick; stems up to 30 cm long, branching from the base, ascendent, furrowed or subangulate, near the base black-corky, roughish, upper part densely papillose and hirsute (hairs up to 1 mm long, appressed, and stiffish). Leaves single or few together in axillary clusters, 5–15 mm apart; sheath 2–3 mm long, 1½–2½ mm wide, narrowing to the petiole and on the margin ciliate (hairs up to 2 mm long); petiole 6–11 mm long, sparsely hirsute (hairs up to 1 mm long); blade 1½–2½ cm long, 1–3 cm wide, fan-shaped, incised or split into 2–3-parted wedge-shaped segments, at the tip sharply toothed; main nerves on both surfaces distinctly flabellate. Umbels placed in the upper part of the stem opposite the leaves; peduncle terete, striate, subpapillose, 5–7½/2 cm long, sparsely hirsute (hairs up to 1½/2 mm long, spreading); bracts forming an involucre, 11 or less, up to 1 mm wide and c. 3½/4 mm wide, acute, lanceolate, at the base ciliate; pedicels 30–50, terete, slender, glabrous, the outer up to 5 mm long, the inner shorter, slightly longer when in fruit. Calyx with c. ½ cm long, sharp teeth. Petals 1½–2½ mm long, c. 1 mm wide, ovate, subconic. Stamens 5, anthers dorsifixed, rounded-elliptic. Styles 2, subfiliform, 1½–1½/2 cm long, curved inwards. Fruit much flattened, kidney-shaped. Mericarps up to 3½ mm long and up to 2½ wide, median rim c. 1 mm distant from the commissure, slightly crowned by the styles, densely covered by knobby hair-like outgrowths; carpophore entire, 1½–2–1½/4 cm long, hardly two-tipped.

Distr. Malaysia: West New Guinea (Central Range, near Lake Habbema, 3225 m camp, Brass 9586, type).

Ecol. Common in mossy glades, 3225 m alt.

Notes. Allied to *T. papillosa* but different by its cuneate to flabelliform leaves.


Perennial (or annual). Main root fusiform, branched. Main stem erect, to 13 cm, at the base to 2½ mm thick, almost covered with the thickened bases of leaf sheaths, producing procumbent or ascendent branches, with scale-like leaves, to 14 cm; upper portion with branches that are like the upper portion of the main stem, whole plant a semi-globe whole. Leaves scattered, more densely set towards the extremities, somewhat forming terminal rosettes; sheaths 2–12 by 3 mm, with membranous margin, tapering into the lamina; lamina 8–18 by 3–9 mm, spatulate, apical portion with 3 acute or obtuse teeth. Umbels opposite the leaves; peduncles 5–12 mm, terete, striate; involucres 8–12, 6–9 by 1½/2 mm, lanceolate; pedicels 10–20, 4–7 mm, inner ones shorter, hardly elongated in fruit. Calyx teeth to ½ mm, triangular, acute. Petals nearly, 1½/2 by 1 mm, pink or pale pink, roundish-elliptical; styles nearly 1½/4 mm. Mericarps to 3½ by 3 mm, entirely glabrous.

15. Trachymene pulvilliforma n. sp.

Ab omnibus speciebus generis Trachymene differt modo crescendi, pulvillos densos formante, foliol detussissimis imbricatis apicem caulis versus et magis minusve in rosulais conferit. Pars inferior foliis semi-amplexicaulis et vaginas, lamina coelebris 2-2'/2 mm longa, 1/2-3/4 mm lata, apice mucronata, unirnervata. Umbellae simplices, brevissime pedunculatae bracteis 2-4 involucratae, pedicellis 1-2. Ex affinitatis T. rosulans (DANSER) BOW.

A herb, probably perennial, entirely glabrous; root fusiform, branching, fibrous; stem prostrate and much branching from the base, branches close, the slightly ascending upper ones forming a half-spherical cushion which is up to 1 cm deep and 5-15 cm in diam. Leaves very densely imbricate, near the top more or less in clusters together, the basal part half amplexicaul and sheathing, sheath appressed, 11/2-3 mm long, 1'/2 mm broad, narrowing towards the blade; blade spoon-shaped, 2-2'/2 mm long, 1/2-3/4 mm wide, one-nerved, tip mucronate. Umbels terminal or opposite the leaf clusters, when flowering hidden among the leaves, when in fruit slightly exserted; peduncle somewhat flattened c. 2 mm long; bracts 2-4, forming an involucre, 1'/2-2 mm long, up to 1/2 mm wide, lanceolate or spatulate-lanceolate. Pedicels 1-2, slightly flattened, c. 1 mm long, in fruit up to 2'/2 mm long. Calyx indistinctly toothed. Petals 5, c. 1 mm long, c. 3/4 mm wide, white. Stamens 5, anthers dorsifixed, rounded-elliptical, pink. Styles 2, subbilobiform, c. 1'/2 mm long. Fruit glabrous, strongly flattened, kidney-shaped. Mericarps up to 2 mm long and up to 1'/2 mm wide, rim indistinct, the median 3/4 mm distant from the commissures, slightly crowned by the styles, carpophore entire, c. 1 mm long, hardly two-tipped.

Distr. Malaysia: West New Guinea, (3 miles E of the summit of Mt Wilhelmina, BRASS 9426, type).

Ecol. Forming bright green cushions, c. 5-15 cm in diam. on old camp site, 3650 m alt.

Notes. Different from all other spp. by its dense mode of growth, its peculiar leaf-shape, and its umbels being 1-2-pedicelled. In mode of growth it comes nearest to T. rosulans.


Annual, pilose and glandular in nearly all parts. Main root fusiform with fibrous branches. Stems single, erect, upper portion with usually simple branches not overtopping the main stem. Lower leaves petioled, petioles 1'/2-4 cm, hardly sheathing; lamina roundish in outline, ternate, leaflets bipinnatifid to bipinnatifipartite, segments narrow with subacute to subobtus apiculate tips; upper leaves sessile or subsessile, less divided, uppermost ones with only 3 narrow segments. Umbels terminal on the main stem and the branches, —flowered: involucres —, linear, nearly filiform towards the tip, nearly as long as the flowers; pedicels 10-25 mm, inner ones gradually shorter, spreading, more erect in fruit. Outermost flowers larger than the other ones, not fruit-bearing, probably male. Calyx teeth very short, subulate. Petals 2'/4-3 by 2'/4 mm, ovate to ovobate, shortly unguiculate at the base, outside with short glandular hairs. Styles nearly 1 mm; ovary glandular hairy. Mericarps 3'/4 by up to 2'/4 mm, roughly tuberculate with glandular hairs.

Distr. Australia, in Malaysia: cultivated as a garden plant.

4. SANICULA

LINNÉ, Sp.Pl. 1 (1753) 235; Bw. Blumea 2 (1936) 159 (lit.).

Erect herbs; leaves palmately 3-5-partite, segments dentate, lobed or pinnately dissected. Flowers in irregular compound umbels with few rays; involucres leaf-like; umbellules usually small, with small involucels. Calyx teeth subherbaceous or membranaceous. Petals white, emarginate with inflexed tip, slightly imbricate. Disk flat with raised margin encircling the styles. Styles from the base filiform or subincrassate. Fruits echinate, ovoid, suberete or laterally subflattened; commissure broad; mericarps with obscure ribs, lateral ones in the commissure, inner surface flat; vitiae slender, solitary in each ridge, some very slender scattered in the endosperm.

Distr. About 40 spp. (depending on specific delimitation) distributed throughout the world and in Hawaii and Patagonia, but not in Australia and New Zealand.


Perennial with more or less creeping rhizomes. Stems 15-75 cm, slender, deeply grooved, glabrous
or rarely like the whole plant hairy. Petiole of the lower leaves 3–20 cm, lamina tripartite to ternate, segments incised and serratulate, teeth mucronulate. Umbels in a dichasium, ending in monochasia, sessile or on peduncles up to 1 1/2 cm, with 5–8 involucres, 4–6 flowered, with 2–3 outer male flowers on pedicels 1/2–1 mm, and 2–4 female flowers, sessile or on pedicels up to 1/2 mm. Calyx teeth 1 1/2–1 by 1/4 mm, oblong, acute. Petals nearly 1 1/4–by 1/2 mm, with inflexed tip. Mericarps nearly 2 by 1 mm, densely covered with about 11/2 mm long uncinate bristles.

5. ERYNGIUM

LINNÉ, Sp.Pl. 1 (1753) 232; BUW. Blumea 2 (1936) 164 (lit.).

Erect herbs, often spinescent. Leaves spiny dentate, entire, lobed or dissected. Flowers in heads or compact spikes, all bracteolate. Calyx teeth rigid, acute or prickly. Petals erect, white, with inflexed tip, scarcely imbricate. Disk flat, raised margin encircling the styles. Styles from the base filiform. Fruit ellipsoid, nearly cylindrical, commissure broad; mericarps with subprominent ribs, inner surface subconcave; vittae inconspicuous or 0; carpophore deciduous.

Distr. Over 200 spp. described, distributed throughout the world with exception of trop. & S. Africa, centering in the New World specially Mexico, in the tropics usually on the mountains, E. rostratum circum-S. Pacific.

**KEY TO THE SPECIES**

1. Radical leaves simple, with a dentate margin
2. Radical leaves distinctly 2-pinnately lobed

—BUW. Blumea 2 (1936) 164.—Fig. 5.

Roots fusiform. Stems 15–60 cm, many times dichasially branched with spreading branches, subglabrous, grooved. Leaves nearly all in a rosette, 3–32 by 1–4 cm, glabrous, lanceolate-spatulate, obtuse, sessile, base more or less narrowly sheath, margin dentate, teeth with a spiny hair. Bracts of the inflorescences 1–6 cm, palmate, lobate to -partite, with spiny tips and teeth, strongly narrowing, lowermost often like normal leaves. Peduncles 1–10 mm; heads 5–10 mm, cylindric, involucres 5–7, spreading, nearly lanceolate with few spiny teeth. Flowers sessile in the axils of narrow membranous-margined bracts 1 1/4–1 1/2 mm long. Calyx teeth nearly 1/4 mm, lanceolate, acute with narrow membranous margin. Petals 1/2–1/4 by ± 1/4 mm, greenish white. Mericarps 1–1/2 by 1/2–3/4 mm, densely warty, glabrous, ribs indistinct.

Distr. Indigenous in tropical America, introduced in some parts of tropical Africa and Asia; in Malaysia: Malay Peninsula, Sumatra, Java.

Ecol. In not too dry regions, in shaded or sun- ny, fertile localities, arable lands and grasslands, sawah-dikes, forest edges and along streambanks.

Uses. Raw or steamed eaten with rice.

Vern. Kangkong kerbau, jeraju gunung (Mal. Pen.); umbu palembang, ketumbor djawa (Sum.); (rumput) walang, katuntjar walanda, katuntjar blandiwalang in several combinations, S. tambaran unga, ketumbor landa, ketul kebo, djiten, djitenan, J; stinkdistel (Dutch).

Notes. In the Malay Peninsula for the first time collected in 1888; in Java observed as early as 1896 [EDELING, Nat. Tijd. Ned. Ind. 31 (1870) 294], in Sumatra in 1915.

Fig. 5. *Eryngium foetidum* L., × 1/3.
The plants smell of bugs caused by an aromatic oil containing the aldehyde dodecen-2-al-1 (Koot-haas, Rec. trav. chim. Pays-Bas 51 (1932) 460).

2. Eryngium moluceanum n. sp. prov.


6. CHAEREFOLIUM


Herb, somewhat hisrate. Stems 25–50 cm, striate and grooved. Lower leaves with petioles to 7 cm with sheathing base, upper leaves subsessile to sessile on the sheaths; lamina 4–11 by 3–15 cm, triangular in outline, bi- to tripinnate, primary leaflets ovate, obtuse, 1/2–2 cm pinnatipartite, with obtuse tips. Compound umbels sessile in a di-monochasm; rays 3–5, 5–25 mm; pedicels 4–9, 2–4 mm, to 5 mm in fruit; involucres absent; involucels 3–4, nearly 2 by 3/4 mm, lanceolate, acute with narrow membranous margin. Petals nearly 1–1 1/2 by 1/2–1 mm, white, obcordate with short inflexed tips. Mericarps 5–6 by 1 mm, sometimes antorsely hisrate when unripe, black and finely granular when ripe, grooved inside, with a beak to 2 1/2 mm; disk flat.

Distr. Indigenous in SE. Europe and W. Asia, cultivated and sub spontaneous in all parts of the world; in Malaysia stated to be cultivated in Java [Miq. Fl. Ind. Bat. I, 1 (1856) 744].

Notes. Description after European materials; no specimens from Malaysia seen by me.

7. TORILIS


Annual to perennial erect herbs, retrorsely pubescent. Leaves pinnately divided. Umbels compound, rays often few. Involucres many to 0, involucels many. Flowers white or reddish, outer ones radiating. Calyx teeth triangular, acute. Petals cuneate or obovate, emarginate, with inflexed tips. Disk continuous with the base of the styles. Fruits ovate to oblong, laterally subflattened, constricted at the broad commissure; mericarps with primary and secondary ribs obscure or sub prominent, lateral ribs in the commissure, muricate-setose, inner face sulcate; carpophore entire or 2-fid.


Stems to more than 1 m, finely striate, rough by appressed bristles. Leaves triangular in outline, sparingly appressed hisrate, pinnate, leaflets pinnatipartite, segments pinnatifid to serrate. Umbels terminal and axillary; peduncles 5–20 cm; rays 4–12, 1/2–3 cm; pedicels 4–10, 1–4 mm, all antorsely hisrate; involucres 2–6; involucels 3–7, nearly filiform. Calyx teeth nearly 1/2 mm, triangular-lanceolate, mucronulate. Petals 1/2–1 mm through, appressed hairy outside. Mericarps about 4 by 1/2 mm, oblong, ribs obtuse, grooves with densely placed uncinate bristles.

Distr. Indigenous in Europe, N. Africa, temperate Asia, Himalayan Mts, introduced in S. Asia and America, in Malaysia: N. half of Sumatra and E. Java (Mt Tengger).

Ecol. Mountains, 1225–2500 m.

Vern. Ambo-ambo (Sum.), tumbaran alas, J.

Notes. This species is said to have been introduced in S. Asia and America among clover seed.

8. CORIANDRUM


Annual, entirely glabrous. Stems to 75 cm, terete, striate. Lower leaves palmitnotolate to -partite, middle leaves pinnate, segments gradually narrower, obtuse, upper leaves pinnate to bipinnate, segments 1/2 mm broad. Compound umbels terminal or seemingly lateral, peduncles 2–10 cm; rays 3–5, 1–2½ cm; pedicels 3–5 mm; involucres 0–1, to 5 mm; involucels 3–5, to 5 by 1½ mm, linear. Calyx teeth nearly 1 mm, triangular-lanceolate to oblanceolate, somewhat radiating. Petals white, radiating, outer ones 3–4 mm, all deeply bipartite with inflexed tips. Mericarps 4 by 2 mm, inside hollow, forming a nearly globose fruit; primary ribs undulated lines, secondary ribs subprominent, filiformous.

Distr. Indigenous from the Mediterranean region to central Asia; cultivated in nearly all parts of the world, in Malaysia: cultivated from 0–2200 m.

Uses. Fruit as spice; mixed with rice in preparing yeast; leaves for flavouring foods; medicinal as a mild stimulant.

Notes. Unripe fruits smell of bugs.
The coriander seeds sold in the markets are stated to have been introduced from India.

9. OREOMYRRHIS


Perennial herbs, often caespitose or villose. Leaves with sheaths, pinnately dissected, or entire, often all in rosettes. Umbels simple. Involucres many. Calyx teeth inconspicuous. Petals entire, imbricate in bud. Disk continuous with the base of the styles. Fruit oblong or narrow, slightly laterally flattened, usually tapering towards the end; commissure broad; mericarps subterete, ribs obtuse, prominent, lateral ones close to the commissure; vittae 1 under each groove and usually 2 at the commissure. Carophylose often bipartite.

Distr. Few spp. circum-S. Pacific from Mexico to N. Borneo.

KEY TO THE SPECIES

1. Leaves compound.
2. Leaves pinnate to bipinnate; primary leaflets in several pairs. Peduncles 0.7–8 cm. Involucres 2–4 mm. Pedicels 1–9. Fruits 2½–3½ cm
   - 1. O. andicola
   - 2. Leaves subticate; lateral leaflets 3–5-particle; terminal leaflet ternate with tripartite segments. Pedicelle 12–33 cm. Involucres 5–8 mm. Pedicels 15–30. Fruits 4–6 mm
   - 2. O. papuana
3. Pedicels 6–8. Fruits 5 by c. 1–1½ mm. Leaves 2–20 cm
   - 3. O. linearis
4. Pedicels solitary. Fruits c. 1½ by 3/4 mm. Leaves 3–4 mm
   - 4. O. azorellacea


Small tufts to spreading soft-haired cushions. Main root fusiform. Caudex with few erect branches bearing one or more rosettes. Leaves 0.8–16 cm; sheath 3–30 by 1–3½ mm, tapering into the petiole, margin membranaceous, dorsally glabrous or short-hirsute, inside short-hirsute or sparingly pilose, rather densely ciliate; petiole 0.3–10 cm, canaliculate, glabrous or short-hirsute; lamina ½–4 by 0.4–1.6 cm, triangular-ovate, pinnate to bipinnate, leaflets 5–11, lower ones with 3–5 secondary leaflets, all leaflets pinnatifid to pinna-

tipartite, segments 1–2½ by ½–1½ mm, thinly coriaceous, glabrous or shortly hirsute, sometimes mucronulate, finely ciliate, margins sometimes recurved; small leaflets only with acute, broad-triangule teeth. Umbels 1 to several in each rosette; peduncles 0.7–8 cm, terete, densely hairy with spreading somewhat silky hairs, or short hirsute towards the apex, sometimes glabrescent, sometimes exceeding the leaves; involucres 5–10, 2–4 mm, ovate-lanceolate with broad base, outside densely sericeous or shortly hirsute, sometimes finely ciliate; pedicels 1–9, 0–1½ mm, to 3 mm in fruit. Petals nearly 1 mm, broad elliptic-ovate, base shortly ciliate or glabrous, white or reddish. Fruits 2½–3½ by 3½–4½ cm by 3½–1½ mm, oblong ovate, somewhat incurved, densely short-hirsute to glabrous.

Distr. Central and S. America from Mexico to the Falkland Islands, moreover in Australia and New Zealand, in Malaysia: Br. N. Borneo (Kina-balu) and New Guinea.
Ecol. Open places, rock crevices, alpine grassland, open bogs, among shrubs, 3150-4240 m.

Notes. *Oreomyrrhis andicola* is very polymorphic. In the vast area which it covers it is glabrous to white-tomentose; the height varies from 1½–50 cm; the rosettes are dense or loose bearing simple umbels or slightly branched stems with few leaves and several umbels arranged again nearly in an umbel; the leaves are bi- to tripinnate, rarely simply pinnate with pinnately divided leaflets; the petioles are longer or shorter than the lamina.

2. *Oreomyrrhis papuana* Buw. Blumea 2 (1936) 175, fig. 5.—Fig. 6.

Perennial, main root fusiform. Caudex with few erect branches with rosettes. Leaves to 18 cm; sheaths 1–4 by ½ cm; tapering into the petioles. Glabrous, margin scarcely membranaceous; petioles 4–12 cm, canaliculate, subglabrous, apical part subhirsute; lamina 1½–2½ by 0.8–2 cm, rhomboid-ovate in outline, subternate to pinnate, segments 2–3-partite, ultimate segments to 7 by 1 mm, lanceolate-cuneate to linear-lanceolate, thick-coriaceous, at the thick margin and beneath on the nerves with antrorse bristles. Umbels 1 or more in each rosette; peduncles 12–33 cm, terete, subsulcate, towards the apex densely hirsute with small retrorsely appressed bristles; involucres 6–9, 5–8 by 1–2 mm, oblong-spatahulate, broad at the base, texture and indumentum as the leaf segments, reflexed in fruit; pedicels 15–30, very short when flowering, to 5 mm in fruit, inner ones shorter, scabrous with short retrorsely appressed bristles. Petals 1–1½ by ± ⅓ mm, oblong-ovate or oblong-obovate. Fruits 4–6 by ca ⅜ by 1⅛ mm, glabrous. Carpophore undivided.


Ecol. Open swampy, grassy localities, 3200–3500 m.


Perennial, caespitose. Roots with fibrous branches. Caudex with numerous erect branches, to 12 cm, beset with fibrous leaf rudiments, at the extremities bearing dense or lax rosettes. Leaves 2–20 cm; sheaths 5–35 by 1–4½ mm, tapering into the petiole, margin yellowish, ½ mm; petiole ⅓–1 mm broad, gradually widening to the narrowly linear blade; lamina to 5 mm broad, glabrous or the upper surface retrorsely appressed hirsute, apical portion on each side 1–4-dentate, margin thickened, in narrow leaves revolute, finely retrorsely ciliate; nervation pinnate, lateral nerves strongly ascending, hardly visible above, strongly prominent beneath. Peduncles 1 to several, 6–30 cm, erect or subcurved, rarely with one leaf, triangular, an-

Fig. 6. *Oreomyrrhis papuana* Buw. (plant × 2/3, fruit × 4).

Fig. 7. *Oreomyrrhis azorellacea* Buw. a–b. mode of branching, × 1, c–d. flowering and fruiting twigs, × 4, e. fruit. × 8, f. mericarp in cross-section, × 24.
Fig. 8. Oreomyrrhis azorellacea Buw., a cushion plant of the alpine grassland on summit of Mt Albert Edward (Papua), +4000 m alt. (BRASS, ARCHBOLD expeditions)

gles subincrassate, retrorsely hirsute towards the apex with appressed whitish bristles to \( \frac{1}{2} \) mm, finally glabrescent; involucres 5–6, 2–5 by \( \frac{1}{2} \)-1\( \frac{1}{4} \) mm, lинgulate, obtuse, towards the connate base retrorsely hirsute; pedicels 6–8, to \( \frac{1}{2} \) mm, inner ones sessile, in fruit 2\( \frac{3}{2} \)-10 mm, densely retrorsely hirsute. Petals 1.1–1.2 by 0.8 mm, violet, triangular. Fruits to 5 by nearly 1 by \( \frac{1}{2} \) mm, slightly curved, entirely glabrous.


Ecol. Open sunny localities, open grasslands, grassy creek banks in open country, 3000–3900 m.

4. Oreomyrrhis azorellacea n. sp.—Fig. 7–8.

Species nova glabrata suberecta, habitu maxime ut alius species generis Azorella. Faciliter distinguenda caule 3-4\( \frac{1}{2} \) cm longo, foliis 2-4-faristis, densissime imbricatis, 3-4 mm longis, inflorescentia uniflora, pedunculo 2 mm longo, bracteis involucris 4, pedicello \( \frac{1}{2} \) mm longo, fructu \( \frac{1}{2} \) mm longo et \( \frac{3}{4} \) mm lato. Forma foliorum valde ad O. linearis HEMSL. accedens tamen planta in toto distincte minor.

A herb, probably perennial, entirely glabrous; stem nearly erect, 3-4\( \frac{1}{2} \) cm long, much branching from the base, branches up to 3 cm long, closely packed and rather stiff, the upper gradually shorter and forming a comparatively dense cushion. Leaves very densely imbricate in 2-4 rows, 3-4 mm long, the lower part amplexicaulose and sheathing; sheath appressed, up to 1 mm wide, slightly ciliate on the pellucid margin and gradually narrowing in the petiole; blade up to \( \frac{1}{2} \) mm long, up to 1 mm wide, stiffish, coriaceous, spreading, concave, 1-nerved, ciliate along the submembranaceous margin, tip blunt. Inflorescences uniflorous, on top of short branches along the stem, hidden among the foliage during flowering and when in fruit. Peduncle 2 mm long, more or less flattened, bracts 4, forming an involucre, spreading, lanceolate, \( \frac{1}{2} \)-2 mm long, \( \frac{1}{2} \)-1\( \frac{1}{4} \) mm wide, connate at the base, suggesting leaves. Flowers on up to \( \frac{1}{2} \) mm long pedicels. Calyx tube shortly campanulate, laterally slightly compressed, c. 1 mm long, \( \frac{1}{2} \) mm wide, indistinctly furrowed; teeth absent. Petals red, 1 mm long, \( \frac{1}{2} \) mm wide, single-nerved, elliptical, acute. Stamens c. \( \frac{1}{2} \) mm long, anthers dorsifixed, rounded-ellipsoid, up to \( \frac{1}{2} \) mm long and as wide. Styles 2, conical, up to \( \frac{1}{2} \) mm long. Fruit c. \( \frac{1}{2} \) mm long, 3\( \frac{1}{2} \) mm wide, slightly narrowed near the top and slightly compressed laterally; rims obtuse, equally slightly prominent, beside the commissures, joining near the top of the fruit; stylodium conical, up to \( \frac{1}{2} \) mm long; mericarp nearly terete.

Distr. Malaysia: East New Guinea (Mt Albert Edward, BRASS 4306, type).

Ecol. Tiny vivid-green plant occurring in dense pin-cushion masses, common on alpine grasslands, 3680 m alt.

Notes. In mode of growth and inflorescence it resembles fallaciously some spp. of Azorella. How-
ever, it has a parenchymatous endocarp, the vitiae are solitary in the furrows and 2 at the commissure; the endosperm is furrowed at the commissure on
cross section. Therefore, it is an Oreomyrrhis. Its leaf shape comes very close to O. linearis, but it is much smaller in all parts.

10. CUMINUM

Annual. Stems 15–50 cm, erect, strongly diver-
gently branched from the base, terete, striate, en-
tirely glabrous. Leaves short-petioled or sessile on
a sheath to 1 by 1/2 cm with membranaceous white
margins, auriculate at the apex or tapering into the
petiole; lamina 3–10 cm, bipinnate, segments to
1 1/2 cm broad, linear. Compound umbels opposite
to the leaves or terminal; peduncles 2–4 cm; rays
4–6, 1–1 1/2 cm; pedicels 3–7, 4–5 mm; involucres
3–5, 2–3 1/2 cm, tripartite or twice tripartite, seg-
ments filiform, sessile on a 1/2 cm long sheath with
membranaceous white margins; involucres 2–4, to
9 mm, margin white-membranaceous. Calyx
teeth 1–1 1/2 mm, linear to subulate, persistent. Petals
nearly 1 by 1/2 mm, white to reddish, obcor-
date with inflexed tips. Mericarps 5–7 by nearly
3 mm, somewhat laterally flattened. main ribs fili-
form, bristly, ridges with a stellate-hairy line.
Distr. Indigenous in Turkestan, cultivated in
all parts of the world; in Malaysia: stated to be
cultivated in the mountains of Java (HEYNEN, OCHSE & BAKH. llcc.).
Uses. Oil distilled from the seeds for making
liqueurs; seeds for seasoning curries: medicinal ex-
ternally and internally as stomachic and astringent.

Ver. Djinten putih, M, djinten bodas, S, djinten
poté, Md, komijn (Dutch), cumin (Engl.), Küssel
(Germ.).

Notes. Description after plants from the Ori-
ent; no specimens from Malaysia seen by me. The
Cuminum sold in the markets is stated to have been
introduced from India.

11. APIUM

KEY TO THE SPECIES
1. Leaves pinnate, with broad tripartite to trilobate petiolate leaflets
   2. A. graveolens
   1. Leaves bi- to tripinnate, with very narrow or filiform segments
   2. A. tenuifolium

Main root fusiform or tuberiform. Stems
25–90 cm, angular, striate and grooved. Petioles
rather long; sheaths to 2 cm in the lower leaves,
white-margined; lamina pinnate, leaflets 2–2 1/2 by
to 3 cm, trilobate to tripartite, petiolulate, in the
upper leaves smaller, ternate to 3-partite. Compound
umbels opposite the leaves; peduncles 0–2
2 cm; rays 10–15, 1–3 cm; pedicels 6–10, 2–3 mm;
involucres and involucres absent. Calyx teeth ab-
sent. Petals 1/2 mm through, white or greenish,
with inflexed tips. Mericarps 1 by up to 3/4 mm.
ribs narrowly winged; stylodium nearly 1/4 mm
high, halves conical. Carophore emarginate.
Distr. Indigenous in the temperate parts of
Europe, Africa and Asia, also in S. America, cul-
tivated elsewhere, in Malaysia: cultivated from
1–2100 m.

Uses. Leaves, petioles and tuberiform roots for
flavouring dishes; seeds as spice and medicinal.

Ver. Saladri, S, celery (Engl.), selderie (Dutch).

2. Apium tenuifolium THELL. in HEGI, III. Fl. Mit-
teleur. 5, 2 (1926) 1140; BUW. Blumea 2 (1936)
181.—Sison ammi (non L. 1753). Jacq. Hort. Vin-
dob. (1773). t. 200 excl. syn. ex THELL. in HEGI
lc.—Cnidium tenuifolium MOENCH. Meth. (1794)
98, excl. syn.—Pimpinella leptophylla PERS. Syn. 1
(1805) 324.—Helosciadium leptophyllum DC. Mém.
Soc. Phys. Genève 4 (1828) 493.—Apium leptophy-
lum BENTH. Fl. Austr. 3 (1866) 372.—Apium ammi
URB. in MART. Fl. Bras. 11, 1 (1879) 341, t. 91.

Main root fusiform. Stems 40–50 cm, striate,
nearly glabrous. Leaves bi- to tripinnate, segments
1 1/2–1 mm broad, nearly filiform. Compound
umbels opposite the leaves; peduncles 0–2 cm;
rays 3–5, 1 1/2–1 cm; pedicels 5–10, 2–4 mm; involu-
cres and involucres absent. Calyx teeth 0. Petals
nearly 0.4–0.6 by 0.2 mm, with strongly inflexed
tips, white. Mericarps 1 1/2 by 1/2 mm, ribs obtusely
keeled. Stylodium bipartite, halves small, conical.
Carophore to 1/3 from the apex bipartite.
Distr. Central and S. America, Australia, New
Zealand, cultivated and adventive in Europe and
Asia, in Malaysia: subspontaneous, 700–750 m.

12. PETROSELINUM
HILL, Brit. Herbal (1756) 424; BUW. Blumea 2 (1936) 191.—Carum sect. Petrose-

Stems 25–100 cm, erect, grooved. Lower leaves to tripartite, leaflets obovate to cuneate, tripartite; upper leaves ternate. Compound umbels terminal and axillary; peduncles 2–12 cm; rays 5–10, 1–3 cm; pedicels 3–15, 2–5 mm; involucres 1–3, involucres 3–8. Calyx teeth absent. Petals nearly 1 by 1/2 mm, with inflexed tips, greenish yellow. *Meri-carpus* 2–21/2 by nearly 1 mm, ribs filiformous.

Distr. Indigenous in S. Europe and N. Africa, cultivated and subspontaneous elsewhere, in Malaysia: cultivated up to 2000 m.

Uses. Leaves for flavouring dishes, and as a diuretic.

Vern. *Potrasoli, M, parsley (Engl.), peterselle (Dutch).*

Notes. According to Shaw the names in Hill’s British Herbal are nomenclaturally not eligible since Hill did not accept the binary system of nomenclature in this work.

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13. **TRACHYSPERMUM**


**KEY TO THE SPECIES**

1. Leaves 2–3-pinnatisect, the ultimate segments of the lower leaves to 1 mm broad. Calyx teeth distinct. Fruit with broad, roundish, scale-like hairs

   1. **T. ammi**

2. Leaves 2-pinnatisect, ultimate segments of the lower leaves more than 2 mm broad. Calyx teeth obsolete. Fruit with narrow, obtuse, nipple-shaped hairs

   2. **T. roxburghianum**


Stems 25–45 cm, striate, glabrous, usually strongly branched. Leaves 2–3-pinnate, ultimate segments to 1 mm broad, narrow-oblong. Compound umbels terminal or seemingly lateral; peduncles 1–11/2 cm; rays 5–9, 1/2–1 cm, to 2 cm in fruit; pedicels 4–15, 1–6 mm; involucres 3–5, oblong, sometimes divided; involucres 4–5, oblong; the bracts of both very unequal in length, hirsute with membranaceous margin. Calyx teeth nearly 0.2 mm, thickly subulate. Petals 0.6–0.7 mm through, obcordate with inflexed tips. Fruits to 2 by 1 mm, along the ribs with broad scale-like hairs.

Distr. Indigenous and cultivated in Egypt, Abyssinia, SW. Asia to E. India, subspontaneous in Europe, in Malaysia: stated to be formerly cultivated in Java (Heyne i.c.).

Uses. Seeds medicinal as a carminative and in plasters; their medicinal agent is thymol. The seeds sold in the native drugstores are stated to have been introduced from India.


Notes. Description after materials cultivated by Heyne in his garden.


Stems 15–90 cm, striate, subglabrous, usually strongly branched. Leaves pinnate; leaflets pinna-tifid to pinna-partite, extreme segments to 3 mm broad, those of the upper leaves gradually narrower to nearly filiform. Compound umbels terminal and axillary; peduncles 2–8 cm; rays 2–6, 1–21/2 cm; pedicels 5–15, 2–6 mm; involucres 2–5; involucres 5–8; both very narrow, finely ciliate. Calyx teeth hardly 0.1 mm. Petals nearly 11/4 by 3/4 mm, obcordate with inflexed tips, white or greenish white. *Meri-carpus* nearly 21/2 by 3/4 mm, oblong, with very short obtuse spreading hairs.

Distr. Of unknown provenance, now cultivated and subspontaneous in tropical SE. Asia, in Malaysia: throughout the Archipelago.

Uses. Raw or steamed eaten with rice; also for flavouring dishes.

14. CRYPTOTAENIA


Rhizome 1-2 by to 1 cm, chambered. Stems erect, to 90 cm, terete, striate. Petioles to 10 cm, upper ones gradually shorter; sheaths with membranous margins, apex auriculate; lamina ternate, leaflets sessile or short-petioliulate, ovate to rhomboid, irregularly biserrate to bidentate, lateral ones often bifid to bipartite. Compound umbels terminal on the stems and the branches, united to leafy panicles; peduncles 1-8 cm; rays 5-7, 3-50 cm, those of one umbel very different in length; pedicels 6-10, 1/2-15 mm, those of one umbellule very different in length; involucres 0-2, to 4 mm, subulate; involucels 2-5, to 1 mm, subulate. Calyx teeth absent, short in fruit. Petals nearly 1 by 1/2-3/4 mm, obcordate with inflexed tips, white. Mericarps 4-6 by 1/2 mm, oblong-ellipsoidal, attenuate at both ends, somewhat laterally flattened, distinctly ribbed; stylopodium conical, bipartite, the halves together with the styles forming nearly 3/4 mm long beaks.

Distr. Indigenous in eastern N. America, China and Japan, in Malaysia: stated to be cultivated by the Japanese (Ochse & Bakli, l.c.).

Vern. Salderi djeepang, M.


15. CARUM


Stems to 55 cm, erect, terete, striate. Petioles to 13 cm, upper ones gradually shorter, uppermost ones absent, all of them with a sheath with membranous margin and auriculate segments divided. Compound umbels terminal to the stems and its branches; peduncles 1-11 cm; rays 5-8, 1/2-2 cm; pedicels 6-14, 1/2-5 mm, to 9 mm in fruit; involucres none or 1, subulate; involucels none. Calyx teeth none. Petals to 1/4 by 1 mm, obcordate with short inflexed tips, white. Mericarps 4-5 by 1 mm, often falcate, ribs distinct, yellowish. Stylopodium bipartite, halves low-conical.

Distr. Indigenous in Europe, temperate Asia, cultivated elsewhere, in Malaysia: stated to be cultivated in the mountains of Java (Miquel, Buwalda, i.c.).

Uses. Seeds in confectionery, also as medicine; oil from the seeds for making liqueur.

Vern. Karwij (Dutch).

Notes. Description after European materials, no Malaysian specimens seen by me. The seeds sold in native drugstores are stated to have been introduced from India.

16. PIMPINELLA


Annual to perennial herbs. Leaves 1-2-pinnate, 1-2-ternate or decompound, rarely undivided and only dentate. Umbels compound; involucres and involucels few or none. Calyx teeth obsolete or small. Petals usually emarginate, often with inflexed tips. Disk continuous with the base of the styles. Fruits ovate or broader than long, laterally flattened, usually constricted at the broad commissure; mericarps terete to subpentagonal, often dorsally flattened, ribs slender, obscurely prominent, inner face flat; ridges with 2-3 vittae. Carpophore entire, 2-fid or 2-partite.

Distr. Over 100 spp. described from Africa, Europe and continental Asia, in Malaysia: Java, Bali, and Luzon.

Key to the species

1. Involucres 3 to more. Lower leaves usually imparipinnate.
2. Fruits densely warty
3. P. pruapatian
2. Fruits hairy
4. P. ascendenst
1. Involucres 1-2. Lower leaves mostly simple.
3. Lower and middle leaves simple, with serrate margin, not lobed. Umbel rays 20-30
2. P. javana
3. Lower leaves orbicular to reniform, often crenate, sometimes lobate, middle leaves ternate to pinnate with incised leaflets. Umbel rays 8-14
1. P. anisum

Annual. Stems erect, terete, grooved, pubescent. Petioles of the lower leaves 4–10 cm, upper ones gradually shorter, uppermost leaves sessile, all with membranously margined sheaths, lower lamina cordate, crenate to serrate, subsequent ones successively incised, ternate and nearly pinnate, leaflets dentate to incised. Umbels terminal to the stems and its branches; peduncles 2½–7 cm; rays 8–14, 4–25 mm; pedicels 7–13, 1–5 mm; involucres 0–2, 3–4 mm, narrow; involucels 0–2, 1 mm, subulate. Petals nearly 1 mm, obcordate with inflexed tips. Mericarps to 5 by 2 mm, ellipsoid, short-hairy by antorse hairs.

Distr. From an unknown provenance, probably from the Orient, cultivated and subspontaneous through the world, especially in the Mediterranean region and Central Europe, in Malaysia stated to be sometimes cultivated in Java (Miq. Fl. Ind. Bat. 1, 1 (1856) 740; Bisschop-Grey, Plant. Ned. Ind. (1883) 204; Koord. Exkurs. Fl. Java, 2 (1912) 727; Wigman in van Gork, O.l. Cult. 2 (1913) 883).

Uses. Fruits carminative and as medicine.

Notes. Description after European materials; no specimens from Malaysia seen by me. The fruits sold in native drugstores are stated to be from India, which gets its supply from Persia.

2. Pimpinella javana DC. Prod. 4 (1830) 122; Molkend. in Mio. Pl. Jungh. (1851) 96, var. macrophylla, sylvestri, microphylla; Buw. Blumea 2 (1936) 188.—Murrthia cordata Zoll. Nat. & Geneesk. Arch. 2 (1845) 576.—Fig. 9.

Stems erect or ascending, 50–150 cm, terete, striate, and densely hairy, almost tomentose in the youth, later glabrescent. Lower leaves nearly in a rosette; petioles to 10 cm, sheaths 3–6 cm; lamina to 12 by 10 cm, entire, ovate in outline, deeply ciliate, subobtuse to acutely serrate; upper leaves gradually smaller and shorter petiolate, more acutely serrate or even dentate, uppermost ones with branches in their axils, often triangular, all of them more or less hairy above, whitetomentose beneath in the youth, glabrescent later. Umbels in an oblong panicle, terminal on the stems and its branches or seemingly opposite the leaves; peduncles 4–15 cm; rays 20–30, 2–4 cm; pedicels 12–16, 3–8 mm; involucres 0–4, involucels 1–4, nearly filiform, shorter than the outer pedicels. Petals nearly 1½ by 1 mm with small inflexed tips. Mericarps nearly 2 by 1 mm, densely hairy with short spreading hairs.

Distr. Malaysia: Java (from Mt Sindoro eastward) and Lesser Sunda Islands (Bali).

Ecol. Open or lightly forested localities, between 1200 and 3125 m.

Fig. 9. Pimpinella javana DC. on Mt Tengger (E. Java), in open Casuarina junghuhniana forest (De Voogd)
17. OENANTHE


Glabrous herbs. Roots fusiform or fasciculate-tuberculate. Leaves 1–3-pinnate, ultimate segments large, linear or minute, rarely reduced to sheaths. Umbels compound. Involucres and involucels several, sometimes few or none. Calyx teeth small, acute. Petals emarginate, with long inflamed tips, white; outer ones of the inflorescence often enlarged. Disk continuous with the base of the styles. Fruits glabrous, ellipsoid or globose, nearly terete; commissure broad; mericarps dorsally flattened, inner face flat; lateral primary ribs broad, corky; dorsal and intermediate ones often much smaller, sometimes obsolete, seldom all ribs subequal; ridges with 1 vitta. Carpophore 0.

Distr. Some dozens of spp. (depending on specific delimitation), mostly in the N. hemisphere, also in S. Africa and trop. Australia.

Perennial. Stems 10–100 cm, erect or ascending from a creeping base, terete, ramose. Petioles to 10 cm, often with sheaths; lamina pinnate to bipinnate, segments ovate, serrate to narrowly oblong, or divided again, this making the leaf 4–5-pinnate. Umbels terminal and opposite the leaves; peduncles 1–20 cm, rarely none; rays 5–15, 1/2–3 cm; pedicels 10–25, 2–5 mm; involucres none or 1; involucels 2–8, 2–4 mm, linear. Calyx teeth nearly 1/2 mm, acute. Petals nearly 1 by 1/4 mm. Mericarps 2–3 by 1/2–1 mm, ribs swollen, marginal much more than the dorsal ones, the latter if strongly swollen nearly confluent.

Distr. SE. and E. Asia, Formosa, Japan, Queensland, in Malaysia: all over the Archipelago.

Ecol. Swampy places, along streams, wet grasslands, and clearings, 1–2800 m, but especially above 1000 m, sometimes cultivated.


Notes. Very variable as to the dimensions of all its parts, the compoundness of its leaves, the length of the peduncles, the number of pedicels in the umbellules, and the dimensions of the fruits. Many forms formerly described as distinct species; all are connected by intermediates.

18. FOeniculum

ADANS. Fam. Pl. 2 (1763) 101; Buw. Blumea 2 (1936) 200.


Perennial, entirely glabrous. Stems erect, to 2 m. Sheaths 4–12 cm in the lower leaves, shorter upwards, apex with cucullate-connate auricules; lamina usually 3–4-pinnate, segments filiform. Compound umbels terminal to the stems and the branches; peduncles 5–16 cm; rays 30–70, 5–7 cm; pedicels 5–30, 1/2–1 cm; involucres and involucels none. Calyx teeth none. Petals yellow, strongly curved inward. Mericarps nearly 5 by 2 mm, ribs filiformous, nearly equal, not at all winged.

Distr. Indigenous in the Mediterranean region, cultivated all over the world, in Malaysia: cultivated throughout the Archipelago, subspontaneous on several mountains in E. Java, common on Mt Tengger (Sand Sea).

Uses. Young leaves and fruits for flavouring dishes; medicinal for giving agreeable flavour to medicines; in European confectionery. The seeds sold in Java are stated to be introduced from India.

Vern. Adas, adas manis, J, venkel (Dutch).

19. ANETHUM


Annual. Stems 50–100 cm, terete, striate; sheaths 11/2–2 cm in the lower leaves, shorter upwards, white-margined, apex with cucullate-connate auricules; lamina 3-pinnate, segments filiform. Compound umbels terminal to the stems and its branches; peduncles 4–13 cm; rays 5–15, 2–4 cm; pedicels 5–25, 1/2–1 cm; involucres and involucels none. Calyx teeth none. Petals yellow, strongly curved inward. Mericarps nearly 5 by 3 mm, moreover with a wing 1/4–1/2 mm, oblong.

Distr. Indigenous in S. and SW. Asia, cultivated in most parts of the world, in Malaysia: cultivated throughout the Archipelago from 10–1050 m.

Uses. Raw or steamed eaten with rice; fruits for flavouring drinks, for native confectionery, in soups, sauces, etc. The fruits sold in Java are stated to be introduced from India.

Vern. Adas (Sum.), walahandji (Sumba), djinten, adas sowa, M, dille (Dutch).
Fig. 10. *Heracleum sumatranum* Buw. (a–c. $\times \frac{1}{2}$, d–f. $\times 3$).
20. PASTINACA
LINNÉ, Sp.Pl. 1 (1753) 262; BUW. Blumea 2 (1936) 203.


Main root fusiform. Stems angular and strongly grooved. Leaves pinnate, leaflets 2–13 by 1–5 cm, oblong-ovate, often 3-lobate to 3-partite, irregularly crenate. Compound umbels terminal on the stems and its branches; peduncles 3–7 cm; rays 5–12, 1–4 cm; pedicels 10–20, 2–7 mm; involucres and involucels none or 1–2. Calyx teeth thin.

Petals yellow, with inflexed tips. Mericarps inclusive the 1/4–1/2 mm broad marginal wing 5–7 by 4–5 mm, broad-elliptic.

Distr. Spontaneous in Europe and temperate Asia, elsewhere cultivated and subspontaneous; in Malaysia cultivated in W. Java, ca 900 m.

Uses. Medicinal as a diuretic.

Notes. Description after European materials; Malaysian specimens scanty.

21. HERACLEUM
LINNÉ, Sp.Pl. 1 (1753) 249; BUW. Blumea 2 (1936) 204.

Perennial or biennial herbs, seldom glabrous. Leaves broad-lobate to tripinnate, rarely ternately dissected, segments broad. Umbels compound with many rays. Involucres few or 0, simple, rarely many; involucels many, rarely divided. Flowers polygamous, often radiating, white or yellowish. Calyx teeth obsolete, seldom small, linear, lanceolate. Petals obovate, cuneate-rhomboid or unguiculate, emarginate to 2-fid with inflexed tips. Ovary hairy or pubescent. Fruits orbicular-obo-vate or elliptical, strongly dorsally flattened; dorsal and intermediate ribs thin-filiform, lateral ribs usually with a broad wing; vittae usually solitary in each ridge, as long as the mericarps or abbreviated and dilatated below. Carpophore 2-partite.

Distr. Over 70 spp. confined to the N. hemisphere.

1. Heracleum sumatranum BUW. Blumea 2 (1936) 204, fig. 6.—Fig. 10.

Stems probably erect, striate or subsulcate, upwards more or less hisrute, incrassate at the nodes; internodes 20–55 cm, upwards shorter. Leaves few, with small rosettes in the axils, sessile on a sheath. Sheaths 40 by 15 mm, amplexicaulious, margins membranous, tips auriculate or narrowed. Lamina to 20 by 28 cm, deltoid in outline, biternate to ternate; terminal leaflet with a to 10 cm long petiole, tripartite or ternate; lateral ones with to 3/2 cm long petioles; petioles of the secondary and tertiary leaflets gradually shorter to 0; leaflets oblong-ovate, long-acuminata, all sarrate to biserate with short-acuminata apicate teeth, beneath thin-hirsute on the nerves. Petioles 10–20 cm; involucres none; involucels 6–7 by circa 1/2 mm, lanceolate, long-acuminata, somewhat hirsute with narrow, membranous margin; rays 9–12, 1/2–3 cm, sulcate, shortly hirsute, to 4–6 cm in fruit, spreading, reflexed later; pedicels to 20, 2–5 cm, densely thin-hirsute, to 8–12 cm in fruit, spreading, later reflexed. Calyx teeth inconspicuous or to 1/4 mm in the marginal flowers. Petals of the central flowers to 1/2 by 1 mm, elliptical to obovate, inflexed tip 1 mm; marginal flowers radiating, outer petals to 3 by 4 mm, broad-loculate. Mericarps 6/2–8 by 5/2–7 mm, roundly ovate, glabrous, with a 2/2 mm broad wing; marginal ribs 1/2 mm from the margin, vittae transversely septate.

Distr. Malaysia: Central Sumatra (Mt Singa-lang).

Ecol. Mountain forests, 2400 m.

Notes. Closely allied to the group enumerated in the Fl. Br. Ind. from H. wallichii DC. to H. barmanicum KURZ. As these species show only slight differences, and H. sumatranum BUW. differs more from them than these species inter se, it is maintained as a different species; however, it might perhaps be better to unite them all to one polymorphic species.

22. PEUCEDANUM
LINNÉ, Sp.Pl. (1753) 244.

Often robust herbs, root fusiform, sometimes tuberous. Leaves pinnate. Flowers bisexual, upper ones sometimes ♂, white or yellow, rarely purple. Compound umbels without involucres. Involucels present. Calyx rim abbreviate, shortly or distinctly toothed. Petals broad-ovate, with a long, inflexed tip. Stylodium thick-conical, surrounded by the calyx rim. Fruit strongly dorsally compressed, narrow- to broad-elliptic, sometimes emarginate; marginal wings coherent, loosening when the meri-
Fig. 11. _Peucedanum japonicum_ THUNB. Basal leaf and flowering stem, × ½, mericarps, × 5 (SIEBOLD H.L.B. 908. 260–495), root, × ½ (MAXIMOVICZ Iter 2, H.L.B. 908. 260–483).
carps are ripe. Mericarps rather thin and slightly concave, with a distinct marginal wing in the base of which the marginal ribs are merging; dorsal side with 3 distinct ribs; vittae narrow, 1–3 between the ribs and 2–6 at the commissure. Carpophore split to the base, filiform.

**Distr.** Large polymorphous genus, sometimes split into several genera formerly recognized as sections, about 200 spp., centering in the Orient, NE. Africa and W. North America, not or scarcely in S. America and absent in Australia, in *Malaysia* only known from the islands N of Luzon.

1. **Peucedanum japonicum** THUNB. Fl. Jap. (1784) 117; HAYATA, IC. Pl. Form. 2 (1912) 57; MERR. Phillip. J.Sc. 30 (1926) 418.—Fig. 11.

Taproot elongated fusiform, apex with erect remnants of sheath nerves 1 cm long; flowering parts puberulous otherwise glabrous. Stem terete, grooved, slightly flexuose, erect, often branched, 1/2–3/4 cm diam., solid, 15–100 cm tall. Branches with distinct nodes, alternate, rather erect. Basal leaves in large specimens long-petioled with 3 bi-jugate, long-stalked, ternate segments, blade c. 30–40 cm diam.; leaves of small specimens and flowering stems much smaller, 7–10 cm diam., biternate; petiole 3–5 cm sheathing over its entire length, amplexicaul at the base, striate; lateral segments 1/2–2 cm petiolulate, terminal ones 11/2–4 cm, all 3-parted; leaflet-segments sessile, often connate at the base, lateral ones oblique, all obovate-cuneate, margins entire, apex broadened 3–5-toothed or -lobed, lobes often dentate, about equal in size 21/2–4 by 1–3 cm; uppermost leaves reduced. Inflorescence corymbiform. Compound umbels terminal, 4–7 cm wide; peduncle 6–7 cm, in fruit to 10 cm, stout, striate, erect. Rays 15–25, unequal in length, 1/2–21/2 cm. Involucres 0. Secondary peduncles in flower 1–2, in fruit 2–3 cm long, hardening. Involucres 7–10, subequal or very unequal, lanceolate-oblong, acute, 2–6 mm. Pedicels 17–20, in flower 1–2 and 4–5 mm, outer largest, in fruit hardening but not elongating. Flowers not radiant. Calyx indistinct. Petals 4, white, c. 1/4 by 1 mm, emarginate through inflexed tip. Stamens inflexed in bud; filaments 2 mm. Stylodium blunt, very thick, cap-like covering tip of ovate ovary and as broad as it, margin crenate. Styles 2, exceedingly short. Fruit partly abortive, 5–6 by 21/2–3 mm, ellipsoid, crowned by the stylodium. Mericarps dehiscing from the base, pendent from the filiform carpophore halves, minutely puberulous to subglabrous, marginal wing about 1/3–1/2 mm broad, ventral side rather flat, through wing subconvex; body darkish, wings and ribs pale brown (description after Japan. specimens in Rijksherbarium).

**Distr.** Japan, Taiwan, in **Malaysia**: Philippines (Batan Islands, N of Luzon; MERRILL 11755, not seen).

Ecol. In crevices of cliffs along the seashore.

**Notes.** The insertion of this species is wholly on Dr MERRILL's authority who collected and identified it. His identification was checked with the late Dr HAYATA while the late Dr JUEL compared a fragment with THUNBERG's type. The only difference with the type was that the Philippine specimen was glabrous. By Ind. Kew it is wrongly reduced to *Ligusticum acutilobium*, an error for *L. acutilobium* S. & Z. (v. St.).

### 23. DAUCUS


Annual, biennial or perennial. Main root fusiform. Stems erect, striate or grooved, hirsute. Leaves 2–3-pinnatifid, segments lanceolate. Compound umbels with flat or round surface when flowering, with incurved peduncles and pedicels and hollow surface in fruit; peduncles 2–25 cm; rays 15–30, 1–6 cm; pedicels 20–30, 1/2–11/2 cm; involucres 3–5 cm, pinnatifid, white-margined towards the base; involucres 5–7, 1/2–2 cm, entire to pinnatifid, lanceolate. Calyx teeth 1/4–1/2 mm, triangular, acute. Petals white or dark red in 5–7 central sterile flowers of the central umbel, with inflexed tips, peripheric ones radiating. Mericarps 3 by 11/2–2 mm, nearly oblong; primary ribs filiform with rather few nearly 1/4 mm long, fine bristles, secondary ribs beset with nearly 1 mm long, rigid bristles.

**Distr.** Spontaneous in Europe, N. Africa, and temperate Asia, cultivated in all parts of the world, in **Malaysia**: cultivated from 0–1800 m, subspontaneous on grassy mountain sides.

**Uses.** Roots as vegetable, young leaves raw or steamed eaten with rice.

**Vern.** Boktel, S, peen, wortelen (Dutch), carrot (Engl.).

### Excluded & doubtful

*Conium maculatum* L.; BOERL. Handl. 1, 2 (1890) 616. This species has never been found in Malaysia. *Hydrocotyle monopetala* BLCO, FL. Filip. (1837) 213. MERRILL places this with doubt in *Ophiirrhiza* (Rub.), cf. En. Philip. Fl.Pl. 3 (1923) 502.


*Hydrocotyle villosa* (non L.f.) KOORD. Teysmannia 11 (1901) 252. Prob. a writing mistake; *H. villosa* L. f. is a native of S. Africa.
FLORA MALESIANA
UNDER THE AUSPICES OF THE
KONINKLIJKE PLANTENTUIN VAN INDONESIÄ
'ROYAL BOTANIC GARDENS OF INDONESIA'
BUITENZORG, JAVA

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FLORA
MAITSEANA
DILLENIACEAE (R. D. Hoogland, Leyden)

Trees, shrubs, lianas or perennial herbs. Leaves spirally arranged, opposite in one species only (Madagascar). Blade simple or, rarely, (only in Acrotrema) to threefold pinnatisect. Stipules absent, but in Acrotrema and a number of species of Dillenia petiole with stipule-like, often wholly or partly caducous wings. Inflorescence cymose or racemose, sometimes reduced to a single flower, terminal or axillary. Flowers ♀, actinomorph to (mainly in the androecium) zygomorphic, hypogynous, mostly yellow or white. Sepals (3–) 4–5 (–20), imbricate, persistent in fruit. Petals (2–) 3–5 (–7), caducous usually within half a day after opening of the flower. imbricate in bud, all equal, apex rounded or emarginate. Stamens ~ 3, often partly staminodial, free or partly coherent by their filaments, centrifugal. Anthercells basifixed, oblong to linear, opening with an apical pore or a longitudinal slit. Carpels 1 ÷ 20, free or connate along the central axis only, with free styles. Ovules ~ 1, anatropous, apotropous. on an axile placenta. Fruit dehiscent or indehiscent, in the latter case permanently enclosed by the sepals. Seeds arillate or with a rudimentary aril, with abundant endosperm and a minute, straight embryo.

Distr. Ca 10 genera, of which one circumtropical (Tetracera), 3 confined to tropical S. America, one in the Old World tropics from Madagascar to the Fiji Islands (Dillenia), one endemic in Ceylon (Schumacheria), one in S. India, Ceylon, and the Malay Peninsula (Acrotrema, fig. 5), one endemic in Borneo (Didesandra), one endemic in Australia (Pachynema), and one on the southern hemisphere from Madagascar to the Fiji Islands, mainly in Australia (Hibbertia, fig. 3). Many species are relatively limited in distribution, none is distributed throughout Malaysia.

Ecol. Most Malaysian species occur in primary or secondary evergreen forests. A few deciduous species of Dillenia are found in monsoon forests or in savannahs, some Tetraceras in open vegetation and thickets and both species of Hibbertia in open scrub.

In size Hibbertia shows the biggest development among the genera with over 100 spp., next in sequence are Dillenia with ca 55 spp. and Tetracera with over 30 spp. Most representatives are found in the everwet parts of the tropics, but the ability of the family to produce drought-resistant forms is distinctly shown by various xerophilous species of Hibbertia and Pachynema, showing remarkable adaptations and reductions in foliage and habit.

As to altitudinal distribution the tropical representatives are generally confined to the tropical zone proper, i.e. below 1000 m. Exceptions are Hibbertia scandens, found both at low altitude in the Aru Islands and at ca 2300 m on Mt Arfak, and some species of Dillenia, which may occasionally be found up to 1800 m.

Notes. A more extensive treatment of Dillenia, including all extra-Malayans species, will be published in Blumea vol. 7, a similar treatment of Tetracera for Asia, Malaysia, Australia, and the Pacific will be published in Reinwardtia vol. 1. Latin diagnoses of new taxa will be given there.

Additional species of Hibbertia, and possibly also of the other Australian genus Pachynema, can be expected to occur in favorable localities in the extreme Eastern part of Malaysia.

For a proper identification of Dilleniaceae it is of primary importance to have flowering material, fruits is less important. Sterile material is almost worthless.

**KEY TO THE GENERA**

1. Receptacle flat. Carpels completely free or loosely coherent along their adaxial side.
2. Stamens ~ free.
3. Anthercells parallel, connective linear.
4. Small perennials herbs. Petiole with amplexicaul wings
5. Small shrubs or climbers. Leaves clasping, but not completely amplexicaul
6. Anthercells diverging towards the base, connective broadened
7. Androecium consisting of 2 groups, each of 1 stamen and 4 staminodes with coherent filaments

**1. TETRACERA**

Flora Malesiana


Shrubs, sometimes straggling, or lianas. Leaves simple, often scabrid on one or both sides. Petiole short, furrowed. Panicles axillary or terminal, few- to many-flowered. Flowers actinomorphic, fragrant. Sepals 4–5, persistent, often reflexed when in fruit. Petals 3–5, caducous, with emarginate apex, whitish or slightly redish. Stamens ~, with broadened connective, thereby anthercells divergent towards the base. Carpels 1–4, free, with a short style, ending in a simple stigma, with 4–20 ovules. Capsule coriaceous, opening with 1–2 longitudinal slits, ovoid with a short beak, one- to few-seeded. Seed glossy dark brown to black. Aril fleshy, cup-shaped, reddish or purplish, enveloping at least the base of the seed, equal- or unequal-sided with fimbriate or laciniate apical margin.

Distr. The only pantropical genus in the family, absent, however, from the Pacific area except New Caledonia. The Malaysian species are confined to the Asiatic-Australian region. There are two local endemics, viz T. maingayi Hoogl. in the Malay Peninsula and T. lanuginosa Diels in New Guinea. The other Malaysian species have rather large areas.

Ecol. Lianas in rain-forests, on forest margins and in hedges; some species occur as shrubs in open country. Usually below 500 m alt., rarely up to 1300 m. None of the Malaysian spp. shows a distinct flowering-time.

Vern. The Malay name ampelas (ampélas, émpélas, ménpléas, mumplas) is in use throughout W. Malaysia for the whole genus, some species being distinguished by epithets. Akar = root or liana and is also found in a number of combinations.

Uses. The scabrid leaves of some species are used as a substitute for sandpaper; the Malay name for sandpaper has been derived from the plantname: ménpléas. The stems can be used as cordage.

Notes. The genus Delima L., still kept apart by Ridley (Fl. Mal. Pen. 1, 1922, 3), is included here in Tetracera, as has been done already by Vahl (Symb. Bot. 3, 1794, 70). Gilg & Werdermann (in Engl. & Pr. Nat. Pfl. Fam. 2nd ed., 21, 1925, 18) retain Delima as a section of Tetracera. It should be noted, however, that the differences between Delima and Eutetracera are only found in the number of carpels, being 2–6 in Eutetracera, 1 in Delima, usually however on the same plant in a number of flowers 2. Of the 4 Malaysian species, belonging to the section Delima, 2 show close relationships to species belonging to the section Eutetracera, viz T. glaberrima Martelli to T. akara (Burm. f.) Merr. and T. maingayi Hoogl. to T. fagifolia Bl. Delima can be retained as a section on practical grounds only; it does not form a natural taxon.

KEY TO THE SPECIES

1. Carpels 1, in a few flowers on the same plant 2 (section Delima).
2. Carpels and fruit hirsute .......................... 1. T. scandens
2. Carpels and fruit glabrous or with minute scales.
3. Inflorescence up to 5-flowered, usually axillary. Flower ca 2½ cm diam. Sepals 4 .......................... 2. T. glaberrima
3. Inflorescence at least 15-flowered, terminal. Flower ca 1–1½ cm diam. Sepals 5.
4. Sepals glabrous inside .......................... 3. T. asiatica

5. Carpels and fruit hairy over the whole surface.
6. Indumentum of the carpels consisting of rather thin villose hairs, caducous. Species from W. Malaysia .......................... 12. T. arborescens
6. Indumentum of the carpels consisting of rather rigid, persistent, straight hairs. Species from E. Malaysia.
7. Hairs of the carpels ca 2 mm long. Inflorescence 2–4-flowered .......................... 5. T. lanuginosa
5. Carpels and fruit glabrous or with minute scales or with few rigid hairs on the back only.
8. Sepals 4. Inflorescence up to 12-flowered, terminal or axillary, without leaves in the basal part. Flower ca 2½–3 cm diam.
8. Sepals 5–6. Inflorescence at least 15-flowered, rarely less-flowered, terminal, often with small leaves in the basal part, or axillary, but then always on a few-leaved branch. Flower ca 1½–2½ cm diam.
10. Sepals glabrous inside.
11. Branches of the inflorescence strigose, without stellate groups of shorter hairs. 9. T. loureiri
11. Branches of the inflorescence with single strigose to hirsute hairs, together with stellate groups of shorter hairs .......................... 10. T. korthalsii

Liana (up to 30 m) or small shrub (up to 2 m). Leaves oblong to obovate, ca 6–15 by 3–7 cm, scabrid, apex and base rounded to obtuse. Petiole ca 6–12 mm. Inflorescence terminal, many-(up to ca 200)-flowered, with in the basal part 1–5 leaves, up to ca 40 by 20 cm. Flower ca 6–8 mm diam. Sepals 4, on the same plant in some (ca 5%) of the flowers, 5, ca 3 by 2 mm, scabrid outside. Petals 3. Stamens 3 mm long; anthercells reaching each other at the apex. Carpels with 0.4–0.7 mm long rigid hairs; ovules ca 10. Capsule ovoid, ca 10 by 6 mm, 1(–2)-seeded. Seeds 4 by 3 mm. Aril 2–3 mm long, fimbriate for 3/4–9/10 of its length.

Distr. Malaysia: Borneo (Kuching); has been cultivated in the Botanic Gardens at Bogor.

Notes. The species is most closely related to Tetracera akara (Burm. f.) Merr., from which it differs by the single carpel, the less densely sericeous inside of the sepals, and the relatively broader leaves.

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Small shrub (to 3 m) or liana (to 12 m) with scabrid branches. Leaves oblong, 6–12 by 3½–5½ cm, scabrid. Petiole 5–10 mm. Inflorescence terminal, 30–150-flowered, in the basal part often with 1–4 leaves, 10–25 by 5–13 cm; branches scabrid. *Flower ca* 8–10 mm diam. Sepals 5, the outer two 2 by 1½ mm, the inner three 4 by 3 mm, scabrid outside. Petals 3. Stamens 3–4 mm long; anthercells slightly separated at the apex. Carpels with *ca* 10–12 ovules. *Capsule ovoid*, *ca* 6–10 by 4–6 mm with a 2–5 mm long beak, 1–2-seeded. Seeds 4 by 3 mm. Aril 5 mm long, limbricate for ½–3/5 of its length.

**Distr.** Ceylon, Assam, Bengal, Andaman Islands, E. Siam, Indo-China, S. China, in Malaysia: Sumatra, Malay Peninsula, and Borneo.

**Notes.** The species has been separated from *Tetracera scandens* (L.) Merr., in which it has been included until now as a glabrous-fruited variety, as it appeared that the difference in the carpel is connected with the number of sepalas. The calyx in *T. scandens* is tetramerous, only in a few flowers on the same plant pentameres, in *T. asiatica* it is in all flowers pentameres.

Within the species 4 subspecies can be recognized. They differ in the shape of the leaf, but the most characteristic and constant difference is found in the structure of the indumentum. As to this character no intermediate forms have been found. The 2 extra-Malaysian subspecies are geographically isolated; these are *ssp. zeylanica* Hoogl. in Ceylon, and *ssp. asiatica* in E. Siam, Indo-China and S. China (Kwangsi, Kwangtung and Hainan). The areas of the two Malaysian subspecies overlap in the Malay Peninsula.

**ssp. andamanica** Hoogl. *ssp. nov.*

Young branches sparsely strigose together with sparsely to profusely distributed divergent tufts of *ca* 3–12 shorter (0.3–0.5 mm long) hairs; branches of the inflorescence similar. *Leaves* generally narrower than in the second Malaysian subspecies, with acute to obtuse apex and base.

**Distr.** Assam, Bengal, Andaman Islands, in Malaysia: Malay Peninsula (rare).


Young branches hirsute with 1½–2½ mm long hairs together with profusely distributed divergent tufts of *ca* 3–12 shorter (0.3–0.5 mm long) hairs; branches of the inflorescence similar. *Leaves* with rounded apex and rounded to obtuse base.

**Distr.** Malaysia: Sumatra, Malay Peninsula and Borneo.

**Ecol.** In forests, up to 1300 m.

**Notes.** The Borneo record is based on sterile material only (*Tetracera setigera* Korth. *ns.*).


Scandent shrub. *Leaves* oblong, *ca* 7½–15 by 3–6 cm, with acute, somewhat acuminate apex, coriaceous, shining above. Petiole 10–20 mm. Inflorescence terminal, rather many-flowered (up to 250), basal part often with 1–3 leaves. *Flower ca* 12–15 mm diam. Sepals 5, the outer two 3½ by 3 mm, the inner three 5 by 3½–4½ mm, scabrid outside. Petals 3. Stamens 2½ mm long; anthercells manifestly separated at the apex. Carpel 1, with *ca* 6 ovules. *Capsule oblong*, 8–12 by 3–4 mm, with a 2–3 mm long beak. Seeds unknown.

**Distr.** Malaysia: Malay Peninsula (Malacca, Selangor, Penang) and Borneo.

**Ecol.** Seems to be rare in lowland forests up to 200 m.

**Vern.** Malay Peninsula: akar ménépelas, a. m. bélina. Borneo: akar amplan.

**Notes.** The specific epithet *laevis* is already occupied in *Tetracera*, hence a new name is needed. The single Borneo record is based on a specimen in the Singapore herbarium bearing the inadequate indication ‘Borneo, Remow, 1703’.


Liana. Branches hirsute with up to 2 mm long hairs, together with groups of very small, stellately grouped hairs (0.1 mm long). *Leaves* elliptic, 5–7 by 3½–4½ cm, slightly scabrid, with rounded apex and base, rather sparsely hirsute with up to 2 mm long, rather rigid hairs. Petiole 10–15 mm. Inflorescence terminal on a few-leaved lateral branch, few (2–4)-flowered, *ca* 3–4 cm long. *Flower ca* 15 mm diam. Sepals 5, approximately circular, the outer two *ca* 4 mm diam., the inner three *ca* 6 by 7 mm, lanuginose outside together with stellate groups of short hairs, glabrous to very sparsely strongly strigose inside. Petals 3, *ca* 9 by 6 mm. Stamens 2½–3 mm long; anthercells strongly separated at the apex. Carpels 2–3, with *ca* 2 mm long, rather thin, ferrugineous hairs. *Fruit* unknown.

**Distr.** Malaysia: NE. New Guinea (April River, Sepik District), once collected.

**Ecol.** Primary forest; *fl.* in September.

DiELSIACEAE


Shrub or large climber, up to 10 m high, with lightly scabrid branches. Leaves elliptic to lanceolate, ca 5–10 by 3–5 cm, with rounded to acute apex and base. Petiole 5–15 mm. Inflorescence terminal, 15–50-flowered, often with 1–3 leaves in the basal part. Flower ca 6–10 mm diam. Sepals 4–5, the outer two circular, ca 1 1/2–2 mm diam., the inner two or three oval, ca 3–4 1/2 by 2–3 1/2 mm, glabrous or rarely sericeous inside, scabrid outside. Petals 3. Stamens 4–5 mm long; anthercells strongly separated at the apex. Carpels 2–4, usually 3, with rather rigid, 0.5 mm long hairs thinner than in T. scandens (L.) MERR., with ca 10 ovules. Capsules ovoid, 5–8 by 3–5 mm with a 1–2 mm long beak, 1-seeded. Seed ca 3 by 2 1/2 mm. Aril 5 mm long, laciniate to 2 1/2–3/4 of its length.

Distr. Queensland (E. coast), in Malaysia: SE. Celebes (Kabaena Island), Moluccas (Mangoli of the Sula group, Ceram, Ambon, Aru Islands), New Guinea, and Louisiades.

Notes. A very variable species, of which 6 varieties are distinguished here between some of which intermediate forms occur. Most of these have been described as separate species, but to my opinion the differences do not justify to keep them apart. As they show no geographical exclusion I have provisionally accepted them as varieties instead of subspecies. For further study more material, with notes on the habitat, is highly desirable.

KEY TO THE VARIETIES

1. Sepals slightly sericeous inside   var. celebica
   1. Sepals glabrous inside.
   2. Leaves glabrous above.
   2. Leaves more or less hairy above.
   3. Leaves relatively small, ca 5–7 by 3–4 mm. Capsules relatively small, ca 5 by 3 mm.
   4. Indumentum consisting of strigose or strigose-hirsute hairs together with stellate groups of shorter hairs.
   4. Indumentum consisting of strigose-hirsute hairs together with shorter, villose hairs.
   var. nordtiana

var. nordtiana.—T. nordtiana F.V.M. l.c.—T. pilophylla DIELS, l.c.—T. volubilis (non L.) RENDLE, l.c.

Young branches, branches of the inflorescences, leaves and outer side of the sepals with strigose or strigose-hirsute hairs, together with stellate groups of shorter hairs. Sepals glabrous inside. Capsules rather small, ca 5 by 3 mm.


Ecol. Rain-forest climber.

Notes. The Malaysian specimens show transitions to var. moluccana (MARTELLI) HOOG.

var. everillii (F.V.M.) HOOG. stat. nov.—T. everillii F.V.M. l.c.

Young branches, branches of the inflorescences, and leaves hirsute with up to 2 mm long hairs. Sepals villose outside, glabrous inside. Capsules rather large, ca 8 by 5 mm.

Distr. Malaysia: SE. New Guinea (Fly River, once collected).

var. wuthiana (F.V.M.) HOOG. stat. nov.—T. wuthiana F.V.M. l.c.

Young branches, branches of the inflorescences, and nerves on the lower side of the leaves strigose, leaves glabrous above. Sepals sparsely strigose outside, glabrous inside.

Distr. Queensland, in Malaysia: an intermediate form to var. nordtiana in New Guinea (Carr 12832, Koitaki).

Ecol. In forest ca 300 m alt.

var. moluccana (MARTELLI) HOOG. stat. nov.—T. euryandra (non VAHL) ROXB. l.c.—T. moluccana MARTELLI l.c.—T. cowleyana BAIL. l.c.—T. boerlagei MERR. l.c.

Young branches and branches of the inflorescences strigose-hirsute with up to 1 1/2 mm long hairs. Leaves sparsely hirsute with rather rigid, up to 1 1/2 mm long solitary hairs. Sepals strigose with up to 0.7 mm long hairs, single or in groups of 2–5, outside, glabrous inside. Capsules rather large, ca 8 by 5 mm.


Notes. Fruites urens glabra RUMP. Herb. Amb. 5 (1747) 13 may be this species, as has been suggested by MERRILL. The Rumphian description, however, is very defective.

var. louisiana (F.V.M.) HOOG. var. nov.

Young branches and branches of the inflorescences strigose-hirsute with up to 0.8 mm long hairs, together with a rather dense indumentum, closely appressed, of shorter, villose hairs. Leaves hirsute with up to 0.5 mm long hairs, most densely so on the nerves above, densely shortly villose on the intervenium, strigose-hirsute on the nerves beneath. Sepals densely villose outside, glabrous inside. Capsules rather small, ca 5 by 3 mm.

Distr. Malaysia: Louisiades (Joanett Island, once collected).
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Shrub to 2 m or liana to 5 m. Leaves elliptic to oblange or obovate, ca 6–10 by 3–5 cm, usually rather thin, slightly glossy above, not scabrid, with acute to obtuse apex. Petiole ca 6–10 mm. Inflorescence terminal on the main branch or on few-leaved axillary branches, few-(usually 4–7)-flowered, up to 8 by 6 mm. Flowers ca 2½–3 cm diam. Sepals 4, 8–10 by 7–9 mm, glabrous. Petals 3–5, usually 4, reddish white. Stamens 6–8 mm long; anthercells reaching each other at the apex. Carpels 3–4, with a few rigid hairs on the back, ovules ca 10–15. Capsules globular, ca 10 mm diam., with a 2–6 mm long beak, 1–7, usually 2-seeded. Seeds 3½ by 2½ mm. Aril 8–10 mm long, finely fimbriate to nearly its base.

Distr. From Chittagong to S. Bonna, S. Siam and S. Indo-China, once collected in China (Fukien), in Malaysia: Sumatra, Malay Peninsula, Java, Madura, and Kangean.

Ecol. Small shrub in open places; low liana, climbing over low shrubs, in brushwood and open forest. From sea-level to 600 m. According to BACKER & VAN SLOOTEN, l.e., propagation mainly by suckers.

Vern. Sumatra: aplus kēdjong (Djambi), baih siepēk, baih sipēk suluh (Lamp.), djēlāt (Pal.), mēnpaś gada (Sum. E. Coast), sipik suluh (Lamp.) waipit sipit (Mengg.). Malay Peninsula: akar pulas divio, ampalaś (ampēlas, émpēlas, hēmēlas, mēmpēlas), ampalaś līchīn, a. mīhsāk, a. mīνyak, a. payah, kalīntai tiānok, na ampalaś akar, Banka: akar tēnpēlas. Java: akar mēmpēlas (tēnpēlas), ašah, ēmpē as (mēmpēlas) akar, kaju aśa(ah) (Mal.): (areq) kī aśa(ah) (Sund.); bo (Jav.). Kangean: buko-buko.

Uses. For Cordage; leaves (Berkill, l.e.) as sandpaper? Medical use unimportant, cf. Berkill, l.e.


High climbing or creeping liana, up to 25 m. Leaves oblong to lanceolate, ca 8–13 by 3½–6 cm, rather coriaceous, bright glossy green above, not scabrid, with acuminate apex. Petiole 5–7 mm.
Inflorescence terminal or axillary, few-(usually 5-8)-flowered, up to 8 by 6 cm. Flowers ca 2½-3 cm diam. Sepals 4, 8-10 by 6-8 mm, glabrous outside, densely sericeous on the centre inside. Petals 3-4, white or greenish white. Stamens 7-8 mm long; anthercells reaching each other at the apex. Carpels 3-4, with 10 ovules. Capsules globular, ca 10 mm diam., with a 1-2 mm long beak, 1-seeded. Seeds 3½-5 mm long, laciniate to ½(3½) of its length.

Distr. S. India, Ceylon, in Malaysia: Sumatra, Malay Peninsula, W. Java, Borneo, and Celebes.

Ecol. In lowland forests, up to 750 m alt.


Notes. *T. axillaris* Martelli represents a small-leaved form, to my opinion of no taxonomical value. The acuminate, glossy leaves are typical for the species.


Low climber. Leaves elliptic to oblong, ca 5-11 by 2½-6 cm, rather coriaceous, not or slightly scabrid, with rounded or obtuse apex. Petiole ca 7-10 mm. Inflorescence terminal, many-(usually 40-80)-flowered, often with 1-2(4) leaves in the basal part, 10-20 by 5-10 cm. Flower ca 10 mm diam. Sepals 5, the outer two ca 4½ by 3½ mm, the inner three 6½ by 4½ mm, slightly scabrid outside. Petals 3. Stamens 4-5 mm long; anthercells manifestly separated to nearly reaching each other at the apex. Carpels 2-3, with 8-16 ovules. Capsules ovoid, 7½ by 5½ mm with a 2 mm long beak, 1-2-seeded. Seeds 2-3 mm diam. Aril unequal-sided, 2-6 mm long, laciniate to ½(3½) of its length.

Distr. Siam and S. Indo-China, in Malaysia: only in the N. of the Malay Peninsula.

Ecol. In thickets and hedges, from sea-level up to 400 m.

Vern. In the Malay Peninsula noted only: mêmûpelas.


Large climber or creeper with scabrid branches. Leaves broadly elliptic to elliptic-oblong or obovate, smooth to slightly scabrid on both sides. Inflorescence 40-200-or more-flowered, terminal, basal part often with 1-2 leaves, 10-30(100) by 6-20 cm, with more or less scabrid branches. Flower ca 10 mm diam. Sepals 5(-6), the outer two 4½ by 3, the inner three (or four) 5 by 4 mm, scabrid outside. Petals 3. Stamens 3½-4 mm long; anthercells strongly separated at the apex. Carpels 3, with ca 9 ovules. Capsules ovoid, ca 7 by 4 mm with a 1-2 mm long beak, 1-seeded. Seeds 4½ by 3½ mm. Aril unequal-sided, 2½-5 mm long, laciniate to ½(3½) of its length.

Distr. Malaysia: Borneo, Palawan, Celebes, W. Moluccas (Taliabu of the Sula group).

Notes. The species can be divided into 2 varieties on account of the leaf-shape; there are no differences in floral characters and intermediate forms are unknown.

var. korthalsii.

Leaves elliptic-oblong, ca 6½-17 by 4-8 cm; apex acute or slightly acuminate, base acute. Petiole ca 8-20 cm.

Distr. Malaysia: Borneo, Celebes, W. Moluccas (Taliabu).

Ecol. Climber in forests, up to 700 m alt.

Vern. Borneo: empélas (Mal.), pampad (Dusun).

Uses. Used for polishing wood.

var. subrotunda (ELM.) HOOGL. STAT. NOV.—*Tetracera subrotunda* ELM. L.C.—*Tetracera elmeri* MERR. L.C.

Leaves broadly elliptic, ca 8½-22 by 5½-13 cm; apex and base rounded. Petiole 12-30 mm.

Distr. Malaysia: Br. N. Borneo (Tawao), Philippines (Palawan).

Ecol. A large climber in primary forest at low alt.

Notes. *Tetracera elmeri* MERR. represents a hirsute form.


Liana up to 10 m or ?tree; younger branches usually more or less scabrid. Leaves elliptic to oblong, ca 8-15 by 5-10 cm, little to very scabrid, with rounded to obtuse apex and base. Petiole ca 15-30 mm long, 2-4 mm broad, up to 8 mm broad in the leaves at the base of the inflorescences. Inflorescence terminal, 25-200-flowered, often with 1-4 leaves in the basal part, 10-40 by 4-15 cm; branches scabrid with stellate groups of hairs. Flower ca 2½-3 cm diam. Sepals 5-6, the outer two 8-9 by 7-8 mm, the inner 3-4 11-12 by 8-9 mm, scabrid outside. Petals 3, rather thick, apex not emarginate. Stamens 5-7 mm long; anthercells mani-
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Strong woody climber, shrub or small tree. Younger branches villose to densely villose-floccose. Leaves obovate to elliptic-oblong, ca 6–10 by 3–5 cm, coriaceous, not scabrid, the upper ones under the inflorescence 3–4 by 2–3 cm, often villose-floccose when young. Petiole 3–5 mm. Inflorescence terminal, (6–)10–50-flowered, up to 15 by 6 cm. Flower ca 15 mm diam. Sepals 5–6, ca 5 by 3 mm, slightly scabrid outside. Petals 3, white. Stamens 4–5 mm long; anthercells slightly to manifestly separated at the apex. Carpels 3, with ca 10–12 ovules. *Capsules* ovoid, 7 by 4 mm with a 2–3 mm long beak, l-seeded. Seeds 2½ by 1½ mm. Aril 3–5 mm long, laciniate to half its length.

Distr. Malaysia: Sumatra (Tapanuli, East Coast), Malay Peninsula, Banka, Billiton, Borneo, and ?W. Java (Papandajan, KORTHALS).

Ecol. Swampy forests, riverside scrubs, only at low altitudes.


Notes. Jack's description is insufficient. From study of a specimen of *Jack*, present in the Leyden herbarium, it is clear that the present species was meant.


Liana, up to 14 m high, branches slightly scabrid. Leaves elliptic to lanceolate, more or less coriaceous, usually shining. Petiole ca 7–20 mm. Inflorescence terminal, ca 40–250-flowered, often with 1–3 leaves in the basal part, ca 15–40 by 8–25 cm; branches scabrid, with small tufts of 0.2–0.4 mm long hairs on the extreme branches only. Flower ca 8–12 mm diam. Sepals 5–6 (–7) by 4½–5½ mm, scabrid outside. Petals 3. Stamens 4½–6 mm long; anthercells manifestedly separated at the apex, connective somewhat emarginate between them. Carpels 3, with ca 10 ovules. *Capsules* ovoid, 5–8 by 4–6 mm, with a 1–3 mm long beak, 1(–2)-seeded. Seeds 5 by 3 mm. Aril ca 7 mm long, unequal-sided, laciniate to 1½–1½ its length.


Notes. The 2 varieties, distinguished here, differ only in their vegetative parts. There is a relatively small number of intermediate forms.

The first to consider *T. fagifolia* Bl. and *T. rigida* Bl. as conspecific was *MIQUEL* (1868) l.c., who used the first name.

var. *fagifolia*.

Leaves ca 12–16-nerved, 1.4–2.25 times as long as broad, ca 7–20 by 5–10 cm; the lateral nerves curving upward, ending in the margin.

Distr. Malaysia: Sumatra (incl. Simalur and Mentawai), Malay Peninsula (Johore), W. Java, Borneo, Philippines.

Ecol. Climber in primary forest, in scrub or in bamboo forest, 100–750 m alt.


var. *borneensis* (MIq.) *HOOG. stat. nov.—Tetracera borneensis* MIq. l.c.

Leaves ca 8–10-nerved, 1.4–3.5 times as long as broad, ca 6–13 by 2.7–5.5 cm; lateral nerves not quite reaching the margin.

Distr. Malaysia: Sumatra (Muara Mengkulem, once collected), Banka, Borneo, SE. Celebes (Kendari).

Ecol. Primary forest; on Mt Kinabalu up to 1300 m.
Fig. 2. *Tetracera fagifolia* Bl. *a.* Flowering branch. $\times \frac{2}{3}$, *b.* flower, $\times 2$, *c.* stamen, $\times 7$, *d.* fruits, $\times 2$, *e.* seed enveloped by aril, $\times 4$. 
2. HIBBERTIA


Small ericoid or erect shrubs, rarely trees or lianas, mostly much branched. Leaves spirally arranged, rarely opposite (Madagascar), simple, often with reflexed margins. Inflorescence dichasial, usually reduced to a few-flowered pseudo-raceme, spike or to solitary flowers. Bracts and bracteoles often present. Flowers sessile or shortly pedicellate. Sepals 5. Petals 5(−3). Stamens n = 3, often partly staminodial, either surrounding the carpels regularly or reduced on one side, free or slightly connate at the basis, introrse, opening with longitudinal slits, rarely with apical pores. Carpels n = 1, with 15–1 ovules, free. Style filiform, usually curved or recurved. Follicles usually one-seeded. Seed arillate.

Dist. A large genus with ca 100 species in Australia and Tasmania, 20 in New Caledonia, one in the Fiji Islands, two in extreme Eastern Malaysia, and one in Madagascar (fig. 3).

KEY TO THE SPECIES

1. Stamens and staminodes all placed on one side of the carpels. Carpels 2. Shrubs 1. H. banksii

1. Stamens placed regularly round the carpels, without staminodes. Carpels 5. Scandent 2. H. scandens

Fig. 3. Distribution of the genus Hibbertia. Separately indicated are the areas of H. banksii (R.Br. ex DC.) Bth. (…), H. scandens (Willd.) Dryand. (3 black spots), and H. scandens var. novoguineensis (Gibbs) Hoogland. (+).


Shrub 1–2 m. Leaves oblong-lanceolate with a few obtuse teeth, stiff with recurved margins, glossy green above, pubescent below with a rusty brown tomentum on the nerves and a yellowish tomentum on the intervenium, 5–15 by 0.7–3 cm. Raceme axillary, 5–12-flowered, 4–6 cm long. Flowers almost sessile. Sepals oblong, acute, densely hairy outside, 8 by 4 mm. Petals yellow, obovate with emarginate apex, 14 by 7 mm. Stamens ca 25, 3½ mm long; staminodes ca 12, on the outside of the stamens, 2.7 mm long. Carpels densely hairy, with 3 ovules. Follicles one-seeded, thin-walled. Seed with membranaceous aril.

Dist. N. Queensland, E. coast, rare, in Malaysia: S. New Guinea, Wassi Kussa River region, once collected (fig. 3).

Ecol. The only New Guinea specimen was found in Agonis scrub.


Low scandent shrub. Leaves lanceolate, acute to acuminate, slightly hairy above, rather densely to densely hairy beneath, 3–12 by 0.4–2½ cm. Flowers solitary on short few-leaved side-stalks, ca 4 cm diam. Sepals ovate, acute, densely hairy outside, woody, 15–18 by 8–9 mm. Petals yellow, obovate with slightly emarginate apex, ca 2 by 1.4 cm. Stamens n = 5, 7–9 mm long. Carpels glabrous, with 6 ovules. Follicles 1–6-seeded. Seed with membranaceous aril.
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**DiLENiACEAE**

**6.** in (1862) (1872) (1890) (1893)6. in (1862) (1872) (1890) (1922) (1855) in (1949) 151

extreme Guinea Dec. Jack, Islands a Ceyl. Gen. and ent usually short figs. irregularly naceous, (1855) Soc. 1. 175; Distr. novoguineensis the Hk./. Beng. in 65; PI. (Trangan: Hb bertia scandens (Willd.) Dryand. var. novoguineensis (Gibbs) Hoogl. stat. nov. (H. novoguineensis Gibbs) with leaves densely hairy beneath, smaller and narrower, 3-8½ by 0.4-1 cm (Arfak Mts). The stamens in the type specimen of H. novoguineensis are 7 mm long, in the collection of Kanehira & Hatusima 9 mm, in var. scandens they are 9 mm. In var. novoguineensis the anthercells are relatively longer than in var. scandens. These differences, however, do not justify to my idea the distinction of the two forms as separate species.

**Ecol.** In Trangan at low alt., on the Arfak Mts between 2000 and 3000 m in low spinneys on burnt open summit.

**Notes.** In Malaysia two varieties can be distinguished on the leaf-shape: var. scandens with leaves rather densely hairy beneath, 6-12 by 1.2-2½ cm (Trangan Island), and var. novoguineensis (Gibbs) Hoogl. stat. nov. (H. novoguineensis Gibbs) with leaves densely hairy beneath, smaller and narrower, 3-8½ by 0.4-1 cm (Arfak Mts). The stamens in the type specimen of H. novoguineensis are 7 mm long, in the collection of Kanehira & Hatusima 9 mm, in var. scandens they are 9 mm. In var. novoguineensis the anthercells are relatively longer than in var. scandens. These differences, however, do not justify to my idea the distinction of the two forms as separate species.

**3. ACROTREMA**


Perennial herbs with a horizontal, woody rhizome. Leaves all radical or on a short stem, simple, pinnatisect or pinnate, the petiole with sheathing, membranaceous, caducous wings. Inflorescence a terminal raceme, sometimes reduced to a single flower, with membranaceous bracts. Flowers 5-merous. Stamens 15–∞, usually in 3 bundles alternating with the carpels. Carpels usually 3, slightly coherent in the centre, with linear, recurved styles, with 2–6 or 10–20 ovules. Follicles irregularly dehiscing, with 1–15 seeds. Seeds with a white membranaceous aril.

**Distr.** Ca 10 spp., 1 in the Deccan Peninsula and 8 in Ceylon, 1 in Lower Burma, Peninsular Siam and the Malay Peninsula (fig. 5).

Stem from very short up to 25 cm long. Leaves obovate, dentate, base auriculate, hairy, deep green, often with a whitish line along the midrib, 7-25 by 3-10 cm; petiole 1-2(-6) cm. Raceme 9-13 cm, erect, ca 10-12-flowered; bracts ca 6 by 2 mm. Flowers yellow, diam. 3 cm, opening singly; pedicel 5-15 mm long. Carpels 3, with 2-6 ovules. Follicles enclosed by the sepals. Seeds finely echinate.

Distr. Lower Burma, Peninsular Siam, in Malaysia: Malay Peninsula, N. Sumatra?, Banka?

Ecology. In dense, wet forests or on moist shady rocks; up to 1000 m alt.

Vern. Once noted: pinai tanah (Pahang).

Notes. One Sumatra record is based on a specimen, collected by Batten Pooll, labeled only: Sumatra, 1939; the other is based on a note by Jack (cf. Gage & Burk, l.c.). Of the Banka record (cf. Kurz, l.c.) I have seen no material. The Borneo record of Merrill, l.c., was based on a specimen of Neurocalyx sp. (Rubiaceae).

4. DIDESMANDRA

Stapf in Hook. Icon. t. 2646 (1900).

Woody plants with scabrid, hairy branches. Leaves with amplexicaul sheath and short petiole. Flowers regular in calyx and corolla, zygomorphic in androecium and gynoecium, placed one-sided on simple or bifurcate branches of a 4-6-branched panicle with reduced central axis, almost sessile. Sepals and petals 5. Stamens in 2 bundles on the adaxial side of the carpels, each bundle consisting of 1 stamen and 4 staminodes with connate filaments, the stamen uncinate curved, exceeding the staminodes, with longitudinally dehiscent linear anthercells, the connective forming a deltoid membrane above the cells, the staminodes only slightly curved. Carpels 2, with a long filiform style; ovule 1, inserted at the base. Fruit a nut. Seed with a thin membranaceous aril.

Distr. Monotypic, known only from Borneo.
Fig. 7. Didesmandra aspera Stapf. a. Habit, $\times \frac{1}{2}$, b. flower, $\times \frac{1}{2}$ (after Staff), c. stamen and 4 staminodes, $\times 3$, d. tip of staminode, $\times 10$, e. ditto of stamen, $\times 10$, f. ovary, $\times 3$, g. seed (black) with unilateral aril, $\times 3$. 
Notes. Most closely allied to *Schumacheria Vahl* from Ceylon, which has many stamens in one bundle, without staminodes.

1. Didemandra aspera Stapf, *l.c.*; Merr. En. Born. (1921) 382.—*Fig. 7.*

Plant ca 2½ m high. Leaves scabrld, ovate, apex acute, base rounded, margin slightly toothed, 15–30 by 7–13 cm, 12–16-nerved; nerves prominent and hairy beneath; petiole channelled, 1½–3 cm. Inflorescence 15–20 cm long. Flowers ca 5 cm diam. Sepals elliptic-oblong, the 2 outer ones smaller. Petals obovate, 25 by 13 mm, yellow. Filament 2 mm long, 1 mm thick, anther 17 mm long, sterile anthers 8–10 mm. Carpels and fruit glabrous; style 15–20 mm.

Distr. *Malaysia*: Borneo (Sarawak), twice collected.

5. Dillenia


Trees or shrubs, often with reddish bark peeling off in thin papery scales. Leaves spirally arranged, simple. Petiole in a number of species with usually wholly caducous, rarely partly or wholly persistent, broad wings, amphicaucaul in the young leaf and then enclosing and protecting the terminal bud. Inflorescence a composed or simple raceme, in a number of species reduced to solitary flowers, usually terminal on consequently sympodial branches, in one species axillary; one species with terminal and cauline inflorescences, some other (mainly extra-Malaysian) ramiflorous with fascicled flowers. Bracts small, caducous, or obsolete. Bracteoles well developed in some *spp.*., in others obsolete. Flowers actinomorphic. Sepals (4–)5–(6), in a few species more, concave. Petals 5, in some species absent, in one species 4–6, usually obovate with rounded apex, yellow or white, rarely reddish. Stamens ~, all of approximately the same length or of different lengths arranged in 2 or more, not always sharply separated groups; occasionally part of the outermost stamens staminodial, in some species a wholly staminodial outer group, in one species a wholly staminodial inner group. Anthercells parallel, opening usually with a terminal pore, less often with longitudinal slits. Carpels 4–20, coherent along the cuneate central part of the receptacle, with filamentous or linear, more or less spreading styles; stigma in most *spp.* indistinct, only in 2 species (*D. serrata Thunb.* and *D. celebica Hooglio.*) distinct, knoblike. Ovules 6 to ca 60. Fruit either dehiscent, the rather fleshy carpels spreading like a star, or indehiscent, enclosed by the more or less enlarged and thickened sepals. Seeds arillate or exarillate, glabrous or rarely finely echinate.

Distr. Ca 60 *spp.*, from Madagascar and the Seychelles to the Fiji Islands, in the North to the *S.* slopes of the Himalayas, Yunnan, Kwangsi and Kwangtung, in Australia only one species on the E. coast of Queensland; not in New Caledonia. The most widespread species are *D. indica* L. (from India to Borneo and Java) and *D. pentagyna* Roxb. (cf. fig. 12). There are a number of local endemics, particularly in the Philippines, New Guinea, and the Pacific Islands.

Ecol. Most species occur in evergreen forests on dry to very wet soil. Some decidious species are found in monsoon forests or savannahs, one evergreen species in savannahs of New Guinea and N. Australia. As to altitudinal distribution the species generally occur below 1000 m, but some are occasionally found above this altitude, up to 2000 m; one species (*D. montana Diels*) has been collected only above 1000 m.

Stilt-roots occur constantly only in a few species, *viz.* *D. borneensis Hooglio.*, *D. eximia Miq.*, and *D. reticulata King*; in a few others they may be occasionally developed, *e.g.* in *D. papuana Martelli* and *D. albiflos* (Ridl.) Hooglio.

The leaves of saplings and young plants are often considerably larger than those of the full-grown plants. In most cases these leaves are relatively narrower, without showing a distinct dimorphism. In
Fig. 8. *Dillenia papuana* Martelli. a. Fruiting branch, $\times \frac{2}{5}$, b. winged petiole of young leaf, $\times \frac{2}{5}$, c. inflorescence, $\times \frac{2}{5}$, d. longitudinal section of flower during full anthesis, $\times \frac{4}{5}$, e. stamens, $\times 2$, f. apex of anther, $\times 4$, g. seed with aril, $\times 2$. 
D. ferruginea (BAILL.) Gilg from the Seychelle Islands, however, a distinct leaf-dimorphism is found between these leaves. In a less degree this is found in Malaysia in D. pentagyna ROXB. and probably in D. pteropoda (MIQ.) HOOG.

In some species the petals drop without having opened in anthesis. In Malaysia this is found only in D. papuan a Martelli and some other New Guinean species.

The dispersal of fruits and seeds is effected mainly by animals. The indehiscent fruits would be eaten mainly by mammals, the arillate seeds of the species with dehiscent fruits by birds. Transport by water is a means of dispersal in D. indica L.

Uses. Though sometimes used for light constructions, the wood is generally of low value because of the short durability. D. pentagyna ROXB. is used for making a charcoal of good quality.

The indehiscent fruits of some species are eaten, in particular in curries and jellies; they have an acid taste. Mixed with syrup they make a cough mixture, and they are sometimes used for washing the hair.

Because of the beautiful flowers and foliage a number of species are suitable as ornamental trees or shrubs, e.g. D. indica L., D. philippinensis ROLEF, and D. suffruticos a (GRIP.) MARTELLI.


Vern. The Malay name 'simpur' (simpoh, sempur, etc.) is in general use throughout W. Malaysia, some species being distinguished by epithets. In the Philippines 'katmon' is in general use.

Notes. Several classifications of the genus have been proposed, the basic one usually being in Dillenia and Wormia as separate genera or subgenera on account of the fruit (indehiscent versus dehiscent) by some authors, on account of the seed (exarillate versus arillate) by others. Other subgeneric classifications are based on the base of the petiole (amplexicaul versus non-amplexicaul) or on the structure of the androecium. It is impossible, however, to distinguish groups, characterized by the combination of more than one character: relationships within the genus are relictual.

Martelli in BECC. Malesia 3 (1886) 150-167 was the first to unite the genera Dillenia and Wormia. He listed the species of both genera, but failed to make formally the new combinations, which have been ascribed to him by DUR. & JACKS. in the first supplement of Index Kewensis.

An important character of the androecium is the position of the anthers in bud; in a number of species the inner row is reflexed outwards. This may be permanent in anthesis. I have used the term ‘straight’ or ‘straight or slightly curved’ in all other cases.

The sequence of the species as adopted here reflects as far as possible their affinity.

KEY TO THE SPECIES

1. Basis of the petiole, later leaf-scar, completely amplexicaul.
2. Petiolar wings not constricted below the blade. Nervation of the wings not sharply separated from that of the blade, though often less distinct.
3. All stamens of approximately the same length. Flowers white ........ 1. D. pteropoda
4. Petiolar wings more or less constricted below the blade. Wings without distinct nervation or nervation different and independent from that of the blade.
5. Sepals 8 or more.
6. Sepals 8-9, not much different in size ........ 13. D. marsupialis
7. Sepals 11-17, distinctly increasing in size towards the centre ........ 14. D. reifferscheidia
8. Sepals 4-6, usually 5.
9. Stamens gradually decreasing in size towards the centre of the flower, the innermost ones staminodial .......... 12. D. fagifolia
10. Stamens all of approximately the same length or the innermost ones longer than the outer ones. If present, staminodes on the outside.
11. All stamens of approximately the same length.
12. Carpels hirsute.
13. Inflorescence simple, distinctly zigzag. Flower ca 6½ cm diam., yellow ........ 2. D. heccariana
14. Inflorescence usually composed, with only slightly zigzag axes. Flower ca 4 cm diam., white.
15. D. albiflora
18. Petiolar wings semi-obcordate. Flowers rather large (e.g. stamens ca 9-11 mm long).
19. Petiolar wings broadly linear. Flowers smaller (e.g. stamens ca 6-7 mm long).
20. D. celebica
10. Stigma indistinct. Flowers with (caducous!) petals.
12. Upper part of petiolar wings persistent
13. Carpels 4–6, usually 5
15. Stamens with a 1–2 mm long acumen at the apex
16. Connective at most slightly exceeding the anther cells.
17. Younger parts with dense villose indumentum
18. Younger parts glabrous or slightly hirsute.
19. Leaves ovate, ca 15–19-nerved. Sepals ca 25 by 22 mm
20. Leaves elliptic, ca 6–9-nerved. Sepals ca 15 by 12 mm
7. Innermost stamens longer than the outer ones, with the apical part reflexed outward in bud.
17. Apex of petiolar wing for ca 1/4 or more of its length exceeding its insertion to the petiole.
18. Flowers solitary on a pedicel, terminal. Apex of the petiolar wings rounded.
19. Flowers ca 6–8 cm diam. Carpels 6–9
18. Flowers in a 2–3-flowered raceme. Apex of the petiolar wings obtuse
17. Apex of the petiolar wing not or hardly exceeding its insertion to the petiole.
20. Upper part of petiolar wings persistent
21. Petiolar wings wholly caducous, or at most small auricles persistent near the basis of the blade.
21. Petiolar wings elliptic-oblong. Flowers large, more than 10 cm diam.
20. D. philippinensis
21. Petiolar wings narrower. Flowers smaller, up to 10 cm diam.
22. Leaves elliptic to oblong, rather coriaceous, 5–8-nerved
23. Leaves oblong to lanceolate, not coriaceous, 8–20-nerved.
23. Apex of the leaf acuminate. Plant often cauliflorous. Flowers whitish
22. A. bolsteri
24. Leaves glabrous, 8–12-nerved
24. Leaves at least the young ones, stipitate on the nerves beneath, 10–18-nerved.
23. D. auriculata
24. D. castaneifolia
1. Basis of the petiole, later leaf-scar, not completely amplexicaul, clasping up to 3/4 of the branch.
25. Inflorescence or solitary flowers typically terminal on leaf-bearing branches, often later lateral, leaf-opposed. Branches consequently sympodial.
26. Deciduous trees, with stilt-roots. Inflorescence appearing with the leaves, often immediately at its base with 2 or 3 branches, forming a loose cluster.
27. Carpels 4–6. Stamens all of approximately the same length. Flowers apetalous
25. D. eximia
27. Carpels 7–10. Stamens not all of the same length. Flowers with (caducous!) petals.
28. Carpels 7–8. Petiole densely hisrate above, nearly glabrous beneath
26. D. borneensis
28. Carpels 9–10. Petiole more densely hairy beneath than above
27. D. reticulata
29. Stamens all of approximately the same length. Pedicel with 3 large verticillate bracteoles. Leaves densely velvety tomentose beneath
28. D. hookeri
29. Stamens in 2 sharply separated groups of different length. No such bracteoles. Leaves not densely velvety tomentose beneath
30. Carpels less than 12.
31. Carpels 6 or more.
32. Flowers in 4 to many-flowered inflorescences.
33. Inflorescence continuously growing. Upper internodes of inflorescence up to 1 cm long. Leaves 6–15 by 3–7 cm
33. Inflorescence with only short time of growth. Internodes of inflorescence longer. Leaves 15–30 by 7–10 cm
32. Flowers solitary or in 3-flowered inflorescences.
33. Leaves small (up to 7 by 21/2 cm), lanceolate, coriaceous
34. Leaves much larger.
35. Leaves elliptic with rounded apex. Flowers ca 16 cm diam
35. Leaves oblong with obtuse to acute apex. Flowers ca 6 cm diam
31. Carpels 4–5
34. Carpels 6 cm diam
31. Carpels 15–20
35. Carpels 21/2–31/2 cm diam
37. Flowers axillary. Evergreen species with small leaves
36. D. pulchella
37. Flowers in twig-born fascicles. Deciduous species with large leaves
37. D. pentagyna
36. Carpels 9–11. Flowers large, ca 15 cm diam
38. D. obovata

Large tree, up to ca 40 m high, up to 1½ m diam. Bark red-orange, peeling off in plates. Leaves elliptic, subcoriaceous, ca 17–21-nerved, 30–100 by 16–60 cm, blade with rounded to obtuse apex, obtuse to acute base and entire to slightly undulate-dentate margin. Petiole ca 5–10 cm long, wings up to 2½ cm broad, often caducous. Raceme simple, ca 4–7-flowered, up to 40 cm long. Flowers ca 10 cm diam. Sepals 5, ca 25–33 by 20–22 mm, slightly to densely velvety outside. Petals white, ca 45–50 by 30–32 mm. Stamens 700, 14–18 mm long. Carpels 8–12, ca 10 by 3½ mm, with 1 cm long styles, each with ca 25 ovules. Fruit dehiscent. Seeds surrounded by a basal, loose, somewhat cup-shaped aril.

**Distr. Malaysia:** Philippines (N. Luzon, Mindanao) and N. Moluccas (Halmahera, Batjan).

**Ecot.** In primary forests, often along streams, from sea-level up to 500 m.

**Vern.** Philippines: *tukoran* (Lam.), *maleigang* (Sul.). Moluccas: several names recorded, but none constant.

**Notes.** Teusmann 5886 from Batjan probably represents leaves from a coppice or from a young plant. The leaves are manifestly dentate and have a very short petiole. They are narrower than in the other specimens, ca 90 by 28 cm, with more lateral nerves (ca 40–50).

**Dillenia papyracea** Merr. and *D. megalophylla* Merr. differ only in the length of the pedicel; this does not seem sufficient argument to keep the two separated. From the Moluccas (including the type specimen) only sterile material is available.


Small tree, up to 6 m high. Leaves oblong to narrowly obovate, ca 20–30-nerved, 18–45 by 8–16 cm, with obtuse, often acuminate apex, rounded to obtuse base and slightly to manifestly dentate margin. Petiole ca 3–6 cm long; wings near their base 4–9 mm broad, gradually narrowing towards the base of the blade, coherent with the blade over a breadth of 1½–2 mm, when older loosening from the base of the blade and near the base of the petiole, but not caducous. Raceme up to 20–flowered, up to 60 cm long, distinctly zig-zag. Flowers ca 6½ cm diam. Sepals 5, ca 17–20 by 14–15 mm. Petals yellow, ca 33 by 22 mm. Stamens ca 130, 11–13 mm long. Carpels 5–6, ca 8–10 by 2 mm with ca 5 mm long styles, the carpels and the base of the styles densely covered with rigid, up to 2 mm long hairs; each with ca 20 ovules. Fruit dehiscent, but the carpels possibly only slightly spreading, the young fruit not enclosed by the sepals. Carpels 25 by 16 mm, 1–3-seeded. Seeds 4 by 2½ mm, with a 0.2–0.4 mm long membranaceous aril.

**Distr.** Malaysia: Borneo (Sarawak).

**Ecot.** In low altitude forests.

**Vern.** Simpoth, *s. delaki* (= male s.), pétasi.

**Notes.** Closely related to *D. albillos* (Ridl.) Hoog.


Tree, up to 17 m high, with red bark, rarely with few stilt-roots. Leaves elliptic to oblong, ca 15–35-nerved, 20–40 by 9–20 cm, with rounded to acute, often slightly acuminate apex, rounded to obtuse base, and slightly undulate to manifestly dentate margin. Petiole ca 2½–4 cm long; wings near the base 5–11 mm broad, gradually narrowing towards the base of the blade, coherent with the blade over a breadth of 1–2 mm, when older loosening from the base of the blade and near the base of the petiole, but not caducous. Inflorescence pendent, up to 30-flowered, composed, being a raceme with the second and often third flower replaced by a secondary raceme, the branches slightly zig-zag. Flowers ca 4 cm diam. Sepals 5, ca 15–20 by 12–14 mm. Petals pale cream white, ca 20 by 13 cm. Stamens ca 160, 5½–8 mm long. Carpels 5–6, ca 4–5 by 1½ cm with ca 5 mm long styles, the carpels and the lower half of the styles rather densely covered with rigid, 0.4–0.7 mm long hairs, each with ca 10 ovules. Fruit dehiscent, the sepals in fruit enlarged to 25 by 15 mm. Carpels 10 by 12 mm, 1–2-seeded. Seeds 4 by 3 mm, finely echi-nate, with a 1 mm long membranaceous aril.

**Distr. Malaysia:** S. Malay Peninsula (E. Johore).

**Ecot.** In dry forest and on dry hillocks in swamps, at low altitude.

**Vern.** Only noted: simpoth.

**Notes.** Closely related to *D. beccariana* Martelli, from which it differs by the composed inflorescence, white, slightly smaller flowers and less densely hairy carpels with distinctly shorter hairs. According to Corner (fieldnote) the biggest trees have the biggest leaves.


Rather large tree, up to 30 m high and 70 cm diam., with thinly scaling, reddish gray bark. Leaves oblong to lanceolate, 16–35-nerved, 20–45 by 8–19 cm, with rounded to acute apex, obtuse to acute base, and nearly entire to manifestly dentate margin. Petiole 2½–6½ cm long, with half-obcordate, caducous wings. Wings broadening towards the apex, the apex rounded, extending
distinctly above its insertion, at the basis 5–8, near the apex 15–30 mm broad, glabrous to densely sericeously hirsute beneath. Raceme 2–6-flowered, up to 15 cm long with straight or rather tortuous axis. Flowers probably apetalous, ca 7 1/2 cm diam. Sepals 5, ca 40 by 25 mm, densely sericeously hirsute outside. Stamens ca 750, 9–11 mm long. Carpels ca 18–19, ca 4 1/2 by 1 1/2 mm, with ca 8 mm long, in the basal half parallel, in the apical half slightly spreading styles with a cushion-shaped stigma, stigma ca 0.4 mm thick and 1 mm diam.; each carpel with 5–9 ovules. Fruit indehiscent, yellowish, appressed globular, 3 1/2 cm high, 6 cm diam. including the enclosing sepals. Sepals in fruit enlarged to 6 x 1/2 by 5 1/2 cm, at the base up to 3 mm thick, not completely covering the carpels at the apex. Carpels 25 by 16 mm, up to 5-seeded. Seeds black with reticulate surface, exarillate.

Distr. Malaysia: Celebes, Buton, and Muna Islands.

Ecol. In primary forests up to 180 m.

Uses. The fruit is eaten.


Notes. Thunberg's binomial is wholly based on Sangiisium Rumph. Rumphius' description and plate are sufficient for the recognition of the species. Dillenia elliptica Thunb. is wholly based on Sangiisium Ecol. Distr. Uses. Rumphius'. The identification of this species is much less certain, but the present species is the only one, that Rumphius' description and plate can be compared with, except that the flowers in Rumphius' species are solitary.

5. Dillenia celebica Hoogl. spec. nov.

Tree, up to 30 m high, 50 cm diam., with small buttresses, greyish brown bark, slightly flaky in large plates, and greyish red heartwood. Leaves elliptic-oblong, ca 15–20-nerved, 13–18 by 6–10 cm, with obtuse to acute, often slightly acuminate apex, rounded-obtuse to obtuse base, and undulate to dentate margin. Petiole 4–8 cm long, with usually 2 1/2–5 mm, rarely up to 10 mm broad wings; wings with slightly auriculiform apex, caducous. Raceme 1–5-flowered, up to at least 4 cm long. Flowers apetalous, ca 4 1/2 cm diam. Sepals 5, ca 21–25 by 16–19 mm, sericeous outside. Stamens ca 300, 6–7 mm long. Carpels ca 11, ca 8 by 3 1/2 mm, with ca 7 mm long spreading styles with a cushion-shaped stigma, stigma ca 0.3 mm thick and 0.8 mm diam.; each carpel with 3–4 ovules. Fruit unknown.


Uses. The wood is used for house-building.

Notes. Closely related to D. serrata, also endemic of Celebes, from which it differs by the much longer petioles, the shape of the petiolar wings, and the much smaller number of carpels. The 2 species are the only ones, where a distinct, knobbylike stigma is found in Dillenia.


Tree, up to 30 m high, 60 cm diam., with abso-
lutely glabrous branches. Leaves rather coriaceous, elliptic to nearly orbicular, 8–13-nerved, 7–27 by 6–22 cm, with rounded apex and base and slightly undulate margin; in bud folded thus as to leave a faint, longitudinal line between each pair of lateral nerves. Petiole 4 1/2–10 cm long, with 5–10 mm broad wings, with a horseshoe-shaped cushion at the insertion. Wings linear with rounded apex, partly caducous, the part falling off being the whole breadth at the base of the petiole, gradually narrowing to a wholly persistent wing at 1 1/2–3/4 of the petiole; apex auriculate, the auricles of both wings coherent above the petiole, extending slight-
ly above the blade. Flowers solitary, terminal, soon lateral, leaf-opposed. Peduncle 5 1/2–7 cm long, at the base triangular in transverse section. Sepals 5, the outer 2 ca 25–28 by 19–20 mm, the inner 3 35–40 by 20–22 mm, glabrous or not. Petals white, at least 25 by 18 mm. Stamens ca 900, 5–7 mm long, with a 0.7–0.8 mm long acumens. Carpels 7–8, glabrous, ca 9 by 2 1/2 mm with 13 mm long styles, each with ca 8 ovules. Fruit dehiscent. Carpels ca 17 by 10 mm, 1-seeded. Seeds ca 5 by 3 1/2 mm, enclosed by a 3 mm long aril.

Distr. Malaysia: Moluccas (Halmahera, Morotai) and Japen Island near NW. New Guinea (Geelvink-Bay).

Ecol. In primary forest, from sea-level to 1000 m.

Vern. Japen Island: karoe ai and wadajow. Notes. For the identity of Dillenia alata Martelli see p. 164. The impression on the leaf, caused by the folding in bud, has not been noted so clearly in any other Dillenia.

The specimens from the Moluccas differ from those from Japen Island, which are entirely glabrous, by a dense short sericeous indumentum on the young branches, on the basal part of the nerves on the lower surface of the leaves, on the lower side of the petiole, on the peduncle, and on the outer side of the sepals. They represent a distinct variety, var. sericea Hoogl. var. nov.


Tree, up to 30 m high, 1 m diam., often with buttresses, with pale reddish brown bark peeling off in very thin papery scales. Leaves elliptic to ovate, ca 20–25-nerved, 15–40 by 10–35 cm, on young trees and saplings narrower, ca 30–35-nerved, 50–100 by 25–50 cm, with rounded to obtuse apex, rounded base, and undulate to slightly dentate margin. Petiole 4–8 cm long, on young trees and saplings up to 10 cm, with half-obcordate, rarely oblong, caducous wings. Wings usually broadening towards the apex, the apex rounded, extending distinctly above its insertion, at the basis 6–10, near the apex up to 35 mm broad. Raceme 4–7-flowered, up to 8 cm long with tortuous axis.
Fig. 9. *Dillenia papuana* Martelli. Trees ca 30 m tall, ca 1 m diam., in 2 m deep inundated flood-plain forest. This type of forest was inundated Jan. to May 1939. Bernhard Camp, Idenburg River, West New Guinea (BRASS, ARCHBOLD Expeditions).

Tree, *ca* 35 m high with 15 m clear trunk, *ca* 40 cm diam., with reddish brown papery scaly bark and brown wood. Younger branches densely villose. Leaves elliptic to ovate-elliptic, 9–14-nerved, *ca* 10–21 by 6–17½ cm, with rounded, slightly acuminate apex, rounded base, and dentate margin, more or less villose on both sides. Petiole 2½–7 cm long, with linear-oblong, caducous wings. Raceme 2-flowered, up to 6 cm long, with densely villose axis. *Flowers* incompletely known, possibly never quite expanding. Sepals 5, the two outermost ones *ca* 30 by 30 mm, the three innermost ones *ca* 35 by 30 mm, the outer ones slightly villose outside. Petals 5, yellow. Stamens *ca* 90, 20 mm long. Carpels 8–9, *ca* 18 by 4 mm, with 9 mm long, only slightly spreading styles; each carpel with 13–14 ovules. *Fruit* unknown.

**Distr.** Malaysia: NE. New Guinea (Central Highlands and Huthnstein Range).

**Ecol.** In forests, 1350 and 2000 m.

**Vern.** Burra (Arona), warawaka (Aiyura).

**Notes.** The species is closely related to *Dillenia schlechteri* Diels and *D. papuanu* Marcelli.


Large tree, up to 35 m high, 2 m diam., with buttresses to 3 m tall, 1 m long; bark reddish brown, flaky; wood reddish brown, hard and heavy. Leaves broadly ovate, *ca* 15–21-nerved, 11–30 by 7½–21 cm, with rounded apex, rounded, slightly cordate base, and slightly undulate margin. Petiole 4–9 cm long, with 4–8 mm broad wings. Raceme 2–6-flowered, up to *ca* 7 cm long. *Flowers* probably never quite expanding, the sepals only slightly diverging, the petals falling off without spreading. Sepals 5, *ca* 25 by 22 mm. Petals bright yellow, cucullate when falling, *ca* 33 by 28 mm. Stamens *ca* 100, 14–17 mm long. Carpels 8–11, *ca* 8–9 by 2½–12½ mm, with 10–12 mm long styles, each with *ca* 14–18 ovules. *Fruit* dehiscent, the sepals enlarged to *ca* 35 by 30 mm. Carpels *ca* 25 by 18 mm, 1-seeded. Seeds *ca* 4 by 3 mm, enclosed by a 2½ mm long aril.

**Distr.** Malaysia: Taninbar and Aru Islands, New Guinea, and islands in the Geelvink Bay.

**Ecol.** In primary forest at low altitudes, on dry or temporarily flooded soil (fig. 9), once collected at *ca* 2000 m.

**Uses.** Said to supply a good timber.

**Vern.** Taninbar Islands: kamjemeje. New Guinea: several noted, but none constant.


Tree, up to 20 m high. *Leaves* elliptic-oblong to ob lanceolate, coriaceous, *ca* 7–11-nerved, 6½–14 by 2½–6½ cm, with rounded apex, obtuse to rounded base, and nearly entire to dentate, mainly in the upper part of the leaf, margin. Petiole 1½–3 cm long, with linear, 1 mm broad, caducous wings. Inflorescence terminal on the leaf-bearing branches or lateral on the older branches in the axil of a leaf-scar: raceme 2–6-flowered, sometimes with one lateral branch, up to 5 cm long. *Flowers* *ca* 6 cm diam., on a 3–6 cm long pedicel. Sepals 4–6, usually *ca* 13–16 by 8–12 mm. Petals as many as sepals, white, *ca* 30 by 14 mm. Stamens *ca* 120–160, the outer ones slightly longer, 9 mm, than the inner ones, 7 mm. Carpels 4–6, usually *ca* 7 by 2½–7 mm, with 5–8 mm long styles, each with 8–10 ovules. *Fruit* unknown.

**Distr.** Malaysia: Philippines (known only from Mindanao, Butuan subprov.).

**Ecol.** In semi-open forests at low altitude.


Large tree, *ca* 35 m high with 28 m clear trunk *ca* 1.2 m diam., with reddish papery scaly bark and yellow to rose-brown wood. *Leaves* elliptic 6–9-nerved, 8–15 by 4½–12 cm, with obtuse to rounded, minutely acuminate apex, obtuse to rounded base, and more or less undulate margin, glabrous. Petiole 3–4 cm long, the wings 3–7 mm broad. Raceme 2–4-flowered, up to *ca* 5 cm long with tortuous axis. *Flowers* *ca* 4–5 cm diam. Sepals 5, 12–16 by 10–13 mm. Petals not known from open flowers. Stamens *ca* 60, 10 mm long. Carpels 7–10, usually 8, *ca* 5 by 2 mm, with 7 mm long style, each with 8–9 ovules. *Fruit* unknown.

**Distr.** Malaysia: New Guinea.
12. Dillenia fagifolia Hoogli. spec. nov.
Large tree, nearly 50 m high with 30 m clear trunk, ca 1 m diam., with branched buttresses and reddish brown, papery scaly bark; wood pinkish or pale red brown. Leaves elliptic, 17-19-nerved, 12½/2-16 by 8-10 cm, with obtuse apex, obtuse to rounded base, and entire to very slightly undulate margin. Petiole 5-5½/2 cm long, with 7-8 mm broad wings. Raceme 6-flowered, with tortuous, ca 6 cm long axis. Flower known only in bud. Sepals 5, the outermost one (and probably in the open flower the other ones of approximately the same size) 22 by 25 mm. Petals present. Stamens in 2 rather distinct groups, the outer ones, ca 60, fertile, decreasing in size towards the centre, 5-2½/2 mm long, with 0.3 mm long acute acumen; the inner ones, ca 90, sterile, ca 1 mm long. Carpels 12, in bud ca 2 by 1 mm, with 1 mm long style, each with 12-14 ovules. Fruit unknown.


Vern. Ainedin (But near Wewak).

Notes. The species is only very imperfectly known. The structure of the androecium, however, is so characteristic, that the said specimen certainly represents a new species. This type of androecium was not yet known in Dillenia.


Small tree. Leaves elliptic to oblong, ca 13-16-nerved, 12-20 by 5½/2-10 cm, with rounded or obtuse, ± distinctly acuminate apex, obtuse to acute base, and nearly entire to distinctly dentate margin, entirely glabrous. Petiole 1½/2-4 cm long, with nearly circular to obovate wings. Wings up to 35 by 22 mm with rounded apex and entire margin, glabrous, wholly caducous. Flowers terminal, solitary, ca 10 cm diam. Sepals 8-9, the outermost ones only slightly smaller than those towards the centre, 3½/2-4 by 2½/2-3 cm. Petals unknown. Stamens in 2 groups, the outer group ca 260, ca 13 mm long. Straight in bud, the inner group ca 75, ca 23 mm long, with their apex reflexed in bud. Carpels ca 15, ca 12 by 2 mm, with ca 20 mm long, recurved styles, each with 7-10 ovules. Fruit indehiscent, subglobose, 4-5 cm diam. including the enclosing sepals. Carpels ca 25 by 12 mm, 1-2-seeded. Seeds enclosed by a membranaceous aril.


Ecol. On forested slopes, up to 1200 m alt.

Notes. Closely related to Dillenia reiflerscheidia Villar, not to D. ochreata, though its leaves resemble very much that species. It is easily recognized from the latter species by the larger number of sepals and larger flowers and fruits.


Tree, up to ca 11 m high, 60 cm diam. Leaves elliptic to obovate, ca 14-20-nerved, ca 15-40 by 10-30 cm, with rounded apex and base and slightly to manifestly dentate margin. Petiole 3-4 cm long, strigose beneath, with obovate wings. Wings ca 3-5 by 2½/2-4 cm, with rounded apex and entire margin, more or less woolly hairy beneath, wholly caducous. Flowers terminal, solitary or less often 2-3 together, if solitary with 2-5 or without bracteoles, if 2 (resp. 3) 1 (resp. 2) with and without bracteoles; ca 17½/2 cm diam. Sepals 11-17, the outer ones ca 20 by 22 mm, the inner ones ca 65 by 40 mm. Petals white or rarely, rose red (var. rosea ELM.). ca 9 by 5 cm. Stamens in 2 groups, outer group ca 375, 11 mm long, straight in bud, inner group ca 60, 25 mm long, with their apex reflexed in bud. Carpels ca 15, ca 12 by 3 mm, with ca 18 mm long, recurved styles, each with 9-12 ovules. Fruit indehiscent, subglobose, 5-8 cm diam. including the enclosing sepals. Carpels 20-25 by 10-12 mm, 1-4-seeded. Seeds black, enclosed by a membranaceous aril.

Distr. Malaysia: Philippines (from the S. half of Luzon to Mindanao, not in the Westernmost islands).

Ecol. In primary forests in humid regions with abundant rainfall, from low altitude to ca 1000 m.

Uses. Construction timber tree. The fruit makes a good preserve.

Vern. Balali (Bik.), katmón (Tag., P. Bis.), k. kadlagan (Bik.), k. kalabó (Tag.), paldi (Bik.).

slightly woolly on young leaves, beneath slightly
to densely woolly on the lateral nerves, on both
sides of the central nerve (continuing on the peti-
ole), and along the line which delimits the bud-
enclosing part of the leaf-basis. Petiole ca 2-6 cm
long with up to 1 1/2 cm broad, usually persistent
wings. Raceme usually simple, sometimes com-
posed, ca 5-12-flowered. Flowers ca 8-11 cm diam.
Sepals 5, ca 15-22 by 8-12 mm, in fruit enlarged
to ca 18-25 by 10-15 mm. Petals bright yellow,
ca 40-50 by 25-30 mm. Staminodes ca 100, 6 mm
long. Stamens ca 175, the outer ones 8 mm long,
straight in bud, the inner ones 13 mm long, with
their apex reflexed in bud, with intermediate
lengths. Carpels 5-8, usually 7, ca 5 by 2 mm, with
yellowish white, ca 1 cm long styles, each with
7-10 ovules. Fruit dehiscent. Carpels red, ca 20-25
by 10-16 mm, each 1-4-seeded. Seeds brown or
black, with a membranaceous, scarlet aril.

Distr. Malaysia: Sumatra (Palembang), Malay
Peninsula, Riouw- and Lingga-Archipelagos, Na-
tuna, Banka, Billiton, W. Java, and Borneo. Con-
trarily to the opinion of de Wit I do not believe
that the species is indigenous in W. Java. All col-
lections are made within a relatively small area
around Bogor and of fairly recent date, all made
at least 30 years after the introduction of the spe-
cies into the Botanic Garden. Moreover, the spe-
cies easily naturalizes, e.g. in Jamaica, where it has
become abundant.

Ec. In marshes, along streams, and on the
margin of forests, often forming thickets, from
sea-level up to 500 m. Flowering continuously, each
flower open for one day only, between 2 flowers
of the same raceme a difference of ca 3-4 days.
Fruit ripe after 36 days (Corner, 1940); seeds
eaten by birds.

Uses. Sometimes planted as an ornamental.

Vern. Malay Peninsula: simpoh, s. ayer (= water
s.), s. gajah (= elephant or big s.), s. pasir
(= sand s.). Natuna: simpoh. Banka: simporn, siper, kaju simpur (= tree s.), kembang mésimpur
or musimpur (= flower s.), minimpur, simpor pram-
puan (= female s.). Bilotion: simpur. Borneo:
dungin (Dusun), simpur, simpur, s. bini (= female
s.), s. ayer (Mal.).

16. Dillenia ochreata (Miq.) Teijsm. & Binn. CaI.
Malesia 3 (1886) 178; Heyne, Nutt. Pl. (1927) 1072.
(1868) 77, t. 1; Koord. Meded. Pl. T. 19 (1898) 327.

Tree, up to 15 m high and 35 cm diam. Leaves
ovate or elliptic-oblong, ca 15-18-nerved, 10-20 by
4 1/2-10 cm, with acute, often slightly acuminate,
less often obtuse apex, rounded to acute base, and
nearly entire to slightly dentate margin, glabrous.
Petiole ca 16-20 mm long, with broad half-obcor-
date wings; wings ca 16-18 by 13-15 mm, with
to entire margin, glabrous, caducous. Flowers solitary,
terminal, ca 6-8 cm diam. Sepals approximately
circular, 2-2 1/2 cm diam., glabrous. Petals yellow,
4 by 3 1/2 cm. Stamens ca 165, the outermost ones
to 7 1/2 mm long, straight in bud, the innermost
ones ca 12 mm long, with the apex reflexed in bud,
with intermediate lengths. Carpels 6-9, ca 7 by
2 1/2 mm, with 7 mm long styles; each with 8 ovules.
Fruit indehiscent, pale green, slightly depressed-
lobular, ca 32 mm diam., 26 mm high. Carpels
very slightly spirally twisted, ca 15 by 12 mm,
1-seeded. Seeds ca 5 by 4 mm, very finely densely
echinate, enclosed by a 10 mm long, rather fleshy
aril.

Distr. Malaysia: NE. Celebes (Minahasa).

Ec. In forests from low altitude to 800 m,
often found on volcanic sand.

Vern. Kelemur (Alf.): some other names noted,
but not constant.

(1914) 519; Wester. Philip. Agr. Rev. 14 (1921)
242; Merr. En. Philip. 3 (1923) 60.—Dillenia
mindanaensis ELM. Leafl. Philip. Bot. 7 (1915)
27b; Merr. En. Philip. 3 (1923) 60.—Wormia
megalantha GILG & WERDERM. in ENGL. & PR.

Tall tree, up to 20(-40?) m high, 40 cm diam.,
with brown and gray bark, scaling off in thin plates.
Flora 1 (1818–1899) 1; the Fruit dentate with 20–30 (Sub.) ovules. In the tent, the inner ones 100, 17–25 mm long, with their apex reflexed in bud; on the outside a small number of staminodes, 6–14 mm long. Carpels 14–16, ca 10 by 3 mm with 22 mm long styles, each with ca 25 ovules. Fruit indehiscent, 5–7½ mm diam. including the enclosing sepal, which are ca 7 by 5 cm, at the basis 8 mm thick. Carpels ca 25 by 11 mm, 1-seeded. Seeds obovoid, 6 by 4 mm, finely shortly echinate, with an 8 mm long, membraneous aril.

Distr. Malaysia: Philippines (S. Luzon to Mindanao, absent from N. Luzon to Palawan).

Ecol. In primary forests at low altitude, up to 1000 m.

Uses. The fruit is eaten. Vern. Kalambog (Bag.), katmón (Bik., S.L. Bis., Bag.), katmón-bayanti (Tag.), lumbóg (Sub.), paláli (Sub.).

18. Dillenia talaudensis Hoogl. spec. nov.

Small tree, ca 8 m high, 11 cm diam.; branches glabrous. Leaves elliptic or ovate, 18–20-nerved, 20–30 by 14–21 cm, with obtuse to rounded apex with small acumen, rounded base, and slightly dentate margin. Petiole 3½–5 cm long, with caducous wings. Wings obovate, up to 12 mm broad, the apex extending about 1½ cm above the insertion, ending into a mucronate acumen. Raceme 2–3-flowered, with 10–12 cm long axis. Flowers known only in bud and as young fruit, on a short, thick pedicle. Sepals 5, the outer 2 ca 21 by 19 mm, the inner 3 ca 30 by 23 mm. Petals in bud up to 22 by 15 mm. Stamens in 2 distinct groups, the outer ones, ca 250, ca 6 mm long in bud, 10 mm in the young fruit, straight in bud, the inner ones, ca 80, ca 11 mm long in bud, 19 mm in the young fruit, with their apex reflexed in bud. Carpels 14, ca 5 by 1.3 mm in bud, with 11 mm (in the young fruit 20 mm) long styles, each with 8–11 ovules. Fruit unknown.


Tree, up to 20 m high, 60 cm diam., with reddish brown bark peeling off in thin papery flakes, and crooked branches. Leaves ovate to elliptic, ca 8–14-nerved, 8–25 by 5–15 cm, with rounded apex and base and entire, slightly recurved margin. Petiole 21/2–4 cm long, with 2–6 mm broad wings; wings narrowing towards the base of the blade, partly caducous, leaving behind a 1½ mm broad part on the lower 1½–3½ of the petiole, the wing on the upper 2½–1½ permanent. Raceme 2–4-flowered. Flowers ca 7½ cm diam. Sepals 5, the outer 2 circular, 1.3 cm diam., the inner 3 elliptic-ovate, 2 by 1½ cm. Petals yellow, 40 by 25 mm. Stamens in 2 distinct groups, the outer ones ca 100, 7–8 mm long, straight in bud, the inner ones ca 18, 11–13 mm long, with their apex reflexed in bud. Carpels 6–8, deep crimson, ca 10 by 4 mm, with red, ca 14 mm long styles, each with ca 8 ovules. Fruit dehiscent. Carpels 18–20 by 10–14 mm, 1–3-seeded. Seeds 4 by 3 mm, black, enclosed by a membraneous, waxy white aril.

Distr. E. Coast of N. Queensland, S to about 20° S, in Malaysia: Waigeo and S New Guinea.

Ecol. In Malaysia found in savannah forests. Notes. The first description of the species was that by DC. (1818) Lc. under the name Wormia alata R.Br., citing Dillenlata alata Banks as a synonym. The first legitimate transfer to Dillenia was effected by Martelli (1886), who, however, described a specimen of Dillenia ovalifolia Hoogl.
Dilleniaceae

2-4 cm diam. including the enclosing slightly fleshy sepals. Carpels slightly spirally twisted, fleshy, 20 by 13 mm, 1-4-seeded. Seeds 5 or 3 mm, very finely echinate, at the base enclosed by a 2 mm long, membranaceous aril.

Distr. Malaysia: Philippines from the Babuyan Islands to the Sulu Archipelago, not in Palawan. Ecol. Common in forests at low and medium altitudes, rarely above 1000 m, once collected at 1800 m.

Uses. The pulp from the fruit is eaten; it makes an excellent sauce or jam and is used, mixed with sugar, as a cough cure. It is also used for cleansing the hair. A red dye is obtained from the bark.

Vern. The following vernaculars are in use: balale, balobayauk, bihis, biskan, balobayauk, eachuchio, dingin, kalambahgul, kambig, katmön, kulambahgul, palali, palale, and pammamalben, the most frequently used ones being katmön and palale.

Notes. Merr. (1923, i.e.) distinguishes a var. pubifolia, which differs from the typical form by the hirsute inflorescences and sepals and the pilose underside of the leaves. The differences are only very slight.

21. Dillenia diantha Hoogl. spec. nov.

Tree, up to 25 m high, 60 cm diam. Leaves elliptic to oblanceolate, 5-8-nerved, ca 6-12 by 4'/2-7'/2 cm, with rounded to obtuse or slightly emarginate apex, rounded to obtuse base, and slightly undulate to dentate margin, glabrous. Petiole 1'/2-4 cm long, with linear-lanceolate, 1-2 mm broad wings; wings with rounded or auriculiform apex, caducous. Inflorescence a 2-flowered raceme, less often flowers solitary; axis 11/2-4 cm long. Flowers ca 9 cm diam. Sepals 5, elliptic, ca 22 by 15 mm. Petals yellow, ca 45 by 29 mm. Stamens in 2 distinct groups, the outer ones ca 155, 9-10 mm long, straight in bud, the inner ones ca 20, 13-15 mm long, with their apex reflexed in bud. Carpels (5-)7-9, glabrous to sparsely shortly hirsute, mainly in the apical part, ca 9 by 2'/2 mm, with ca 15 mm long styles. Cell-wall inside the apical part and wall of the stylar canal hirsute. Each carpel with 9-11 ovules. Fruit dehiscent, the sepals enlarged to ca 28 by 20 mm. Carpells 18 by 16 mm, showing the hirsuteness inside the apical part. Seeds unknown.


Uses. The wood is used for building purposes.

Vern. Babacabao (Ibanag dial.), malacatson (Tag.), marapalaloc (Ilocano).

Notes. The leaves of the species are similar to those of D. luzoniensis and D. monanthus; the species is easily distinguished by the winged petiole and consequently amplexical leaf-scar.


Tree, up to 20 m high. Leaves elliptic-oblong, ca 15-20-nerved, 10-25 by 4-11 cm, with acuminate apex with ca 1 cm long acumen, acute to obtuse base, and slightly dentate margin, most strongly so in the upper part of the leaf. Petiole 2-4'/2 cm long, with lanceolate, 4-6 mm broad wings; wings villose-pubescent beneath, caducous. Inflorescence either a terminal, 2-4-flowered, up to 10 cm long raceme, or cauleine with a woody, sparingly branched axis with flowers solitary or in 2-flowered racemes terminal on this sympodially built axis. Cauleine inflorescence with ovate bracts, representing the winged petiole of the normally developed leaf, conduplicate, ca 10-20 mm long, 2 × 5-10 mm broad, amplexicaul, leaving amplexicaul scars on the axis. Flowers ca 6 cm diam. Sepals 5, elliptic, ca 20 by 16 mm. Petals whitish, 30 by 13 mm. Stamens in 2 distinct groups, the outer ones ca 160, 5-5'/2 mm long, straight in bud, the inner ones ca 25, 7-8'/2 mm long, with their apex reflexed in bud. Carpels 8-10, ca 6 by 3 mm with cylindrical, 7 mm long styles, each with 6-8 ovules. Fruit dehiscent, globular, ca 2'/2 cm diam. including the enclosing sepals, which are up to 30 by 30 mm, at the base 0.4 mm thick. Carpells ca 15 by 9 mm, 1-seeded. Seeds obovate, 5 by 3'/2 mm, exarillate.


Notes. The present species is the only one in Dillenia where these sympodially built cauleine inflorescences are found. The twig-born and cauleine inflorescences of Dillenia pentagyna and related species most probably are monopodial and comparable with the inflorescences of Dillenta pulchella.


Slender, tall tree, up to 30 m high, with flaky reddish brown bark. Leaves oblong, ca 8-12-nerved, 7-16 by 3-7 cm, with rounded-obtuse to acute apex, rounded to obtuse base, and entire to slightly undulate margin, glabrous. Petiole 1'/2-5 cm long, with up to 7 mm broad, linear-lanceolate wings; wings caducous except often a small, up to 5 mm long, upper part, remaining as 2 small auricles below the blade. Raceme 1-3-flowered, up to 11 cm long. Flowers ca 8-10 cm diam. Sepals 5, the outer 2 ca 17-19 by 15-17 mm, the inner 3 ca 25-30 by 20-24 mm. Petals narrowly obovate, yellow, ca 40 by 16 mm. Stamens in 2 distinct groups, the outer ones ca 225, 8-10 mm long, straight in bud, the inner ones ca 28, ca 18 mm long, with their apex reflexed in bud; yellow. Carpels 6-10, ca 8 by 3 mm, with linear, red, 16 mm long styles; each with 9-11 ovules. Fruit unknown.

Distr. Malaysia: New Guinea. Ecol. On riversides and in ridge forests. Ca 1 m long proproots are noted for this species.

Leaves elliptic to obovate, ca 18–28-nerved, 15–25 by 9–15 cm, with rounded to obtuse apex, obtuse to somewhat cordate base, and entire to undulate-dentate margin; in saplings longer and narrower, 45–80-nerved, 35–75 by 13–25 cm. Petiole 3–7 cm long, in saplings up to 17 cm. Inflorescence a (3–) 5–12(–18)-flowered composed raceme, forming a loose cluster. Flowers appearing with the leaves, apetalous, ca 21/2 cm diam. Sepals 5, about circular, 9–12 mm diam. Stamens all of approximately the same length, ca 150–180, 41/2–51/2 mm long; margin of the anthers ciliate. Carpels 4–6, usually 5, white, ca 31/2 by 11/2 mm, with 5 mm long, white styles, each with ca 30 ovules. Fruit indehiscent, dark green, slightly flattened-globular, ca 30 mm diam., 25 mm high including the enclosing sepal, which are up to 40 by 27 mm, at the basis up to 8 mm thick. Carpels 10 by 7 mm, 1–2-seeded. Seeds 51/2 by 31/2 mm, with a rudimentary, about 0.2 mm long aril.

Distr. Malaysia: Sumatra, Malay Peninsula, and Borneo.

Ecol. In primary forests at low altitude (to 300 m), on wet to rather dry soil. Fl. in the Mal. Pen. from March to May, fr. from April to July; in Sumatra and Borneo fl. from July to Nov., fr. from Nov. to Jan.

Uses. The wood is rarely used in house-building.

Vern. Mal. Pen.: simpoh, s. jangkang (=stilted s.), merah. Sumatra: bawal (Djambi), bira (Indr.), djangkang (Pal.), gewal, gawar (Indr.), mempelu (Sum. E. Coast), sedjérangkong (Pal.), simar timbaho darat (Tapan.), simpur, s. kidjang, s. rawang (Pal.). Borneo: bériga, riga (Daj.), djongang (Mal.), entepung rimba (Mal.), ketang bajut (Daj.), kadjang (Mal.), markadjaung (Daj.), suretang (Daj.), témpur (Daj.).

26. Dillenia borneensis Hoogl. spec. nov.

Tree, probably deciduous, up to 40 m high, 70 cm diam., with stilt-roots. Leaves elliptic to elliptic-oblong or obovate, ca 25–35-nerved, 25–40 by 12–20 cm, with rounded apex, obtuse base, and minutely undulate-dentate margin. Petiole 4–9 cm long, densely serically hirsute above. Inflorescence a 3–10-flowered composed raceme, forming a loose cluster. Flowers appearing with the leaves, ca 6 cm diam. Sepals 5, elliptic, 1.2–2 by 0.8–1.4 cm. Petals yellow, ca 21/2 by 11/2 cm. Stamens ca 335, in 2 distinct groups, either the outer group all of the same length, ca 8 mm long, straight in bud, the inner group ca 14 mm long, with their apex reflexed in bud, or the stamens of the outer group gradually decreasing in size towards the centre from 11 to 4 mm, with their apex more or less reflexed in bud, those of the inner group ca 13 mm long, with their apical part (ca 2 mm) reflected. Carpels 7–8, ca 8 by 1 mm, with ca 8 mm long styles, each with ca 25–50 ovules. Fruit unknown.

Distr. Malaysia: Borneo.

Ecol. In primary and secondary forest at low altitude.

Vern. Gérige, riga, rogung (Daj.), simpur (Mal.).
Fig. 11. *Dillenia reticulata* King with stilt-roots in the Mal. Peninsula. *Courtesy For. Res. Institute, Képong.*
Notes. Most specimens have the second type of androecium; the first type was found only in one collection, which agrees with the species in all other characters. As, however, the flowers in this specimen (Jaheri 840) are not attached to the specimen, but added loose, I have not given this form varietal rank, though I am convinced that the flowers belong to the species. When better known, the two forms may have to be distinguished as separate varieties. The species is strongly characterized by the densely hirsute upper side of the petiole.


Deciduous tree, up to 40 m high, 17 cm diam., with conspicuous still-roots. Leaves elliptic or elliptic-oblong to obovate, ca 25–35-nerved, 15–30 by 10–20 cm, with rounded to slightly emarginate apex, obtuse to rounded or cordate base, and entire to slightly undulate-dentate margin. Petiole 4–10 cm long. Inflorescence a (3–)5–10–(15-)flowered composed raceme, forming a loose cluster. Flowers appearing with the leaves, ca 8 cm diam. Sepals 5, broadly elliptic, ca 20–25 by 16–20 mm. Petals yellow, ca 35 by 16 mm. Stamens ca 400–440, all straight in bud, those of the outer whorl ca 11 mm long, those immediately within this whorl 5 mm long, the size gradually increasing towards the centre of the flower to 9 mm in the innermost ones. Carpels 9–10, ca 6 by 1½ mm, with 5–6 mm long styles, each with 50–70 ovules. Fruit indehiscent, greenish yellow, slightly flattened-globular, ca 35 mm diam, 30 mm high including the enclosing sepals, which are up to 45 by 42 mm, at the base 6 mm thick. Carpels 16 by 8½ mm, 1–3-seeded. Seeds 3½ by 2½ mm, with a rudimentary, ca 0.2 mm long aril.

Distr. Malaysia: Sumatra, Malay Peninsula, and Borneo.

Ecol. In primary forests at low altitude, on wet to rather dry soil. The stilt-roots are also developed when the tree grows in a never-flooded habitat. As far as can be derived from the few collections, the flowering- and fruiting-time agree with those of Dillenia eximia Miq.

Vern. Mal. Pen.: simphoh, s. jángkang (=stilted s.), s. pàya (=marsh s.). Borneo: simpur, tèmpiruán.

Notes. In the vegetative state the species is not distinguishable with certainty from hisurate forms of Dillenia eximia Miq. Dillenia rhizophora Boerl. & Koord. is such a status, most probably referable to the present species.

On account of the hairiness of the carpels two varieties can be distinguished: var. reticulata with the carpels hisurate in the apical part, and var. psilocarpella HooGl. var. nov. with glabrous carpels. The first variety is known only from the Malay Peninsula, the second from the whole area of the species.


Tree, 10–15 m high, or, more often, low shrub, 1½–2 m high, with reddish wood. Leaves oblong to oblanceolate, ca 30–40-nerved, 17–22 by 7–9 cm, with rounded, sometimes slightly acuminate apex, acute base, and entire to slightly dentate margin, densely velvety-tomentose beneath. Petiole 1½–4 cm long. Flowers single, rarely 2, terminal, 4–5 cm diam., the pedicel with 3 verticillate bracteoles; bracteoles lanceolate, 20–35 by 7–10 mm. Sepals 5–6, ovate to elliptic, ca 15 by 10 mm, densely silky hairy outside. Petals yellow, ca 25 by 13 mm. Stamens ca 200, all of approximately the same length, 8–10 mm long, with sharply emarginate apex. Carpels 6–7, ca 5 by 1½ mm with 11 mm long styles, each with ca 18 ovules. Fruit indehiscent, 2–2½ cm diam. including the enclosing sepals, which are up to 25 by 14 mm. Carpels 14 by 6 mm, 1–5-seeded. Seeds obovate, 3½ by 3 mm, exarillate.

Distr. Indo-China and Siam, N. to ca 17° N., in Malaysia: only in Peninsular Siam.

Ecol. In open deciduous forests and savannahs.

Notes. Pierre l.c. describes and figures the stamens as being of different lengths, arranged in 2 groups. I analysed several flowers, but always found all stamens of approximately the same length. This species is the only Malaysian one, which combines this character with a not amplexicaule leaf-basis.


Small tree, ca 5 m high. Leaves subcoriaceous, elliptic to oblong, ca 6–12-nerved, 6–15 by 3–7 cm, with rounded to slightly emarginate apex, rounded base, and entire to slightly undulate margin, glossy. Petiole ½–1 cm long. Raceme terminal, later lateral, leaf-opposed, with only one flower at the same time, up to 40 cm long with 30 scars of fallen flowers; axis more or less zig-zag. Flowers 6–8 cm diam. Sepals 5, elliptic, 15–18 by 10–14 mm. Petals yellow, 4–5 by 3–4 cm. Stamens in 2 distinct groups, the outer ones ca 120, 8 mm long, straight in bud, the inner ones ca 50, 14–20 mm long, with their apex reflexed in bud; on the outside often a few staminodes, 7 mm long. Carpels 7–8, ca 8 by 2½ mm, with 10 mm long styles, each with ca 16 ovules. Fruit indehiscent, the sepals pink, enlarged to ca 25 by 15 mm. Carpels 17 by 14 mm, 1–2-seeded. Seeds ovoid, 3 by 2 mm, enclosed by a membranaceous, up to 5 mm long aril.


Ecol. On riverbanks in forests at low altitude.

Notes. As Merrill (1923) included under the species a number of specimens of Dillenia diantha HooGl. his data on vernacular names and altitudinal distribution are not reliable. He gives as the altitudinal limit 1200 m.
**Dilleniaceae** (Hoogland)


Trec, up to 40 m high with 20 m clean trunk, 75 cm diam., with gray to brown bark, scurfy with reddish scales, and red to dark brown heartwood. Leaves coriaceous, elliptic to oblong, ca 10–13-nerved, 15–30 cm by 7–10 cm, with rounded to acute, sometimes slightly acuminate apex, acute, often unequal-sided base, and slightly undulate, entire or dentate margin, glossy. Petiole 2–5 cm long. Raceme simple or composed, the only lateral branch at the place of the second flower, up to 12-flowered, sometimes in inflorescencescrowded at the end of a branch and inflorescence therefore seemingly up to 30-flowered. Flower 7–10 cm diam., the pedicle distinctly thickened at the apex. Sepals 5, elliptic to ovate, 20–25 cm by 13–16 mm, glabrous to rather densely tomentose outside. Petals bright yellow, 40–50 by 25–33 mm. Stamens in 2 distinct groups, the outer ones ca 300, 10–11 mm long, straight in bud, the inner ones ca 30, 16–20 mm long, with their apex reflexed in bud. Carpels 5–10, usually 6–8, 12–14 by 21± mm, with 16–20 mm long, pink styles, each with 20–25 ovules. Fruit dehiscent. Carpels 18–20 by 12–16 mm, yellowish green outside, whitish inside, 1–3-seeded. Seeds 6 by mm, dark brown, with a 2–3 mm long, red, membranaceous aril.

**Distr.** Malaysia: Sumatra, Malay Peninsula, Banka, W. Java (E. to Nusa Kambangan), Borneo, and Philippines (Balabac Island, S of Palawan).

Ecocl. In forests on rather dry to swampy soil, often along streams.

Uses. The wood, which has a durability indoors of 15–20 years, is sometimes used in housebuilding.

Vern. A large number of vernaculars has been noted: Sumatra: ampalu, a. rimbo (Tapan., Sum. W. Coast), bahah falah (Simalur), boengah-simpur (= flower-s.) (Indrag.), enehé (Enggano), kakek bakoerok (Tapan., Sum. W. Coast), nilau birih (Djamb.), pellelogoa (Mentawe), pisang mawe (Sum. E. Coast), simpur (Djambi, Sum. E. Coast, Palemb., Benk.), s. arêng (Lamp.), s. ayer (Lamp.), s. kimbe (Palemb.), s. lakk (Banka), s. pêrampuan (Lamp.), s. rawang (Lamp., Palemb.), s. rimba (Benk., Banka, Palemb.), s. talang (Palemb.), s. tiputh (Sum. E. Coast), s. way (Lamp.), sisoté (Atjeh). Malay Peninsula: kambut hutan, penaga hlu, simpur, s. ayer, s. padi, s. pagar, s. pasir, s. paya. Java: djajadian (Sund.), drêgêl (Jav.), ki sêgêl, sêgêl, simpur sêgêl, s. tjai (Sund.), s. bbutt. s. lanang (Jav.), simpur (Mal.), wuru (Jav.). Borneo: alang-alang (Daj., Punan), djajining (Mal., Bondaese), djelangan (Tidung, Batak), djewiq (Mal., Berauw), djiling, djochin (Daj.), gara (Daj., Kapuas), kadjamining (Daj., Kapuas; Mal., Sumpit), kajuringin (Daj.), kandikara (kêndikara, kandik-kara) (Mal., Kutinese), kanigara (kênigara, kali-gara) (Bandjar., Bondar., Mal.), kêgingin, arib (Daj.), pampan (Dusun rungus), ranadaman (Banggi), ringin (Daj., Dusun), simporotan (Mal., Br. N. Borneo), simpur (Mal., Br. N. Borneo), s. bakir (Mal., Sarawak), s. laki (Mal., Brunei, Sawa-wak and Sandakan), tidahura, tjamining (Daj., Siangese). In the Bahas Indonesia kêndikara has been accepted.

Notes. Corner (1939, l.c. distinguishes 2 varieties besides the typical form. *Dillenia excelsa* var. pubescens (Corn.) ex Masamune is distinguished by the tomentose-hirsute indumentum on the outer side of the sepals, continuing on the pedicel and the axis of the inflorescence. This is the commonest form of the species in the Malay Peninsula and is also found in Sumatra, Borneo, and the Philippines. In Borneo intermediates to the typical form with glabrous sepals are frequent. *Dillenia excelsa* var. tomentella (Martelli) Corn. ex Masamune is distinguished by the hirsute indu-
mentum on the intervemum on the lower side of the leaf; it is found in Sumatra, the Malay Peninsula, Banka, and Borneo.

The species is rather variable, but is easily recognised by the rather large, coriaceous, lucid leaves, and the typically thickened apex of the pedicle, which occurs in most species, but is in none so pronounced.


Shrub, 3 m high or higher, with smooth bark, scaling off in plates. Leaves rigidly chartaceous, narrowly obovate to oblanceolate, ca 7–9-nerved, 3½–7 by 1.1–2½ cm, with acuminate apex, acute base, decurrent along the petiole, and entire to slightly undulate margin; glossy above. Petiole 1–1½ cm long. Flowers solitary or, rarely, in a 2–3-flowered raceme, ca 5 cm diam. Sepals 7–9, elliptic to obovate, the outer ones ca 12 by 7 mm, the inner ones ca 15 by 10 mm. Petals lemon yellow, ca 3 by 1.3 cm. Stamens in 2 distinct groups, the outer ones ca 70, 7–8 mm long, straight in bud, the inner ones ca 20, 12–16 mm long, with their apex reflexed in bud. Carpels 5–8, usually 7, bright red, ca 6–8 by 1½–1·8 mm, with 12 mm long, white styles, each with 6 ovules. Fruit dehiscent. Carpels 15 by 10 mm, 1-seeded. Seeds obovate, 3½ by 2·8 mm, enclosed by a yellow, membranaceous aril.

Distr. Malaysia: Philippines (Sibuyan Isl.).

Ecol. Scattered along forested river banks from about sea level to 300 m.


Tree, up to 30 m high and 1 m diam. but usually smaller, 6–12 m high and 30–40 cm diam., with rather knotted trunk and low-attached crown. Leaves ovate or elliptic, ca 18–25-nerved, 10–25 by 7–13 cm, on saplings ca 50-nerved, 30–60 by 14–18 cm, with rounded to obtuse, on saplings acute apex, rounded to acute, often unequal-sided base, and entire to obscurely dentate margin. Petiole ca 2½–5 cm long. Underside of the leaf and petiole hirsute-tomentose. Flower ca 16 cm diam. Sepals 5, elliptic, 25–30 by 16–27 mm, the innermost ones the narrowest, the two outer ones densely villose outside, the third one with one glabrous margin, the inner ones densely villose on the central part only. Petals yellow, 6½–7½ by 5–6 cm. Stamens in 2 distinct groups, the outer ones ca 450, 16–20 mm long, straight in bud, the inner ones, ca 25, 25 mm long, with their apex reflexed in bud. Carpels 8–12, usually 10, 6–7 by 2–2½ mm. with 20 mm long, yellowish white styles; each with ca 50 ovules. Fruit indehiscent, dull yellow, depressed-globose, ca 4½ cm high, 6 cm diam. including the enclosing sepals, which are ca 7½ by 5½ cm, at the base 1½ cm thick. Carpels ca 22 by 10 mm, each with 1–7 seeds in glutinous pulp. Seeds obovoid, 5 by 4 mm, black, glabrous, exarillate.

Distr. Siam and Indo-China to ca 17 30° N, in Malaysia: Sumatra, Malay Peninsula (except Malacca and Johore), Banka. In Java cultivated only.

Ecol. On sandy or rather dry spots, in belukar, at low alt.

Uses. The wood is used in Indo-China for making small objects.

Vern. Simpoh ajer (Mal. Pen.). simpur lakl (la-laki) (Banka) (= male s.), s. minjak. ranggang wakka (S. Sum.).


Tree, up to 20 m high, 35 cm diam., with reddish brown bark. Leaves oblong, ca 15–20-nerved, 16–30 by 7–16 cm, with acute to acuminate apex, acute to obtuse base, and nearly entire to manifestly dentate margin. Petiole 1½–5 cm long. Flowers solitary or in a 2–3-flowered raceme with the flowers attached close to each other, ca 6 cm diam. Sepals 5, ovate, 10–14 by 9–11 mm, densely silky hirsute outside. Petals yellow, ca 25 by 15 mm. Stamens in 2 distinct groups, the outer ones ca 200, 6–7½ mm long, straight in bud, the inner ones ca 18–20, 10–11 mm long, with their apex reflexed in bud. Carpels 7–10, white, ca 4–5 by 1½ mm, with white, 5–6 mm long styles, each with 15–20 ovules. Fruit indehiscent, yellow or orange-yellow, about globular, 2–2½ cm diam. including the enclosing sepals, which are up to 35 by 20 mm, up to 2½ cm thick at the base. Carpels ca 12 by 7 mm, 1–2-seeded. Seeds 5 by 3½ mm, exarillate.

Distr. Malaysia: Sumatra (incl. Nias and Siberut Islands), Malay Peninsula (W.-side only), and Borneo (Sarawak and Br. N. Borneo).

Ecol. In forests at low altitude to ca 350 m. Uses. The wood is sometimes used in house-building.

Vern. Malay Peninsula: simpur, s. bukit, and s. padi. Sumatra: sipang-sipang and diwa saopang (Sum. E. Coast). wahon bonho (Nias), suramak delok (Simalur).

34. Dillenia monantha MERR. Philip. J. Sc. Bot. 9 (1914) 321; En. Philip. 3 (1923) 60.

Smooth-barked tree, up to 17 m high. Leaves subcoriaceous, elliptic-oblong to lanceolate, ca 7–9-nerved, 8–14 by 3½–7 cm, with rounded to obtuse, rarely acute apex, obtuse to acute base, and slightly

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undulate-dentate margin. Glossy. Petiole 5–25 mm long. Flowers solitary, terminal, ca 10 cm diam. Sepals 5, 15–22 by 12–15 mm. Petals yellow, ca 50 by 28 mm. Stamens ca 110, the outer ones from 9 mm long, straight in bud, the inner ones up to 15 mm long, with their apex reflexed in bud, with intermediate lengths. Carpels 4–5, ca 7–8 by 1 1/2 mm, glabrous to sparsely hisrate with 0.2–0.4 mm long, rather rigid hairs, each with 11–16 ovules. Styles 8 mm. Fruit dehiscent, carpels ca 15 by 13 mm.

**Distr.** Malaysia: Philippines (from Palawan to Busuanga).

**Ecol.** In dry secondary forests and in open grasslands at low altitudes.

**Vern.** Malacatemon (Palawan).


Tree, up to 30 m high, 120 cm diam., with rather crooked trunk and irregular, usually rather lowly (up to 15 m) attached crown. Leaves bright green above, oblong, ca 25–50-nerved, 10–35 by 5–13 cm, on saplings and young trees up to 70 by 18 cm, with acute to acuminate apex, rounded to acute base, and slightly to manifestly dentate margin. Petiole 2 1/2–7 1/2 cm long, on saplings and young trees up to 15 cm. Flower 15–20 cm diam. Sepals 3, elliptic, 4–6 by 3–5 cm, up to 1 cm thick at the base. Petals white, 7–9 by 5–6 1/2 cm. Stamens in 2 distinct groups, the outer ones, ca 550, 13–15 mm long, straight in bud, the inner ones, ca 25, 20–22 mm long, with their apex reflexed in bud; yellow. Carpels 14–20, ca 14 by 3 mm, yellowish green, with linear-lanceolate, white, 25 mm long, up to 3 1/2 mm broad styles; each with 40–80 ovules. Fruit indehiscent, yellowish green, 8–10 cm diam. including the enclosing sepals, which are up to 15 by 12 cm, 2 1/2 cm thick at the base. Carpels ca 35 by 15 mm, each with 5 or more seeds in colourless glutinous pulp. Seeds reniform, 4 by 6 mm, black, finely echinate, exarillate.

**Distr.** Ceylon, India (Deccan Peninsula, Bengal, Assam), S. China (Yunnan), Burma, Siam, Indo-China, in Malaysia: Sumatra, Malay Peninsula, W. and M. Java, Borneo.

**Ecol.** Mainly on stony banks of rivulets (Saraca-streams, CORNER) and rivers, mainly at low elevation up to 500 m. Once collected at 1700 m (Atjeh, Sumatra).

Uses. The fruit, in particular the enclosing sepals, is eaten fresh and in curries and jellies. With syrup a cough mixture is made from it. The wood is moderately hard and has a durability under water of ca 3 years, is sometimes used for house-building or gunstocks (India). The species is planted rather often as an ornamental tree.

**Vern.** The Malay name, in use in Sumatra, the Malay Peninsula and Java is simpur or s. ayer (= water s.). In Sundanese the name is sém púr, s. batoe (= stone s.) or s. tjaí (= water s.), in Java the sém púr or kosar. In the Philippines, where the species is cultivated, it is known under the Singhalese name hondapara. **Engr.:** elephant-apple.

Notes. The dispersal of the seeds is said to be effected by animals, among others by elephants (BLATTER & MILLARD), or with current water. In the latter case the seeds may germinate in the fruit, which is left behind on the bank of a river, often partly filled up with mud, which gives a favorable substratum for the germination.


Tree, up to 40 m high with 25 m clean trunk, 90 cm diam., with reddish bark. Leaves elliptic to obovate, 4–8, usually 6–7-nerved, ca 5–12 by 3 1/2–6 1/2 cm, with rounded, sometimes slightly emarginate, to obtuse apex, acute base, decurrent along the petiole, and entire margin. Petiole 1–1 1/2 cm long. Flowers axillary, solitary or 2–3 serially placed, less often 3–6 on the apical part of a branch in the axil of distinct leaf-scars. Flowers ca 3 1/2 cm diam., on 2 1/2–7 1/2 cm long pedicels. Sepals 5, ovate to elliptic, the outer one ca 8 1/2 by 7 mm, the inner four 12–16 by 8–11 mm. Petals yellow, about oblong, 20 by 9 mm. Stamens in 2 distinct groups, the outer ones ca 110, 4 3/4–7 1/4 cm long, straight in bud, the inner ones ca 10, 8–11 cm long, distinctly thinner than those of the outer group, with their apex reflexed in bud; opening with lateral longitudinal slits. Carpels 4–6, usually 5, ca 4–4 1/2 cm.
by 1–1 1/2 mm, with 5 1/2–6 1/2 mm long styles; each with 7–10 ovules. Fruit dehiscent. Carpels ca 15 by 12 mm, 1–2-seeded. Seeds obovate, 3 by 2 mm, enclosed by a red, membranaceous aril.

**Distr. Malaysia:** Sumatra (not in the Lampong Distr.), Malay Peninsula, Riouw- and Lingga Archipelagos, Banka, and Borneo (only W. Borneo, Sarawak, and Br. N. Borneo).

Ecol. In primary or old secondary lowland forests, on wet, often peaty soil. Seems to be flowering at irregular intervals.

Uses. The wood, which is hard and heavy, is of good quality and is used in house-building.

**Vern.** Sumatra: *djaja keling* (Pal.), *dungan* (Sum. E. Coast), *simar pinasa* (Tapun.), *simpur paja* (Sum. E. Coast). Mal. Pen.: *simpur ayer* (= water s.), *s. paya* (= marsh s.), *s. paya hitam* (= black marsh s.). Riouw-Arch.: *pérépat darat*. Borneo: *debak lulus, ilas* (Daj.), *simpur bukit, s. laki, s. paya, s. rimbah* (Brunei and Br. N. Borneo).

**Notes.** The present species is the only one in *Dillenia* with axillary flowers. Probably the inflorescences of a group of cauli- and ramiflorous species, of which *Dillenia pentagonya* Roxb. is the only Malaysian representative, are comparable to the 3–6-flowered leafless branches, which sometimes occur in the present species, in which the axis is reduced.


Deciduous tree, up to 25 m high, with usually rather crooked, up to 12 m high clear trunk, to 1 m diam. Bark smooth, grayish, peeling off in thin scales. Leaves elliptic-obovate, ca 25–50-nerved, 20–50 by 10–20 cm, with rounded to obtuse apex, acute base, decurrent along the petiole, and manifestly dentate to nearly entire margin. Petiole 1 1/2–5 cm long, slightly winged with permanent, not amplexicaul wings. Leaves on saplings and young plants ob lanceolate, up to 75-nerved, up to 120 by 40 cm, with up to 15 mm broad petiolar wings, not sharply separated from the blade, distinctly nerved like the blade. Flowers 2–7 in a fascicle on an up to 3 mm long, short shoot with hairy bracts, on branches of 6 mm and more diam.; flowering mainly when leafless. Flowers 2 1/2–3 cm diam., on a 2 1/2–6 cm long pedicel without bracteoles. Sepals 5, elliptic, 8–12 by 5–9 mm. Petals yellowish or whitish, 15–20 by 5–10 mm. Stamens in 2 distinct groups, the outer ones 60–90, 2 1/2–4 mm long, straight in bud, the inner ones 10, 6–9 mm long, with their apex reflexed in bud, opening with longitudinal slits. Carpels 5–(6), ca 3 1/2–4 by 1 1/2–1 3/4 mm, with 4 mm long styles; each with 5–20 ovules. Fruit indehiscent, approximately globular, yellow, orange or red, 15 mm diam., 13 mm high including the enlarged, fleshy sepal, which are up to 16 by 14 mm, up to 3 mm thick at the base. Carpels ca 8 by 5 mm, 1–(2)-seeded. Seeds ovoid, 5 by 3 1/2 mm, exarillate.

Distr. In monsoon-regions, in continental Asia: India (Deccan Peninsula, N. to United Prov. and Assam), Burma, Andamans, Siam, Yunnan, Indo-China, and Hainan, in *Malaysia*: M. and E. Java (W. to Cheribon), Kangean, S. Celebes (Makassar and Muna Isl.), and Lesser Sunda Islands (Timor, Sumba, and Wetar) (cf. fig. 12).

**Fig. 12. Geographical distribution of Dillenia pentagonya** Roxb. (disjunct shaded areas).
with fascicled flowers; the other species are found only in the monsoon-regions of continental Asia.

38. Dillenia obovata (Bl.) Hoogl. comb. nov.—

Deciduous tree, with rather crooked trunk, up to 35 m high with up to 14 m clear trunk, to 70 cm diam. Leaves obovate, dull with a waxy coating beneath, ca 30–45-nerved, 20–40 by 12–20 cm, with rounded, on young plants and saplings acute, apex, acute, gradually narrowing base, and entire to slightly dentate margin. Petiole 1½–4 cm long. Flowers solitary, rarely 2 or 3, at the end of short side-branches, near the basis of the peduncle with a number of bracts, flowering mainly before the appearance of the leaves. Flowers 14–16 cm diam. Sepals elliptic, ca 30–38 by 20–30 mm. Petals bright yellow, 6½–8 by 4½–5½ cm. Stamens in 2 distinct groups, the outer ones yellow, ca 200–240, 12–13 mm long, straight in bud, the inner ones
yellowish white, ca 40–55, 22–24 mm long, with
their apex reflexed in bud. Carpels ca 9–11, ca 13
by 2 mm, with 20 mm long styles, each with 25–35
ovules. Fruit indehiscent, yellow or orange-col-
oured, approximately globular, 35–40 mm diam.
including the enlarged fleshy sepals, which are up
to 50 by 40 mm, 6 mm thick at the base. Carpels
ca 25 by 10 mm, 1- to few-seeded. Seeds 5 by
3½ mm, exarillate, embedded in transparent slime.

Distr. Lower Burma, Indo-China, and Siam, in
Malaysia: Northern part of the Malay Peninsula,
S. Sumatra, and W. Java.

Ecol. In secondary forests, on stony, period-
ically rather dry soils. Fl. at the end of the
relatively dry period, about April in the Malay
Peninsula, July to October in S. Sumatra and
W. Java.

Uses. The fruit is eaten in curries, the wood
sometimes used in house-building.

béné, s. rimba, s. talang. Java: sëmpu (Jav.), sëmpu,
s. batu (Sund.).

Notes. Dillenia aurea Sm. is a closely re-
lated species, occurring in NE. India and N. and
Central Burma; cf. Parkinson (1935). The dif-
ferences in reproductive parts are slight, but the leaf-
shape in adult state is very characteristic.

Excluded and doubtful

Dillenia grandifolia Wall. Cat. (1828) no 946, no-
men; HK. f. & Th. Fl. Ind. 1 (1855) 71; Mtq. Fl.
Ind. Bat. 1, 2 (1859) 12; HK. f. & Th. Fl. Br. Ind.
1 (1872) 38; King, J. As. Soc. Beng. 58, 2 (1889)
368; Ridl., J. Str. Br. R. A. S. 59 (1911) 61; Fl. Mal.
Pen. 1 (1922) 11; Craib, Fl. Siam. En. 1 (1925) 22;
Corn. Wayside Trees Malaya (1940) 203.

The type-collection consists of leaves from a
young tree or sapling and is referable either to
Dillenia ovata Wall. ex HK. f. & Th. or to Dillenia
reticulata King. Most of the later literature refers
to specimens belonging to the latter species. From
study of the leaves of saplings of both species,
which come into consideration, the identity must
be decided.

Dillenia indica var. aurea (Sm.) O.K. Rev. Gen.
Pl. 1 (1891) 4.

Kuntze, when making this new combination,
had a specimen of Dillenia ovata Wall. ex HK.
f. & Th., from cultivation in the Botanic Gardens
at Bogor. Dillenia aurea Sm. is an Indian species;
cf. sub D. obovata (Bl.) Hoogl.

36, 1 (1863) 547.

The description is insufficient for identification.
Of the Javanese species Tetracera fagifolia Bl.
comes nearest to it; most probably the species will
have to be reduced to it.
CAPRIFOLIACEAE (J. H. Kern, Bogor, and C. G. G. J. van Steenis, Leyden)

Small trees, shrubs or twining woody plants, rarely herbs; branches terete. Glands present in various parts. Indumentum consisting of simple hairs, or in Viburnum sometimes lepidote; glandular hairs mostly present. Stems often pithy. Leaves decussate, simple or deeply divided (Sambucus), sometimes provided with pitted or cup-shaped glands exuding resin. Stipules absent or very small. Flowers $\varphi$, actinomorphic or zygomorphic, mostly cymosely arranged, 4-5-merous; outer flowers in an inflorescence sometimes differing from the normal ones, rarely (Sambucus p.p.) some fls aborted into extra-floral nectaries. Calyx adnate to the ovary, (4-)5-fid or -toothed, mostly constricted below the limb; sepals often enlarged in fruit. Corolla epigynous, gamopetalous, sometimes 2-lipped, lobes mostly imbricate in bud. Stamens inserted on the corolla tube, alternating with the lobes, extrorse or introrse. Anthers free, 2-celled, dorsifixed, versatile, cells parallel, opening lengthwise, mostly introrse; filaments sometimes reflexed or curved in bud. Ovary inferior, 1-(2)-3-5-(8)-celled, in fruit cells sometimes partly abortive. Style terminal, often slender with one knoblike stigma, or 3 short partly connate styles. Ovules 1(-∞), pendulous or axile. Fruit a drupe or berry, rarely a capsule. Seeds often only one per fruit, often with bony testa. Endosperm copious, sometimes ruminate; embryo straight, often small and linear, axial, cotyledons oval or oblong.

Distr. Ca 10–14 genera, mainly distributed on the N. hemisphere, in the tropics mostly confined to the mountains, on the S. hemisphere only Viburnum and Sambucus, an endemic genus in New Zealand, two monotypic endemic genera in New Caledonia, in Australia only Sambucus in the eastern part.

Ecol. Caprifoliaceae do not play an important role in Malaysian vegetation as to numbers: both Loniceræ and some spp. of Sambucus may predominate locally in mountain thickets and clearings. Most members of the family are insect-pollinated; Loniceræ has a nocturnal fragrance; the exact function of the peculiar metamorphosed flowers in Sambucus javanica is not known.

Uses. Many spp. of all three genera treated here are used as ornamentals. The honey-suckles (Loniceræ) have mostly fragrant flowers.

Notes. The family seems to be most related to the Valerianaceæ to which the foliage of Sambucus and the occurrence of valerianic acid in Viburnum add in importance, but there is no unanimity on the delimitation of the family.

Baillon (Hist. Pl. 7, 1880, 352 seq.), McAtee (Bull. Torrey Bot. Club 48, 1921, 149), and Fritsch (Bot. Centr. Bl. 1892, ii, p. 169) are of opinion that Caprifoliaceæ ought to be merged into Rubiaceæ. The occurrence of interpetiolar stipules or appendages accepted to represent stipules obscure a clear distinction. I fail to understand why Kurz can eliminate Scyphiphora from the Rubiaceæ and refer it to Caprifoliaceæ (J. As. Soc. Beng. 45, ii, 1876, 133; For. Fl. 2, 1877, 4) ‘by the structure of the ovary and position of the ovules which are tell-tale marks of its caprifoliaceous descent’, as the gynoecium is very variable in Rubiaceæ. Moreover, Scyphiphora possesses stipules bearing collers (see below).

With Carlemannia and Sylvianthus (the latter absent from Malaysia) the case is different; Hooker f. and Pitard included them in Rubiaceæ. Solereder in his valuable study on the anatomy of the rubiaceous complex showed (Bull. Herb. Boiss. 1, 1893, 171, 173, 174) that they belong to Caprifoliaceæ, by absence of stipules and presence of capitate-glandular hairs typical of Caprifoliaceæ. He is followed by Hallier f. and Breckamp.

However, a general merging of Caprifoliaceæ into Rubiaceæ seems to us undesirable, as by that procedure the various caprifoliaceous genera would be assigned to various rubiaceous tribes, and come to remote positions not reflecting their affinity.

Another question is whether, contrarily, genera hitherto accepted as rubiaceous ought to be removed to Caprifoliaceæ. Solereder (l.c.), followed by Krause (Ber. D.B.G. 28, 1909, 446-452) and Glück (Blatt- u. Blütenthorng. Stud. 1919, 135) have focussed attention to the regular and typical occurrence of resin-glandular bodies, or trichomes, on the adaxial basis of Rubiaceæ stipules, called colleters. Colleters are known in a limited number of other families and genera such as Cunoniaceæ, Rhizophoraceæ, Caesalpiniaceæ, and, as was found recently, are also typical for Nothosagus. Dr Bakhuisen van den Brink Jr, who is now revising Rubiaceæ for this Flora, has found them in all genera hitherto studied except a few, viz: Dentella, Hedyotis, Boreria, Spermacoceæ, Richardsonia, Anoites, Allaeophanta, and Dioida, of which genera some appear to be aberrant in Rubiaceæ on account of their ovules, by which character they come now wide apart in rubiaceous taxonomy, whereas in other points they appear
closely allied (cf. also Boerlage, Handl. 2, 1891, 9, 10 & 19). The research on the problem whether these are really rubiaceous is one of time-consuming nature and of too great importance to be solved prematurely. Pending continued research the present revision is published in the old circumscription of *Caprifoliaceae*. It seems desirable to make additional karyological investigations on genera eventually to be joined to *Caprifoliaceae* as in the old circumscription the basic chromosome numbers seem to be rather constantly 8 and 9 (cf. Sax & Krebs, J. Arn. Arb. 11, 1930, 147–152). An account of pollen structure seems also desirable.

The genus *Gaertnera* is distinct from *Rubiaceae* by a superior ovary and absence of colleters, and will be treated, in this Flora, as loganiaceous, though Solfereder (Ber. D.B.G. Gen.-Vers. Heft 1890, p. 70; Bull. Herb. Boiss. 1, 1893, 169) assigns it to *Rubiaceae*. In both families it keeps an isolated position.

The family appears to us a coherent and natural one: minor though by no means neglectable characters common to all are: glandular hairs and glands in other parts, enlarging sepalas, a distinct constriction between ovary and sepalas, and dorsifixied anthers, a character hitherto not specially stressed in literature (in *Sambucus* the cells are free but fixed in the middle!).

Leaves of juvenile forms of some species are occasionally distinctly lobed, e.g. in *Symphoricarpus* and *Lonicera*.

In collecting *Caprifoliaceae* it is urgent to collect both full-grown flowers and ripe fruits.

The first author is responsible for the revision of *Viburnum*, the second author for the rest.

**KEY TO THE GENERA**

1. Leaves pinnate
2. Leaves simple.
4. Shrubs, small trees, or lianas. Corolla 5-merous, Stamens 5. Drupe or berry.
5. Ovary-cells with more than 1 ovule. Corolla 2-lipped, at least 12 mm long. Style simple, long, with a capitulate stigma. Berry

**1. LONICERA**


Shrubs or (in Malaysia exclusively) woody climbers twining to the right, or, in the absence of sufficient support, locally scrambling shrubs; bark at last lengthwise splitting, twigs mostly contorted. Leaves hairy or glabrous, entire (in the Malaysian spp.), free (or in extra-Malaysian subg. *Periclymenum*) connate. Stipules absent, but leaf-bases connected by a raised line on the node. Flowers 5-merous, mostly sessile, in 2-flowered, axillary, peduncled or rarely almost sessile cymes, not rarely specially developed towards the end of the branches and forming a leafy terminal panicle. Cymes occasionally 3-flowered. Each pair of flowers subtended by 2 bracts and 4 bracteoles, the latter sometimes covering the ovary. Calyx-tube ovoid or subglobose, teeth mostly small. Corolla elongated, mostly 2-lipped, upper lip representing 4 lobes, and mostly 4-lobed at its apex, lobes imbricate in bud. Stamens 5, anthers introrse, mostly exserted; filaments inserted near the apex of the tube. Ovary 2–3-celled, style filiform, elongated, usually exert, and exceeding the stamens, stigma capitulate. Ovules axile, 3–8 per cell, pendulous. Berries mostly few-seeded, free or (in extra-Malaysian spp.) connate in pairs. Seeds generally ovoid with fleshy albumen and a terete embryo.

**Dist.** Ca 150 spp. described from the N. hemisphere, centering in the Himalayas to Central and E. Asia, not in Ceylon, crossing the equator only in Malaysia.

The Malaysian spp. belong to § Nintooa DC. comprising ± 30 spp. centering in SE.–E. Asia, with 1 sp. in the Mediterranean.

Ecol. In Malaysia only found in the W. part, confined to the zones above 1000 m alt.

Uses. Two spp. are used widely as ornamentals.


Notes. In the absence of sufficient support specimens may turn to scrambling, but they are in the forest true lianas.
For measurements of flowers, full-grown open flowers should be used. All Malaysian spp. including the cultivated ones belong to § Nintooa.

In my eye Rehder has distinguished too many spp. in this section. His subsections Longiflorae and Breviflorae I think are rather artificial.

**KEY TO THE SPECIES**

1. Bracts below each pair of flowers foliaceous
   1. L. japonica

2. Bracts subulate to lanceolate, not leafy
   2. L. confusa

3. Bracts ovate-lanceolate
   5. ovate-lanceolate, 177

4. Flowers in the dried state at most \( \pm 2/2 \) cm long.

5. Bracts internodes sparsely ioled, edges apex to (1856) Bekn.
   7. L. javanica

6. Flowers thickish, crowded towards the twig-ends, peduncles short, congested towards the twig-ends, flowers not exceeding the leaves. Capitate glandular hairs absent or negligible. In anthesis only the lower lip recurved. Internodes stiffish, twigs not shiny-brown
   6. L. acuminata

3. Bracts ovate-lanceolate
   6. L. acuminata

4. Flowers slender, 2–4 on slender axillary peduncles. Flowering parts hairy and besides with capitate glandular hairs. In anthesis both lips recurved. Internodes slender, twigs soon shiny-brown

7. L. javanica

3. Bracts subulate to lanceolate, not leafy
   2. L. confusa

2. Ovary hairy all over
   2. L. confusa


Twining. Twigs short-pubescent, glabrescent, sparingly glandular-hairy, shiny-brown, ultimate internodes short-tomentose. Leaves ovate-oblong to ovate-lanceolate, base rounded to truncate, apex acute, acuminate or subacute, midrib and edges pilose, darkgreen and shiny above; 3–8(1/2) by 11/2–2 cm, petiole 3/4–1 cm. Flowers fragrant, 3–5 cm. Peduncle 1/4–1/2 cm, tomentose. Bracts petiolate, leafy, oblong-ovate, or oblong-ovobate, 10–18 by 4–8 mm. Bracteoles roundish, 3/4 mm, hairy, glandular, ciliate. Calyx-lobes linear from a triangular base, hairless, \( \pm 1/2 \) mm, ciliate. Corolla 4–5 cm, creamy, or pale rosa-tinged towards the base, fading orange-yellow, lobes as long as the tube, hairs mixed with capitate glandular hairs, tube \( \pm 2/2 \) cm, lobes 1/2 of the limb of upper lip. Style glabrous, \( \pm \) as long as the corolla. Stamens glabrous. Berry glabrous, 6–7 mm diam., black.

Distr. From Yunnan to Formosa & Japan, in Malaysia: cultivated as an ornamental up to \( \pm 1000 \) m.

Ecol. Fruit is rarely set in Malaysia, fl. Jan.–Dec. Uses. BURKILL (Dict. 1935, 1363) says that at Singapore Chinese import flowers from China; they are said to possess antifebrile, corrective and astringent properties. The vegetative parts contain a saponin.

**Notes.** An early introduction, possibly via the Botanic Gardens at Bogor, as far as known never run wild. Many varieties have been distinguished (REHDER, l.c.).


Whole plant short-tomentose, with the exception of the upperside of the leaves which is sparingly pubescent. Twigs \( \pm \) eglandular. Leaves ovate-oblong to oblong, base rounded, truncate, or subcordate, apex acute or acuminate, margin tending to recurve, texture tending to be bullate by impressed nerves and reticulations, 3–6 by 11/2–3 cm. Petiole 1/2–11/4 cm. Inflorescences lateral, condensed, \( \pm \) 7-flowered or at the end of twig multiflorous, provided with reduced leaves, exceeding the leaves, on 1–2 cm long stalks; cymes \( \pm \) sessile or some mm peduncled. Bracts linear, as long as or longer than the ovary, rarely subspathulate. Bracteoles suborbicular, 1 mm, hairy. Calyx-lobes narrow-triangular, hisurate, shorter than the ovary. Corolla 4–5 cm, pubescent, lobes \( \pm \) as long as the slender tube, provided with capitate glandular hairs; apex of the upper lip split for 1/5 of its length, lobes ovate. Style glabrous. Stamens only slightly hairy towards the base.

Distr. China, Hainan, in Malaysia rarely cultivated as an ornamental.
Note. Closely allied to L. japonica, in one species I found subspathulate bracts tending to become foliaceous.


Slender, ± entirely glabrous. Internodes 4–7 cm. Leaves subtriangular at the base, without distinct reticulations, thickish, narrowed towards the base, elliptic to oblong-elliptic, acuminate, 4–9 by 2–3 cm, nerves 4–5 on either side, not prominent; petiole 1/3–1 cm long. Peduncles axillary and terminal, 1–1 1/2 cm long, 2-flowered; at the twig-ends sometimes 4 ± together. Flowers slender, glabrous except some small negligeable cilia on the edge of the calyx and bracts, white or rosa-like beige. Bracts half as long as the ovary, lanceolate-acuminaté, 1 1/2–2 mm. Bracteoles suborbicular-ovate, 1 mm, blunt. Calyx-tube (ovary) constricted at the apex, free part shorter than the ovary, split halfway down, lobes ovate, subacute, 1 mm. Corolla slender, 5 1/2–6 1/2 cm long; tube 3 1/2–4 cm, upper lip split into 4 lobes ± 1 1/2–1 1/2 cm of its length. Style subglabrous with reflexed, sparse, white hairs, 6–7 cm long. Stamens subglabrous, distinctly exserted.

Distr. S. Siam (Puket), Ava (Burma), Yunnan, in Malaysia: Sumatra (rare).

Ecol. Thickets and forest borders in the mountain regions, 1000–1250 m, fl. Apr.–June.

Vern. Kaju kaleh simienjak (Alahanpandjang).

Notes. Rehder places this well-defined sp. incorrectly in subsect. **Breviflorae** because of the fact that Miquel described the flowers after specimens in the immature bud state. Although I have not seen the type specimen of L. leiantha Kurz the description is wholly fit for Sumatran plants, at which Merrill has already hinted.


Scrambling shrub, branches hisurate by long spreading, and short hairs, intermixed with very few ± sessile glandular-capitate hairs. Leaves oblong-elliptic, not bullate, but nerves and reticulations impressed above, base rounded, apex short-acuminate, 6–11 by 2 1/4–5 cm, glabrous above except the base of the midrib, spreading-hisurate underneath on nerves and reticulations, and with short-stalked, sparse capitate-glandular hairs, edge ± flat, filmbiature ± 2 mm long hairs; nerves 5–6 pairs; petiole 5–7 mm, yellow-hairy. Peduncles axillary, 1 1/2–3 1/2 cm, yellow-hairy, 2-flowered. Bracts linear-lanceolate, ± 3 mm, hairy, as long as the ovary, twice as long as the ovate-acuminaté, 1 1/2–2 mm similar bracteoles. Flowers hairy, white fading to pale yellow, 5–6 cm long. Calyx-tube urceolate, drying bluish, glabrous, teeth linear, hisurate, 1 1/2–2 mm long. Corolla-tube 3 1/2–4 1/2 cm long, very thin (1–1 1/2 mm diam.), straight, hisurate by reflexed rather appressed, setaceous yellow hairs, glandular, yellow-strigose inside, upper lip strongly involuted-recurred, ± 15 by 3 1/2–4 mm, lobes ovate blunt, ± 2 mm, lower lip spreading, ca 6 by 1 mm. Filaments glabrous, ± 2 1/2 cm exserted, anthers 3 mm, linear. Style glabrous, long-exserted, 7 1/2–8 cm, stigmatic knob distinct.

Distr. ?Hainan, in Malay: Malay Peninsula (Pahang), twice collected.

Ecol. Scrambling over bushes by Bertam River, ca 1000 m, fl. April–June.

Notes. My former referring this sp. provisionally to L. pulcherrima has been entirely wrong; it is perfectly distinct from all other Malayans spp. The affinity of this sp. seems to be with the E. Asiatic L. affinis Hook. & Arn., L. similis Hemsl., and L. macrantha Spr. From L. simanesis Gamble differing by long-exserted stamens and style, from L. similis and macrantha by thinner, eglandular corolla. F. C. How & N. K. Chun 70187 from Hainan seems an exact match.


Climbing or scrambling, branches short-tomentose. Leaves ovate, blunt or acute, base shortly narrowed, glabrous above, short glaucous-tomentose beneath, nerves and reticulations impressed above, 3–7 1/2 by 1 1/2–2 1/2 cm. Petiole tomentose, 1 1/2–1 1/2 cm. Flowers in terminal-congested, many-flowered leafy panicles exceeding the leaves, stalks and flowering parts with subsessile, red, capitate-glandular hairs interspersed in the tomentum. Bracts narrow-lanceolate, 2 mm, tomentose. Bracteoles ± orbicular, ± 1 mm, shorter than the ovary, tomentose. Calyx-tube ellipsoid, glabrous except near the apex, lobes lanceolate, as long as the tube, 1 1/2–2 mm. Corolla pale yellow turning orange with age, tube 2–2 1/2 cm, slender, subangular, tomentose, lips ± 1 1/4–1 1/4 cm, upper lip incised to 1/4–1/5. Stamens far exserted, filaments sparingly hairy towards the base, anthers 3 mm. Style far exserted, glabrous or occasionally with a few negligible, spreading hairs.


Ecol. Streambeds, forest borders, open rocky places, 850–1400 m, fl. Sept.–Feb.

Notes. Seems to occur in continental Asia and should be compared with L. leshchenaultii Wall. from India. L. reticulata (non RAFIN.) CHAMP. from Klangsi (Lau 4649) seems to be an exact match.


Woody climber or scrambling shrub. Twigs patentently hirsute. Internodes rather short. Leaves ovate-oblong to lanceolate, variable in shape, base rounded, truncate or subcordate, apex acute to acuminate, texture often bullate by impressed nerves and reticulations, both sides green, hairiness in various degrees but midrib above always hairy, 3–8 by 1½–4 cm; petiole patent-yellow hairy, 1/4–1 cm. Cymes mostly contracted towards the twigs ends, infl. not exceeding the leaves. Peduncle densely patent-hirsute, sometimes with few sessile glands. Bracts 5–8 mm rarely shorter, narrow triangular, as long as or longer than the ovary. Bracteoles 2 mm, acute oblong, shorter than the ovary. Calyx green, lobes ciliate, with a few stiff hairs on the back. Corolla 2–2½ cm long, sulphureous, not fragrant, rather thick and club-shaped in bud, in anthesis upper lip erect, lower lip reflexed; tube glabrous or with few reflexed stipitate hairs, sometimes with few sessile glands. Style ± as long as the corolla, mostly hairy. Berry black.

Distr. India to S. China and Formosa, in Malaysia: Sumatra, Java, Bali, Philippines (Luzon).

Ecot. Forest borders, thickets, ericoid crooked forest, mossy forest, 1800–3300 m, fl. Jan.–Dec.

Vern. Ki serok, S.

Notes. Both L. acuminata and L. javanica show the remarkable 'mass-elevation effect' (cf. J. Arn. Arb. 27 (1946) 447; Fl. Mal. 4 (1949) xlix, f. 37). Cf. fig. 3. In Java the species exclude each other altitudinally, and represent vicarious species (fig. 3). On the summit of Mt Pangrango, W. Java, DOCTERS VAN LEEUWEN studied the variability (l.c.). He noted the occurrence of φ of the anthers of which do not contain pollen. He also mentioned the insect pollination by Bombus. Part of his observations belong to L. javanica. Aberrative forms
I found in the herbarium are with 3-verticillate leaves, and others with occasionally flowers in triads. A duplotype in fruit at Kew leaves no doubt about the identity of *L. mindanaensis* Merr.

Fig. 2. *Lonicer a acuminata* Wall. on summit of Mt Pangrango, W. Java (Docters van Leeuwen).


Slender, twining. Ultimate twigs short-hairy, mixed with capitulate-glandular hairs, internodes soon glabrate, shiny-brown, rather long. *Leaves* ovate to obovate, or obovate-oblong, base truncate, rounded or cordate, apex acute to acuminate, upperside glabrous or the base of the midrib hairy, beneath glaucous, short-pubescent, 4–11 by 2–6½ cm; petiole ½–1 cm, pubescent. *Inflorescences* short-grey-hairy, mixed with distinctly stalked capitulate-glandular hairs, terminal and in the upper axils so as to form a rather lax, leafy panicle, exceeding the leaves; lower branches up to 6 cm, with reduced leaves, upper internodes not abbreviated. *Flowers* creamy, fragrant; later fading into yellowish. Bracts linear-lanceolate, as long as or longer than the calyx. Bracteoles ovate, shorter than the ovary. Calyx purplish, lobes lanceolate, 1½–2 mm, the lobes mostly rather densely grey-hairy, sometimes only ciliate. Bud club-shaped, thickened end ± 1½–1¼ of the mature bud, often acute. Corolla 18–30 mm (fresh 3–3½ cm) long, the tube slender, 1 mm or thinner, 1–2 cm, lobes narrow, 8–14 mm long, ± 1–2½ mm broad, during anthesis both lips recurved, lobes as long as the tube or shorter; hairs on the corolla recurved, except the capitulate glandular ones. Anthers thin, 2–4 by ½–½ mm. Stamens protruding, glabrous. Style often longer than the corolla, glabrous, exerted. *Berry* dark purple, ripe prob. black.

**Distr.** Malaysia: Java, Lesser Sunda Islands (Bali), Philippines (Mindanao).

**Ecot.** Forests and forest borders, 1000–2000 m; cf. the note under *L. acuminata*.

**Vern.** Ki seroh, S. gauod-bukid (Buk.).

**Notes.** Appareently closely allied to *L. glabra* DC. and *L. affinis* Hook. & Arn. from continental Asia, and in some respects to *L. macrantha*. The density of pubescence is very variable, ranging from hairless forms to almost glabrous ones; leaf-shape and size also vary, even on one twig from ovate to obovate. Pubescence of calyx-teeth varies from ciliate to tomentose. Occasionally 3-lobed leaves occur on young shoots. Sometimes 4-flowered cymes are observed.

**Fig. 3. Altitudinal localities (in metres) of *Lonicer a acuminata* Wall. (×) and *L. javanica* (†) in Java and Bali. Mountains arranged from W towards E. Thickened vertical lines indicate the altitude of the summits.**

2. **VIBURNUM**

Caprifoliaceae (Kern &

Dec. 1951]

181

Steenis)

V.

Ridl. F1. Mai. Pen. 2 (1923) 1; Backer, Bekn. Fl. Java,
em. ed. 8 (1949) fam. 175, p. 2; Kern, Reinw. 1 (1951) 107.
Shrubs or small trees. Leaves petiolate, simple, entire or serrate-dentate or trifid,
pinnate- or palmate-nerved, (in the Malaysian species) exstipulate. Inflorescence
terminal, compound, corymbiform or paniculate, primary rays usually whorled,
flowers cymosely arranged. Bracts and bracteoles usually small, caducous. /"/oue/'^
actinomorphic, the marginal ones sometimes (not in Malaysia) radiant, neutral.
Calyx 5-lobed or 5-partite. Corolla white, creamy or pink, rotate, campanulate,
hypocrateriform or tubular; lobes 5, imbricate in bud. Stamens 5; filaments narrow.
Ovary 1 -celled. Ovule anatropous, pendulous from the apex, solitary. Style short,
conical; stigmas 3, often connate. Fruit a drupe, crowned by the persistent calyx
and style, 1 -seeded. Endocarp horny or stony, in cross-section often undulate or
with inflexed edges. Albumen often ruminate.
Philip. 3 (1923) 577;

Distr. Large genus; several hundred, often polymorphous species in Europe, Asia, and America,
16 spp. in Malaysia.
Uses. None of the Malaysian species are known to be of importance economically.
anat. Moll & Janssonius, Mikr. Holzes 4 (1920; 5. V. coriaceum: M. & Js. p. 19, V. sam-

Wood

bucinum:

p. 20,

V. lutescens: p. 11.

satisfactory identification both flowers and ripe fruits are required, a condition rarely
From 3 spp. flowers are unfortunately hitherto unknown.
The stellate hairs mentioned to occur in some spp. are apparently not properly stellate but fasciculate
hairs (c/. McAtee, Bull. Torrey Bot. CI. 48, 1921, 149 seq.).

Notes. For a

found

in the

herbarium.

KEY TO THE SPECIES
(for flowering specimens)

the flowers of V. amplificatum, V. corniitidens and V. clemensae are unknown, these species have
been omitted.
15. V. propinquum
1. Leaves triple-nerved. Tube of corolla hairy within
1. Leaves penninerved. Tube of corolla glabrous within.
2. Corolla squamulose without. All young parts densely co%ered with minute rusty-coloured peltate
scales. Leaves entire, the underside at first densely covered with minute scales, later on densely
6. V, punctatum
punctulate
2. Corolla quite glabrous or pubescent without, sometimes gland-dotted, but not squamulose. Young
parts without peltate scales.
mm. Filaments
long, lobes
;
3. Corolla pubescent without, rotate, tube very short, about
16. \'. luzonicum
long. Young branchlets ferrugineous-pubescent
l'/2-2
yar. luzonicum
4. Adult lea\es pubescent
4. Adult leaves nearly glabrous except for the midrib.
va/-. apoense
5. Leaves nearly entire
5. Leaves strongly dentate.
war. floribundum
6. Apex of leaves acute to shortly acuminate
var. sinuatam
6. Apex of leaves slenderly acuminate
long.
3. Corolla glabrous or gland-dotted without, tube at least 1
7. Filaments adnate to the throat of the corolla. Corolla shortly salvershaped-campanulate. limb
13. V. odoratissimum
long, lobes 2
horizontally spreading, finally reflexed; tube 2-3
7. Filaments adnate to the base or the tube of the corolla. Shape of the corolla diff"erent.
long, lobes 1-2 mm. Filaments 5-7(-9) mm.
8. Ovary pubescent. Corolla glabrous, tube 1-1' 2
7, V. sambucinum
Leaves large, 10-25 by 5-10 cm, coriaceous, entire

As

'

mm

1

mm

mm

mm

mm

.

mm

Ovary and axes of inflorescence densely pubescent.

9.

Underside of leaves glabrous except for a few hairs on the nerves
Underside of leaves villous
Ovary and axes of inflorescence subglabrous

10.

10.
9.
8.

.

.

var.
vor.

var.

sambucinum
tomentosum
subglabrum

Ovary not pubescent.
Corolla distinctly tubular, tube at least 3 times as long as lobes, the latter about 1 mm, erect.
Leaves quite entire, underside with distinct glandular pit at the base on both sides of midrib,
apex obtuse or shortly and bluntly acuminate. Filaments inserted at base of corolla, 7-8
2. V. beccarii
long
12. Leaves usually distinctly dentate, sometimes nearly entire, underside bearded in nerve-axils,
but without glandular pits, apex mostly gradually long-acuminate. Filaments usually about
1. V. coriacemn
4
long

II.

12.

mm

mm


13. Tube of corolla 3-4 mm long. Filaments about 4 mm long, adnate 1/2-1 mm above base of corolla. Flora var. coriaceum
14. Tube of corolla about 6 mm long. Filaments up to 6 mm long, adnate 2-3 mm above base of corolla. Flora var. longiflorum
11. Corolla not distinctly tubular, tube less than 3 times as long as lobes, the latter usually more than 1 mm long.
15. Leaves thinly coriaceous. Corolla 2-2 1/2 mm long. Filaments inserted at base of the corolla. (Between 500 and 1500 m altitude, sometimes up to 2300 m) 10. V. lutescens
15. Leaves manifestly coriaceous. Corolla 3 mm long. Filaments adnate to the corolla 1/2-1 mm above the base. Without fruits hardly distinguishable from V. lutescens. (Altitude at least 2300 m) 11. V. junghuhnii
14. Inflorescence corymbiform. Tube of the corolla usually exceeding 1 mm. Filaments at least 6 mm long.
16. Filaments 6(-7) mm long, in bud with inflexed top.
17. Corolla shortly tubular-turbinate, globular in bud, tube about 2 mm, lobes 1/2-2 mm. Leaves gradually long-acuminate 4. V. platyphyllum
17. Corolla broad-tubular, obovoid in bud, tube about 2 1/2 mm, lobes about 1/2 mm. Leaves obtuse or shortly and bluntly acuminate 3. V. glaberrimum
18. Filaments (8-9)-10 mm long, serpentine in bud.
18. Leaves dull, hispidulous on the midrib and the primary side-nerves at the underside, without glandular pits. Corolla rotate-cupular, tube (1-1 1/2) mm, lobes 2-2 1/2 mm. 8. V. hispidulum
18. Leaves shining, glabrous, with distinct glandular pits at the base. Corolla turbinate, tube 2 1/2-3 mm, lobes 1 1/2-2 mm 9. V. vernicosum

**KEY TO THE SPECIES**

(for fruiting specimens)

1. Leaves triple-nerved. Fruits nearly globose, 4-5 mm long, 4 mm wide 15. V. propinquum
2. Leaves penninerved. Fruits usually compressed, if not, more than 5 mm long.
3. Fruit oblong, 16 by 7 mm. Internal cavity of the fruit bilobate in cross-section. Leaves entire, glabrous, elliptic-oblong to slightly obovate, up to 26 by 12-13 cm 12. V. amplificatum
3. Fruit smaller.
4. Leaves minutely papillose-rugulose, entire. Ventral side of endocarp forming a narrow split, central cavity at most 1/2 mm in diameter 14. V. clemensae
4. Leaves smooth, usually dentate or serrate. Central cavity of fruit about 2 mm wide.
5. Fruit ovoid, 6-7 by 4-5 mm. Internal cavity of fruit nearly circular in cross-section. Leaves dentate to nearly entire 13. V. odoratissimum
6. Fruit obovoid, 7-9 by 5-7 mm. Internal cavity of the fruit broad, bilobate in cross-section. Leaves closely crenate-dentate 11. V. junghuhnii
2. Endocarp undulate in cross-section, *i.e.*, with shallow grooves on both sides, without internal split or cavity.
7. All young parts densely covered with minute peltate scales. Underside of the leaves at first densely covered with minute scales, later on densely punctulate. Fruit elliptic to somewhat obovoid, 9-11 by 6-7 mm 6. V. punctatum
7. Young parts without peltate scales.
8. Ripe fruit small, 5-6(-6 1/2) mm long.
9. Leaves usually ovate-lanceolate, gradually long-acuminate. Fruit ovoid to broad-ellipsoid, 6(-6 1/2) by 5-6 mm. 1. V. coriaceum
9. Leaves broader, obovate to obovate, obtuse or shortly and bluntly acuminate. Fruit about 5 by 5 mm, ovate to nearly orbicular 3. V. glaberrimum
8. Ripe fruits larger (without flowers hardly determinable!)
10. Nerve-axes and leaf-base without glandular pits or spotty glands. Midrib and primary nerves somewhat hispidulous beneath. Young branchlets and axes of inflorescence glabrous or sparingly hispidulous. Young fruits glabrous 8. V. hispidulum
10. Nerve-axes and/or leaf-base at underside glandular pitted or with (sometimes indistinct) spotty glands. Midrib and primary nerves not hispidulous.
11. Young branchlets densely pubescent. Axes of the inflorescence pubescent, glabrescent. Young fruits thinly pubescent, soon glabrescent. Underside of leaves at the base with (sometimes indistinct) spotty gland on both sides of midrib 7. V. sambucinum
12. Axes of the inflorescence densely pubescent, later on glabrescent.
13. Underside of leaves glabrous except for a few hairs on the nerves . var. sambucinum
13. Underside of the leaves villous . var. tomentosum
12. Axes of the infructescence nearly glabrous . var. subglabrum
11. Young branchlets and axes of infructescence glabrous to somewhat (not densely) pubescent. Young fruits glabrous.
14. Leaves large, up to 22 by 10 cm, ovate to oblong-ovate, apex gradually narrowed into an elongated and slender acumen . 4. V. platyphyllum
14. Leaves smaller, obtuse or shortly and bluntly acuminate.
15. Young axes of the inflorescence pubescent, glabrescent. Young parts not vernicosus. Primary nerves at the underside of the leaves little prominent . 2. V. beccarii
15. Infructescence quite glabrous. Young parts vernicosus. Primary side-nerves at the underside of the leaves prominent . 9. V. vernicosum
6. Leaves dentate or serrate (sometimes superficially).
16. At least at the midrib of the leaves pubescent. Leaves chartaceous, rarely subcoriaceous. Fruit ovate, much compressed, 5-7 by 5-6 mm, ripening red (always?) . 16. V. luzonicum
17. Adult leaves pubescent
17. Adult leaves nearly glabrous except for the midrib.
18. Leaves nearly entire
18. Leaves strongly dentate.
19. Apex of the leaves acute to shortly acuminate . var. floribundum
19. Apex of the leaves slenderly acuminate . var. sinuatum
16. Leaves glabrous (sometimes bearded in the nerve-axils), more or less coriaceous. Fruit ripening purplish or bluish black.
20. Leaves thickly coriaceous, beneath with shallowly sunken glands in the nerve-axils, margins conspicuously coriunculate-dentate. Fruit broadly ovate, 8 by 6-7 mm . 5. V. cornutidens
20. Not combining these characters.
21. Infructescence shortly paniculate. Fruit oblong-elliptic, 7-10 by 4-5 mm or still larger. 10. V. lutescens
21. Infructescence corymiform. Fruit more ovate or ovoid, smaller.
22. Leaves usually ovate-lanceolate, gradually long-acuminate, distinctly dentate. Fruit 6(-6½) by 5-6 mm . 1. V. coriaceum
22. Leaves broader, ovate to obovate, obtuse or shortly and bluntly acuminate, nearly entire. Fruit 5 by 5 mm . 3. V. glaberrimum


Shrub or small tree up to 15 m. Young parts thinly stellate-pubescent. Leaves coriaceous, somewhat shining, glabrous above, often bearded in the nerve-axils on the underside, ovate to lanceolate, 10-24 by 4-8 cm, apex mostly gradually long-acuminate, base rounded or somewhat acute, margins superfliously remotely dentate to rather densely serrate-dentate, sometimes almost entire; primary nerves 5-7 on each side, indistinctly anastomosing; petiole 2½-4 cm. Inflorescence umbellate, corymiform, up to 10 cm across; axes thinly stellate-pubescent; peduncle short, up to 2½ cm; primary rays 5-7. Bracts and bracteoles small, ovate. Flowers somewhat scented. Calyx-limb obscurely toothed, 1½-2 mm diam., teeth triangular, acute. Corolla tubular, ellipsoid-obovoid in bud, creamy white to white, sometimes pink without, usually dotted with brown; tube 3-4 mm, lobes erect, rounded triangular, 1 mm. Stamens exserted: filaments with inflexed top in bud, white, adnate to the corolla-tube 1½-1 mm above the base, about 4 mm long; anthers oblong, purplish, 1-1½ mm. Ovary cylindric, glabrous or lepidote, 1½-2 mm long. Drupe ovoid to broad-ellipsoidal or nearly spherical, slightly compressed, bluish black, 6-6½ by 5-6 mm; endocarp undulate in cross-section, dorsally 2-grooved, ventrally 3-grooved, lateral grooves often obsolete. 

Distr. SE. Asia, in Malaysia: Sumatra, Java, Lesser Sunda Islands (Bali, Lombok, Flores, Timor).

Ecol. In open primary and secondary forests, especially in forest borders, sometimes in brushwood or in grassy plains, from 1000 to 1500 m upward, often common and one of the pioneers in natural reaflorestation. Fl. fr. Jan.-Dec. Vern. Often noticed names: kiapu, kilikuran, S. tementilis, merniran. J.

Notes. Extremely variable in all its parts, mainly in leaf shape.

var. longiflorum Kern, l.e. Tube of corolla 6-7 mm long, lobes 1 mm. Filaments about 6 mm long, adnate to the corolla 2-3 mm above the base. 

Distr. Malaysia: Sumatra (Eastcoast).
Fig. 4. *Viburnum coriaceum* Bl.  a. Flowering twig, b. flower, c. ovary, d. aestivation of stamen, e. fruit, f. cross-section through fruit,—*V. sambucinum* Bl., g. flower, h. aestivation of stamen,—*V. odoratissimum* Ker, i. flower, j. cross-section through fruit,—*V. lutescens* Bl., k. cross-section through fruit.

Sporangial or climbing shrub or small tree up to 8 m. *Leaves* coriaceous, upperside glabrous, underside minutely gland-dotted and with a distinct glandular pit at the base on both sides of the midrib, often smaller glands in the nerve-axes; elliptic, obovate or ovate, 8–15 by 5–8 cm, apex obtuse or shortly and bluntly acuminate, rarely somewhat emarginate, base cuneate to nearly rounded, margins entire; midrib prominent beneath, primary nerves much less prominent, 4–8 on each side, arcuately anastomosing; petiololes 1 1/2–3 1/2 mm. *Inflorescence* corymbiform, umbellately branched, 6–12 cm across (in fruit up to 15 cm), young axes rather densely brown stellate-pubescent, glabrescent; peduncle rather stout, up to 12 cm; primary rays 5–8. Bracts and bracteoles small, linear-lanceolate, rusty stellate-pubescent. Calyx-limb cupular, obscurely lobed, minutely gland-ciliolate, otherwise glabrous. Corolla tubular, obovoid-ellipsoid in bud, white; tube 3–4 mm, lobes erect, rounded to rather acute, minutely gland-ciliolate, 1 mm. Stamens long-exserted, with inflexed top in bud, inserted at base of corolla, 7–8 mm; anthers oblong, purplish, about 2 mm. Ovary cylindric, glabrous, 2 mm long. *Drupe* ovate, compressed, (young) bluish green, 9–10 by 6–7 mm. Endocarp undulate in cross-section, dorsally 2-grooved, ventrally 1-grooved.

**Distr.** **Malaysia:** Malay Peninsula (Perak, Pahang) and Sumatra (Atjeh, Eastcoast, Westcoast). **Ecol.** In forests and thickets, 1100–1900 m.


Small tree, nearly glabrous. *Leaves* coriaceous, shining, glabrous except for the bearded (or glan- dular pitted) nerve-axes on the underside, ovate or elliptic, (6)–8–15 by (3)–6–8 cm, apex broadly and obtusely acuminate to nearly rounded, base rounded or slightly decurrent-cuneate, margins entire or remotely undulate-dentate; nervation rather prominent beneath; primary nerves 6–8 on each side, anastomosing; petiole 2–4 cm. *Inflorescence* umbellate, corymbiform, 5–10 cm across, axes thinly stellate-pubescent, glabrescent; peduncle stout, 2–4 cm long; primary rays 5–7. Bracteoles very small, caducous before anthesis. Calyx-limb ob- surely lobed. Corolla broad-tubular, obovoid in bud, glabrous, tube about 2 1/2 mm, lobes erect, rounded, about 1 1/2 mm. Stamens exerted; filaments adnate to base of corolla, in the flower-bud inflexed at the top, about 6 mm; anthers oblong, 1 1/2–2 mm. Ovary cylindric, glabrous, 1 mm long. *Drupe* ovate to nearly orbicular, compressed, 5 by 5 mm. Endocarp obscurely undulate in cross-section, with 2 shallow dorsal grooves and 1 shallow ventral groove.

**Distr.** **Malaysia:** Philippines (Luzon, Mindanao). **Ecol.** In primary forests; altitude according to Merrill (1909 l.c.) 300–450 m, according to Merrill (1923) l.c., 1000–1400 m.

Note. Closely allied to *V. coriaceum*, which is unknown from the Philippines. The differences are presumably sufficient to justify specific separation. The corolla of *V. coriaceum* is more distinctly tubular, the corolla-bud more ellipsoid. The stamens of *V. glaberrimum* are inserted at the base of the corolla, those of *V. coriaceum* somewhat adnate to the tube; the filaments are 6 mm long, those of *V. coriaceum* reach this length only in some large-flowered specimens.


Tall tree, nearly glabrous. *Leaves* firmly chartaceous to subcoriaceous, somewhat shining, pale olivaceous when dry, glabrous, ovate to oblong-ovate, 9–22 by 4–10 cm, apex gradually narrowed to the usually elongated and rather slender acumen, base obtuse to somewhat acute, margins entire to obscurely undulate; primary nerves 6–7 on each side, somewhat prominent beneath, indistinctly anastomosing, axes on the lower surface (often also axes of coarser secondary nerves) glandular-pitted; petioles 4–5 cm, of the smaller leaves 1–2 cm. *Inflorescence* large, umbellate, corymbiform, up to 18 cm across, axes thinly stellate-pubescent, glabrescent; peduncle 4–6 cm long; primary rays about 7. Flowers numerous, fragrant. Calyx-limb with short but distinct triangular teeth. Corolla globular in bud, when open shortly tubular to somewhat turbinate, gradually slightly widened towards the top, white, glabrous, tube 2–2 1/2 cm, lobes erect, rounded, 1 1/2–2 mm. Stamens exerted; filaments inserted at base of corolla, in the flower-bud with inflexed top, sometimes moreover with a distinct fold in the lower part, 6–7 mm; anthers oblong, 2 mm. Ovary cylindric, glabrous, 1 mm long. *Drupe* oblong-ovate, compressed, 8–9 by 6 mm. Endocarp slightly undulate in cross-section, with 2 dorsal grooves and 1 ventral groove.

**Distr.** **Malaysia:** Philippines (Leyte). **Ecol.** In forests, at about 500 m.

Note. Very closely allied to *V. glaberrimum*, from which it is possibly not specifically different. The main differences are the much larger leaves with slender acumen (also smaller-leafed forms occur), the more distinct calyx-teeth, the shape of the corolla (widened to the top, in *V. glaberrimum* broad-tubular) and the larger fruits.


Small, glabrous tree, about 5 m high. *Leaves* thickly coriaceous, shining, olivaceous or brownish olivaceous, obovate to elliptic, 10–14 by 7–10 cm, apex rounded to shortly and obtusely acuminate, base acute, margins conspicuously coniculate-dentate, teeth straight, obtuse, 1–2 mm long, chiefly terminating the primary nerves, these about 9 on each side, nearly straight, once (sometimes twice) forked, beneath with glandular pits in the axils; petals 2–3 1/2 cm long. *Inflorescence* umbellate,
corymbiform, about 15 cm across; peduncle stout, about 5 cm long; primary rays 5–7. Drupe broadly ovate, compressed, 8 by 6–7 mm. Endocarp slightly undulate in cross-section, dorsally 2-grooved, ventrally 1-grooved.

Distr. Malaysia: Philippines (Luzon, only known from Mt Baudan).

Ecol. On forested slopes at 1800 m.

Vern. Manano (igorot).

Note. Flowers unknown. Like V. platyphllum an ally of V. glaberrimum. The species is (sufficiently?) characterized by the thickly coriaceous, broad, dentate leaves and the broadly ovate fruits.


Shrub or small tree up to 18 m. Young parts densely covered with minute, rusty-coloured, peltate scales, leaving numerous punctiform scars when they fall off. Leaves coriaceous, upper surface glabrous, underside densely covered with minute scales, neither bearded nor glandular-pitted in the nerve-axes, elliptic-lanceolate to lanceolate, 5–13 by 2–4½ cm, apex bluntly acuminate, base attenuate, margins entire; primary nerves 5–7 on each side, rather prominent beneath, anastomosing; petioles 1–1½ cm. Inflorescence umbellate, corymbiform, 5–10 cm across (infructescence up to 15 cm), axes densely squamulose; peduncle very short, 1–3 cm; primary rays 3–5. Bracts and bracteoles minute, ovate-lanceolate, firmbrate. Flowers fragrant, about 5 mm wide. Calyx-teeth ovate-triangular, obtuse, light-margined, squamulate, about 3/4 mm long. Corolla white, glabrous within, squamulate without, glabular in bud, nearly rotate (only slightly campanulate) when open, tube 1 mm, lobes broad-ovate, rounded, somewhat overlapping, 2 mm. Stamens somewhat exerted; filaments in bud with inflexed top, inserted near base of corolla, 3–4 mm; anthers elliptic, 1 mm. Ovary cylindrical, lepidote, 1½–2 mm long. Drupe elliptic or slightly obovate, much compressed, young squamulose, ripening black, 9–11 (–12) mm by 6–7 mm. Endocarp undulate in cross-section, with 2 dorsal and 3 ventral grooves.

Distr. SE. Asia, from Nepal, Kumaon and the Deccan to Siam and Indochina, in Malaysia: N. Sumatra (Atlch), twice collected.

Ecol. Secondary growths, 800–1000 m.


side Trees (1940) 183; Backer, Bekn. Fl. Java, em. ed. 8 (1949) fam. 175, p. 4; Kern, Reinw. 1 (1951) 129.—V. integrerrimum Wall. Cat. 457; Hook. f. & Th. J. Linn. Soc. 2 (1858) 176.—V. forbesii FAWC. in FORBES, Wand. (1885) 506, excl. var. —Fig. 4 g–h, 5.

Shrub or small tree, up to 10–15 m. Young branchlets densely stellate-pubescent. Leaves more or less coriaceous, glabrous except for a few hairs on the nerves and the bearded nerve-axils at the underside (see var. 2), here with an often indistinct spotty gland at the base on both sides of midrib, elliptic-oblong to oblong-lanceolate, 10–25 by 5–10 cm, apex abruptly short-acute, base cuneate, margins entire; nervation rather prominent beneath; primary nerves 5–7 on each side, anastomosing; petioles up to 4 cm long. Inflorescence densely many-flowered, umbellate, corymbiform, up to 15–18 cm across, axes densely stellate-pubescent; peduncle stout, 4–6 cm long; primary rays 6–8. Bracts and bracteoles small, linear-lanceolate, stellately pubescent. Flowers small, 3–4 mm diam., very fragrant. Calyx-limb with ovate-triangular, acute, ciliate lobes, 3½–1 mm long. Corolla rotate or campanulate, glabular in bud, white or creamy, tube 1 (1½) mm, lobes spreading, ovate, rounded, (1½)½ (–2) mm, usually tube somewhat shorter than lobes, not rarely the reverse. Stamens long-exsert; filaments almost filiform, serpentine in bud, inserted at base of corolla, (4–)5–7 (–9) mm; anthers elliptic to oblong, 3½–1 mm. Ovary cylindric, usually densely hairy, 1½–2 mm long. Drupe ovate, much compressed, young thinly hairy, glabrescent, ripening bluish black, (7–)9 (–10) by (5–6)–7 mm. Endocarp undulate in cross-section, dorsally 2-grooved, ventrally 3-grooved, lateral ventral grooves often obsolete.

Distr. Cambodia, in Malaysia: chiefly in the western part, often frequent, Malay Peninsula, Sumatra, Borneo, Java (rare in the central and eastern part), Lesser Sunda Islands, Celebes and the Moluccas, but here presumably very rare (Ceram).

Ecol. Open primary and secondary forests, in brushwood, particularly at forest-edges in the lower mountain zone (up to 1800 m), occasionally in swampy places in the lowlands. Fl. fr. Jan.–Dec.

Vern. Ki kukuran, ki bewog, S, bleber, J, and many other local names.


Distr. Malaysia: Malay Peninsula, 1100–1800 m.


Underside of the full-grown leaves softly villous by simple, forked and stellate hairs.

Distr. Siam, in Malaysia: Malay Peninsula (Selangor), Sumatra (especially in the northern half), the typical form probably restricted to higher altitudes, 800-1200 m.


Tree up to 24 m. Leaves coriaceous, dull, glabrous above or somewhat hispidulous on midrib and primary nerves, hispidulous beneath, especially on midrib and primary side-nerves, punctulate, neither glandular-pitted nor bearded in nerve-axils, elliptic to elliptic-oblong or obovate, 12-17 by 8-9 cm, apex abruptly shortly and bluntly acuminate (acumen up to 5 mm), base cuneate to broadly cuneate, margins entire; nervation prominent beneath; primary nerves 5-7 on each side, anastomosing; petioles 2-6 cm. Inflorescence umbellate, corymbiform, 10-15 cm across; peduncle short, up to 5 cm; primary rays 6-7; bracteoles firm, ovate to lanceolate, gland-dotted, ciliate, 4-6 mm long. Calyx-limb cupular, glabrous, obscurely lobed, 1 mm long. Corolla (creamy) white, globular in bud, rotate-cupular when open, tube 1(-1½) mm, lobes ovate to oblong, 2-2½ mm. Stamens much exerted; filaments thick, serpentine in bud, inserted at base of corolla, 9-10 mm; anthers oblong, 2 mm. Ovary cylindric, lepidote, 1½ mm long and thick. Drupe oblong-elliptic to slightly obovate, compressed, 9-10(-11) by 6-7 mm. Endocarp undulate in cross-section, dorsally 2-grooved, ventrally 3-grooved.

Distr. Malaysia: Br. N. Borneo (Mt Kinabalu), ± 2000 m.

Note. Differs from V. vernicosum mainly by its dull hispidulous leaves, the absence of glandular pits at the leaf-base and the rotate-cupular corolla.


Shrub or small glabrous tree, up to 10 m. Young parts very shining, vernicose. Leaves coriaceous, shining, chiefly on underside densely punctulate and gland-dotted, beneath with distinct glandular pit at the base on both sides of midrib and often smaller ones in higher nerve-axils, elliptic to slightly obovate, 12-18 by 6-11 cm, apex shortly and abruptly acuminate (acumen up to 1 cm long), base acute, margins entire; primary nerves 5-7 on each side, prominent beneath, anastomosing. Petioles 1-3 cm. Inflorescence umbellate, corymbiform, up
to 11 cm across; peduncle stout, up to 6 cm long; primary rays 5–7; bracteoles firm, oblong to lanceolate, with membranous margins, gland-dotted, 5–7 mm long. Calyx-limb obscurely lobed. Corolla creamy white, gland-dotted on outside, turbinate, obovoid in bud, tube 2½–3 mm, lobes erect, rounded triangular, 1½–2 mm. Stamens much exserted; filaments thick, serpentine in bud, inserted at base of corolla, (8)–9–10 mm; anthers oblong, 2 mm. Ovary cylindric, lepidote, verrucose, 1–1½ mm long. Drupe ovate, compressed, purplish-black, 10 by 7–8 mm. Endocarp undulate in cross-section, (often irregularly) 2-grooved on dorsal side, 3-grooved on ventral side, lateral grooves often nearly absent.

Distr. Malaysia: Bornoe.

Ecol. Primary and secondary forests, 900–2700 m.

Note. Very polymorphous species. The above description refers to what presumably may be called the common form. Specimens with larger, elliptic fruits (12–14 by 7–8 mm), others with broad-elliptic leaves (14–16 by 9–11 cm) were also collected.

10. Viburnum lutescece Bl. Bijdr. 13 (1826) 655; DC. Prod. 4 (1830) 325; Maxim. Mél. Biol. 10 (1880) 651; GAMBLE, J. As. Soc. Bengal 72 (1903) 114; KOORD. EXK. Fl. 3 (1912) 286; KOORD. FL. Tjiob. 32 (1918) 38; RIDD. FL. MAL. PEN. 2 (1923) 2; CORNER, Wayside Trees (1940) 183; BACKER, BEKN. FL. JAVA em. ed. 4 (1949) fam. 175, p. 5; KERN, REINW. 1 (1951) 142.—V. monogyynum BL. Bijdr. 13 (1826) 655.—V. sundaliam Miqu. FL. Ind. Bat. 2 (1856) 121; K. & V. BIjdr. 5 (1900) 43.—V. colebrookianum (non Wall.) DANGUY, FL. GÉN. I. C. 3 (1922) 9.—V. elegans JUNGH. NAT. GEN. ARCH. 2 (1845) 36.—Fig. 4k.

Shrub or small tree, up to 10 m, usually much lower. Youngest parts thinly stellate-pubescent. Leaves thinly coriaceous, undersides glabrous, undersides thinly stellate-pubescent to almost glabrous, very variable in shape, broad-elliptic, ovate or oblong-elliptic, up to 18 by 10 cm, apex short-acuminate, base nearly rounded to cuneate, margins in upper 1½–2½ coarsely crenate-serrate to finely serrate, teeth shortly mucronate, lower 1½–2½ entire or superficially dentate; nervation rather prominent beneath; primary nerves 5–8 on each side, indistinctly anastomosing; petals 1–2 cm. Inflorescence terminal or spuriously lateral, paniculate, short-pyramidal, 5–9 cm across, 5–7–(10) cm long; axes stellate-pubescent, glabrescent; primary branches 4–7, verticillate. Bracts and bracteoles minute, stellate-pubescent. Flowers somewhat fragrant, 4–5 mm wide. Calyx-teeth ovate-triangular, 3/4 mm long. Corolla glabrous in bud, nearly rotate (only slightly campanulate) when open, creamy white, glabrous, tube 3/4–1 mm, lobes ovate, rounded, 1½–2 mm. Stamens somewhat exserted, filaments inserted near base of corolla, in bud with inflexed top, white, 2–3 mm; anthers elliptic, sordidly white, 1 mm. Ovary cylindric, glabrous, 1–1½ mm long. Drupe oblong-ellipsoid, somewhat oblique, slightly compressed, ripening purplish-black, 7–10 by 4–5 mm (rarely 11–12 by 7–8 mm; Bornoe, Malay Penins.). Endocarp undulate in cross-section, with 2 dorsal and 1 ventral groove.

Distr. SE. Asia, in Malaysia: Malay Peninsula (local), Bornoe (few times), Sumatra, Java, Lesser Sundan Islands (Bali, Lombok).

Ecol. Primary and secondary forests, brushwood, often common but scattered, usually 500–1500 m, rarely lower (~150 m) or higher (one record of 2400 m from Mt Patuha). FL. JR. JAN.—DEC.

Vern. Many native names have been recorded, e.g. ki ranta, ki kukuran, ki bewog, Bd. tjere, wuru watu, J. Kapoor-kaporan, porkaporan, Md. kaju nasi (Sum).

Uses. Sometimes cultivated as a hedgeplant, easily propagated by cuttings. Ripe fruits are readily eaten by birds.

11. Viburnum junghuhnii Miqu. FL. Ind. Bat. 2 (1856) 123; K. & V. BIjdr. 5 (1900) 47; KOORD. EXK. FL. 3 (1912) 286; BACKER, BEKN. FL. JAVA em. ed. (1949) fam. 175, p. 4; KERN, REINW. 1 (1951) 147, f. 7.—V. lutescece (non BL.) HALLIER f. MED. RIJKS-HERB. 1 (1911) 15 p.p.

Subarboreal shrub or small tree, up to 18 m. Leaves coriaceous, broad-elliptic, obovate-elliptic to nearly lanceolate, apex rounded or short acuminate, base more or less attenuate, closely crenate-dentate, teeth apiculate, glabrous, (4)–8–12½ by 3–6 cm; nervation very prominent beneath; primary nerves 5–7 on each side, anastomosing; petals 1½–2½ by ~4 cm. Inflorescence terminal or pseudolateral, paniculate, short-pyramidal, up to 5 cm long and 8 cm wide; lower ramifications 3–5-nately whorled, upper ones alternate; peduncle 3–6 cm; bracteoles small, lanceolate to ovate. Flowers fully 5 mm wide, fragrant. Calyx-limb 1½ mm long, distinctly toothed, teeth ovate-triangular. Corolla creamy white, glabrous in bud, rotate-campanulate when open, glabrous, tube short, fully 1½ mm, lobes up to 2 mm, ovate, rounded. Stamens hardly exserted; filaments in bud with inflexed top, inferior part adnate to corolla 1½–2 mm; free part 1½–2 mm; anthers elliptic, 1 mm. Ovary cylindric, glabrous, 2½ mm long. Drupe obovoid, 7–9 by 5–6 mm, compressed. Endocarp in cross-section slightly undulate and with strongly incurved edges, ventral side therefore deeply intruding, embracing a broad, bilobate cavity.

Distr. Malaysia: Sumatra (Westcoast: Mt Korintji), Java.

Ecol. Forests, 2300–2600 m.

12. Viburnum amplificatum Kern. REINW. 1 (1951) 150, f. 8.—Viburnum sp. MERR. PL. ELM. BORN. (1929) 297.

Shrub-like tree. Leaves thinly coriaceous, dull, dark olivaceous above, brown beneath, glabrous, neither glandular pitted at the base nor bearded in the nerve-axils, elliptic-oblong to slightly obovate, up to 26 by 12–14 cm, apex abruptly short-acuminate (acumen rather blunt, 1½–2 cm), base cuneate to somewhat rounded, margins entire, sometimes distantly and obscurely undulate; nervation prom-
inert beneath; primary nerves 5—7 on each side, anastomosing; petioles 2—4 cm. Infrafractuscence umbellate, corymbiform, about 13 cm diam.; peduncle stout, about 7 cm; primary rays 7—8. Drupe oblong, very slightly dilated upwards, much flattened, with a distinct groove on both sides, black, 16 by 7 mm. Endocarp with broad longitudinal groove on the dorsal side, the incurved edges forming a deep, broad, in cross-section bilobate furrow on the ventral side.

Distr. Malaysia: Br. N. Borneo (Tawau).

Note. Flowers unknown. The species is readily recognizable by its large leaves and fruits and by the cross-section of the endocarp, reminding one of V. junghuhnii.

13. Viburnum odoratissimum Ker, Bot. Reg. 6 (1820) LI. 456; DC. Prod. 4 (1830) 326; Clarke in Hook. f. Fl. Br. Ind. 3 (1880) 7: Maxim. Mel. Biol. 10 (1880) 645, 649; Rehder in Sargent, Trees and Shrubs 2 (1908) 107; Danygu in Fl. gen. I.C. 3 (1922) 5; Murr. En. Phil. 3 (1923) 577; Backer, Bebn. Fl. Java em. ed. 8 (1949) Fam. 175, p. 3; Kern, Reinw. 1 (1951) 152, f. 9.—V. hasseltii Myq. Fl. Ind. Bat. 2 (1856) 123; K. & V. Biadr. 5 (1900) 46; Koord. Exk. Fl. 3 (1912) 286.—V. zambalense Eml. Leafl. Philip. Bot. 9 (1934) 3181.—Fig. 41—.

Shrub or small tree, sometimes up to 20 m, glabrous, only youngest parts with few stellate hairs. Leaves more or less coriaceous, dull or somewhat shining, glabrous or underside with few scattered stellate hairs and somewhat bearded in the nerve-axils, elliptic-oblong to oblong-lanceolate or obovate, 8—15 by 3—7 cm, apex shortly and bluntly acuminate, rarely rounded or emarginate, base attenuate, margins in the upper half obtusely (sometimes distinctly) toothed or nearly entire, cartilaginous; nervation prominent beneath; primary nerves 5—7 on each side, indistinctly anastomosing; petioles (1/2—1)2 cm. Infrafractuscence paniculate, more or less elongated pyramidal, up to 10 cm long and wide, many-flowered; axes slightly stellate-pubescent; peduncle 2—5 cm, primary branches verticillate, divaricate; bracteoles linear-lanceolate, ciliate, 1—3 mm long. Flowers fragrant, 3—6 mm wide. Calyx-limb cupular, 1 mm long, teeth broad-triangular, glabrous or sparsely ciliate. Corolla obvoid to ellipsoid-obvoid in bud, shortly funnel-shaped-campanulate when open, creamy white, glabrous or sometimes with some stellate hairs on outside, tube gradually widened upwards, 2—3 mm, limb horizontally spreading, finally reflexed, lobes broad-ovate, rounded, somewhat overlapping, 2 mm. Stamens exerted, filaments adnate to corolla-throat, in bud with flexed top, 2—3 mm; anthers oblong, 1/2—1 1/4 mm. Ovary glabrous, 1/2—2 mm long. Drupe ovoid, 6—7 by 4—5 mm, purplish-black. Endocarp dorsiventrally compressed and strongly incurved, edges nearly touching, ventrally side strongly concave, embracing a cavity of 1/2—2 mm diam. Seed strongly compressed, falcate in cross-section, 1 mm thick.

Distr. Eastern India to Indo-China, E. China & Formosa, northward to Japan, in Malaysia: Philippines (Luzon, Mindoro, Panay, Negros, Leyte, Mindanao), Celebes. The record for W. Java (Mt Pangrango, Kuhl & van Haslett) is presumably a misstatement; it has not been retracted there.


Note. The above description has only reference to the Malaysian form. The widespread species is extremely variable both in the shape of the leaves and in the flowers.


Small glabrous tree. Leaves coriaceous, dull, in dry state olivaceous above, yellowish or brownish green beneath, minutely papillose-rugulose all over (under the lens), underside glandular-pitted both in the axes of the primary and secondary nerves, elliptic to oblong-lanceolate or slightly obovate, 9—11 by 3—5 cm, often inkequalateral and somewhat falcate, apex abruptly short-acuminate to nearly caudate, rarely rounded, base cuneate, margins entire, cartilaginous; nervation prominent beneath, primary nerves 4—5 on each side, anastomosing; petioles 2—2 1/2 cm. Infrafractuscence nearly sessile, small (4—8 cm long), paniculate, lowest branches tertiatae, middle ones opposite, upper ones alternate. Bracteoles minute, lanceolate. Drupe ellipsoid or oblong-ovoid, not compressed, 10 by 6—7 mm, shining, calyx-teeth persistent, triangular, 3—4 mm long. Mesocarp thin, scantly fleshy. Endocarp strongly incurved, dorsal side orbicular in cross-section, edges touching, ventral side folded to an internal longitudinal crest 2—2 1/2 mm broad, slightly widened at the upper margin, here embracing a cavity of about 1/2 mm diam. Seed compressed, reniform in cross-section, 2 mm thick.

Distr. Malaysia: Br. N. Borneo (Mt Kinabalu).

Note. Flowers unknown. Easily distinguishable from V. odoratissimum by the minutely rugulose leaves and the smaller number of primary side-nerves, but mainly by the size of the fruit and the quite different cross-section of the endocarp.


Shrub. Leaves thinly coriaceous, glabrous except for the bearded axes of primary side-nerves on the underside, ovate to ovate-lanceolate, often somewhat falcate, 6—8—(11) by 2—4—(5) cm, apex acute to long-acuminate, base cuneate to broadly cuneate, margins on both sides 1—2 cm above the base with an impressed small gland, nearly entire, only minutely and distantly serrulate, teeth reduced to mucros hardly 1/2 mm long; nervation prominent beneath. Basal primary nerves nearly as prominent as the midrib (leaves therefore triple-nerved), more apical 2—3 pairs less prominent, all side-nerves anastomosing; petioles 1—2 cm. Infrafractuscence umbellate, corymbiform, (3—)5—7 cm across, axes glabrous; peduncle short, 2—5 cm; primary rays 5—7. Bracts and bracteoles minute, ovate, ciliate. Calyx-limb 1 mm long, obscurely lobed; lobes ovate, obtuse,
glabrous, about 1/2 mm. Corolla whitish or yellowish green, 4 mm wide, campanulate-rotate, globular in bud; tube broad, scarcely 1 mm long, hairy within, lobes ovate to oblanceolate, rounded, recurved in anthesis, 1 1/2 mm. Stamens exerted; filaments adnate near base of corolla, in bud with inflexed top, 2-2 1/2 mm; anthers broadly elliptic, 3/4 by 1/2 mm. Ovary 3/4-1 mm long and wide, glabrous.

Drupe globose-ovoid, bluish black, 4-5 by 4 mm. Mesocarp thin, scanty fleshy; endocarp thin, orbicular in cross-section, ventrally slightly 1-grooved. Seed ovoid; albumen deeply ruminated.

Distr. China (Hupeh) and Formosa, in Malaysia: Philippines (Luzon: Rizal, Benguet).

Ecol. Mossy forest, 2200-2450 m.

Notes. The triplenunerved leaf with marginal glands (reminding one of those of Vaccinium spp.), the hairy corolla-tube, the achenoid drupe and the peculiar cross-section of the endocarp characterize this species; it stands isolated among the other Malaysian Viburnums. According to Elmer J.C. the strong odour, especially in cured specimens, is that of Valeriana. The same fact had already been stated by Hallier in V. sambucinium, V. coriaceum and V. lutescens. Van Itallie ascertained the presence of valeric acid in V. sambucinium. On this ground Hallier supposed the close relationship of Viburnum with the Valerianaceae (Med. Rijksherb. 14 (1912) 36; op. cit. 37 (1918) 92).


Shrub 3-6 m high. Ultimate ramifications (often densely) ferrugineous-pubescent. Leaves extremely variable, chartaceous to subcoriaceous, young ones pubescent by simple antrorse and stellate hairs, more or less glabrescent, 3-8 by 2-5 cm, ovate to lanceolate, apex acute to long acuminate, base broadly cuneate to rounded, often inequilateral, margins almost entire to sinuate-dentate in upper part; nervation prominent beneath, often hidden by indument; primary nerves 5-7 on each side, usually terminating in teeth, lower ones anastomosing; petioles densely pubescent, 1/2-1 cm. Inflorescence terminal or spursiously lateral, umbelate, corymbose to semi-globose, 3-5 cm across, axes densely ferrugineous pubescent; peduncle very short, up to 2 cm; primary rays 3-6. Bracts and bracteoles small, lanceolate, pubescent and ciliate, 1-2 mm. Flowers slightly odorous, 3-5 mm wide. Calyx hardly 1 mm long, deeply lobed, lobes ovate-lanceolate, pubescent. Corolla rotate, globular in bud, creamy white or somewhat pink, strigose and stellate-pubescent without, glabrous within, tube very short (1/2 mm), lobes elliptic-oblong, rounded, 1 1/2-2 mm. Stamens exerted, but shorter than corolla-lobes; filaments adnate to base of corolla, 1 1/2-2 mm; anthers broadly elliptic, yellow, 1/2-3/4 mm long. Ovary cylindrical, distinctly pubescent, 1 mm long. Drupe ovate, much compressed, red (or ripening black?), 5-6 by 5-6 mm. Endocarp slightly undulate in cross-section, the 2 dorsal and 3 ventral grooves often obsolete.


Vern. Many local names have been noticed, e.g. atalá, tilba (Lg.), atiba (Bon.), bangas-bangas (Bag.), bagiro (Bik.), pnut (Gad.).

var. apoense Elm. Leafl. Philip. Bot. 7 (1915) 2577; Merr. En. Philip. 3 (1923) 577; Kern, Reinh. 1 (1951) 162.

Leaves subcoriaceous, nearly glabrous except for midrib, ovate-lanceolate, apex long-acuminate, acumen often falcate, margins nearly entire; primary nerves often anastomosing.

Distr. Malaysia: Philippines (Luzon, Mindanao).

Vern. Angganan, atadatu (Buk.), bangas-bangas (Bag.).


Leaves chartaceous, nearly glabrous except for midrib and primary nerves, ovate, apex acute to shortly acuminate, margins rather strongly dentate in upper half, primary nerves for the greater part terminating in teeth.


var. sinuatum (Merr.) Kern, Reinh. 1 (1951) 163.—V. sinuatum Merr. Gov. Lab. Publ. 35 (1906) 65; Philip. J.Sc. 1, Suppl. (1906) 137; En. Philip. 3 (1923) 578.

Leaves oblong-ovate, apex slenderly acuminate, acumen usually falcate, margins coarsely sinuate-dentate; otherwise as var. floribundum.

Distr. Malaysia: Philippines (Luzon, Negros), Moluccas (Buru).

Vern. Taringongog (Neg.).

3. SAMBUCUS


Trees, shrubs, or erect herbs. Stem and branches pithy, nodes often with stipule-
like appendages. Leaves imparipinnate, or incompletely bipinnate, rarely laciniate. Leaflets serrate or divided, opposite or alternate. Flowers actinomorphic, articulated with the pedicel, mostly white, in terminal, flat or convex corymb; flowers sometimes dimorphic: gynodioecious, or part of them aborting into nectarial glands. Bracts mostly absent. Bracteoles 1 or absent. Calyx-tube short, limb 5-parted. Corolla rotate, 5-lobed, lobes valvate or imbricate(?). Stamens 5, inserted on the base of the corolla; filaments filiform, erect; anthers oblong, latrosc, cells free, attached in the middle. Ovary 3–5-celled, each cell with 1 ovule; stigmas 3 or 5, short, broad, on a cushion-like style. Berry 3–5-seeded. Seeds with ± flat sides, back convex, granulate, embryo ± as long as the seed, terete.

**Distr.** Ca 10–20 spp., throughout the globe, absent from Oceania, S. & Central Africa, and Australia (except its E. part and Tasmania), centering in the N. hemisphere.

**Uses.** None of the various medicinal uses ascribed to the elder in Europe, Asia, and America is known from Malaysia.

**Notes.** The discrimination of the specific characters as given by von Schwerin is not very satisfactory, specially if only herbarium materials are available. Though the colour of the berry varies rather in several species, it is sometimes accepted for specific delimitation between others. Leaf-shape and indumentum represent variable characters. The size and shape of the seeds may furnish additional specific characters (cf. fig. 1). Among Caprifoliaceae it seems that Sambucus represents the closest relation to Valerianaceae.

Some specimens show well-developed stipules; these are hairy inside towards the base but do not possess colleters.

**KEY TO THE SPECIES**

1. Corymb with a number of flowers aborted into top-shaped, mostly yellow nectaries. Seeds ovate.  

1. **Sambucus** javanica  

2. Upper 1–2 pairs of leaflets sessile-adnate. Leaves simply pinnate. Berry oblong . . . . 3. **S. adnata**  

2. Upper leaflets not adnate. Leaves often bipinnate. Berry globular . . . . . . 2. **S. canadensis**


Little branched, more or less weedy, erect shrub 1–3½ m. Pitt white. Twigs terete, nodes between the petioles often with recurved, rarely foliaceous, stipular appendages. Leaflets 2–6-jugate, higher ones often 1–3-foliolate, rachis often with foliaceous appendages at the base of the leaflets, uppermost leaflets very rarely adnate to the terminal leaflet and the rachis. Leaflets oblong to linear-lanceolate, shortly stalked to sessile, sometimes adnate to the rachis, base cuneate to cordate, symmetric to oblique, mostly opposite, rarely alternate, apex acuminate, shallowly serrate, lower teeth glandular-swollen, 7–22 by 1½–6½ cm; midrib and base of side-nerves hairy above, hairy or glabrous beneath. Corymb flat-topped, 3–5–(7–) rayed, mostly hairy to subglabrous, with a foliate base, near the branching often with stalked glands. **Part of the ffs** deformed into erect, stalked, yellow, orange or sometimes (?) green, top-shaped, persistent, nectaries, 3 mm diam., impressed at the top.1 Pedicels 0–2 mm. Calyx-tube sulcate lengthwise, lobes triangular, acute, persistent, ½ mm. Corolla white or creamy, fragrant (as in S. nigra), (1½–2½)–3½ mm long, lobes acute, valvate in bud, (1½–2½) mm. Filaments mostly ± ½ mm, as long as the yellow anthers not exceeding the corolla-lobes, the latter spreading, rarely reflexed.

(1) Not galls as Danguy (F. Gén. I.C. 3, 1922, 4) supra (sic!).
Stigmas 3, narrowed towards the apex. Ovary 3-seeded, sulcate. Ripe **berry** ovoid, black, 3-seeded, 3–4 mm diam. Seeds ovate, pointed 2 mm long.

**Distr.** SE.—E. Asia, Japan, Formosa, in **Malaysia**: not E. of the line Philippines-Celebes-Lombok, but not yet found in the Malay Peninsula!

**Ecol.** Everet primary and secondary forests, thickets, clearings, mostly in ± shaded localities, (350–)700–2000 m, fl. fr. Jan.–Dec. The nectaries have been actually found to contain honey. The habit has been described as 'straggling', but this is certainly incorrect.

**Vern.** *K. katumpang, k₂ tamblég, k₂ téspōng, bêbêdjaran, S. mantjo, sêngitan, J. galamah, kalamat (Ig.), sauco (Sp.), sélando (Karo-Batak), Javaanse vlier, D, tatamaikang (Minah.).

**Notes.** PʻEi describes the fruits as red from China. It is quite possible that Malaysian specimens represent some varieties; e.g. I found in a specimen from Sumatra (Doct. v. Leeuwen 12831) the petals recurved and filaments twice as long as the anthers instead of as long as these. In hairy young infl. the flowers are mostly subsessile. Along with normal flowers I found sometimes stamens exposed in flowers with apparently aborted corollas. *S. javanica* is, apparently, the only representative of the section Scyphidanthe Miq. *S. hookeri* Rehd. does not appear to be different.


Shrub 1–3½ ft, forming subterranean sprouts. Twigs with stipular glandular appendages on the nodes or not, 3–5-jugate, in the larger leaves the lowest 1–2 pairs of leaflets mostly 2–3-foliolate, rachis not rarely with small, gland-tipped, leafy appendages; leaflets opposite, ovate to lanceolate, base variable, apex acuminate, base of margin entire, above serrate, 4½–12 by 1½–4 cm; midrib hairy on both sides, underside hairy on the nerves. **Corymb** 20–45 cm diam., convex, (4–)5-rayed, ± glabrous, axes purple. Pedicels 5–6 mm. Flowers feebly fragrant. **Calyx**-tube 1 mm high, hardly sulcate, lobes ovate, blunt, after anthesis apressed, in fruit dark purple. **Corolla** creamy, 4–4½ mm, lobes blunt, often toothed, 3–3½ mm, imbricate in bud. Filaments small in bud, in anthesis 3 mm, spreading. Anthers yellow, oblong. Ovary 5-seeded, stigmas 5. **Berry** globose, subapplanate, shiny black-purple, 4–5 mm diam., (4–)5-seeded. Seeds ± 2½ mm long, oblong-elliptic.

**Distr.** N. America, said to have been imported in Java as late as 1918 from Indochnina by the Botanic Gardens, Bogor (v. WELSEM, *i.e.*), but rapidly dispersed in gardens throughout Malaysia as an excellent, often rich-flowering, ornamental.

**Ecol.** Cultivated, 200–1300 m, fl. Jan.–Dec. The flowers remain open for several days, they do not produce honey in Java; easily propagated by cuttings; if cut twigs are partly defoliated, the infl. remains fresh for several days.

**Vern.** Amerikaanse vlier, D, American elder, E. **Notes.** The differences between *S. canadensis* L. and *S. mexicana* Presl ex DC. (Prod. 4 (1830) 322; STANDELEY, Tr. & Shr. Mexico (1926) 1395;—*S. bipinnata* SCHL. & CHAM. Linnaea 5 (1830) 171; CORNER, Wayside Trees (1940) 182, t. 40) seem slight and both *spp.* were considered conspecific by SARGENT. The main differences are apparently the oblong shape and sulcate surface of the berry in *S. mexicana*. The 2 specimens of *S. mexicana* I could examine had smaller flowers and more roundish anthers than those of *S. canadensis*.

3. **Sambucus adnata** Wall. ex DC. Prod. 4 (1830) 322; HOOK. f. Fl. Br. Ind. 3 (1882) 3; SCHWERIN, Mitt. Deutsch. Dendr. Ges. (1909) 41; PʻEi, Bot. Bull. Ac. Sin. 1 (1947) 7.—Fig. 1e.

**Distr.** Himalaya to China, ?E. Africa; mountains.

This species does not belong to § Scyphidanthe Miq. though SCHWERIN treated it as such; it is more related to *S. canadensis*. Entirely different from *S. javanica* by absence of nectaries, oblong-elliptic 2½–3 mm long seeds, apparently constantly 1–2 pairs of upper leaflets connate with the rachis, oblong and larger berries (type at Kew!). There is one specimen in Herb. Leiden (899–89–80) said to come from Celebes, but the specimen consists of one leaf only and is too poor for proper identification. Its upper leaflets are adnata, but this is a feature also occurring, though very rarely, in *S. javanica*. I doubt the occurrence of *S. adnata*, which is a native of continental SE. Asia (India to China), in Malaysia.

4. **CARLEMANNIA**


Generally generally-branched herbs, subglabrous or hairy, apparently erect. Inflorescence with sparse sessile or stalked, capitate-glandular hairs. **Leaves** mostly
obliquely elliptic, crenate-dentate, parenchyma apparently with glands at the underside. Petioles connected by a raised line, in which no interpetiolar stipule can be distinguished. Flowers white, yellowish or pink, in short-peduncled terminal sometimes also axillary corymbos. Calyx-tube globose, constricted at the apex; lobes 4–5, subequal or unequal, persistent. Corolla tubular, club-shaped in bud, circumsciss at the base, lobes 4, rather narrowly imbricate in bud, two outer two inner. Stamens 2, inserted in the middle of the tube, alternating with the lobes, dorsifixed, cohering in bud and enclosing the style; filaments short, terete or somewhat flattened, extending towards the corolla base but distinctly forming part of the corolla tube; anthers linear, latrorse, included in the tube, relatively large, opened already in bud, connective apiculate. Pollen granular. Disk annular-short-cylindric, consisting of two parts alternating with the ovarial cells, placed below the anthers. Ovary 2-celled, each cell with ovules inserted on a thick basal placenta. Style filiform, included, stigma clavate, erect, 2-fid. Capsule membranous, ± globular, or more or less pyramidal, ± inflated, and 4-lobed, each lobe with a few veins, 2-celled, loculicidally 2-valved. Seeds minute, oval, testa smooth or reticulated, albumen granular or stony, embryo minute at the top of the alben- (ex auct.).


Ecol. Montane forest plants.

Notes. For a discussion on the systematic position compare the notes at the head of the family. Hallier, after having switched in a few years his opinion from Gesneraceae to Saxifragaceae, finally agreed with Solereder assigning this genus to Caprifoliaceae.

Few figures exist of the genus; that of Schumann is wrong. The flowers are 4-merous and the corolla is definitely imbricate in bud; the number of sepals may vary to 5. The relative large size of the stamens, their coherence in bud enclosing the style, the anther-cells shedding pollen in bud, point to an unusual anthesis, on which no field observations are available. The typical 'glassy' hairs, constricted apex of the calyx, and dorsifixed anthers remind of a longitudinal section of the flower of Dentella, also a plant without interpetiolar stipules. The capitulate-glandular hairs, typical cymose infl. and symmetric flower point towards Lonicera, the reduction in the androecium, unknown or extremely rare in Rubiaceae, to Valerianaceae acc. to Bremerkamp.


Puberulous delicate herb, 20–50 cm. Stems terete, older nodes articulated. Leaves membranous, ovate-oblong to lanceolate, base and apex acute to subacuminate, sparsely white-hairy on both sides, hairs relatively coarse, 4–9 by 1½–3½ cm, primary nerves 5 pairs; petiole 2½ cm. Corymb terminal, condensed to dense, above 2 reduced spathulate leaves, ± 2½ cm diam., puberulous, not or hardly exceeding the leaves, 7–10 many-flowered, each pair with a reduced cyme at the base; peduncle 1–2 cm. Fls in pairs, only 1 narrow bract resembling the sepals; pedicels 1 mm; no bracteoles observed. Calyx tube hairy, 1 mm; lobes 4–5, linear, erect, hairy, 3–4 mm, exceeding the middle of the mature bud, in fruit 3-nerved, equal. Corolla hairy towards the tip by thick glassy hairs on a raised bulbous base, imbricated margins and inside glabrous, prob. pale, 6–6½ mm, lobes slightly unequal, the larger ones ovate, rounded, ± 1½ by 1½ mm. Disk short-cylindric, ½ mm high, consisting of two parts, margin slightly constricted, lobes below the anthers. Filaments 1 mm, anthers 2½ mm, linear, opened in bud, their tip just reaching the throat of the corolla. Style filiform, its base fusiform-swollen above the disk, glabrous, 5 mm; stigmatic arms narrow, ± 1 mm, fibrous, also in opened flowers often sticking to one of the anthers, not exceeding the stamens. Capsule 4–5 mm through, distinctly 4-lobed or 4-horny at the base, broader than high. Seeds ovate-oblong, hardly 1 mm, testa reticulate.

Distr. Mishmi Hills (NE. Himalaya), Tonkin, Yunnan in Malaysia: NE. Sumatra (mountains above Medan-Deli), apparently local.

Ecol. In forests, 1000–1300 m, fl. Dec.–July.

Notes. Allied to C. griffithii Hook. f. which differs by oblong sepals, 1–2 mm, distinctly unequal, and not reaching the middle of the corolla, larger fls, shorter filaments and ± glabrous fruit without distinctly stellate-spreading basal lobes. I have not seen the fruit lobes dehiscing as Ridley mentions. The size of the leaves by which the Indo-Chinese variety was distinguished seems of little value. The
type material is in a slightly older state than the Sumatran specimens are, but I am perfectly satisfied about their identity.

Excluded

_Lonicera Gaertn._ = Loranthaceae.

*Lonicera chinensis* Wats., *L. confusa* DC., *L. javanica* DC., and *L. macrantha* DC. were mentioned to occur in the Philippines by F.-Villar, Nov. App. (1880) 104, but these records have been excluded by Merrill, Gov. Lab. Publ. (Philip.) 29 (1905) 50; En. Philip. 3 (1923) 578.


_Viburnum alternifolium_ Zoll. & Mor. Syst. Verz. (1845–1846) 59 = _Ilex alternifolia_ (Zoll. & Mor.) Loes.
**POLEMONIACEAE** (C. A. Backer, Heemstede)

Annual or perennial herbs or shrubs, sometimes climbing by means of foliar tendrils, rarely small trees. *Leaves* spirally arranged or opposite, exstipulate, sessile or petioled, entire or more or less deeply divided, or compound. *Flowers* axillary or terminal, solitary, gynoecious, corymbose or capitate, actinomorphic or slightly zygomorphic. Calyx 5-lobed or 5-partite, with or without transparent fields, persistent. Corolla gamopellyous, 5-lobed or 5-partite; lobes contorted in bud. Stamens 5, on the corolla-tube, inserted at equal or unequal height, alternating with the segments; filaments free from each other, included or exserted; anthers dorsifixed, 2-celled; cells opening longitudinally. Ovary superior, sessile on a disk, 3 (rarely 2)-celled; ovules in each cell 1–∞, inserted in the inner angle; style 1, filiform, 3 (rarely 2)-fid. *Fruit* a loculicidal or septifragal capsule, rarely indehiscent. Endosperm mostly copious; embryo straight or slightly curved.

Distr. N. America and the Andes, rare in the Old World, absent from Africa and Australia. Genera 12, represented by upwards of 250 species. In Malaysia one American genus is more or less naturalized; a few other species are cultivated in gardens.

Uses. The Indonesian species are exclusively of horticultural value.

**KEY TO THE GENERA**


2. Filaments inserted at very unequal height. Leaves entire.

3. Filaments inserted at equal height.

1. **COBAEA**

Cav. Icon. 1 (1791) 11.

Climbing shrubs or herbs. *Leaves* spirally arranged, pinnate; rachis ending in a much branched tendril, branches of tendril terminated by a minute sharp claw. Leaflets opposite, herbaceous, usually in 3 pairs, lowest pair quite near the leaf-base. *Flowers* solitary or gynoecious, axillary or on top of short branch, long pedicelled, rather large. Calyx-tube sometimes well-developed, usually very short; segments valvate with recurved margins, either short and broad or long and narrow. Corolla campanulate, 5-lobed or 5-partite; segments short and broad or long and narrow. Stamens inserted at equal height above the base of corolla-tube; filaments filiform with a thickened hairy base, about as long as corolla or longer, sometimes much longer. Disk thick, 10-lobed. Ovary ovoid-oblong, glabrous; cells 2–∞-ovuled; style about as long as corolla or longer; style-arms linear. *Capsule* oblong, coriaceous or pergamaceous, septifragal, 3-valved; central column very thick. Seeds in each cell 1–∞, 2-seriate, peltately attached, large, much compressed, winged all round; tests becoming slimy when steeped in water; cotyledons large, fleshy.

Distr. Species 18, native of tropical America, a few introduced into other countries; one of these has become more or less naturalized in Java.

**KEY TO THE SPECIES**

1. Calyx-tube with 5 prominent flat folds; segments not or slightly longer than broad, rounded or retuse with an apical point and broadly reflexed, mutually appressed margins. Corolla-segments much shorter than the tube, broadly triangular, obtuse. Flowers patent or erecto-patent

2. Calyx-tube without prominent flat folds; segments much longer than broad, acute, with narrowly reflexed, mutually appressed margins. Corolla-segments much longer than the tube, narrowly linear, at the apex divided into 2 very short, narrow segments. Flowers pendulous.

(1) The genera *Phlox* and *Gilia* are represented in Malaysia by cultivated ornamentals only; they are not further treated here.

Fig. 1.

Robust perennial climber, 3–8 (up to 20?) m high. Stem angular, glabrous. Leaflets in 3 or sometimes 2 pairs, glabrous, obtuse or acute, mucronate; lowest pair subsessile, not stipuliform, oblong-ovate from an obtuse, truncate or emarginate, subequal, often broadened base; higher ones distinctly stalked, ovate to oval or oblong from an obtuse, acute or contracted base, 3½–13 by 1½–6 cm; lateral nerves confluent into a thin intramarginal nerve; petiolules 1–2 cm. Flowers patent or erecto-patent. Peduncle robust, 8–30 cm long, near the base with 2 pinnate bracts. Calyx 3–3½ cm long, cleft more than halfway down, widely gaping; tube 1–1½ cm long, very wide, with 5 strongly prominent flat folds; segments foliaceous, slightly or hardly longer than broad, broadly oval-ovate, rounded or retuse, with a short or longish point, green, pale-veined, glabrous without, very densely short-white-pubescent within. Corolla 4½–6½ cm long, very wide, lobed much less than halfway down, at first pale green, usually turning darkviolet, rarely not changing its colour; tube slightly constricted above the broad campanulate base, above the constriction gradually widened, outside along the upper margin densely short-pubescent, otherwise glabrous, within with a broad densely villous ring at the insertion of the stamens, otherwise glabrous; segments broadly triangular, rounded or very obtuse. Stamens about as long as the corolla or slightly or distinctly longer, often upturned at the apex, filaments glabrous above the pubescent base; style glabrous; style-arms comparatively short, erect or erecto-patent. Capsule elliptic-oblong, 5–9 cm long. Seeds numerous, blackish brown, ± 1½ cm long.

Distr. Native of Mexico, Central America and Brazil, in the mountainous districts of Java cultivated as an ornamental and locally met with as an escape from gardens, not truly naturalized, 1200–1800 m. Fl. Jan.–Dec., fr. July–Aug.


Herbaceous, climbing, 2–4 m high. Stem very slender, angular, densely white-woolly about the nodes, otherwise glabrous or subglabrous, purplish green; leaf-rachis thin, 4–6 cm (disregarding the apical tendril), glabrous above the pubescent base.

Leaflets 3 pairs, subequal, narrowly oblong-oblancoate from an obtuse, rounded or subtruncate base, very acute, thin, light green, obscurely and remotely ciliate, otherwise glabrous, 3–8 cm by 3½–2½ cm; petiolules 4–8 mm. Flowers solitary, pendulous; peduncle thin, glabrous ebracteate, 6–

Fig. 1. Cobaea scandens Cav. as an escape near Tjibodas mountain garden, W. Java (Jensen).
CRASSULACEAE (C. A. Backer, Heemstede)

Herbs or undershrubs, usually succulent, perennial, less often annual or biennial. Leaves spirally arranged, opposite or whorled, exstipulate, simple or compound, entire, dentate, crenate, serrate or deeply incised. Flowers ♀, rarely unisexual, actinomorphic, usually cymose or cymose-paniculate, rarely spicate or solitary in leaf-axils, pedicelled or sessile, mostly 4–5–, rarely 3– or polymerous. Sepals free or nearly so, or united into a distinct tube, after anthesis marcescent and persistent as are the petals. Petals the same number as sepals, rarely more, hypogynous, free or variously connate. Stamens either as many as petals and alternate with them or twice their number, perigynous or all or partly inserted on the corolla; filaments free from each other; anthers 2-celled; cells introrse, dehiscing longitudinally. Hypogynous scales as many as carpels, placed singly at the back of them, free or at the base adnate to the base of the carpels. Carpels superior, the same number as petals, epipetalous, free or connate at the base, 1-celled. Ovules inserted on the adaxial side, mostly many, biseriate, rarely solitary or few. Styles as many as carpels, free, linear or subulate, short to long. Fruit follicular, membranous or leathery, opening on the adaxial side. Seeds minute, endosperm usually fleshy; embryo straight.

Distr. About 20 genera and upwards of 700 spp., in the frigid, temperate and warm regions of Europe, Asia, Africa, northern and tropical America, rare in S. America and Australia, absent from Polynesia. Ecol. Mainly plants of sandy, stony, rocky, sunny localities. Uses. Some species are used for medicinal purposes, many are cultivated as ornamentals.

KEY TO THE GENERA

1. Petals free or very shortly connate
   2. Petals united more than halfway up into a distinct tube

1. SEDUM

LINNÉ, Sp. Pl. 1 (1753) 430; Gen. Pl. ed. 5 (1754) no 513.

Annual or perennial, erect, ascending or prostrate, sometimes caespitose or muscoid, fleshy herbs, rarely undershrubs, glabrous or glandular pubescent. Leaves very variable, alternate, opposite or verticillate, entire or serrate. rarely laciniate, flat or suberete, often spurred at the back of the base. Flowers usually in terminal cymes, rarely spicate or solitary in leaf-axils, ♀ or by abortion unisexual. Sepals 4–5, free or almost so. Petals as many, rarely 6–7, free, yellow, white or purple. Stamens as many as petals or usually twice their number, perigynous; epipetalous ones often adnate at the base of the base of the petals. Filaments filiform or subulate; anthers short, 2-lobed. Hypogynous scales entire or emarginate. Carpels 4–5, free or connate at the base, each narrowed into a longer or shorter style. Styles stigmatose on the inner side of the apex. Ovules usually several, rarely solitary or few. Follicles 4–5, free, erect or spreading, 1–∞-seeded.

Distr. Species upwards of 350, mainly in the temperate and frigid zones of the N. hemisphere, a few in the S. hemisphere, absent from S. America S of Peru, Antarctica and Australia, in the tropics restricted to the mountains, also in Formosa. In Malaysia only one species in Luzon.

Ecol. Most species prefer sandy or rocky places. Many are cultivated as ornamentals.


Succulent, entirely glabrous, probably perennial herb, 8–15 cm high, with a not very strong, creeping rootstock. Stems arising at intervals from the rootstock, erect or suberect, thin or thickish, simple or sparingly branched. Roots thin. Leaves
rather crowded, alternate, sessile, oblong-obovate-spathulate, flat, obtuse, quite entire, fleshy, at the back of the base produced into a downward pointing, short, broad, obtuse spur, 5–20 by 3–6 mm. Cymes rather small, 3- to many-flowered, rather dense. Flowers sessile, sometimes with 1 or more leaves at the base. Calyx 3–4 mm long, 5-fid to quite near the base; segments distinctly unequal, rather narrow, slightly tapering towards the very obtuse, thickened apex, marked with many short, in sicco purplish streaks. Petals 5, free, bright yellow, elongate-ovate, very acute, 5–7 mm long. Stamens 10; filaments rather long but distinctly shorter than the corolla; epipetalous ones with their base adnate to the base of the petals. Hypogynous scales small, subcuneate, slightly emarginate. Carpels 5, shortly connate at the base. Styles ± 2 mm. Follicles widely spreading, ovoid, acuminate, gibbous at the base of their inner sides, crowned by the recurved styles, ± 5 mm long. Seeds (not seen) in each carpel 15 or fewer, oblong-cylindrical, shortly apiculate, minutely puncticulate throughout, ± \( \frac{3}{4} \) by 1/3 mm.

Ecol. Boulders, crags, rock-crevices, 1200–2500 m.

Note. In the latest monograph of the genus by RÖDERSTROM (Acta Hort. Goteb. 10, 1935, App. 239) this species is tentatively reduced to \( S. aizoon \) L., which differs by unspurred, usually dentate leaves and larger dimensions. \( S. aizoon \) L. occurs in Siberia, China, and Japan.

2. KALANCHOE

ADANS. Fam. 2 (1763) 248 (Calanchoe auct.)—Bryophyllum SALISB. Parad. Lond. (1805) t. 3.

Erect or ascending, very succulent, herbaceous perennials, rarely woody up to 6 m. Leaves either simple and then entire or more or less deeply incised (often spuriously pinnate) or trilobate or pinnately 5-foliolate. Flowers terminal in corymbose or paniculate cymes, pedicelled. Calyx more or less deeply 4-lobed or 4-fid. Corolla distinctly gamophyllous, 4-lobed less than halfway down; segments patent or recurved. Stamens 8, inserted on the corolla-tube, 2-seriate. Hypogynous scales 4. Ovaries 4, in the Malaysian species erect, free or slightly connate at the base, each narrowed into an erect longish filiform style, many-ovuled. Follicles 4, enclosed by the withered calyx and corolla. Seeds \( \infty \) (often not developing in Malaysia).

Distr. Species ± 60 or more acc. to BERGER (in E. & P. ed. 2, 18a, 1930, 404), centering in Madagascar and Africa, few spp. in Asia, one probably native in the drier parts of Malaysia, two introduced from tropical Africa and naturalized, sometimes on a large scale, and one exclusively (and rarely) cultivated.

Ecol. Mainly inhabitants of dry rocky or sandy, sunny or slightly shaded localities.
Uses. Sometimes cultivated for medicinal or ornamental purposes.

KEY TO THE SPECIES

1. Flowers pendulous. Pedicels \( \frac{3}{4} \)-2\( \frac{1}{2} \) cm. Calyx divided much less than halfway down, 1\( \frac{1}{2} \) 4 cm long. Corolla-segments red; tube much constricted above the longitudinally furrowed base, widened above the constriction. Stamens inserted far beneath the middle of the corolla-tube at the apex of the basal widening. Hypogynous scales broadly ovate or subrectangular. Styles longer than the ovaries. Detached leaves producing young plants from the crenatures of their margins and sometimes also from the midrib.

2. Calyx terete, 2\( \frac{1}{2} \)-4 cm long. Corolla totalling 3–5\( \frac{1}{2} \) cm, its base with 8 deep folds; segments ovate-lanceolate, cadavertly acuminate, 1\( \frac{3}{4} \)-1\( \frac{1}{4} \) cm long. Stem under the inflorescence subterete or obtusely quadrangular. Leaves simple or 3- or 5-foliolate

1. K. pinnata

2. Calyx quadrangular, 1\( \frac{1}{2} \)-2 cm long. Corolla totalling 2–2\( \frac{1}{2} \) cm, its base not deeply folded; segments shortly acuminate, 3–5 mm long. Upper part of the stem immediately under the inflorescence acutely quadrangular. Larger leaves deeply pinnately 5–11-fid.

2. K. prolifera

1. Flowers erect or erecto-patent. Pedicels 4–10 mm. Calyx divided almost to the very base, 4–12 mm long. Corolla-segments yellow or orange-yellow; tube lageniform, quadrangular, 1–2 cm long. Stamens inserted in the upper half of the corolla-tube. Hypogynous scales narrowly linear-subulate. Styles shorter than the ovaries. Stem terete or obtusely quadrangular. Detached leaves not producing plants from their margin, neither from the midrib.

3. Larger leaves deeply pinnatifid or bipinnatifid, with narrow segments

3. K. laciniata

3. Leaves crenate-serrate-biserrate, not deeply incised

4. K. integra

Robust, unbranched herb, 0.3–2 m high, glabrous (barring outside of corolla-base; see beneath), in the basal part often somewhat woody, ascending from a rooting base or often quite erect; younger part of stem with swollen nodes, green with dark purple blotches. Adult plants leafy only in the upper half or, during anthesis, almost or quite leafless. Pairs of leaves in young plants rather crowded, in old ones remote; lowest leaves not deeply divided, middlemost ones of robust plants often palmately trifoliolate, less often pinnately 5-foliolate. Leaves or leaflets oval-oblong (the lateral ones from an oblique base), obtuse, crenate or doubly crenate, 5–20 by 2.5–5 cm; highest floral leaves small, simple, narrow; all leaves thickly fleshy, bordered with purple. Petiole semi-amplexicalous with a much broadened base, 1/2–10 cm long; lateral petiolules short. Cymes panicked; panicles much varying in size, 10–80 cm long, rather lax; cymes often many-flowered, their peduncles erecto-patent, patent or ascending, 3–8 cm. Calyx terete from a rounded, in the centre slightly intruded base, green, strongly tinged with purple; segments ovate-triangular, very acutely acuminate, 2/4–1 cm long, somewhat less wide. Corolla in lower half green, in upper half (especially the exserted part) red; tube much constricted above the ellipsoid or subglobose, 1–1/4 cm long, strongly 8-folded base, which bears on the outside, especially in the lowest part, numerous short, thick glandular hairs; folds much prominent, alternately narrow and placed opposite the corolla-segments, and wide and alternating with these; constricted part short, narrow, quadrangular, gradually passing into the much widened, slightly ventricose, obtusely quadrangular upper part; segments recurved. Filaments green at base, pinkish upward, up to 3/4 cm long, slightly exserted. Hypogynous scales adhering at the base to the bases of the ovaries, subrectangular, yellow, 2–2/4 by 1/4–2 mm. Ovaries ovoid-oblong, free or connate at the very base, green, glabrous, 1/2–1 cm long, narrowed into the styles 2 1/2–3/4 cm long. Seeds (not seen) ellipsoid-oblong, obscurely longitudinally striate.

Distr. Supposed to have originated from trop. Africa, the centre of the genus, but since long carried over to other countries, at present pantropical. Introduced into Malaysia very long ago, at present throughout the Archipelago.

Ecol. From the plains up to 3000 m, in sunny or slightly shaded places, either stony or not, but always dry and never very far from human habitations, locally often gregarious. Not rarely cultivated, either as a medicinal plant or for its curious habit of producing single young plants from the crenatures of the leaves either still attached to the plant, or, more often, cut off and hung in a shaded spot on a wall.

Uses. Pounded leaves are used for headache and for poulticing, also as a remedy for fever. In N. Sumatra the plant is used in rice-ceremonies.

Vern. Wonderblad (= miracle leaf), D, life-plant, E, buntrimis, S, tjoftor bebek (with many variants), M, sosor bebek, J; local names: gepamed (Gajo), dingin dingin, kapal kapal (Batak), kumanbol (Minahassa), buntrimis teneng, S, daun tumbu.
daun (Banka), didindin banen (Atjeh), daun sêdjuk, M, sêpohori (Palemb), tjèkèr bêbêk, tj. itik, M, djampê, djukut kawasa, têrê, S, suru bêbêk, sosor bêbêk, têrês, tudju dêngên, J, daun antjar bêbêk, d. ghamèt, djampê, tjoberbê, tjotjor bhikhij, tj. ètèk, tombu daun, Md, kadju têmor (Kangean), mamala (Halhâm), raoe kufiri (Ternate), kabi kabi (Tidore); Philippines: abisrâna (Ikê), agèlêca (Sp.), aritanja (Bik.), balangbang (Il.), iïgîgiga (Î.); kapal kalap (Sul.), karitana (Bis.), katakatakan (Tag.), cukong (Bon.), lapak lapak (Sul.), putûputk (Bon.), siempreviva (Sp.). Mal. Peninsula: sêdingin, sêringin, kêrenchong, sêtawaw padang, tombu daun, ganti hatang, rajak bangun.

Note. The young plants developing on the leaves fall off after having produced some roots and a thin stem bearing a few small leaves. They may be transported by rain-wash. In Malaysia the plant never fruits.

A precocious flowering of marginal plantlets was observed by Forbes in Java (Natur. Wand. 1885, 82) later affirmed on specimens from NE. Sumatra by J. Kuyper (Trop. Natuur 20. 1931, 96, fig.): each plantlet had 5–7 leaves and a terminal flower. Specimens of this peculiar race were cultivated at Bogor for some years by Dr F. W. Went (fig. 1).


Robust, erect, quite glabrous, $\frac{1}{2}$–2 m high. Lowest leaves and topmost ones of flowering specimens not deeply divided; middle ones profoundly pinnatisect, spuriously odd-pinnate, with 2–5 pairs of lateral segments and an odd one; segments oblong, slightly or rather deeply crenate, green, usually with purple borders, very fleshy, 5–22½ by 2–8 cm; petiole robust, semi-amplexicaul. Panicule terminal, erect, 50–80 cm long, many-flowered; racemes of inflorescence obliquely quadrangular or subterete. Calyx segments broad, cupulidate. Corolla 2–2½ cm long, distinctly constricted above the subglobose, not deeply furrowed base, widened above the constriction, shortly 4-lobed; segments ovate, shortly acuminate, red, 3–5 mm long. Filaments slightly exserted from the corolla-tube. Hypogynous scales broadly ovate with a rounded apex, slightly broader than long, $\frac{1}{2}$–2 mm long. Ovaries appressed against each other. Fruit.

Distr. Native of Madagascar, in Malaysia introduced into Java long ago (date unknown; collected there for the first time in Febr. 1894); at present copiously naturalized in some mountainous districts of the western part.

Eco. Hedges, thickets, road-sides between 1000 and 1600 m, locally numerous and sometimes gregarious, but, on the whole rare. Fl. never in the lower regions and rarely (March–Aug.), but sometimes profusely, in the mountainous zone. Fruits seem never to be produced in Java.

Uses. Sometimes cultivated as a hedge-plant, also at much lower altitudes (down to 150 m). Vern. Buntiris, S.

Notes. Young plantlets frequently develop at the bases of the pedicels and from the marginal creations and the midrib of the leaflets (either still attached to the plant or not). A single leaf can give birth to as many as 50 plantlets, which soon fall off and may be distributed by rain-wash.


Erect, rather robust, not or sparingly branched, very fleshy, $\frac{1}{2}$–1½ m high. Stem terete, either glabrous (so in the few Malaysian specimens seen by me) or clothed, as well as the inflorescence, with scattered minute crisped hairs; lower internodes short, intermediate and higher ones gradually longer. Leaves numerous, very variable; the lowest simple, oval, undulate-dentate, shortly petioled or sessile; intermediate ones deeply pinnatifid or bipinnatifid, with narrow, oblong or linear, acute, more or less canaliculate, coarsely dentate-serrate segments, pale glaucous green, ± tinged with purple when young, 8–15 cm long; their petioles $\frac{1}{2}$–4 cm, fleshy, flattened on the anterior side, with a much broadened, semi-amplexicaul base; upper leaves much smaller, narrow, often entire or almost so. Panicles 10–30 cm long, consisting of many-flowered rather dense cymes, the lower long peduncled; bracts linear, plano-convex, small. Calyx green, variable as to size, 4–10 mm long, glabrous or pubescent, segments erect or erectopatent, ovate-lanceolate, tapering towards the acute apex. Corolla salver-shaped; tube very distinctly widened downwards, ± $\frac{1}{4}$ cm long, green at the base, yellowish upwards; segments 4, widely patent, bright yellow, oval or oval-oblong, glabrous (Malaysian specimens) or pubescent, ± 1 cm long. Anthers slightly exserted. Hypogynous scales entire, 3–3½ mm long. Ovaries lanceolate, glabrous,
Fig. 2. *Kalanchoë integræ* O.K. after a specimen from Mt Jang, E. Java, nat. size.
green, 5–6 mm long. Styles glabrous, 2–4 mm. Follicles not seen.

Distr. Hindustan, Bengal, China, and Burma, in 
Malaysia locally cultivated, not wild.

Ecol. In the lower regions not rarely in gardens, often as a potplant near Chinese habitations.

Note. Detached leaves lack the power of producing young plants. But when a leaf is cut off with part of a stem there may arise a new plantlet from the axil.


Erect or ascending, rather robust, usually unbranched, fleshy, 1/3–1 3/4 m high, with a strong taproot. Stem terete or obtusely quadrangular, glabrous throughout or in the upper part beset with short, glandular hairs; old stems fistular; lower internodes short, highest much longer. Leaves (often falling off in or before beginning of the anthesis) oval-oblong-obovate-lanceolate-spathulate from a more or less cuneate base, or the upper lanceolate-linear, obtuse, lightgreen, glaucous or more or less tinged with purple, rather shortly to rather long petiolated (lower), shallowly or coarsely crenate-serrate-dentate-biserrate, or the upper entire or almost so and sessile or subsessile, thickly coriaceous, glabrous (Malayam specimens) or glandular pubescent, 4–30 by 2/5–12 1/2 cm; petiole with a much broadened, semi-amplexicaulatus base. Cymes subcorymbose or, in well-developed speci-
mens, united into a long peduncled, rather wide and comparatively short panicle, many-flowered, rather dense; the lower on long erecto-patent peduncles. Rachises of inflorescence glabrous (so in Malaysia) or glandular pubescent. Pedicels 4–8 mm, glabrous or glandular pubescent. Calyx 4–12 mm long; segments erect or erecto-patent, elongate-triangular, acute, glabrous or shortly ciliate or on the outside glandular pubescent. Corolla variable as to size, above the greenish base yellow or orange-yellow; tube in the lower half distinctly ventricose (especially when fruiting), much contracted upwards. Segments patent or subacute, after anthesis erect and twisted together, oval-elliptic-obovate with a recurved short apical point, 3/4–1 1/4 cm long, glabrous or ciliate or on the outside glandular pubescent. Filaments short, glabrous; anthers either all included or those of the upper series slightly exserted. Hypogynous scales entire, 3/2–5 mm long. Ovaries free or subconnate at the base, appressed against each other, glabrous, 1/2–1 cm long. Styles included, filiform, glabrous. Follicles ovoid-oblong, acuminate by the style-bases, in their upper halves slightly recurved when fully ripe, 1–1 1/4 cm long.

Distr. Brazil, tropical and South Africa, S. and SE. Asia, in Malaysia: Java, Madura, Lombok, Celebes, Philippines.

Ecol. From the plains up to ± 2000 m, in sunny, stony or rocky places, frequently on almost bare rocks (e.g. of Java-streams), and in light Casuarina forest, locally often abundant. Flowers and fruits freely; very conspicuous when in full flower. In Java the distribution of the species is remarkable; the localities are confined to East Java (E of Malang) save some very local spots in Krawang on old-volcanic peaks. In East Java the localities are mostly situated on the eastern (hottest and driest) slopes of the mountains.

Uses. Ornamental.


Notes. Variable. Many forms differing only in characters of very slight taxonomic value have been described as species. They all pass into each other. Hamet (l.c.) regards this species as a form of K. laciniata in which he may be right. I have provisionally kept it apart because in Malaysia no transitional forms have been found. Separated leaves lack the power of producing new plants, but when a leaf is cut off with a bit of the stem, there arise from the axil first some roots, afterwards a leafy stem.
ELATINACEAE (C. A. Backer, Heemstede)

Annual herbs. Leaves stipulate, opposite or verticillate, simple. Flowers axillary, solitary, glomerate or fascicled, actinomorphic,  ♂ , small or minute; sepals 2–5, free or shortly connate, imbricate in bud, pellucid or with pellucid margins, 1-nerved or nerveless, persistent. Petals the same number as sepals, not or slightly surpassing them, imbricate in bud, free, membranous, persistent. Disk absent. Stamens as many as petals (and alternating with them) or more, but not more than twice their number, persistent; anthers dorsifixed, small, 2-celled; cells bursting longitudinally. Ovary superior, 2–5-celled, isomerous (except in Bergia trimera); cells ~ovuled. Ovules in the inner angles of the cells. Styles equal in number to the cells, free, short, persistent. Capsule small, septicidally dehiscent. Seeds many, minute, oblong, straight or curved, in transverse section terete; embryo straight or curved; cotyledons short; no endosperm.

Distr. Genera 2, in the temperate and tropical zones of both hemispheres, both of them in Malaysia. Ecol. Inhabitants of permanently or seasonally swampy or inundated localities. In some extra-Malaysian spp. the leaves are heteromorphous, the submerged ones being much divided. Vegetatively several Elatinaceae are rather plastic as is the case with many other waterplants, e.g. Callitrichaceae. In some Elatines flowers are not rarely cleistogamous, cf. E. triandra (cf. Niedenzu, E. & P. ed. 2, 21, 1925, 272). Vern. No reliable names.

Note. At first sight Elatinaceae might be confused with representatives of some other families with opposite leaves and minute axillary flowers. Easily perceptible differentiating characters against Callitrichaceae and Aizoaceae are the presence of a calyx and corolla, Halorhagaceae, Nyctaginaceae and Rubiaceae the superior ovary, Serophulariaceae the free corolla segments, Lythraceae the free calyx lobes, Amaranthaceae the at least 2-celled ovary, and Urticaceae bisexual flowers and alternipetalous stamens.

**KEY TO THE GENERA**

1. Flowers (in the Malaysian species) glomerate or fascicled, 5-merous. Sepals acute, with a strongish midrib ............................................. 1. Bergia


2. Elatine

**1. BERGIA**

LINNÉ, Mant. 2 (1771) 152, no 1309.

Annual herbs, erect, ascending or decumbent. Leaves opposite, shortly petioloed, finely serrate. Stipules persistent. Flowers (in the Malaysian species) fascicled or glomerate, 5-merous. Sepals free, acutely acuminate, keeled by the strongish midrib, with broad pellucid nerveless margins. Petals oval-oblong, thinly membranous. Stamens the same number as petals or more, but not more than 10. Ovary and capsule globose or ovoid, 5-celled; stigmas capitate. Seeds oblong, with rounded ends, faintly curved, with a faint or strong, scalariform reticulation.

Distr. Species  20; in Malaysia 2, inhabitants of the lower regions, mostly in anthropogenic localities.

**KEY TO THE SPECIES**

1. Entire plant glabrous; stems thick, succulent, not fistular but divided by radiating septa into a peripheral whorl of rather wide air-vessels. Pedicels 1½–3 mm long. Sepals 1½–2 mm long. Petals slightly exceeding the sepals. Stamens 10. Seeds strongly reticulated ..................................... 1. B. capensis


Fig 1. Bergia capensis L. Habit, × ½. Courtesy Pasuruan Exp. Station.
Elatinaceae

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Herb with a creeping, 8–50 cm long main stem and ascending branches; stems terete, red or pink, faintly shining. Stipules erect, ovate-triangular, long-acuminate, acute, dentate, membranous, 2–3 mm long. Leaves subsessile, oblong-lanceolate or lanceolate, from an acute base, acute, finely serrulate, with red teeth, 11/2–21/2 cm; petiole 1–3.5 mm. Flowers in many-flowered, dense clusters, 5-merous. Sepals erect, broadly elliptic, shortly acuminate, acute, light green, tipped with red, 11/2–2 mm long. Petals at first erect, afterwards widely patent or recurved, oblong or subpathulate, white, transparent. Filaments thin, filiform from a slightly broadened base. Ovary subglobose; styles erect-recurved, 1/4–1/3 mm long. Capsule subglobose, with 5 longitudinal furrows, ± 21/2 mm diam. Seeds slightly less than 1/2 mm long.

Distr. Hindustan, Ceylon, in Malaysia: Java.


2. Bergia ammanniioides ROXB. (Hort. Beng. 1814, 34, nomen nudum) ex ROTH, NOV. PL. SP. (1821) 219; DC. Prod. 1 (1824) 390; ROXB. Fl. Ind. 2 (1832) 457; DALZ. & GIBS. Bomb. Fl. (1861) 14; BTH. Fl. Austr. 1 (1863) 180; OLV. FL. Trop. Afr. 1 (1868) 132; Dyer in Hook. f. Fl. Br. Ind. 1 (1874) 251; TRIMEN, Fl. Ceyl. 1 (1893) 92; BAILEY, Queensl. Fl. 1 (1899) 100; COOKE, Fl. Bomb. 1 (1901) 73; BACK. FL. Bat. 1 (1907) 82 (excl. syn. B. repens BL.); VOORL. Schoolfl. (1908) 19; Schoolfl. (1911) 86; KOORD. Exk. Fl. 2 (1912) 623; MERR. SP. BLANC. (1918) 273; EN. PHILIP. 3 (1923) 103.—Elatine ammanniioides W. & A. Prod. (1834) 41; SP. LANNAEA 1 (1841) 167 (excl. syn. B. repens BL.); MIO. Fl. Ind. Bat. 1, 2 (1859) 119 (excl. syn. B. repens BL.); BRITTEN in FORR. Nat. Wand. (1885) 500.—Tiliaea rubella BLANC. FL. Filip. (1837) 75, ed. 2 (1845) 56, ed. 3, 1 (1877) 106.—Bergia serrata BLANC. FL. Filip. (1837) 273; MERR. PHILIP. J. SC. 2 (1907) BOT. 431; FL. MANILA (1912) 333; SP. BLANC. (1918) 273; EN. PHILIP. 3 (1923) 103.—Spergula serrata BLANC. FL. FIL. ed. 2 (1845) 271; ed. 3, 2 (1878) 140.—Bergia glandulosa TURCZ. BULL. SOC. NAT. MOSCOW 27° (1854) 371; ROLFE, J. Bot. 23 (1885) 210.—Bergia oryzetorum FENZL in ZOLL. SYST. VERZ. HEFT 3 (1855) 62; BACK. Onkr. SUIKER, (1930) 453, t. 428; BEK. Fl. JAVA, ed. 4 (1942) fam. 53, p. 1.

Annual, often branched from the base, erect, ascending or decumbent and then with erect, suberect or ascending branches, frequently somewhat woody at the base, 8–50 cm long; stems terete. Stipules erect, narrowly triangular, very acute, along the margins and on the back of the midrib rather thinly beset with short or rather longish glandular or subglandular hairs, membranous, 21/2–5 mm long. Leaves elliptic-oblong, oblong or obovate-oblong, from an acute or contracted base, acute, very shortly dentate-serrate and remotely gland-ciliate, sparingly finely hairy or glabrous above, 10–40 by 2–15 mm; petiole 2–5 mm. Flowers in few- to many-flowered fascicles. Pedicels thin, very variable as to length, usually 2–12 mm, sometimes up to 22 mm long. Sepals in Malaysia always 5 (in Hindustan and Ceylon usually 3), ovate-oblong, rather long- and narrowly acuminate, concave, keeled by the strong green midrib, otherwise thinly membranous and transparent, shortly ciliate, 3–4 mm long. Petals the same number as sepal, slightly shorter than these, oval-oblong, obtuse, thinly membranous, white, 21/2–3 by 1–11/4 mm. Stamens usually as many as sepals (in Java always so), narrowly subulate (in the Philippine specimens often 7–10) and the super-numerary of these then much narrower than the others, subfiliform (in dried materials often difficult to observe), rather long. Ovary ovoid. Styles in Malaysia 5, erect-recurved, ± 1/2 mm long (thick stigmas included). Capsule ovoid, ± 2 mm long. Seeds numerous, with a faintly prominent reticulation, light brown, ± 11/2 mm long.

Distr. Tropical Africa, Afghanistan, Persia, tropical Asia and Ceylon to S. China, Formosa and Australia, in Malaysia: Java, Madura, Timor, Philippines (Luzon).

Ecol. Dry regions, from the plains up to ± 100 m above sea-level, in seasonally inundated and again dried out localities, especially in fallow paddy-fields, also on road-sides and railway-embankments, locally often very numerous.

Note. Philippine specimens with long pedicels and some supernumerary stamens have been described as Bergia serrata BLANC. They strikingly resemble typical plants.

2. ELATINE

LINNÉ, SP.PL. (1753) 367; GEN. PL. ED. 5 (1754) 451.

Small glabrous herbs of swampy, muddy or inundated localities. Leaves in the Malaysian species opposite, shortly stalked. Flowers solitary, minute, 2–4-merous. Sepals shortly connate at the base, obtuse, nerveless. Petals exceeding the sepals, broadly oval, white or pink. Stamens as many as petals or twice their number. Ovary globose. Fruit globose with an impressed apex and a very thin transparent wall. Seeds numerous, straight or curved, with a scalariform reticulation.
Distr. Species ± 12, throughout the area of the family.

Note. The small size and habitat of *Elatine* are probably the major causes for its scarcity in the herbaria. A special search would doubtless reveal many additional localities outside Sumatra and Java; the late Dr. P. J. Eyma collected a specimen near the Wissel Lakes, SW. New Guinea (Eyma 4455) at ca 1700 m alt., but unfortunately the material at hand does not permit critical naming.

**KEY TO THE SPECIES**

1. Flowers sessile or obscurely pedicelled, often not expanding. Stamens in expanded flowers longer than the sepals.
   - E. *triandra*

1. Flowers on pedicels 1/2-1 1/2 mm long, expanding. Stamens shorter than the sepals.
   - E. *ambigua*


Delicate creeping herb, often much branched and forming dense patches, 1-15 cm long. Stipules minute, ovate-triangular, acutely acuminate, dentate, deciduous. *Leaves* opposite, ovate-oblong-lanceolate-spathulate, decurrent winglike along the petiole, obtuse, rounded or emarginate, entire, pinnately, with or without a row of distinct glandlike hyathodes along the margin, 3 1/2-15 by 1 1/2-4 mm. *Flowers* sessile or obscurely pedicelled in one axil only of a pair of leaves; those of successive pairs alternately on the right and the left side of the stem. Sepals 2-3, half as long as the petals. Petals broadly oval, white or pink, 1-1 1/4 mm long. Stamens 3, in expanded flowers longer than the sepals. Stigmas 3, almost sessile, punctiform. *Capsule* subglobose, 1 1/2-1/4 mm diam. Seeds oblong with rounded ends, faintly curved, yellowish brown, 1/2 mm long.

Distr. N. America, Europe, and Hindustan to Australia and New Zealand, in *Malaysia*: N. Sumatra, Java.

Ecfl. In Java in the eastern part in shallow lakes with very limpid water, and on inundated rice-fields, living quite submersed, forming dense patches on the bottom, locally very numerous, 500-2000 m. Many closed flowers seen, not a single expanded one.

Note. Fassett accepts Pursh's taxon as a var. *americana* (Pursh) Fassett of *E. triandra* (Rhodora 33, 1931, 72: ibid. 41, 1939, 373). Fernald (ibid. 43, 1941, 208 seq.) maintains that there is an important difference between *E. triandra* and *E. americana* in the structure of the ovary, viz that in the first the seeds are borne the whole length of the central axis and are horizontally divergent, whereas in the latter the seeds are borne at the base of the central axis and stand vertically. The material at hand from *Malaysia* is insufficient to check this criterion.


Leaves 2 1/2-5 mm long. Pedicels distinct, 1/2-1 1/2 mm. Stamens shorter than the sepals. Otherwise quite like the preceding species and probably only a temporarily terrestrial form of it.

Distr. Hindustan, Fiji Islands, and *Malaysia*: Java. In W. Java at 250 m above sea-level in a single specimen, in E. Java at 1900 m in large numbers; in both localities on sandy mudbanks in and along riverbeds.
 HYDROPHYLLACEAE1 (C. A. Backer, Heemstede)

I. HYDROLEA


Annual or perennial, unarmed or spinous, bitter herbs or undershrubs, often glandular-hairy. Stem terete, farciolate, with a peripheral whorl of air-vessels. Leaves spread, simple, entire, exstipulate. Flowers 9, actinomorphic, solitary, opposite or between the leaves, or by stunting of the leaves, more or less arranged in a racemiform or paniculiform inflorescence, distinctly pedicelled, lilac blue. Calyx persistent, 5-partite to near the base, segments lanceolate, imbricate in bud, after anthesis not or hardly accrescent. Corolla gamopetalous, deeply 5-partite; limb rotate; segments imbricate in bud, oval, obtuse. Stamens 5, free, inserted in the throat of the corolla, alternating with the segments; filaments filiform from a broadened base, glabrous or papillate; anthers 2-celled, bifid at the base and apex, opening lengthwise. Disk absent. Ovary superior, 2- (rarely 3-, very rarely more-) celled; placens adnate to the dissepiment, spongy, entire or in cross-section bifid; styles 2 (rarely 3 or more), free; stigmas capitata-clavate. Ovules ~. Capsule globose or ellipsoid, loculicid, or both loculicid and septicid, 2(rarely more)-valved, or bursting irregularly. Seeds ~, very small, longitudinally ribbed; endosperm small, straight.

Distr. Species ± 20, in the tropics of both hemispheres; in Malaya 2, of which one indigenous, the other introduced and naturalized in Java.

Ecol. Inhabitants of permanently or intermittently humid or swampy localities at low altitudes, often gregarious. Stem-bases often swollen by spongy aerenchyma.

KEY TO THE SPECIES

1. Placentas in cross-section entire. Corolla from the base of the tube up to the tips of the segments 4 1/2-7 mm long. Styles 1 1/2-2 mm. Stem unarmed, glabrous or only at the top glandular hairy

2. H. zeylanica

1. Placentas in cross-section 2-partite. Corolla from the base of the tube up to the tips of the segments 10-12 mm long. Styles 6-8 mm. Stem in the Javan specimens spinous and down to far beneath the top clothed with patent, rather long, gland-tipped very viscid hairs

2. H. spinosa


Perennial. 0.10-1.50 m long, often much branched. Stem in the lower part creeping and freely rooting, emitting many erect branches, in the higher part erect. Leaves variable as to shape and size, usually narrowly lanceolate, less often oblong or elliptic, from an acute or (broader leaves) slightly

(1) Rather small family consisting of ca 18 genera and ca 230 spp., mostly American, few in Africa, Asia, and the Sandwich Islands.

Besides Hydrolea a few American spp. of the genera Nemophila and Wigandia are sometimes cultivated as ornamentals in Malaysia. Cf. WIGMAN, Teysm. 32 (1921) 49.
Fig. 1. *Hydrolea zeylanica* (L.) Vahl, flowering branch, nat. size. *a.* bud, *b.* flower in anthesis, *c.* ovary, *d.* ovary in section (details enlarged; after Wight).
obtuse base, acute, quite glabrous or along the margins shortly and indistinctly ciliolate, 1½–12 cm by 1½–2½ cm; primary nerves 4–11 pairs. Petiole 2–5 mm, glabrous or, in young leaves, glandular hairy. *Flowers* either solitary opposite or between the leaves or arranged in shorter or longer lax or rather dense racemes or panicles, which are often combined into a leafy paniculiform inflorescence; pedicels patently glandular hairy or glabrous, 2–10 mm. Calyx usually clothed on the outside with patent, gland-tipped hairs, rarely glabrous, during anthesis 5–7 mm long, afterwards slightly accrescent; segments narrowed towards the tip. Corolla tube white, segments lilac blue with a white base, at last widely patent, oval, obtuse, 2½–4 mm wide. Filaments 2½–4 mm long, white or lilac, glabrous, their broadened base white as are the anthers. Apex of ovary finely pubescent. Styles 2, widely divergent, thinly pilose, lilac blue; stigmas white. *Capsule* ellipsoid, 4–5 mm long, thinly pilose, bursting irregularly. Seeds oblong, 1½–2½ mm long.

**Distr.** Ceylon, Hindustan, Further India; also reported for Queensland (not seen from there), in *Malaysia*: only in the western half: Simalur, Sumattra, Malayan Peninsula, SE. Borneo, Java, SW Celebes, Philippines.

**Ecol.** From the plains up to ±1000 m, in permanently or periodically swampy or inundated localities, very often in paddy-fields, also in shallow pools and on river-banks, locally often so numerous that the flowers tinge the whole field blue. *Fl. Jan.–Dec. in favourable localities.*

**Uses.** Young leafy tops of the stems are eaten. In India the foliage is used as a poultice for ulcers.

**Vern.** Several names, all of them unreliable as they are also applied to other more or less similar plants: gágábusan, sém-bung, djukut saáit, S., gunda, J, S. batlíhin fonáu (Simalur).

**Note.** Most of the Malaysian specimens have a glandular calyx. In Borneo and Central Java specimens with a glabrous calyx (*var. glabra Brand*) have been collected.


**var. spinosa.—var. euspinosa Brand, l.c. 181.**

Perennial, 0.60–1.30 m long, often much branched. Stems rather robust, erect or usually in the lower part creeping, copiously rooting and sending up many erect strong branches; thorns (metamorphosed branches) axillary, patently glandular hairy with a very sharp glabrous apex, often bearing small leaves, at last 1½–6 cm long; the larger ones not rarily ramified. *Leaves* oblong or lanceolate from an acute base, often slightly undulate, on both surfaces and along the margin thinly glandular pubescent, 1–12 cm by 1½–3 cm; primary nerves 10–20 pairs. Petiole rather densely glandular pubescent, 2–15 mm. *Flowers* arranged in dense small-leaved racemes or panicles which are combined into a leafy, often dense and rather large paniculiform inflorescence. Pedicels patently glandular hairy, 1½–8 mm. Calyx outside densely clothed with long gland-tipped hairs, during anthesis 7–9 mm long, afterwards not or hardly accrescent; segments acute. Corolla tube white at the base, segments a fine lilac blue, at last widely patent, oval, obtuse, 5–8 mm wide. Filaments 8–10 mm, glabrous; their widened base papillate. Ovary on the top clothed with short glandular hairs, otherwise glabrous. Styles 2 or sometimes 3, very rarely more, divergent, violet, glandular-pubescent. *Capsule* broadly ellipsoid, with a glandular pubescent apex, 6–7 mm high, mostly 2-valved. Seeds oblong, longitudinally ribbed, brown, 1½–2½ mm long.

**Distr.** Native of tropical America, already long ago introduced into *Malaysia*: yet only locally naturalized in the N. part of W. Java.

**Ecol.** Sunny or slightly shaded permanently or periodically humid or swampy localities; pools, irrigation ditches, fallow paddy-fields, usually gregarious, locally often very numerous, 1–250 m. *Fl. Jan.–Dec.*

**Note.** Entire plant intensely bitter.

**Excluded**

*Ellisiophyllum* MAXIM. has sometimes been regarded as hydrophyllaceous, but will in this Flora, and in agreement with many recent authors, be treated in the *Scrophulariaceae*. Cf. also BRAND, PIfl. R. 59 (1913) 185.
JUNCACEAE\(^1\) (C. A. Backer, Heemstede)

Perennial or annual herbs, tufted or with an erect or creeping rhizome. Stems mostly leafy only at the base but sometimes also in the higher parts. \textit{Leaves} spirally arranged, cylindric to flat and grass-like, mostly linear or filiform, sheathing at the base or entirely reduced to a sheath; sheaths open or closed, sometimes ciliate at the top. \textit{Flowers} mostly protogynous and anemophilous, solitary or in anthelas, panicles, corymbs or heads, usually small, actinomorphic, φ or (♂)♀. Tepals 6, free, in two whorls, rarely only 3, glumaceous or coriaceous, rarely white. Stamens 3–6, when 3 opposite the outer tepals; filaments thin; anthers basifixed, introrse; cells opening longitudinally; pollen in tetrads. Ovary superior, 1-celled or divided by 3 septa into 3 cells; style short to long; stigmas 3, papillose; ovules 3, inserted at the base of the ovary or numerous and biseriate on 3 parietal placentas. \textit{Fruit} a dry, 1- or 3-celled capsule, loculicidally 3-valved. Seeds sometimes tailed; embryo in the middle or at the base of the endosperm, small.

\textit{Distr.} Genera 8, with 250–300 species, especially in the temperate and cold regions of both hemispheres; in the tropics restricted to the mountainous districts.

\textit{Ecol.} Mainly herbs of wet or moist habitats above 1000 m, sometimes gregarious.

\textit{Uses.} In Malaysia unimportant. Some species used for tying parcels, some for medicinal purposes. In Europe \textit{Juncus} is largely used for mats and chair-bottoms.

\textbf{KEY TO THE GENERA}

1. Fruit many-seeded; placentas parietal. \textit{Leaves} glabrous, flat to terete
2. Fruit 3- or fewer-seeded; placentas basal. \textit{Leaves} along the margins with long very fine hairs, flat

1. JUNCUS

Linné, Sp.Pl. (1753) 325; Gen. Pl. ed. 5 (1754) \textit{no} 396.

Perennial or annual herbs. Stems often tufted, or crowded on a creeping rhizome. \textit{Leaves} either all radical or also higher on the stem, grass-like or terete and stem-like. \textit{Flowers} small, sessile or peduncled in dense or lax cymes. Inflorescence terminal or sparsely laterally and then its bract continuous with the stem. Tepals 6, glumaceous, equal or the 3 inner smaller. Stamens 3–6, attached to the base of the tepals; filaments filiform; anthers erect, oblong or linear. Ovary sessile; placentas 3, parietal, sometimes hardly prominent, more frequently protruding and sometimes connate in the middle; ovules many in each cell; style short or longish; stigmas 3, linear, often twisted. \textit{Capsule} 3-valved; valves usually bearing the placentas in their middle; rarely the 3 placentas becoming detached and remaining free or cohering into a central column. Seeds minute, ovoid or oblong, very faintly ribbed; embryo small, near the hilum.

\textit{Distr.} Species ± 200, largely spread over both hemispheres, most abundant in the cool and temperate zones, but also occurring in the mountainous districts of the tropics, usually in moist or marshy localities.

\textbf{KEY TO THE SPECIES}

1. Inflorescence on each flowering stem a solitary, pseudo-lateral, many-flowered cyme; its single bract terete, continuous with the terete or subterete stem and resembling it. Flowers with 2 minute, membranous basal bracteoles. Stems erect, close-set in a row on a creeping rhizome.
2. Perianth 2–2½/4 mm long, pale green or yellowish. Stamens usually 3. Capsule with a rounded or truncate top, 2½–2–2½/4 mm long. Seeds ± 1/2 mm. Cymes 1½–5 cm long, rarely longer (up to 10 cm), dense or rather loose. Stem in the living plant not or hardly ribbed, in dried specimens faintly and very closely ribbed; their basal sheaths dull or faintly shining

\textbf{1. J. effusus}

\(1\) The author wishes to express his sincere thanks to Mr. R. D. Hoogland for valuable help in identifying and discussing some aberrant Papuan and Philippine specimens of the very variable \textit{J. prismatocarpus} R.Br.
2. Perianth 3 1/2-5 mm long, brown. Stamens 6. Capsule shortly mucronate on an obtuse apex, 3-3 1/4 mm long. Cymes 4-10 cm long, often rather lax. Stem in the living plant distinctly ribbed, ribs separated by interspaces which in dried specimens are as broad as the ribs themselves or broader. Basal sheaths of stems much shining.


Erect, quite glabrous perennial herb, 0.40-1.20 m high, with a horizontal, rather short, creeping, very short-jointed symподial rhizome. Stems tufted, terete in the living plant not or hardly ribbed, in dried specimens with very close-set faint longitudinal ribs; pith continuous. Basal sheaths closely embracing the stem, dull light- or darkbrown, obtuse, the inner often crowned by a deciduous awn. Not-flowering stems leafless (not computing the basal sheaths). Cymes pseudolateral, solitary, sessile, mostly 1 1/2-5 cm long, rarely longer (up to 10 cm), dense or lax, usually many-flowered; bract of the inflorescence continuous with the stem and resembling it, very acute, 5-20 cm long. Flowers partly sessile, partly stalked, stalks up to 8 mm long. Floral bracts 2, very close together, ovate, thin, rather, 3/4 mm long. Tepals narrowly ovate-lanceolate, very acute, firm with transparent thin margins, subequal, 2-2 1/2 mm long, pale green or yellowish. Stamens 3, much shorter than the tepals, rarely 4-6; filaments thin, short; anthers comparatively large, linear. Style very short; stigmas long, erect, filiform. Capsule oblong, trigonous, with a round or truncate (in Malaysian specimens not impressed) apex, brown, 2 1/2-2 3/4 mm long, 3-valved; placenta rather deeply intruded. Seeds numerous, oblong, not tailed, ± 1/2 mm long, very faintly reticulate-ribbed.

Distr. World-wide in the temperate zones (especially in the N. hemisphere) and the mountainous districts of the tropics, not in Australia, in Malaysia: N. Sumatra (Atjeh), Java, Br. N. Borneo, Philippines (Luzon, Mindanao), New Guinea; undoubtedly native!

Ecot. Wet places, pools, morasses, lake-borders, river-banks, 1400 to 3000 m, locally numerous, but on the whole rare.

Uses. In the Malay Peninsula the pith is imported from China and used as a drug (cf. Burkill, Dict. 1935, 1172).


Erect, quite glabrous, more or less glaucescent perennial herb, 0.50-1.20 m high, with a horizontal, short, creeping, very short-jointed, symподial rhizome. Stems tufted, terete or slightly compressed, in the living plant rather distinctly longitudinally ribbed, in dried specimens very distinctly so, with rather close-set ribs, separated by interspaces which, at least for the greater part, are as broad as the ribs themselves or broader; pith in the typical form divided by transverse interspaces, in some forms, possibly of hybrid origin (J. effusus × inflexus?), otherwise quite like the typical form, continuous. Basal sheaths very closely embracing the stem, shining darkbrown, acute or obtuse, 5-20 cm long. Cymes pseudolateral, solitary, sessile, 4-10 cm long, rather lax, not very many-flowered. Bract of the inflorescence continuous with the stem and resembling it, very acute, 15-20 cm long. Flowers partly sessile, partly stalked; stalks up to 10 mm long. Floral bracts 2, very close together, unequal, thinly membranous, 1 1/2-2 mm long. Tepals narrowly ovate-lanceolate, very acute, brown, with a firm midrib and thinly membranous margins, 3 1/2-5 mm long, slightly unequal. Stamens 3, often partly abortive, shorter than the tepals; filaments thin, moderately long; anthers linear. Style short, its arms rather long, erect or ascending. Capsule oblong obtuse, with a distinct, 1/4-1/5 mm long mucro (persistent style-base), 3-3 1/4 mm long, 3-celled, with very thin sepa. Seeds numerous, oblong, very faintly longitudinally ribbed, very faintly transversely striate between the ribs, brown, 3/4-1/8 mm long.

Distr. Europe, N. and S. Africa, W. and SE. Asia, Ceylon, and introduced in New Zealand, in Malaysia: Java, thus far only collected in the easternmost part.

Ecot. Wet places, river-banks, 2100-2700 m, locally numerous but on the whole rare.

Vern. Mendon banyu, J. zeegroene rus, D, hard rush, E.
Fig. 1. *Juncus effusus* L. Tufts in a shallow pool; water covered by *Lemma & Azolla*. E. Java, ca 1950 m alt.

Note. I am not at all convinced that the specimens with a continuous pith but otherwise quite like the typical form are of hybrid origin. See also Hegi, l.c.


Very variable, pale-coloured annual, usually 10–30 cm long, rarely longer. Stems tufted, all fertile, erect, erecto-patent or decumbent, slender, terete, soft, often branched, leafy. *Leaf-sheaths* rather long, not auricled. Leaves linear, very narrow, channelled down the face, the lowmost up to 16 cm long, the higher shorter. Inflorescence terminal, branched; branches erect or obliquely erect, rather straight. *Flowers* either solitary and remote or in more or less remote (sometimes almost crowded) clusters of 2–6; each flower at the base with a bract and 2 bracteoles; flowers nearly sessile, pale-coloured, very variable as to size, 3–7 mm long. Bracts and bracteoles thinly membranous, ovate, acute. Tepals narrowly ovate-lanceolate, very acute, the 3 inner often much smaller than the outer. Stamens 6, in the topmost flowers often 3. Style distinct; stigmas straight. *Capsule* oblong, trigonous, usually shorter than the perianth, 3–5 mm long; placentas at length often detached from
the valves, either free or cohering into a central column. Seeds numerous, ellipsoid, tailless, brown, extremely faintly ribbed, $\frac{1}{3} - \frac{1}{2}$ mm long.

**Distr.** Almost cosmopolitan in the northern temperate zone, in the tropics restricted to the mountainous regions, in *Malaysia:* Philippines (Luzon), according to *Merrill* *l.c.*, probably introduced.

**Ecol.** Permanently or temporarily humid localities, often gregarious. In Luzon along bridle-trails in mossy forests at 1900 m.

**Vern.** *Paddengräs, D, toad rush, E.*


Perennial quite glabrous herb, (15-)30-70(-100) cm high. Stems tufted, erect, erecto-patent, ascending or floating, or some of them prostrate and then often rooting and emitting erect flowering branches, terete or compressed, with continuous pith. **Leaves** few, partly basal, partly cauline, on often long sheaths with 2 short, obtuse auricles at the top, linear, acute, rather thick, compressed, hollow but divided by rather remote cross-partitions into compartments which, in dried specimens, give them a jointed appearance, 5-20 cm long. **Inflorescence** a terminal very lax corymb made up of few to many usually 5-10-, but sometimes fewer- or more-flowered heads which sometimes bear in their centre a small tuft of short, very narrow leaves; the heads partly sessile at the ramifications of the inflorescence, partly on stalks of $\frac{3}{4}$-5 cm length. Bracts in the heads ovate-lanceolate, acute, much shorter than the perianth, thinly membranous. Perianth $3 \frac{1}{2} - 4 \frac{1}{2}$ mm long. Tepals of about equal length, ovate-lanceolate, very acute, longitudinally nerved. Stamens 3, before the outer tepals, shorter than these, sometimes 1-3 before the inner tepals; filaments rather long; anthers linear, sometimes very short. Style very short; stigmas much longer, often recurved or sinuous. **Capsule** pale brown, rarely castaneous, narrowly prismatic, with prominent acute angles, rarely ovate with rounded angles, acute, varying from slightly shorter to considerably longer than the perianth; placentas not or hardly intruded, hence the fruit 1-celled. Seeds numerous, oblong, rather regularly longitudinally ribbed with faint, rather remote transverse nerves between the longitudinal ones, yellow, ca 0.5-0.8 mm long.

**Distr.** Ceylon, SE. to E. Asia, Australia, Tasmania and New Zealand, in *Malaysia:* N. Sumatra,
2. **LUZULA**

Perennial herbs, usually tufted and stoloniferous. *Leaves* for the greater part crowded at the base of an erect or ascending stem, grass-like, linear from a sheathing base, tapering towards the often thickened or shortly acute apex, frequently fringed with long, very fine white hairs. *Flowers* either solitary or subsolitary and loosely paniculate or crowded into dense clusters; the latter often forming a raceme or panicle which may be contracted into a dense spikelike inflorescence; each flower subtended by a scarious bract and enclosed at the base by 1–2 scarious short bracteoles. Tepals 6, free, glumaceous, equal or slightly unequal, ovate-lanceolate, acute or partly obtuse. Stamens 6, singly before the tepals; filaments thin; anthers erect, oblong or linear. Ovary sessile, 1-celled; ovules 3, erect from a very short basal placenta; style 1, deciduous; arms 3, usually slender. *Fruit* ellipsoid or obovoid, often crowned by the style-base, 3-valved. Seeds 3 or fewer, oblong, faintly reticulate-ribbed, often with a basal or apical elaiosome; embryo small, near the hilum; albumen subfarinaceous.

Distr. Species ± 60, in both hemispheres in the frigid, temperate and torrid zones, in the latter restricted to the mountainous districts. In **Malaysia** 2 species, only high up in the mountains.

**KEY TO THE SPECIES**

1. Flowers solitary or subsolitary, united into a very loose, rather large panicle. Elaiosome minute, at the top of seed. Tips of leaves terminated by a very short, triangular, acute point, not thickened 1. **L. effusa**


Stoloniferous erect or ascending perennial, 25–70 cm high. Lower leaves crowded at the base of the stem; the higher ones more remote and gradually diminishing in size; all leaves linear from a sheathing base, flat, with a much tapering apex, terminated by a very short, shortly triangular not thickened point, along the smooth margins and often also on the surfaces with a few scattered long very fine white hairs, the larger leaves 6–12 cm by 6–12 mm. *Flowers* in an elongate very lax panicle, the lower branches of which arise from the higher leaf-axils; branches often nodding or drooping; flowers for the greater part solitary on pedicels 4–12 mm long, for the rest shortly pedicelled or subsessile. Perianth 2–2 ½ mm long. Tepals narrowly ovate-lanceolate, very acute. Stamens 6, slightly shorter than the perianth; filaments very thin, ± ¾ mm long; anthers oblong, ½–¾ mm. Capsule about as long as the perianth, broadly ellipsoid-obovoid, trigonous, crowned by the style-base. Seeds usually 3, erect, oblong or oblong-obovoid, brown, faintly reticulate-ribbed, on the rounded top with a minute pale elaiosome, ½–¾ mm long.

Distr. E. Himalaya to China, in **Malaysia**: Philippines, Br. N. Bornéo (Kinabalu), S. Celebes (Bonthain, Latimodjong), New Guinea.
Ecol. In burnt forest-fringes, scattered through forests, on steep rock walls, in upper border of mossy forests, 2100–3300 m.


Erect, often tufted perennial herb, 10–36 cm high. Stem glabrous, hollow. Leaves for the greater part crowded at the base of the stem, linear from a sheathing base, with a narrowed, rounded or very obtuse distinctly thickened apex, along the smooth margins fringed with rather remote long very fine white hairs, flat, firmly herbaceous, 5–10 by 3–5 mm; higher stem-leaves few, remote, gradually diminishing in size, the topmost acting as bract to the inflorescence. Spikelets in dense head-like clusters, all or for the greater part collected at the apex of the stem into a short, dense, often spiciform 1½–3 cm long inflorescence. Floral bracts elongate-ovate, very acute, distinctly paler than the spikelets. Sepals oblong-ovate, very acute, ± 2½ mm long, in their upper halves dark-brown, often pale-margined, subequal or slightly unequal. Stamens 6, slightly shorter than the perianth; filaments rather long; anthers shortly linear-oblong; style 1–1½ mm. Stigmas longish. Capsule broadly obovoid, rounded at the top, distinctly shorter than the perianth, ± 2 mm long. Seeds or fewer, oblong, brown, with a rather large, basal, white elaiosome, faintly reticulate-ribbed, ± 1½ mm long.

Distr. Extremely polymorphous, distributed throughout the globe, in Malaysia: Philippines (Luzon) and New Guinea.

Ecol. Alpine grasslands on sandy banks of streams, in recently burnt forest-areas, on slopes in pine-forests, extending into the mossy forest along trails, locally common, 2000–3700 m.

Vern. Veldbies, D, wood rush, E.

Note. In Malaysia hitherto only the above described form has been collected.

Excluded

‘Juncus communis Mey.’ see. Kurz, Natuurk. Tijd. N.J. 27 (1864) 221, ‘in swampy places round the lime-kinl at Muntok’, Banka Island

I have not traced the specimen on which this record is based, but the fact that J. communis = J. effusus L. has never been found below 1400 m alt. leads to the conclusion that Kurz’s identification is wrong, and that he had before him some Cyperaceae.
PEDALIACEAE (C. A. Backer, Heemstede)

Annual or perennial herbs, often strongly smelling, frequently clothed with glandular or mucigenous hairs (the latter consisting of a very shortly stalked 4-lobed knob becoming slimy when wetted). Leaves opposite or the upper spirally arranged, extipulate, petioled, simple or the lower 3-partite or palmately 3-foliolate. Flowers ♀, either solitary in leaf-axils (often between 2 glands), or in terminal racemes, nodding, zygomorphic. Calyx deeply 5-partite. Corolla much exceeding the calyx, gamopetalous, mostly very oblique; tube widened upwards; lobes 5, in bud imbricate, the anterior one much the largest. Stamens inserted near base of corolla, included, either 2 (anterior ones) perfect with 3 staminodes or 4 perfect, didynamous, with or without 1 posticus staminode; anthers free or cohering in paits, 2-celled; connective often gland-tipped; cells parallel or widely diverging, opening lengthwise. Disk hypogynous, fleshy. Ovary superior, either 1-celled with 2 opposite parietal deeply intruded, T-shaped placentas touching in the middle and consequently spursly 4-celled, or 2-4-celled and then the cells often halved by a parietal radial spurious dissepiment. Ovule either 1 in each compartment, or numerous and superposed. Style long; stigma 2-4-lamellate. Drupe or capsule; cells 1- of more-seeded. No endosperm; cotyledons flat.

Dist. About 60 spp. belonging to 3 genera (Martyniaceae proper) in the tropics and subtropics of America and to ± 15 in the Old World which, the Australian Josephinia excepted, are confined to or centering in Africa; many genera are monotypic. Some spp. are now ubiquitous weeds having escaped from cultivation. Of the genera treated here only Josephinia is native to Malaysia.

Ecol. The bulk of the spp. is found in dry regions or on the beach. They often show structures adapted to a xerophytic habitat. The fruits of the Pedaliaceae are often provided with hooks, sometimes bizarre in shape, or wings.

Notes. Martyniaceae are included here in Pedaliaceae.

KEY TO THE GENERA

2. Ovules and seeds ∞, superposed in each cell. Capsule oblong, unarmed, dehiscent. Higher leaves often spirally arranged. ...................... 1. Sesamum
   2. Ovules and seeds 1 in each cell. Fruit ellipsoid to subglobose, spiny, indehiscent. Leaves opposite.
      2. Josephinia
      3. Martynia

1. SESAMUM

LINNÉ, Sp.Pl. (1753) 634; Gen. Pl. (1754) no 782.

Erect or decumbent herbs, beset with very short, white, mucigenous hairs, moreover often with much longer articulate hairs. Leaves opposite or the upper spirally arranged; the larger ones sometimes compound or deeply divided, the smaller simple, entire or shallowly serrate-dentate. Flowers solitary in the axils of the higher leaves. Calyx persistent, small. Corolla-tube decurved, gradually widened upwards, at the back of the base subgibbous, inside beneath the insertion-point of the filaments with a ring of hairs; lobes of limb patent, rounded. Stamens 4, didynamous; anthers free, with a bifid base; cells ± parallel; connective gland-tipped; staminode minute or absent. Disk equal. Ovary (in normal flowers) 2-celled; cells halved by a parietal radial false dissepiment; each compartment containing many 1-seriate superposed ovules; stigma (in normal flowers) 2-lamellate. Capsule oblong or slightly broadened upwards, acuminate or obtuse-rounded, obusely quadrangular with 4 longitudinal grooves, unarmed, dehiscing longitudinally from
the top more or less deeply down; the false dissepiments splitting longitudinally. Seeds in each compartment numerous, horizontal or suboblique, much compressed, obovate with a rounded apex, in their basal part or throughout their length margined or very narrowly winged; testa on the broad surfaces either smooth, finely scrobiculate or transversely ribbed. Seeds often rich in oil.

Distr. Species ± 18 centering in the warmer regions of Africa, few in Asia; 2 of them frequently cultivated as an oil-seed, viz S. indicum and S. radiatum. Both of these occur in Malaysia, where S. indicum is very common, S. radiatum, on the whole, very rare.

Note. For abnormal flowers see the note under S. indicum.

**KEY TO THE SPECIES**

1. Quite ripe seeds on their broad surfaces with finely reticulate ribs or almost smooth. Fruit crowned by a very conspicuous subulate beak. Lowest leaves often deeply divided or palmately compound.

1. S. indicum

2. S. radiatum


Strongly smelting annual, 0.15–1.50, rarely up to 2 m high, often branched. Stems and branches in their upper part obtusely quadangular, with furrowed sides. Lower leaves opposite, rather long petiolate, ovate from a rounded or obtuse base, acute or rather obtuse, in robust specimens often 3-lobed, 3-partite or palmately 3-foliolate, in feebler ones undivided; higher leaves gradually shorter petiolate, more ovate-oblong-lanceolate or even linear from an acute base; petioles of lower leaves 2–15 cm, of highest leaves frequently only a few mm; limb 4–20 cm by 1/2–15 cm, in large leaves coarsely or superficially serrate-dentate. Pedicels erecto-patent, 2–5 mm. Calyx 4/4–7 mm long, in fruit thickened and obconical; segments oblong or ovate-oblong, rather obtuse. Corolla totalling 2½–3½ cm, in pale-seeded forms white, in brown- and black-seeded forms violet, often spotted with yellow. Filaments glabrous; anthers 2½–4 mm, glabrous or along the margins thinly hairy; staminode minute, reflexed, or wanting. Ovary densely pilose; style glabrous, white, 1–1½ cm; stigmas laimellae lanceolate, rather acute. Capsule erect, prismatic from a rounded base or slightly broadened upwards, at the rounded apex abruptly contracted into a conspicuous shortly subulate, rather obtuse beak, 1½–3 cm (beak included) by 6–12 mm, finally splitting down to the very base; endocarp of the valves with an acuminate apex. Seeds 2½–3 mm long, yellowish white, brown or black, finely reticulate or almost smooth; one of the broad surfaces of the seed very narrowly margined all round, often with a longitudinal midrib; the opposite surface slightly more convex and margined only at the base, without a midrib.

Distr. Herb of ancient cultivation, native country not known with certainty: Africa or possibly Asia. At the present time grown for its oleiferous seeds throughout the warm regions of the world; rather commonly cultivated throughout Malaysia; not yet reported from New Guinea.

Ecol. In Malaysia cultivated from the plains up to ± 1000 m, especially in the drier regions. Frequently met with on fields as a relic of cultivation, also on road-sides and in open grassy localities, but there, as a rule, not firmly established. In 1919 I saw in several islands of the Kangean Archipelago apparently wild specimens in places where, according to the natives, the plant had never been cultivated and where it bore no vernacular name.

Uses. The seeds are pressed to obtain oil; also used as an ornament for the top of cakes.

Vern. Many names of which widhen and lenga with some variants are the commonest.

Notes. A monstrosus white-flowered cultivated form of this species is characterized by a 4-celled ovary and 4 stigmatic lamellae; in this form also
each ovary-cell is halved by a longitudinal parietal false dissepiment, which may be only partially developed. The capsule is proportionally much broader than that of normal forms.


Disagreeably smelling annual, 0.40—1.20 m high or sometimes higher, usually branched; stems and branches in their upper parts obtusely quadrangular, with furrowed sides. *Leaves* varying from ovate-elliptic (the lower) to narrowly oblong (the upper), at the base and apex acute or rather obtuse, 3½—11 cm by 1½—4 cm; lower more or less coarsely dentate-serrate, but never deeply divided or compound; higher entire or nearly so; petioles ½—2½ cm, from the base of the stem upwards gradually diminishing in length. Pedicels erect, 4—8 mm, in fruit thickened and obconical. Calyx 5—7 mm, segments oblong or ovate-oblong, rather obusate. *Corolla* totalling 3—4 cm, violet or violet with white. Filaments glabrous; anthers 4—5 mm, hairy on the back, staminode absent. Ovary densely pilose; style glabrous, white; stigmatic lamellae oblong or lanceolate. *Capsule* erect, prismatical from a rounded base, with a rounded or very obtuse apex, rather densely pilose, 2½—3 cm by 8—10 mm, finally splitting down to the very base; endocarp of valves slightly retuse at the apex, crowned by a short central point. *Seeds* ± 3 mm long, brown or black, dull or feebly shining; on both surfaces, especially on the flatter one, with several subhorizontal ribs emanating from a central longitudinal field; the flatter surface all around with a sharp margin; the opposite surface distinctly more convex, on the one side delimited by the same margin, on the other in the lower part delimited by a second sharp margin uniting with the other one beneath the apex of the seed; margins much more pronounced than in the preceding species.

Distr. Native of tropical W. Africa, where, according to Burkill, it is cultivated for its oil-containing seeds. In other warm countries run wild. In Malaysia: Malay Peninsula, Sumatra, N. Borneo.

2. **JOSEPHINIA**

*Vent.* Jard. Malm. 2 (1804) 67, t. 67.

Erect or decumbent *herbs*, beset with very short, mucigenous hairs, moreover often with shorter or longer ordinary hairs. *Leaves* dentate or divided into 3 distinct segments. *Flowers* in the higher leaf-axils. Calyx persistent, small, segments subequal or posterior one smaller. Corolla-tube decurved, much widened upwards, at the back of the base subgibbous, inside beneath the insertion-point of the filaments with a dense ring of short hairs; lobes of limb patent. Stamens 4, didynamous; anthers free; cells ± parallel, with a deeply bifid base; connective gland-tipped. Disk on the posterior side slightly thickened. Ovary 2—4-celled, cells halved by a parietal radial false dissepiment; each compartment containing a single basal erect ovule; stigmatic lamellae equal in number to ovary-cells. *Fruit* ovoid-oblong-globular, beaked or not, aculate, 4-, 6- or 8-celled; cells 1-seeded. Seeds erect, oblong, not winged.

Distr. Species 4 in Australia: one of them extending to Malaysia as far West as Java.


Rather long-lived *herb*, strongly smelling (like *Sesamum indicum*), frequently woody at the base, with a robust, often very long (penetrating into the soil to a depth of many dm), reddish brown taproot. Stem frequently divided at or near the base in widely divericating, ascending, long, often sinuous, terete branches, 1½—3½ m long, at the top densely and finely hoary-pubescent. *Leaves* ovate, ovate-oblong or oblong, from a rounded, obtuse or acute base, gradually tapering upwards or shortly acuminate, acute, entire or the larger ones coarsely dentate-serrate, upper side less densely hairy than below; lower 3—12 cm by 3½—6 cm; topmost often small; petiole densely hoary-pubescent, that of lower leaves 2—7 cm, of higher gradually shorter. Pedicels erecto-patent, 3—5 mm, rather densely hoary-pubescent, after anthesis somewhat thick-
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Fig. 1. Josephinia imperatricis Vent. Stem with flowers and fruits, × 2/3.

Fig. 2. Localities of Josephinia imperatricis Vent. in Malaysia.

ened, not or hardly lengthened. Calyx externally densely hoary-pubescent, 4–5 mm long; segments oblong, rather acute or rather obtuse; posterior segment shorter, 2 anterior ones longer than the others. Corolla pale pink or pale violet, in the throat and on the anterior segment dotted with red or violet, externally densely shortly pubescent, totalling 2 1/4–3 1/4 cm; narrow basal part of tube 2 1/2–4 mm; posterior and lateral lobes of corolla very short; anterior lobe much larger, broadly ovate, 1–1 1/4 cm long. Disk thick. Ovary densely appressed hairy, usually 3-, sometimes 4-celled (consequently with 6 or 8 compartments); stigma 3- or sometimes 4-lamellate. Fruit globose or broadly ellipsoid, crowned by a narrowly pyramidal, short, obtuse beak, 11–15 mm diam. (spines included), densely patently hoary; spines rather strong, conical, 2 1/2–3 1/2 mm long, obtuse as long as the fruit remains attached to the plant, afterwards drying up and becoming much sharper; endocarp woody. Testa thick.

Distr. N-NE. Australia and East Malaysia: South- and eastcoast of the eastern half of Java, Madura, Kangean Arch., Lesser Sunda Islands (Bali, Lombok, Sumba, Timor, Leti, Moa), Saleyer, Buton, S. & NE. Celebes, Tanimber Islands, and SE. New Guinea (incl. adjacent isl.).

Ecol. Beach-wall and sandy fields behind it, usually 1–5 m above sealevel, but sometimes much higher (up to 300 m), on the whole rather rare but locally often gregarious. The fruits are transported by the sea and by tillage of the soil. They are produced in great numbers.

Vern. Several but very local and of little value.

Note. Teysmann recorded from Timor a second species of Josephinia (Nat. Tijd. N.l. 34, 1874, 462) but his material belongs to J. imperatricis. I can find no argument for separating J. grandiflora from the latter, the difference in the fruit-structure as described by R. Brown being due to the appearance of false dissepiments during ripening.

3. MARTYNIA


Annual erect herb, clothed with patent, long, glandular-viscid hairs. Leaves opposite, long-petioled, broad, palmatinerved. Flower in the axil of a deciduous bract,
Fig. 3. *Martynia annua* L. Flowering stem-top, a branch with fruits, two pyrenes, and details of flowers, all $\times \frac{2}{3}$, anthers $\times 3$. 
at the base with 2 membranous bracteoles. Calyx 5-partite to the base; segments unequal, 2 anterior ones broader than the others, posterior segment longest. Corolla obliquely campanulate-thimbleshaped, on the anterior side much dilated above the short basal part; lobes broad, very unequal, anterior one much the largest. Perfect stamens 2 (anterior ones); anthers cohering; cells widely divergent; connective glandless; staminodes 3. Disk unequalsided. Ovary 1-celled, divided into 4 compartments by 2 deeply intruding, parietal, opposite, T-shaped placentas touching in the middle rendering the ovary spuriously 4-celled; each compartment with 1 ovule pendent from its apex; stigma unequally 2-lamellate. Fruit a beaked drupe; pericarp rather thin, 2-valvate, deciduous; endocarp remaining attached during a long time to the pedicel, crowned by 2 strong, clawlike very sharp hooks, woody, with 8 strong, rounded longitudinal ribs and a central empty cavity; compartments 1-seeded. Seed oblong.

Distr. Monotypic genus, native of Mexico, naturalized in several tropical and subtropical regions.

1. Martynia annua LINNÉ, Sp. Pl. (1753) 618; KOORD. EXK. FL. 3 (1912) 187; DAMMERMAN, NAT. TIJD. N.I. 86 (1926) 44; TROP. NATUUR 15 (1926) 74; BACKER, BEKN. FL. JAVA EM. ED. 9 (1949) FAM. 197, P. 2.—MARTYNYIA DIANDRA GLOXIN, OBS. (1875) 14, T. 1; JACQ. HORT. SCHOENBR. 3 (1798) 21, T. 289; LINDL. BOT. REG. N.S. 9 (1836) T. 2001; DC. PROD. 9 (1845) 253; CLARKE, FL. BR. IND. 4 (1884) 386; FORBES, NAT. WAND. (1885) 513; BAILEY, QUEENSL. FL. 4 (1901) 1188; BACK. ANN. J.B.B. SUPPL. 3 (1909) 407; ALSTON, HANDB. FL. CEYL. 6 (1931) 221; GAGNÉ, Fl. gén. I.C. 4 (1935) 610.—Fig. 2.

Erect rank herb, frequently widely branched, 1/2-1 1/2 m high. Stem suberecte, thick, fistular. Leaves broadly ovate from a coriaceous base, with a triangular apex, repand-dentate, herbaceous, pale green, 15-30 by 15-22 cm; petiole thick, fistular, often tinged with purple, 12-25 cm. Racemes by the development of a branch in each of the highest leaf-axils often seemingly in bifurcations of the stem, erect, 5-13 cm, not very dense. Flowers not very many. Bracts and bracteoles pale pink; bracts clawed, 1 1/2-3 1/2 cm long; their blade oval or oval-obovate, 1-2 cm wide, distinctly veined. Pedicels 1-2 1/2 cm. Bracteoles at the calyx-base during anthesis still present, ovate-oblong, 1 1/2-2 1/4 cm long. Calyx yellowish white or greenish yellow, 1 1/2-2 cm long, falling off after anthesis. Corolla totally 5 1/2-6 1/2 cm, tube 3 1/2-4 1/2 cm, outside pale pink, on the anterior side within with stalked glands and yellow and purple dots; segments broadly rounded, pink with a dark purple blotch; anterior segment much larger than the others, with a yellow blotch beneath the purple one. Filaments white, glabrous, 1 1/2-1 3/4 cm; lateral staminodes 4-6 mm, posterior one 1 1/2-2 mm. Disk broadest on the back, glabrous. Ovary glabrous. Style 2 1/2-3 cm, posterior lamella of stigma obtuse, anterior one slightly longer, acute. Drupe green, ovoid, with a short upturned beak; endocarp black, very hard, ± 3 cm long.

Distr. Native of Mexico, locally naturalized in India and Queensland and in Malaysia: Java (only surroundings of Batavia) and Lesser Sunda Islands (Sumba, Timor).

Ecol. Lower regions, in waste places, on refuse-dumps, locally sometimes numerous, but, on the whole, scarce, apparently preferring periodically dry regions.

Vern. Kuku matajan (tiger's claw), M, karikuku (Sumba).

Excluded

Sesamum javanicum BURM. f. FL. IND. (1768) 133, 'habitat in India' according to MERRILL (Philip. J.Sc. 19, 1921, 380) = Artanema longifolium (L.) BOLD. (Scroph.).
Fig. 1. *Cannabis sativa* L. Flowering twig with 9 flowers, × ½, the same, × 1½, fruit, × 6.
CANNABINACEAE (C. A. Backer, Heemstede)

I. CANNABIS

LINNÉ, Sp. Pl. (1753) 1027; Gen. Pl. ed. 5 (1754) no 988.

Erect tall annual, usually branched. Leaves simple, with 2 free stipules, in the lower part of the stem opposite, in the higher part spirally arranged, long-petioled, palmate, 3–11-foliolate. Flowers (♂)(♀) or mostly (♂♂). Male flowers in short, dense cymes, which are united into lax, foliate, terminal panicles, very shortly pedicelled. Tepals 5, free, oblong, membranous, imbricate. Stamens 5, epitepalous; filaments erect and short in bud, linear, with a narrowed apex; anthers comparatively large, basified, 2-celled, cells opening longitudinally, rudimentary ovary absent. Female flowers solitary in the axil of a small, primary, membranous, entire bract closely enveloping the ovary, each enveloped by a spathaceous, conspicuous, acuminate, secondary bract. Perianth absent. Ovary sessile, 1-celled; style central; stigmas 2, sessile, long, filiform, caducous. Ovule solitary, pendulous. Achene closely enveloped by the much enlarged, secondary bract, broadly ovate, with a concave rimmed base, much compressed, faintly keeled on the lateral margins; pericarp smooth, hard, crustaceous, easily splitting into two halves; albumen unilateral, scanty, fleshy; embryo large, horseshoe-shaped; cotyledons large; radicle long.

Distr. Monotypic, native of Central Asia, cultivated in tropical Asia, naturalized in N. America. Uses. See under the species.


Stem slender, slightly angular, usually 1–1 1/2 m tall, sometimes much taller, rather densely appressed-pubescent when young. Stipules erect, filiform or narrowly subulate, ± 1/2 cm long. Leaves (3–)5–7–(11)-foliolate; upper ones often 1-foliolate. Leaflets sessile, narrowly lanceolate from a narrowed base, long-acuminate, acute, rather coarsely acutely serrate, on the upper surface very scabrid by short stiff hairs inserted on top of a cystolith (very conspicuous in dried leaves), on the lower surface appressed-pubescent and rather densely beset with sessile glands, 6–14 cm by 3–15 mm. ♀: Tepals oblong, greenish white with pellucid white margins, finely appressed-pubescent, ± 5 mm long. Anthers yellow, 3–4 mm. ♂: Enveloping bract on the back rather densely clothed with patent short, thick, glandular hairs, darkgreen, rather small during anthesis, afterwards much enlarged. Stigmas up to 1/2 cm long. Fruiting bract much contracted above the broad base, in the upper half with inrolled margins, up to 3/4 cm long. Fruit smooth, shining, yellowish or brown, ± 4–5 mm long. Seed containing oil.

Distr. Native of Central Asia, cultivated either as a fibreplant or as a narcotic in many other countries. Use. In Malaysia sometimes cultivated on a small scale, exclusively for its leaves which are smoked as an intoxicant. The narcotic is the dried prepared tops of the female plant taken when the seeds are yet undeveloped. This drug is called hashish. Before the war it was forbidden to cultivate hemp in the Netherlands Indies, and the drug was, mostly with ripe fruit, often secretly smuggled into the country.

Vern. Hennep, D, genja (Sum.), ginjé djawa, J, hemp plant, E.

Note. Plant of very early cultivation, recorded for Java already more than 900 years ago by the Chinese. In Malaysia the ♀ plant is not cultivated, and the ♂ always possesses some ♂ flowers at the base of the ♀ inflorescences.
Fig. 1. *Azima sarmientosa* (BL.) B.&H. Female twig with fruits, part of male inflorescence, $\times \frac{1}{2}$, single male flower, $\times 8$. Courtesy Pasuruan Exp. Station.
SALVADORACEAE

1. AZIMA


Much-branched, erect or rambling shrubs, armed with axillary spines. Leaves opposite, often with rudimentary stipules, simple, quite entire. Flowers in axillary or terminal racemes or panicles, or in axillary fascicles, unisexual (monocious or dioecious) or sometimes partly bisexual, actinomorphic, 4-merous. Calyx campanulate, 4-lobed or 2-4-partite. Petals 4, free, imbricate in bud, oblong or lanceolate. Disk absent. Ø: Stamens 4, alternating with the petals, longer than the corolla, in Ô reduced to staminodes; filaments slender, free or connate at the base; anthers oval, cells 2, back to back, opening longitudinally; no rudimentary ovary. Ô: Staminodes 4, not exceeding the corolla, anthers barren. Ovary superior, globose, 2-celled or imperfectly 4-celled; ovules 4, erect from the base; style short or almost absent; stigma subsessile, large, deeply bifid. Ô like Ô, but with 4 perfect stamens. Berry globose; with a thin endocarp. Seeds 1–3, erect, flat, orbicular, exalbuminous; cotyledons coriace, thick; testa coriaceous.

Distr. Few spp. in tropical and subtropical Africa and tropical Asia, one extending into West Malaysia.

Ecol. Like most members of the family the Malaysian sp. occurs in hot, dry regions.


Erect glabrous shrub with often long, rambling or drooping branches, 2–4 m long; leaf-axils often with 1–2 patent thin, straight, very sharp, base of each petiole 2, minute subulate, subpersistent. Leaves variable as to shape, ovate, elliptic, oblong, oval, suborbicular or obovate from an acute, obtuse or rounded base, abruptly tipped with a small triangular not or hardly spinous point, thinly coriaceous, flexible with a strong midrib and thin lateral nerves and veins, shining, 2–6½ cm long by 1½–2½ cm; petiole 3–7 mm. Flowers in racemes or panicles of 1–25 cm long; lower of these axillary, higher often united in a terminal panicle with wide-divaricating branches; rachises thin. Distribution of sexes various; some specimens Ø, others Ô or (ØÔ); the (ØÔ) ones sometimes with a few Ô flowers. Bracts persistent, patent, elongated-ovulate, very acute, not spiny, 1½–2½ mm long. Calyx, corolla, staminodes of Ô and stamens of Ô persistent after anthesis. Ô Flowers rather crowded, sessile or sub sessile. Calyx more or less deeply divided into obuse erect segments, 2–2½ mm long. Petals somewhat exceeding the calyx, oblong, entire or at the apex slightly denticate-serrate, green, 2–2½ mm long. Filaments exceeding corolla; anthers oblong, 1½–2½ mm. Ô Flowers on 1–8 mm long pedicels. Calyx 1½–1¼ mm long. Corolla as in Ø but only 1½–2 mm long. Staminodes not exceeding the corolla; anthers anthers sagittate. Ovary imperfectly 4-celled; stigmatic arms broad, widely divaricating. Ô like Ô, but with perfect stamens. Berry globose, white, ± 6 mm diam. Seeds 2–3, less often 1.

Distr. Continental SE. Asia, in Malaysia not yet recorded from Sumatra, the Malay Peninsula, Borneo, the Moluccas, and New Guinea.

Ecol. In northern Java in dry coastal regions from the plains up to 160 m, in periodically very dry localities: thickets, hedges, field- and forest-borders, locally not rarely rather numerous.

Vern. Papadjaran, S. bukangan, Md. ainglyri (Ilk.).

Notes. The crushed branches emit an offensive smell reminding of that of the bruised leaves of Diplotaxis tetranthia LAMK, with which MIQUEL, F.-VALLAR, &c. confused this species, differs i.a. by its stiff erect habit, narrower, more rigid, strongly spine-tipped leaves with a narrowed base and the often 4-nate and on the whole, stronger axillary spines. Acc. to BURKILL it has been introduced in Penang (Dict. 1935, 276).

(1) Palaeotropical and subtropical, small family, in Malaysia only represented by one genus.
PUNICACEAE (C. A. Backer, Heemstede)

PUNICA


Shrubs or small trees, usually spiny. Leaves opposite, alternate or fascicled, stipulate, simple, entire, penninerved, small. Flowers terminal and subterminal, sessile or nearly so, rather large, \( \varphi \), actinomorphic. Calyx thickly coriaceous, coloured, camphyllous; tube campanulate-urecolate, adnate to the ovary and produced above it, inside with an annular thickening; segments 5–9, valvate in bud, ovate-triangular, acute, persistent. Petals the same number as calyx-lobes and alternating with them, imbricate and strongly crumpled in bud, obovate, deciduous. Stamens very numerous, inserted on the annular thickening of the calyx, deciduous; filaments incurved in bud, filiform, free; anthers dorsifixed, 2-celled; cells bursting longitudinally. Ovary entirely inferior or free at the top; cells several in 2–3 superposed rows, exceptionally 1-seriate; ovules numerous; those of the lower cells axile, of the upper parietal; style 1, robust, with a thickened base; stigma capitate. Berry large, subglobose, crowned by the unaltered calyx-segments, thick-walled, finally bursting irregularly, entirely filled up by the seeds. Seeds very numerous; outer layer of testa thick, fleshy-juicy; inner layer horny; endosperm none; cotyledons convolute.

Distr. Two spp. viz. P. protopunica Balf. f. confined to Socotra, and P. granatum L., a plant of very ancient cultivation in S. Europe, N. Africa, the Orient, tropical Asia, Malaysia, and China. Also introduced in the New World.


Shrub or small crooked tree, \( \frac{1}{2} – 5 \) m high, often much branched from near the base; branches often ending in a spine, moreover frequently with axillary leaf-bearing or leafless spines; when very young tetragonous or narrowly tetrapetalous, afterwards obtusangular or subterete, glabrous. Leaves mostly opposite, oblong-lanceolate from an acute or less often rather obtuse base, acute, obtuse or emarginate, entire, firmly herbaceous, shining above, 1–9 by \( \frac{1}{2} – 2\frac{1}{2} \) cm; midrib much prominent beneath; lateral nerves rather numerous, erecto-patent or ascending, thin. Flowers 1–5 at the top of the branchlets; 1 of them terminal; the others solitary in the highest leaf-axils, odorless. Calyx (receptacle included) 2–3 cm high, red or pale-yellow; segments erecto-patent or slightly recurved, thick, at the apex on the back with a yellowish green gland, along the margin densely and shortly papillose, \( \frac{1}{4} – 1\frac{1}{4} \) cm long. Petals erecto-patent or patent, with a rounded or very obtuse apex, flaming red or white and then turning brown when fading, \( 1\frac{1}{2} – 3 \) by 1–2 cm. Stamens glabrous, \( 1\frac{1}{2} – 1 \) cm long. Style surpassing the stamens, \( \frac{1}{4} – 1 \) \( \frac{1}{4} \) cm. Berry 5–12 cm diam., variable as to colour, yellowish green, white, reddish brown or rarely blackish violet. Seeds obtusangular, red, pink or yellowish white.

Distr. Probably originating from Persia and some adjoining countries, from there introduced into S. Europe, N. Africa (Carthago; hence the name poma punica), the Orient, SE. Asia, Malaysia, and China. In the Levant the plant has run wild.

Ecol. Cultivated as a fruit-tree or for medicinal purposes throughout the lower regions of Malaysia, 1–1000 m, always on a very small scale and nowhere naturalized. The fruits produced in Malaysia are of poor quality. The farther from Persia the more inferior, on an average, are the fruit (BURLII). A dwarfed from (P. nana L.) and a double-flowered form are cultivated as ornamental plants, often in pots.

(1) I do not agree with Griffith (Posth. Pap. 2, 1849, p. iii, x) and HALLIER f. (Med. Rijksherb. 35, 1918, 17) who combined Sonneratiaeae (and Crypteroniaceae) with Punica in one family.
Uses. The root-bark is a highly valued specific for tape-worm.

Vern. In many languages *dalima* or *délina*, moreover: *gangsalan*, *J*, and several local names.

Note. *Fl.* Jan.–Dec., mostly sparingly.

Fig. 1. *Punica granatum* L. Flowering and fruiting twigs, nat. size (after Ochse).
Fig. 1. Rivinia humilis L. Habit, nat. size, a. bud, b. flower, c-d. stamen, e. young fruit, f. fruit, g. seed (a-b × 4, c-e × 5, f-g × 2½).
**PHYTOLACCACEAE** (C. A. Backer, Heemstede)

Herbs, shrubs or (not in Malaysia) trees. *Leaves* alternate, simple, entire; stipules minute or absent. *Flowers* in terminal, axillary or lateral racemes, bracteate and bibracteolate, ♂ or unisexual, actinomorphic or zygomorphic, mostly (so in the Malaysian species) monochlamydeous. *Tepals* 4–5, herbaceous or membranaceous, free, imbricate in bud, coloured during and often also after anthesis, equal or unequal, persistent. *Stamens* 3 to many, usually inserted on a hypogynous disk, either regularly or irregularly arranged, 1–2-seriate; those of the only or outer series more or less alternating with the tepals; filaments slender, free, persistent; anthers dorsi- or basifixed, dehiscing longitudinally. Ovary superior, composed of 1 or more carpels; these either free or laterally coninate. Styles as many as carpels, short, or none, free. Ovules solitary in each carpel, basal. *Fruit* of 1 or more carpels, juicy or dry. Seed erect; embryo large, peripheric, enclosing the endosperm.

**Distr.** Genera upwards of 20, mostly inhabitants of the tropics of both hemispheres, mainly of America. In Malaysia 3 herbaceous or subshrubby genera, all introduced from tropical America.

**Ecol.** The Malaysian species inhabit anthropogenic localities: open jungles, forest-borders, roadsides, waste places.

**Uses.** None of any importance.

**KEY TO THE GENERA**

1. Tepals in all flowers 5. Styles 5–10. Fruit a juicy, 5–10-seeded, black or dark red berry 3. Phytolacca
1. Tepals in all flowers 4. Style 1 or none. Fruit 1-seeded.
2. Flowers zygomorphic. Ovary densely pubescent. Style none; stigma consisting of many hairs. Raceme nodding at the top, usually more than 10 cm long when adult. Fruit dry with 4 apical, reflexed, very sharp spines. Bruised leaves smelling of onions 2. **Petiveria**

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### 1. **RIVINIA**

LINNÉ, Sp.Pl. (1753) 121; Gen. Pl. ed. 5 (1754) no 150.

Erect slender herbs, often woody at the base. *Leaves* on longish petioles, exstipulate, ovate-oblung or ovate-lanceolate, long-acuminate, acute, herbaceous. *Flowers* ♂, in terminal and pseudolateral, erect or erecto-patent, often somewhat flexuous, rather lax racemes. Pedicels slender, minutely bibracteolate above the middle or near the top. *Tepals* 4, subequal, during anthesis patent or ± reflexed, white or pinkish, after anthesis slightly accrescent, turning green, at first conniving, finally often spreading or reflexed. Stamens 4, alternating with the tepals, shorter than these; anthers dorsi-fixed, bifid at both ends, glabrous. Ovary unicarpellate, subglobose, glabrous. Style short, decurved after anthesis; stigma capitate. *Fruit* a globose, 1-seeded berry. Seed lenticular, glabrous or shortly hairy.

**Distr.** Species 3!; closely allied, native in tropical America; one of these naturalized in Madagascar, Réunion, Ceylon, tropical SE. Asia and *Malaysia*.


(1) According to Heimerl in E. & P. ed. 2, 16c (1934) 147, the genus consists of one variable species only.

Miq. Fl. Ind. Bat. 1, 1 (1858) 1014.—Tithonia humilis O.K. Rev. Gen. 2 (1891) 552.—Fig.1.

Erect herb, not rarely with a woody base, usually repeatedly branched, 40–100 cm, rarely up to 2 m high; stem in the upper part short, patently pubescent. Leaves rather remote, ovate-oblong or ovate-lanceolate, from a very obtuse, rounded or subcordate base, long-acuminate, acute, glabrous above, shortly pubescent on midrib beneath, 4–12 by 1½–4 cm; petiole shortly patently pubescent, 1–3½ cm. Racemes erect or erecto-patent, thinly patent short-pubescent, 4–10 cm long (peduncle included), ±-flowered. Pedicel erecto-patent or widely patent, during anthesis 2–3 mm long, afterwards 3–4 mm. Tepals during anthesis white or pinkish, 2–2½ mm long, in fruit 3–3½ mm. Berry bright red, 3½–4 mm diam. Seeds moderately densely clothed with patent, short hairs, ± 2 mm diam.

Distr. Native in tropical America, naturalized in Ceylon, Further India &c., in Malaysia: Singapore, N. Sumatra, Java, Madura, Philippines, etc. Introduced in Java more than a century ago, at present naturalized throughout the island, 1–450 m.

Ecol. Slightly shaded localities, under hedges, at the foot of walls, open jungles, campong borders, waste places, locally often rather numerous, but not gregarious.

Vern. Coral-berry, E.

Note. In the Malay Peninsula the root is said, but not proved, to be very poisonous; a child in Cutchetta was poisoned by the berries, the case not being fatal (Burkill, i.e.). Cattle eat the herbage in Australia; it imparts an unpleasant smell and taste to the milk; their excreta also smell of it (C. T. White, Queensl. Agr. J. new ser. 25, 1926, 274).

2. PETIVERIA


Erect undershrubs; stipules subaxillary, subulate, minute. Leaves on short or medium-sized petioles, ovate-elliptic-lanceolate, smelling of onions when bruised. Flowers ♀, zygomorphic, small. Racemes terminal and axillary, erect or nodding at the top. Pedicels very short, bearing 2 minute bracteoles. Tepals 4, oblong-linear, during anthesis spreading and yellowish white, afterwards erect, accrescent, turning green, indurating. Stamens 4–8 on the base of the perianth and shorter than this, unequal; anthers dorsifixed, linear, with a deeply bifid apex and a slightly 2-lobed base. Ovary unicarpellate, oblong, densely pubescent, on the top with 4 or 6 deflexed bristles which afterwards change into short, sharp spines, 1-celled. Style absent; stigma lateral on the ventral upper half of the ovary, consisting of many longish hairs. Fruit exserted from the enclosing perianth, narrowly cuneiform, compressed, dry, indehiscent; pericarp coriaceous, adhering to the seed. Seed linear.

Distr. Species 1 or 2, native in the warmer regions of America, one on a very small scale naturalized in Java.


Erect, 1½–1½ m high; stem thin, hairy in the upper part. Leaves elliptic-oblong or slightly obovate, from an acute base, with a narrowed or acuminate, acute, obtuse or rounded apex, wavy, pubescent on the main nerves above, glabrous beneath, 6–17 cm by 2½–6½ cm; petiole 1½–1½ cm. Racemes spiciform, often nodding at the apex, rather lax, 10–40 cm long. Bracts ovate, acutely acuminate. Pedicels 1½–1 mm. Perianth 3–4 mm long, afterwards up to 6 mm. Stamens 6–8, erect. Fruit-spines 4, ± 3 mm long.

Distr. Native of the warmer parts of America, established and reproducing itself by seeds in a few localities near Bogor (W. Java), outside the Botanic Garden from which it is probably an escape, at ± 240 m alt.

Ecol. Under hedges.

Use. When the food of cattle contains Petiveria it imparts an unpleasant smell and taste to milk and meat.

Vern. Guinea-hen weed, gully root, E.

Note. Though the fruits readily adhere to passers-by the plant is still far from common.

3. PHYTOLACCA

Linné, Sp.Pl. (1753) 441; Gen. Pl. ed. 5 (1754) no 521.

Erect (or scandent) herbs (or shrubs), glabrous barring the papillate or shortly hairy main-axis of inflorescence; stem often angular. Leaves exstipulate, ovate-oblong-lanceolate, acute at both ends, herbaceous. Flowers ♀ [or (♂) ♂] in terminal anthesis 3–4 mm long, afterwards up to 6 mm. Stamens 6–8, erect. Fruit-spines 4, ± 3 mm long.

Distr. Native in tropical America, naturalized in Ceylon, Further India &c., in Malaysia: Singapore, N. Sumatra, Java, Madura, Philippines, etc. Introduced in Java more than a century ago, at present naturalized throughout the island, 1–450 m.

Ecol. Slightly shaded localities, under hedges, at the foot of walls, open jungles, campong borders, waste places, locally often rather numerous, but not gregarious.

Vern. Coral-berry, E.

Note. In the Malay Peninsula the root is said, but not proved, to be very poisonous; a child in Cutchetta was poisoned by the berries, the case not being fatal (Burkill, i.e.). Cattle eat the herbage in Australia; it imparts an unpleasant smell and taste to the milk; their excreta also smell of it (C. T. White, Queensl. Agr. J. new ser. 25, 1926, 274).
or pseudolateral, often long, sometimes spiciform, erect racemes; pedicels shortish or short, sometimes very short. Perianth herbaceous, coloured, 5-partite; segments spreading during anthesis, afterwards often more or less reflexed, equal or slightly unequal, ovate, oval or obovate, afterwards often dark red. Stamens (6-)7–22–(33), 1–2-seriate, more or less irregularly arranged; those of the inner or only series inserted on the outer margin of the disk; those of the outer series on the undersurface of the disk; filaments filiform-subulate; anthers dorsifixed, bilobed at both ends. Carpels 5–10(–16), whorled, laterally connate throughout their length into a depressed globose ovary. Styles terminal on the inner angle of the carpels, erect or recurved, subulate, short. Fruit baccate, depressed globose, longitudinally 5–10-furrowed. Seeds oval from an inequilateral base, strongly laterally compressed, shining black.

**Distr.** Species ca 25, tropical and subtropical, mostly in America, a few in Africa and Asia, several species in Europe frequently cultivated as ornamentals. In **Malaysia** only 3 introduced American species.

**Ecol.** Along road-sides, forest- and field-borders, open jungles, waste places.

**Notes.** Besides the spp. mentioned below, **Buysman** (Flora 107, 1915, 221) mentions to have cultivated the shrubby **Ph. dioica** L. at Nongkodjadjar in E. Java; it did not flower.

**Phytolacca acinosa** Roxb., a plant with **free ripe carpels**, is indigenous to Japan, China and the Himalaya. It has sometimes wrongly been credited (e.g. by Koorders, Exk. Fl. Java) to Java where it does not occur.

**KEY TO THE SPECIES**

1. Stamens in all flowers, also in the lowermost ones, 7–9, all of them inserted on the outer margin of the disk ........................................ 1. **Ph. octandra**

2. Pedicels during anthesis 11/2–2 mm, under the adult fruit 1–21/2 mm ........................................ 2. **Ph. icosandra**

3. Pedicels during anthesis 2–4 mm, under the adult fruit 4–7 mm ........................................ 3. **Ph. purpurascens**


Bracketed herb, 40–60 cm high; stem angular. Leaves oblong-lanceolate or ovate-lanceolate from an acute base, gradually narrowed towards the apex or acuminate, 6–15 by 11/4–6 cm; petiole 1–3 cm. Adult raceme 8–25 cm long (1/4–3 cm peduncle included), dense; rachis more or less densely papillate or almost smooth. Pedicels during anthesis 1–2 mm, under adult fruit 2–3 mm. Tepals ovate, varying from rather acute to rather obtuse, during anthesis pink, 2½–3 mm long, under the fruit 3–4 mm. Styles 7–9, usually 8. Fruit with 8(7–9) longitudinal furrows. Seeds ± 2 mm long.

**Distr.** Native of tropical America, extending from Mexico to Columbia, elsewhere locally naturalized, in **Malaysia** in N. Sumatra and W. Java, very local; ± 1700 m above sea-level.

**Ecol.** Road-and water-sides, field-borders, waste places.

**Uses.** Young sprouts and leaves can be used as a vegetable.

2. Phytolacca icosandra** Linné, Sp. Pl. (1753) 60; PERS. SYN. 1 (1805) 523; WALTER, Pfl. R. 39 (1909) 60; BACKER, Bekkn. FL. JAVA, em. ed. 4 (1912) fam. 61, p. 3.—**Ph. decandra** (non L.) BACKER, Bull. J.B.B. II, 12 (1913) 26; **Buysman**, Flora 107 (1915) 221.

Erect herb, 50–100 cm high; stem angular. Leaves ovate-oblong, oblong or lanceolate, 6–20 by 11/2–9 cm; petiole 2–6 cm. Racemes erect or sub-erect, 12–35 cm long when adult (including 5–10 cm long peduncle), rather dense, sometimes very dense; rachis of raceme red, rather densely patent-papillose. Tepals ovate-ovate-ovoblate, during anthesis pink, 3–4 mm long, under the ripe fruit dark red, 4–5 mm. Stamens, at least in the middle and lower flowers, 10–22, partly on the margin of the disk, partly on the underside of it; in the highest flowers sometimes not more than 7–9, on the margin of the disk. Styles 7–10. Fruit 7–8 mm diam., faintly lobed. Seeds ± 2½ mm.

**Distr.** Native of tropical America, in **Malaysia**: W. & E. Java, 300–1200 m, locally established.

**Ecol.** Forest-borders, light forests, road-sides, waste places, locally sometimes very numerous but, on the whole, rare.

**Note.** The ripe berries are greedily devoured by some species of birds.


Erect herb, 3/4–11/2 m high; stems angular. Adult racemes not very dense, 20–35 cm long (5–13 cm long peduncle included); rachis sparingly short
papillate. Stamens 12–19. Styles 6–8, rarely 5. For the rest like Ph. icosandra.


Note. Most reluctantly I have kept up Ph. purpurascens as a separate species. In my opinion it is simply one of the many forms of Ph. icosandra, into which it passes by numerous intergrades; it cannot even justly claim varietal rank.

Excluded

SPARGANIACEAE¹ (C. A. Backer, Heemstede)

1. SPARGANIUM

LINNÉ, Sp.Pl. (1753) 971; Gen. Pl. ed. 2 (1754) no 925.

Aquatic often rather large perennial herbs with creeping, subterranean stolons. Stem simple or branched, leafy at the base, stiff or flaccid, erect or floating, bearing a terminal spike or panicle. Leaves long, linear from a sheathing base. Flowers (♂♀), crowded in separate globose clusters; lower clusters ♀, in or above the axil of a leafy bract, stalked or sessile; higher clusters ♂, bractless or with a small bract. ♂: Perianth actinomorphic, choriphylous. Tepals 3(−6), spatulate. Stamens 3(−6); filaments free or connate at the base; anthers basifixed, oblong; pollen globose. ♀: Tepals as in ♂ but larger. Ovary 1, exceptionally 2, sessile with a narrow base, unilocular; ovule 1, pendulous; style 1, usually simple, rarely forked; stigma unilateral, short. Fruits densely crowded, sessile with a narrow base, crowned by the style, indehiscent; exocarp spongy, endocarp hard; testa thin; embryo in the middle of the mealy endosperm.

Distr. Temperate and colder regions of the N. hemisphere, crossing the tropics in Malaysia over the mountains towards Australia and New Zealand. About 15 species have been distinguished, in Malaysia only one sp. occurs.

Ecol. Usually in shallow stagnant or slowly moving fresh water. Flowers anemophilous.


Perennial, erect, glabrous, aquatic herb, 40–80 cm high. Basal leaves distichous, erect, above the wide basal sheathing part more or less contracted (sometimes stalk-like), above the more or less trigonous contraction broadened, narrowly linear

(1) The family consists of one genus only.

Fig. 1. Sparganium simplex Huds., nat. size.
with a tapering rather obtuse apex, smooth-mar-gined, rather thick and hard, in a living state dis-


tinctly keeled below, up to 80 cm long (basal sheath included), \( \frac{3}{4} - \frac{1}{2} \) cm wide, rather densely and finely longitudinally nerved, between the nerves rather closely horizontally cross-veined; higher cauline leaves and bracts linear from a stem-clasp-
ing base. Inflorescence erect, long-stalked, up to 70 cm long (stalk included), not surpassing the leaves. \( \delta \) Flower-clusters (upper part of inflores-
cence) 4–8, bractless or with a small bract, rather close together, many-flowered. Tepals often 3, thin with a thickened midrib, \( \pm 2\frac{1}{4} \) mm long. Stamens 3 or more, greatly exceeding the perianth; filaments very thin, 4–5 mm long; anthers oblong, \( 1\frac{1}{4} - 1\frac{1}{2} \) mm. \( \delta \) Flowers falling off after anthesis, leaving the rachis bare. \( \varphi \) Clusters 2–6, remote, usually inserted far above the axil of the leaf-like, linear, 6–25 cm long bract, very many-flowered, very dense, during anthesis 1–1\( \frac{1}{4} \) cm diam., in fruit up to 2\( \frac{1}{2} \) cm
diam. Tepals 3 or more, spathulate with a subrhomboid apex, strongly 1-nerved, 5–6 mm long, per-
sistent after anthesis. Style (short stigma included) \( \pm 4 \) mm. Fruits densely crowded, squarrose, short-
ly (up to 2 mm) stalked, oblong or ovoid-oblong, 5–6 mm long (including stalk, but not computing the often curved style); endocarp rather thick, usu-
ally 1-celled.

Distr. Covering the area of the genus, in Ma-


laysia very rare: Central Sumatra, New Guinea (Arfak and Tafa Mts).

Ecol. On shores of lakes and streams in shad-


oesty forests, at an altitude of 1500–2400 m, some-
times gregarious.

Vern. Kleine egelskop, D, simple bur-


reed, E.

Note. Rather variable species. The material of
the Arfak Mts in W. New Guinea is sterile (cf.
Hatusima, Tokyo Bot. Mag. 56, 1942, 421) but in
all probability represents this species.
Erect or ascending herbs, annual or perennial, sometimes woody at the base. Leaves alternate, stipulate or not, simple, petioled, serrate or serrate-dentate, biglandular at the base or not, herbaceous. Flowers in the Malaysian species solitary in the leaf-axils or in terminal racemes, actinomorphic, ♀️ homostylos or heterodistylos, ephemerous. Calyx gamophyllous, 5-fid, after anthesis circumsciss at the base; segments imbricate in bud. Petals 5, inserted in the throat of the calyx-tube, contorted in bud, free, shortly clawed or subsessile, deciduous after anthesis. Stamens 5, inserted on calyx-tube, alternating with the petals; filaments filiform-subulate, free; anthers introrse, 2-celled; cells opening longitudinally. Ovary superior, sessile, 1-celled; placentas 3, parietal; ovules 3 to numerous. Styles 3, terminal, free, slender; stigmas penicilliform. Capsule globose or ovoid, loculicidally 3-valved. Seeds numerous, incompletely arillate, with a raised scalariform reticulation; endosperm copious, horny or fleshy; embryo large, straight.

Distr. Tropical America and Africa, represented there by 7 genera and about 80 to 100 species: 2 genera (3 species) naturalized in Malaysia.

Uses. Sometimes cultivated as ornamentals.

KEY TO THE GENERA

1. Flowers (in Malaysia) in terminal racemes. Calyx ebracteolate. Petals shorter than 1½ cm. Throat of the calyx with a fimbriate corona, which passes also over the base of the petals. Leaves without basal glands, densely stellate-hairy beneath.

   1. Piriqueta 1. Flowers solitary in leaf-axils; pedicel adnate to the petiole. Calyx bibracteolate. Petals longer than 1½ cm. Throat of the calyx without a corona. Leaves biglandular at base, not stellately hairy beneath.

   2. Turnera


Erect annual, 30–60 cm high; stem terete, moderately densely clothed with short, fine patent pubescence, moreover with scattered long, very acute, in sicco brownish, tubercole-based bristles. Leaves elliptico-oblong from a rounded or subcordate base, obtuse or acute, dentate-serrate, densely stellately pubescent and thinly bristly on both surfaces, 4–10 cm by 1½–5 cm; petiole 3½–4 cm. Stipules absent. Racemes 10–40 cm, rather lax, leafy only in the basal part. Flowers (in Java) homostylos. Pedicels finely stellately pubescent and patently pilose, during anthesis 1–2 cm long, afterwards 2–4 cm, jointed 3–4 mm below the apex. Calyx thinly stellately hairy, 5-fid over 1½–2½ of its length; segments unequal, ovate, caudately acuminate, acute, with pellucid margins. Petals obovate, with a rounded-truncate, ± crenate top, pale yellow, 3½–5 mm by 2½–3 mm. Filaments ± 2½ mm; anthers ± ¾ mm; their base sagittate. Ovary broadly ovoid, densely appressed pilose; styles ± 1 mm; stigmas as long or slightly shorter, yellow. Capsule smooth,
with an apical hair-tuft. Seeds curved, reticulate-ribbed and distinctly tubercled, brown, glabrous, 1½–2 mm long.  

Distr. Native of Brazil, long ago introduced into the Bogor Botanical Gardens, since long naturalised in the region between Djakarta and Bogor.  

Ecol. Waste places, road-sides, dry fields, 1–250 m, locally not rarely numerous but on the whole rather scarce.  

Note. The Javan plant markedly differs from the description by Urban, i.e., by the much smaller, homostylos flowers and the possession of many long bristles. Yet I cannot reduce it to another species.

2. Turnera


Erect or ascending perennial (or annual) herbs, (shrubs or trees), invested with simple (or stellate) hairs. Leaves often with 2 marginal basal glands, above the base dentate-serrate, distinctly gland-dotted beneath. Flowers solitary in the leaf-axils, heterostylos or homostylos; pedicel adnate to the petiole, with 2 apical bracteoles. Calyx-tube often with thickenings above the insertion-point of the stamens, segments often very acute. Petals on a short hairy claw, obovate, caducous after anthesis. Stamens inserted above base of calyx-tube, margins of the filaments cohering with base of calyx-tube. Ovary globose-ovoid; stigmas multifid. Capsule broadly ovoid, obtuse, verruculose, 3-valved down to near the base; valves with recurved tops. Seeds globose to oblong, often curved, with a raised scalariform reticulation and a unilaterial aril.  

Distr. Upwards of 50 spp. in the warmer regions of the New World from Mexico to Argentina; 2 of these naturalized in other warm countries, both in Malaysia.  

Ecol. Both species possess, in their fat-containing aril, an elaisome, attracting ants; consequently their seeds are dispersed by ants, and both spp. are myrmecochorous (cf. Lock, Ann. R. Bot. Gard. Perad. 2, 1904, 107). In Turnera subulata J.Sch. Cross-fertilisation is a necessary condition for setting fruit (cf. van Welsem, Trop. Natuur 1, 1912, 148; van der Pluij, ibid. 19, 1930, 147; Docters van Leeuwen, ibid. 24, 1935, 1). Many insects have been found visiting the flowers.  

Note. Urban, in his monograph, cf. infra, accepted the two species distinguished here as belonging to one polymorphic specific population. The observed intersterility, the many morphological and physiological differences induce us to accept them as two good species, though we admit that it is possible that in the centre of the native habitat a swarm of intermediate forms may show them to represent extreme forms of one large collective species.

KEY TO THE SPECIES

1. Pedicel throughout its length adnate to the petiole. Bracteoles linear-subulate, l-nerved, entire, without marginal glands. 1½–1⅓ cm by 1–1½ mm. Calyx 1⅓–2 cm high. Flowers heterostylos. Petals at the base dark purple, higher sulphurous, at the broadly rounded apex light yellow, overlapping at the base. Corolla at last widely expanded with a campanulate centre. Ovary without apical tubercles. Fruit 5–7 mm high. Seeds fewer than 20. Often bushy from near the base. T. subulata

1. Pedicel at the apex free over a length of 3–5 mm; the free part obconic. Bracteoles lanceolate, penninerved, serrate, with 2 large marginal glands, 1–3½ cm by 2½–6 mm. Flowers homostylos. Calyx 2–2½ cm high. Petals canary-yellow, self-coloured, with a truncate, ± dentate apex, not overlapping at the base, 2½–2½ cm by 11–13 mm, at last almost expanded flat. Ovary with 6 apical tubercles. Fruit 9–10 mm high. Seeds more than 30. Leaves lanceolate or ovate-lanceolate, acute, 4–15 by 1–3½ cm, rather soon deciduous, leaving on the bare stems a knotty scar; petiole 3½–4 cm. Erect, branched in the apical part, not bushy. T. ulmifolia


Perennial herb, often woody at the base, 30–80 cm high, with a frequently very strong taproot; stems terete, leafy over a considerable length, densely appressed pubescent. Leaves not crowded, ovate-
TuRNERACEAE

very conspicuous when bearing open flowers which are very showy and most fugacious.

Uses. Ornamental. In the Malay Peninsula poultices made from the roots are applied to boils.

Vern. Kembang pukul délapan, M (8 o'clock flower).

Notes. The flowers expand at + 8 a.m. and wither ± 3 hours afterwards or, when the forenoon is very rainy, in the beginning of the afternoon. Cut branches, even when put at once in water, wilt very rapidly.


Perennial herb, often woody at the base, 40–150 cm high, with a frequently strong taproot; stem terete, usually leafy only in the upper part, densely appressed pubescent. Leaves at the tops of the branches often approximate or even crowded, from a cuneate, entire base rather coarsely dentate-serrate, moderately densely and not very distinctly glandular beneath, on both surfaces moderately densely clothed with longish, ± patent or appressed

usually also the erecto-patent lateral nerves distincttly prominent beneath. Petiole with 2 rather large apical lateral glands, appressed hairy, 1/2–1 1/4 cm long. Stipules erect, very minute, long-hairy. Flowers in the higher leaf-axils. Pedicel 1/3–1/2 cm. Bracteoles at the calyx-base, broadest at the base, very acute. Calyx densely appressed pubescent and gland-dotted without, glabrous within except on the pilose base; tube rather abruptly widened in the upper half 1/2–3/4 cm long; segments narrow, very acute, 1–1 1/2 cm long. Petals with a slightly hairy, 3–4 mm long claw, blade obovate, broadly rounded, entire, above the claw glabrous, finally above the base much spreading or subreflexed, 2–3 1/2 cm by 1 1/2–2 1/2 cm. Filaments with broad membranous-margined bases; anthers inserted dorsally a little above their base. Ovary ovoid, densely clothed with appressed white hairs, with 3 glabrous apical depressions (style-scars). Capsule ovoid, obtuse, finely verruculose, hairy, rather thick-walled. Seeds subprismatic, on one end crowned by a semiglobular boss, brownish yellow, 2 2/3 by ± 1/3 mm; aril white.

Distr. Native of tropical America, introduced into Java more than a century ago, probably as an ornamental, since long naturalized in Java in the region between Djakarta and Bogor and in Central Sumatra (Padang).

Ecol. Inhabitant of sunny localities, fields, waste places, railway-embankments, railway-yards, old brick walls, 10–250 m, locally often copious,
white hairs; midrib strongly prominent beneath; petiole with 2 rather large, apical, lateral glands. Stipules erect, triangular, $\pm 1\frac{1}{2}$ mm, long-hairy. 

*Flowers* in the higher leaf-axils. Bracteoles lanceolate, broadest far above the middle, very acute. Calyx densely appressed-pubescent without, not distinctly gland-dotted, glabrous within; tube cylindrical, widened only at the very top, $\frac{1}{2}$–$\frac{3}{4}$ cm long; segments lanceolate, caudately acuminate, up to 2 cm long. Petals with a short, slightly hairy claw; lowermost part of flower not campanulate, blade obovate, $2\frac{1}{4}$–3 cm by 11–15 mm. Ovary ovoid with 6 small apical tubercles and between them 3 minute style-scars, densely white-hairy with a glabrous green top; styles (stigmas included) $\pm 2\frac{1}{2}$ cm. Capsule ovoid, obtuse, rather thick-walled, 3-valved to below the middle; valves recurved in the upper part. Seeds cylindric-clavate, at the narrow end crowned by a semiglobose boss, brown, $2\frac{1}{4}$–$2\frac{1}{2}$ cm by $\frac{5}{6}$–$1\frac{1}{4}$ mm; aril white.

**Distr.** Native of the West Indies, already very long ago, as an ornamental, introduced into other warm countries, also into *Malaysia*, and there naturalized in many regions: Sumatra, Malay Peninsula, Riouw, Java, Madura, Borneo.

**Ecol.** In Java in sunny dry localities, 1–20 m, especially in the coastal regions: grassy fields, waste places, under coconuts, often on sandy soil, light jungles, as a rule in scattered specimens. The statement by van Welsem (Trop. Natuur 1, 1912, 147) that he found the plant in great numbers in W. Java between Padalarang and Tjimahi (700–750 m alt.) was erroneous. Van Welsem saw the plant from a rapidly moving railway-carriage (oral statement of van Welsem); it afterwards proved to be *Argemone mexicana*.

**Uses.** In Java sometimes, but rarely, cultivated as an ornamental.

**Note.** The flowers expand at about 6 in the morning and wither at 11 a.m. Cut branches, when at once put into water, do not wilt rapidly.
BIXACEAE¹ (C. A. BACKER, HEEMSTED)  

1. Bixa

LINNÉ, SP. PL. (1753) 512; GEN. PL. ED. 5 (1754) NO 581.

Small trees or erect shrubs. Leaves spirally arranged, simple, petioled, entire, palmatifid, densely red-dotted. Stipules small, very caducous. Flowers in terminal corymb or panicles, actinomorphic, 0, rather large. Pedicel with 5–6 apical glands. Sepals 4–5, free, imbricate in bud, falling off as soon as the flower expands. Petals 4–7, free, imbricate in bud. Stamens numerous, inserted on an annular hypogynous disk; filaments thin, free; anthers horseshoe-shaped, passing over the top of the filament and with both ends closely applied to it, 2-celled; cells opening in the middle (on the top of the filament) by short slits which unite into a spuriously apical pore. Ovary superior, usually bristly, 1-celled, with 2 opposite parietal slightly intruding placenta. Style 1, sinuous, rather thick; stigma 2-dentate. Ovules very numerous. Capsule compressed contrary to the placenta, usually softly prickly, rarely smooth, loculicidally bivalved; endocarp membranous, separating from the valves. Seeds numerous, obovoid, angular; testa fleshy, very densely studded with small, round, red, sessile glands; albumen well-developed, not oil-containing; embryo rather large.

Distr. Monotypic, native and cultivated in tropical America; cultivated in many other tropical countries.

Ecol., Uses. See beneath under Bixa orellana.

1. Bixa orellana LINNÉ, SP. PL. (1753) 512; BURM. F. FL. IND. (1768) 120; DC. Prod. 1 (1824) 259; BLUME, BIJDR. (1825) 56, 100; BLANCO, FL. FIL. (1837) 456; Ed. 2 (1845) 317; Ed. 3 (1878) 221, T. 231; MOR. SYST. VERZ. (1945/46) 34; CLOIS, ANN. SC. NAT. (1857) 260; MQ. FL. IND. BAT. 1, 2 (1859) 108; HOOK. F. FL. BR. IND. 1 (1872) 190; KING, MAT. FL. MAL. PEN. 1 (1890) 54; GRESH. NAT. T. (1894–1900) 49, T. XIV; KOORD. MINAH. (1898) 344; K. & V. BIJDR. 5 (1900) 32; K. & SCH. & LAUT. FL. DEUT. SCH. GEB. (1901) 451; BECC. NELLE FOR. (1902) 594; BACK. FL. BAT. 1 (1907) 62; SCHOOLF. (1911) 69; KOORD. EKZ. FL. 2 (1912) 624; MERR. FL. MAN. (1912) 333; INTERPR. (1917) 376; SP. BLANC. (1918) 274; EN. BORN. (1921) 410; EN. PHILIP. 3 (1923) 103; RIDL. FL. MAL. PEN. 1 (1922) 252; BACK. & SLOOT. THEEONKR. (1924) 176, T. 176; HEYNE, NATT. PL. (1927) 1132; BURK. DICT. 1 (1935) 330; BACK. BEK. FL. JAVA, EM. ED. 4 (1942) FAM. 82, 1; STEEN. FL. SCH. INDON. (1949) 282.—PIGMENTARIA RUMPH. HERB. AMB. 2 (1741) 79, T. 19.—ROCA SONNERAT, VOY. NOUV. GUIN. (1776) 29, T. 13.—Fig. 1–2.

Shrub or small tree, 2–8 m high; bark dark-brown; tough; young branchlets densely rusty-scyal, glabrescent. Stipules oblong, acute, 6–10 mm long. Leaves herbaceous, ovate from a shallowly cordate, less often truncate base, gradually long-acuminate, at first densely scaly beneath, glabrescent, very densely red-dotted, 71/2–24 by 4–16 cm; 5-nerved; lateral nerves on each side of midrib several, connected by numerous transverse nerves; larger nerves prominent beneath; petiole tere, thickenened at base and apex, at first densely scaly, glabrescent, 41/2–12 cm long. Panicles or corymbs 8–50-flowered; bracts early caducous, 5–10 mm long. Pedicel terete or subcompressed, thick, densely red-squamose, 8–10 mm long, much thickened at the apex and bearing there 5–6 large, sessile, shining glands alternating with the sepals. Flowers 4–6 cm across. Sepals obovate, concaevate, obtuse, purple, densely rusty-scyal, 10–12 mm long. Petals 5–7, unequal, obovate, obtuse or retuse, light red, veined, 2–3 by 1–2 cm, on the back with many oblong dots, deciduous. Disk ± 1 mm high. Filaments at the base yellow with a few dots, at the apex red; anthers violet; ovary subglobose, densely clothed with red-blotched bristles, 21/2–31/2 mm high. Style thickened upwards, 12–15 mm long; stigmatic teeth very short. Ovules red-dotted. Capsule from a subtruncate base either broadly ovate, with a broadly rounded abruptly and shortly acuminate apex (so in most Indonesian specimens) or elongate-ovate with a much narrowed, rather long-acuminate apex, 14–4 cm long, 2–31/2 cm wide, more or less densely clothed with long, filiform thckish, very acute, stiltish but not sharp, in a dry state very brittle bristles, at first red, afterwards greenish, finally brown, opening down to the base by two persistent valves; funiculus rather long with a disciform apex. Seeds 4–5 mm long.

Distr. Frequently cultivated throughout Malaysia but no specimens as yet seen from the Lesser Sunda Islands. I never saw an indisputably wild specimen.

¹ In this Flora Bixaceae are treated as a monogenic family.
Ecol. In Java specially in the W. and Central parts, up to ca 2000 m, in living fences and along road-sides, sometimes on premises, rarely in small plantations.

Uses. Formerly frequently used as a wind-break in tea plantations but as such fallen into disuse because of its liability to be attacked by Helopeltis. The form mostly cultivated in Indonesia is the inferior one with broad-topped shortly acuminate fruit (see above); the much superior variety with elongate-ovoid, long-acuminate fruits has been collected only here and there in Java. Both forms

Fig. 1. Bixa orellana L. Flowering branch and separate fruit.

Fig. 2. Some halved fruit of forms of Bixa orellana L. at Bogor. a–c. white fruits, d–g. red fruits.—a. hairs brown, fruit yellow-green (V. ii. 8), b. hairs and fruit green (V. ii. 6), c. ditto (in hedge of Bot. Gard.), d. hairs red, fruit greenish (V. iii), e. hairs red, fruit green with red apex (V. ii. 2), f. fruit and hairs red (iv. F. 88a), g. fruit green, hairs red (M. iv. 1). Compiled by Eyma; between brackets number in Bot. Gard. Bogor; all × 1/2.

are at present economically unimportant. In the Botanic Gardens and Economic Gardens at Bogor many forms are cultivated with different fruit-shapes, in which the late Dr Eyma could distinguish the forms depicted in fig. 2.

A dye (anatto) is prepared from the outer coat of the seeds. This dye was formerly used for the colouring of fabrics but this use has gone out as the colour is not durable; anatto has since long been superseded by aniline dyes. At present it is still used for the colouring of butter and cheese. The leaves are sometimes used medicinally for treating fever in children.


Vern. Kasumba (with many variants and addi-
tions), M, sometimes with the addition kēling, which points to introduction from the south of Hindustan (Coromandel, Malabar), or, in a broader sense, from overseas, galinggēm, galuga, S, barada (Bugin), satumbal (Sumatra), parada (Cêlebes), djabe bang (Borneo) and some local names. Philippines: Achuēte (general), achi, a(t)suite (Ilk.), acohēte, aseüte, atseuēte (Tag.), achoēte (Tagb.), apatut (Gad.), chhanang, janang (Sul.), chōtes, sotis (Bis.).

Note. The late Dr P. J. Eyma made a survey of forms represented at Bogor, noting the shape of the fruit, its colour, the colour and length of the bristles on it, and the colour of the corolla. He found no less than 18 combinations, some of which have been pictured in fig. 2.
Fig. 1. *Typha angustifolia* L. from Java. $\times \frac{1}{2}.$
TYPHACEAE\(^1\) (C. A. Backer, Heemstede)

1. TYPHA

LINNÉ, Sp. Pl. (1753) 971; Gen. Pl. ed. 5 (1754) no 924.

Perennial, paludal or aquatic herbs with a creeping rhizome; stems erect, solid, submerged at the base. Leaves biseriate, partly radical or subradical, partly cauline, lower congested, higher remote, elongate-linear, rather thick and spongy, blunt-margined; their sheathing bases excreting slime on their inner side. Flowers very numerous, very closely packed in 2 or less often 3, superposed, contiguous or more or less remote terete unisexual spikes; upper spike male; the 1–2 lower ♂; all spikes at the base with a foliaceous bract which falls off long before anthesis; the ♂ spikes here and there between the flowers often with a similar bract. ♂ Flowers consisting of 3 flat hairs together surrounding 2–5 stamens; anthers basifixied, linear, 2-celled; connective shortly produced; cells back to back, bursting longitudinally; pollen-grains free or cohering in tetrads. Rachis of ♂ spathe closely studded with patent cylindrical thickish excrescences; between these excrescences and on their basal part beset with flowers containing a fertile ovary; higher part of the excrescences bearing rudimentary ovaries. ♀ Flowers with or without a very narrow bracteole; bracteole with a more or less broadened, often dentate-acuminate apex either entirely hidden by the flowers or their apex visible externally. Ovary borne by a long very thin stalk (gynophore) which bears long hairs on its base, fusiform, 1-celled; style distinct thin; stigma broadened, unilateral, linear or spathulate. Fruit small, fusiform, or elongate-ovoid, falling off together with its stalk from the ptilose axis of the spike, finally bursting by a longitudinal slit; seed pendulous, striate; endosperm mealy; embryo narrow, straight, nearly as long as the seed.

Distr. Throughout the world between the arctic circle and lat. 35 S, comprising \(\pm 7\) spp., in Malaysia only one very variable species.

Ecol. Marshy places, shallow pools of fresh or brackish water, often gregarious.

Uses. The rhizomes which are rich in starch are eaten in many regions where food is scarce, or in periods of famine. The leaves are used for thatching huts, for thatting and for coarse basket-work. The spikes are often used for decoration; the plump of the ripe ♀ spadices was formerly used for stuffing pillows.

Note. By GEZE, GRAEBN, HALLIER, and others following, various names have been given to Malaysian Typha, mostly based on the shape of the bracteoles in the ♀ spike. In my opinion no specific delimitation can be based on Malaysian specimens on these characters, as they vary and merge. And I have accepted all of them as belonging to one species.


Robust. Stem terete, 1½–3 m high. Leaves linear, tapering in their apical part, rather acute, 8–22 cm by 6–16 mm, very convex beneath, by longitudinal and transverse septa divided into a great number of acriferous compartments; their upper surface cal- naliculate at the base, higher up flat; their base very markedly sheathing. ♂ Spike 15–30 cm long, longer than the ♀ one, separated from it by an interval of 1½–12 cm, very rarely contiguous to it, its rachis very distinctly compressed, tapering in the

\(^1\) This family consists of only one genus.
upper part, without excrescences, densely clothed
with longish, ± woolly hairs, the rachis persistent
till long after the fall of the ♀ flowers but at last
falling off. Stamens 2–3 on a minute common stalk,
intermixed with narrowly linear or narrowly spa-
thulate hairs; the apex of these often broadened,
entire or shortly toothed; anthers linear; connective
shortly produced, rounded; pollen-grains free. ♀
Spike 1 or not very rarely 2 superposed, close
together, cylindrical, oblique or rounded at the
base, rounded at the top, 7–28 cm long, when ripe
2–2½ cm thick, darkbrown, cushion-like; excres-
cences on its axis at best 1 mm long.

Flowers intermixed with very many bracteoles; these very
variable, filiform with a more or less thickened,
entire or often toothed-acuminate, brown or
brownish apex, either exceeding the slightly brown-
tipped hairs of the gynophore and then their apex
visible on the outside of the spike or shorter and
then hardly or not at all visible externally; hairs on
the base of the gynophore rather close-set, white.
Style longish; stigma flattened, lanceolate, acute,
often curved. Fruit with an acute base and broader
obtuse or subtruncate apex.

Distr. Throughout the area of the genus, in
Malaysia: N. Sumatra, Philippines, Java, Kari-
mondjawa Isl., Bawean, Madura, Kangean Arch.,
Timor, New Guinea.

Ecol. Especially at low altitudes in the plains
and there often in slightly brackish water, but
also in mountainous districts, often gregarious,
up to 1725 m.

Uses. See under the genus.

Vern. Ampēt, Md, lēmbang, M, ėmbēt, J, asi-
wung radja mantri, wallīn, wawalingian, S, taktēnas
(Timor), heikrē (Nw. G.). Philippines: Balangōt
(Tag., S.L. Bis., P. Bis.), homai homai (Bis.), kaid-
kēd (Pang.), lampakānai (C. Bis.), tubal-tubal (C.
Bis.), buhai-buhai (P. Bis.), anibung (Bon.), badok-
badok (I lk.), dosi-dosi (I g.), palabog (Buk.), lisdodde,
D, lesser reedmace, E.

Note. On the shape of the bracteoles of the ♀
flowers some varieties or species have been based.
However, these are connected by transitional
forms. The most common form in Java has brac-
teoles of which the much broadened, often dentate
tip is visible externally. It has been distinguished
as Typha javanica SCHNIZL. = T. domingensis
PERS. var. javanica GEZE.
FLAGELLARIACEAE (C. A. Backer, Heemstede)

Erect, ascending, climbing or floating perennials, often robust, stoloniferous or not. Leaves spirally arranged or bifarious, sessile or distinctly stalked, ovate-lanceolate or oblong-lanceolate-linear, with or without a spirally coiled, tendril-like apex; their sheaths embracing the stem, either closed all round or more or less deeply split on the anterior side. Blade closely longitudinally nerved or subpen-nerved; nerves connected by numerous short, often oblique transverse veinlets. Flowers arranged in terminal, sessile or peduncled panicles, sessile, actinomorphic, ♀ or unisexual, rather small. Perianth hypogynous, calycine or corolline. Tepals 6, 2-seriately imbricate, free or shortly connate, persistent. Stamens in ♀ and ♂ 6, free; anthers basifixed, 2-celled; cells bursting by an introrse longitudinal slit. Ovary in ♀ and ♂ superior, sessile, 3-celled; cells with a solitary ovule in the inner angle; stigmas 3 or one deeply 3-lobed stigma, sessile. Fruit drupaceous, indehiscent. Seeds or kernels 1–3; albumen copious; embryo small.

Distr. Genera 3, in the tropics of the Old World, all of them in Malaysia.

Ecol. Inhabitants of damp forests, thickets, morasses and slowly moving parts of rivers.

Uses. Unimportant. Stems used for basket-work; stems and runners sometimes eaten raw; leaves and roots occasionally used for medicinal purposes.

KEY TO THE GENERA

1. Flowers bisexual. Leaves sessile or very shortly stalked. Terrestrial, not stoloniferous.

2. Erect. Stem fistular. Leaves very distinctly longitudinally plicate, apex not tendril-like, base acute. Perianth calycine

1. Joinvillea

2. Climbing. Stem solid. Leaves not plicate, tips (except the very lowest) tendril-like, base rounded or subcordate, abruptly contracted into a very short petiole. Perianth corolline, white

2. Flagellaria

1. Flowers unisexual, ♀ with a small rudimentary ovary crowned by 3 short stigmas; ♂ with 6 antherous small staminodes and a well-developed ovary with a sessile, depressed, deeply 3-lobed stigma. Stem solid. Lower leaves on rather long petioles, sprouting from a cleft basal sheath. Aquatic or terrestrial, at a somewhat advanced age stoloniferous

3. Hanguana

1. JOINVILLEA


Robust, reed-like herbs. Stem enclosed to up or near the panicle by closed leaf-sheaths. Leaves spread, lanceolate or linear from a tapering base, herbaceous but hard and stiffish; the transverse veinlets rather distant. Panicle broad, rather lax, pubescent. Flowers solitary, distant, small, ♀. Bracts minute, deciduous. Perianth small, calycine. Tepals of about equal length, the outer ovate, acute, inner oblong, obtuse or rounded. Stamens 6 (occasionally 1 aborted?); anthers with a bifid base. Ovary conic; style none or very short; stigmas 3, linear, rather long. Drupe broadly ovoid-globose; exocarp thin, succulent; endocarp bony, 2–3-seeded. Seeds globose or ovoid, testa membranous.

Distr. Species 3, closely allied, one in West Malaysia, extending from Sumatra across the Malay Peninsula and N. Borneo to Palawan (Philippines), the others far remote in the New Hebrides, N. Caledonia, Fiji, Samoa, and Hawaii.

Ecol. Plants of light forest on a non-swampy soil.


Often several-stemmed, 1½–4½ m tall. Stems suberetere, hard, glabrous, reedlike. Leaves sub-sessile, tapering to a long point, usually along the margins and on both surfaces rough by the presence of numerous rather distant very short, stiff
2. FLAGELLARIA

LINNÉ, Sp. Pl. (1753) 333; Gen. Pl. ed. 5 (1754) no 450.

Robust, climbing, entirely glabrous herbs with terete, solid, hard stems. Leaves bifarious, subsessile, tapering towards the top and there, barring the very lowest, ending in a dorsally flattened, hard tendril, which is coiled in the shape of a watch-spring and thickens after having grasped a support, firmly herbaceous, densely longitudinally nervied, with numerous rather faint, short, oblique cross-nervules, not plicate. Leaf-sheaths tubular, in the Malaysian species closed up to the very apex. Panicles most variable as to size. Flowers ♦. Sepals free, coloured, membranous, 3 inner larger, persistent. Filaments filiform, at last exserted; anthers linear or linear-oblong, inserted with a bifid base. Ovary narrow, obtusely triangular; style very short; stigmas rather long, linear-clavate, at last exserted. Drupe subglobose; exocarp succulent, thin; endocarp bony, 1- or rarely 2-seeded. Seeds globose or, by mutual pressure, more or less flattened; testa crustaceous.

Distr. Species 4, one widely spread from tropical Africa, through tropical Asia, and Malaysia, to Polynesia and N. Australia, the 2nd in N. Caledonia, the third confined to the Samoa and Fiji Islands and the Bismarck Arch., and a fourth undescribed species of colossal dimensions in San Cristo Island (Solomon Is., L. J. BRASS 2835).

Ecot. Plants of humid but not constantly swampy forests.

Note. To make out whether the tropical African species is a variety of F. indica, as sometimes assumed, falls beyond the scope of the present revision.

KEY TO THE SPECIES

1. Panicle with long, erect, lower main branches and erect secondary branches, fastigate in habit, peduncled, 30-50 cm long. Flowers inserted at distinct intervals. Drupes 12 mm long, endocarp sulcate, pyrenes 8 mm long .......................... 2. F. gigantea

Perennial climber, 2–15 m long, rarely longer. Stem in the basal part often more or less woody, higher up herbaceous but hard. Leaves bifarious, ovate to lanceolate or linear, base rounded or slightly cordate, abruptly contracted into a dorsally flattened petiole 3–10 mm long, firmly herbaceous, most variable as to size, 3–50 by 1/2–6'/2 cm; sheath terete, 1–7 cm long, sub truncate, faintly herbaceous, on both sides of the petiole with a very narrow thinner apical rimlike auricle, longitudinally ribbed; ribs at the top converging into the petiole. Panicle erect, mostly forked and consisting of 2 main branches, widely branched (often from the very base), 3–30 cm long, bearing on its short ultimate branchlets the sessile flowers in very short, dense spikes. Flowers solitary, subtended by a short, broad, bract, white, odorous. Tepals erect, oval, rounded, thinly membranous, 2–2'/4 mm long, stamens and
stigmas at last far exserted. Ovary narrow; stigmas erecto-patent. Drupe subglobose, smooth, pink, ± 6 mm diam., mostly with a single fertile 1-seeded cell and 2 minute empty ones, rarely with 2 fertile and 1 empty cell.


Ec. Moist (not swampy) forests from the sea-coast up to 1500 m, frequent in forest-borders along the inner margin of the mangrove. Fl. fr. Jan.–Dec.

Uses. Stems sometimes used for basket-work as a rather poor substitute for rotan (rattan). Young stems and leaves used for making hair-wash. Various medicinal applications are recorded.

Vern. Very many local names of which may be mentioned: lampion, S, owar, S, Md, kokrok, wowo, wuludan, J, rotan (with diverse additions such as dapt, dini, kroh, laki, lanang, manchik, marouw, and several others in Malay-speaking regions), rotaung da ursa (Sum. E.C.), owal’at’ (Talaulud), riuna (Morotai), paikut laki (Duyuk), mugung (Finschhafen), monggun (Konstantinhausen). Philippines: Amud, ti-gual, u-ti-unk (Ib.), arayan, tingula (Tag.), bolung-ndi (Tag., Pamp.), au-di (Ig.), au-di-si-gayang, venagaayang (Is.), booboaya, ouag-oudig (Mbo.), hoad-nai, ouag-oudi (Bik.), houd (S. L. Bis., Mbo.), (h)uak (Bis.), indi (Pang.), kala-nai, kala-nuinau, tinayang (Ibn.), pawa, sagakap, tanau (P. Bis.), nág (Sul., Bis., Bag., Bik.).

Note. A small-leaved form has been described as Fl. minor BL., a large-leaved one as Fl. philippinensis ELM. Between these and the normal forms all intergrades occur: they can not even claim varietal rank.

Sterile specimens show a faint resemblance with Gloriosa superba L., which has subimilar leaves, but may be at once recognized by the not-bifarious sheathless leaves.

Fl. neocaldonica SCHLTR. is different by its size, dorsally keeled sheaths, a cordate leaf-base, &c.


Distr. Fiji, Samoa, and the Bismarck Arch. (New Ireland), might occur also in New Guinea. Certainly distinct from the preceding species, in which also coarse specimens and broad cordate-based leaves occur. Reinecke 264 from Samoa exactly matches the original description.

3. HANGUANA

Blume, En. Pl. Java (1827) 15.—Susun BL. in SCHULT. Syst. 7 (1830) xcv, 1493.—Veratronia Miq. Fl. Ind. Bat. 3 (1859) 553.

Ascending herb, often robust, at a somewhat advanced age stoloniferous. Stem terete, solid. Stolons creeping or floating, often long, enveloped by appressed sheaths which finally dissolve into fibres. Leaves for the greater part crowded at the base of the plant, erecto-patent, lanceolate from an acute, often decurrent base, rather thick, densely longitudinally nerved, with numerous close-set thin cross-nervules, between the longitudinal nerves very densely and finely longitudinally striate, not plicate; lower leaves long-petioled; higher leaves much more remote, smaller, on shorter petioles; topmost ones sessile or subsessile with a broad base, small, passing into the primary bracts. Lower leaf-sheaths long and broad, stem-clasping, deeply split on the anterior side, gradually narrowed into the petiole. Panicles peduncled, 1–3 times patently branched; primary branches 1 to several in the axils of rather large bracts, usually branched again; ultimate branches spiciform. Flowers more or less distant, either solitary or in small clusters, sessile with a broad base in the axil of a short, broad bract, (♂) (♀). Sepals shortly connate at the base, green or yellowish or the inner dotted with red; 3 outer short; 3 inner considerably longer, vaulted.—♂: Branches of panicle usually thinner and longer than those of ♀, often with a greater number of flowers. Stamens 6, on the base of the perianth, about as long as the inner tepals; filaments filiform from a broader base; anthers small, inserted in a basal cleft. Ovary rudimentary, small; stigmas 3, erect or erecto-patent, shortly clavate.—♀: Staminodes 6, inserted on the base of the perianth, anantherous; those opposite the outer sepals very minute, narrowly triangular; 3 others much longer and broader, rounded, dorsally compressed. Ovary broadly ovoid-globose; stigma sessile, deeply divided into 3 spreading broadish short arms. Fruit drupaceous; exocarp thick, fleshy; endocarp thin-walled, 3-celled, 1–3-seeded.
Dec. 1951]  

**Flagellariaceae** (Backer)  

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Distr. Monotypic, tropical SE. Asia to Malaysia, and Micronesia (Palau).  

Note. The fruit is not baccate, as is often mentioned in literature. Dr. G. Erdtman, Stockholm, finds the pollen much resembling that of some Liliaceae. Kurz, l.c., also stresses this affinity.

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**Fig. 2. Hanguana malayana (Jack) Merr.** Colony in Rawa Tembaga, E of Djakarta.


Perennial herb, very variable as to the dimensions of all its parts (except those of the flowers), either aquatic (in morasses and slowly moving water) or terrestrial (in humid forests). Stem ascending, above the lower rooting or floating part rigidly erect, 1/2–2 m high (panicle included), at a somewhat advanced age emitting from the basal part one or more creeping or floating densely sheathed, often long runners which at their apex develop into a new plant behaving in the same way, especially those of the often very robust aquatic form, which frequently generate large, dense, nearly impenetrable masses, parts of which frequently separate, by a rise of the water, from the motherplant and form floating islands. The terrestrial form, as a rule, much less robust and forming fewer, shorter, feebler runners, not generating dense masses. Both forms, when young, usually more or less densely crispy hairy, afterwards glabrescent. Leaves stiff, 20–120 by 11/2–15 cm. Panicle (disregarding peduncle) 10–120 cm long, 1–3 times branched. Outer tepals 2–21/2 mm long, inner 21/2–3 mm. Drupe oblong, much surpassing the perianth, up to 2 cm long, shining red.

Distr. Ceylon, Indochina, Micronesia (Palau), in Malaysia: as yet not collected in the Lesser Sunda Islands and the Moluccas.
Ecol. From the plains up to ± 1500 m, in morasses, along lake-shores and rivers, in slowly moving fresh water and in humid forests. See description of the species above. In the *Hanguana*-morasses this plant frequently suppresses all other species with the exception of a few orchids (*e.g.* *Vanda hookeriana* Rchb. *f.* which seems to have a predilection for such localities) and is able to form floating islands in lakes. The floating capacity is due to the air in the numerous air-vessels in the plant; a fresh rhizome 50 cm long, 10 cm diam. weighed hardly 1½ kg (van den Ende, *l.c.*).

Uses. Blume in *Roem. & Schult. l.c.* p. 1494 states that the roots of the aquatic form (*anthelmintica*; see beneath) are used in Java by veterinary surgeons as a vermifuge. This statement has not been confirmed by any subsequent author. In New Guinea the stems and runners of this form are said to be eaten raw by the Papuans.


Note. The aquatic form has been described as *Susum anthelminticum* Bl. = *S. malayanum* Planch. *f.* *aquatica* Back. = *Hanguana malayana* Merr. *subsp. anthelmintica* Bakh. *f.* The terrestrial form was described as *Hanguana kassintu* Bl. = *Susum malayanum* Planch. *f.* *sylvatica* Back. = *Hanguana malayana* Merr. *subsp. kassintu* Bakh. *f.* Though the typical aquatic and terrestrial forms look very different, the differences are, as a matter of fact, of very slight taxonomic value. The 2 forms differ mainly by their size and are connected by a series of intermediates; they can lay no claim to the rank of species or subspecies, not even to that of varieties, and are simply edaphic forms comparable to those of *Polygonum amphibium* in Europe.

Van den Ende, *l.c.*, maintains to have found all flowers ♀ in S. Sumatra, but I surmise he mistook the staminodes for stamens. At Bogor Bot. Gardens, and in the Rawa Lakbok, Central Java, I never found fruit in ♀ specimens.

The first who identified *Veratrotia* with *Susum* was Kurz (1873) followed by Beccari (*Bull. Soc. Tosc. Ortic.* 8, 1884, 70, *cum tab.*).
CALLITRICHACEAE (C. A. Backer, Heemstede)

1. CALLITRICHE


Delicate, annual or perennial herbs, aquatic and then either entirely submerged, or floating in the upper part, or, in humid localities, not rarely terrestrial and creeping, with slender stems. *Leaves* opposite. At the summits of floating stems often spuriously rosulate, extispulate, small, linear, elliptic, oblong or spatulate, entire, herbaceous, in the *Mal. sp.* triplenuermed. *Flowers* minute, unisexual, axillary, solitary or rarely one ♂ and one ♀ flower from the same axil, often with 2 caducous, transversal, opposite, tender concave bracts. Calyx and corolla absent. ♂: Stamen 1; filament thin, anther 2-celled, cells bursting lengthwise, the slits becoming confluent at the top. ♀: Ovary sessile or subsessile, 4-lobed, 4-celled. Ovule solitary in each cell, pendulous from the top of the cavity. Styles 2, free, often long, papilllose. *Fruit* 4-lobed, with longitudinally margined or winged lobes. Testa membranous; endosperm fleshy; embryo terete, straight.

**Distr.** Only genus in the family, worldwide distributed, not yet known from S. Africa and in various regions scarce, in *Malaysia* apparently very rare, the only record proving its being indigenous is from the New Guinean highlands. Because of their small size terrestrial forms are easily overlooked.

**Ecol.** Stagnant or slowly moving fresh water, or, in humid localities, terrestrial, often gregarious.

**Notes.** The number of recognized species greatly depends on personal conception of specific delimitation, and so varies from few to ± 25. The difficulties are partly due to the inconstancy of the vegetative characters under various ecological conditions. Submerged leaves of several species are narrowly linear with a notched apex as figured in Hegn, Ill. Fl. Mitt.-Eur. 5, 1 (1925) f. 1804, as *C. verna*.

**Nomencl.** The nomenclature of the species is, if formal typification is applied, very much confused, according to Hylander (Uppsala Univ. Årskr. 1945, no 7, p. 235–236). As Samuelsson has shown (Veröff. Geobot. Inst. Rübel 3, 1925, 603–628, fig. 1), the earliest Linnaean species *C. palustris* embraces 5 species. Linné himself split it into two others, one of which is, of course superfluous, and both of which also include more than one species. Following Samuelsson, the best, at least the most practical, solution is to reject these earlier Linnaean names as *nomina ambigua*, and accept the species as defined or emended by Lönnroth in his Uppsala thesis of 1854, as has been done by most subsequent authors.

**Syst.** There is no unanimity about the systematical position of the genus which is placed in the Geraniaceae by Engler, and in the Lythraceae by Hutchinson. C. A. Jörgensen (Jahrb. Wiss. Bot. 64, 1925, 440–442) is of opinion that it represents a reduced sympetal type.


**SAMUELSSON** i.e., points attention to the extremely high vegetative polymorphism of this species, due to habitat. There seems to be no necessity to name all these forms.

The Malaysian materials belong to 3 forms, a terrestrial, an aquatic partly emersed, and an aquatic entirely submersed form. The first and the third form differ much in aspect.

**Terrestrial form.**—Fig. 1.

Minute delicate creeping herb rooting at the base, stem thin, branched, 1–2½ cm long, rather densely leafy. Roots solitary from the lower nodes, thin, rather long. *Leaves* opposite, not pseudo-rosulate, elliptic-oblong-spataulate from a mostly cuneate or contracted, less often obtuse base, rounded at the apex, 1½–1½ mm by ½–1½ mm; petioles either passing gradually into the blade (spatulate leaves) or distinctly set off (elliptic leaves), at best ½ mm long. *Flowers* in very many leaf-axils, sometimes in one axil only of a pair, mostly however in both axils and then either both of them ♀ or one ♀, the other male (pseudo-male?), subsessile; bracts not found. ♂: Filament erect, thin, at best ½ mm long; anther minute, yellow; cells bursting, but apparently effete; connective slightly produced between the cells. ♀: *Fruit* much compressed, broadly obovate or subcuneate, distinctly notched, ½ mm by ½ mm; fruit-lobes rounded at the apex, very narrowly double-winged on the back; wings broadest at the apex (½ mm), very thin, pair-wise approximate and parallel; the pairs opposite. Styles spreading, very short, at best ½ mm, finally deciduous; pericarp translucent. Seeds obliquely ovoid-oblong, rather thick, brown,

finely reticulate-ribbed, fully $3/4$ mm long, $1/3$ mm broad.

**Distr.** *C. verna*, taken in a strict sense, occurs in N. and S. America, throughout Europe, S. Africa, temperate regions of Asia, S. Queensland, in **Malaysia**: Java.

![Fig. 1. Callitriche verna L. a. Tip of a stem, b-f. ripe fruit (b-c. lateral, d. seen on top, e-f. detached segments). All enlarged (after material from Tjibodas).](image)

The above described terrestrial form in **Malaysia** was thus far collected only in the Mountain Garden Tjibodas (W. Java, alt. ± 1450 m); there possibly rather recently introduced but thriving very well and spontaneously reproducing. May be expected to spread outside of the garden.

**Ecol.** Humid, stony localities, there mixed with other small moisture-loving plants.

**Note.** Found in Java for the first time in 1950 by Dr S. J. van Ooststroom & Mr J. H. Kern; then already numerous but very local, easily escaping observation. The Java form seems to be closely related to *f. caespitosa* Schultz (see Hegi, l.c., 201, f. 1808), which mainly differs by its much larger dimensions. Though the stamens and the styles of the Javan plant seem to be abortive, ripe fruits are abundantly produced.

**Aquatic, partly emersed form.**

Much larger than the above described terrestrial form, 10 cm or more long, very much branched, forming dense masses. **Leaves** spatulate, ± 10 by ± 3 mm (including the long petiole), rounded at the apex, with many sessile, patent, circular shallowly lobed hairs, resembling dots. Stamen of $\phi$ 4–5 mm; ovary of $\phi$ as in the above described terrestrial form, but styles much longer (up to 4–5 mm); **fruit** as in the terrestrial form.

**Distr.** In **Malaysia**: NE. New Guinea (Morobe District), 2700 m (M. S. Clemens 5733, 41125).

**Entirely submersed aquatic form** (*C. papuana Merr. & Perry, l.c.*).

**Leaves** very narrowly linear with a subcircular apical incision, 1-nerved, up to 15 mm by $1/3$–$1/2$ mm. **Flowers** unknown. **Flowers** very shortly pedicelled. Styles divergent, $11/2$–2 mm long. Almost ripe **fruit** ± $11/2$ mm long, ellipsoid-obovoid, slightly longer than broad, slightly notched at the apex, compressed but rather thick; wings along the narrower sides of the fruit, pairwise approximate, parallel, very narrow; seeds oblong.

**Distr.** In **Malaysia**: Central New Guinea (Brass 9541).

**Ecol.** Rooting in shallows of Lake Habbema, 3225 m.

**Note.** Notwithstanding the different aspect of the plant the fruits of this submerged form agree fully with those of *C. verna* barring the slightly larger dimensions of the former.

**Excluded**

**Callitriche** sp. mentioned by **Kurz** (Nat. Tijd. N.I. 27, 1864, 167) from clear streams in the Menumbing Hills, Banka Island. seems very doubtful, firstly because Kurz’s material was sterile and has not been traced in the herbarium, and secondly because all specimens of **Callitriche** hitherto found in the Malaysian tropics occur at much higher altitudes.
VALERIANACEAE (C. A. Backer, Heemstede)

1. VALERIANA

LINNÉ, Sp.Pl. (1753) 31; Gen. Pl. ed. 5 (1754) no 43.

Perennial herbs, with a short, often strong-smelling rootstock. Lowest leaves in a basal rosette, higher ones decussate, simple, odd-pinnate or deeply pinnatifid, exstipulate but those of one pair often connected by a raised line, radical ones often long-petioled. Flowers small, ♀ or unisexual, bracteate, sessile, cymose; cymes united into an often large, terminal panicle or corymb. Bracts small, opposite, persistent, oblong or linear, on the ultimate branchlets of the inflorescence only one bract of each pair flower-bearing. Calyx small, persistent; limb during anthesis short, inrolled, deeply divided into 10 or more segments, these in fruit unrolling, much accrescent, finally widely patent, plumose, pappus-like. Corolla gamopetalous, caducous after anthesis, small; tube funnel-shaped, much widened above the very short, narrow basal part, unequalsided; lobes 5, patent, oblanceolate or linear, imbricate in bud. Stamens 3, inserted about halfway down on the corolla-tube, alternating with the lobes, exserted or not; filaments thin; anthers small, versatile, 2-celled, oval-suborbicular, or sub-biglobose, cells opening lengthwise. Ovary inferior, 3-celled, only one cell perfect, 1-ovuled, the two others barren or imperfect; ovule pendulous. Style thin, filiform, shortly 3-lobed or subentire, glabrous, exserted or not. Fruit small, dry, indehiscent, 1-seeded, ovate-oblong, much compressed, with 3 dorsal, 1 ventral, and 2 marginal ribs, 1-celled, the two barren or imperfect cells either enlarged or reduced to narrow ridges. Seed pendulous; albumen absent or scanty.

Distr. Very many spp. centering in Andine Chile, the others nearly all on the N. hemisphere,
scarcely in the mountainous districts of the tropics, absent from Australia, in *Malaysia* only known from Central Sumatra and Java.

Ecol. Open or slightly shaded, moderately moist localities in the mountains.

Use. Shortly after the outbreak of the second World War H. A. C. Boelman & U. G. Bijlsma in Java showed the tincture of *Valeriana hardwickii* to be equivalent in pharmaceutical properties to *radix valeriana officinalis* (cf. Natuurwet. Tijd. N.I. 101, 1941, 194-199), and to furnish a valuable substitute.


- **Kentranthus ruber** (L.) DC., a native of Europe, is sometimes cultivated for ornamental purposes in the gardens of Java.

**Exclusively cultivated**

According to Bakhuizen van den Brink Jr (in Backer, Bekn. Fl. Java em. ed. 8, 1949, fam. 176, p. 2) *Kentranthus ruber* (L.) DC., a native of Europe, is sometimes cultivated for ornamental purposes in the gardens of Java.

**Excluded**

*Triplostegia* will be treated in this Flora under the *Dipsacaceae*, cf. p. 290.
PONTEDERIACEAE (C. A. Backer, Heemstede)

Halophobous, aquatic or palustrial perennial herbs, rooting in the mud or free-floating. Stem erect or floating, solid, with numerous air-chambers as are the petioles. Leaves rosulate or alternate, or solitary at the top of the stem, emersed, floating or submerged, broad or narrow, curvinerved (when emersed); petioles sheathing at the base. Flowers ♀, ephemeral, mostly in racemiform, spiciform, subumbelliform or paniculiform inflorescences which are subtended by 1–2 spathe-like or tubular leaf-sheaths, rarely solitary or pairwise in the leaf-axils. Bracts minute or absent. Flowers often simultaneously or centrifugally expanding. Perianth choriphyllous or gamophyllous, 6-merous, actinomorphic or zygomorphic, blue or lilac, rarely yellow, after anthesis marcescent and tightly including the ovary or the fruit. Stamens 6 or 3, rarely 1, on the base, in the tube or in the throat of the perianth, often unequal; filaments free; anthers 2-celled, cells bursting lengthwise, rarely opening by pores. Ovary superior, sessile, 3-celled, with axile placentas or 1-celled with 3 parietal or with 1 apical placenta. Ovules numerous or 1 and then pendulous from the apex of the cell. Style 1; stigma entire or minutely 3-lobed. Fruit a 3-valved capsule or indehiscent. Seed(s) longitudinally ribbed. Embryo central, terete, straight, hardly shorter than the copious, mealy endosperm.

Dist. About 8 small genera and ± 25 species, 6 genera confined to the New World, one in Madagascar, one widely distributed in the Old World; in Malaysia one native genus, one introduced and abundantly naturalized, and one occasionally cultivated as an ornamental.

Ecol. Inhabitants of fresh water.

Uses. Frequently used as potherbs.


Note. As in many other waterplants the vegetative characters show a rather wide range of variability.

KEY TO THE GENERA

1. Flowers distinctly pedicelled. Perianth actinomorphic, almost choriphyllous. Posterior tepal not with a discolorous blotch. Stamens 6; one mostly longer than the others. Filaments glabrous.

1. Monochoria

2. Flowers sessile. Perianth strongly zygomorphic, very distinctly gamophyllous, posterior segment with a discolorous blotch. Stamens 3 or 6, and then 3 much larger than the others. Filaments, at least those of the longer stamens, hairy.

2. Monochoria

2. Tepals 1½ cm long or longer. Stamens 6; anthers dorsifixed. Inflorescences often with more than 10 flowers. Cultivated and often wild

2. Eichhornia

2. Tepals shorter than 1 cm. Stamens 3; anthers basifixed. Inflorescences 2–7-flowered. Exclusively cultivated; not further treated here

3. Heteranthera (reniformis R. & P.)

1. MONOCHORIA

Presl, Rel. Haenk. 1 (1830) 127.—Gomphima RAFIN. Fl. Tell. 2 (1836) 10.

Glabrous, palustrial herbs. perennial or under unfavourable circumstances pseudo-anual, with long petioled radical leaves, and erect or obliquely erect stems arising from a suberect or creeping root-stock; each stem bearing at its top a single acute, densely curvinerved leaf, the petiole of which forms a prolongation of the stem. Flowers in terminal solitary, sub sessile or shortly stalked, centrifugal, short or shortish, racemiform or subumbelliform inflorescences, which at first are hidden within the broad sheath of the cauline leaf, then burst forth, next bend forwards and after anthesis finally become quite deflexed. Inflorescence at the base, opposite the sheath of the floral leaf, with a large bract. Tepals 6, lilac blue with a green median nerve, free almost to the very base, spreading during anthesis, afterwards spirally contorted; 3 inner broader; median nerve of tepals thickened after anthesis.
Stamens 6 on the base of the perianth, subequal, or unequal: 5 with smaller yellow anthers, the sixth with a longer filament mostly provided with a lateral, obliquely erect tooth, its anther mostly larger, blue. All anthers basified, opening by a porelike slit. Ovary 3-celled, cells ~-ovuled. Style filiform, stigma subtended by minutely 3-lobed. Ripe capsule exploding loculicidally into 3 valves which are torn from the pedicel and are flung away together with the many longitudinally ribbed seeds.

Distr. Three spp. in the Old World, from NE. Africa to Manchuria southward to S. Australia (vide infra), two of which in Malaysia.

Ecol. The Malaysian species are decidedly halophobous. They inhabit freshwater pools, ditches, canal-banks, and flooded paddy-fields.

Uses. All parts, barring the roots, frequently eaten as a vegetable.

Notes. Neither the spp. nor the sections distinguished by O. Schwartz (cf. E. & P. ed. 2, 15a, 1930, 186) agree with my views. In both M. hastata and M. vaginalis the inflorescence is a pseudo-raceme, which is, specially in M. hastata, distinctly abbreviated, but occasionally provided with a manifest main axis. On the other hand M. cyanea distinctly differs from the two other spp. (except M. hastata var. elata) by distinctly spaced flowers, by equal anthers, and inapplicable filaments. Therefore, I propose to divide the genus into two sections, sect. Eumonochoria O. Schwartz (incl. sect. Deutomonochoria O. Schwartz) and sect. Limnostachys (F.V.M., pro gen.) Backer, stat. nov.

**Key to the species**

1. Anthers equal. Filaments not provided with an obliquely erect tooth or appendage. 3. M. cyanea

1. Anthers unequal, one much larger than the others, its filament provided with a tooth or appendage.

2. Tillering, with a suberect or oblong, usually very short, rarely longish rootstock; old plants often forming dense tufts, but these tufts free from each other. Leaves of adult plants varying from broadly ovate to ovate-oblong from an obtuse, rounded, truncate or cordate but never sagittate or hastate base, up to 12-1/2 cm long, often much smaller; basal lobes, if present, broadly rounded. Racemes 3-25-flowered. Flowers dark blue, mostly simultaneously expanded or nearly so. Pedicels 4-25 mm, rarely up to 40 mm. Perianth 11-15 mm long. Plant 5-50 cm high

1. **M. vaginalis**

2. Rootstock of older plants well-developed, creeping, branched, so that these plants at last form large groups, the components of which are, or have been, subterraneously connected. Leaves of adult plants triangular-ovate, nearly always with a sagittate or hastate, very rarely with a cordate base, 7-25 cm by 4-20 cm; basal lobes divergent, mostly with an acuminate or narrowed apex. Racemes 15-60-flowered. Flowers pale blue, succeeded in groups, so that the flowering is extended over a few days. Pedicels of the lower flowers 15-30 mm, of the higher 7-20 mm. Perianth 15-18 mm long. Plant 30-100 cm high, generally much more robust than the preceding species.

2. **M. hastata**

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Stems erect or obliquely erect. Leaves extremely variable as to shape and size, when adult mostly 2-12½ cm by ½-10 cm, in very young specimens entirely submerged without a distinct blade; leaf-top acuminate, very acute. Petioles broadly sheathing at the base, very variable as to length. Inflorescences soon deflexed, rather short, sometimes subumbelliform. Flowers of few-flowered inflorescences often unfolding simultaneously and all withering in the afternoon of the same day, of the many-flowered racemes opening centrifugally in
Fig. 1. Monochoria hastata (L.) Solms. Courtesy Pasuruan Exp. Station.
groups, so that the florescence extends over a few days. Perianth lilac blue. Capsule ellipsoid, ± 1 cm long. Seeds oblong, ± 5/6 mm long, brown with ± 10 longitudinal, very thin ribs, between the ribs densely and very finely transversely striate.

Distr. SE. Asia to China, Japan and throughout Malaysia.

Ecol. From the plains up to ± 1550 m, as well in periodically very dry as in constantly humid regions, in swampy or inundated localities, along ditches, in shallow pools and especially in flooded paddy-fields, where the plant is often one of the commonest weeds, and, after the drying-out of the field, completely dies off, developing anew from seeds in the following inundation-period. In constantly swampy localities it can reach a higher age and attain rather large dimensions, though it never becomes so robust as well-developed specimens of the following species.

Uses. The entire plant, barring the roots, furnishes an excellent vegetable. The juice of the leaves and the roots is used for medicinal purposes.

Vern. Very many local names, the principal ones of which are: Bengkok, wêwêhian, J. biâh biâh, S. bira birâdin, Md. étêjêng (with various additions) M, S. Philippines: Bigagigasan, gagîn-ukd, kalâbia (Tag.), gabi-gâbi (Bis.), kahalâng, hakâkâlîng (If.), bit-lagat, lapalâpa (Ilk.), sakslâng (Ig.), saksakong (Bon.), laugîng, upî-ûpi (Bik.). Mal. Pen.: Kêlayar.

Note. Specimens with few-flowered inflorescences and small, often narrow, proportionally long leaves have wrongly been described as varieties or even separate species with one of the epithets linearis, ponciflora or plantaginea. They are either young or feeble, or were collected in deepish water.

See further the note under the following species.

The East Asiatic M. korakowii REGEL and the NE. African M. africana (SOLMS) N.E.BR. are in my opinion racial varieties of M. vaginalis (Burm. f.) PR.


At an advanced age robust herb with erect or obliquely erect stems, up to 125 cm high; rhizome often long and strong, clothed with the remains of old sheaths. Petiole of radical leaves up to 60 cm long, of the floral leaves much shorter, its sheathing base much broadened. Inflorescences erect or suberect, at last horizontal or ± deflexed, shortly stalked, dense. Pedicels erect or obliquely erect. Perianth somewhat lighter blue coloured than that of the preceding species. Filaments white. Top of the style densely patently short-hairy. Capsule ellipsoid, ± 1 cm long. Seeds oblong, ± 5/6 mm long, brown, with ± 10 very thin longitudinal ribs, between the ribs densely and very finely transversely striate.

Distr. Tropical SE. Asia and throughout Moutgaysia, not yet recorded from the Moluccas & Lesser Sunda Islands.

Ecol. From the plains up to ± 700 m, in and along freshwater pools, on canal banks, on mud-flats in rivers, along irrigation-ditches, sometimes in paddy-fields though there much less frequent than the preceding species, locally often numerous, but, on the whole, much less common than the preceding species.

Uses. Almost all parts of the plant, barring the roots, furnish a relished dish.


Note. Herbarium specimens when not collected with the rhizome are difficult to distinguish from M. vaginalis, in the few cases they possess broadly rounded basal leaf-lobes instead of the typical acuminate or narrowed ones. Such specimens might be of hybrid origin.

var. elata (RIDL.) BACKER, stat. nov.—Monochoria elata RIDL. J. STR. BR. R. AS. SOC. no 79 (1918) 99; FL. MAL. PEN. 4 (1924) 345; HOLTTUM, M.A.H.A. Mag. 5 (1935) 164, eum icon.

Robust, ca 1½ m tall. Leaf-blades reduced, narrow lanceolate-hastate. Inflorescence elongated, to 12 cm. Anthers 5 mm long, the 6th 8 mm long. Distr. Lower Siam, in Malaysia: Malay Peninsula (Kedah).

Ecol. In rice-fields, fl. Nov. Flowers close at 14.30 hours; the inflorescence lasts several days; flowers pale blue as in var. hastata. Recommended for ornamental purpose in shallow water.

Note. A distinct variety, not differing specifically from M. hastata, apparently of local distribution. The anthers in var. hastata measure mostly 3 mm, the 6th 5 mm.

3. Monochoria cyanea (F.V.M.) F.V.M. FRAGM. PHYT. AUSTR. 8 (1872) 44; BAILEY, QUEENSL. FL. 5
Blade absent or ovate, acuminate, sometimes cordate at the base. Flowers distinctly spaced in a raceme, apparently opening simultaneously. Stamens equal or subequal, filaments without appendages. Stigma with distinctly protruding papillar appendages. Fruit apparently appressed to the rhachis. Seeds 2 by 1 mm, barrel-shaped, with 10-12 prominent ribs.

**2. EICHHORNIA**

*Kunth, En. 4 (1843) 129.—Eichhornia auct.*

Aquatic herbs of sympodial structure, floating or creeping, rooting from the nodes; components of the sympodium annual or perennial. *Leaves* rosulate or alternate, often long-petioled, broadly ovate-rhomboid or linear-lanceolate. Inflorescence terminal, peduncled, spiciform, 2- to many-flowered, during anthesis erect, afterwards deflexed. *Perianth* zygomorphic or subactinomorphic, lilac blue, often with a yellow blotch, 6-fid, marcescent after anthesis. Stamens inserted in the throat of the corolla or deeper, decurved, unequal, often 3 longer, 3 shorter. Filaments inappendiculate, hairy in the Malaysian species. Anthers inserted near the base. Ovary sessile, 3-celled; cells many-ovuled. Style filiform. *Fruit* (never produced in Malaysia; not seen by me) membranous, many-seeded.

**Distr.** According to Solms, 5 spp. in tropical America; one of them naturalized in tropical Asia and elsewhere.

Ecol. Inhabitants of stagnant or slow-moving fresh water, often growing gregariously.


Floating herb with a very short leafy main-stem, sending down a large bunch of long fibrous roots, in very shallow water sometimes rooting in the mud, 30-50 cm high (in flower), rarely higher, emitting axillary, moderately long stolons the top of which grows out into a new plant, which readily separates from the mother-plant and begins an

**Fig. 2. Eichhornia crassipes** (Mart.) Solms at Djombang, E. Java (de Voogd).
Flora bright Malaysia. Many filaments entirely Asia, hairy. segment green simultaneously shorter. greater long-peduncled, oid from ones very Sumatra, median the showy, sheath mate glabrous, broadly Petioles 260 Distr. 3

Flowers from the base. Leaf blade broadly ovate or rhomboid from a shallowly cordate, truncate, rounded or broadly cuneate base, very obtuse, finely and densely curvinerved, firmly herbaceous, quite glabrous, 7–25 cm long and wide. Inflorescences long-peduncled, pedunele with two closely approximate bracts: lower bract with a long tubular sheath and a small blade, upper bract almost entirely enclosed by the sheath of the lower, for the greater part tubular, apiculate. Flower-bearing axis very angular, up to 15 cm long, often much shorter. Flowers per inflorescence 3–35, usually simultaneously expanding and withering, very showy, said to be trimorphous (in Malaysia only a form occurs with 3 very short anterior filaments, the 3 other much longer; stigma at medium height between the anthers of the long and the short filaments). Perianth-tube 1½–1⅞ cm long, with a green base and a pale top, slightly curved: segments ovate to oblong or obovate, lilac; posterior segment with a bright yellow, blue-bordered median blotch, 3–3½ cm long; more forward placed segments gradually smaller. Stamens curved; filaments glandular hairy. Style glabrous; stigma hairy. Fruit never produced in Malaysia.

Distr. Native of Brazil, introduced and naturalized in several other tropical countries, e.g. SE. Asia, Queensland, Guam, &c., in Malaysia: Sumatra, Malay Peninsula, Java, Borneo, Philippines. In 1894 introduced in the Buitenzorg Botanic Gardens, where it thrived exceedingly well and by its exuberant growth soon became a nuisance. Cart-loads of it were thrown in the Tji Liwung (river which crosses the Botanical Gardens) and were carried downwards by it to waters in the plains; it was also sent out as an ornamental or as a surface-covering for fishponds. At present spread from the plains up to ± 1600 m. About 1902 it appeared in several places in continental SE. Asia; in the Philippines it was introduced as an ornamental about 1912.

Ecol. Inhabits stagnant or slow-moving fresh water such as broad rivers near their banks, lakes, canals, railway-ditches, morasses, pools, tanks; exceptionally and only temporarily on inundated paddy-fields. By its luxuriant growth and extremely rapid propagation the plant has become locally a very troublesome weed, covering entirely the surface of the water, crowding out all other plants, choking watercourses and greatly hampering water-traffic and fishing. At present it is tried to eradicate this pest by spraying with chemicals (Vaas, l.c.). By a sudden rush of rising water, caused by heavy rains, great masses of it may be torn loose, forming, as it were, floating islands, which are carried by rivers to the sea where they immediately die off.

Uses. Besides for the purposes mentioned above the plant is used as a manure and for fattening pigs. Young leaves, petioles and inflorescences are sometimes used as a vegetable.

Vern. Many names. The principal of these are:
Waterhyacinth, D, E, bia bia, M, etjeng (with various additions), M, S, gendot, S, ilung ilung, mampau, mampoh, nappong, bengai gondo (Born.), sekar bopong, wewéhan, bengok, J. Mal. Pen.: kemeling télur, kéladi bunting, bunga jamban.

Note. The plant often displays gregarious flowering and presents than a very beautiful spectacle. It contains much potash.

Excluded

CORYNOCARPACEAE (C. G. G. J. van Steenis, Leyden)

1. CORYNOCARPUS


Fig. 1. Corynocarpus australasica C. T. White. a. Flowering branch. × 1/2. b. insertion of a lower branch of panicle, with 2 adnate bracts. c. flower. d. section of flower. e. sepal, inner and lateral side. f. petal and adnate stamen. g. staminodes, the lower with the basal gland. h. staminodes from fresh material; b–h. enlarged (drawn after C.H.B.: V.B. 83).
Evergreen, glabrous trees or shrubs, without resin-tubes. **Leaves** spread, simple, entire, more or less crowded towards the ends of the shoots, shining, exstipulate; midrib sulcate; shoots with perular terminal buds. Branches often in pseudo-whorls. Inflorescences terminal, sometimes latera, generally not exceeding the leaves. **Flowers** on the ultimate axis in fascicles of 3, towards the end solitary, pedicellate, bracteate. **Calyx** deeply 5-lobed, fleshy, persistent, petaloid, lobes inequal, concave, imbricate, 2 outermost smallest. Petals 5, thinner than the sepals, inserted at the margin of the disk-like receptacle. **Stamens** 5, attached to the base of the petals; filaments flattened or terete, slightly thickened towards the base; anthers dorsifixed, dehiscing lengthwise, intrors. Staminodes petaloid, dentate in the upper half, top mostly pointed, alternating with the petals. **Disk** glands 5, ovoid to ellipsoid, epistaminodial. Ovary ovoid, originally 2-celled, one cell soon abortive. Styles 1–2; stigma punctiform. **Ovule** 1, pendulous, anatropous. **Fruit** drupaceous, or a nut, with fibrous endocarp. Testa membranous; cotyledons plano-convex; albumen absent.

**Distr.** Four spp., one each in New Zealand and adjacent islands, N. Caledonia, the New Hebrides, and N. Queensland & E. Malaysia.

**Uses.** In New Zealand the fleshy exocarp and the seeds of *C. laevigata* Forst. are found edible by the Maori tribe, the prune-like fruit being prepared before, to remove some prussic acid containing glucosids. By its big fruit the New Guinea species is promising as a food plant, but nothing is definitely known about its properties.

**Notes.** Both Engler and Hutchinson place this moneneric family in the *Celastraceae* or *Celastrinae* but Wettstein in the *Terebinthales*; Hallier f. finally included them in the *Rosaceae*.

1. **Corynocarpus australasica** C. T. White, Cont. Arn. Arb. 4 (1933) 57, t. 5; Steen. Bull. J.B.B. III. 13 (1933) 101; Merr. & Perry, J. Arn. Arb. 22 (1941) 541; Steen. ibid. 28 (1947) 421.— *Corynocarpus* sp. Bull. J.B.B. III, Suppl. (1930) 82.—Fig. 1, 2.

Small to medium-sized tree, 4–12 m; branchlets angular, their bark grey. Perular bracts thick, triangular, acute, warty, persistent, outer ones 4–6 by 3–4½ mm, inner ones narrower. **Leaves** elliptic-oblong, distinctly acute-, mostly falcate-ascinate, base cuneately narrowed into the sulcate petiole 1–2 cm, 9–22 by 3–9 cm. Nerves 9–11 pairs, erect, curved, anastomosing near the margin, impressed above, prominent below as is the stout midrib; parenchyma with whitish-crystal dots. Panicle broadly pyramidal, 6–16 cm long, 5–25 cm broad; axis angular, primary branches bracteate. **Flowers** fragrant, whitish, tips of the petals slightly rosa, after flowering the whole flower distinctly rosa, flower parts long-persistent. Sepals broadly elliptic with rounded tip, after blossoming very concave, 2 outer 1½–2½ by 1½–2 mm, inner ones 2½–3½ by 2 mm, 3-veined. Petals obovate-oblong to elliptic, 2½–3½ by 1½ mm long, with 1 vein. Filaments terete, white, 1½–2½ mm long; anthers brownish, later darkbrown, acute-ovate, ½ mm long, lower half of the cells free. Staminodes obovate-oblong, 2½–3 mm long. **Disk**-glands yellowish or yellow-green. **Ovary** green, ca 1 mm high; style 1, sometimes obliquely inserted, little over 1 mm; stigma greenish-brown, punctiform. Receptacle developed as a flat disk between the ovary and the insertions of the sepals, conrate with the bases of the petals. **Fruit** a nut, not fleshy, globular to broad-elliptic but variable in shape, pointed at both ends; pericarp hard, irregularly shallow-ribbed, 3–5 by 3½–3½ cm, greyish-green to red; exocarp 2 mm diam.; endocarp woody, closely adhering, inside smooth with

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Fig. 2. **Fruit of Corynocarpus australasica** C. T. White, × 3/4. Centre: outside; bottom: halved pericarp, innerside; right: seed with testa; top: testa removed (drawn after bb 22121).
irregular ribs and a furrow in the apical half, purple, 2 mm thick. Testa membranous, prominently lengthwise veined. Embryo hard, oblique, bony, with a longitudinal groove between the cotyledons, $2\frac{1}{2} \times 2\frac{1}{2} \times 2$ cm.


MYOPORACEAE (S. Bloembergen, Bogor)

I. MYOPORUM


Shrubs, trees, or prostrate plants. Leaves spread, rarely opposite, entire or toothed, exstipulate. Flowers ♀, zygomorphic, rarely almost actinomorphic, small, axillary, solitary or usually in clusters of 2, 3 or more. Calyx and corolla 5-lobed. Stamens 4, rarely 5, in pairs of unequal length, inserted on the corolla-tube and alternate with the lobes. Anther-cells opening lengthwise, confluent at the apex, usually forming a single reniform cell after dehiscence. Ovary superior, not lobed, 2-10-celled with 1 ovule in each cell, rarely 2-celled with 2 ovules per cell. Style simple entire or obscurely notched at the apex. Drupe 2-10-celled.

Distr. Ca 35 spp., largely in Australia, 1 species in E. Asia, further in the Pacific, Rodriguez Isl. and Mauritius.

Ecol. Most representatives are heliophilous and thermophilous; many are drought plants.

Notes. The Myoporaceae are centering in Australia; their affinity is generally accepted in the Tubiflorae with Plantaginaceae, Scrophulariaceae, etc.


Treelet up to 3 m. Leaves lanceolate, acute to subacuminate, attenuate into the 4-10 mm long petiole, glabrous, entire, pinnatifid, 3-10 by 1-1½ cm. Flowers white, 2-6 axillary; pedicels 5-11 mm. Calyx nearly regular, glabrous (4-)5-merous, cup-shaped tube 1/4-1½ mm high, 1½-1⅔ mm wide, segments narrow-triangular 1-1⅔ mm long, often strongly acuminate towards the acute apex. Corolla nearly regular (4-)5(-6)-merous, entirely glabrous, tube campanulate-infundibuliform 3-4½ mm high, 3-4 mm wide; lobes spreading rounded at the apex. 1½-2⅔ mm long, ½-2½ mm broad. Stamens (3-)4(-5), glabrous, 2 longer ones 3-3½ mm long, shorter ones 2½-3½ mm long, inserted resp. nearly in the middle and somewhat below the middle of the tube. Anthers ½-1 mm long. Ovary ovoid, conical towards the apex, 3-4-celled, 1½-3 mm long, 1-1½ mm diam. Style terete 2-3½ mm long; stigma short flat. Drupe ovoid, red-brown or purple, 3-4-celled, glabrous, up to 4½ mm long, 4 mm diam., crowned by the persistent style or style rest.


Fig. 1. Myoporum papuanum Kraenzl. Flowering twig, × 1/2, flowers, × 5, drupes, × 2.
Ecol. Rare, near the coast, in savannahs, grassfields, and open forests.

Notes. This species may prove to be a geographical variation of some polymorphic Australian population, presumably of *M. acuminatum*. BTH. Brass 8848, found near Jotefa (Jautefa) Bay, differs by recurved fruiting pedicels, a bearded corolla throat, and purple drupes. It occurred abundant on limestone shores. It is scarcely separable from some Queensland specimens (Clemens a. 1944, Vickery 15.11.36, and Hubbard 6649).
**AIZOACEAE (C. A. Backer, Heemstede)**

Annual or perennial herbs or undershrubs, sometimes fleshy. **Leaves** simple, entire or subentire, opposite, spread. or spuriously whorled, sometimes minute, stipulate or not. Stipules often small, scarious, fugacious. **Flowers** axillary, solitary, clustered or fascicled, cymose, pseudoracemose, or subumbellate, actinomorphic, usually 5, often small and inconspicuous. **Tepals** 5, either free, imbricate in bud, herbaceous with scarious often white margins or entirely scarious, persistent, conniving before and after anthesis, or a distinctly gamophyllous, corolline or calycine 3–8-lobed perianth with usually persistent, herbaceous lobes imbricate or rarely valvate in bud. **Stamens** 1–5, perigynous or hypogynous, free or connate at the base, either singly or in groups, often alternate with the perianth lobes. **Anthers** 2-celled, dehiscing lengthwise. **Capsule** and **fruits** often enclosed by the perianth and falling off with it.

**Distr.** About 23 genera (if *Mesembryanthemum* is split into segregates many more) and over a thousand spp. (over 800 belonging to *Mesembryanthemum*), distinctly centering in the S. hemispherical sub-tropics of the Old World, mainly in S. Africa, with a secondary centre of development in Australia, in Malaysia and other essentially forested tropics poorly represented by some widely distributed, partly peritropical genera and widely distributed weeds.

**Ecol.** On the whole preferring arid or periodically dry often sandy country, some maritime (*Sesuvium, Trianthema*).

**Uses.** Some vegetables (*Tetragonia*), some used for extracting potash, many ornamentals (*Mesembryanthemum*).

**Notes.** By some authors this family has been split into two separate families mostly called *Molluginaceae* (with a free perianth) and *Ficoidaceae* (with a gamophyllous perianth) but in my opinion this is unnecessary.

By some authors *Aizoaceae* have been merged with *Portulacaceae*. The Malaysian representatives of this allied family can easily be recognized by the presence of two connate or free distinct sepals outside the corolla and a 1-celled ovary.

**Key to the Genera**

1. Tepals 5, free.
2. Seeds estrophilate. Flowers in terminal cymes or pseudoracemes or in stalked umbels. Leaves narrow, glabrous
   1. **Mollugo**
   2. Seeds distinctly strophilate, strophiole with a long filiform appendix which is curved round the seed and closely resembles a funicle but is not attached to the placenta. Flowers in axillary fascicles. Leaves mostly not very narrow, often hairy
   2. **Glinus**
3. **Perianth** 3–8-lobed, gamophyllous, corolline or calycine.
4. **Leaves** opposite or spuriously whorled. **Ovary** superior. **Fruit** dehiscing by an operculum
   4. **Styles** 3–4. Flowers solitary in the leaf axils, distinctly stalked. Leaves comparatively narrow
   5. **Tetragonia**
   3. **Sesuvium**
   4. **Trianthema**

1. **MOLLUGO**


**Erect** or **diffuse**, slender, glabrous herbs, mostly annual. **Leaves** spuriously verticillate or partly subopposite, lanceolate, linear-lanceolate or for a greater or smaller part obovate-subspathulate, entire. **Flowers** small, in terminal cymes which often end in pseudoracemes or in stalked umbels; single flowers pedicelled. **Tepals** herbaceous, with scarious, often white margins. **Stamens** 3–5, alternating with the tepals, less often 6–10, free; filaments filiform, rarely (not in Malaysia) dilated in the middle. **Ovary** ovoid or broadly ellipsoid, 3-celled. **Styles** 3, filiform. **Fruit**, when falling off, leaving the persistent pedicel. **Seeds** estrophilate; testa granulate or faintly reticulate; embryo annular.
Distr. Species ± 15, distributed over the warmer regions of the globe, extending into Europe and N. America, in Malaysia thus far only one species; a second may be discovered.

Ecol. Mostly in settled areas or as a weed of cultivation or in open or waste places.

Uses. Used as a potherb or for medicinal purposes.

Note. The distinction between the genera Mollugo and Glinus has been exposed by Fenzl (Ann. Mus. Wien 1, 1836, 346–353, 372) who found an essential difference in the structure of the seeds. Bentham & Hooker f. (Gen. Pl. 1, 1867, 857) hold this character insufficient, and some subsequent authors share this opinion, e.g. Wilson (N. Am. Fl. 21, 1932, 268), and the late Dr P. J. Eyma, whose notes have been used to complete this revision. Eyma’s argument is that plants showing a very close resemblance are now assigned to two different genera, Glinus and Mollugo, merely on the strength of the seed structure which might be an artificial means of dividing what ought to be kept together. However, this was known to Fenzl (J.c. p. 372), and I do not agree with Eyma.

**KEY TO THE SPECIES**

1. Ripe seeds very distinctly granulate. Leaves often more than 3 mm wide . . . . 1. *M. pentaphylla*
1. Ripe seeds not at all granulate but very faintly reticulately ribbed. Leaves less than 3 mm wide

2. *M. cerviana*


Glabrous throughout, often much and widely branched (frequently from the very base), annual, with a thin main root, 2–35 cm high, erect or with prostrate main-branches, when old often tinged brownish red. Stem thin, angular. Leaves usually in false whorls of 3–9, mostly 3–5, not rarely partly opposite, entire, pale beneath, 10–50 by 1/2–10 mm; lowermost ones (often disappearing before anthesis) ± rosulate, oblong-obovate-spandulate, distinctly petiolated; higher leaves rarely of the same shape, mostly lanceolate or linear-lanceolate from a narrowed acute base, shortly petiolated or sub-sessile, acute; midrib prominent beneath. *Flowers* in terminal or leaf-opposed peduncled lax cymes with often long racemiform ultimate branches. Bracts small, persistent. Pedicels erecto-patent, thin, 1/2–6 mm, persistent and decurred till long after the fall of the fruiting perianth. Tepals oval-oblong, obtuse, inside white, outside green with white margins, at an advanced age often turning brown, 1/2–2 mm long, during anthesis (in sunny morning-hours) widely patent, afterwards conviving to a globe. Stamens 3; filaments filiform, not dilated in the middle, short. Styles white. *Capsule* broadly ellipsoid, faintly 3-lobed, ± 2 mm long. Seeds reniform, darkbrown, finely granulate, ± 3/4 mm diam.

Distr. Tropics and subtropics of the Old World, apparently very rare in Australia; throughout Malaysia, also in New Britain, Micronesia, New Caledonia.

Ecol. In dry as well as in moist regions, mostly in settled areas, often in sandy or stony localities, sometimes on old lava-streams (Ternate), 5–1200 m, fields, gardens, premises, open places, teak-forests, locally often abundant.

Uses. Eaten as a potherb and used for medicinal purposes.

Vern. Java: *Djukut kalut*, dj. *taridi*, dj. *saidj*, dj. *titiran*, S. *galingsa*, j. moreover several local names; in the medicine-trade sold under the name of *daun mutirai*. Philippines: *Lepowo* (Bun.), *malagos*, *malag Ros* (Tag.), *pisig-pisig* (Bag.), *salsalita* (Bis.), *siتلنل Saudi, *sulangkang* (Sub.).

Note. Boorsma found a saponin in it and much saltpetre. Its small dimensions make it worthless as a fodderplant.

2. **Mollugo cerviana** (LINNÉ) SER. in DC. Prodr. 1 (1824) 392; BTH. Fl. AUS. 3 (1866) 334; BAIL. Queensl. Fl. 2 (1900) 712; KOORD. Exk. Fl. 2 (1912) 206.—*Pharmacoeum cerviana* LINNÉ, Sp. Pl. (1753) 272; BURM. f. Fl. Ind. (1768) 76.

Glabrous, glaucous annual, usually purplish, 3–20 cm high, with an often longish but not thick main-root. Stems mostly numerous from a broad root-crown, erect, erecto-patent or prostrate, very slender, with somewhat thickened nodes, frequently much branched. Radical leaves (often withering before anthesis) rosulate, linear, linear-narrowly lanceolate or subspathulate from a narrow base, 5–30 mm long. Cauline leaves in spurious whorls of 3–8 or higher ones opposite, subsessile or very slightly petiolated, narrowly linear or subspathulate from a narrow base, obtuse or obscurely apiculate, 6–18 by 1–11/4 mm. Peduncles subumbellate or solitary at the tops of the branches, rather long, thin, stiffish. *Flowers* in lax pseudoracemes or 2–4 subumbellate at the ends of the peduncles. Pedicels erect or patent, filiform, stiffish, 6–18 mm long.
Tepals patent during anthesis, before and after anthesis erect, oval-oblong, with an obtuse or rounded apex, with broad, white scarious margins, 2⅓–3½ mm long. Stamens 3–5; filaments longish, filiform. Styles erecto-patent or spreading, hardly ⅓ mm long, comparatively thick. Capsule broadly ellipsoid, equaling the perianth. Seeds closely packed, reniform-subsemiombicircular, brown, not granulate but laxly and slightly prominently, irregularly reticulately ribbed, less than ⅓ mm long.

Distr. S. Europe, tropical and S. Africa. S. to SE. Asia, Ceylon, and Australia, not yet recorded from Malaysia, but, considering the general distribution, possibly occurring there somewhere.

Ecol. Dry regions at low altitudes, often in sandy localities.

Uses. According to Trimen (Fl. Ceyl. 2, 1894, 272) in Ceylon much used as a medicine against fever. Fenzl (Ann. Wien. Mus. 2, 1839, 304) states that according to a manuscript note in Burman's herbarium the plant is used in Hindustan as a remedy for bilious fever and syphilis.

2. GLINUS


Diffuse, glabrous or hairy, often much branched annuals. Leaves opposite or spuriously whorled, oblong, oval, ovate, obovate or spatulate, entire or obscurely dentate. Flowers axillary in few-flowered clusters or fascicles, pedicelled or subsessile. Tepals with scarious, frequently white margins, often unequal. Stamens 3–20, free or, when numerous, fascicled, in the Malaysian specimens usually 3–15 and free; filaments filiform. Ovary ovular or oblong, 3–5-celled. Styles erect, spreading or recurved, linear or oblong-elliptic, persistent. Capsule 3–5-valved. Seeds ∞, distinctly strobiliolate; strophiole with a long, thin appendix encircling a considerable part of the seed and resembling a funicle but not attached to the placenta; testa finely granulate.

Distr. Probably about 10 spp. in the tropics and subtropics of both hemispheres, elsewhere sometimes introduced.

Ecol. The 2 Malaysian spp. inhabit by preference dried-up pools and ditches and fallow rice-fields, less often waste places. They often grow gregariously and intermixed.

Uses. Sometimes used for medicinal purposes.

Note. For the distinction of Mollugo and Glinus see the notes under the former genus.

KEY TO THE SPECIES

1. Tepals acute, outside usually with many stellate, white hairs, often densely woolly, 6–10 mm long. Stamens 5–15, rarely more. Styles usually 5, linear, erect or erecto-patent, 1¼–1½ mm long. Capsule usually 5-valved. Flowers often sessile or subsessile.

1. Gl. lotoides

1. Tepals obtuse, glabrous or thinly pubescent outside, 3–5 mm long. Stamens 3–4. Styles 3, less often 4, oval-oblong, widely patent or recurved, less than ⅓ mm long. Capsule 3–, less often 4-valved. Flowers always very distinctly (4–15 mm) pedicelled.

2. Gl. oppositifolius

1. Gl. lotoides LINNÉ, Sp.Pl. (1753) 463; BURM. f. Fl. Ind. (1768) 112, t. 36, f. 1; DC. Prod. 3 (1828) 455; BLANCO, Fl. Fil. (1837) 413, ed. 2 (1845) 288, ed. 3, 2 (1878) 169; ZOLL. SYST. VERZ. (1854) 141; MIQ, Fl. Ind. Bat. 1, 1 (1858) 1063, Sum. (1860) 150; KOORD. EXK. Fl. 2 (1912) 206; BACK. ONKR. SUiker. (1930) 249; BEKÎN. FL. JAVA, EM. ED. 4 (1942) FAM. 57, p. 2.—GL. dictamnoides LINNÉ, Mant. 2 (1771) 243; DECNE, NOUV. ANN. 3 (1834) 449; SPAN. LINNÉA 15 (1841) 207.—MOLLUGO HIRTA THRUB. PROD. P.L. CAP. 1 (1794) 24; SER. IN DC. PROD. 1 (1824) 391; F.-VILL. NOV. APP. (1880) 100; VIDAL, PLANT. CUMING. PHILIP. (1885) 16; REV. PL. VASC. FILIP. (1886) 144.—TRYPHERA PROSTRA BL. BIDR. (1825) 549; ZOLL. SYST. VERZ. (1854) 141 (SPHALMATE: TRIPHERA); DC. PROD. 13, 1 (1859) 423, 424.—PHARMACEUM PENTAGYNUM ROXB. FL. IND. ED. CAREY 2 (1832) 103.—GLINUS ASTROLASION ZIP. EX SPAN. LINNÉA 15 (1841) 207.—MOLLUGO LOTOIDES A. RICH. FL. ABYSS. 1 (1847) 48.—MOLLUGO LOTOIDES W. & A. EX CLARKE IN HOOK. F. FL. BR. IND. 2 (1879) 776; MERR. FL. MAN. (1912) 199; SP. BLANC. (1918) 140; EN. PHILIP. 2 (1923) 135.

Prostrate or ascending pluricauline annual, often with a long, strongish taproot. Entire plant when young greyish green, at an advanced age often reddish brown. Stems spreading in all directions, much branched, 15–90 cm long, terete, with thickened nodes, especially in the higher part clothed with white, stellate hairs. Stipules linear, acute. Radical leaves rosulate, fagacious; higher leaves opposite or spuriously 3-nate, broadly oval or oval-obovate from a cuneate base, obtuse or rounded at the apex, often minutely apiculate, frequently with undulate margins, on both surfaces more or less densely (often very densely) clothed with white, stellate hairs or glabrescent above; 10–35 by 6–21 mm; petiole 4–15 mm. Flowers usually in fascicles of 3–8, rarely more (up to 16), mostly very shortly pedicelled or subsessile.
Pedicels 1-2 mm, stellately hairy, sometimes much longer (up to 15 mm). Tepals during anthesis (sunny morning-hours) erecto-patent, before and after anthesis erect or conning, oblong, distinctly mucronate, 6-10 mm long, inside quite glabrous, outside more or less densely stellately-hairy, green, the in bud overlapped margins white. Stamens (in Malaysian specimens) 5-15; filaments filiform or very narrowly ligulate; anthers white. Ovary glabrous, during anthesis ± 3 mm high. Styles 5, erect or obliquely patent, 1 1/2-1 1/2 mm long. Capsule 5-valved. Seeds very numerous, closely packed, reniform, brown, finely granulate, ± 1/2 mm long.

Distr. S. Europe, N. & trop. Africa, S.-SE. Asia, Ceylon, and Malaysia to Australia and America, in Malaysia: Sumatra, Java, Lesser Sunda Islands (Bali, Sumba, Timor), Celebes (also Selayar Island), and Philippines.

Ec. 1. In settled areas of the dry regions up to ± 800 m in seasonally swampy and again desiccated localities on heavy soils, in dried-up pools and ditches and on fallow rice-fields, locally often very numerous and then very conspicuous by its white or reddish brown colour, often growing intermixed with the following species.


Note. Flowers and fruits very profusely.


Erect, ascending or almost prostrate, usually pluricauline, often much branched annually with a strongish taproot; stems 10-60 cm long, terete, with thickened nodes. Leaves for the greater part in spurious whorls of 3-5 of which usually 2 leaves larger than the others, oblong-obovate-spathulate from a tapering or slightly contracted base, with a rounded, obtuse, acute or minutely cuspidate apex, glabrous or thinly hairy, 6-40 cm by 3-15 mm; petiole 1-8 mm. Flowers in fascicles of 2-6, always distinctly pedicelled; pedicels thin, glabrous, 4-15 mm long when adult. Tepals during anthesis (sunny morning-hours) erecto-patent, before and after anthesis erect, oblong, obtuse, green with scarious margins or the inner almost entirely scarious, quite glabrous, 3-5 mm long. Stamens 3-4; filaments filiform. Ovary glabrous; styles 3-4, widely patent or recurved, oval-oblong, less than 1/2 mm long. Capsule oblong, 3-3 1/2 mm long, 3-4-valved. Seeds closely packed, reniform, brown, finely granulate, ± 1/2 mm long.

Distr. Trop. Africa and Asia throughout Malaysia to N. Australia.

Ec. 1. In settled areas of the dry regions, from the plains up to ± 100-(275) m, in seasonally swampy or inundated and again desiccated localities, in dried-up pools and ditches and on rice-fields, either fallow or used for a second crop (in crop-rotation), locally often very numerous, frequently growing intermixed with the preceding species but less conspicuous than this and, on the whole, less common, often also on lighter soils, sometimes in sandy localities near the sea.

Uses. According to Fenzl (Ann. Wien. Mus. 2, 1839, 303) this herb is considered in Hindustan as promoting digestion and salivation and, moreover, as a medicine for bowel-complaints and syphilitic affections.


Note. Often profusely flowering and fruiting. Where Gl. lotoides and Gl. oppositifolius grow intermixed, as is often the case, an intermediate form, probably a hybrid, is not rarely found. This form has distinctly petioled leaves, agreeing in shape with those of Gl. lotoides, but, on the whole, smaller and less densely hairy: flowers subsessile, smaller than those of Gl. lotoides, 3-4 mm long; tepals acute, hairy. Like in Gl. oppositifolius there are 3-4 stamens: fruit 3-valved; styles agreeing in shape with those of Gl. lotoides but shorter.

3. SESUVIUM

Linne, Syst. ed. 10 (1759) 1058.

Prostrate, creeping, ascending or erect succulent herbs or undershrubs. Leaves opposite, exstipulate, often by their sheathing bases connected in pairs, linear, lanceolate or oblong, very fleshy. Flowers axillary (only spuriously so?), solitary, clustered or cymose, sessile or stalked, bibracteolate, actinomorphic, ♀. Perianth
Fig. 1. *Glinus oppositifolius* (L.) DC., × $\frac{1}{2}$.
gamophyllous, deeply 5-partite; tube obconical; segments oblong, obtuse, just below the apex often dorsally apiculate, coloured inside. Stamens either 5, alternating with the perianth-segments, or ~, inserted in the mouth of the perianth-tube; filaments filiform or very narrowly linear, free or connate at the base; anthers 2-celled. Ovary superior, 3-5-celled; cells ~-ovuled. Styles 3–5, filiform, stigmatose on the inner side. Capsule oblong, thin-walled, 3–5-celled, operculate. Seeds several in each cell, globose-reniform; testa smooth; embryo annular.

**Distr.** Species ± 8 in the tropics and subtropics of both hemispheres, often littoral, in *Malaysia* only the cosmopolitan *S. portulacastrum* L.


Perennial, prostrate or creeping herb, with a strong taproot, often much branched and densely caespitose, quite glabrous. Stems rooting from the nodes, terete, rather thick, solid, succulent, green or very often red, 20–80 cm long. Leaves mostly lanceolate, linear-lanceolate or linear, less often oblong, broadest above the middle, very succulent, flat above, convex underneath, green or, at the base, red, finely pale-punctate, 25–70 by 6–15 mm. Petioles 7–15 mm long, dilated at the base into a scarios crus-puncticulatus sheath. Flowers solitary in the leaf-axils. Pedicels thickened upwards, 1/2–1 1/2 cm long, rarely longer. Perianth 8–10 mm long, 5-cleft to far below the middle. Segments with a dorsal, subapical, erect, subulate, obtuse, fleshy, ± 1 1/2 mm long apiculus; the parts exposed in bud fleshy, green outside, overtopped margins membranous pink, inside of perianth pink. Stamens ~, filaments free, pink or pinkish violet, shorter than the perianth-lobes, anthers darker-coloured. Ovary glabrous, 3- or sometimes 4-celled. Styles as many as cells, white. Capsule included by the perianth, oblong, 9–11 mm long. Seeds long-funicled, shining black.

**Distr.** Cosmopolitan in the tropics, throughout *Malaysia*, but not yet reported for Borneo. In Celebes thus far only collected in the extreme NE. part, in Sumatra only in the NE. part.

Fig. 2. *Sesuvium portulacastrum* (L.) L. on the sandy beach of W. Bali (De Voogd).

**Ecol.** Saline, clayey or sandy, humid or muddy localities near the sea and along tidal creeks between 0 en 1 m above seal level, often in dense patches; frequently conspicuous by bright red stems.

**Uses.** Furnishes an inferior vegetable, edible only after having been repeatedly cooked (in order to remove the salt taste).

**Vern.** Many local names of which *gelang, gelang pasir, sarmini, air, M*, and *krokot*, J, are the
commonest. Philippines: Bilang-bilang, dampalit (Bis.), tarumpalit (Bis.), karampalit (Pamp.).

Note. The cooked plant smells and tastes of purslane. The late Dr P. J. Eyma made a note on the interpretation of the original Linnean descriptions in Species Plantarum (1753) of Trianthema portulacastrum and Portulaca portulacastrum (now Sesuvium portulacastrum), the described habit of which coincides with the recent conception of these species, but the floral description of which seems to be reversed; Linné seems to have corrected this himself in his later editions.

4. TRIANTHEMA

Linné, Sp.Pl. (1753) 223; Gen. Pl. ed. 5 (1754) no 278.

Procumbent, diffuse, glabrous, papillose or hairy herbs, rarely undershrubs. Leaves opposite, obovate, ovate or oblong-linear, entire, those of one pair often very unequal; petioles dilated and sheathing at the base, often pairwise connate. Stipules minute or absent. Flowers axillary, solitary, glomerate or fascicled, sessile or stalked. Perianth gamophyllous, tube in the Malaysian species short. Segments 5, or rather large, beneath the apex with a dorsal micro, coloured inside. Stamens 5—∞, alternating with the perianth segments, solitary, paired or in groups. Filaments filiform; anthers short. Ovary superior, with a truncate or impressed apex, 1—2-celled; placentas basal, usually adnate to the septum; cells 1- or few-ovuled. Styles 1—2, longitudinally stigmatose. Capsule terete or turbinate, with an obtuse, truncate or impressed apex, rarely beaked, 1—2-celled, operculate; operculum thick-walled, containing 0—2 seeds, indehiscent; basal part of fruit thin-walled, 2—9-seeded. Seeds long-funicled, globose-reniform; testa ribbed or granulate; embryo annulate.

Distr. Species ± 15, widely distributed in the tropics and subtropics of both hemispheres, especially in Australia.

KEY TO THE SPECIES

1. Style 1
   2. Perianth-tube free from the petioles. Stamens 5. Flowers all or for the greater part clustered, ± 3 mm long. Young leaves distinctly papillose
      2. Perianth-tube throughout its length adnate to the basal part of the petioles. Stamens 10—25. Flowers solitary, 4—5 mm long. Leaves not distinctly papillose


Annual or perennial, often pluri cauline, frequently with a very strong taproot, usually much branched from the very base. Branches prostrate, 20—60 cm long, terete, much tinged with purple, thin, narrowly fusiform. Young parts studded with glassy papilae. Leaves linear or linear-lanceolate, greyish green, glabrous, fleshy-succulent, with a well-developed central aquiferous tissue, 20—30 by 2'/2—4 mm; those of one pair not very much differing in size. Petiole much shorter than the lamina, dilated at the base into a semi-amplexicaul sheath, usually bearing on the top, on either side, a minute dentiform stipule; sheaths of one leaf pair free from each other. Flowers in clusters of 2—6, or rarely, and only a few, solitary, often crowded on short lateral branchlets, sessile, free from the petiolar sheaths. Perianth ± 3 mm long, throughout its length longitudinally ribbed, 5-cleft ± half-way down; tube obconical. Segments obliquely erect or at last spreading-recurred, ovate-triangular, rather acute or rather obtuse, with a dorsal subapical minute obtuse micro, inside sordidly white with grey markings. Stamens 5, much shorter than the tepals; anthers purplish. Ovary with an obconical base, its apex rounded-truncate, impressed in the centre. Style 1, excentric, very short. Capsule enclosed by the calyx-tube, its operculum thick; its apex seedless inside but with its inverted-cupshaped basal part narrowly surrounding a single seed which it carries away in falling off; basal part of the fruit cup-shaped, thin-walled, likewise 1-seeded; both seeds in unopened fruits pressed against each other. Seeds subhorizional orbicular, concavo-convex, brownish black, faintly reticulate-ribbed and especially around the margin studded with short white papilae which swell up when wetted, 1—1'/4 mm diam.

Distr. Tropical Africa and Asia to Victoria, in

Prostrate or ascending often much branched annual with a firm taproot. Stems suberecte or slightly angular, thickened and flattened on the nodes, glabrous or finely pubescent, 15–50 cm long. Branches in the axils of the smaller leaves of the pairs, alternating. Leaves thin-fleshy, quite entire, purple-margined, oring the petiole quite glabrous; those of one pair very unequal in size; larger ones oval-obovate-obcordate from a cuneate base, obtuse, rounded or retuse, 11/2–5 by 1–41/2 cm; smaller ones either of the same shape or more oblong, 8–30 by 4–25 mm. Petioles 4–30 mm, on the top of the flattened upper surface with a few short, thick hairs; their sheathing membranous bases connate pairwise below into a funnelshaped pouch which bears on its apex on the right and the left a small stipule. Stipules acuminate from a pale base, with an acute red apex, on the midrib thinly beset with short thick hairs, 2–21/2 mm long. Flowers sessile, solitary in the leaf axils; their lower part hidden by the petiolar pouch. Perianth totalling 4–5 mm, usually pale pink, rarely white; tube adnate throughout its length to the base of 1 or 2 petioles, segments rather obtuse with a longish dorsal, subapical mucro. Stamens 10–25; filaments white, glabrous, 2–3 mm; anthers pale pink. Ovary ± turbinate, truncate, glabrous, incompletely divided into 2 superposed cells by a transverse inner ring; both cells ovulate. Style 1, ± 3 mm long, unilaterally stigmatose throughout its length. Capsule partly exserted, with a truncate bilobed apex; operculum fleshy, containing 1–2 seeds, indehiscent; basal part of the fruit thin-walled, 2–9-seeded. Seeds reniform, dull black, with faint wavy ribs, 13/4–21/2 mm broad.

Distr. Pantropic, in Malaysia: Malay Peninsula, Philippines, Java, Madura, Lesser Sunda Islands (Sumbawa, Flores, Timor), Moluccas (Ternate), S. New Guinea.

Ecol. In Java throughout the drier parts of the island from quite near the sea up to ± 200 m, in sunny, periodically dry localities, either saline or not, in cultivated or fallow fields, on roadsides, preferably on clay near the sea, locally often numerous.

Use. Van Steenis (loc. p. 175) states that the young leaves are sometimes eaten as a vegetable.

Note. For the interpretation of the Linnean description see the note under Sesuvium portulacastum.


Herb with a strong taproot. Stems prostrate, more or less (usually not very much) branched, angular and striate, sometimes up to 2 m long but mostly much shorter (50–75 cm); young parts rather densely beset with small white papillae, tardily glabrescent. Leaves oval-oblong-obovate-subspathulate from an acute base, acute, obtuse or rounded at the apex, rather densely studded (especially on the midrib and along the margins, moreover on the petiole) with small, white, at last shrivelling white papillae, ± fleshy, 11/2–5 cm by 5–18 mm, those of one pair ± unequal. Petioles rather long, 3–20 mm, scarious-margined; their much dilated sheathing bases not connate into a pouch and not concealing the flowers. Flowers few to rather many in dense, sessile or subsessile clusters, shortly pedicelled or subsessile. Bracteoles oblanceolate, thinly membranous. Perianth ± 4 mm long, deeply 5-partite; tube free from the petioles, shortly obconical. Segments much longer, oval, with broad membranous margins and a thicker, longitudinally nerved central field, ending near the top of the segment in a longish dorsal mucro, glabrous, green outside, pink within. Staminens 10–15, free, shorter than perianth. Ovary cylindric-oppyramidal, crowned by 2 recurved shortish styles. Capsule ± 4 mm long, with a cylindrical, faintly 2-lobed, solid bead; bead separating from the basal part of the fruit by a circular cleft; bead containing 2 seeds; lower part of the fruit with 2 superposed seeds. Seeds orbicular-reniform, with slightly prominent ribs on the back and faint tubercles on the sides, dull-black, ± 11/2 mm diam.

Distr. Ceylon, Hindustan, Australia, in Malaysia: Lesser Sunda Islands (Sumbawa and Timor).

Ecol. Grassy localities in seasonally dry regions, only rarely collected.

Note. According to Trimen loc. the fully expanded flowers are very pretty.
5. TETRAGONIA


Erect, ascending, prostrate or climbing herbs or undershrubs, studded all over with minute, shining, white papillae. Leaves spirally arranged, flat or slightly undulate, fleshy, exstipulate. Flowers axillary, solitary or fascicled, sessile or stalked, greenish or yellowish. Perianth-tube produced above the ovary; segments 3–5, short, often unequal. Stamens 1 or more in the mouth of the perianth tube, alternating with the segments, solitary or in groups. Ovary semi-inferior, 2–9-celled, with 1 pendulous ovule in each cell. Styles equal in number to the cells, linear, stigmatose along the inner side. Fruit turbinate or obovoid with a hard, almost woody endocarp; the herbaceous or almost fleshy epicarp tipped with the enlarged calyx-limb, with apical tubercles or horns which not rarely develop into a flower, a branchlet or a spine, indehiscent.

Distr. Species 50–60, mainly in the S. hemisphere, especially in S. Africa and Chile, a few in Australia, Tasmania, New Zealand, Polynesia, and Japan, in Malaysia only a cultivated species.


Fleshy, widely branched (often from the very base), annual. Stems erect when young, afterwards trailing-ascending, thick, terete or slightly angular, light green, 10–100 cm long. Leaves ovate-rhomboid-triangular from a ± decurrent, cuneate or contracted base, obtusely acuminate or obtuse, flat or slightly undulate, darkgreen above, light green or pale green beneath, dull on both sides, 1½–11 by 1–7½ cm; petiole thick, ½–2½ cm. Flowers solitary or 2–3 together. Pedicels ± 2 mm. Perianth-tube turbinate, during anthesis 1½–2 mm high, under each segment with a short hornlet, which enlarges after anthesis and sometimes develops into a flower or a branchlet. Segments 3–5, often 4, during anthesis patent with recurved margins, afterwards erect or connivent, green externally, yellowish green or pale green inside, 2–3 mm long, unequal; 1–2 of them broadly ovate or semi-oblanceolate, obtuse or rounded, the 2 lateral ones narrower, ovate-triangular, obtuse. Stamens 4–10: filaments yellow, 1–1½ mm. Fruit turbinate, obtusangular, subtruncate, 2–5-horned, ¼–1½ cm long, 4–10-seeded.

Distr. Wild in the coastal regions of Australia, Tasmania, New Zealand, Japan, and the Pacific Islands.

Uses. In Malaysia, especially in the mountainous regions, cultivated as a potherb, mostly 1000–1700 m, e.g. in W. Java and N. Sumatra.

Vern. Nieuw-Zeelandse spinazie, D, New Zealand spinach, E, kabak, M.

Excluded

Fig. 1. *Myrica javanica* Bl. a–c ♂, d–i ♀.—a. Flowering twig, b–c. flower analysis, d. flowering twig, e–g. flower analysis, h–i. longitudinal section of flower and fruit. (a & d nat. size, others enlarged.) After Blume.
MYRICACEAE (C. A. Backer, Heemstede)

MYRICA


Trees or erect shrubs, often dotted with yellow glands and strongly aromatic. Leaves spirally arranged, exstipulate, or stipulate in young plants only, shortly petioled, simple, entire, serrate-dentate or more or less deeply pinnatisect, pinnerved. Flowers in axillary, solitary or spiked or racemated catkins, (♂) (♀) or (♂♀); when the inflorescence is (♂♀), then the (♂) flowers below the (♀); each flower subtended by a bract. Sepals and petals absent, or the (♀) with 2 or more minute sepaloid bracteoles. (♂): Stamens 2–20, usually 2–4; filaments free or more or less connate into a column; anthers erect, 2-celled; cells opening by longitudinal slits. Rudimentary ovary, as a rule, absent. (♀): no staminodes. Ovary sessile, 1-celled. Style deeply bifid; branches short or longish, stigmatose on the inner side. Ovule 1, basal, erect, orthotropic. Drupe ovoid, ellipsoid or globose, tuberculate; endocarp hard. Seed erect, not comose; testa membranous; endosperm none; embryo straight; cotyledons plano-convex; radicle short.

Distr. Species according to Chevalier ca 50, but this number may be greatly reduced. By some authors the genus has been split into 3 genera, but I am inclined to accept only one.

N. and S. America, Canaries, tropical and S. Africa, Europe, N.-, tropical and East Asia, Malaysia, and Hawaii, not in Australia. In Malaysia 2 polymorphic species. Moreover, some forms, represented by inadequate materials from East Malaysia, may in the future prove worthy of specific rank. They will be dealt with at the end of this paper.

Ecol. Heliophilous, often gregarious, sometimes locally vulcanophile in the mountainous regions.
Uses. See under M. javanica Bl.


KEY TO THE SPECIES (see also p. 279)

1. Leaves of adult specimens shallowly or coarsely but always distinctly serrate or crenate-serrate, 2–71/2 cm wide, entirely hairless. Leaf-base acute or obtuse. Young branchlets quite glabrous. Stigmas narrowly ovate-triangular, 1/2–1 1/4 mm long.

1. M. javanica

1. Leaves of adult specimens quite entire, 1–4 1/2 cm wide, usually more or less densely hairy. Leaf-base acute, rounded or cordate. Young branchlets usually hairy. Stigmas linear-filiform. ± 2 1/2 mm long.

2. M. esculenta


Much branched tree or erect shrub, 2–10 m high, exceptionally up to 20 m; trunk crooked; no buttresses. Crown rather dense. Branchlets greyish black, hairless, densely beset with sessile yellow glands when young. Leaves elliptic, obovate or oblong-cbovate from an acute or obtuse base, at the apex rounded, very obtuse, or sometimes slightly emarginate, shallowly to rather coarsely serrate or crenate-serrate, firmly coriaceous, hairless, when young on both sides rather densely beset with sessile yellow glands, afterwards, especially on the upper surface, soon losing the glands which leave shallow pits, 4–14 cm by 2–71/2 cm; midrib strongly prominent beneath; lateral nerves on either side of the midrib 5–12, erecto-patent, often forked, frequently ending in a short, thick marginal toothlet, faintly prominent to slightly depressed above,
rather prominent beneath; petiole firm, $\frac{1}{2}$-11/2 cm. Flowers (c) (q), very exceptionally a few q flowers among the c ones. c: Inflorescences solitary in the leaf-axils, erect to widely patent, 4-18 cm long (peduncle included); rachis clothed with numerous yellow glands and many more or less patent short hairs, in the higher part bearing several at last widely patent catkins, rarely bearing part of the catkins on short secondary branchlets; catkins solitary in the axil of an ovate, acute, 2-3 mm long bract, sessile, $\frac{3}{4}$-3 cm long. Single flowers in the axil of a bract; floral bracts quite free from the staminal column, ovate, shortly acuminate, strongly vaulted, shortly hairy along the margin and on the back and studded with yellow glands, 2-21/2 mm long, persistent. Stamens usually 4, very rarely 3 (see note); filaments for the greater part of their length connate into a shorter or longer column; staminal column thick, thinly patently hairy and studded with yellow glands. Anthers shortly stalked, vertical, contiguous, thick, with many sessile glands, bivalved; no rudimentary ovary. c: Inflorescences solitary in the leaf-axils, erect or erecto-patent, not or sparingly branched, rather lax, 3-7 cm long; rachis clothed with very many sessile yellow glands and a number of patent short hairs; catkins solitary in the axil of an ovate-triang- 

gular acute, $\frac{1}{2}$-2 mm long bract, 5-10 mm long very dense. Flowers 5 or more, imbricate, each in the axil of a small ovate, acute hairy bract. Bracteoles at the base of the flower 2, appressed against the ovary, ovate, shortly acuminate, ciliate, hairy and glandular on the back, $\frac{3}{4}$-1 mm long. Ovary ellipsoid-ovoid, very densely studded with short rounded tubercles. Stigmas 2, sessile, spreading narrowly, ovate-triangular, acute, flat, red, $\frac{1}{2}$-11/4 mm long. Berries 1 or rarely 2 per catkin, broadly ellipsoid, with many yellow glands, otherwise glabrous, black with bluish violet juice, rather acid not palatable.

Distr. Malaysia: Central Sumatra, Java (Mt Salak to Mt Jang), Lesser Sunda Islands (Balî, Lombok), N. and Central Borneo, Philippines, N. and S. Celebes, New Guinea, 900-3300 m.

Ecol. Prefers open, sunny, stony localities, often near active craters, on ridges, and lavastreams, there often forming a pioneer-vegetation and becoming gregarious, elsewhere mixed with other shrubs and small trees forming a rather dense jungle in which it may predominate. Fl. fr. Jan.-Dec.

Vern. Maungkoan, piitisan, sang, wuru kêtêk, J. têtêkêan, têkê, S. Philippines: Hûndâng (C.Bis.).

Uses. The wood furnishes a highly valued fuel. An excellent charcoal is made of it. Ripe berries are edible. Cultivated for reafforestation, also as a road-side or a court-yard tree.

Note. Fruits sought after by several species of birds, i.e. pigeons, which spread the seeds. In the crop of a single pigeon 144 viable seeds were found. On Mt Kinabalu epiphytic specimens were said to have been collected on big trees by M. S. Clemens in Aug. 1933.

Not too young juvenile forms possess obovate, rather deeply, narrowly and very acutely serrate leaves of $2^{1/2}$-6 cm by $1^{1/2}$-3 cm; leaf-teeth with a thickened apex; stipules narrowly ovate-lanceolate, acute, 2-4 mm long, caduous.

M. vidaliana Rolfe i.e. is a Philippine form of this species with small ($1^{1/2}$-6 cm by $3^{1/4}$-2 cm), shallowly serrate leaves. Male inflorescences small; stamens 3, rarely 2. This form passes into typical M. javana- 

tica by intergrades.


Small tree, 3-15 m high; trunk crooked, irregularly branched; bark grey. Branchlets usually moderately densely clothed with patent, longish, less often short, thin hairs, mixed with scattered sessile yellow glands, sometimes hairless and more or less densely glandular only. Leaves lanceolate, lanceolate-ovate or oblong-ovate, from a gradually narrowed, acute, narrowly rounded or (young trees) narrowly cordate base, acuminate or not, with an acute or rather acute, less often obtuse apex, on adult trees entire and firmly coriaceous, on the upper surface with or without minute yellow glands, beneath bearing many caducous minute glands which leave a shallow pit on falling off, ciliate or not, either thinly pubescent on both surfaces (especially on larger nerves), or only beneath, or quite glabrous, shining darkgreen above, on adult trees 21/2-15 cm by 1–41/2 cm (for very young trees see beneath); midrib strongly prominent beneath; lateral nerves on either side of midrib 5–15, obliquely erect or ascending from a patent base, inarching near the margin or not, prominent beneath. Petiole firm, pubescent or glabrous, 2–10 mm. Flowers (c) (q). c: Inflorescences solitary in the leaf-axils, erecto-patent to widely patent, 3–8 cm long (short peduncle included). Rachis thin, usually rather densely clothed with more or less patent,
longish or short white hairs, between the hairs with scattered yellow glands, sometimes hairless and glandular only, bearing several rather remote, at last widely patent catkins; catkins singly in the axil of a triangular, 1½-2½ mm long, hairy bract, sessile or shortly stalked, 1½-1½ cm long, dense or rather lax; their rachis patent hairs. Floral bracts ovate-triangular, patent hairy on the back, ± 1½ mm long. Stamens 4, rarely 3, very rarely 2; filaments connate at the base into a column 1½-1½ mm long; anthers distinctly or hardly stalked, vertical, contiguous, thick, red, beset with numerous very short, comparatively thick hairs, ± ½ mm long; no rudimentary ovary. φ: Inflorescences solitary in the leaf-axils, erect or more or less widely patent, 1½-5 cm long, simple. Rachis thin, mostly clothed with patent longish or short hairs, mixed with scattered yellow glands, sometimes hairless. Catkins in the lower part remote, higher up often crowded, placed singly in the axil of an ovate-triangular, hairy, 1½-3 mm long bract, sessile, 1½-2 mm long, consisting of 10 or fewer densely crowded flowers. Floral bracts ovate-triangular, acute, hairy and glandular, ± ½ mm long. Bracteoles very minute, ovate-triangular, pubescent, ± ½ mm long. Ovary hairy when young. Styles at last spreading or reflexed; filiform-subulate, hairy at the base, ± ½ mm long. Berries red, 1-3 per catkin, ellipsoid, beset with broadly rounded tubercles, red, ± 1 cm long.

**Distr.** SE. Asia, Malay Peninsula, Sumatra, Banka, Billiton, Borneo, Java (rather rare and local), Philippines, Lesser Sunda Islands (Bali, Lombok, Sumba, Flores), from the plains up to ± 1700 m.

Ec. Light forest, jungles, locally numerous, with preference for dry, well-drained situations, in the Malay Peninsula both on hot sandy dunes and on stony laterites. *Fl. fr.* Jan.–Dec.

**Vern.** Ki keeper, S. samben, woor gesik, J. men-kikir(an) (M. Bill.), silom (Batt.), kétinah (Sumba). Moreover, some local names. Mal. Peninsula: *Telur chickah, gelinckek, készami, keteng, fenteking, kay-teng, kusama, gilinche.*

**Notes.** The closely allied *M. rubra* (Lour.) S. & Z. (*M. nagi* DC.; non Thunb. *quae est Podocarpus*)! seems to differ only by its larger (1½-1½ cm diam.) edible fruits, for which it is cultivated in Cochinchina, China and Japan. I have seen no authentic specimens and must refrain from pronouncing a definite opinion, whether it is specifically distinct.

Leaves of seedlings are stipulate, subsessile, narrowly lanceolate-ovoboate from a narrowly cordate base, acute, sharply and often coarsely serrate or often pinnatisect, thin, 20-35 by 5-7 cm; lateral nerves on either side of midrib up to 15; stipules narrowly ovate-lanceolate, very acute, ± ½ mm long, deciduous. See also Corner (1940) and Steen. (Fl. Mal. 1, 4, 1948, xx).

As the tree grows up the juvenile form passes very gradually into the adult form; lateral shoots of old trees may repeat the juvenile form.

**INSUFFICIENTLY KNOWN MALAYSIAN FORMS OF MYRICA**

(1) *Myrica* specimens, collected in 1912 by Stresemann on Mt Sofia in Central Ceram (no 20 and 132) and a φ specimen from Mt Togha, Buru (no 379), preserved in the herbaria at Leyden and Bogor, possess densely woolly young shoots, and crowded, oval-oblong, firmly coriaceous, very shallowly but distinctly serrate, 4-5 cm long, 1½-3 cm wide leaves with an acute or obtuse base and an obtuse or rounded apex, in a young state densely woolly on both surfaces, glabrescent above except on the larger nerves, much more persistently hairy beneath, densely gland-dotted on the lower surface, much less densely so above; midrib much prominent beneath; lateral nerves on either side of midrib 4-8, rather widely patent, prominent beneath; petiole densely hairy, ½-1 cm. No 20 is sterile; no 379 bears young male inflorescences, 6-7 cm long; main-axis densely woolly; catkins several, spicate, patent, very dense, ± ½ cm long; their rachis thinly patent short-hairy; floral bracts broadly ovate, densely woolly on the back, ± 2 mm long; stamens 4 or sometimes 3; filaments connate below; anthers vertical, thick, hairless, gland-dotted.

As the female flowers, the styles of which afford in this genus an important character, are as yet unknown I must refrain from naming it. It is certainly closely allied to *M. javanica* of which it may be a deviating form.

(2) The Arnold Arboretum Herbarium possesses a very small-leaved *Myrica* species collected in New Guinea (Brass 10938, Oct. 1938), with very young φ flowers unfit for examination and description. It is clearly allied to *M. javanica* and may be one of the numerous forms of this very polymorphous plant.

**Excluded**

SONNERATIACEAE
(C. A. Backer & C. G. G. J. van Steenis, Heemstede/Leyden)

Trees. Leaves opposite, biseriate, exstipulate, simple, entire, coriaceous. Flowers ♀, either 1–3 together at the summits of the branchlets or in terminal corymbs, pedicelled, rather large, actinomorphic. Calyx thickly coriaceous, persistent, gamosepalous; segments 4–8, valvate in bud, acute, often coloured inside; tube of fruiting calyx flat or not. Petals either absent or as many as calyx-segments; in the latter case either broad and wrinkled or very narrow and smooth, alternating with the sepals. Stamens mostly many, sometimes 12, inserted on the calyx, often many-seriate, inflexed in bud; filaments filiform-subulate; anthers medifixed, reniform or oblong, 2-celled; cells opening lengthwise. Ovary superior, sessile with a broad base, during anthesis enclosed by the calyx-base, 4–∞-celled; sepa thin; ovules numerous on thick, axile placentas. Style 1, long, robust; stigma 1, capititate, entire or slightly lobed. Fruit resting on the calyx-tube, either an indehiscent berry or a valvate capsule, many-seeded. Seeds small, exalbuminous.

Dist. Two small genera, one extending from tropical East Africa and adjacent islands to Queensland, Micronesia and Melanesia, the other confined to SE. Asia and Malaysia.

Ecol. Sonneratia are trees of the mangrove and seacoasts generally, Duabanga is a component of the evergreen rainforest belt. The flowers of Sonneratia are ephemeral and expand at sunset; they frequently emit an offensive smell and are conspicuous by a mass of exerted coloured stamens. The pollen is sticky acc. to Van der Pui. For a discussion of the pollination see the notes under S. caseolaris (L.) Engl. On the breathing roots of Sonneratia see under the genus.

Uses. The economic value of Sonneratiaaceae is, on the whole, small. The wood is used for fuel, and for house- and boat-building. Of some spp. the fruit is eaten by the people. From the fruits of Sonneratia pectin can be extracted; see under S. caseolaris (L.) Engl.

Wood anat. Compare next part.

Note. Sonneratiaaceae (Blattiaceae Nie. in E. & P. 3, 7, 1893, 16) are treated here in their strict sense. By various authors they have been merged with the Puniceae, the Lythraceae or the Myrtaceae, often together with Crypteroniaceae.

KEY TO THE GENERA

1. Flowers 1–3 together at the ends of the branchlets. Petals absent or very narrow, smooth. Stamens very many; anthers reniform. Fruit an indehiscent berry. Seeds not tailed at the ends 1. Sonneratia

1. Flowers in 5- to rather many-flowered terminal corymbs. Petals broad, crisped. Stamens 12 or many; anther-cells curved or replicate over one end of the connective. Fruit a 4–8-valvate capsule. Seeds tailed at both ends by the protracted testa . . . . . . . . . . . . . . . 2. Duabanga

1. SONNERATIA


All parts glabrous; trunk surrounded by ‘breathing-roots’ arising vertically from often very long horizontal roots buried at slight depth in the substratum; no buttresses. Flowers 1–3 together at the summits of the ultimate, mostly pendulous branchlets, 4–8-merous. Calyx-tube obconical or cup-shaped, under the ripe fruit either unaltered or flattened; segments ovate-oblong-triangular, often coloured inside. Petals very narrow or quite absent, caducous. Stamens very many, cadu-
Fig. 1. Scheme of root-system in *Sonneratia*: Tr. = trunk, C.r. = cable-roots, Pn. = pneumatophores, N.r. = nutrition-roots, A.r. = anchor-roots. After Troll.

corous; anthers comparatively small, reniform. Disk saucer-shaped. Ovary 10- or more-celled; style sinuous in bud. Fruit an indehiscent *berry*, depressed-globose, crowned by the style-base. Seeds embedded in evil-smelling pulp, not tailed at the ends.

**Distr.** Species 5, along the tropical shores of East Africa and adjacent islands, Asia, Hainan, *Malaysia* and N. Australia, to S. Riu Kiu Islands (Iriomote), Micronesia (Carolines: Ponape, Kusaie, Pelew, Yap, Truk, Palau, Korror), Melanesia (New Ireland, the New Hebrides, Solomon Islands), and New Caledonia. Not in Formosa!

**Ecol.** Inhabitants of coral-terraces (either inundated by flood or not), shallow parts of calm seas, the mangrove and the banks of tidal rivers and creeks.

The structure and functioning of the root-system of *S. caseolaris* has been studied by C. Troll (Ber. D.B.G. 48, 1930, Gen.-Vers. Heft p. (81)–(99); Planta 13, 1931, 311–473; Trop. Natuur 22, 1933, 33–39). He has found that the so-called 'aerophores' are emitted by numerous long horizontal cable-roots and serve to produce fine nutrition roots penetrating horizontally in the uppermost layer of the steadily in-

Fig. 2. *Sonneratia*, old specimen, NE. Java, prostrate stems with oyster colonies (Jeswiet).
creasing (rejuvenated) silt. The aerophores themselves do not serve for respiration; this function belongs to the nutrition roots the production of which follows the deposition of silt layers. These observations are mutatis mutandis valid for all mangrove aerophores or pneumatophores (fig. 1).

Uses. On the whole rather unimportant. The wood of S. alba is locally used for house- and boat-building, elsewhere only as (a rather inferior) fire-wood or not used at all. The young berries which have a sour taste are locally eaten; they are also used as a medicine. See for the extraction of pectin from the fruits under S. caseolaris (L.) Engl.

Notes. There has been, in the past, a considerable confusion both in Malaysian and extra-Malaysian literature about the application of some specific names though two had been accurately described and figured by Rumphius. This has partly been caused by the absence of complete herbarium materials with full field notes, and partly by the presence of two rather rare, ill-recognized spp. One should study the species in situ where they can easily be distinguished both in the flowering and fruiting states. The lack of good materials is to some extent due to the fact that the flowers are nocturnal and short-lived; petals and stamens soon fall out. For a proper identification a collector should note: the colour of the inside of the calyx, of the petals (in buds or young flowers), and the stamens, and the poise of the calyx under adult fruits. The leaf-shape is, generally, less important for specific distinction.

In order to define the proper geographical distribution of the species a revision has been made of the whole genus and type species have been examined. Of the 5 species distinguished, three occur in Malaysia, one extends to the Kra isthmus and one to Lower Burma; these two may be expected to turn up elsewhere in West-Malaysia.

As to literature, pure and applied, no attempt has been made to correct all erroneous records.

**KEY TO THE SPECIES (flowering material)**

1. Petals absent.
2. Stigma large fungiform, 6 mm through. Calyx 4-(exceptionally 6-)merous, 1 1/2-2 cm long (incl. ovary). Leaves narrow.
3. Stigma capitate, ca 3 mm diam. Calyx (5-)6-8-merous, 2 1/2-4 1/2 cm long (incl. ovary).
4. Calyx smooth throughout, not ribbed. Leaves obovate to suborbicular, 7-10 1/2 by 5-9 1/2 cm, rather thickish. Leaf base shortly contracted-decurrent. Nerves thickish, (pro gen.) distinctly prominent on the upper surface.
5. S. griffithii
6. Calyx finely verruculose, tube distinctly ribbed and somewhat contracted at the rim; inner side of the segments strongly tinged red. Leaves broadly ovate or broadly oval to suborbicular, rounded or subcordate at the base, broadly rounded at the top, 4-10 by 3-9 cm. Nerves very thin, not distinctly prominent on the upper surface.

**KEY TO THE SPECIES (fruiting material)**

1. Calyx 4-(exceptionally 6-)merous, ca 2 cm long (incl. ovary). Leaves narrow. Ovary 5-8-celled. Fruit 1 1/2-2 cm diam.
2. Calyx tube and lobes under the ripe fruit flat-expanded, tube at most obscurely ribbed.
3. Leaves obovate to suborbicular, base rounded, shortly contracted into the petiole, apex broadly rounded or emarginate, 7-10 1/2 by 5 1/2-9 1/2 cm. Nerves (pro gen.) distinctly prominent on the upper surface.
4. Leaves elliptic-oblong or oval-obovate, base contracted or cuneate, apex blunt or rounded, 5-13 by 2-5 cm.

(1) The often fugacious petals may be very narrow and inconspicuous, strongly resembling the filaments. They are best observed in mature buds.

Tree, 3–15 m, rarely up to 20 m, with many often very strong breathing-roots and a rather lax crown. Ultimate branchlets drooping, when young obtusely quadrangular, rarely sharply 4-angled, occasionally even narrowly 4-winged; in the latter case the internodes often quadricornate at the apex. Leaves variable in shape, elliptic, oblong or oval to obovate from a contracted or cuneate base, blunt or rounded at the apex, mucronate or not, 5–13 by 2–5 cm; on either side of the rather strong midrib with 8–12 more or less widely patent very thin, often inconspicuous lateral nerves, light green; petiole broad, very short, frequently almost obsolete. Flowerbuds broadly oval, with a rounded or very obtuse apex, less than twice as long as broad. Flowers (5–)6–8-merous. Calyx tube during anthesis shallowly cup-shaped, smooth; tube not or hardly ribbed; segments usually distinctly longer than the tube, inner side greenish- or yellowish-white. Petals linear-lanceolate, dark red, 1¼–2½ cm by ½–3 mm. Filaments 2½–3½ cm long, in their lower part red, in their upper part white. Ovary 16–21-celled. Segments of fruiting calyx subhorizontally spreading. Ripe berry resting on the flattened calyx-tube, green, 3–4 cm high, 5–7½ cm broad.

Distr. Tropical SE. Asia & Ceylon to N. Australia, Solomon Islands, and New Hebrides, in Malaysia: Malay Peninsula, Sumatra (also Simalur & Banka), Java (also Madura), Borneo, Celebes, Philippines, Moluccas (Ambon, Buru), Timor, New Guinea.

Ecol. Less salt parts of mangrove-forests on a deeply muddy soil, never on coral-banks, often along tidal creeks with slow-moving water and ascending these as far as the flood mounts. In anthesis the flowers contain abundant honey. Fl. Jan.–Dec.

BECCARI (Nelle for. di Borno 1902, p. 140, in ann.) makes the following observation:—On ascending the Sarawak one encounters, after passing Kuching, always in great numbers the kauy p’dada, i.e. Sonneratia lanceolata Bl. (in my opinion only a variety of Sonneratia acida), which inhabits not only estuaries but can also grow in localities where the water is occasionally fresh. The leaves of this plant have the power of shifting, during heavy rains, the position of their blades from horizontal (as is usually the case) to vertical. I have observed this fact for the first time not in Borneo, but during my journey to Kendari in Celebes (1874) along the streambed of the river Lepo lepo, where I have also noticed that the flowers of Sonneratia, which, being nocturnal, are closed in the day-time, are visited by honey-eating birds in the evening and the first hours of the morning.' DOCTORS VAN LEEUWEN (Ann. J.B.B. 37, 1927, 26) supposes that the flowers are pollinated by large night-moths. VAN DER PUIJ (Flora 131, 1936, 25–26, f. 16) saw bats drinking the nectar, with which the cupshaped torus is filled. Brass mentions a thickened leaf apex which might point to guttation pores. LANE-POOLE saw in the Gulf of Papua *S. acida* as a resting tree for fireflies gathering in such numbers on certain individual trees that at night the whole tree is lit with a soft greenish glow which is often quite distinctly reflected in the water.' Uses. The young berries, which have a sour taste, are eaten by the people; they wood is used for fuel but as such only when better fire-wood is unavailable. The breathing roots, after having been boiled in water, furnish an inferior substitute for cork.

TH. M. MEIJER, L. DE VOS & J. P. J. SAMWEL described the extraction and properties of pectin extracted from the fruits (De Ingenieur in Ned. Indië 5 (sect. 5), 1940, no 9, p. 5–7, f. 1).
Fig. 3. a. Sonneratia ovata Backer, flowering twig and fruit, b. S. alba J.Sm., fruit, c. S. caseolaris (L.) Engl., fruit, × 2/3.
Vern. Many names the commonest of which are: Pédada, pérépat, pidada, M, bidada, J, bôgên, S, with local variants, bôrémang (Mal. Pen.). Philippines: Pagatapat, palapat, hikau-hikauan (Tag.), ilukabbân, lukabbân (Ibn.), payar (Pang.).

Sonneratia are:

1. Mangium (Fl. caseolaris (L.) F. Muell., 1849; Fl. caseolare L., 1753; Fl. caseolaris Rumph.) a species of Mangium typified, made, first described, typified, etc., by Linné.

2. Amb. (Fl. caseolaris N. H. Br., 1862; Fl. caseolaris L., 1753). Mangium caseolare was first described by Linné in 1753. Mangium caseolare was typified by Linné in 1753. Linné also described and typified Mangium caseolare. Gærtner, when publishing Aubletia caseolare (De Fruct. 1788, 379), in synonymy Mangium caseolare, but from his description and plate (t. 78, 2) it appears that he made, again, no distinction between the two Rumphian plants.

In 1819 Sir J. E. Smith (in Rees Cyclop. xxxii.) disentangled the confusion by segregating and typifying the two species which Rumphius had described. He singled out *S. alba* (based on Mangium caseolare album Rumph.) as a new species. The other part of Rhizophora caseolaris (based on Mangium caseolare rubrum) he identified—as had been done previously by Lamarck (Dict. 1, 1789, 429)—with Sonneratia acida L.f., which he adopted as its proper name as it was amply described and well distinguished.

For the question to which segregate of Rhizophora caseolaris L., which, according to art. 52 of the Rules, to our regret should be preserved and retyped, we have considered that Smith intentionally gave a new name for a part of the type thus having accomplished the retypification himself, leaving the old name of Linné for the rest, that is Mangium caseolare rubrum Rumph. = Rhizophora caseolaris L., p.p.em. (syn. S. acida L.f.). Merrill (Fl. Man. 1912, p. 344 and Interpr. Rumph. Herb. Amb. 1917, p. 383) did the same, though he later reversed his opinion (En. Philip. Fl. Pl. 3, p. 138) but he states to have not seen the original literature.


Small or medium-sized tree, 2-5-20 m high; young branchlets obtusely quadrangular. Leaves broadly oval or ovate to orbicular, rounded or subcordate at the base, broadly rounded at the top, 4-10 by 3-9 cm; lateral nerves several, widely patent, very thin; petiole 2-15 mm. Flowers solitary or 3 together; pedicels 1-2 cm, sometimes none. Buds broadly oval, with a rounded or very obtuse apex, less than twice as long as broad, finely verruculose, in anthesis 2½-3 cm long, tube widely cupular from an abruptly contracted, shortly stipitiform base; ribs decurrent down the stalk-like lower part. Segments usually 6, ovate-triangular, during anthesis as long as the tube or slightly longer, their inner side strongly tinged with red, in fruit appressed to the berry. Petals absent. Filaments white. Ovary 13-15-celled. Ripe berry 3-4½ cm broad, 2½-3½ cm high.

DISTR. Siam (KERR 17875, 14246, 4345, Put. s.n., A. MAREAN 673), in Malaysia: Malay Peninsula (Singapore; Sg. Menyala in Negri Sembilan, CF 571; MAINGAY 654), Riouw Arch. (Stantan in the Anambas Islands, Java (also in Karimondjawa Islands), S. Celebes, Moluccas (Sula Islands), SE. New Guinea (Daru Island). Fig. 5.

ECO. 1. Land-side of tidal forests in the less salt parts on a muddy soil, along tidal creeks, never on coral-reefs. Locally numerous but, on the whole, rather rare. FL. Jan.–Dec.

Vern. Gédobu (Mal. Pen.).


Tree, 3-15-20 m high, with many breathing roots (these, on the whole, less robust than those of *S. caseolaris*) and a broad, rather lax crown. Leaves emarginate, obovate or oval from a cuneate base, broadly rounded at the top, often emarginate, 5-12½ by 3-9 cm, rather thickly coriaceous, on either side of the rather strong midrib with 11-14 widely patent, very thin, sometimes hardly conspicuous lateral nerves; petiole stout, flattened on the anterior side, 3-10 mm. Flowerbuds oblong, narrowed at base and apex, 2-3 times as long as...
broad. Flowers solitary or 3 together, 6–7–(8)–merous. Calyx in flower 3–3 1/2 cm long; tube obconical or campanulate from a contracted base, distinctly angular, angles as many as segments and alternating with them; segments ovate-oblong, usually conspicuously shorter than the rest of the calyx, 1 1/2–2 cm long, segments outside green, inside red, during anthesis more or less erect, under the ripe berry entirely reflexed. Petals in young flowers always present but very inconspicuous, strikingly resembling the filaments, 13–20 by 1 1/2–1 1/4 mm, white or in the lower half more or less tinged with red. Filaments white. Ovary 14–18-celled. Tube of fruiting calyx conspicuously obconical-turbinate, 1 1/2–2 cm high. Ripe berry ± 3 cm high, ± 4 cm broad.

Distr. N. Madagascar, Seychelles and trop. E. Africa, SE. continental Asia and Andamans to N. Australia, S. Riu Kiu Islands (Iriomote), Micronesia (Pelew), Solomon Islands, the New Hebrides and N. Caledonia, in Malaysia: Malay Peninsula, Sumatra (also Enggano & Banka Islands), Java (also coral-islands in and before the Bay of Dja-karta, Bawean, Madura & Kangean Islands), Lesser Sunda Islands (Bali), Borneo (also Pulu Laut), Celebes (also Saleier & Muna Islands), Philippines, Moluccas, New Guinea & New Ireland.

Ecol. Shallow parts of calm seas, seashores, along the mouth of tidal creeks. Prefers salt water and grows as well on a sandy or rocky as on a muddy soil, not rarely on coral-terraces. Often gregarious and predominating, but usually not forming a dense growth, except sometimes where better fuel-trees have been destroyed. In closed forest the clear bole may attain 15 m.

Uses. In the Minahasa (NE. Celebes) the wood is valued for ship- and house-building (under the roof), Elsewhere it is only used as fire-wood or not used at all.

Vern. Names as those of S. caseolaris. Moreover: Posi-posi (Ternate). Philippines: pagatpát (general); bunyvan (C. Bis.), buňgalan (P. Bis.), palalåan, pirara, pêdada (Mag.), dahûn-lâlâk, palâ-pât, polasâpât, polatâ, palâpât (Tag.), patâpât (Mbo).

Notes. The fragment of the type of S. mossambicensis at Kew is insufficient for critical examination; as well as all other African sheets from Somaliland, Zanzibar (Greenway 1355), Pendamb and Mafia Islands, Tanga Bay, Luabo River at Zambesi mouth (Kirk), the Seychelles (Aldabra group), and N. Madagascar (Baron 6631, 6733, Nossi-bé, J. M. Hildebrandt 3133) between 1st and 19° SL belong to S. alba J.Sm.

S. alba appears to be the most widely distributed species both towards Africa and the West Pacific.


Medium-sized tree up to 12 m; twigs pendulous. Leaves sparse, 5 1/2–13 by 1 1/2–3 1/4 cm, gradually tapering towards the apex, attenuate at the base; nerves and veins indistinct; petiole 1/2–2 cm. Inflorescence mostly 3-flowered. Buds oblong, 1/2 cm long, Calyx (incl. tube and lobes) in flower ± 1/2–2 cm long, smooth, not ribbed; segments twice as long as the tube. Ovary 5–8-celled, nearly free from the calyx. Stigmas in bud roofing over the androecium, but little protruding above it, during anthesis flattening and broadening, up to 7 mm diam., papillose, persistent. Fruit pale, broader than high, broadly globose; walls not thickened, 12–18 mm high, ± 2½ cm diam. Calyx tube flat (as in S. caseolaris), lobes under the ripe fruit apparently horizontally expanded or subreflexed.

Distr. India (Sunderbuns, the Deccan as far as the Concan, Madras, Bombay, Orissa, Transgangetic Peninsula to Chittagong, Pegu, and Moulmein), and Ceylon, to be expected in the Malay Peninsula and elsewhere in West Malaysia.

Ecol. A well-characterized species, on the whole much less common than S. alba and S. caseolaris. In a specimen all stigmas were covered by adhering quartz sand which suggests that they are sticky.

Note. The only ovary available to us was 5-locular. The only specimen cited by TRIMEN (Handb. Fl. Ceyl. 2, 1894, 230) from Kotiyar possesses 6 sepals and may be distinguished as f. hexasepala, f. nov. (TRIMEN, Aug. 1885).


Tree, 5–20 m tall, up to 1 m diam. Leaves obvolute to suborbicular, base rounded, shortly contracted into a short petiole, apex broadly rounded to sub-elliptic, texture rather thickish, nerves 10–12, (pro gen.) distinct, strongest, distinctly prominent on the upper surface, obliquely ascending; blade 7–10½ by 5½–9 cm. Mature bud 2½–3 cm long. Flowers greenish-white (PARKER). Calyx entire, smooth and not ribbed, tube rather wide-campanulate from a suddenly contracted base. Lobes 6–7, in fruit together with the tube horizontally expanded, not enveloping the base of the fruit, 6½ cm diam., thick. Fruit 2½–3 cm high, 4½–5½ cm diam., hard, many-celled, apex very broadly rounded; style apparently less persistent than in S. caseolaris (= acida). Type: GRIFFITH 2433.
Fig. 4. Sonneratia griffithii Kurz. a. Twig (LACE 2966), ×\(\frac{2}{3}\), b. opened bud (KERMONE 7136), nat. size, c. ditto (KERR 16548), nat. size, d. flower beyond anthesis (KERR 16548), nat. size, e. ripe fruit, lateral (KERR 14246), nat. size, f. ditto, basal (LACE 2966), ×\(\frac{2}{3}\).
Flora (1849) F.; Flowers pointed 288 frequent celled, but Fig. ker, 7136), Tijd. 52, 14246, em. (1923) KooRD. 1.

Ecol. Said to be common in mangrove swamps, but it is scarce in herbaria, of which the above is a complete enumeration; LACE says: 'in places frequent on banks of streams, sends up many sharp-pointed aerophores'; KURZ defines its occurrence: 'common in littoral forests from Pegu down to Tenasserim, ascending the rivers as far as they are brackish'. Fl. Jan. (Siam), fr. Jan. (Siam), March (Burma), April (Bengal).

Note. Allied to, but distinctly differing from S. caseolaris (L.) ENGL.; by several authors confused with other species.

2. DUABANGA


Buttressed tall trees with pendulous ultimate branches. Leaves glaucous beneath. Flowers in terminal, 5- to many-flowered corymbs, 4–8-merous. Calyx-tube obconical or cup-shaped, segments triangular-ovate. Petals shortly clawed, broad, crisped. Stamens 12 or many, filaments long, filiform-subulate from a broadened base; anther recurved or replicate over one end of the connective. Ovary 4–8-celled, stigma thick, lobed. Capsule loculicidally 4–8-valved. Seeds tailed at both ends by the produced testa.

Distr. Species two, SE. Asia and Malaysia (as far E as New Guinea). Fig. 6.

Ecol. Evergreen forests.

Uses. Wood used for house- and boat-building.

KEY TO THE SPECIES

1. Flowers and fruit 4-merous. Calyx-tube obconical. Stamens 12. Anther-cells narrowly hairpin-shaped; extrorse arm of hairpin about half as long as introrse arm, closely applied to it and adnate to it.

2. Flowers and fruit 5-8-merous. Calyx-tube widely cup-shaped. Stamens more than 50, biseriate. Anther-cells recurved but not narrowly hairpin-shaped; extrorse arm of curve much less than half as long as introrse arm, not closely applied to it and not adnate to it.


Tree, 25–35 m, sometimes up to 45 m, 0,70–1,00 m thick; trunk columnar, unbudded. Very young branchlets and both surfaces of very young leaves rather densely clothed with appressed short thickish brown hairs, very soon glabrescent; young branchlets obusely quadrangular, becoming terete with age. Leaves ovate, oblong or lanceolate from a shallowly cordate base, acuminate, firmly coriaceous, on either side of the (on the lower surface) much prominent costa with numerous widely patent arcuate lateral nerves inarching near the margin and forming there a strong intramarginal nerve, darkgreen above, paler beneath, 7–30 by 4–12 cm; petiole 4–8 mm. Corymbs few- to rather many-flowered, 4–15 cm across, dense or rather lax, at first finely pubescent, afterwards glabrous. Pedicels thick, 1–1 1/2 cm (in bud 1 1/2 cm, in fruit to 3 1/2 cm). Buds ovoid-oval, shortly acuminate, with 4 longitudinal ribs (formed by the contiguous margins of the sepals). Flowers inodorous? Calyx when fully expanded during anthesis ± 2 1/2 cm diam., afterwards slightly enlarged; segments shortly acuminate, acute, under fruit patent or reflexed. Petals caducous, shortly clawed, oval, yellowish, about as long as sepals. Stamens 1-seriate, on a narrow circular rim; filaments with a broadly linear lower half and a filiform-subulate upper half; anthers at first yellow, afterwards brown. Style pale green; stigma dark green or red. Capsule ovoid-oblong, 2 1/2–3 cm long, 4-valved.
Seeds $\approx$, 5–6 mm long (2–2½ mm long tails included); nucleus $\pm$ 1 mm.

Distr. Malaysia: Java (only easternmost part), Lesser Sunda Islands (Bali, Lombok, Sumbawa), Borneo, Celebes, Talaud, Philippines, Moluccas (Halmahera, Ternate, Batjan, Ambon, Ceram), New Guinea. Fig. 6.

Ecol. Evergreen forests, 60–1200 m, in NW. Sumbawa observed to predominate in majestic trees on the slope of Mt Tambora, possibly also occupying this position in E. Flores.

Uses. Wood used for house- and boat-building.

Vern. In Java: Takir, J, takêr, Md; in Bali: kadijimas; in Lombok: radjumas; in Talaud: waroh. Further several local names. Philippines: Adha, adka, karawan, lutub (Bik.), agas, banabang-bug-tong, buiwang, bultang, lokot, loko-tok, lokotn, luktub, malapalipikpik (Tag.), arik, kadig (Ibn.), bukag, kadil, kador (Iik.), buyukan (God.), dahâ (Mbo, P. Bis.), dâpul (Ting.), hoi (Bon.), ilolo (P. Bis.), kaudio, karig (Neg.), lamad (Mag., Bag.), lutub (Sul.).


Tree, 18–30 m, scarcely buttressed, glabrous in all its parts; branches drooping, young branchlets obtusely quadrangular. Leaves ovate-oblong from a broad, cordate or rounded base, shortly acuminate, on both sides of the (on the lower surface much prominent costa with numerous widely patent arcuate lateral nerves, glaucous beneath, 10–30 by 5–10 cm; petiole robust, 3–8 mm; flush reddish pink. Corybms drooping, rather many-flowered, $\pm$ 15 cm across, rather lax. Pedicels robust, 3–4 cm. Calyx-tube widely cup-shaped, segments ovate, acute, 2½–3½ cm. Petals slightly clawed, with an oval, rounded crisped blade, white, 2½–3½ by 1½–2½ cm. Stamens upwards of 50; filaments filiform from a slightly broadened base, white; anthers very mobile, curved but not narrowly hairpin-shaped. Free top of ovary broadly conical; stigma slightly lobed, darkgreen. Capsule subglobose, green, eventually turning brown and splitting with 5–7 longitudinal clefts.

Distr. From the S. slopes of the E. Himalaya (Sikkim) to Assam, Burma, Siam, Yunnan, Laos, Kambodja, Cochinchina, Annam, Tonkin, and Andamans, extending to Malaysia: Malay Peninsula (as far as Negri Sembilan). The areas of this and the preceding species do not touch, much less overlap. Statements to the contrary are either entirely wrong or must be based on cultivated specimens. Fig 6.

ECOL. RIDLEY (Disp. 1930, p. 119) says: 'It is an inhabitant of forests in the Malay Peninsula, where it is widely scattered, but not common. The trees are sporadic, at some considerable distance from each other. It appears to prefer loose open soil, which is not to be found in a large quantity in dense tropical forests; but the very numerous, minute seeds blown across the jungle may here and there find a suitable spot for growth, and so carry on the spread of the plant, though in these forests the greater number of seeds must perish for want of a suitable growing spot.' According to CORNER, I.e. one of the characteristic trees of all the passes of the Main Range in the Mal. Peninsula from G. Angsi to Kroh.

Uses. Wood used for tea-boxes and for house- and boat-building. Malays eat the very acid fruits (BURK. I.C.).

Vern. Malay Peninsula: Pedada, p. bukit, p. darat, kedada, kedada bukit, berembang bukit, b. darat, bermah (Kroh), berombong bukit. As bukit means hill or mountain, the Malays apparently observe acutely the affinity of Sonneratia and Duabanga as pedada is the universally used name for the former, and the names can thus be translated: inland-Sonneratia.

Notes. The flowers emit an offensive smell.

Excluded

DIPSACACEAE¹ (C. G. G. J. van Steenis, Leyden)

I. TRIPLOSTEGIA

Wall. in DC. Prod. 4 (1830) 642; in DC. Coll. Mém. 7, Valér. (1832) 19, t. 5.—

Hoeckia ENGL. & GRAEBN. Bot. Jahrb. 29 (1901) 598.—Fig. 1.

Erect, perennial herbs; rootstock horizontal; stem-base (? always) provided with 2 elongated, spindle-shaped, subterranean tubers. Leaves decussate, dentate to pinnatifid, exstipulate, mostly crowded into a basal pseudo-rosette, cauline ones distant, gradually reduced; base decurrent into the petiole; petioles clasping the stem. Panicle terminal, bracteate, branches decussate, forked, cymose, outermost in triads; rachis and branches distinct from the stem by the presence of capitate-glandular hairs. Flowers ♀, articulated on a short pedicel, 5-merous, subactinomorphic. Base of the pedicel sustained by 2 narrow, ciliate, 1-nerved bracts ending in a thickened (? glandular), blunt nerve-tip. Ovary surrounded by 4 conspicuously capitate-glandular, persistent bracts connate at their extreme base and cuspidulate (in fruit hooked) at their apex (outer epicalyx) and a tubular, 8-ribbed, utricle-shaped, persistent inner epicalyx with a slight constriction at its apex below a minute, crenulate or toothed limb. Calyx minute, epigynous, 5-lobed. Corolla epigynous, gamophyllous, white, pink or red, caducous; tube funnel-shaped; lobes 5, equal, rounded, erect, imbricate in bud. Stamens 4, equal, alternating with the lobes; filaments free towards the apex of the tube; anthers intrors, dorsifixed. Style 1, terete, stigma capitate. Ovary 1-celled, narrow. Ovule 1, pendulous from the apex of the cell to halfway the ovary. Fruit 1-seeded, thin-walled, surrounded by the inner epicalyx, and this in turn by the hardened, 4-lobed, capitate-glandular outer epicalyx, the tips of which are hooked; fruit with epicalyces breaking off from the top of the pedicel as a diaspore. Seed oblong, subterete, acutish towards both ends, smooth but for two faint, longitudinal ridges; albumen plentiful; embryo scarcely shorter than the seed.

Distr. Two spp., from the Sikkim-Himalaya, S. China and Formosa, to E. Malaysia.

EcoI. A decidedly microtherm genus with a most peculiar, apparently undescribed, 'double' adaptation for epizooic dissemination by the (probably sticky) glandular-capitate mucor-like hairs and the hooked tips of the lobes of the outer epicalyx which embrace the fruit and fall off with it from the articulation at the apex of the pedicel. The comparison I made formerly between distribution and dispersal methods in Valeriana and Triplostegia (cf. Bull. J.B.B. III, 13, p. 257, 403-404) loses much of its value by the detection of the above-described dispersal mechanism. 'Hoeckia' was reported to smell of valerianic acid.

Anat. Acc. to Gagnepain (Bull. Soc. Bot. Fr. 47, 1900, 333) the pollen resembles that of Scabiosa.

Notes. Dipsacaceae contain about 10 genera, all native to Europe and Asia, with some outliers in N. Africa & Ceylon; Triplostegia in Celebes and N. Guinea represents the single record on the S. hemisphere. The Dipsacaceae are undoubtedly allied to the Valerianaceae, which are distinct by their typically 3-celled ovary and absence of an epicalyx. Englär & Graebner in describing the genus Hoeckia from China, assumed to have found a missing link between the two families in ascribing to Hoeckia a single epicalyx and a 3-celled ovary with 2 abortive cells. However, they clearly erred in the interpretation of the floral parts of Hoeckia and mistook the inner ribbed epicalyx for the pericarp. There is no doubt that Hoeckia is a true Triplostegia; it is clearly identical with T. glandulifera Wall., which I find confirmed by Handel-Mazzetti (Symb. Sin. 7, 4, 1936, 1055).

Leaf-size and shape are, in Triplostegia, very variable and not fit for specific distinction. There is, also, variation in the subterranean parts dependent on habitat.

Three Triplostegias have been erratically described by Léveillé (Bull. Géogr. Bot. 24, 1914, 282; ibid. 25, 1915, 13) which do not belong to the Dipsacaceae. According to the types kindly put at my disposal by Sir William Wright Smith they represent:


(1) According to Bakhuizen van den Brink Jr (in Backer, Bekh. Fl. Java, em. ed. 8, 1949, fam. 177, p. 1) Scabiosa atropurpurea L., an annual from the E. Mediterranean, is sometimes cultivated as an ornamental in gardens in the mountains of Java.
T. mairei Lév. = Chrysosplenium heuryi Franch.
T. pinifolia Lév. = Sedum asiaticum DC.


Fragile, 5–15 cm long, erect, mostly with a distinct rosette at the base of the stem or higher on the stem, above a creeping branched rootstock. Cauline leaves reduced, 1–2 pairs. Leaves spathulate to obovate-oblongate, coarsely dentate or sub-pinnatifid in the upper portion, basal part entire, tapering into a distinct or indistinct petiole, 1–3 cm long, upper surface puberulous towards the margins, lower surface with scattered hairs on midrib and nerves. Inflorescence few-flowered and congested, stalks expanding in fruit. Bracts linear-spathulate, puberulous, margins ciliate, 2½–3 mm. Flowers white. Pedicels very short, in fruit to 1 mm. Lobes of outer epicalyx narrow-triangular, short-pubescent and capitate-glandular, 1½–1⅓ mm, the acute tip mucronate, hardening and hooked in fruit, slightly exceeding the calyx. Inner epicalyx pubescent on the ribs, 1½ mm long; limb consisting of 8 minute triangular teeth. Calyx cup-shaped, ± ⅓ mm long, 5-lobed halfway down, lobes broadly triangular acute. Corolla 3–4 mm long, tube funnel-shaped, twice as long as the broadly elliptic, rounded, obliquely erect lobes; one vein in each lobe. Filaments erect, inserted just below the incisions, ⅛ mm long; anthers exerting from the tube. Style 2 mm long, straight; stigma capitulate.

Distr. NW. India, Sikkim, Yunnan, E. Tibet, Szechuan, and Formosa, in Malaysia: Central Celebes (summit of Mt Kambungo) and New Guinea, 2000–3300 m, expected to occur also in Luzon and Ceram.

Ecol. Fl. March–August.

Notes. From a mixture of some mountain herbs collected by the late Dr P. J. Eyma in Central Celebes, 1937, I segregated one tiny, unintentionally collected specimen, which I assumed to be identical with the New Guinean specimens on the strength of the original, inadequate description and a crude drawing of the type I had made at Kew in

Fig. 1. Triplostegia glandulifera Wall. a. Habit (of type of T. repens Hemsl.), b. schematic section of a flower (after Höck, 1891), c. flower without corolla, on pedicel with two bracts (from type of T. repens), d. diaspore (Wilson 3776), e. habit of fresh New Guinean material (Brass 9208), f. section of outer epicalyx in fruit (Wilson 3776), g–h. seed (from ditto). (a & e nat. size, others enlarged).
1934. This remarkable find, forming a transition station between Formosa and New Guinea, was, unfortunately, apparently lost after the war.

I can find no adequate specific characters for distinguishing the Papuan specimens from the continental Asiatic ones. They are all dwarf, but dwarf specimens are also known from Yunnan. The Asiatic specimens attain mostly a length of 20–50 cm. According to Merrill & Perry the substratum is to be held responsible for the place on the stem (rootstock) where the basal rosette develops.

The closely allied *T. grandiflora* Gagn. (*syn. T. delavayi* Franch. ex Diels), from Yunnan, can easily be distinguished by a tubular, 7–10 mm long corolla.
Dioscoreaceae (I. H. Burkhill, Leatherhead, Surrey)

Rhizomes (rarely spiny) producing annual, mostly twining shoots, in Malaysia twining either to the right (fig. 4c) or the left (fig. 4a). Stems consisting of a main stem and sterile branches, both bearing leafless flowering axes. Leaves petiolate, generally cordate, simple and entire or palmately lobed, or palmately compound, except in the latter triplinerved; apex generally glandular, developed before the blade (forerunner tip); blade usually glandular on the lower side chiefly towards the base. Flowers hermaphrodite or dioecious, ♀ with staminodes, ♂ without even a rudimentary ovary, actinomorphic, 3-merous, mostly inconspicuous and greenish, ♂ often massed together and scented. Tepals in two whorls of 3. Stamens in 2 whorls of 3, the inner sometimes sterile; anthers usually introrse. Torus an urceolate, perianthoid chamber in Stenomeris, a saucer or cup in many spp. of Dioscorea, fleshy in Dioscorea § Enantiophyllum, in some spp. enlarged into a cone making the stamens appear to be connate. Style 1 with 3 bifid stigmas. Ovary 3-locular, inferior, sometimes separated from the perianth by a constriction. Ovules 2 in each cell or ∞ (in Stenomeris), anatropous. Fruit a capsule, but it breaks up rather than dehiscs in Trichopus. Seeds winged or wingless (in Trichopus); endosperm horny, embryo in a marginal pocket.

Distr. Ca 9 genera and about 600 spp. (Dioscorea large, the other genera small or monotypic). Pantropic with considerable extensions into temperate regions. The Stenomerideae and Trichopodeae are restricted to the warm humid regions where Nepenthes grows and their geologic history must have been that of Nepenthes: they may be regarded as the survivors of the hermaphrodite ancestry of the Dioscoreeae.

Ecol. The base of the stem is modified for storage of food and water in various ways by conversion into a thickened rhizome or a swollen vertical body of fixed position in the soil or most commonly into a short cormous body with tuberous outgrowths of annual duration. The storage organs are protected against herbivorous animals either by the overlying soil or by poisonous substances, or in a few species by a corky covering, or in a very few species by thorny roots.

The annual stems do not twine from their base, but commence to twine at a little distance above the soil, and do so consistently either to the right (fig. 4c) or to the left (fig. 4a). Departure from this rule has been observed in none but a single African species; and there are dwarf species among which is Trichopus zeylanicus (see p. 297) which do not attain sufficient height for twining. The direction of twining is an important taxonomic character.

The cauline axes are differentiated above ground in various degrees of completeness into (i) the main stem, (ii) branches arising from it, inded with fertility, not themselves carrying flowers, but carrying (iii) leafless axils which bear the flowers. Flowering commences as a rule well above the commencement of twining, and at the level where it begins, there is usually a diminution in the size of the leaf blades such as causes the leaves most useful taxonomically to be immediately below the horizon at which the flowers commence.

The corollation of the leaf characteristic of the family is completed in the last stages of its enlargement; and leaves that are hindered, say, by want of building material, from growing to their maximum, such leaves as occur towards the distal ends of stems, are less cordate than more favoured leaves. The leaves of seedlings at an age when the plants are few-leaved, are much larger at the base than leaves borne later in association with flowers (fig. 10).

The flowers are entomophilous. In the hermaphrodite flowers of the Stenomerideae and Trichopodeae there are elaborate arrangements to secure cross-fertilization which is inevitable in the dioecious Dioscoreeae.

Sometimes 3 of the stamens, invariably the inner 3, are staminodial, and they are then as a rule modified, compelling visiting insects to move in such a way as to pick up pollen. The flowers are inconspicuous except in the Madagascan genus Avea (Trichopodeae), and of moderate

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(1) This treatment of the Dioscoreaceae, more profuse than the general plan of this Flora, is justified by their economic importance, and above all by their difficulty. The specific delimitation accepted here is narrower than that adopted by some other authors; the present writer based his views on an exceptionally extensive and detailed knowledge of Malaysian Dioscoreaceae during many years of study of fresh materials. The separation of the sexes demands keys for each sex and such have been provided where the material made this possible; keys based entirely on vegetative characters proved to be ineffective.—Ed.
size but inconspicuous coloration in *Stenomeris*; or in *Dioscorea* they are green and small or very small; but they are often scented and the male flowers are massed together.

There is a greater abundance of male plants and a much greater abundance of flowers on male plants.\(^1\)

The outer tepals usually are a little larger than the inner ones and cover them in the bud. Among the *Dioscoreaceae* of Malaysia, sterilization of stamens in the flowers is found in none but species of sect. *Laophyton*; sterilization occurs in two other Malaysian sections but not in species found in Malaysia.

The cells of the ovary enlarge so as to provide in advance space for the wings on the seeds which remain small until just before ripeness. The position of the ovules on the placenta, whether near the apex or the base or at the middle is bound up with the direction in which the wings grow. The act of pollination induces growth under the capsule and this growth is used through geotropism to determine the poise of the capsule.

**Anat.** There is a tendency throughout the family to have longitudinal ridges on the stems; sometimes they are inconspicuous, sometimes raised into ridges or wings, and they invariably overlie the vascular bundles that descend from the petiole; their number in each internode depends on the arrangement of the leaves.

Anatomical studies enabled Queva to state (Mém. Soc. Sc. Lille IV, 20, 1894, 42) that *Stenomeris* and *Trichopus* agree with *Dioscorea* in internal structure. Fig. 6 shows the shape of the epidermal hairs; they possess a taxonomic value and so also does the nature of the glandular fore-runner tip (see Orr, Notes R. Bot. Gard. Edinburgh 14 no 68, 1923, and 15 no 73, 1926).

Glands are of two kinds (i) spherical or lenticular superficial groups of cells, chiefly on the backs of the laminae but also on stems and petioles, and (ii) larger, often lobed, agglomerations of excretive cells with a pore to the surface. Orr found no case of the two occurring in association in any of the species which he was able to examine.

**Notes.** There is controversy about the rank of *Stenomerideae* and *Trichopodeae*: should they be raised to the rank of families, *Stenomeridaeae* and *Trichopodidaeae*, as Hutchinson suggests (Fam. Fl. Pl. 1934, 141), or retained as tribes? The latter is preferable because the former obscures the epigenesis of the *Dioscoreae*. The botanists who first examined *Stenomeris* and *Trichopus* were puzzled by them. Gaertner (1788) saw a resemblance of *Trichopus* to *Commelina*: Lindley (1832) referred it to *Artisloe-chiaeae*, seeing a similarity between it and *Asarum*; but Klotzsch (1859) suggested *Dioscoreaceae*.

Planchon (1852) put *Stenomeris* into the *Burmanniaceae* because the flower is similar in shape to the only *Thismia* then known. Beccari brought it (1870) into the *Dioscoreaceae* and agreed with Klotzsch as to the position of *Trichopus*.

Today the genera are well established; but much information is needed before the interrelations of the sections of *Dioscorea* are understood. The sequence adopted here, namely *Stenomeris*—*Trichopus*—*Dioscorea* commencing with the section *Stenophora*, is employed as epigenetic: hermaphroditism is held to have preceeded dioecism; unlimited seed production to have been the rule before limitation to six ovules in an ovary and enlargement of the base of the stem into a rhizome to have existed before the development of the compound tuber-bearing corm. In this sequence the units in which the forerunner tip is little developed find an early place and so also do those that do not have complex hairs. In the present treatment our monograph of *Dioscorea* (cf. Ann. R. Bot. Gard. Calc. 14, 1936 & 1938) is mostly followed.

**KEY TO THE GENERA**

1. Flowers hermaphrodite.

2. Fruit a capsule with numerous winged seeds. Torus developed into a perianthoid chamber, wherein the sexual organs are completely enclosed (*Stenomerideae*) .......................... 1. *Stenomeris*

2. Fruit breaking up rather than dehiscing. Ovules 2 in each cell. Seeds wingless. Torus flat (*Trichopodeae*).

3. Sexes in separate plants. Fruit a capsule with winged seeds in each cell (*Dioscoreae*) ........................ 3. *Dioscorea*

**1. STENOMERIS**


Underground a short rhizome. Stem tough, unarmed, twining to the left, with loosely paniculate flowering branches. *Leaves* entire, cordate at their largest, but distally gradually losing their auricles until the base of the lamina is obtuse or even acute, herbaceous, drying, as does the whole plant, a dark brownish purple. *Flowers* hermaphrodite; torus developed into a perianthoid urceolate chamber which en-

closes entirely the sexual organs and carries marginally the 6 tepals. *Stamens* 6, inserted just within the mouth of the chamber by rather stout, flattened, deflexed filaments which bring the anthers parallel to the chamber wall with their introrse anther-cells dehiscing towards the wall; beyond the anther-cells the connective is prolonged as a slender process which reaching the apex of the columnar style may adhere there and seems usually to do so, but the manner is not yet known.1 Style rising into the perianthoid chamber from the base, columnar, ending in three bifid stigmas. *Ovary* widening upwards to make the floor of the chamber, 3-locular with numerous ovules. *Fruit* a triangular capsule, dehiscent along its whole length at the angles. Seeds developing a wing forwards and outwards, the body of the seed flat, triangular, and widened from its insertion to its wing.


Ecol. Ever wet, humid, lowland forests.

Note. Taubert's sections *Hematanthera* and *Mystranthera* appear untenable, cf. discussion under *Dioscoreafofolia*.

**KEY TO THE SPECIES**

1. Panicle long and directed downwards, the flowers on it more or less facing earthwards. Tepals 6–15 mm long, slender above the base

2. 1. *Dioscoreafofolia*  
3. 2. *S. borneensis*


Underground parts unknown. Plant glabrous, though perhaps with a minute scurfiness about the inflorescences. Stem smooth. Leaves that are below the horizon of flowering large, even to 21 by 19 cm, exactly coriaceous save for their acumination, and when of this size 13-nerved from the base; petiole about half as long as the blade with the lower pulvinus occasionally much elongated (as in fig. 1); (though such a pulvinus is not prehensile it aids climbing by preventing slipping from supports). Fertile branches sometimes of great length, arching out from the axil and then pendent, sometimes bearing a few small assimilating leaves. Flowers cymosely arranged, mostly facing earthwards; pedicels as long as, or longer than the flowers, thin or even capillary. Many flowers are open at the same time, and anthesis is deliberate. Tepals during anthesis gradually recurving; tube 3–7 mm deep, persisting in a disorganized state to fruit-ripening; lobes 6–15 mm long, if more than 10 mm long and associated with a tube 4 mm long (or longer: var. *megalanthera* Burk. n. var.), tube slightly contracted at the mouth; lobes growing a little during anthesis, narrowed rapidly at the base by ceasing growth from above downwards. *Stamens* as described above. *Ovary* with 9 ridges, 1–2 mm long. *Capsule* at ripeness to 35 cm long or longer, with perhaps 100 seeds, pendent but not always straight, dehiscing along its whole length. Seeds to 7–9 mm long widening evenly from the attachment to 2–3 mm in width and with 6–7 broken lines on each face, included the wings to 2½ cm long, the wings to 1 cm in width, so placed in the capsule that one seed scarcely overlaps another.

Distr. *Malaysia*: Philippines (fig. 3c).

Ecol. *S. Dioscoreafofolia* occurs only in the most evenly humid parts of the Philippines, which parts are towards the eastern ocean; it grows near streams at low elevations. The progress of anthesis is indicated here by the three drawings fig. Id–f. Because in anthesis the tepals progressively move away from their early upright position Taubert's use of their position to define his *S. wallissii* cannot be justified, nor Beccari's in defining *S. cuminigiana*.

The blades are poised, as is general in the family, with the acumination pointing downwards. Fl. May & June, Dec. & Jan.

Notes. It is desirable to justify the reduction of *S. cuminigiana*. Beccari had but two specimens when he assigned the one to *Dioscoreafofolia* and the other to *S. cuminigiana*, consequently the variability of the flower was hidden from him: one of the two was an isotype of *Dioscoreafofolia*, the other a unique no 1739 which the writer has seen but owing to the paucity of the material he is obliged to accept the internal structure of its flower from Beccari without verification. Beccari enumerated four differentiating characters: he stated that (i) the prolongations of the connective which unite with the style in *Dioscoreafofolia*, fail to do so in *S. cuminigiana*; (ii) the leaves are 7–9-

1 BECCARI suggested, that there is a nectary at the apex.
Fig. 1. Stenomeris. — a. Rhizome, × 2½. — St. dioscoreifolia Planch.: b. inflorescence of var. megalanthera Burk., × 4½, c. infructescence with part of valve removed to expose seeds, × 2½, d-f. three stages in the anthesis of var. megalanthera Burk., × 2, g-h. flowers as of the type, × 2, i. vertical section through flower showing downwardly bent stamens and their prolongations which reach the style, × 2, j. a stamen from the face turned downwards the chamber wall, k. seeds, × 2.— St. borneensis Oliv.: l. flower from type specimen showing its blunt tepals, × 2, m. flower from isotype of St. mindanaensis Knuth, × 2.
nerved and gradually acuminate in the first but 13-nerved and abruptly acuminate in the second; (iii) the throat which is ‘constricted and strengthened by a somewhat outstanding ring’ in the first is ‘scarcely constricted’ in the second, and (iv) the perianth lobes which are erect and then recurved in the first, are ‘erect to spreading and bent inwards at the apex’ in the second.

Material now available shows that characters ii, iii, and iv make an unbroken series throughout, then, as to the first character, seeing that the adhesion is a secondary phenomenon in the development of the flower, failure to achieve adhesion would seem to be merely an accident. On reducing S. cumingiana Taubert’s sections of the genus, Nematanthera and Mystranthera fall. Cumming preserved two inflorescences, one only 4 cm long, the other 10 cm, apparently belonging to a plant of weak growth.

2. S. borneensis Oliv. in Hook. l.c. Pl. 4 (1894) t. 2328; Ridley. Mat. Fl. Mal. Pen. 2 (1907) 85; Ridley & Winkler, Bot. Jahrb. 44 (1910) 529; Merr. En. Born. (1921) 119; Ridley. Fl. Mal. Pen. 4 (1924) 313; R. Knuth, Pfl. R. 87 (1924) 328.—S. mindanaensis R. Knuth, l.c.—Fig. 1 i–m.

Underground a short horizontal rhizome with an uneven surface, scars of a few more or less amplescual scale-leaves and white flesh. Plant glabrous except for a minute scurf on the inflorescences. Stems climbing to 5 m, faintly ridged at the base where they are 2–3 mm in diam.: ridges 3 from each leaf-base. A few scale-leaves are produced before the first assimilating leaves. Lower leaves to 25 by 18 cm, the largest 11-nerved, in appearance exactly as those of S. dioeciofolia. Panicles smaller than in that species but otherwise similar. Flowers with shorter and broader perianth lobes; the lobes usually to 4 mm in length, rounded at the apex in specimens from Borneo, bluntly pointed in specimens from Mindanao (var. mindanaensis R. Knuth); the rest of the flower as in S. dioeciofolia, capsule perhaps shorter.


2. TRICHOPUS


Glabrous, preserving through life the habit of the first-year seedling of Dioscorea, which lies in the arrest of the second leaf of a stem to the advantage of the first. In the surface soil a rather dry, 1–4 cm long rhizome with occasional branching, ascending slightly at the apex and dying behind, losing its scale-like leaves before death, coated with chaffy very acute scale-leaves up to 5 mm long. Stems 5–7(–20), erect or ascending, to 12 cm below the solitary leaf, with c. 7 low ridges. Fertile branch with dichotous scale-leaves similar to those on the rhizome but shorter, with flower buds in their axils, the whole looking like a spikelet of Brumus. Flowers extruded from between the protecting scale-leaves one at a time until 1 or 2 are pollinated whereupon those following are arrested. Leaf (in Malaysia) always cordate-sagittate, 10 by 4 cm, primary nerves 5–7, 3 reaching the blunt apex, the outer being in the margin. Blade shortly acuminate below the apex; margin undulate; petiole usurping the line of the stem by pushing the fertile branch to one side, vertical (in Malaysia). Pedicels to 7 cm long, nodding, dull purple with a greenish colour towards the base. Tepals (in Malaysia) to 1 cm long. Stamina 6, anthers raised on short zigzag filaments widening into broad connectives with the anthers edge to edge and making a roof over a chamber into which pollinating insects should enter; beyond the anthers the filament is prolonged into a process which projects forwards between the stigmas. Style stout. Fruit 3-winged, wings thick instead of flat as in Dioscorea, to 13 by 6 mm, somewhat trapezoid by reason of the way in which they narrow towards the apex and the base of the fruit, broadest
Fig. 2. *Trichopus zeylanicus* Gaertn. ssp. *travancoricus* (Bedd.) Burk. a. fruiting plant, × 3/3, b. rhizome branching (near arrow), × 3/3, c. two inflorescences, × 7, d. flower showing its poise, × 2, e. outer tepal, × 2, f. stamen seen from outer side, × 20, g. section through flower indicating how the prolonged connective passes between the stigmatic arms, h. two sides of a seed, showing the difference in sculpture, × 3.
above mid-length. Seeds upwards of 6 freed by the fruit walls breaking irregularly, wingless, flat, more so on one side than on the other, and differently invaginated.

Distr. Monotypic, Ceylon and Southern India, in Malaysia: Malay Peninsula. The area is remarkably similar to that of the dilleniaceous genus Accrorena.


Characters as of the genus.

Distr. Ceylon, S. India, and Malaysia: Malay Peninsula (Kelantan, where the rivers Lebir and Galas unite, and Pahang, at a place near the Pahang River, about 300 km further south). Fig. 3a.

Ecol. In Ceylon it grows in lowland sandy forest near streams and in the Malay Peninsula in lowlying forest. In these places it is liable to be flooded; but that similar conditions rule where it grows (at about 1000 m alt.) in S. India is not known.

In Ceylon and the Malay Peninsula the dispersal of the seeds is undoubtedly by sudden floods which break the fruit from its slender peduncle and carry it away. The upright position of the leaf blades as seen in Madaya is doubtless a reaching out for light from above, for when the plant was grown in a glass house at Kew, their poise was less upright (see Bot. Mag. t. 7350); moreover, herbarium specimens from Ceylon show that the poise may differ. It is not known if the flower is scented.

Notes. The Malayan plant agrees exactly with that of Travancore (Trichopodium travancoricum).

Fig. 3. Geographical distribution of a. Trichopus, b. (▲) Stenomeris borneensis Oliv., c. Stenomeris dioscoreifolia Planch.

BEDD). The Ceylon plant undoubtedly differs by deltoid or even linear-lanceolate, erect leaves and tepals 3 mm long, but Thwaites held the Travancore plant to be conspecific with the Ceylon plant and would therefore have regarded the Malaysian as conspecific also. If consent be given to that view, this distinguishing name is required for the Indian-Malaysian plant: Trichopus zeylanicus ssp. travancoricus (BEDD.) BURK. stat. nov.

The subspecies is then to be defined on the size of the flowers. It may be commented that the Ceylon plant possesses a variability which is absent from the Indo-Malayan subspecies.

3. DIOSCOREA


Underground in a few spp. a rhizome, in more spp. a firm, often woody corm which gives off well defined parenchymatous tubers and replaces them annually; as a rule these tubers are buried at the ends of long stalks, and in some species they are without stalks and may be regarded as not more than lobes of the corm; in 2 (perhaps 4–5) species of Malaysia spiny roots are produced. Stems in all the Malaysian species twining, some very tall; often woody at the base and armed, always tough; the direction of twining—to the right (fig. 4c) or to the left (fig. 4a)—is characteristic of whole sections. Axillary buds often more than one in an axil and
then in vertical column with the youngest lowest. Leaves more frequently alternate than opposite; when both conditions are associated, they are alternate on thin axes becoming opposite as the plant strengthens, simple or palmately compound (§)

Fig. 4. **a.** Dioscorea bulbifera L. showing a stem which twines to the left, a leaf with its characteristic ladder-like secondary venation, and a male inflorescence, $\times \frac{1}{2}$, **b.** the large petiolar auricle of D. bulbifera L., **c.** D. laurifolia Wall. ex Hook. showing a stem which twines to the right, the interruption of the secondary nerves as they cross from midrib to primary nerve, and the male inflorescence which in this species has strongly developed negative geotropism in the axis of the spikes, $\times \frac{1}{2}$, **d.** D. pyrifolia Kunth, a group of 9 inflorescences showing how they are decurved and showing also, as is common, that fertilization may be intermittent, flowers at one horizon obtaining effective pollination and at another dying infertile doubtless as a consequence of unsuitable weather when they were ripe, $\times \frac{1}{2}$, **e.** vertical section through a flower of D. sexrimata Burk. showing the enlarged torus, **f.** similar section through a flower of D. luzonensis Schauer, **g.** section through a flower of D. filiformis Bl. showing wart at base of flower.
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*Lasiophyton*, poised so that the forerunner tip is towards the ground; in compound leaves the nerves in the leaflets are pinnate; in simple leaves the primary nerves are palmate. Petiole with a pulvinus at each end, which adjusts the poise of the blade. Male flowers frequently in small cymes racemosely arranged along the fertile axes; at the distal end of the axis the cymes reduced to single flowers so that this part is a raceme or, in some sections, a well defined spike. Flowers always small and green, but in *D. bulbifera* tinted at times with rose and the green so diluted that the flower is at times loosely called white, often scented (as benzoin), in more than half of the *spp.* of Malaysia opening but little in anthesis. *Stamens* 6, all fertile or the inner 3 as staminodes (*§ Lasiophyton*). Female flowers in spikes or spike-like racemes; pollination stimulates growth under the ovary so that a short pedicel is made which adjusts the position of the capsule (fig. 5); the ♀ flowers rather more widely opened than the male and produced in much smaller numbers, their perianth lobes are as a rule more fleshy. Staminodes very small. Style columnar, stigmas deflexed about its column in all Malaysian species. **Capsules** dehiscing from the apex downwards along the wing-margin and sometimes freeing the margin which, then, looks like a fine wire (fig. 5 k, 5 o). *Seeds* always much flattened, winged from the margin, sometimes from the whole margin, sometimes towards the apex of the cell and sometimes towards the base.

**Distr.** Species about 600, distributed through the tropics and the warm temperate zones of the world, very largely montane, some ascending to considerable heights; none naturally common to the Old and

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the New Worlds and only one common, without the aid of man, to the continents of Africa and Asia. Many are plentiful where they occur.

Section *Stenophora* has its centre in China whence it extends in the one direction to the Balkans and in the other direction appears in the United States and Canada. The 2 species marking its frontier towards India, enter Malaysia from the north and 2 other little known species, endemics of Malaysia, are attached here to the section.

The sections *Stenocorea* and *Paramecocarpa* are shared by the Indo-Chinese Peninsula and Malaysia. *Combilium* holds but one species, apparently an entrant into Malaysia from Indo-China, but it may be native of New Guinea as well as Indo-China.

* Opsophytum, Lasiophytum and Enantiophyllum are common to Asia and Africa and spread throughout the tropics of both continents. Of sections that penetrate Australia, *Enantiophyllum* extends furthest and then *Opsophytum; Lasiophytum* stops at the Torres Straits.

**Ecol.** It is not known what insects pollinate the flowers, but it is evident that insects do adequate service even when no small distance separates male and female plants from each other. Fig. 4d suggests, that stormy weather may interrupt the activity of whatever the agent may be. The sterilized inner 3 stamens in *Lasiophytum* make baffles in the path of visiting insects: they block the mouth of the flower and cause a visiting insect to touch the pollen-producing anthers. All the Malaysian species of other sections have 6 fertile stamens; though reduction to 3 is met with in two of them, it occurs outside Malaysia.

**Uses.** The food-value of the yams is great, but some are naturally so poisonous that preparation extended over even as much as seven days is required to make from them a meal that can be eaten. One of the most poisonous is *D. hirsuta* (see p. 318) which is the chief famine-food of much of the tropical East. *D. esculenta* (see p. 307) and *D. alata* (see p. 330) produce yams that are eaten after a short boiling. *D. alata* is a cultigen of specific rank, and *D. esculenta* var. *fasciculata* a cultigen of varietal rank. Many wild yams from the forests are eaten after prolonged boiling and others after an all-night boiling along with wood-ashes to mitigate their acidity. Among poisonous species an abundance of saponin causes *D. piscatorum* to be used for stupefying fish in rivers, and *D. praetert* for killing lice in the hair. Many hold tannin enough to make them unsavoury, yet not prevent the needy from eating them. Good or bad, the food-value of every yam lies in the amount of starch that it furnishes; but since the important starch

![Fig. 6. Dioscorea hairs from various species, all drawn to the same scale. a. *D. esculenta* (Lour.) Burk.: T-shaped hairs with two supporting cells the upper of which varies greatly in length, b. *D. blumei* Pr. & B. and c. *D. pentaphylla* L.: 2-celled hairs similar to those of *D. hirsuta* Dennst. (fig. e) but the cell-walls are thin and the cavity collapses, usually with torsion, d. *D. pyrifolia* Kunth: stiletto-hairs in which the supporting cell is surrounded by 4 small round cells, e. *D. hirsuta* Dennst.: rigid hairs consisting of a straight or curved long cell with strong walls raised on an equidimensional cell (or sometimes in its section on 2 such cells), f. *D. orbiculata* Hook. f.: dendroid hairs, g. *D. caucasica* Lipsky: one-celled type of hair present in it and other species of § Stenophora.](image-url)
tubers of American origin, Sweet potato, Irish potato and Manioc, were brought into the homes of the
yams, all have lost ground to them.

Vern. The uses mentioned above are naturally connected with quite a number of vernaculars; these
in turn may give hints on the wanderings of palatable cultigens. As far as they are reliable and important
they have been enumerated or discussed under the individual species.

Notes. The genus Dioscorea is so closely knit, that to divide it on a higher level than sections is un-
reasonable; KNUTH's use of Helminth as a genus was a convention now out of date, and SALISBURY's
divisions the result of inadequate knowledge of Dioscoreaceae. Not until 1897 when Uline proposed
divisions based on all the characters, was there any taxonomy likely to persist; and that is not yet stable.
It is unfortunate that the underground parts which collectors neglect, furnish a first line character. Second
in importance comes the direction of the twining; thirdly the manner in which the seeds are winged and
their colour, the shape and the poise of the capsules; fourthly the shape that the torus of the flower takes;
fifthly the completeness or incompleteness of segregation of flowers from parts wholly given to photo-
synthesis; and after that such anatomical features as the hairs exhibit and the glands, etc. Fig. 5 and 6 are
inserted to aid the student in regard to characters derived from the capsules and hairs respectively: the
capsules are given at the angle at which they stand when mature, which is reflected in most cases; if
directed forward as on the lower line, they then hold seeds winged all round the margin.

The limits of the sections above are not identical with the limits suggested by Uline and by R. KNUTH.
§ Stenophora Uline (1897), as recognized here, contains what Uline put into it and § Macropoda, in-
cluding also KNUTH's (1924) § Orientali-Asiaticae and § Japonicae. § Stenocorea (1914), § Combilium
(1914) and § Paramecocarpa (1924) were created by PRAYN and the author at the dates given: species of
the first and last, and perhaps of the second, were unknown to Uline. § Opsophyton Uline (1897) was
greatly and mistakenly enlarged by KNUTH, and is returned to what it was to Uline. § Lasiophyton,
§ Botryosicyos, and § Trieuphorostemon which were created by Uline (1897) and retained by KNUTH
(1924), are united here, but a note regarding the union of § Trieuphorostemon with § Lasiophyton will be
found on p. 314 forward where the combined section is discussed. ULINE'S § Stenophyllidium is inseparable
from § Enantiophyllum: it contains two Australian species, one of which approaches the Torres
Straits so nearly that it should be sought in New Guinea.

**KEY TO THE SECTIONS (♂ plants)**

1. Stems twining to the left (fig. 4a). Flowers usually pedicelled.
2. Leaves simple.
3. Tepals on a broadened torus.
4. Torus saucer- or cup-shaped.
5. Inflorescence with flowers in cymose groups towards the base e.g. a second flower on the pedicel
6. Inflorescence a spike or a raceme with solitary flowers.
8. Hairs abundant, T-shaped (fig. 6). Sp. 9 .............................................. Sect. 3. Combilium, p. 307
10. Tepals free, on the end of the pedicel. Sp. 13 .............................................. Sect. 5. Opsophyton, p. 311

12. Stems twining to the right (fig. 4c). Flowers invariably sessile. Sp. 22-59.

**KEY TO THE SECTIONS (♀ plants)**

1. Stems twining to the left (fig. 4a).
2. Leaves simple.
3. Capsule as broad or almost as broad as long (fig. 5a-c). Seeds usually winged evenly all round.
4. Hairs, if present, not T-shaped.
5. Capsules reflexed against the axes of decurved infructescences, their walls as a rule rather thin.
   Sp. 1-4 .............................................. Sect. 1. Stenophora, p. 303
6. Capsules facing earthwards on decurved or more or less horizontal infructescences. Sp. 5-8.
   Sect. 2. Stenocorea, p. 305
7. Capsules decidedly longer than broad.
9. Capsules parallel-sided and horizontal (fig. 5d). Sp. 10-12 .............................................. Sect. 4. Paramecocarpa, p. 309
   Sect. 5. Opsophyton, p. 311
12. Stems twining to the right (fig. 4c). Sp. 22-59 .............................................. Sect. 7. Enantiophyllum, p. 320

1. Section Stenophora

(1924) 313.—Sect. Orientali-Asiaticae R. Knuth, l.c. 252.—Sect. Japonicae R. Knuth, l.c. 254.—Fig. 5a–b, 6g, 7.

Underground a rhirome, often short; but there are species in which by report it may be 2 m long. Plant glabrous (in Malaysia), stems twining to the left. Bulbils only produced (rarely) in D. prazeri. Leaves alternate, simple but not always entire, invariably with large auricles at the base of the lamina making it cordate in varying degree. § Flowers in cymes disposed racemously on leafless flowering axes; cymes 2–4-flowered reduced to 1 distally. ♀ Flowers on decurved or pendent leafless axes, almost spicate; after fertilization the pedicel reflexes the capsule so that it faces upwards. Seeds at maturity of the capsule which dehisces from the upper end downwards winged all round, but not evenly.

Distr. Predominantly temperate, reaching the Amur River northwards; absent from the Pacific. Two well-known spp. occur widely along its southern frontier towards the Indian Peninsula and Malaysia, two others are inadequately known.

Note. Glands have not been found in the forerunner tips of the leaves. About one quarter of the spp. carry epidermal hairs, either of a single elongated cell (fig. 6g) or of a filament of cells, 2–3 in number; but the hairy species do not reach Malaysia. There are spp. with 3 of the stamens in the male flowers sterilized, but again these do not reach Malaysia.

**KEY TO THE SPECIES**

1. Male flowers sessile or almost so.
2. Male flowers for the most part solitary; perianth raised by a short tube. Capsule wings 2½ times as long as wide. Leaves entire, cordate.

   1. D. prazeri


Rhirome branching freely, short and stout, gray-brown or nearly black; flesh white and very poisonous. Stem smooth, ridges very indistinct, climbing to 4 m. Leaves cordate or long-cordate, usually to 12 (–20) cm in either dimension, 7–11-nerved; secondary nerves differing a little from the network; both surfaces shining; petiole half as long as the lamina. Male flowering branches 1–3 together, from upper leaf-axils or sometimes collected on branches with reduced leaves, cymes 1–3 mm apart: the axis between the cymes apt to be flexuous; narrow wings descend from the bracts; bracts broadly ovate and abruptly long acuminate. Perianth-cup less than 1 mm deep. Tepals 1½ mm long, ovate and almost rounded above. Anthers turned outwards, much shorter than their filaments. Female flowering axes solitary, directed downwards, with about 20 flowers and to 30 cm long. Tepals shorter and thicker than those of the male flower, only just united at the base. Capsules, though rarely more than 8 mature, near enough to each other to imbricate, becoming a satiny chestnut brown; wings broadly semi-obcordate or subhemispherical, rarely semicircular, the base of the capsule obtuse as it passes into the short curved stipe and the apex cordate with shoulders (fig. 5a). Seeds ovate-oblong, to 12 by 8 mm, reddish at maturity but the wing pale.

Distr. From the eastern Himalaya and the mountains between Assam and Burma where it is abundant, southwards through the Shan Hills to the Isthmus of Kra, in Malaysia: forward to the northern edge of the Malay Peninsula (Perlis). Fig. 7a.

Ecol. At its southern limits it grows on limestone. It ascends the mountains of NW. India from near sea-level to 1600 m. It approaches in the Hima-
Dioscoraceae


Rhizome wide-ranging, perhaps even to 2 m, 1/2–1 cm diameter, dark brown, with white flesh. Stem slightly ridged, unarm, with stipule-like processes at the base of the petioles on the better developed axes. Leaves deeply trifid above a cordate base, shortly acuminate, 9-nerved, two primary nerves reaching the forerunner tip along with the midrib and the second pair reaching the tips of the lateral lobes; petiole 1½–2½ the length of the blade. Male flowers in small subsessile cymes with up to 4 flowers, spaced along a leafless conspicuously angled axis; bracts ovate-acuminate, very thin in texture, 1½ mm long; pedicels exceedingly short. Tube of the flower campanulate or urceolate, 1 mm long, its thin walls strengthened by the vascular bundles which descend in it from the insertion of the filaments; tepals 1 mm long, long-ovate, obtuse, 1-nerved. Stamens all alike, the filaments inserted just below the tepals, incurved, 0.3 mm long; anthers introrse, small. Female flowers on downwardly directed spike-like racemes; axis angled, to 20 cm long or even longer; pedicels 1 mm; bracts ovate-acute, very thin, 1½ mm. Tube of the flower absent. Outer tepals obovate, obtuse, just exceeding 1 mm, inner ones lanceolate, a little shorter than the outer. Style short. Capsules 1–2 cm apart and scarcely imbricate, wings a little broader than semicircular and sometimes widest above the middle, retuse at the apex, nearly truncate at the base.

Distr. From Siam westwards to N. Burma and eastwards into Cambodia; southwards passing beyond the Isthmus of Kra into Malaysia to the Siamese Circle of Puket. Fig. 7b.

Ecol. Like D. prazeri it grows on limestone at its southern limit.


Rhizome imperfectly known, but slender, branching, brown in colour with white flesh. Stem smooth. Leaves cordate-sagittate with rather elongated auricles which are distally rounded, 9 cm long by 8 cm across the auricles and 4 cm above them; primary nerves 3, the two outer forking and curving in the auricles; upper surface shining; lower dull; petiole about as long as the blade. Male flowers in small cymes disposed on a solitary, probably horizontal, rather stiff axis which sometimes carry small branches at the base; the cymes up to 2 cm apart; axis angled, to 30 cm long; pedicels to 1 cm long. Tube of the flower extremely short; tepals ovate, spreading in anthesis so much as to make the flower almost petalliform. Outer tepals a little broader than the inner ones, to 1½ mm in length. Stamens 6, on very short filaments which raise the anthers so that they touch at the centre of the flower. Female plant unknown.

Distr. Malaysia: Philippines (N. Palawan). Fig. 7c.

Note. It is feared that the only specimen which was obtained, was lost in the destruction of the Bureau of Science, Manila, in 1945.


Lower parts unknown. Stem terete, unarm, at least in the upper parts. Leaves subcordately ovate to narrowly ovate, acuminate, the largest seen 11 by 6 cm, but larger are to be expected and these will be more cordate, 7-nerved; petiole rather short, approximately ½ the length of the blade. Male plant unknown. Female flowers on decurved branches to 30 cm long. Tepals ovate. Capsules spaced so that they scarcely imbricate; wings broader than semicircular and widest in the upper third, to 22 by 22 mm; the capsule truncate above and drawn out into the stipe below. Seeds with a pale brown wing.

Distr. Malaysia: Borneo (Sarawak). Fig. 7d.

Note. The underground parts are needed to confirm the conclusion, arrived at from the shape and poise of the capsule, that it belongs to the section Stenophora.

2. Section Stenocorea


Underground one or more descending tubers. Plants glabrous, stems twining to the left, apparently unarmed. Bulbils unknown. Leaves, it seems, always alternate, typically cordate, but not invariably (cf. D. stenomeriflora). Male flowers pedicellate, one at a time along leafless branches which are decurved in all the species except D. stenomeriflora; the pedicel carries a bracteole above mid-length and is reflexed in all the species except D. stenomeriflora so that the flower faces upwards.
Stamens 6. Female flowers distinctly pedicellate, on decurved spike-like racemes similar to those of the male except that the pedicels do not become reflexed.

Distr. Siam, Cambodia to 15° N, in Malaysia: E. Sumatra, Celebes, Central Java; apparently never abundant.

**KEY TO THE SPECIES**

1. Male flowering axes spreading and their flowers directed forward. Leaves very much longer than broad.  
5. D. stenomericiflora

2. Leaves twice as long as broad.

3. Pedicels of male flowers to 1½ mm long. (Capsules to c. 25 mm long)  
6. D. daunaea

3. Pedicels of male flowers to 4–5 mm long. (Capsules unknown).  
7. D. keduenisis

2. Leaves nearly as broad as long. (Capsules of great size, their fertile part even to 40 mm along the placenta; the stipe much elongated)  
8. D. sumatrana


Lower parts unknown. Stem vigorous, recorded as climbing to 25 m, ridged. Leaves herbaceous, long-elliptic, 16 by 3 cm, base obtuse or rounded; at lower horizons large sagittate leaves up to 28 by 16 cm occur, but it is questionable if a sagittate outline always occurs; primary nerves 3–5, and the outer of them give a branch to the auricle in the large leaves; secondary nerves very distinct from the network, widely spaced, crossing the space between one primary nerve and another without interruption; upper surface shining; petiole short, 1/4 to 1/6 the length of the blade, narrowly winged, these wings pass into the outer primary nerves at the back of the blade as in D. bulbifera and certain other species. Male flowering axes on short leafless branches, to 35 cm in length, stretching outwards from the upper leaf-axes and bearing possibly more than 100 flowers. Flowers produced singly; from the midrib of the bract of each a pronounced ridge descends the axis; bracts lanceolate, keeled, to 2 mm long; pedicels to 2 mm long, directed obliquely forward. Torus expanded into a wide cup. Outer tepals lanceolate, obtuse, just over 1 mm long, 3-nerved; inner ones similar, but a little less acute. Stamens 6, inserted at the base of the flower; filaments short, stout at the base, incurved, not long enough to lift the anthers out of the cup. Female flowering axes solitary or 2–3 together, decurved from the axis of distal leaves or sometimes on short leafless branches; axis conspicuously angled. Bracts lanceolate-ovate, to 1½ mm long. Tube of flower 1 mm deep. Outer tepals narrowly ovate, to 3 mm long, subacute, inner ones a little shorter. Capsules not yet known.

Distr. Malaysia: Malay Peninsula (Perak to Singapore), Sumatra (East Coast).

Ecol. Fl. Febr.–April, Oct. (Perak), fr. 2 months later, both flowerings occurring at times when the mountains have heavy rains.

Note. This has been described by error as a new genus, Peripetasma, in the Merispermaceae.


Tubers apparently more then one a year, descending deeply into the soil from the corm. Leaves lanceolate-ovate-sagittate, shortly acuminate, to 16 by 6 cm (acumen 8 mm long), 5–7-nerved; secondary nerves rather distinct as they traverse the network; upper surface bright; lower paler; petioles to 4 cm. Male flowering axes solitary or 2 together, or sometimes on short leafless branches, or branching themselves, i.e. they tend to be paniculate; axis straight, angled; bracts lanceolate-acuminate. Pedicels to 1 mm long. Buds globose. Torus making a cup 1½ mm deep. Outer tepals ovate, acute, inner ones blunter and a little broader. Stamens 6, 3 upright and 3 inclined towards each other. Female flowering axes solitary, either from the axis of the leaves or from axis of bracts replacing the leaves on short branches which grow to 30 cm long; axes winged. Bracts ovate-acuminate, 3 mm long. Pedicel in anthesis 3–4 mm. Capsule (rather before complete maturity) with wings 25 by 12 mm, semicircular except that the widest part is rather above mid-length and that they are slightly drawn out at the base; apex truncate.

Distr. Mountains of the Tenasserim-Siam border and those SE of Bangkok, and southwards in Malaysia to the southern parts of Peninsular Siam.

Ecol. Fl. Jan.–March at which time there is little rain.


Lower parts unknown. Stem faintly ridged. Leaves long-cordate or cordate-linguiform, acuminate, to 14 by 5 cm, 5-nerved; petiole about 1½ as long as the lamina. Male flowering axes solitary or 2 together from a leaf-axil, to 18 cm long. Flowers solitary, to 30 in number or more on each axis; axis angled. Bracts lanceolate-acuminate, to 2 mm long. Pedicels 4–5 mm long. Buds pear-shaped. Flowers wide open in anthesis; tube very short. Outer tepals narrowly ovate, obtuse, 2 mm long.
inner ones a triole longer and blunter. Stamens inserted at the base of the perianth lobes. Female plant unknown.

Distr. Malaysia: Central Java, SW. Celebes.

8. D. sumatrana PRAIN & BURK. Kew Bull. (1931) 90; Ann. R. Bot. Gard. Calc. 14 (1936) 75, pl. 32/3.—Fig. 5c.

Lower parts unknown. Stems apparently terete. Leaves cordate but not exactly so, because the auricles tend to be drawn out rather than rounded, to 9 cm across, 5–7-nerved; secondary nerves not conspicuous in the network; petiole c. ½ as long as the blade. Male flowering axes solitary or 2–3 together, directed downwards from the axis of upper leaves or not infrequently on short special leafless branches: axis rigid, up to 15 cm, many-flowered; bracts lanceolate, reflexed along with the pedicel, acute. Pedicels to 1 mm. Tube of flower in anthesis ½ mm deep. Tepals long-ovate, acute, 1½–2 mm long. Stamens inserted below the tepals with their filaments inclined towards the centre of the flower, 3 of them shortest. Female flowering axes solitary, directed stiffly downwards from the axis, with numerous flowers which face forward and remain facing forward while the pedicel, at first 3–4 mm long, grows into a curved stipe 2–3 cm long. Tepals lanceolate-acute, 2 mm long. Capsule remarkably large (fig. 5c), facing earthwards; wings 4 by 3½–4 cm: apex retuse; base drawn out into the stipe. Seeds winged to a width of 3 cm.

Distr. Malaysia: Sumatra (East Coast).

Note. The size of the capsule is not approached in any other Dioscorea.

3. Section Combilium

PRAIN & BURK. J. As. Soc. Beng. new ser. 10 (1914) 19; R. KNUTH, Pfl. R. 87 (1924) 186, in small part only; PRAIN & BURK. Ann. R. Bot. Gard. Calc. 14 (1936) 79.—Fig. 5c.

Tubers 4 to many, thrust downwards from a corm lying close to the surface of the soil, esculent, and protected in the wild plant by a formidable cheval-de-Frise of thorny roots, wherein the longest thorns are those directed upwards; but races of cultivation are largely without thorns. Plant abundantly hairy with T-shaped hairs (fig. 6a). Extra-floral nectaries are of the deep kind (see p. 294). Bulbs absent. Leaves alternate, entire and cordate or broadly cordate. Male flowers almost always one at a time distributed along rather stiff axes which ascend from distal leaf-axes; if there be more than one flower the arrangement is cymose. Torus expanded into a saucer-shaped tube. Female flowers on decurved spikelike racemes; capsules reflexed.

Distr. Monotypic, native in SE. Asia and Malaysia, widely dispersed by cultivation.


Tubers as described above, protected by thorny roots in the wild plant and by man’s vigilance in cultivation; skin of the tubers bright brown or gray-brown, thin so that the tuber is easily bruised, often rough with indurated bases of rootlets; flesh white, sometimes with a trace of bitterness at the surface, but on the whole sweet and esculent. When the tubers are many, they tend to be shorty cylindrical with both ends rounded; when they are few and relatively larger as in various cultivated races, they may be lobed; sometimes they are large and may weigh over 3 kg. Plant pubescent with T-shaped hairs, the shank of which varies in length and when short brings the tomentum close down on the epidermis; the cross piece is of a single cell; exposed surfaces are glabrescent. Stems 1 or rarely more, terete, prickly at the base and diminishing so upwards: basal internodes carry prickles, medial at the nodes only, one at each side of the petiole and distal none. Leaves when very large to 15 by 17 cm, but most of them do not exceed 10 by 10 cm, acuminate acute at the apex, the forerunner tip a
small micro, 9–13-nerved; secondary nerves fairly regular but not conspicuously ladder-like; petiole 1–1 1/2 times as long as the blade, sometimes with small prickles in its pubescence. Male flowering axes almost invariably solitary, carrying flowers one at a time or very rarely 2–4 in a small cyme, the flowers to 70 or more; axis slightly angled. Bracts ovate-acuminate, to 2 1/2 mm long. Pedicels to 1 1/4 mm, but usually nearly absent. Torus a shallow cup. Outer tepals broadly lanceolate, acute, 1 1/2 mm, inner ones a trifle shorter. Stamens all alike inserted just below the perianth lobes, the vascular bundle strengthening the cup, forming a ridge; filament 1 mm long, curved so as to cause the anthers to dehisce upwards. Female flowering axes solitary from upper leaf axils, to 40 cm, decurved, slightly angled. Bracts ovate, acuminate, 2 mm long. Pedicels in anthesis very short. Torus scarcely developed into a tube under the perianth lobes. Outer tepals lanceolate-ovate, obtuse, 1 1/2 mm long, inner ones more acute. Capsules (only one seen and it not quite ripe) reflexed, 27 by 12 mm, subacute at the apex and nearly truncate at the base. Seeds winged all round.

Distr. Native in Siam and Indo-China, but very local; also growing wild, but without certainty of being indigenous, in the Sontal Hills of N. India, on Mt Popa in central Burma, in the Shan Hills, and perhaps in New Guinea. By A.D. 1498, when the Portuguese found their way into the Indian Ocean, it had obtained a dispersal in cultivation from Madagascar to Tahiti; and it appears to have had centres of relatively intensive cultivation in two parts of northern India, in Burma and Siam and in and around either end of New Guinea. As a servant of man it does not equal D. alata; but it can be raised where the humid season is short for D. alata and a return taken at 6 months, which is before the tubers become firm and fibrous. After A.D. 1500 it was carried round the Cape to the shores of the Atlantic in company with D. alata but not in rivalry. Those parts of Malaysia without a dry monsoon are rather too humid for its thrift.

Out of the wild population in the remote time when he became conscious of primitive agriculture man has acquired by selection forms with larger tubers, getting fewer at the same time, and lobed tubers, and his operations reduced the armature of thorny roots. It is convenient to distinguish the two intergrading varieties upon which Roxburgh based two species as:

var. spinosa (ROXB.) PRAIN & BURK. (1914).—D. spinosa Roxb. l.c., non BURM.—Plants well provided with thorny roots.

var. fasciculata (ROXB.) PRAIN & BURK. (1914).—D. fasciculata Roxb. l.c.—Plants ill-provided with thorny roots.

There are some cultigens in var. spinosa and with them all the truly wild plants; var. fasciculata consists entirely of cultivated plants.

Plants in the field-crops of India never flower, and certain races never do so in Malaysia. In what measure this may be a climatic response or alternatively a consequence of the gathering of the crop is unknown. On the other hand some of the races cultivated in Malaysia never flower freely, or if they flower do so in the male sex only; everywhere it is extremely rare for any form of the female plant to flower; and fruiting does not follow.

A good idea of the range in shape of the tubers is found in the two cited papers from the Gard. Bull. Str. Settlement.

RUMPHIUS writing between 1653 and 1692, stated of Malaysia, that D. esculenta was cultivated in the greatest degree from Celebes through Buton, to the Moluccas, Ambon and Banda; and was to be found in Java, Bali and Bima, but not in great quantity though particularly near Jakarta to which centre immigrants from among the eastern folk had taken it.

Vern. Malay and Sundanese names sustain the view that W. Malaysia has obtained both var. fasciculata and var. spinosa from E. Malaysia. Both languages hold names distinguishing the two varieties, while linking it to D. alata; in Malay the names ubi tetropong (pipe D. alata) and ubi torak (trident yam), and in Sundanese huiw taropong and huiw landak (porcupine D. alata) are used.

The first of each pair is var. fasciculata; the second, as the qualifying words show, is var. spinosa. There is also a name in Javanese, uwi mayong (cat-fish D. alata), which provides another indication of the cultivation in Java of var. spinosa. Rumphius excludes D. esculenta from the genus ubi, giving its proper name as kombili. He does not state that any of the races in Ambon were altogether without thorns, but he states that the fewer the thorns the better the race; and his kind with numerous tubers, which was grown in garden fences where it never flowered, was certainly var. fasciculata. Among the others was var. spinosa. The noun kombili becomes kembali, gembali, gembili, gembilém, gembolo, gembulu, kembali and bili in western Malaysia, and is applied also to Coleus tuberosus. Blume seems to have been aware of the confusion when he called the Coleus 'kummuli java' (Bijdr. 1826, 383). It is a strange confusion; for appearance and taste are very distinct.

Through the area which Rumphius indicates as that of intense cultivation, D. esculenta is known today by a noun of considerable variability and completely specific. It is siawu, siwu, siapu, sayawu, sayabu, sayahu, sayafu, sayahul, sihuo, siyau, hyisu, isahu and isayahu. An outflow of the noun from the area is to be expected, and perhaps is seen in the use of sahe in N. Borneo; and in uwi sayavu of N. Celebes. The relationship of siawu tosudo or wisudo employed in eastern Java and Bali is not evident; w here equals uwi. Where Buginese and Makassarese are spoken this plant is known as opa or appa; and an apparent outflow of it is the name ubi opang recorded from Java. In the same languages of Celebes the yam is liable to be
classified under *lame*, as *lame chengka*, but may be simply *chengka* or *chingka*. The outflow of names of the *siawu* group towards the north is blocked by equally firmly established names of more than one group. Thus in the Bisayan languages of the central Philippines *bodot*, *borot*, *bolot*, *bolod* is established in a way that makes another name unnecessary, until the speaker seeks to indicate races, and in the languages of W. Luzon, *tagui*, *tuqui*, *tugi*, *dogue*, *roguing*, *tungo* and *tongo* does the same up to a certain point. In Ilocano, Sambali and Tagalog *boga* and *buga* are used, to denote a race. The names recorded from New Guinea seem to have racial values; for instance *diba*, *nemu* and *tattukava* in the Hanubada language of the E. end of the island have racial values. Lastly it would seem useful to list some dissimilar names that they may not miss attention by those interested in the languages; they are as unlike each other as the names of wider use given above; given alphabetic-

ally they are:—*aneg* (Ibanag of Luzon); *bangam* (Sambali of Luzon); *bian* or *biham* (Bali); *dukai* (Ivatan of the islands N of Luzon); *invod* (Palawan); *kaburan* (Madura); *kaming* (Bikol of S. Luzon); *karat* (Pangasinan of W. Luzon); *katilin* (Ceram); *luttu* (Ibanag of Luzon); *nal* (S. New Guinea). Branderhorst in recording the last name connects it with a verb meaning to eat.

It is not at present useful to enumerate the many double names under *ubi*, *hiwi*, etc. that are racial; it may suffice to suggest that there are several races spread from Burma to the eastern parts of Malaysia, varying in name but not in nature; and to add they do not vary in nature because reproduction is entirely by clones so that the characters are constant; and the main direction of the prehistoric spreading of this useful plant has been out of the continent of Asia through the Philippines, thence to diffuse towards the S and SE, and ultimately towards the SW.

### 4. Section Paramecocarpa


Tubers descending into the soil, apparently not to a considerable depth, protected against herbivores in some *spp.* and probably in all by a poisonous saponin in addition to thorny roots on the surface of the tubers. Corm little developed for new tubers appear in the axils of scale leaves against the soil, as if misplaced bulbls. Hairs, when present, of the stiletto shape as in *D. pyrifolia* of § *Enantiophyllum* (fig. 6d). Extrafloral nectaries of the deep kind exist, at least in *D. piscatorum*. Bulbils not recorded. *Leaves* entire, cordate, alternate, chartaceous. *Male flowers* one at a time along spreading flowering axes. Torus expanded into an infundibular tube from the rim of which the tepals become reflexed during anthesis. *Female flowering axes* decurved, carrying numerous pedicellate flowers which face forward; but after fertilization the pedicel lifts the capsule to a horizontal position (fig. 5d). Style stout. *Capsules* horizontal when ripe or very slightly ascending, elongated, their sides parallel. Seeds with a triangular body and winged from it on the outer side and forward (in the Tonkin species also from the base).

**Distr.** *Ca 5 spp.*, from the S. border of China southwards to *Malaysia* as far as the equator and to Palau Islands. Fig. 8.

**Notes.** The section approaches *Stenomoritis* in: (i) a great demand for humidity, (ii) the elongation of the capsules, with (iii) forwardly directed wings on elongated seeds, and (iv) reflexed perianth lobes. When KNUTH described *D. kjellbergii* he suggested a new section *Celebenses*; but beyond all doubt this species is a typical member of the section *Paramecocarpa*.

**KEY TO THE SPECIES**

1. Stem (as far as known) sparingly prickly. Leaves about as broad as long. Hairs on the inflorescence and rather sparingly on the backs of the leaves.
2. Leaves about 13 by 13 cm. *Tepals* 1 1/2 mm long
3. Leaves about 10 by 8 cm. *Tepals* 1 1/2 mm long
1. Stem with long crests of confluent prickles on the lower internodes. Leaves distinctly longer than broad and half as large again as those of *D. flabellifolia*, glabrous. (Inflorescences unknown.)

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Tuber unknown. Plant to some extent hairy, but glabrescent. Stem to 14 mm in diam. at the base and there abundantly prickly, above with scattered small prickles. Leaves almost exactly cordate, with the margin very evenly rounded, shortly acuminate, to 16 by 20 cm, but as a rule not larger than 13 by 13 cm, 9-nerved; primary and secondary nerves distinct above and somewhat impressed, prominent below, the secondary almost ladder-like; surfaces of the lamina equally bright on the two sides; petiole puberulous or pubescent, shorter than the lamina by 3/4 to 1/3. Male flowering axes 1–4 together from the axils of upper leaves, more or less ascending and sometimes erect, to 45 cm, carrying upwards of 70 pale green flowers which are for the most part solitary though there may be sometimes a second flower cymose on the pedicel of the first; axis conspicuously ridged. Bracts lanceolate, acute, puberulous, 3 mm long; bracteoles placed rather above the middle of the pedicel. Torus a funnel-shaped perianthoid tube 1/2 mm. Tepals lanceolate, ridged on the inner face just within their margins and down the middle line, 11/2 mm long. Stamens inserted just below the tepals, raising their anthers well out from the tube; filaments 1/2 mm long. Female flowering axes to 80 cm, sometimes branched, axis strongly ridged. Tepals recurved as in the male, but less sharply, 11/2 mm long. Stigmas big, extruding from the flower. Pedicel 6–8 mm long in anthesis. Ovary more or less pubescent. Capsules horizontal from the downwardly directed axis or perhaps slightly ascending by being reflexed towards rather more than 90°; wings to 35 by 9 mm, the obtuse apex raises the withered remains of the flower by 1–2 mm; stipe to 1 cm. Seeds inserted on the lower half of the placenta, their outer margin narrowly winged, wing widening upwards and extended from the apex of the seed towards the apex of the cell, to 35 mm long wing included.

Distr. Micronesia (Palau), in Malaysia: Philippines (Luzon, Mindoro), Br. N. Borneo. Fig. 8c–d.

Ecol. Chiefly in the eastern more humid parts of Luzon.

Vern. Paymut (Tagalog).

Note. The Palau specimen described as D. ledermannii Knuth is tentatively referred here, the capsule being slightly different from the Philippine plant.


Lower parts unknown. Inflorescence thinly hairy and a few hairs on the leaves. Stem terete in its distal parts, to 5 mm in diam., unarmed, firm in texture, glabrous except in the leaf-axils. Leaves at the horizon of flowering to 11 by 9 cm (assuredly larger at a lower horizon), very shortly acuminate, 7-nerved with firm margins; the secondary nerves ladder-like; petiole to 5 cm. Male flowering axes solitary from upper leaf-axils or on very short leafless branches, 10–20 cm, carrying 20–30 flowers which are directed slightly forward; axis angled. Bracts ovate, acute, 1/2 mm long. Pedicel 1–2 mm, with scattered hairs, with a bracteole in its lower part. Funnel-shaped perianthoid torus-tube nearly 1 mm deep; tepals long-deltoid 1/2 mm long. Stamens inserted just below the perianth lobes; anthers conspicuously exerted, opening upwards. Capsules (teste R. Knuth) on axes to 60 cm long, in a slightly immature state 40 by 12 1/2–17 1/2 mm.

Distr. Malaysia: Central Celebes (Malili). Fig. 8c.


Tubers more than one, clavate, arising in axils where the base of the stem touches the soil surface, unarmed or with short roots which may be indurated into thorns, some of which (teste Keith) come above the soil; skin liver-coloured; flesh the red colour of diluted blood, intensely poisonous. Plant glabrous. Stems to 8 mm in diam. near the ground where there are 4–5 lines of confluent flat prickles; these give place upwards to scattered prickles and then more or less cease. Leaves except in their greater size and complete glabrousness as those of D. flabellifolia, attaining 18 by 14 cm, 9-nerved; petiole shorter by 1/4 than the blade, with scattered small prickles on the back and the sides.
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Flowers unknown, acc. to Knuth those of his 'D. borneensis' are formed on male inflorescences reaching a length of 70 cm.

Dist. Malaysia: N. Sumatra, Malay Peninsula (Perak and Pahang, P. Tiuman), and Borneo. Fig. 8b. Ecol. The sapogenin in the tubers stigmatis pupils and the tubers are used as an alternative to Derris. Attention was drawn to this in 1908 by a Malay who exhibited the plant at an Agri-Horticultural Exhibition in Kuala Lumpur. BURKILL & HOLLINTON proved the effect (see BURK. Dict. 822); GATER tried the tubers as an insecticide and found them effective, but less so than Derris. Being a substitute for Derris it shares the name tuba, and is known as tuba uhi (tuba yam) in the Malay Peninsula, tuba gunjo (wild tuba) among the Batakans of Tapanuli and tuba podeh gantung among the Dayaks of the Sanggau valley of Borneo. It is recorded that rasped tubers are put into the runnels of rice fields in Tapanuli 'to kill injurious worms'. Beyond all doubt the tubers are edible to such animals as wild pig and are preserved from molestation by their poisonousness as well as by their thorny roots. Ignorance of the flowers is probably due to flowering not occurring until the climber has topped the forest.

5. Section Opsophyton

Uline in E. & P. Nachtr. (1897) 84; R. Knuth, Phl. R. 87 (1924) 88 pro subsect. Euopsophyton; Pro&R. BURK. AN. R. Bot. Gard. Calc. 14 (1936) 109.—Fig. 4a–b, 5f.

Tuber annually replaced, solitary, produced close under the surface of the soil, swelling downwards from a rather thick attachment; in Asia and the East that attachment does not possess any length, but in Africa it makes a definite stalk; flesh poisonous in varying degree, the least poisonous being cultigens derived from D. bulbifera. Hairs as a rule absent, when present finger-like and of one cell. Extra-floral nectaries of the superficial kind. Leaves cordate, alternate. Male flowers in spikes or spike-like racemes which may be collected together into large inflorescences; torus without enlargement, tepals long and narrow. Female flowers on decurved axes and after pollination the ovary is reflexed. Capsules twice as long as broad or relatively longer. Seeds winged towards the base of the cell.

Dist. Ca 5–6 spp. native in the Old World, only one sp. in Malaysia.


Tuber (as produced in the East) globose to pyriform, rarely somewhat lobed, usually covered densely with harsh short roots, nauseous in the wild plant and in quantity poisonous; but with tubers fit to eat in various cultigens selected by man, weighing up to 1 kg. In certain cultigens the tuber is suppressed in favour of rather large bulbils. In the wild plant bulbils numerous; a seedling only a few months old can be made to produce one by a checking of its growth; bulbils usually in the leaf-axils but at times displacing flowers at the base of flowering axes; small bulbils are as a rule warded; when large they may be smooth; in Africa curiously angled bulbils are produced. Flesh usually pale yellow, perhaps tinted with violet, and it oxidizes when cut to orange; very mucilaginous. Leaves usually broadly cordate, but sometimes long-cordate [var. heterophylla (ROXB.) PRAIN & BURK. (1936)], up to 20 by 2 cm and even to 32 by 32 on unusual plants, 5-nerved, secondary nerves very conspicuously ladder-like; upper surface shining and slightly bulled between the secondary nerves, lower duller, with the nerves prominent; petiole from half as long to as long as the blade, sometimes marginally winged with wings that ascend to the backs of the outer primary nerves; these wings descend on the stem having between them a wing from the centre of the base of the petiole. Subfoliaceous auricles (fig. 4b) may occur at the base of the petiole and partly embrace the stem; they are larger than in any other sp., but they are commonly altogether absent. Male flowering axes pendulous, 1–4 from the axil of a bract or rarely
of a leaf; those arising from axes of bracts may make large pendulous inflorescences (fig. 4a) even to 100 cm; axis carrying the flowers to 14 cm, though usually about 4 cm; when large with perhaps 100 flowers which open from the lowest upwards in a succession that is often by no means as obvious in the genus; flowers facing forwards which, the axis being pendulous, means towards the earth, pleasantly scented, sometimes tinted with a rose coloured pigment and generally with the green so diluted that collectors have called them white. Torus very small, tepals and stamens crowded together. Outer tepals linear-lanceolate, 1 1⁄2–4 mm long, but nothing like the large flowers of the Himalayan var. simbha PRAIN & BURK. (1914) have been met with in Malaysia; inner ones not so acute. Stamens half as long or a little longer, anthers as long as the filaments. Female flowering axes directed downwards but not rigid, solitary or 2 or more together from a leaf-axil, carrying about 40 flowers which appear sessile but after pollination show that they have enough pedicel to direct the ovary upwards. Bracts long-acuminate. Outer tepals rather broader than those of the male and greener, rarely more than 1 1⁄2 mm long, inner ones a trifle shorter and blunter than in the male. Capsules bright chestnut and usually formed in large numbers, imbricating; wings rounded at both ends (fig. 5fi) sometimes rather broader towards the apex than below, 20–22 by 8–9 mm. Seeds as a rule not quite as broad as their wing, but nearly so.

Distr. From the Atlantic coast of Africa to the furthest islands of the Pacific, the most prolific and the widest spread of all the Dioscoreas. The dry countries from the Sahara to the Punjab interrupt its distribution; and on the African side of this break the plants are liable to carry small hairs which they do not carry in Asia; and they have angular bulbils whereas those of Asia have rounded bulbils; moreover there is the difference noted above in the shape of the tuber. The African plants are conveniently called collectively var. anthropophagorum (CHEV.) PRAIN & BURK.


KEY TO THE VARIETIES

1. Tubers and bulbils acid and nauseous; wild plants.
   2. Leaves shortly cordate . . . var. bulbifera
   2. Leaves elongated, long-cordate.
      var. heterophylla

1. Tubers and bulbils selected by man not to be acid and nauseous, less or little so.
   3. Bulbils dark-gray-brown, abundantly warted. var. suavior
   3. Bulbils large, smooth, glivous . . . var. sativa

Var. bulbifera is that met with in Malaysia wherever the plant grows. Var. heterophylla is fairly plentiful in Penang in association with the type and has been obtained sparingly to the south as far as Malacca. Its stems are rough at the base. ROXBURGH attributed var. heterophylla also to the Moluccas, but no specimens have been seen derived thence. The known dispersal of the cultigens is given below.

If a growing stem of one of the cultigens with large bulbils be examined, starch is found, often in quantity, within the parenchyma, showing that what man has done is to select races, not with the amelioration of increased starch and food production, but with a loss of ability to transport the elaborated food to the base of the plant. And the plant, therefore, must die each year. Consequently maintenance of its situation is dependent on the bulbils with broken tenancy. Man obtained large bulbils in Asia and Africa, but as said above growing to unlike shapes. The cultigens of the two continents have been distributed widely without intermingling, unless it be in remote Tahiti to which var. anthropophagorum, after having been taken to America along with negro slaves was carried to Tahiti by Spaniards after Tahiti had received cultivated D. bulbifera from out of Asia. Asia, more progressive than Africa, has gone much further than Africa in abandoning a line that had ceased to reward the cultivator adequately; but there is left a wide dispersal of the Asiatic cultigens to show how they gave at one time an adequate reward. In contrast Africa still cultivates D. bulbifera considerably and would seem still to be endeavouring ennoblement.

Ecol. From a rather extensive study of D. bulbifera in India a climatic limit has been determined towards the dry NW where its existence ceases (PRAIN & BURK. Ann. R. Gard. Calc. 14, 1938, 433–4). This limit is where the rainfall of the wetter six months diminishes to less than 700 mm, an amount seemingly just adequate, though 1000 mm serve better. This observation in India leads to an expectation that there is little land in Malaysia insufficiently humid to provide a home. D. bulbifera crosses Torres Straits into Australia and passes down the east coast in the coastal margin to 21° S; but here, though the summer rains of Brisbane exceed 700 mm, it does not reach that city. Towards the W. coast of Australia it does not overpass Port Darwin. It ascends the Himalaya to 1800 m and is recorded in Yunnan at 2700 m, heights which cause the records of it on the mountains of Malaysia to be unsatisfying; there are specimens in herbaria from 1000 m in Sumatra, Borneo and Java; it probably exceeds this. Mountains however, are not where it is most abundant; this is always near sea-level and it seems to find a home readily in small islands. It was found in Verlaten Island and Sebesi near Krakatoa when the returning vegetation was investigated (DOCTERS VAN LEUWEN, Krakatoa, 1936, 435). It gets some dispersal by floating bulbils. The high forest chokes it out; disturbed wooded land is suitable; and in coastal woodland which is always exposed to storm damage as well as to interference by man; storms and man working together produce conditions favourable to it, and so aid in creating a greater abundance of it near the sea than in little inhabited country. The widest distribution of any Dioscorea with the greatest amount of reproduction by bulbils points to bulbils as of great value in its drift. It
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may be added here that a seedling, checked at the age of a few weeks, is able to produce a bulbil before its stem perishes down to the ground, and so to carry on as two plants, one from the bulbil and the other from the tuber, the former making trial of a new spot. By its bulbls a female plant, occupying a new site can multiply while awaiting the establishment of a male within pollinating distance. Adult D. bulbifera is very floriferous and commonly produces an abundance of seed. The pollinating agents, presumably insects, have not been detected; the flowers are pleasantly scented. Male and female flowers resemble each other, more closely than the flower of the two sexes in many species of Dioscorea. The maximum of its flowering in Malaysia north of the equator is in September, and south in May.

Econ. The tubers of wild plants become increasingly unpalatable as the time of new growth approaches. They are bitter and acrid and the backward tribes who fall back on them slice and cook them with lime and wood ashes; the product is rather like starch paste with acridity introduced. Vile in taste," wrote Rumphius, adding humourously, ‘but suited to the Amboinese stomach.’ The bulbls of the varieties suavior PRAIN & BURK. (1914) and sativa PRAIN (1903) are much pleasanter and the best even pleasant to eat. Until recently the latter existed on the edge of Singapore from former cultivation and the names ubi china (Chinese Yam) and ubi kastella (Portuguese Yam, literally Yam of Castile) lingered but without providing proof that the Chinese or Portuguese had brought it either from China or elsewhere. The same variety, cultivated near Jakarta, passed as huwi singapura (Singapore Yam), as if Singapore had supplied it. It has been found elsewhere in the Malay Peninsula to which it is certainly exotic. Var. suavior has been recognized in specimens from Java, Madura, Buru, and Halmahera. Both varieties have been met with among collections from the SE of New Guinea and from the islands to the eastward. It is interesting that var. sativa, as it grows in Singapore, produces fertile female flowers at the base of male axes.

It may be well to remark that PRAIN did not use the name ‘sativa’ for his variety in reference to any previous application of that adjective to this species. The earlier applications of the adjective in the form of Dioscorea sativa from Linnaeus to Bentham were extremely confused (PRAIN & BURK. in Kew Bull., 1919, 339). Bentham in 1861 accepted it as for D. bulbifera and for a time many botanists followed him; this was an error for there is no doubt regarding the earlier use of the name D. bulbifera. Thunberg’s D. sativa was D. bulbifera as cultivated in Japan: the type of D. bulbifera var. sativa PRAIN is a plant brought to India from the Pacific and cultivated in Jail gardens under the name Otatehkote potato. The writer has eaten its bulbls and found them pleasant, as cooked.

Vern. The names ubi atas (top-side Yam) in Malay and huwi buwah (fruit Yam) in Sundanese, can only be applied to cultivated varieties; and their use is evidence of former resort to these varieties in western Malaysia. In the islands of SE. Malaysia where the importance of D. esculenta is declared by consistent naming (see under that species) D. bulbifera has names as abobo, abubu, ahahu and ohihu; but it must be added not without a little confusion with D. peutaphylla and D. hispida. Abau, used for D. bulbifera in Solor appears to be of the same group of names; and attention may be directed to similarities in the Javanese names jebubug and kambulu. There is another name, boti and botil, used in Roti and Timor to cover it and D. hispida (q.v.). Singal is an isolated name reported from Timor. In the Bisayan languages of the central Philippines there would seem to be two groups of names, (i) baung, bohayyan, bayyangan and banayan, and (ii) puhulan, pologan and pugan. In Luzon it is oribubuk (Ilocano) and ubi-ubihan or utong-utongan (Tagalog).

6. Section Lasiophyton

Uline in E. & P. Nachtr. (1897) 84; emend. PRAIN & BURK. J. As. Soc. Beng. new ser. 10 (1914) 7, to incl. sect. Tri euphorostemon and sect. Botryosicyos Uline, &c.; R. Knuth, Phl. R. 87 (1924) after Uline, 131, 137, 150; PRAIN & BURK. Ann. R. Bot. Gard. Calc. 14 (1936) 135.—Fig. 5g–o, 6b–c, e.

Tubers renewed annually from a corrn that is superficial in the soil, stalked or not, or in D. hispida as lobes on the corn, harmless or poisonous, sometimes very poisonous. Plants as a rule pubescent with characteristic hairs (fig. 6b–c, e). In the Malaysian species the lower equidimensional cell of the hair is single; elsewhere it may be doubled. Sometimes both cells are coloured red, sometimes only the lower. Extrafloral nectaries superficial. Stems twining to the left, in most species prickly at the base. Leaves alternate palmately compound, usually with 3 or 5 leaflets, sometimes simple. The forerunner tip is not well-developed and in most species receives but a single nerve. Male flowers one at a time along the flowering axes; pedicellate (except in D. hispida), the pedicel growing out of the stem carries up the bract with the flower. The flower-carrying axes are assembled into large leafless inflorescences.
Female flowers on downwardly directed axes and after pollination reflexed. Capsules rather longer than twice their breadth. Seeds winged towards the base of the cell.

Distr. Over 20 spp. from the Atlantic to Tahiti.

Anat. Orr (Notes Bot. Gard. Edinb. 15, 1926, 138) describes a lignified coat about the extrafloral nectaries of D. hispida such as he detected in none of the other species of Dioscorea that he examined. Uline sub divided too much when he made sections out of the material which constitutes this section; his section Botryosicyos cannot be upheld; but it must be admitted that the separation of $Trieu phorostemon$ from $Lasio phyton$ can be argued on the differences in the male flowers and the tubers. If $Trieu phorostemon$ be kept, then 21. D. hispida is the only member of $Lasio phyton$ in Malaysia; the rest are in Africa.

**KEY TO THE SPECIES (♂ plants)**

1. Stems as they dry discolouring, indicative of their herbaceous nature. Flowers pedicelled. Fertile stamens 3.
2. Plants scarcely coarse. Leaflets produced at the horizon of flowering rarely exceeding 10 cm in length.
3. Pubescence soft but not silky, rusty-red and abundant. Leaf blade herbaceous. Middle leaflet 3–5 times as long as broad .
   16. D. pentaphylla
3. Pubescence silky and very abundant everywhere .
   15. D. pierrei
3. Pubescence short on the inflorescences and scant on the leaves. Middle leaflet 2–2½ times as long as broad.
   20. D. scortechinii
4. Flowers 1 mm diam. Leaf blade subcoriaceous. Pubescence white on the perianth, but rusty-red on the bracts .
   14. D. tamarisciflora
   20. D. scortechinii
4. Flowers 1 mm diam. Leaf blade subcoriaceous. Pubescence white on the perianth, but rusty-red on the bracts .
   14. D. tamarisciflora
2. Plants coarse. Leaflets up to 18 cm long.
5. Leaf blade coriaceous
   5. Leaf blade herbaceous.
   6. Leaf blade and smaller axes firmer than in the next and spikes less densely set together .
   18. D. cumingii
6. Leaf blade and smaller axes less firm and the latter more densely set .
   19. D. blumei
5. Leaf blade coriaceous
   5. Leaf blade herbaceous.
   6. Leaf blade and smaller axes firmer than in the next and spikes less densely set together .
   18. D. cumingii
   19. D. blumei
5. Leaf blade coriaceous
   5. Leaf blade herbaceous.
   6. Leaf blade and smaller axes firmer than in the next and spikes less densely set together .
   18. D. cumingii
   19. D. blumei

**KEY TO THE SPECIES (♀ plants)**

1. Stems as they dry discolouring, indicative of their herbaceous nature.
2. Plants scarcely coarse. Capsules 2–2½ cm long, completely reflexed at maturity.
3. Apex of capsule obtuse.
   4. Pubescence short, not very abundant .
   14. D. tamarisciflora
4. Pubescence long and silky, abundant .
   15. D. pierrei
   16. D. pentaphylla
2. Plants coarse. Capsules not less than 2½ cm long, and up to 4½ cm, usually more or less horizontal.
5. Leaves coriaceous. Capsules rounded above .
   17. D. elmeri
5. Leaves coriaceous or nearly so. Capsules truncate above .
   20. D. scortechinii
5. Leaves herbaceous. Capsules truncate above. (diagnostic characters fail in .
   18. D. cumingii
regard to ♀ plants of the following species .)
   19. D. blumei
1. Stems as they dry preserving a bright straw colour, firm. Capsules large and woody .
   21. D. hispida


Tubers one or two or three, descending from a corm at the surface of the soil, cylindric, to 30 cm long with a hard black cortex studded with short indurated root-bases. Stem to 6 mm in diam. at the base and with a few prickles, with red or dirty white thin pubescence. Leaves ternate; petiole equal in length to the middle leaflet; middle leaflet narrowly elliptic, long acuminate, peninnerved, to 6 by 2½ cm; base acute; lateral leaflets slightly inequilateral, with one primary nerve in addition to the midrib on each side of it; upper surface of the leaflets with a few hairs, the nerves scarcely raised, lower with red-brown hairs; petiolules 2–3 mm. Simple leaves may be produced distally and are of small size. Male flowering axes usually gathered together on leafless branches which attain 20 cm; axis to 4½ cm, with upwards of 45 flowers closely set except that there are a few bare mm at the base. Pedicel 1½–1 mm. Bracts ovate, acuminate, hisrute with white and deep red hairs. Torus not flattened. Outer tepals broadly ovate, very obtuse, less than 1 mm long, pubescent outside. Inner tepals spathulate and thick, glabrous. Stamens ½ mm long, filaments as long as the anthers; staminodes overtopping the anthers. Female inflorescences as those of D. pentaphylla (see p. 315). Capsules differing in the apex being obtuse; wings 22 by 7 mm (see fig. 5h).

Distr. From Peninsular Siam to Malaysia: Malay Peninsula (as far as Johore), rare and local.

Tuber stalked and clavate, as much as 130 cm long by 8 cm in diam.; flesh edible. Stem with scattered prickles, abundantly softly pubescent. Leaves 3–5-foliolate; petiole shorter than the middle leaflet by 1⁄4, with red-brown hair; middle leaflet elliptic to ovate, moderately acuminate; base acute, pinnerved, to 15 cm long; outer leaflets inequilateral or ovate and smaller than the middle leaflet by 1⁄4; upper surface of the leaflets with scattered red-brown rather stiff hairs, lower densely pubescent; petiolules to 5 mm long. Male flowering axes on leafless branches which attain 30 cm; axes 1–2 together to 30 mm long, their flowers set touching. Bracts ovate, rather acute, densely pubescent on the back; pedicels 1⁄2 mm. Outer tepals exactly ovate above a broad base, 1 mm long, pubescent outside. Inner tepals narrowly obovate, glabrous, shorter than the outer ones and thick. Stamens as in D. tamarisciflora, staminodes over-topping them. Female flowering axes decurved, 1–2 together, densely pubescent. Bracts lanceolate to 1 mm long. Outer tepals linear-lanceolate, acute, rather less than 1 mm long pubescent outside, inner ones a little shorter. Pedicels less than 1 mm long, reflexed after pollination. Capsules just imbricating, retaining their pubescence to ripeness by which time it is bleached white, subtruncate at the apex, rounded at the base, wings 22 by 7 mm.

Distr. Annam, Cambodia and thence down Peninsular Siam beyond the Isthmus of Kra to the border of Malayasia, at Pang-nga in the Circle of Puket.


Tuber in some varieties elongated and burying deeply, in others not so and then globose or pyriform, in some cultigens palmitely lobed, never stalked, generally if short by bristly roots, or if long with such roots on the upper part; flesh white or lemon yellow, sometimes with purple flecks in it, nauseous in the wild plants, though not particularly so if deep burying. Stem single, to 7 mm in diam. at the base, climbing to 10 m, and usually abundantly prickly over the lowest inter-nodes, pubescent, but then glabrescent. Bulbils plentiful, globose or shortly ellipsoid, rarely cylindrical, skin brown, flesh yellow. Leaves 3–5-foliolate; petiole shorter than the middle leaflet by about 1⁄4, pubescence deep rusty red or dirty white; middle leaflet broadly obovate or obovate, apex softly acuminate, not glandular, base obtuse or rounded, to 15 by 4–7 cm; outer leaflets inequilateral with one additional primary nerve outside the midrib; leaflets relatively broader when 3 than when 5, pubescent on both surfaces, but soon glabrescent above. Petiolules at most 5 mm. Male flowering axes for the most part gathered on leafless branches of considerable size, only rarely axillary; axis to 3 cm long, carrying upwards of 50 flowers placed close together or in contact. Buds appearing to be globose because the bract and bracteole so wrap them as to hide their flat base. Pedicels 1–2 mm; bract and bracteole near the apex. Bracts usually broader than long. Outer tepals broadly lanceolate, subacute, pubescent or glabrous at the back, to 1(–11⁄2) mm long; inner ones rather broader and blunter, glabrous. Stamens inserted at the base of the tepals, the 3 fertile stamens shorter than the staminodes; anthers twice as long as the filament. Female flowering axes directed downwards, 1–3 together from a leaf-axil, up to 25 cm long, pubescent, the hairs variable in the intensity of their redness. Tepals as in the male plant. Flower inverted after pollination. Capsule blackening somewhat as it ripens, with rounded shoulders about the apex though just retuse at the flower, base usually rounded; wings to 20 by 6 mm, retaining some pubescence until of full size.

Distr. From Upper India through Malayasia to the remoter islands of the Pacific (probably carried by man); in Thursday Island but not in Australia. North along the Himalaya (to 1900 m), and across S. China through Yunnan and Kwang-tung to c. 22° N.

Ecol. The climatic requirements of D. pentaphylla are almost those of D. bulbifera. It is, moreover, like D. bulbifera in the quantity of the bulbils that it produces and the freedom with which it seeds: but it has not furnished man as D. bulbifera has, with cultigens altered in bulbils, but it has yielded cultigens with the shape of the tuber altered. Fl. N. of the equator Sept.—Oct., S. of the equator April—May.

Taxon. Within its wide range it has a number of varieties, some of them cultigens. The tubers of certain of them are figured in the 'Gardens Bulletin Straits Settlements' and the 'Philippine Agriculturist and Forester'; references to these figures are entered into the following key, cited resp. as G.B. and P.A.
KEY TO THE VARIETIES

1. Tubers elongated to more, generally to much more, than twice their diameter (G.B. 2, 92; P.A. 3, 207). Red pubescence rather abundant, the leaflets rather narrow. ... var. malaica

2. Tubers not elongated to more than twice their diameter and frequently considerably lobed.

3. Large vigorous plant, leaflets to 20 cm long, red pubescent. Flowers large. Distal leaves not uncomonly simple (G.B. 3, 258).
   var. papuana

   var. javanica

2. Tubers flattened (by fascination), smooth-skinned. Leaflets rather narrow, rather silvery pubescent.

4. Leaflets to 20 cm long. Flowers relatively large. Tubers (G.B. 3, 258; P.A. 3, 207) generally larger than in the following.
   var. palmata

4. Leaflets to 14 cm long. Flowers smaller than in the above. Tuber (G.B. 3, 258) smaller.
   var. saccrdotalis

E. co. It has been said that the jungle tribes of the Malay Peninsula seek it more than any other Dioscorea (Skeat & Blagden, Pagan Races 1, 1906, 109); but this seems doubtful as the supplies are small. The high forest shuts it out, and perpetual humidity is unfavourable. To lesser humidity is apparently due a greater abundance of N of Penang and in the country behind Malacca. In both parts it is planted in garden fences whence tubers may be dug if required. The variety used is var. malaica RAIN & Burk. (J. As. Soc. Beng, new ser. 1, 1914, 23): rather long tubers, the middle leaflet is c. 4 times as long as broad. The Sakai call it jabet or chabet. Plants of N. Borneo may equally be referred to var. malaica.

In a similar way D. pentaphylla is planted in garden hedges in other parts of Malaysia, in several varieties. Ochse (i.e.) has given an account of those in Java, describing the tubers of the most usual form as small, cylindrical and unbranched, calling it huwi sawut (fibrous yam). With it are more nobbled plants as huwi jahe (ginger yam, so named from the shape), which is var. javanica Burk. (Gard. Bull. Str. Settld. 3, 1924, 258).

Huwi sawut can bear no botanical name at present because the Sundanese and the Javanese do not apply the vernacular name strictly. It occurs in bamboo thickets, on forest margins and in similar places, as well as in garden hedges; in the hedges it has encouragement without cultivation and now and then is dug for food, eaten roast or boiled by itself or in mixed vegetables as a flavouring.

Superior to huwi jahe and considerably superior to the average huwi sawut is var. saccrdotalis Burk. (i.e.). It has high sounding names as huwi mantri (priest’s yam), huwi putri (princess’ yam) and huwi dewata (sacred yam); it has been suggested that they came to denote it because it was a food allowed on Hindu fast days. The foliage of these Javanese economic varieties is smaller than that of var. malaica and the male flowers are small in a degree which makes recognition easy, not of the exact variety for that depends on the tuber, but that one of the group is under the eye.

Var. saccrdotalis is recorded from the Res. of Madiun, Pasuruan and Besuki in E. Java and the Kangean Isl. between 1 and c. 1000 m. Its leaflets are broader, in proportion to their length, than those of the wider spread var. javanica Burk. (i.e.) and not uncommonly there are simple leaves towards the stem-ends. The type was cultivated by K. Heyne at Bogor, but he did not record whence he obtained it.

Var. javanica occurs in Celebes as well as in Java, and would seem to occur through the Lesser Sunda Islands. Rumphius’s account of D. pentaphylla is interesting (Herb. Amb. 5, 359); he wrote in particular of its uses in Sumbawa, where three kinds occurred. The first he called the white kind; it produced large white-fleshed tubers of which the extremities could be eaten although of vile flavour; the second he called the red kind and it had hard red flesh; it produced smaller tubers and they were better to eat; the third, called the black kind, turned black in cooking and blackened the water in which it was boiled. These cannot as yet be assigned to varietal names.

The Ambonese, Rumphius recorded, would transplant tubers from the forest to their gardens but not much and they would eat the produce of their gardens but not the plant direct from the forest unless driven by famine. The two tubers figured by him (pl. 177), the one lobed, the other clavate, represent respectively the cultivated and the wild plant.

The above references do not dispose entirely of the forms of the species in SE. Malaysia, for Forsten collected in Bima (Sumbawa Island) a very graceful plant which has not been seen from elsewhere.

In the Philippines there are at least two varieties: one may be referred to var. malaica Burk., the other has been named var. palmata Burk. (i.e.); it is a cultigen close to var. saccrdotalis, but larger in tuber. A plant appearing to be var. palmata has been collected in Timor.

In New Guinea there is a very robust var. papuana Burk. (i.e.) with a remarkably prickly stem up to 12 mm in diam. and so large as to have paired scale-leaves at the base. Can it be D. globifera R. Knuth which otherwise remains unplaced?

Vern. A few names which suggest transference within Malaysia from one place to another doubtless originate with the adoption of a cultivated race. A name recorded by Rumphius for Ternate is ubi pariaman suggesting transference from Priaman in NW. Sumatra. Another place-name ubi magin-dano meaning yam of Menado, is in use in N. Celebes. Various descriptive names under ubi and huwi have been mentioned under Economy. It is very interesting to record that the name jabet used by the Central Sakai of the Malay Peninsula has been obtained by Backer in central Java and in this connection to point out the similarity of jabet
to 
s 


Underground parts unknown. Stem thicker than that of D. pentaphylla and of greater growth. Leaves harsh, 3–5-foliolate; petiole shorter than the middle leaflet by about 1/4; middle leaflet ovate or elliptic-ovate, very shortly acuminate, to 13 by 7 cm, base obtuse; outer leaflets very inequilateral, with one primary nerve outside the midrib; upper surface glabrous at maturity, lower with abundant rusty red hairs on the larger nerves. Male plant uncertain. Female flowering axes solitary or 2 together from the axils of upper leaves, decurved, to 20 cm long and then bearing c. 40 capsules, densely red-brown pubescent. Bracts broadly ovate, to 2 mm. Pedicel after pollination turning the fruit upwards. Outer tepals lanceolate-ovate, acute, densely covered outside by red-brown hairs, inner ones similar, but less pubescent. Capsules chestnut-coloured, rounded at both ends, but variable in the evenness of rounding at the base, appearing to be a little uncertain in the way of dehiscence; wings 25 by 10 mm.

Distr. Malaysia: throughout the Philippines. Taxon. Variable and divisible into the following varieties:

KEY TO THE VARIETIES

1. Capsule to 30 mm long.
2. Leaflets to 7, more or less ovate.
3. Pubescence moderately abundant, rusty red. Var. inaequifolia

3. Pubescence dense, of matted white or whitish hairs.

2. Leaflets to 9 (–11), linear-lanceolate or lanceolate. Var. polyphylla

1. Capsule to 40 mm long. Var. ramosii

The first and the third of these are respectively D. inaequifolia ELMER and D. polyphylla R. KNUTH, here reduced to varieties, the last, var. ramosii BURK., has not been described hitherto unless it is synonymous with D. heptaphylla SASAKI (Trans. Nat. Hist. Soc. Formosa 21, 1931, 47; for a comment on SASAKI’s description see Ann. R. Bot. Gard. Calc. 14, 1938, 423), which was obtained in the island of Botel Tobago, or Koto sho, which is 80 km E of the southern point of Formosa. Var. ramosii has been obtained in both sexes on the slopes of Mt Iraya in the island of Batan (RAMOS 79927, 79946) and on Camiguin Volcano in the island of this name (EDAÑO 79173). These islands are between Luzon and Formosa.

Var. polyphylla (R. KNUTH) BURK., by which reason of its many leaflets appears more distinct from the other components of D. cumingii than it really is, occurs from the N. parts of Luzon to the latitude of Manila, whence southwards var. inaequifolia (ELM.) BURK. replaces it. Near the boundary between these two the type of var. cumingii was obtained, at an unspecified locality in the Province of Batangas (CUMING 1469).

Econ. Elmer recorded that parts of the tuber, obviously the lower parts, are eaten as food in the Province of Benguet, Luzon. He gave to it the Igorot name kasi. Pari is said to be its name in the Bagobo language of Mindanao. Townsfolk who do not need to eat tubers of D. pentaphylla and its

Underground parts and lower parts of the stem unknown; distal parts glabrous (doubtless glabrescent), sparingly prickly, faintly ridged. Bulbils none seen. *Leaflets* 5, thinly herbaceous; petiole c. 7 cm, sparingly clad with rather stiff hairs; middle leaflet elliptic, obtuse or almost rounded at the base, abruptly acuminate, to 12 by 5 cm; outer leaflets only slightly inequilateral; upper surface of the blades glabrous; lower retaining to maturity a small amount of rusty red hair; nerves prominent; petiolules to 10 mm. *Male inflorescences* up to 50 cm long, the primary axis branched and the branching twice or thrice repeated, shortly pubescent, ultimately glabrescent. Bracts carried almost at the top of the pedicel which is 1 mm long, broadly triangularly ovate, ± acuminate, rusty red haired. Flower-bearing axes to 2 cm long so densely placed that they touch one another. Outer tepals ovate, obtuse, bordered and beset down the middle line by red-brown hairs 1½ mm long, inner ones elliptic, shorter than the outer ones, obtuse. Stamens overtopped by the staminodes. Female plant unknown.

**Distr.** Malaysia: W. Java (Mt Salak, S of Bogor); collected by ReINWARDT, and not collected since. Also in N. Sumatra?

**Notes.** LINNÉ had made two spp.: *D. pentaphylla* and *D. triphylla* on closely similar material, and BLUME identified the more vigorous part of his material with the first, and the less vigorous plants with the latter.

A d plant similar to ReINWARDT's has been obtained in N. Sumatra (at Sibolangit, LÖRZING 4816, 4817), well-collected except the tuber; base of stem 12 mm diam., paired scale-leaves at the base, leaves 3–7-foliolate, middle leaflet 28 by 10 cm. It is likely that the base of ReINWARDT's specimen was as large. If it be, as is probable, that the Javan and Sumatran specimens belong to the same species, there is a reasonable possibility that in both places a polyphylous condition has been thrown by local *D. pentaphylla*. If so, is *D. cunningii* an established polyphylid?

HAINES (Fl. Bihar & Orissa 1925, 1123) has suggested that the Indian *D. kakkapershadii* PRAIN & BURK., a larger plant than *D. pentaphylla*, is a polyphylid. It is desirable that the chromosome numbers should be taken of any giant specimens resembling *D. pentaphylla*.


Tuber pyriform to clavate; flesh firm. Stem abundantly prickly at the base, to 6 mm in diameter, from pubescent to glabrescent. Leaves 3–5-foliolate, herbaceous; petiole about as long as the middle leaflet, glabrous; middle leaflet elliptic, acuminate, acute at the base, to 8 by 4 cm, outer leaflets inequilateral with one primary nerve outside the midrib; blades below with short red-brown hair, nerves prominent; petiolules to 5 mm. *Male flowering axes* aggregated into long leafless inflorescences, 1–4 together; flowers to 25 on the flower-bearing axes 5 cm long, touching each other, pubescent with red-brown hair. Bracts narrowly ovate, acuminate, covering but not enwrapping the flower, densely pubescent, 1½ mm long. Pedicels carrying the bract close under the flower. Outer tepals ovate, acute, 1 mm long; filament as long as the anther; staminodes subspathulate, overtopping the stamens. Female flowering axes solitary from the axils of upper leaves, with c. 35 flowers buried in red-brown hair but later glabrescent. Bracts lanceolate, acute, densely pubescent, 1½ mm long. Fertilized ovary in a horizontal position. Outer tepals broadly ovate, acute, 1½ mm long, densely pubescent outside, inner ones similar except thinner margins. *Capsules* blacken as they ripen, slightly retuse at either end, margins parallel; stipe 2 mm; wings 40–50 by 11–12 mm.

**Distr.** Tonkin (a variety), *Malaysia*: Simalur Island, N. Sumatra, Malay Peninsula (from Perak southwards).

Java 1 (1911) 308.—Helinia hirsuta Kunth, En. Pl. 5 (1850) 438; Queva, Mém. Soc. Sc. Lille IV, 20 (1894) 193, 381.—Fig. 5k–n, 6e.

Tuber in a general way globose, but lobed, occasionally slightly elongated, up to 35 kg or even more, straw-coloured to light grey outside, produced at the surface of the soil and intensely poisonous, flesh white to lemon yellow. Stem to 9 mm in diam. or more, usually prickly, green to straw-coloured, at first pubescent, then glabrescent. Bulbils never seen. Leaves 3-foliate; petiole as a rule rather longer than the middle leaflet, to 25 cm long, frequently with small prickles on the larger nerves on the back; middle leaflet elliptic or elliptic-oblong, rarely obovate, still more rarely tri-partite, acuminate, acute at the base, to 30 by 28 cm; lateral leaflets inequilateral, the outer half 3-nerved; blade herbaceous in the Indian var. daemona (RoXB.) PRAIN & BURK. (1934), more or less chartaceous in the varieties of Malaysia particularly in var. reticulata (Hook.f.) PRAIN & BURK. (1927) upper surface thinly silky when young, then glabrous, with all the nerves conspicuous; lower surface retaining its hairs to some extent; petiolules to 10 mm. Male flowering axes gathered into large leafless inflorescences twice or thrice compound, sometimes 50 cm long; axes bearing the flowers usually solitary, with upwards of 40 flowers which are closely packed in var. daemona, but spaced in the other varieties, clothed in tawny or white hairs [var. mollissima (PRAIN & BURK.) PRAIN & BURK. (1927)]. Bracts just overtopping the flowers, sub-saccate and acuminate, pubescent at the back. Outer tepals orbicular, very thin at the margin, pubescent on the back at the middle, 8/4 mm diam., inner ones a little longer and firmer, incurved. Stamens all fertile, 1½ mm long, anther as long as the filament. Female flowering axes solitary from upper leaf axils, downwardly directed, when capsules are mature pendulous by their weight. Flowers spaced. Bracts triangularly lanceolate, pubescent, 2–2½ mm long. Fertilized ovaries and capsules facing more or less upwards. Outer tepals ovate-lanceolate, pubescent, inner ones a trifle smaller. Capsules becoming glabrous, honey-coloured, imbriicating, apex obtuse in various degrees, base variable and at times one wing may be more truncate than another (fig. 6e); sometimes the wings are retuse at the base above the stipe; wings broadest above the middle, to 40–50 (–60) by 10–12 mm, their margin sometimes freed in dehiscence and looking like a fine wire. Seeds winged to the base of the cell.

Distr. W. India through Malaya to W. New Guinea, also in New Ireland. As it is cultivated to some extent, the occurrence in New Ireland and N. Guinea may be due to man.

KEY TO THE VARIETIES

1. Male flowering spikes dense, flowering terminal part not more than twice as long as thick; foliage more herbaceous than chartaceous.

   1. Male flowering spikes considerably longer and the flowers barely touching each other.

   var. daemona

2. Vigorous plants with capsules truncate or even retuse at the apex.

3. Hairs honey-coloured . . var. hispida

3. Hairs white denser as a rule var. mollissima

4. Less vigorous plants with much smaller almost acute capsules . . . . var. scaphoides

Var. hispida is universal in Malaysia. Var. mollissima is reported to occur in various localities from Burma to Java, and always in country where var. reticulata occurs. Var. scaphoides PRAIN & BURK. (1927) occurs in Siam and southwards down Peninsular Siam to the Circle of Puket. Var. daemona has been reported from various localities within Malaysia but all these need verification, because the determination has depended on imperfect herbarium material. The undisputed distribution of var. daemona is from the Bombay coast to the western edge of Burma. LINNE confused D. hispida with D. pentaphylla under the name D. tripitylla; and when JACQUIN figured it calling it D. tripitylla his very excellent figure went far towards fixing that name. But DENNSTEDT put forward two names for it in 1818 and one of them D. hirsuta—it stood second in order of pages—BLUME took for it and led a school which employed it. ROXBURGH had already issued D. daemona. Botanists in India became divided, some following BLUME and some ROXBURGH. MERRILL in 1917 showed that by rule DENNSTEDT’s first name, D. hispida, is the correct one. Writers on African plants confused the African D. dumetorum PAX; and the circumstance has this of interest in it that, whereas D. hispida is the chief famine food of tropical Asia, D. dumetorum takes the same position in a large part of tropical Africa (see CORKILL, Ann. Trop. Med. 42, 1948, 278).

Econ. D. hispida owes its importance in famine to the comparative ease with which it surface-growing tubers can be gathered, and to their size which goes far towards relieving a situation of distress. After harvesting follow days of preparation during which the poisonous alkaloid, dioscorine, must be washed out of the tissues by water. The process entails a killing of the tissues in which slicing, pounding, rasping and boiling may be used in various ways: then must follow days of soaking in water, sea water or water with salt in it being best. The final product is a starchy meal which can be made into palatable preparations and moreover will keep if dried and kept dry. The alkaloid is present in the foliage as well as in the tuber. A piece of the raw tuber of the size of an apple kills a man. A proverb of the Island of Roti runs—he who eats boti (the local name for the tuber) must die’. Pounded tubers are used in India for poisoning bait for tigers. All mammals are susceptible and beyond all doubt the plant is very well protected in the forests. In many countries it is customary to prepare the meal, though in most of them to use it only when there is scarcity; but Hindu priestly law permitted the eating on fast days (cf. under D. pentaphylla). It would seem that D. hispida is planted in Java more than elsewhere; but it has not been demonstrated that a race less poisonous than
the wild plant is employed. Malays who made palm sugar from Arenga formerly encouraged it because they employed pounded tubers as a paste to keep sterile the wounds of their tapping. This accounts

for an unusual abundance about villages near Malacca; and for a like abundance which exists no longer but was observed by Ridley in Singapore Island (see J. Str. Br. R. As. Soc. 33, 1900. 167).

Vern. There is a Mon-Khmer word khoei for yam, converted everywhere in Burma to kywe and restricted by the Burmese to D. hispida which appears on the tongues of the Northern Sakai and Perak-Temiar of the mountains between Perak, Kelantan and Pahang in the form kuai. It is not used by those who live in the lowlands whose noun for D. hispida is the unlike word gadong. Gadong—gadung in Java—is widespread; it is used in Sumatra, the Malay Peninsula, Borneo, and by the Bugis of Celebes, through Java and down the Lesser Sunda Islands at least to Sumbawa where it loses its terminal ug and becomes gada. It is known to the Northern Sakai, along with kawaii and recorded from them as gadu. It invariably indicates D. hispida, but the Battaks of Sumatra extend it, with qualifications, to other Dioscoreas. It is a well defined name, as befits a plant of considerable importance. In the northern parts of the Philippines D. hispida is widely named by a noun commencing with k: karut, karot, kadut and kayos, passing to orot, orkot and gayos. Among the Tagalog of Luzon, curiously the Spanish word nyamit has been taken into use for it in the form namit. One would doubt the origin were it not that another Spanish word, sarsaparilla, has been adopted in the Sambuli language (see below under § Enantiophyllum). In Bali and on the opposite coasts of Celebes D. hispida is named sikapa, siapa, sikapang or sikapu. In Bali yangga and diaungga are also used. In Roti and Timor, botil and bottil are used, but cover also D. bulbifera. There is another name in Timor, kasmun.

About the Alfura Sea the following names are known: butule, hayule, hayiuru or hayuro. Ondo or ondot occur in Ceram and Amboyna. Lede is reported from Bima in Sumbawa; lef from the Serwatti Islands (near Timor), and from the Kei Islands; and lastly mauno in the Bikol language of Mindanao and bagai in the Mangyan language of Central Mindoro.

7. Section Enantiophyllum


Tubers 1 or sometimes 2 or more, usually deeply descending into the soil, annually replaced, never poisonous though sometimes unpleasant to eat, chiefly from tannis and saponins. Stem twining to the right, usually armed, particularly at the base. Hairs usually absent, if present as stiletto hairs (fig. 6) or dendroid hairs. Extra-floral nectaries of the deep kind. Leaves entire, opposed or alternate; on thin axes alternate, on axes thicker at origin opposite; petiole not auriculate at the base. Male flowers in spikes axillary or more generally cauliflorous. Flower fleshy, particularly the torus (fig. 4e–g), the latter not enlarging into a cup, in some spp. of Celebes growing upwards; tepals incurved through anthesis so that the flower scarcely expands; outer tepals ovate, 3/4–2 mm, inner ones narrower at the base and ± shorter and blunter. Filaments as long as the introrse anthers. Bract repressed against the axis and curving round the bud, not so in ffs; bracteole inserted within
one margin of it. Female flowering axes decurved, 1 to 3 together from a leaf axil; flowers and capsules facing forward; wings of the capsules as broad as or broader than long; stipe growing facetiously with the ripening capsule. Seeds winged all round with a smoky brown, membranous wing conform to the loculus, of 2–3 cm diam.

Distr. The Enantiophylla make a compact group of species often difficult to discriminate, spread through the tropics of the old World from the Atlantic to the Pacific.

Ecol. Most of them protect their tubers by deep burial in the soil. One species which does not bury deeply has much tannin in its tubers and a few others have thorny roots; but none of these are Malaysian. Some hold saponins. Man uses the tubers of almost every one for food when circumstances make the labour of digging them up worth while. He created D. alata as a cultigen taking advantage particularly of such variations as it produced towards shallow burying, perpetuating the variations in clones. In Malaysian Enantiophylla largeness of lamina and presence of hairs are associated characters; the species possessing hairs are placed at the end of the taxonomic sequence adopted here. None of the hairy species pass into Malaysia eastwards of Borneo and Java, and hairiness is absent except that D. merrillii, a local species of the Philippines, has a few hairs (fig. 13d).

The commonest species of the section in W. Malaysia is the hairy D. pyrifolia, in contrast the commonest species to the eastward, is the glabrous D. nummularia.

The distribution in Malaysia of species with narrow leaves is illustrated in fig. 11. The intensive negative geotropism of the male flowering axes (fig. 4e) has been used to bring the species that have it together at the commencement of the sequence. This character is not met with outside Malaysia except slightly in western Africa. D. laurifolia and several others have strongly benzoin-scented flowers. This species is used again (fig. 10) to illustrate the dissimilarity of seedling and mature leaves. Female plants possess fewer useful taxonomic characters than male plants. The capsules vary in size as shown in fig. 5 (lowest line, where p is the largest of Malaysia and r the least).

Vern. Every villager in Malaysia distinguishes by name D. alata from all the wild species of Enantiophyllum as definitely as he distinguishes D. esculenta, D. hispida, D. bulbifera and D. pentaphylla, but he does not distinguish consistently the wild Enantiophylla one from another, nor from the genus Smilax. Often for instance, those who speak Sundanese will give the name as chanar or banar (that is Smilax), adding a qualifying word. Curiously the resemblance to Smilax, which is genuine, has introduced into the Sambali language of Luzon the Spanish word sarsaparilla, by application to D. nummularia, in the form sapsaparilha. Malays classify the wild Enantiophylla as akar (climber) with a qualifying word such as keminiyan (benzoin)—e.g. akar keminiyan or climber with benzoin-scented flowers. Javanese substitute aroi for akar. Kemhang, recorded as a Semang name is a distortion of keminiyan. It is not unusual to cut the tough stems to serve as cordage, whence the Malay word tall (cord) may take the place of akar. It is recorded as used in the Malay Peninsula, Ambon, and eastern New Guinea. Rumphius used it for D. nummularia as tall cupang which he translates penny cord, cord strung with coins or mussel shells (the leaves); Rumphius's further names, daun keping-keping and daun pitis-pitis, may be translated coin-leaved. Rumphius goes on to explain that there is an acrid juice in the stem which irritates the skin and gives rise to the name daun bisol (boil leaf). The tubers hold the same juice; but it does not prevent the wild pigs from eating them.

Names for the wild Enantiophylla in the Philippines are of more than one series; it is not obvious why this is so. The series are (i) dulfan, dulfan, duluyan, dulan; (ii) kiroi, kiru, kwiroi, kwiru, kwireot, kirini, and (iii) ubag, kobag. These are used in the several languages of eastern Luzon from the northern end down to Manila for D. luzonensis, D. divaricata, D. nummularia, etc. In Javanese the following names belong to the wild Enantiophylla of that island: weru, werung, kerung, werungan, wirung, gadungan. Waro used in Ambon seems to be of the group.

KEY TO THE SPECIES

1. Male flowering spikes negatively geotropic (fig. 4e).
2. Male flowers carried on leafless branches. Blades of contemporaneous leaves not cordate at the base.
3. Blade very coriaceous.
   4. Blade ovate to broadly elliptic, rounded under the acumen ........ 22. D. havilandii
   5. Blade ovate and narrowed into the acumen ........ 23. D. bancana
3. Blade coriaceous, ovate and narrowed into the acumen, 10 by 5 cm ........ 24. D. laurifolia
3. Blade herbaceous, to 15 by 7 cm ........ 25. D. prainiana

(1) It is impossible to construct a key for the determination of female plants of the section Enantiophyllum; they do not exhibit adequate characters.

NAVES introduced the names of several species of the Enantiophylla into his Novissima Appendix (1880) which are most unlikely to occur in the Philippines, and as his material was destroyed in 1899 in the burning of the Guadeloupe convent at Manila, all that can be done towards elucidation is to enumerate them among the 'excludendae'.

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5. Blade coriaceous.

6. Blade to 17 by 10 cm. Male spikes to 20 cm long. 26. *D. warburgiana*
6. Blade to 4 by 2 cm. Male spikes to 5 cm long. 27. *D. vanvuurenii*

5. Blade herbaceous.

7. Blade lanceolate or long-lanceolate. 28. *D. vilis*

8. Male flowers relatively small, the sepals 1 mm long. Auricles of leaves generally rounded. 29. *D. peperoides*

1. Male flowering spikes positively geotropic, carried in fascicles in leaf-axils or towards the ends of weakening stems in the axils of bracts that replace the leaves. 30. *D. luzonensis*

1. Male flowering spikes but little influenced by geotropism.

9. Torus in the male flower growing upwards centrally, causing the petals and stamens to appear connate or adnate (fig. 4e).

10. Male flowering spikes in large axillary fascicles. 32. *D. sarasini*
10. Male flowering spikes 1 or 2 together along compound flowering branches. 33. *D. sexrimata*

9. Torus in the male flower not growing upwards centrally.

11. Spikes distributed among the foliage leaves, arising direct in their axils.

12. Blade ovate. Fascicles of spikes small. 34. *D. oryzetorum*
13. Male flower bud warted at the base inwards in the axil (fig. 4g). Blade very thin. 35. *D. gracilipes*


14. Blade very thin. 34. *D. oryzetorum var. angustifolia*
15. Buds of male flowers globose. 36. *D. elegans*
15. Buds of male flowers elongated. 37. *D. moultonii*

11. Spikes produced on leafless branches.

16. Leafless branches small; spikes of unequal sizes. Leaves very coriaceous. Stems very woody. 38. *D. lamprocaulina*

16. Leafless branches shorter in general than the axillant leaves, the spikes not showing irregularity in length, but diminishing as the leaf diminishes with its distance from the base of the branch.

17. Blade at least 4 times as long as broad.

18. Leafbase rounded; lower side bright. Capsules relatively large. 40. *D. grata*
17. Blade broadly ovate, acumen long. 41. *D. opaca*
17. Blade cordate large, abruptly acuminate. 42. *D. wallichii*

16. Leafless branches well developed, as a rule much longer than the axillant leaves. Spikes maintaining a uniform length (but unknown in *D. madiunensis*).


20. Leafbase obtuse or rounded on mature plants (youth forms possess auricles).

21. Capsule of large size, wings reaching 27 by 30 mm. 43. *D. madiunensis*
21. Capsule smaller, wings to 22 by 25 mm.
22. Blade very thin, drying a deep purple-brown. 44. *D. sitamiana*
22. Blade thinly coriaceous, usually rounded at the base, not turning brown.
23. Blade exactly ovate. 45. *D. nieuwenhuisii*
23. Blade large and long, to 20 by 5 cm. 46. *D. kingii*
23. Blade small and elongated, to 10 by 2½ cm. 47. *D. salicifolia*

20. Leafbase auriculate.


25. Stem cylindric. Auricles at the base of the lamina usually with the inner margin bayed about the petiole. 48. *D. filiformis*
25. Stem quadrangular with a wing on each angle. Auricles not bayed towards the petiole. 49. *D. alata*


26. Leafbase with rounded auricles.

27. Leaf and capsules drying a red-brown. Blade in general a little shorter than that of the species which follow. 50. *D. nummularia*
27. Leaf and capsules inclined to be glaucous green when dry. Blade in general rather longer than in the last. 51. *D. glabra*
26. Leafbase with divaricate auricles and the margin between the auricle and the apex rather straight. 52. *D. divaricata*
26. Leafbase subtruncate, and blade somewhat hastate in consequence. 53. *D. loheri*

19. Hairs present on at least some part of the plant, particularly on petiole and inflorescences.
29. Blade thinly coriaceous. Hairs only on the flowering branches.
30. Capsule wings not much wider than semicircular, to 18 by 22 mm.
28. Blade cordate. Pubescence more extensive and in _D. orbiculata_ dendroid as well as stiletto hairs.
31. Leaf margin hyaline. Male flowers nearly or quite in contact one with another, not pubescent outside.
32. Male flower buds not in contact, the spines long. Upper surface of the leaf glabrous.


Tuber unknown. Stem glabrous, wiry, probably unarmed throughout. Bulbils none seen. Leaves alternate, decidedly coriaceous, elliptic or the larger so broad as to be almost circular, sometimes ovate _[var. ovalifolia]_ PRAIN & BURK. (1938), abruptly acuminate (acumen to 10 mm), base just cordiform, to 11 by 9 cm, 5-nerved, the outermost nerves submarginal and the intermediate much nearer to the margin than to the midrib; upper surface somewhat shining, the larger nerves just prominent after the leaf has been dried; petiole 1/3 the length of the lamina. Male flowering axes gathered into large leafless branches up to 70 cm long, the axes directed strictly upwards and flowerless through 2-5 mm at the base, then fertile with about 40 flowers, angled. Buds globose, up to 1 mm long. Female flowering axes to 35 cm and probably at times even shorter. Capsules broader than in the species immediately following; wings to 20 by 22 mm, apex notched, base truncate.

Distr. _Malaysia_: Borneo (Sarawak and Kutai) and Billiton. Fig. 9a.

Ecol. Mountain ridges, near Kuching apparently common.

Vern. _Akar kowat_ (Kuching).

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Underground parts unknown. Stem as that of _D. havidanllii_. Bulbils none seen. Leaves alternate, decidedly coriaceous, ovate or ovate-elliptic, to 15 by 6 cm, acuminate, base rounded, nerves 5 with courses as in _D. havidanllii_; petiole to 3 cm long. Male flowering axes in large leafless inflorescences, perhaps not quite so strongly negatively geotropic as those of _D. havidanllii_ for they curve upwards less abruptly than do those of _D. havidanllii_. Female flowering axes 1-3 together markedly angled. Capsule unknown.

Distr. _Malaysia_: Banka. Fig. 9a.

Note. A study of the plant in life is desirable in order to decide if it really differs from _D. laurifolia_.


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Fig. 10. Leaf-shape in _Dioscorea laurifolia_ WALL. ex Hook. f.: a. the first assimilating leaf of the seedling, b-c. the first and second leaves of the first developed stem, _d-e_. the first and second leaves of the second developed stem, which stem is not arrested as is the first at the second leaf, f. a leaf from the vegetative part of an adult plant, g. a leaf from a flowering part. All drawn × 1/3; the proportions work out approximately as 1: 4: 5: 9: 7: 12: 6.
Tubers 1 or perhaps 2, descending into the soil but not very deeply, flesh red to pink, fibrous in the upper parts. Stem wiry, unarmed, faintly ridged, rooting at times from lower nodes that happen to lie on sufficiently moist soil. Leaves alternate, coriaceous, lanceolate-ovate, to 16 by 5 cm on the mature plant, not much less on plants that are not quite mature but of a different shape being auricled at the base (fig. 10), 5-nerved, the outer nerve submarginal, the intermediate nerve as near to the margin as to the midrib; upper surface dull with the larger nerves slightly prominent, lower surface shining, smooth but with the larger nerves raised; petiole rather short, between 1/3 and 2/4 of the length of the lamina. Male flowering axes usually on leafless branches or branch-ends, but occasionally spikes are found in the axils of assimilating leaves, to 7 cm long, angled, with 40-60 flowers spaced their own diameter apart. Buds slightly longer than globose. Female flowering axes 1-2 together to 10 cm long or a little more. Capsules relatively large, wings to 27 by 24 mm, apex of capsule retuse, base obtuse.

Distr. Malaysia: Malay Peninsula, W. side (not yet in Kelantan, Pahang, and Trengganu). Fig. 9a.

Ecol. Plentiful in the mountains, particularly the Main Chain, 0-1200 m. Fl. irregularly, flowers strongly benzoin-scented.


Tuber thrust deep into the soil, subglobose, to 30 by 15 cm, on the end of a stalk perhaps 30 cm long, flesh yellow. Stem climbing to 16 m, unarmed, to 5 mm in diam. at the base. Plant glabrous. Bulbils not seen. Leaves alternate on the thinner stems and opposed on the thicker, elliptic or ovate-elliptic, to 15 by 7 cm, acuminate, base rounded, 5-7-nerved, the outermost nerves when there are 7 very weak and submarginal, 5-nerves more usual; secondary nerves only a little more distinct than the network which is only just visible on the upper surface; lower surface with prominent primary nerves; petiole to 6 cm or 1/2 to 1/4 the length of the blade. Male flowering axes gathered into decurved inflorescences which may be 60 cm long; the axes themselves to 8 cm with upwards of 60 flowers set their own diameter apart. Buds ovoid and not exceeding 1 1/2 mm in length. Female flowering axes to 50 cm long, markedly angled. Capsules relatively large; wings 25 by 30 mm, apex retuse to almost truncate, base almost truncate.

Distr. Malaysia: NE. Sumatra (Berastagi and Sibolangit), Malay Peninsula (Perak, S to Singapore) and apparently also in Pahang and Trengganu, but the material brought as yet from these two States is sterile, Central Celebes (a plant, Kjellberg 2009, from Malili). Fig. 9c.

Ecol. Ascending in the Malay Peninsula to 350 m, but in Sumatra to 500 m and yet higher.

Note. Attention is drawn to the manner in which the primary nerves may diverge at the base of the lamina—a gradual diverging which implies an unusual ratio between the rates here of longitudinal and latitudinal growth.

D. kingii should be compared, as the same happens in it. Ridley (Fl. Mal. Pen. 5, 1925, 340) holding this species and his D. tenuifolia to be one, claims the latter name for it.


Underground parts unknown. Plant glabrous. Stem unarmured in the upper parts, probably through-out, smooth. Bulbils none seen. Leaves at the horizon of flowering opposite, almost coriaceous, elliptic-ovate, to 17 by 10 cm, shortly acuminate, 7-nerved, the outermost nerves weak and submarginal; upper surface with the nerves distinct, the secondary tending to break up in the network; petiole short, to 5 cm or 1/2 to 1/4 the length of the lamina. Male flowering axes, as far as seen, in fascicles in the leaf-axils, unusually long, to 20 cm, bearing about 80 flowers spaced at rather more than their own diameters apart, conspicuously angled. Buds globose, to 1 1/2 mm long. Female flowers unknown. Capsules broad, wings 22 by 22 mm, on a stipe 6-7 mm long.

Distr. Malaysia: Celebes (N. peninsula). Fig. 9d. Ecol. Fl. irregularly; flowers benzoin-scented.


Underground parts unknown. Plant glabrous. Stem in the upper parts unarmured, scarcely ridged. Bulbils none seen. Leaves at the horizon of flowering opposite, coriaceous, ovate, to 3 by 2 cm, shortly acuminate, 5-nerved; petiole about 1/4 the length of the lamina. Male flowering axes in small fascicles on leafless branch-ends and also in the axils of leaves on the stem, to 5 cm in length, erect in response to gravity, with about 60 flowers. Buds globose. Female plant unknown.

Distr. Malaysia: Central and SE. Celebes (Kendari at 300 m, Kjellberg 671). Fig. 9b.


Tuber apparently burying itself deep, edible, slender, attaining 25 cm and more. Plant glabrous. Stem 3–4 mm in diameter at the base and with a few small prickles there, unarmed above, terete or

very obscurely ridged, climbing to 16 m (Koorders). Bulbils none seen. Leaves alternate, herbaceous, broadly lanceolate to narrowly ovate, 10 by 4 cm, acuminate, 7-nerved; upper surface with the larger nerves prominent; petiole to 4 cm or to \( \frac{1}{4} \) or \( \frac{1}{5} \) of the lamina. Male flowering axes all in fascicles in leaf-axes, 1–3 together. Assuming an upright position in response to gravity, to 7 cm long with about 50 flowers; axis strongly ridged and minutely scabrid. Buds globose except that the base is flattened. Female flowers unknown. Capsules rather large, apex retuse, base almost retuse, about 18–20 mm; stipe 7–8 mm long.

Distr. Malaysia: Java (from Mt Gedeh eastward). Fig. 9e, 11d.

Ecql. In the mountains, 650–2400 m, apparently rare, also in Casuarina forest.

Notes. The nomenclature has been confused from not recognizing Blume's plant of D. filiformis: a careful examination of Blume's authentic specimens, which are unfortunately only with very young bud, leads to the conclusion that they represent poor specimens of what has later been called D. myriantha (see p. 329).


Underground parts unknown, but assuredly as those of D. luzonensis. Plant glabrous. Stems, at least in the upper parts, unarmed, with very faint ridges. Bulbils none seen. Leaves on the larger stems opposed, but on the plant more often alternate than opposed, broadly cordate with evenly rounded auricles or angular auricles [var. sagittifolia Prain & Burk. (1914)] to 12 by 12 cm, 7–9-nerved, acuminate: petiole about as long as the lamina. Male flowering axes 1–4 together in fascicles in leaf-axes, more or less erect, up to 6 cm long with about 60 flowers spaced so as to be in contact one with another; axis angled. Buds rather more elongated than globose, to \( \frac{1}{2} \) mm long. Female flowering axes 1–2 together slightly angled. Capsule slightly retuse at the apex, more or less rounded at the base; wings 17 by 10 mm. nearly semicircular; stipe to 3 mm long.

Distr. Tonkin (a variety) and Malaysia: Philippines. Fig. 9f.

Ecql. Chiefly in the mountains of Luzon, ascending to 1300 m, where pine forests commence, growing there in thickets, but also found at sea-level in Golo Island off Mindoro and on limestone cliffs in the Pabellones Islands off Palawan.

Notes. D. peperoides is very closely allied to D. luzonensis but has much smaller flowers and slightly different leaves. It has not been found that the two grow together. There is no indication that it is distinguished in the field from D. luzonensis and is probably used as food equally.


Tuber one a year, subovate, descending down to a depth of 1 m: flesh white or pinkish white, esculent. Plant glabrous. Stem unarmed, faintly ridged. Bulbils none seen. Leaves on the larger stems opposed, but more often alternate than opposed, cordate with the auricles somewhat hastately extended, somewhat acuminate, 15 by 12 cm, 5–7-nerved: petiole about as long as the lamina. Male flowering axes 2–4 together in fascicles in the axis of upper leaves, to 7 cm long with about 60 flowers spaced their own diameter apart. Buds nearly globose, to 2 mm long. Female flowering axes solitary, to 22 cm long, carrying up to 35 flowers, angled. Capsules truncate at the apex, very obtuse at the base, wings to 22 by 15 mm. ashy green when nearly dry, stipe to 5 mm long.

Distr. Malaysia: Philippines (Luzon, Palawan). Fig. 9f.

Ecql. Chiefly at low elevations, not collected in the parts of Luzon where the climate has no break in humidity, but plentiful in the provinces near Manila where there are two dry breaks in the year. Fl. Sept. or possibly earlier. The size of the male flowers is noteworthy.

Vern. In Luzon it shares its names with D. peperoides; and in a less measure with other mem-
bers of the genus. In Tagalog it is kobag or ubag; pakwit, korini and nayatbang. The number and diversity is curious. In Ilocano it is kamangeg and in confusion with D. bulbifera is arlibukuk or aril-
bubu.

Uses. The tubers are often used as food, chiefly because it is abundant where it grows and search is quickly rewarded. To dig it out is laborious but to many worth while.

Soc. 41 (1904) 34; R. KNUTH, Pfl. R. 87 (1924) 289;
414, pl. 146.—D. zollingeriana (non KUNTH) MIQ.
Fl. Ind. Bat. Suppl. (1860) 611; RIDL. Mat. Fl. Mal.
Pen. 2 (1907) 82; Fl. Mal. Pen. 4 (1924) 317, in
part.—D. oppositifolia (non L.) BACKER, Handb.
Fl. Java. 3 (1924) 115, in part.

Tubers several each year, sphaeroidal, at the ends of rather long descending stalks; flesh escu-
culent. Plant glabrous. Stems sparingly armed at
the base, ascending to 16 m. Bulbils none seen. Leaves
mostly opposed, but also alternate, herbaceous,
eliptic or elliptic-ovate, rather shortly acuminate,
base rounded to obtuse, 15 by 7 cm, rarely larger
even to 16 by 11½ cm, 7-nerved; lower surface
sometimes bronzed; petiole to 7 cm. Male flow-
ering axes 1 or 2 together from upper leaf-axes and
also on weak stem-ends from the axes of bracts
that displace leaves, directed downwards appar-
etly in a geotropic response, up to 80 cm long
with perhaps 40 flowers spaced 2–3 times their own
diameter apart, slender, angled. Buds globose
except for a flattened base, to 1 mm long. Female
flowering axes solitary, attaining 50 cm, with about
40 flowers; axis markedly angled. Capsules large,
 apex retuse, base almost truncate; wings 30 × 35
mm; stipe to 6 mm in length.

Distr. Malaysia: Sumatra (East Coast & Pa-
lembang), Banka, and Malay Peninsula (Singapore
Island).

Note. The leaves, when large, suggest those of
D. orbiculata, but are glabrous.

32. Dioscorea sarasinii Ul I ne ex R. KNUTH, Pfl.
R. 87 (1924) 291, excl. fig. 56; PRAIN & BURK. Ann.

Underground parts unknown. Plant glabrous.
Stem in the upper parts unarmed, faintly ridged.
Bulbils none seen. Leaves alternate, but often two
so close as to appear opposed, elliptic or elliptic-
avate, abruptly acuminate, rounded at the base,
chartaceous, to 12 × 5½ cm, 7-nerved; upper
surface quite smooth; petiole to 2 cm or about 3¼
the length of the lamina. Male flowering axes in
dense fascicles in the axes of leaves, up to 10 cm
long with perhaps 60 flowers spaced 2–3 times their
diameter apart; axis slender, angled, slightly flexu-
ous. Bracts deltoid-acuminate, 1 mm long. Buds
ovoid from a narrow base, to 1½ mm long. Petals
said to be greenish white. Stamens in two series,
obviously by elevation of the torus as described in
D. sexrinata; the torus raises those before the
inner tepals higher than those before the outer
tepals. Female flowering axes attaining 60 cm in
length with upwards of 100 flowers; axis slightly
angled. Capsules unknown.


Note. There is a resemblance to D. vanuuanrenil
but an absence of negative geotropism in the male
flowering axes.

33. Dioscorea sexrinata BURK. Kw Bull. (1950)
259.—Fig. 4c.

Underground parts unknown. Plant glabrous.
Stem unarmed in its upper parts, 2 mm thick at the
horizon of flowering, wiry and in its appearance
like the stem of D. laurifolia. Bulbils not seen.
Leaves opposed on the thicker parts and alternate
distally, lanceolate or broadly lanceolate, base
rounded or very obtuse, apex acuminate, to 13 by
3 cm; margin strengthened, 5-nerved; petiole equal-
ing only 1/4 the length of the lamina, or even less.

Male inflorescences one at a time from the axes of
upper leaves, some of them exceeding the leaves in
length; others shorter; the flower-bearing axes

related on these, 1 or 2 together, are laxly disposed
after the manner of the inflorescence of D. lampro-
caula; anthesis proceeds up the axes whereas in
many species of Dioscorea anthesis is nearly simul-
taneous along its whole length. Half grown buds
are globose, later the base widens and forms a
saddle half embracing the axis. Filament as long as
the anther. The torus lifts the organs of the flower:
the inner tepals a little, the stamens before the
outer tepals rather more, and those before the inner
tepals more still; superficially the stamens appear
connette, but the impression is false; the lower part
of the mid-line of the petals, and the backs of the
filaments have their attachment to the torus con-
tinued upwards and there arise from this six narrow
slits as a complication in the flower-structure.
Female flowers unknown. Capsule (known only
from detached valves) just retuse at the apex, the
wings 22 by 18 mm; stipe 6–7 mm.

Distr. Malaysia: Celebes (SE. Peninsula).

Ecol. In rain forest and among shrubs. ± 300
m alt., fl. in September. If it be right that water
held by the fleshiness of the male flowers of Enan-
tiophylla preserves them fresh during anthesis for
a longer time than would be possible without it,
then this upward growth of the torus is an adapta-
tion of interest and it appears as an advance that
has originated in Celebes.

34. Dioscorea oryzerorum PR A IN & BURK. Kw
(1938) 363, pl. 133.

Tubers several as globose endings on long stalks
differing from those of D. glabra in these stalks
which are sometimes branched; flesh white. Plant
glabrous. Stems unarmed, smooth. Leaves oppo-
site, varying much its shape, elliptic-cordate
to ovate-lanceolate or even linear-lanceolate with a
rounded base [var. angustifolia PR AIN & BURK.
(1927)], acuminate, 10 by 2–6 cm, 5–7-nerved,
upper surface with the network obscure; petioles
of the broader leaves about 3¼ the length of the
lamina, but petioles of the narrower leaves short to
very short. Male flowering axes usually on leafless
branched, but if not then 1-3 together in leaf-axils, the leafless branches to 12 cm in length; flowering axes very thin, to 4 cm in length with flowers to the number of 50. Buds ellipsoid, directed slightly forward, to 1 mm long. Outer tepals 1 mm long. Inner tepals a little shorter, oblanceolate or subspathulate. Stamens with very short filaments. **Female flowering axes** solitary, to 20 cm long, angled, rather slender. Capsules relatively small, subglaucous in a degree similar to that of *D. glabra*; apex very slightly retuse; base nearly truncate; wings to 14 by 11 mm; stipe 4-5 mm long.

**Distr.** Siam from 16° N southwards beyond the Isthmus of Kra to *Malaysia* in the Siamese Circle of Sri Tamarat at Kao Chem Tung Song about 8° N, in deciduous forest and scrub or among bamboos.

**Note.** This species possesses variability in its leaf blades as a specific character, demonstrated in the ratio of the breadth to length. Broad-leaved specimens approach *D. glabra*.


Underground parts unknown. Plant glabrous. Stem unarmed above and perhaps throughout, wiry. Bulbils none seen. Leaves herbaceous, opposite, broadly lanceolate, tapering to the apex so that they are scarcely acuminate, base rounded, 8 by 2 cm, 5-nerved; petiole to 3 cm or 1/3 the length of the blade. **Male flowering axes** solitary or sometimes in small fascicles in the upper leaf-axils, to 6 cm long with perhaps 30 flowers spaced about twice their own diameter apart; axis not quite straight, capillary, with ridges descending from the bracts. Buds with a rather broad base and a minute wart over the axis on the upper side, at maturity 1 mm long. **Female flowering axes** wiry, few-flowered. Capsules apparently not more than 5 on an infuctescence, slightly retuse at the apex, nearly truncate at the base; wings 14-16 by 11 mm; stipe about 4 mm long.

**Distr.** Peninsular Siam, between the Isthmus of Kra and the border of *British Malaya* in the Circles of Puket, near Panggna, and of Surat at Kachanadit.

**Ecol.** It is a limestone plant and a dwarf.


Underground parts unknown. Plant glabrous. Stem in the upper parts unarmed, terete. Bulbils none seen. Leaves (at least in the distal parts of the stem) alternate, lanceolate or lanceolate-ovate, acuminate, rounded or just cordiform at the base, 9 by 2 cm, 5-nerved or obscurely 7-nerved; upper surface shining and smooth; petiole short, not exceeding 3/4 the length of the lamina. **Male flowering axes** 2-3 together in the axis of the upper leaves, to 7 cm long with 30-40 flowers spaced about their own diameter apart. Buds ovoid, 1 mm long. **Female flowering axes** solitary, rather slender, to 30 cm long, conspicuously ridged, with capsules so spaced as scarcely to imbricate. **Capsules** subtruncated above, more or less rounded below; wings 20 by 15 mm; stipe 3 mm long.

**Distr.** *Malaysia*: SW. New Guinea (Utakwa river), 150 to 930 m. Fig. 11g.


Underground parts unknown. Plant glabrous. Stem unarmed in the upper parts, wiry, terete. Bulbils none seen. Leaves alternate, coriaceous, broadly lanceolate, narrowed rather gradually into the acumination, base rounded, 8 by 2 cm, 5-nerved; reticulation rather prominent below; petiole short, only 1/2 cm long. **Male flowering axes** 1-3 in small fascicles in the axis of upper leaves or in the axils of bracts towards stem-ends, 5-10 cm long with over 60 flowers spaced more than their diameter apart; axis angled conspicuously. Buds elongated and directed obliquely forward, rather more than 1 mm long. **Female plant** unknown.

**Distr.** *Malaysia*: Borneo (Sarawak). Fig. 11c.

**Note.** There is in the Herbarium at Bogor a sterile specimen from Billiton collected by Vor- derman with similar leaves, and in the Leyden Herbarium capsules obtained by the same collector in the same island. They have the shape of capsules of *D. pyrifolia*, and it is likely that *D. moultonii* has such. These specimens do not prove that *D. moultonii* occurs in Billiton, but suggest that it should be looked for.


Underground parts unknown. Plant glabrous. Stem very prickly at the base, the prickles 3-4 mm long, very tough to more or less woody, to 7 mm in diameter. Bulbils produced which when large are branched. Leaves alternate, coriaceous, from narrowly ovate to nearly orbicular, to 17 by 13 cm, 5-7-nerved; nerves somewhat prominent on the lower surface; petiole to 6 cm or half the length of the lamina. **Male flowering axes** collected together along leafless branches which may themselves branch again; the axes varying much in length, the flowers on them spaced at about twice their diameter apart. Buds not flattened at the base and directed obliquely forward, to rather more than 1 mm in length. **Female plant** unknown.

**Distr.** *Malaysia*: N. Sumatra, Malay Peninsula (Perak, Pahang, Johore), Java (Preanger).

**Ecol.** The Johore locality was swampy forest on the coast; but the other localities are on hills and mountain slopes.


Underground parts unknown. Plant glabrous. Stem wiry, terete, possibly entirely unarmed. Bulbils not seen. Leaves firm, narrow, broadest at
the horizon of the insertion of the petiole which, as they are rounded or only just cordiform at the base, means that they taper almost from the base to pass very gradually into the little defined acumen, 12 by 1½ cm; upper surface smooth and shining; petiole to 2–2½ cm long. Male flowering axes 1–2 together on very short leafless branches from the upper leaf-axils, branches attaining no more than the mid-length of the axillar leaf; axis very red when dry, to 4 cm in length, with about 50 flowers spaced their own diameter apart. Buds slightly elongated, 1 mm long. Female flowering axes though short, rather stout and rigid, solitary, with up to 10 flowers, ridged. Capsules bunched close to the axil, only 1–3 to an infructescence, apex retuse; base almost truncate; wings 12–14 by 9–10 mm; stipe 1–2 mm long.

Distr. Peninsular Siam (Circle of Puket), in Malaysia: to the N of the Malay Peninsula (Langkawi Islands, Kedah Peak, G. Baling). Fig. 11a.

Ecol. A limestone plant.


Underground parts unknown. Plant glabrous. Stem possibly arched at the base, thin. Bulbs none seen. Leaves alternate, rather firm, linear-lanceolate above a very slightly cordiform base, tapering evenly to the apex, 8 by 0.8 cm, 5-nerved; petiole only 1½ cm long, slender. Male flowering axes solitary or a small number along weak leafless branches which scarcely exceed the length of the axillar leaves; axis slightly angled, to 2½ cm in length, with about 20 flowers spaced their own diameter apart. Buds subglobose over a broad base, less than 1 mm long. Female flowering axis short, giving rise to few capsules. Capsules with the apex truncate, base obtuse, wings 20 by 15 mm; stipe about 3 mm long.

Distr. Malaysia: Philippines (Luzon: Rizal prov.), NW, New Guinea (Nabire: Kanehira & Hatusima 12301). Fig. 11f.

Ecol. In New Guinea in *Agathis*-forest at 300 m.

Note. A first impression was that *D. grata* is a depauperate state of *D. lokeri*; but this has not been demonstrated; and the detection of the plant in New Guinea goes against it. The New Guinea plant is an exact match of that of the Philippines.


Underground parts unknown, but the tuber is said to be eaten. Plant glabrous. Stem with minute prickles near its base, ridged, to 4 mm in diam. Bulbs not seen. Leaves coriaceous, opposite or subopposite, broadly ovate, rounded at the base, with a long acumen, to 14 by 9 cm, 5-nerved; lower surface with even the smaller nerves some-

what prominent; petioles to 8 cm. Male flowering axes on small leafless rather lax branches and on leafless branch-ends, 1–3 together, to 5 cm long, with ca 30 flowers spaced rather more than their own diameters apart, slender, straight, ridged. Buds somewhat elongated, to 2 mm long. Female plant unknown.


Ecol. Mountains, 850–1750 m.


Tuber descending deeply into the soil, 1 m or more long; flesh white, edible. Plant glabrous. Stem armed at the base, smooth, to 4 mm in diameter. Bulbs not produced. Leaves alternate, herbaceous, broadly cordate, shortly acuminate, to 25 by 25 cm, 7-nerved; lower surface somewhat glaucous; petiole about as long as the lamina, its lower pulvinus as a rule tinged with a purplish red. Male flowering axes on leafless axillary branches not exceeding 10 cm which have a characteristic pyramidal shape; axes that bear the flowers to 5 cm long carrying 20–30 flowers spaced rather more than their own diameter apart. Buds globose, 1 mm in diameter. Female flowering axes 1–2 together, to 50 cm long. Capsules usually not more than 5 on an infructescence; apex rounded or truncate; base obtuse or rounded; wings 18 by 15–18 mm; stipe about 4 mm long.

Distr. India (Bombay coast to the Bengal plains, the lower Himalaya and hills of the Assam-Burma frontier), S to beyond the Isthmus of Kra in Malaysia in the Circle of Surat at Chumpawn.


Underground parts unknown. Plant glabrous. Stem possibly armed at the base, very inconspicuously ridged. Bulbs none seen. Leaves opposed or alternate, ovate or lanceolate-ovate with a slightly cordiform base, acuminate, 8–10 by 4 cm, 5-nerved; petiole to 3 cm or more or less ½ the length of the lamina. Male plant unknown. Female flowering axes 1–2 from upper leaf-axils, to 15 cm long. Capsules large, apex and base retuse; wings to 28 by 25 mm, stipe to 6 mm long.

Distr. Malaysia: Java (Mt Gedeh, Ponorogo), hills and mountains.

Note. The capsules of this species are the largest among Malaysian *Eunapiophylla*.


Underground parts unknown. Plant glabrous. Stem unarmed in the upper parts. Bulbs none seen. Leaves opposed, herbaceous, oblong-ovate,
shortly and abruptly acuminate, drying a dark brown colour; base rounded or very obtuse, to 6 by 2 1/2 cm on the parts collected (but larger leaves certainly occur below the horizon of flowering), 5-nerved; petiole short, only about 1/2 cm long. Male flowering axes 1-3 together on leafless branches of moderate length or on leafless branch-ends, 4-5 cm long, angled, with 20-30 flowers spaced their own diameter apart. Buds globose, except that the base is flat, 1 mm long. Female plant unknown.

Distr. Malaysia: Borneo (Sarawak, Kinabalu).


Underground parts unknown. Plant glabrous. Stem unarmed in the upper parts, very indistinctly ridged. Bulbils none seen. Leaves opposed, rather firm, exactly ovate, acute or acuminate, the base nearly rounded, 8 by 3 1/2 cm, 7-nerved; petiole to 5 cm. Male flowering axes aggregated rather densely on leafless branches or branch ends which attain 20 cm in length; axis angled, to 2 cm long; flowers spaced about their own diameter apart. Buds sub-globose, 1 mm long. Female plant unknown.

Distr. Malaysia: East Central Borneo.


Tubers several in one year, thrust deep into the soil on long stalks; flesh soft and more or less esculent. Plant glabrous, of vigorous growth. Stems very prickly at the base and markedly furrowed, attaining 6 mm in diam., becoming unarmed upwards, climbing to 20 m and perhaps more. Bulbils none seen. Leaves opposed, firm, broadly lanceolate to elliptic-ovate, rounded at the base or just cordiform at the horizon of flowering (leaves in youth forms are sagittate), to 15 by 4 1/2-5 1/2 cm, sometimes larger even to 20 by 4 1/2 cm, 5-7-nerved, the primary nerves with the peculiarity of the first pair not leaving the midrib at the base of the lamina, but curving away a few mm above; lower surface often suffused with a reddish purple colour (var. purpureoviria PRAIN & BURK. ex RIDL.); petiole about 4 cm long. Male flowering axes 1-4 together, assembled on large leafless branches that are produced high among forest trees and difficult to obtain; axes rather wiry, to 3 cm long and carrying about 30 flowers spaced about their own diameter apart. Buds sub-globose, 1 1/2 mm long, sometimes with a small wart over the axis on the base. Female flowering axes solitary. Capsules slightly retuse at the apex, nearly truncate at the base; wings 20 by 22 mm; stipe to 6 mm long.

Distr. Malaysia: Malay Peninsula. Ecol. In high forest; it seems to grow for many years without flowering.


Underground parts unknown. Plant glabrous, Stem unarmed in its upper parts, faintly ridged. Bulbils none seen. Leaves opposed or alternate, firmly herbaceous, lanceolate or sometimes with the base just cordiform, shortly acuminate, up to 10 by 2 1/2 cm, 5-nerved; petiole short, usually only 2 cm. Male flowering axes aggregated on leafless branches of considerable length, but not uncommonly some in fascicles in the leaf-axils; axes 1 1/2-2 cm long, the longer of these are found at the base of the large branches and the shorter near the end so that the inflorescence tapers a little. Buds globose above their flat base, to 1 mm long. Female plant not yet known.

Distr. Malaysia: Sumatra, W. Java, Borneo. Fig. 11b.

Ecol. Mostly in the hills and montane, but also in the lowland.

Note. The specimens from E. Java (KOORDERS 23608) and from NE. Celebes (KOORDERS 16731), referred to D. salicifolia, do not belong to this species.


Tuber descending deeply into the soil, 50 cm and more long, increasing in diameter somewhat downwards until 2 cm through near the apex; flesh white or nearly so, esculent. Plant glabrous. Stem unarmed, often with a purple flush, with very faint ridges. Bulbils produced. Leaves opposed on the larger stems, but more often alternate, herbaceous, between cordate and hastate, the basal sinus cut into a bay on either side of the petiole (this character is very well marked in the type of D.
myrianthka, but not so well marked in the type of *D. filiformis*; the laminae in the first measure to 10 by 7 cm and those in the second to 10 by 5(1/2) cm, acuminate, 5-7-nerved, the first pair of primary nerves nearer to the margin than to the midrib; upper surface dull; lower often tinted with purple.

**Fig. 12. Distribution of *D. filiformis* Bl.**

petiole rather shorter than the lamina. Male flowering axes either on special leafless branches with relatively long internodes between one group of axes and the next, or less commonly in fascicles in leaf-axils, 10–15 mm long, zigzag with a flower on each angle, narrowly ridged beneath each bract. Buds globose over a flat base and with a minute wart on the upper side against the axis, 1 mm long. Female flowering axes solitary, to 20 cm long, rather slender and a little flexed at the flowers, but not zigzag as are the male flowers. Capsules rather large; apex retuse; base almost truncate; wings to 24 by 22 mm, somewhat shining when dry; stipe 3 mm long.

**Distr.** Siam and throughout the N. and S. parts of Malaysia, but not yet known from the most equatorial, and not yet found in New Guinea. Fig. 12.

**Vern.** Aroil huwi charuk (or snout yam climber), S. didlang, J. kiroi or kiru (Tagalog) are recorded, but convey little information as they are not exclusive.


**Tuber** polymorphous, (i) cylindrical or clavate and deeply descending into the soil even to 1½ m, (ii) globose and stout and short (*D. globosa* Roxb.), (iii) pyriform, (iv) lobed in various way, (v) fingered, (vi) fingered and fasciated (*D. vulgaris* Miq.), (vii) losing its positive geotropism with a subsequent change of direction in the soil (*D. spiceulata* Bl. only as to ref. to Rumph); skin brown to black; flesh white or ivory coloured or purple, either superficially or throughout (for the complete range of shapes see Ann. R. Bot. Gard. 14, pl. 125), never poisonous. Plant glabrous. Stem unarmed though rather rarely rough or warty close to the soil, climbing to 10 m, quadrangular and as a rule conspicuously 4-winged above the very base at which the leaves are not decussate. Bulbils abundant, more so in some races than in others. Leaves generally a few alternate at the very base, thereafter opposite, herbaceous, subsagittately or sub-hastately ovate, rarely subhastately deltoid, slightly acuminate, usually to 22 by 15 cm, the upper surface bright green, 5-nerved; petiole about as long as the lamina, sometimes marginally frilled, sometimes with the pulvini suffused with purple. Male flowering axes 1–2 together, aggregated on leafless branches which only rarely exceed 30 cm in length, with upwards of 20 flowers spaced about their own diameter apart. Buds somewhat flattened at the base, otherwise nearly globose 1 mm long, at times the axis a little zigzag with the buds on the angles. Female flowering axes 1 from an axil, decurved but rigid, to 60 cm long with about 20 flowers, angled or at the base narrowly winged. Capsules at the apex slightly retuse, at the base obtuse; wings 17–20 by 15 mm; stipe 3–4 mm long.

**Distr.** Cultivated throughout Malaysia and indeed throughout the moister tropics. It originated in continental Asia, but seems to have been ennobled not a little in Malaysia (see Burkill, Adv. Sc. 7, 1950, 443). It thrives on a rainfall of 1500 mm annually with a resting period of about 2 months. It gives its harvest at the same time as the rice; and in parts of the East where the amount of rice raised is not quite adequate, *D. alata* is one of the first of the supplementary resources, but since the introduction of American sources of starchy food *D. alata* has lost considerably in importance. Because it keeps well and the crop is ready when the period of calms begins sailors carried it on voyages and man early took it both out into the
Dioscoreaceae

Pacific and to such parts on the western side of the Indian Ocean as are not too dry for its thrift. Europeans after A.D. 1500 carried it round the Cape to both sides of the Atlantic. It is invariably grown from clones, and varietal names are therefore inappropriate.

Vern. The tuber is called ubi, ovi, owe, oh! hubi, huwi, oh!, through western Malaysia, eastwards iwi, wiwi, willi, almost to the exclusion of other nouns. But in Celebes lamé meaning that which is planted, holds a place. It is lulu in Banda; heri or helli in Ambon; gusno in Halmahera, kinampai among the Bisayan languages of the Philippines. Right through Polynesia the name used is derived from ubi.


Tubers descending deep into the soil, increasing in diameter downwards slowly by a long undefined stalk, to 1 m long and 6 cm in diam.; flesh white, esculent. Plant glabrous. Stem armed, sometimes abundantly at the base, rather wiry, with very obscure ridges. Bubils none seen. Leaves opposed on the larger stems and alternate elsewhere, but more abundantly opposed than alternate, firmly herbaceous, from exactly cordate to broadly elliptic, with a rounded base, apex rather abruptly acuminate, to 11 by 9 cm, 5–7-nerved; petiole to 7 cm. Male flowering axes 1–4 together, aggregated on downwardly directed leafless branches to 4 cm long, with about 50 flowers spaced their own diameter apart, angled. Buds almost globose above a flattened base, to 11/4 mm long. Female flowering axes 1–2 together, to 15 cm long: axis angled. Capsules with the apex retuse, the base obtuse; wings 20 by 22 mm; stipe to 5 mm.

Distr. Pacific as far as Tahiti (whither perhaps man took it) to East Malaysia: (westward the N. corner of Borneo and Celebes in great abundance, not yet recorded from the Lesser Sunda Islands).

Ecol. & Vern. The esculent tuber of this most common species of Dioscorea in E. Malaysia lies too deep, yields too little and that unpleasant in carrying saponin to give the plant any prominence as a source of food. The tough stems serve for a handy bit of cordage when needed in the forest, whence the word tali or cord in its name (see under Euantiothrylhum above). Some additional recorded names are uwi in tuwa in N. Celebes, ubing basal in Tagalog (Luzon) which recalls Rumphius's ubi bisol, banan in Bagobo (Mindanao), tatopo in Halmahera, singgo in the Klem language of western New Guinea and boku of Port Moresby (New Guinea). It shares pakito in Tagalog with its allies.

Notes. A slight difference of the NE. Celebes specimens from the type (from Ambon) led to the distinction of D. koordersii Prain & Burk. ex Koord.-Schum. which name does not cover D. koordersii sensu R. Knuth, the latter being a state of D. filiformis Bl.

Rumphius’s figure of the fruiting plant is good; the second figure, that of the plant in bud, is only useful in regard to the stem, as there is in the foliage that which suggests Rumphius’s figure of Stemona (fig. 129). It is as if the artist had not gone direct to life, but to a wrong model to obtain his way of representing the leaves.


Tuber single or sometimes more than 1, descending deep into the soil on a long stalk gradually increasing in diameter, cylindric, to 50 cm long, 4 cm diam.; flesh white, esculent. Plant glabrous.

Stem abundantly armed at the base, climbing to 8 m, tough, very faintly ridged. Bubils not produced. Leaves herbaceous, oppositely or alternate, long-cordate, the base varying between cordiform, hastate and rounded, to 14 by 16 cm, but usually not larger than 10 by 10 cm, 5–7-nerved; petiole usually 4–5 cm. Male flowering axes 1–4 together aggregated on leafless branches which attain at times 70 cm in length, only very rarely fascicled in leaf-axils; axis to 4 cm in length with about 25 flowers set at less than their diameter apart. Buds globose over their broad base, 1 mm long. Female flowering axes solitary or 2 together, to 40 cm long with upwards of 50 flowers; axis angled. Capsules slightly retuse at the apex, very obtuse at the base; wings 15–18 by 14–20 mm; stipe to 4 mm long.

Distr. India (particularly in Bengal) and Burma to the centre of the Malay Peninsula. In general a common species wherever it occurs.

Ecol. The tubers are eaten if it is worth while to dig for them. Rarely is the plant encouraged by those who use it for food. It has little importance in the Malay Peninsula though used by the pagan races. It is of considerable importance to the An- damanese.

To distinguish it from D. nummularia is often
difficult in herbaria. Dried leaves of the latter are redder and those of *D. glabra* browner; and the blade in *D. glabra* is as a rule somewhat longer than that of *D. nummularia*.


Tuber 1 or more, thrust deep into the soil on a long stalk, stalk and tuber together to 1 m in length; flesh edible. Plant glabrous. Stem armed at the base, rather wiry, slightly ridged. Bulbils none seen. Leaves opposed, herbaceous, cordately sagittate or ovate-hastate, the ariecles not evenly rounded but drawn out as barbs, acuminate, to 16 by 8 cm, 7-nerved; petiole to 7 cm. *Male flowering axes* 1–2 together, aggregated on leafless branches or branch-ends which attain 60 cm in length, carrying upwards of 30 flowers spaced their own diameter apart, slender, angled. Buds globose, above a broad base, 1 mm long. *Female flowering axes* solitary, to 18 cm in length, angled. Capsules with the apex slightly retuse, the base obtuse; wings to 21 by 22 mm; stipe to 4 mm.


Note. *D. divaricata* may be described as *D. nummularia* with the outer margins of the laminae straightened. As the leaves of the *Dioscoreas* are variable the propriety of maintaining it as a species has been questioned, but botanists who have been familiar with it in life have maintained it. The vernacular names reflect the difficulty of isolating it. Tagalog names recorded for it are: *kiroi, kireot, buloi, paket, pakwit, kobag, and ubag; Ilocano, Pangasinan and Sambali: *duitian, durian, duwan, diwiyian; Biscayan: ballicicog.* They are shared by the species whose tubers are used alternatively.


Tuber less elongated than that of *D. divaricata* but in general similar. Plant glabrous. Stem armed at the base, firm, very indistinctly ridged. Bulbils none seen. Leaves opposed as a rule, mostly ovate with the base if not rounded somewhat truncate, but the larger leaves are hastate, acuminate, as a rule about 9 by 2 cm, but at times to 20 by 9 cm, 7-nerved; petiole to 4 cm. *Male flowering axes* 1–3 together, aggregated on rather long leafless branches which attain 20 cm in length, or at times in axillary fascicles; axis angled, to 6 cm long with about 40 flowers spaced their own diameter apart. Buds globose above a broad base, 1 mm long. *Female flowering axes* to 14 cm long or longer, angled. Capsules apparently exactly as those of *D. divaricata*.

Distr. Malaysia: Philippines (Luzon, in the provinces near Manila).


Underground parts unknown. Stem presumably armed at the base, wiry, faintly ridged. Bulbils none seen. Leaves opposed, rather coriaceous, long-ovate, sometimes just cordiform at the base, otherwise rounded, shortly acuminate, to 12 by 5 cm; petiole to 5 cm. *Male flowering axes* 1–2 together, aggregated on leafless branches which as far as known are more lax and shorter than those of *D. nummularia* and *D. divaricata*; parts of the branch carry hairs thinly scattered which do not extend onto the axes that carry the flowers; hairs of the stiletto type; axes of the spikes to 4 cm long with flowers spaced about their own diameter apart. Buds nearly globose above their broad base, 1 mm long. *Female plant* unknown.

Distr. Malaysia: Philippines (Mindoro, Mindanao), in the hills. Fig. 13d.

Note. As fig. 13 suggests, *D. merrillii* occurs as if marking the front of an advance of hairiness from western Malaysia towards the East.

KEY TO THE VARIETIES

1. Stems, when the plant is mature, abundantly prickly in their lowest 10 cm.

2. Lower surface of the leaf with a grey tint.

3. Blade carries hairs on the back near the petiole, the upper part is without them.

   var. diepenhorstii

4. Lamina carries hairs generally, on the lower surface ........... var. pyrifolia

5. Lower surface of the leaf coated with tawny hairs .............. var. borneensis

6. Lower surface of the leaf dries a bright rust red. 

   var. ferruginea

1. Stem without prickles, even at maturity.

   var. subinermis

Var. subinermis Prain & Burk. (1938) occurs in the central parts of the Malay Peninsula.

Var. borneensis Prain & Burk. i.e. seems to be common in NE. Borneo.

Var. diepenhorstii (Miq.) Prain & Burk (1914) is frequent in Java and S. Sumatra.

Var. pyrifolia and var. ferruginea Prain & Burk. (1914) are met with throughout the area that the species occupies. O. Kuntze published (op. cit.) two other varietal names: on a visit to Palabuhan Ratu, on the south coast of western Java he met with D. pyrifolia in var. pyrifolia and var. diepenhorstii, and when he came to name them he called them D. mammularia (non Kuntz) Ridl. Mat. Fl. Mal. Pen. 2 (1907) 81.—D. preangeriangea Uline ex Prain & Burk. J. As. Soc. Beng. new ser. 10 (1914) 33 in syn.—D. oppositifolia (non L.) Backer, Handb. Fl. Jav. 3 (1924) 115, in chief part; Onkr. Suiker. (1931) 191 with fig. 203.—D. sandakavanesis R. Kunth in Fedde, Rep. 36 (1934) 127.—Fig. 4d, 4d.

Tubers more than 1 each year, thrust deep into the soil even to 2½ m by long stalks from which they are not sharply differentiated; flesh white; the corm whence the tubers arise is intensely woody. Stems abundantly armed at the base, climbing to 10 m, glabrescent, ca 5 mm in diam. Bulbils absent. Leaves opposed except a few at the very base of the stem, rather firm, ovate-elliptic from a cordiform base, acuminate, the acumen with large glands in it, to 11 by 8 cm; youth leaves hastate; lower surface drying often an intense rust-red, pubescent in various degrees, sometimes only at the petiolar end of the blade; petiole to 4½ cm long. Male flowering axes 1–4 together, aggregated on leafless branches or branch-ends; axes to 5 cm long, with perhaps 50 flowers spaced their own diameter apart or a little less, pubescent or puberulous, often curved and upwards showing a slight inconstant negative geotropism. Buds globose above their flat base, 1 mm long. Female flowering axes (1–2)–3 (together), to 24 cm long, pubescent, angled. Capsules glabrous at maturity, apex slightly retuse; base subtruncate; wings 18–22 by 22 mm; stipe to 7 mm.

Distr. Malaysia: Sumatra, Mal. Peninsula, Borneo, and W. Java (E. to Cheribon). Fig. 13b.

Ecol. Ascending to 700 m and possibly higher, confined to an ever-wet climate and often close to running water, so favoured by a wet soil as on roadside borders in Malacca to increase where the road dips into a hollow. It cannot thrive in the tall forest; it will hold a place in the sun provided that the soil is shaded.

The large glans on the leaf-tips have been described by Orr (Not. R. Bot. Gard. Edinb. 73, 1926, 139).


Econ. The tubers escape human use and the vernacular names are such as akar kemenyan or benzoin climber which recall the scent of the flowers.


Lower parts unknown. Stem climbing to 16 m, distally unarmed, but probably armed at the base. Bulbils none seen. Leaves opposed, exactly ovate, shortly mucronate, to 8 by 5 cm at the horizon of flowering, 5-nerved; upper surface apparently pubescent when young, but not so when fully grown; lower surface with rather short tawny or reddish hairs in abundance; the secondary nerves broken considerably in the network; petiole to 2 cm. Male plant unknown. Female flowering axes as far as known, rather short and slender; their flowers not seen. Capsules with the apex just retuse, the base truncate; wings 21 by 22 mm, conspicuously broad; stipe to 4 mm.

Distr. Malaysia: Java (Besuki), once found. Fig. 13c.

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Tubers 1 or 2 each year, driven deep, even to 2 m, into the soil by long stalks, tubers to 8 cm in diam.; skin tawny orange; flesh lemon yellow, fibrous in the upper part of the stalk but edible. Stem warty but not armed at the base, pubescent, to 8 mm in diam. Bulbils large. Leaves more often alternate than opposed, from exactly cordate to ovate-cordate, acuminate, typical leaves to 12 by 9–11 cm, but sometimes as large as 24 by 20 cm; lower surface permanently pubescent, upper surface glabrescent; petiole as long as the blade, usually livid in colour at the pulvini. Male flowering axes 1–2 together (usually 2), aggregated on leafless branches which attain 18 cm in length and are densely pubescent; axes to 2 cm long with flowers to the very base, these in number to 30 or more, so little spaced that they touch one another. Buds globose above a flat base, to 1 mm long. Female flowering axes 1–3 together in axils of leaves or sometimes on very short axillary branches; axis densely pubescent, up to 15 cm long, with up to 40 flowers. Capsules retaining to ripeness in sheltered angles some of their pubescence; apex retuse; base almost truncate; wings 15 by 18 mm; stipe 3–4 mm.

Distr. SE. Asia and Malaysia: Sumatra (West Coast, once collected), Java (E to Madium), not in the Moluccas. Fig. 14.

Ecol. It has the largest leaves of any of the Enantioptyla, the leaf surface containing almost 200 cm². Fl. Java: April–June, India: Aug.–Dec. Ripe fruit has not yet been obtained in Java.

Econ. The needy eat the tubers in India, but they make a poor food and it is difficult to think that man can have transported it intentionally.


Tubers several each year on long spreading stalks that may reach 2 m in length; flesh white, edible, delicate. Stem rather sparingly armed at the base, climbing to 10 m, slightly ridged, with rusty red pubescence when young. Bulbils none seen. Leaves usually opposed, rather firm, orbicular below the acumen or orbicular-ovate or orbicular-cordate, with a well developed acumen (to 2 cm long), pubescent when young but glabrescent to 18 by 14 cm, 7-nerved; the larger hairs dendroid (fig. 6); petiolo to 10 cm, pubescent. Male flowering axes 1–6 together, usually aggregated on leafless branches which may be 70 cm long; rarely a few of the axes in fascicles in leaf-axils; axis to 6 cm long with upwards of 50 flowers spaced along it at more than their own diameter apart, coated with brown dendroid hairs. Buds globose above a broad base, 1 mm long. Female flowering axes solitary, up to 15 cm long and with upwards of 30 flowers; axis with a coating of brown hairs. Capsules large, becoming glabrescent before reaching full size; apex truncate; base rounded-truncate; wings to 30 by 26 mm; stipe 8–9 mm.

Distr. Malaysia: Sumatra (Asahan), Malay Peninsula (from Puket to Johore). Fig. 13a.

Ecol. By no means uncommon in Perak, fl. Oct.–Nov., but also in the less rainy months May–June.

Econ. & Vern. The Pagan tribes of the Malay Peninsula eat the tubers; the northern Sakai call them takob and waih; but the second vernacular covers more species than D. orbiculata; it may have been derived from the Mon-Khmer noun khoai. Takob is a name well enough known for Malays to use it as akar takob (takob climber). Further names collected from pagan tribes are kud, kedak and kakap.


Tubers very like those of D. pyrifolia, flesh edible. Stems abundantly armed with rather small prickles in the lower parts but unarmed above, climbing to 30 m, densely pubescent, faintly ridged
under the pubescence. Bulbils none seen. Leaves opposed, herbaceous, elliptic-cordate or exactly cordate, or more rarely oblong (var. velutina O. K.), acuminate, usually to 12 by 12, but occasionally attaining 25 by 22 cm, 7-nerved, retaining a thin pubescence on the upper surface and more pubescence on the lower; petiole at times prickly, up to 4(–6) cm. Male flowering axes 1–4 together, aggregated on leafless branches which rise in the axis of upper leaves and attain 30 cm in length; axes conspicuously longer if at the base of one of these large inflorescences than towards the end, with a characteristic short sterile part at the base below the flowers as a stalk 2–5 mm long, their total length to 2–2½ cm. Flowers about 20 or more, usually touching each other though not in var. oblongifolia; pubescent axis angled under the pubescence. Buds more or less globose above a flattened base, 1 mm long. Female flowering axes to 20 cm long, covered with tawny hairs; bracts dense-

Excluded and doubtful species

*Dioscorea aculeata* Naves in Naves and F. Villar, Novis. App. Fl. Filip. (1880) 260, from the island of Panay is probably *D. aculeata* L. (1754, not of 1753) and therefore would be *D. esculenta* Burk.

*Dioscorea batatas* Naves, op. cit. 258, from Manila, would not be *D. batatas* Decne (which is *D. opposita* Thunb.) and may represent *D. divaricata* Blanco.

*Dioscorea bolonjonica* Blanco, Fl. Filip. (1837) 800, ed. 2 (1845) 551, ed. 3, 3 (1879) 208 = *Pueraria phaseoloides* Benth. (Leguminosae). *Dioscorea eburnea* Naves, op. cit. 260, from Antique, Philippines, as based on Rumphius's Herb. Amb. is probably a clone of *D. alata* L.

*Dioscorea glabra* Naves, op. cit. 258, from Boso-boso in Rizal Province, Luzon, as a misinterpretation of Vidal's no 3932 would be *D. peperoides* Prain & Burk.

*Dioscorea globifera* R. Knuth, Pfl. R. 87 (1924) 149 may represent *D. pentaphylla* L. var. papuana Prain & Burk. described above, p. 316.

*Dioscorea japonica* Naves, op. cit. 259, certainly not *D. japonica* Thunb., is indeterminable.

*Dioscorea mindanaensis* R. Knuth, Pfl. R. 87 (1924) 271; Prain & Burk. Ann. R. Bot. Gard. Calc. 14 (1936) 70. The name is virtually a nomen nudum, the scrap to which it was given being inadequate even for the establishment of the section. But it is interesting to know that a *Dioscorea* occurs on the E. slopes of Mt Apo in Mindanao (S. Philippines) at the considerable height of 2000 m.

*Dioscorea oppositifolia* Naves, op. cit. 258, from S. Mateo, near Manila and from the islands of Panay, Cebu and Negros, cannot have been *D. oppositifolia* L. and is indeterminable.

*Dioscorea repanda* Blume, En. Pl. Java. 1 (1827) 22 is an indeterminable immature condition of one of the species of section *Enantiophyllum*.


*Dioscorea verticillata* Lamk., Dict. Encycl. 3, 3 (1789) 231 = *Rubia cordifolia* L. (Rubi.); cf. Daveau, Bull. Soc. Bot. Fr. 75 (1928) 254–256. This was based on a Javan specimen collected by Com-merson.
Fig. 1. a–e. Gnetum costatum K. Sch., f. G. leptostachyum Bl., g. G. latifolium Bl. var. laxifrutescens (ELM.) MGF, h. G. latifolium Bl. var. latifolium f. latifolium, i. G. macrostachyum Hook. f., j. G. tenuifolium Ridl. (a. c flowering twig, b. c flower, x 10, c. sterile c flower, x 10, d. c inflorescence, e. fruit, f. section of c inflorescence, x 8, g–h. fruit, i–j. infructescences).
GNETACEAE (F. Markgraf, München)

GNETUM


Glabrous trees, shrubs or, for the greater part, vines. Leaves decussate, simple, entire, peninnerved, exstipulate, mostly provided with fine, pellucid lines (spicular cells) parallel to the secondary nerves and then bearded on fracture. Spikes ramified or simple, axillary or often cauline, dioecious, each one with 2 opposite basal scales and several collars containing moniliform hairs and sessile flowers, either numerous spirally arranged male ones below a ring of some sterile female ones, or a ring of few fertile female ones. ♂ Flower: a claw-shaped, transversely splitting perianth and a central stamen with 2 (in G. gnemonoides one) apical, yellow microsporangia that open by an apical median split. ♀ Flower: a fleshy outer envelop (‘perianth’) and 2 thin inner ones (‘integuments’), the innermost with a long, slender, apical tube, and an orthotropous ovule; sterile ♀ flower without the middle envelop. Fruit pink (in G. neglectum and G. oxycarpum yellow), consisting of the fleshy outer envelop, which in some spp. is narrowed into a stalk, the hardened, ribbed middle envelop, the thin, silky, inner envelop, and a large, horny seed with small embryo.

Distr. About 30 species, of which 7 in northern S. America, 2 in western tropical Africa, the remainder in tropical Asia from Bombay to Fu-Kien, through Malaysia to Fiji, neither in Formosa nor in Australia or New Caledonia. Centre of present development: eastern Malaysia. The distributional areas of several species present some marked lines within the archipelago.

Ecol. All species inhabit the tropical rainforest below 1500 m altitude, except G. microcarpum which has been reported from Mt Tahan (Pahang, Mal. Pen.) at ca 2000 m. Large-leaved and -fruited taxa are produced in the moist air of mountain gorges. Small-leaved taxa occur both in the rain forest (G. diminutum and G. microcarpum f. silvestre) and in drier localities; examples of the first are represented by G. montanum f. parvifolium in E. China and G. microcarpum f. campestre in the Malay Peninsula, examples of the latter are G. latifolium var. minus and G. leptostachyum var. abbreviatum, all growing near the lower limit of the cloudy forest.

Most Malaysian species are tall lianas, but G. costatum and G. gnemon are arborescent, though the latter species is sometimes climbing as has repeatedly been reported from New Guinea.

According to Ridley (Disp. p. 240, 352) the pink fruits of Gnetum are dispersed by birds, but some are probably disseminated by water, e.g. G. gnemonoides with large corky fruits 7/12 by 37/14 cm. Gnetum seeds are sometimes found in excreta of civet-cats (Viverridae). Hemsley reported Gnetum seeds from the beach (Rep. Chall. 297).

Uses. The inner bark of several species, G. gnemon, G. latifolium, and others, is highly praised for its fibre, and is used all over Malaysia for twisting thread, string and cordage. The fibre is strong and durable in seawater and is mostly used for fishing nets and lines; in Papua carrying nets are made from it. If the fibre could be purified it would do exceedingly well for paper. G. gnemon is principally cultivated as a fruit tree, the embryo being pounded and eaten roasted, but also cooked in soup. Seeds of some other species are also used. The flush and inflorescences of G. gnemon are cooked in soup or eaten as vegetable which in the raw state causes a little itching in the mouth. Trees are sometimes coppiced for rapid production of flux. The only species really cultivated is G. gnemon var. gnemon; it is a straight tree, leafy from the base; it is sometimes planted in small orchards, but mostly in mixed gardens. It is found, outside Java, not rarely in old clearings and secondary forest (Heyne, Nutt. Pl. 1927, p. 121–125).


Vern. Mélindju, ménago, gênéo, tangkil, kliat (all reported several times). See also under the separate species.

Notes. The family represents a peculiar climax of gymnosperms holding some characters of dicotyledons as well. The floral organs are interpreted in very different ways. The most recent review is given by Fagerlind (Ark. för Bot. 33 A, 1946, no 8), who assumes the ♀ envelopes to be composed of several leaves according to development comparable to that of the whole strobilus.
In collecting Gnetum, one should try to get both sexes in each locality and take care of the brittle inflorescences.

Some remarkable teratological foliar deviations have been described by Costerus & Smith (Ann. Jard. Bot. Btsg 33, 1923, 99–102), e.g. 4-whorled leaves and reduction of leaves to scales or thorns resembling those in Ephedra. Adventitious leaf-borne shoots have been studied by J. van Beusekom (Thesis, Utrecht, 1907, pp. 141, 1. 1–3); their origin is ascribed to the sting of a coccide. They were later reported from Java by van Steenis (Trop. Naut 28, 1939, 69, fig.). Sometimes the inflorescence collars are transformed into a continuous spiral band (Thompson, Amer. J. Bot. 3, 1916, 139–140).

**KEY TO THE SPECIES (♂ plants)**

1. Trees or shrubs, only occasionally and partly climbing. Leaves thin, yellowish when dried. Inflorescence yellowish; collars flat, almost always conspicuously distant from each other. 
   Sect. Gnemonomorphi subsect. Eugnomones
   2. Trees. Sterile ♂ flowers ovate, long-beaked; beak finely velvety, whitish. 
   2
   3. Shrubs. Inflorescences simple, tender, its axis scarcely ½ mm thick, flower clusters up to 2 mm in diam. 
   3
   4. Trees. Inflorescences almost always branched, all collars distant. 
   4
   5. All collars distant. Sterile ♂ flowers beaked (oblong, glabrous). 
   5
   6. Only the uppermost collars contiguous. Sterile ♂ flowers globose with short tip. 
   6

**SPECIES**

1. Lianas. Leaves brown or black when dry, coriaceous (thin only in G. neglectum and G. tenuifolium). Inflorescence not yellowish, its collars always fairly approaching each other (the axis never visible between them), their edges bent upward. 
   Sect. Cylindrostachys MGer
   7. Collars of inflorescence dish-like, the flowers coming out freely. 
   7
   8. Leaves with numerous spicular cells parallel to the secondary nerves, therefore silky above when dry. Stamen with one microsporangium only. 
   8
   9. Leaves thin, green when dry, large, elliptic. Inflorescence simple (rarely once branched), slender (3 mm broad), spike itself 2 cm long. 
   9
   10. Leaves small, obovate and tailed, distinctly reticulate, black when dry, striate above by spicular cells. Inflorescence once branched, slender (3 mm broad), spike itself 1–1½ cm long. 
   10

**SPECIES**

11. Leaves elliptic, brown when dry, distinctly reticulate, secondary nerves distinctly joined. 
   var. funiculare
   12. Dry leaves nigrescent, inconspicuously reticulate, secondary nerves ending open. 
   12
   13. Leaves almost orbicular. 
   13
   14
   15. Leaves small, up to 9 cm. Spike short, 1½ cm long. 
   15
   16. Leaves large, up to 20 cm. Spike 2–4 cm long. 
   16
   17. Collars of inflorescence cylindric, keeping the flowers enclosed. 
   17
   18. Inflorescence branched, mostly large (unknown in 9. G. ridleyi from Pahang, but ♀ ones of this type), with very long stalks (in var. abbreviatum short). 
   18
   19. Inflorescence unbranched, often caudine. 
   19
   20. Leaves thin, tapering at both ends (inflorescence unknown, but the ♀ one is simple and slender). 
   20
   21. Leaves coriaceous. Inflorescence thick (4–5 mm). 
   21
   22. Inflorescence 6 cm long, drooping (unknown in 8. G. klossii from Borneo, but its rough ♀ one is of this type). Flowers numerous, embedded in many hairs. 
   22
   23. Inflorescence short (2–3 cm), mostly erect. 
   23
   24. Inflorescence very thick (7 mm). Leaves large. 
   24
   25. Leaves oblong-ovate, somewhat silky above by spicular cells. Flowers immersed into few hairs. 
   25
   26. Leaves elliptic, not silky. Flowers immersed into numerous long hairs. 
   26
   27. G. macrostachyum
1. Trees and shrubs, only occasionally or partly climbing. Leaves thin, yellowish when dry. Inflorescence yellowish, collars flat. Fruit almost velvety.
2. Tree. Flowers ovate, long-beaked; beak finely velvety, whitish.
3. Collars of inflorescence remote.
5. Shrub. Inflorescence simple, at least its two lowermost internodes long, all others short and hidden. Fruit small (1 cm long), inserted on a thickened rhachis.
7. Fruit oblong. Axis of inflorescence thick (1 mm); internodes 1 1/2 cm long.
8. Inflorescence branched (unknown in 5. G. arboreum, but the male one branched, small).
9. Leaves obovate-cuneate, tailed, small, distinctly nervet below, densely striate by spicular cells above. Fruit long-stalked.
10. Leaves broadest in or below the middle, mostly large, not densely striate above.
11. Leaves brown when dry, secondary nerves distinctly joining.
12. Secondary nerves at the leaf base approaching each other, all with a straight lower part. Inflorescence not so rich, 15 cm long. Flowers obliquely beaked, conical, embedded in few hairs. Fruit stalked.
14. Leaves small (not longer than 9 cm). Fruit ovate, small (1 1/2 cm long).
15. Leaves large. Fruit large, 2-2 1/2 cm, broadly ovate, long- or short-stalked.
16. Secondary nerves remote but not extremely so. Spike short (4 cm). Collars contiguous. Fruit 2 cm long, longitudinally furrowed, acute, with a long, slender stalk.
17. Leaves silky above by numerous parallel spicular cells. Flowers obtuse. Fruit obtuse, large, warty.
19. Leaves fleshy, with indistinct nervation, more or less glaucous.
20. Leaf base mostly acute, leaves often lanceolate. Collars of inflorescence with angular lower edge.
22. Inflorescence moderately thick (4 mm), shortly stalked, mostly upright. Leaves small, up to 15 cm long.
23. Leaves firm (not fleshy), with distinct nervation, not glaucous, not cuneate. Inflorescence 3 cm long.
24. Leaves fleshy, with indistinct nervation, more or less glaucous. Inflorescence 1 1/2-2 cm long.
25. Leaf base mostly acute, leaves often lanceolate. Collars of inflorescence with angular lower edge.

**KEY TO THE SPECIES (9 plants)**

1. Gnetaceae
2. G. diminutum
3. G. costatum
4. G. brunonianum
5. G. gnemon
6. G. gracile
7. G. tenerum
8. G. ovatifolium
9. G. arboveum
10. G. abbreviatum
11. G. leptostachyum
12. G. latifolium var. fusciculare
13. G. latifolium var. laxiflurescens
14. G. minus
15. G. neglectum
16. G. tenuifolium
17. G. tenuifolium
18. G. gnemonoides
19. G. microcarpum
20. G. oxycarpum
20. Leaves obovate-cuneate, striate above by spicular cells. Flowers obtuse, not embedded in thick hair masses. Fruit obtuse, 4 cm long. 10. G. loerzingii
20. Leaves elliptic, not striate above. Flowers embedded in thick hair masses.

21. Leaves broad-elliptic. Fruit large, acute, rough
21. Leaves twice as long as broad. Fruit not rough.

22. Collars contiguous, their hair tufts enormous. Fruit small, up to 2 cm long, almost globose. 13. G. macrostachyum
22. Collars remote, their hair tufts large, but not enormous.

23. Leaves large. Inflorescence elongate. Fruit shining, large, broad-ovate, 2½ cm long, 1½ cm broad
23. Leaves small. Inflorescence short. Fruit small, elliptic, 1½ cm long, 8 mm broad. 12. G. diminutum

Section Gnemonomorphi


Male inflorescences with visible internodes between the collars (though very short in the shrubby G. gnemon var. griffithii & var. ovalifolium).

Subsection Eugenones

MGF l.c.

Leaves thin. Trees and shrubs, only exceptionally climbing. Dried leaves and inflorescences yellowish. Fruits finely velvety (except in G. gnemon var. tenerum).


Tree or shrub, up to 22 m tall, 40 cm diam., without buttresses, exceptionally a climbing shrub. Crown monopodial, narrow, cylindrical; trunk grey, marked with conspicuous or faint rings. Leaves thin, yellow when dry, tapering at both ends, but varying in shape and size, 7½-20 by 2½-10 cm; secondary nerves bent, joining; petiole 6-18 mm. *Inflor.*, solitary, axillary, simple or once branched, yellowish, 3-6 cm long, collars 3 mm broad. *Infloresc.* with broad sporophyll, twice as long as the perianth (3 mm). Sterile *Infloresc.* flowers globose, tipped or beaked, 2 mm thick, 10-15 in a ring. *Infloresc.* flowers 5-8 at each node, globose, tipped or beaked, 3-4 mm long, inner tube exserted by 1 mm. *Fruit* ripening yellow, then orange-yellow or pink, sessile (exceptionally stalked), ellipsoidal, shorty apiculate, 1-3½ cm long, almost velvety; middle envelop ribbed.

Distr. From Assam throughout Malaysia to Fiji, but not native in the Andaman Islands, Sumatra, and Java.

Ecol. In rainforest at lower altitudes, but shrubby by varieties ascending up to 1500 m in India.

Uses. Young leaves and inflorescences are eaten as vegetable, fruits are also edible.

Vern. Gènêmo (Alf.), saéde (Talaud), rukiti (Morotai), kai-kai (Celebes), ondêpi (S. New Guinea).

var. brunonianum (GRIFF.) MGF, l.c. 440, t. 1, f. 6b; CORNER, Wayside Trees (1940) 726.—G. brunonianum GRIFF. Not. Pl. As. 4 (1854) 30-31.

Shrub, 0.6-3 m. Collars remote, only the uppermost ones contiguous, axis unbranched; *Infloresc.* flowers shortly tipped; fruit small, 1 cm long.

Distr. Assam, Burma, Tenasserim and W. Malaysia: Malay Peninsula, Anambas Islands, Karimata Islands, NW. Borneo. Fig. 2.

Ecol. Ascends into the mountain rainforest, often to 1200 m, in Perak up to 1500 m.

Vern. Chêpêrai (Johore), mêlîling (Raub).

var. griffithii (PARL.) MGF, l.c. 442, t. 1, f. 5, 6-6b.—G. griffithii PARL. in DC. Prod. 16, 2 (1868) 349.
Shrub. Collars all remote, though often not far. Flowers beaked, oblong. Fruit small, globose. Leaf margins often parallel. 

**Gnetaceae** (Markgraf), 7'—341 cm mm. 

**Distr.** Assam, Burma, Lushai, Annam and Tenasserim to **Malaysia**: Malay Peninsula. Fig. 2. 

Ecol. Ascends into the mountain rainforest as well (Assam 1500 m).


Collars all contiguous or only the 2 lowermost remote, axis unbranched. 

**Distr.** From the Fiji Islands to **E. Malaysia**: westwards to Celebes, rare. Fig. 2. 

Uses. Fibres used for nets and ropes. 

**Vern.** Mariwa (Solomons), saédé (Talaud), mulai (New Ireland).

**var. tenerum** MGF, l.c. 444, t. 1, f. 3–4. 

Shrub or small tree, 3 m tall. Inflorescence very slender, collars remote. Flowers gradually tapering. Fruit small, 1½ cm long, ovate, acute. 

**Distr.** **Malaysia**: Malay Peninsula (from Pang southward), Borneo. Fig. 2.

**var. gracile** MGF, l.c. 444, t. 1, f. 1a. 

Shrub. Leaves small, not longer than 9 cm. Inflorescence slender, collars few, remote. Fruit small, oblong. 

**Distr.** SW. & Central Celebes (Makassar, Malili). Fig. 2.


Tree, ca 20 m high. Leaves thin, but slightly thicker than in *G. gnemon*, yellowish when dry, tapering at both ends, large (15–18 cm long), petiole short (⅓ cm), secondary nerves bent, joining. Inflorescences solitary, axillary, simple, yellowish, 6–7 cm long, collars remote, 3 mm broad; flowers with tender, long-exserted sporophyll; sterile flowers ovate, beaked, finely whitish-pubescent, up to 10 in a ring. Inflorescences similar, their flowers immersed in dense whitish hairs. Flowers long-acuminate, finely whitish-pubescent. Fruit red or pink, obliquely fusiform, 4 cm long, 1 cm thick, conspicuously tapering at the base, sharply acuminate at the top, its outer envelop fleshy but thin, the longitudinal ribs of the hard middle one visible therefore in the dry state already from the outside. Seed fusiform, furrowed. 

**Distr.** Solomon Islands (Bougainville, Malaita, only *dé*), in **Malaysia**: E. New Guinea. Fig. 2. 

Ecol. In rainforest, at low altitudes up to 1350 m, not in swamps. 

**Vern.** Böiwa (Waría region), kem, roro, haboi.
Section Cylindrostachys


Subsection Stipitati


Male collars flat, their margins bent outward, allowing the flowers to come out freely in anthesis and distinctly visible before anthesis. Fruits stalked.

3. Gnetum tenuifolium RIDL. J. Str. Br. R. As. Soc. 59 (1911) 188; ibid. 60 (1911) 66; Fl. Mal. Pen. 5 (1925) 277; Markgraf, Bull. Jard. Bot. Btbg III, 10 (1930) 456, t. 6, f. 5–10.—Fig. 1.

Leaves thin, green when dry, tapering at both ends, large, up to 24 cm; secondary nerves bent, joining. ♀ Inflorescences erect, simple or once branched, slender; spike 2 cm long. ♀ Flowers short, 1 1/2 mm. Sterile ♀ flowers 6–10 in each collar, ovate, low. ♀ Inflorescences erect, simple; spike 4 cm long; collars very close to each other. ♀ Flowers 6–10, fusiform, 2 mm long, tube of innermost envelop 2 mm exserted. Fruits in a dense spike, 2 cm long, elliptic, acute, furrowed lengthwise, their outer envelop comparatively thin, fibrous, middle one ribbed, hard but also thick. Seed apiculate.

Distr. Malaysia: Malay Peninsula, Sumatra. Fig. 3.

Ecol. Rainforests at low altitudes.


Large liana. Leaves dark green, black when dry, leathery, of variable shape; secondary nerves bent, running out inconspicuous, not joining, the 2–3 lowermost approximate, tertiary venation indistinct (distinct only in the brown-drying var. junci- culare). ♀ Inflorescences lax, branched, most so if cauliflorous, up to 12 cm long; spikes 4 cm long, 4 mm broad, their collars open. ♀ Flowers numerous (about 50), sporophyll 3 mm long, half exserted, the 2 sporangia narrow. Sterile ♀ flowers 6–8 in each collar, broadly conical. ♀ Inflorescences similar, up to 15 cm long, their spikes 8 cm long, their collars 3 mm spaced. ♀ Flowers 6–9, acuminate and bent upward, 4 mm long, inner envelop rather deeply split. Fruit pink, ellipsoidal, 1 1/2–2 1/2 by 1 1/2 cm, distinctly stalked (axis of inflorescence elongated up to 30 cm); outer envelop shining, fleshy, fibrous, 2 mm in diam., middle one hard but thin, inner one papery. Seed broad-oblong.

Distr. From the Andamans, peninsular Siam and Tonkin throughout Malaysia to New Ireland, not yet found in the Lesser Sunda Islands.

Ecol. Rainforest, ascending to 1800 m in Borneo, not rare.

Use. Bark fibre is used for making ropes and nets.

Vern. Akar leia (Bunguran).

var. latifolium.—var. blumei MGF, Bull. J.B.B. III, 10 (1930) 459, t. 7, f. 1.

Leaves elliptic, black when dry, nerves not joining. Spike 2–4 cm long. Fruit stalk thick, almost never longer than half as long as the fruit.


f. latifolium.—var. brachypodum MGF, Ic., t. 1, f. 6.—Fig. 1h.

Fruit of the broadest type, sometimes almost globose, obtuse, four times as long as its stalk.

Distr. Malaysia: rather frequent in the Philippines, also in New Guinea.

f. longipes MGF, Ic., t. 7, f. 7.

Fruit large, somewhat attenuate, not longer than its stalk.

Distr. Indo-China and Malaysia: Philippines (Luzon) and New Guinea.

var. laxifrustescens (ELM.) MGF, Bot. Jahrb. 60 (1925) 148; Bull. J.B.B. III, 10 (1930) 463, t. 7, f. 8–10.—G. laxifrustescens ELM. Leafl. Philip. Bot. 4 (1912) 1478.—G. latifolium var. peekelli MGF, Bot. Jahrb. 60 (1925) 148.—Fig. 1g.

Leaves broad-elliptic, almost orbicular, black
when dry. Fruit claw-shaped, twice as long as broad, tapering into the stalk.

Distr. Melanesia (New Ireland, New Britain), in Malaysia: Philippines & Moluccas (Kei & Tanimbar Isl.).

var. minus (Foxw.) MGF, Bull. J.B.B. III, 10 (1930) 463.—G. minus Foxw. Philip. J. Sc. 6 (1911) 176, t. 33.

Leaves small, not longer than 9 cm, elliptic. Spikes only 1½ cm long. Fruit small, 1½ cm long, four times as long as its stalk.

Distr. Indo-China, in Malaysia: Borneo (Kinabalu), Philippines, SE. Celebes.

Ecol. In Borneo up to 1500-1800 m.


Leaves brown when dry, nerves distinctly joining, tertiary venation distinct, reticulate; blade elliptic, large.

Distr. Peninsular Siam to Malaysia: through the Malay Peninsula and the islands round Sumatra (Banka, Lingga, Riouw, Simalur) to Java.

Vern. Areuj kasungka, S. taungkil, J.


Twigs conspicuously lenticellate. Leaves obovate-cuneate, small, up to 8 cm long, long-petiolate, leathery, brown when dry; secondary nerves 4-5 pairs, joining, tertiary ones distinct, reticulate. Inflorescences short, once branched; spikes 1-1½ cm long, 3 mm broad. Flowers few, scarcely 1 mm long; sporophyll 2½ mm long, thick. Sterile flowers about 8, narrow, their inner envelop not split. Inflorescences unknown. Fruit-bearing axis 4 cm long; collars 5 mm spaced. Fruit broadly elliptic, tipped, 2½ cm long, not shining, stalk 2 cm long, outer envelop fleshy but thin.

Distr. Malaysia: Philippines (Luzon). Fig. 4.

Subsection Sessiles

MGF, l.c. 472.

Collars of male inflorescences cylindric, not bent outward (except in G. gnemonoides), so that in anthesis the flowers must force their way out. Fruits sessile.


Small liana. Leaves papery, not shining, lanceolate-elliptic, tailed, up to 23 by 9 cm, changing from yellowish to black when dried; secondary nerves straight, broken before the margin, joining, very distant from each other, up to 3 cm; petiole rather long, ca 2 cm. Inflorescences unknown. Inflorescences unbranched or once branched, slender, 8 cm long; collars 3 mm spaced. Flowers glabrous, apiculate, immersed in a dense hair cushion, 5-6 in each collar. Fruits elliptic, obtuse, not shining, yellowish-brown, 1½ cm long, 8 mm thick, whorls spaced ca 8 mm on the slender axis; outer envelop rather thin-fleshy, middle one leathery, inner one papery.

Distr. Malaysia: Borneo. Fig. 4.

Ecol. Small climber of swampy rain forests at low altitudes.

Note. Blume and most other authors have partly mixed this species with G. cuspidatum Bl. Male plants are very much desired.


Liana with flattened, woody stems. Leaves leathery, brown or blackish when dry, oblong-elliptic, up to 25 by 10 cm, often much smaller; secondary nerves bent, distinctly joining, rather distant from each other, tertiary nerves indistinct. Inflorescences cauline, simple, thick, about 6 cm long, 5 mm thick, pendulous. Flowers numerous, 80-100, obconic, 2 mm high; sporophyll exserted by 1 mm; sterile flowers 10, acute, ovate. Inflores-

Liana. Leaves leathery, brown when dry, elliptic, not tailed, about 22 cm long, 11 cm broad, secondary nerves bent, indistinctly joining, tertiary nerves finely reticulate. Inflorescences unknown. Fruiting axes simple, cauleine, 20 cm long, with thick, rough, 2 cm long internodes. Unpollinated φ flowers in a dense hair tuft, 5 mm long, broadly ovate; outer envelop rough, very fleshy, middle and inner ones papery. Fruit obovate-oblong, obtuse, to 5.3 cm long, 1½–3 cm diam., rough by wavy warts formed by protruding, flabellate epidermal cells; outer envelop moderately fleshy, middle one leathery and indistinctly ribbed, inner one papery. Seed 3 cm long.

Distr. Malaysia: NE. Borneo (Sandakan and Mt Kinabalu). Fig. 4.

Note. The rough surface of branches, inflorescences, flowers, and fruits is so characteristic, that it should be easy to recognize male plants.


Stout climber. Leaves leathery, elliptic, black when dry, up to 18 by 9 cm, transversely striate above by some fibres; secondary nerves straight, directed forward, indistinctly joining, tertiary ones reticulate. φ Inflorescences unknown. φ Inflorescences cauleine, large, 16 cm long, 18 cm wide, branched twice or three times, spike 8 cm long, collars numerous. φ Flowers 6–8 to each collar, immersed in dense hair tufts, broadly ovate, their outer envelop containing many fibres. Fruits large, 5–6 cm long, 2½ cm thick, ellipsoidal, tapering to both ends, sessile, but by means of a basal cushion, obtuse; outer envelop fleshy and very fibrous, middle one slightly woody, with longitudinal ribs, inner one papery, fibrous. Seed 3 cm long.

Distr. Malaysia: Malay Peninsula (Pahang: Telom), rare. Fig. 4.


Liana. Leaves obovate, cuneate, leathery, up to 16 by 6 cm, brown when dry; secondary nerves bent, indistinctly joining, tertiary ones inconspicuous, upper leaf surface transversely striped by fibres. φ Inflorescences axillary, erect, once branched, thick, 3 cm long, 7 mm broad. φ Flowers broadly obconic; sterile φ flowers ovate. φ Inflorescences unknown. Internodes of fruit-bearing axis 1½ cm long, 4 mm thick; unpollinated flowers 6 in each collar, ovate. Fruits wine-red, obovate-ellipsoid, not shining, 4½ by 2½ cm; outer envelop fleshy, middle one woody and fibrous, inner one papery. Seed oblong, striped, 24 mm long.

Distr. Malaysia: N. Sumatra and Enggano Island. Fig. 4.


Liana. Leaves coriaceous, yellowish-brown when dry, elliptic, up to 20 cm long, 8 cm wide, but mostly short, upper surface silky by means of a transverse striping by densely set fibres; secondary nerves straight, joining at a conspicuous distance before the margin, tertiary nerves reticulate below. φ Inflorescences axillary, branching once, spikes about 2–3 cm long, 4 mm thick; collars bent outward by their upper edges. φ Flowers numerous, narrowly obconic, 1½ mm long; sporophyll fimbri, 2½ mm long, with only one sporangium. Sterile φ flowers 8 to each collar, globose, apiculate. φ Inflorescences axillary, not branching; spike 4 cm long; collars densely approximate. φ Flowers 4–6 to each collar, ovate-globose, rather obtuse, outer envelop fleshy and fibrous, tube of the inner one not split. Fruits sessile on a much thickened axis, 5–6 cm long, 2 cm thick, ellipsoidal, obtuse, tapering into a basal cushion, shining, but very warty; outer envelop very thick, 5 mm, fleshy, very fibrous, middle one woody, conspicuously ribbed, inner one papery. Seed oblong, 3½ cm long.

Distr. New Hanover, in Malaysia: Malay Peninsula (Taiping), Billiton, Borneo, Celebes, Philippines (rare), Moluccas (Aru Islands), New Guinea. Absent from the outer arch of islands (Sumatra, Java, Lesser Sunda Islands).

Ecol. In rainforests at low altitude, up to 300 m.

Vern. Rakiti guni gunini (Halmahera).


Climber. Leaves coriaceous, brown when dry, elliptic, shining, small, 15 cm long. 6 cm broad, secondary nerves bent, indistinctly joining, tertiary
Fig. 5. *Gnetum gnemonoides* BRONGN. a–c ♂, d–h ♀ (a. twig, b. inflorescence, c. flower, × 10, d. sterile ♀ flower, × 10, e. inflorescence, f. section of flower, × 4, g. infructescence, h. fruit without outer layer).
ones reticulate below. \& **Inflorescences** cauleine, pendulous, short, spikes 3 cm long. \& Flowers numerous, obconic; sporophyll 1/2 mm exserted. Sterile \& flowers 6 to each collar, ovate. \& **Inflorescences** simple, cauleine, up to 10 cm long in the fruiting stage. \& Flowers 10 to each collar, immersed in a dense hair tuft, obliquely ovate. **Fruits** shining, ellipsoidal, small, 1/2 cm long, 8 mm broad; outer envelop moderately fleshy, middle one slightly woody, inner one papery. Seed 1 cm long.

**Distr. Malaysia:** Borneo. Fig. 3.

**Ecol.** In rainforests especially on mountains, up to 1800 m.

**Note.** Closely allied to **G. cuspidatum**.


**Climber.** Leaves leathery, elliptic-oblong, 18 cm long, 8 cm broad, brown when dry, secondary nerves bent, distinctly joining, tertiary ones reticulate. **Inflorescences** simple, thick (7 mm), 5 cm long, axillary. **Flowers** obconic, 11/2 mm long; sporophyll very shortly exserted, embedded in a dense hair tuft twice as long as the collars. Sterile **flowers** about 10 to each collar, ovate. **Inflorescences** cauleine, simple, 9 cm long, 1 cm thick. **Flowers** 8–10 to each collar, embedded in a thick, long hair mass which is still more conspicuous than in the **ones**, globose, apiculate. **Fruits** shining, ellipsoidal, small, 2 cm long, 12 mm broad; outer envelop thinly fleshy, middle one leathery, inner one papery; hair masses twice as long and twice as large as in the flowering stage.

**Distr. Tenasserim** (Tavoy), Siam, and Indo-China to **Malaysia**: Sumatra, Malay Peninsula, Java, Borneo, and New Guinea.

**Ecol.** Apparently restricted and rare in the Archipelago, more frequent only in the Malay Peninsula.


**Climber.** Leaves fleshy, shining, greyish brown when dry, oblong or lanceolate, about 10 by 4 cm; secondary nerves indistinct, straight. **Inflorescences** cauleine, erect, long-stalked, 11/2 cm long, 31/2 mm thick. **Flowers** numerous, obconic; sporophyll long-exserted. Sterile **flowers** many, ca 20–30 to each collar, fusiform. **Inflorescences** cauleine, simple, erect; spikes 21/2 cm long. **Flowers** 8 to each collar, ovate, 3 mm long. **Fruits** not shining, up to 2 cm long, ellipsoidal; outer envelop thinly fleshy, middle one leathery, inner one papery. Seed oblong, 1 by 1/2 cm.

**Distr. Tenasserim** (Mergui) to **W. Malaysia**: Malay Peninsula (also Langkawi), Sumatra and surrounding islands (Lingga, Riouw, Anambas, Banka). Fig. 4.

**Ecol.** The Malay Peninsula.

**f. campestris** (Ridl.) Markgraf, i.e., t. 9, f. 1.—**var. campestris** Ridl. i.e. **Leaves** lanceolate.


**Climber.** Leaves fleshy, greyish brown when dry, elliptic, small, 12 cm long, 5 cm broad, secondary nerves straight, indistinct. **Inflorescences** cauleine, short, erect, simple. **Flowers** clavate. Sterile **ones** ovate, **Inflorescences** similar. **Flowers** 8–10 to each collar, ovate, 4 mm long. **Fruits** yellow, not shining, oblong, with a very acute apex, 21/2 cm long, 8 mm broad; outer envelop thinly fleshy, middle one coriaceous, inner one papery.

**Distr. Malaysia:** Mentawai Islands (Siberut) near Sumatra. Fig. 4.

**Note.** Related to **G. microcarpum**.

16. **G. leptostachyum** Bl. Rumphia 4 (1848) 5; Paral. in DC. Prod. 16, 2 (1868) 352; Markgraf, Bull. Jard. Bot. Btzg III, 10 (1930) 488.—Fig. 11.

**Climber.** Leaves coriaceous, brown when dry, elliptic-oblong, up to 30 by 12 cm, often much smaller; secondary nerves bent, distinctly joining. **Inflorescences** often cauleine, much branched, up to 33 cm long, catkins 3–6 cm long, 3–4 mm thick. **Flowers** 30–40 to each collar, immersed in a dense hair tuft, broadly obconic; sporophyll filiform, twice as long as the perianth. Sterile **flowers** 8–10 in each collar, ovate. **Inflorescences** similar, their catkins 10 cm long. **Flowers** 6 to each collar, immersed in a dense hair tuft, globose, 3 mm thick. **Fruits** pink, shining, shortly ellipsoidal, obtuse, 2 cm long, 11/2 mm thick; outer envelop thinly fleshy, middle one thinly woody, inner one papery. Seed 12 mm long, 8 mm thick.

**Distr. Malaysia:** Borneo, with a var. elongatum Markgraf in Indo-China and Siam. Fig. 3.

**Ecol.** Stout rainforest liana, preferring higher altitudes, up to 1500 m.

**var. leptostachyum**.—**var. tenuis** Markgraf, i.e., 489.

**& Spikes** narrow, 3–4 cm long, 3 mm broad. **Spikes** lax, internodes 8 mm long.

**Distr. Malaysia:** Borneo.

**var. robustum** Markgraf, i.e., 490.

**& Spikes** stout, 6 cm long, 4 mm broad. **Spikes** compact, their internodes 3 mm long.

**Distr. Malaysia:** Borneo.

**Vern.** Bahahu (Dusun), paliat paliat (Kedayan).

**var. abbreviatum** Markgraf, nov. var.

**Leaves** small (up to 12 by 6 cm), hard, distinctly
reticulate below. ♀Inflorescences short (up to 6 cm), catkins 1½ cm by 3 mm. Internodes of fruiting ♀ ones very short (5 mm). Fruits large (2½ by 1½ cm).

Distr. Malaysia: Br. N. Borneo (Kinabalu).

Ecol. Stout liana of mossy, tall forest, 1300–1800 m.

Note. The varieties leptostachyum and robustum are without geographical significance. Var. elongatum Mgr, however, and var. abbreviatum prefer higher altitudes, the more so, the nearer to the aequator. Both combine floral characters of the lowland varieties in a different manner.

Doubtful


Sheets from Malaysia distributed under this name belong to G. latifolium Bl.; from other regions they either belong to G. formosum Mgr or to G. montanum Mgr. A real type of Abutua indica does not exist, only uncertain leaves in the British Museum; the type locality is the home of more than one species. So the name remains doubtful.

Gnetum karstenianum Warb. Monsunia (1900) 196, 197, Moluccas (Batjan). The type consists of leaves only.

Gnetum philippinense Warb. l.c. Philippines (Luzon). The type consists of leaves only.

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UNDER THE AUSPICES OF
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THYMELAEACEAE—GONYSTYLOIDEAE (H. K. Airy Shaw, Kew)

DOMKE, Bibl. Bot. 27, Heft 111 (1934) 30, 33, 103.

Trees, rarely shrubs. Leaves simple, mostly glandular-punctate, exstipulate. Flowers ♀, actinomorphic, 5-merous. Calyx-tube short, tube (and usually segments) densely setulose-hairy within. Corolla represented by 7–40 deltoid to linear-subulate processes, rarely by a low entire annulus. Stamens 8–80; filaments free, short, slender; anthers hippocrepiform. Disk 0. Ovary (2–)3–5(–8)-locular; cells with one anatropous ovule pendulous from the apex. Style elongate, filiform, sometimes accompanied by 'parastyles' at the base; stigma small, capitate. Fruit a thick-walled, woody, dehiscent, 1–5-seeded capsule, or a thin-walled, (?) indehiscent, 1–2-seeded capsule. Seeds large, without chalazal fold, usually with aril. Endosperm 0.

Distr. Almost confined to Malaysia, occurring in all parts of the archipelago except E. Java and the Lesser Sunda Isl.; found also in the Nicobar, Solomon and Fiji Islands. Genera 3. The greatest number of species is concentrated in Borneo, with apparently a marked inner centre of differentiation in the western part of the island. Fig. 1.

Ecol. Primary rain-forest at low and medium altitudes; one important species in freshwater swamp or peat forest.

Uses. Timber for planks, etc.; heartwood (Kayu Gam) for incense.

Notes. Subfam. Gonystyloideae differs from subfam. Aquilarioideae in: leaves usually pellucid-punctate; petals subulate to deltoid, often numerous, rarely represented by a low entire annulus; anthers hippocrepiform; disc absent; seeds without chalazal fold, usually with aril.

It differs from subfam. Thymelaeeoideae in: leaves usually pellucid-punctate; calyx-tube very short or wanting; petals subulate to deltoid, often numerous, rarely represented by a low entire annulus; anthers hippocrepidiform; disc absent; carpels 2–8; seeds usually without aril.

Fig. 1. Distribution of the subfam. Gonystyloideae. Continuous line: Gonystylus [and G. macrophyllus (Miq.) A.S.]. Black and hatched area: Amyxa. Black area: Ætoxylon (and Gonystylus & Auxanthus). X: Gonystylus areolatus Domke ex A.S. Numerals indicate the number of species of Gonystylus known from the principal islands.
1. Leaves (and branches) opposite or subopposite, coriaceous, smooth, with very lax, open, rather obscure venation. Inflorescence umbellate or almost so. Calyx-segments truly valvate. Corolla represented by a low, entire annulus. 'Parastyles' absent. Fruit irregularly subglobose or subpyriform, verruculose, apparently indehiscent.

2. Leaves (and branches) perfectly alternate, chartaceous to coriaceous, nervation lax or more often close, very distinct, rarely obscure. Inflorescence variously thyroid, or rarely racemose, never umbellate. Calyx-segments imbricate, or only subvalvate. Corolla represented by 7–40 deltoid to filiform-subulate processes. 'Parastyles' sometimes present. Fruit various.

2. Leaves rather thinly chartaceous, with very few main lateral nerves, the ultimate nerves almost invisible. Inflorescence a very slender, much-branched, many-flowered thyrse. Flowers small, sericeous outside. Petals 10, approximate in pairs. 'Parastyles' subulate-corniform. Fruit thin-walled, with a long cylindrical beak, apparently indehiscent.

2. Leaves chartaceous to coriaceous, with numerous lateral nerves, these together with the ultimate nerves usually very conspicuous. Inflorescence irregular, not very slender, sometimes very robust, the flowers arranged in a nodose-fasciculate manner. Flowers usually much larger, usually tomentellous but rarely sericeous outside. Petals 7–40, not approximate in pairs. 'Parastyles', when present, very small and ciliate. Fruit a thick-walled, woody, beakless, dehiscent capsule.

1. **Gonystylus**


Mostly tall trees, occasionally shrubs. Leaves alternate, chartaceous to very coriaceous, commonly with sparse persistent hairs below, especially on midrib; young parts sericeous, tomentose, or velutinous. Inflorescence paniculate (i.e. basically racemose), the main branches few, ± elongate, the lateral branches short, consisting of extremely condensed irregular nodulose racemes, often reduced to fascicles of flowers; or, in § Auxanthus, consisting of dense regular racemes of more or less unlimited growth. Bracts minute or, in § Auxanthus, small, falling very early. Flowers long-pedicelled. Calyx ± cupular, divided to about 1/3 or 1/4; segments thick, tough, imbricate or subvalvate, slightly unequal (3 larger and 2 smaller), ± tomentose without, always densely hispid-setulose within. Corolla represented by a ring of 7–40 deltoid or subulate, rigid, erect or incurved, glabrous or retrorse-hispid, sometimes pubescent processes (referred to in the descriptions below as 'petals'), often ± shortly united below. Stamens about equal in number to the petals, rarely twice as many, inserted among the setulae at the base of the calyx; filaments very short and slender; anthers basifixed, broadly or narrowly oblong to obovate, doubled back over the top of the linear-tetragonal connective and current down its back, 4-locular at first, later 2-locular by confluence of adjacent pairs of locelli. Ovary sessile, ± globose, always densely hispid-setulose, (2–)3–4 (–5)-locular (rarely 6–8-locular); style elongate, filiform, wiry, sinuate-controrted, glabrous or pubescent, very occasionally accompanied at the base by 3–7 small clavate or subglobose ‘parastyles’; stigma punctiform to capitate. Ovules solitary in each cell, pendulous from the apex, anatropous. Fruit a globose, or rarely (§ Auxanthus) lanceolate, woody, 2–5-valved, loculicidal (rarely indehiscent?) capsule, 1–5-seeded; mesocarp thick and fibrous, usually ± verruculose; exocarp thinly fleshy. Seeds large, with smooth softly coriaceous testa, and thin dorsal aril arising from the fleshy funicle; cotyledons large, horny.

Distr. A genus of about 20 spp., its area almost coinciding with that of the Malaysian region, outside this known only from the Nicobar, Solomon and Fiji Islands.
Fig. 2. *Gonystylus areolatus* Domke *ex* Airy Shaw. *a.* Habit of flowering twig end, ×1/3, *b.* bud with part of calyx and some petals removed, ×3, *c.* petal, ×3, *d.* stamen, ×3, *e.* ovary with style and 'parastyles', ×2 (all details from a mature bud). The buds and flowers in *a.* with thickened short pedicels or with swellings in the pedicels are galled and abnormal (after the type, *Jaheri* 773, from Dingai River, 0° 40' N, 114° 25' E.).
Ecol. Typically trees of the primary non-inundated rain-forest at low and medium elevations, reaching 1200 m in Sumatra and 1500 m in Borneo and the Philippines. *G. bancanus*, however, is a component of the (mainly coastal) freshwater swamps of the Malay Peninsula, Sumatra and Borneo, and it is possible that a second species occurs in this formation in Brunei; in such situations there is a development of pneumatophores. According to C. L. DURANT (For. Rep. Brunei 1933, p. 7) *G. bancanus* (ramin) is invariably associated with *Combretocarpus* and *Crypterontia*.


Uses. The wood of most species seems relatively unimportant, but in recent years there has been considerable exploitation of that of *G. bancanus*—largely owing to this species sometimes occurring in pure stands—for internal building construction, planks, cases, etc. Export of *ramin* is estimated to constitute one third of the total timber export of Sarawak (*cf.* Mal. For. 14, 1951, 167, 231, 233). The use as incense, by the natives of Sumatra, Java and Borneo, of the (?due to fungal action) resin-impregnated heartwood, or *kayu garu*, has been known since the time of Rumphius.

Notes. The systematic position of *Gonystylus* has been somewhat disputed, BAillon, Gilg and others having proposed to constitute it a separate family near the Tiliaceae. Its position as a member of the Thymelaeaceae has, however, been well substantiated by Domke's work (1934, l.c. 1–3 et passim), and confirmed by Erdman's (1946, l.c.) investigation of the morphology of the pollen and JANSSONIUS'S (1934 and 1950, l.c.) examination of the wood.

The characteristic colours assumed by the foliage of the different species on drying are noteworthy.

**KEY TO THE SPECIES**

1. Leaves very long, 40–50 cm, venation bullately impressed above, very prominent below. Inflorescence robust, with a very thick rachis, up to 5 mm thick. Flowers large, with c. 40 petals and 80 stamens. Style robust, with large stigma, and 4–7 small clavate 'parastyles' near the base
   2. *G. areolatus*  

1. Leaves shorter, 3–40 cm, venation not bullately impressed. Inflorescence much less robust. Flowers smaller, petals and stamens 10–40. Style slender; stigma small; 'parastyles' absent, but sometimes represented by 3–4 small rounded humps.

2. Inflorescence-branches prolonging almost indefinitely, forming long crowded cicatricose racemes with a few flowers at the apex at the time of flowering. Leaves large, up to 29×14 cm. Petals 15–16, densely retrorse-setulose. Capsule lanceolate, 3- or 6-ribbed, apex as it were shortly and stoutly 3-winged (Sect. Auxanthus Airy Shaw)
   1. *G. augescens*  

2. Inflorescence-branches not elongating, bearing fascicles or short irregular racemes of flowers on short nodulose side-branches. Petals glabrous or occasionally setulose. Capsule ± globose, not or scarcely ribbed.

3. Leaves gradually narrowed at the apex into a relatively long slender acumen, cuneate at the base, up to 20×5/2 cm, almost glabrous, drying chestnut-brown. Inflorescence ferrugineous-tomentellous, branches shortly racemiflorum. Flowers truncate at the base
   11. *G. acuminatus*

3. Leaves not gradually narrowed into a long acumen, usually rather suddenly narrowed into a relatively short acumen or cusp, sometimes rounded or even retuse.

4. Pedicels 2–3 cm. Leaves usually large (up to 40×15 cm).

5. Inflorescence elongate, up to 20 cm long, branches relatively slender, often simple. Leaves drying ochraceous-brown; petiole relatively long and slender, up to 2½ cm long
   5. *G. macrophyllus*  

5. Inflorescence short and stout, 7–12 cm long. Petiole short and stout, 9–13×2–4 mm.

6. Leaves cuneate at the base, drying light green with a narrow dark brown edge; nerves rather robust, dense, strongly reticulate. Calyx densely tomentellous. Petals about 40
   4. *G. reticulatus*  


3. *G. calophyllus*

4. Pedicels 1½–2 cm; leaves small or medium.

7. Calyx-segments strongly reflexed or revolute at anthesis; petals 7–12. Inflorescence usually considerably branched. Flowers small. Leaves small, up to 13×5 cm, distinctly shagreened.

8. Petals tomentellous throughout and setulose within. Leaves elliptic or almost rhomboid, glabrous or almost so, usually ochraceous when dry; nerves rather steeply ascending
   14. *G. forbesii*  

8. Petals glabrous. Leaves elliptic to oblong but never subrhomboid; drying brownish or greenish; nerves rather widely spreading.

9. Young parts and inflorescence densely fulvo-velutinous. Leaves usually ± pubescent below, glossy above (even when dry), rather variable in shape, often cuneate at base
   15. *G. velutinus*

9. Young parts and inflorescence tomentellous. Leaves glabrous or almost so below, dull above when dry. regularly elliptic-oblong, mostly rounded at base
   16. *G. maingayi*

(1) Probably related to *G. macrophyllus*, but imperfectly known, is 6. *G. xylocarpus*. Leaves more rigidly coriaceous, rounded or very shortly subapiculate at apex. Fruits exceptionally massive and woody; pericarp almost stony.
7. Calyx-segments not or scarcely reflexed at anthesis.

10. Petals 10. Flowers very small (4-5 mm). Leaves drying a dull purplish-leaden colour, up to 15 X 6 cm


11. Leaves drying a dull purplish-leaden colour; midrib flat or slightly raised above. G. confusus

11. Leaves not drying purplish-leaden.


13. Petals 20-22. Leaves chartaceous, drying greyish-green above with a narrow brown border, pinkish-brown below; nervation lax, the primary nerves being distinctly differentiated from the secondaries. G. keithii


14. Midrib flat or channelled above. Sepals ovate-deltoid. 

15. Leaves small, 4-15 by 2-7 cm, coriaceous, often conduplicate, drying dull purplish-red below and chestnut above; nervation relatively inconspicuous. G. bancanus

15. Leaves various, but not conduplicate. nor drying as above; nervation more conspicuous.

16. Inflorescence densely fulvous-tomentellous. Leaves strongly shagreened, often persistently tomentellous below. 13. G. affinis

16. Inflorescence thinly adpressed-pubescent or subsericeous. Leaves not strongly shagreened, glabrous or shortly adpressed-pubescent below. G. borneësis

17. Leaves 12-24 by 4-7/2 cm

17. Leaves 9-11 by 3-4 cm 17. G. pendulus

The colour of the leaves on drying being for many of the species very characteristic, the following synopsis may be found useful for herbarium specimens:

Dull purplish-leaden: calophyllus, confusus, micranthus.

Green: reticulatus (both surfaces), keithii (grey-green, upper surface only, lower surface purplish-leaden).

Dull purplish-red or purplish-brown below, chestnut above: bancanus.

Chestnut-brown throughout: brunnescens, acuminatus.

Ochraceous-yellow or ochraceous-brown: forbesii, macrophyllus (variable), stenosepalus, areolatus.

Remainder indeterminate shades of brown, or colours not easily expressed in words.


Small tree; branchlets dark brown, glabrous. Leaves broadly elliptic or elliptic-oblong, 16-29 by 8-14 cm; base rounded to somewhat cordate, more rarely very broadly cuneate; apex rounded and shortly cuspidate-acuminate; margin often strongly reflexed, almost revolute at the base, firmly coriaceous, - chestnut-brown when dry, darker below, glabrous except for the sparsely puberulous midrib below, minutely shagreened on both surfaces; nerves very conspicuous, rather crowded, widely spreading; petiole robust, 10-15 by 3-4 mm, minutely puberulous. Inflorescences up to 18 cm long, 2-21/2 mm thick, with 2-3 branches, densely ochraceous-tomentellous at first, later glabrescent; scars of the fallen flowers and bracts forming a dense, regular, nodulous spiral [somewhat resembling that seen in the Iaccacine Steonomurus corniculatus Becc. (Cantleya johorica Ridl.)], in 4 vertical rows, the successive members of each row being about 3-4(8) mm apart. Bracts ovate-oblong, up to 7 by 21/2 mm, culate, subsericeous, caducous. Pedicels 8-13 mm long, sericeous. Buds subglobose. Flowers (expanded) 7-9 mm diam. Sepals deltoid-ovate, 4-5 by 2-21/2 mm, subobtuse, densely fulvo-sericeous. Petals c. 16, subulate, 3 mm, densely retrorse-setulose within, sparingly setulose or sub-glabrous without. Style pubescent. Fruit (imma-
ture) broadly lanceolate, 51/2 by 21/4 cm, 3-valved, 6-ribbed, the locular ribs broad, rounded or slightly angled, the sutural ones narrow, traversed by a fine groove, and forming a shortly 3-winged apex to the fruit, minutely rugulose, glabrous but covered with a fine brownish meal; calyx persistent, scarcely enlarged. Seed (very immature) compressed, narrowly elliptic, 21/4 by 3/4 cm, solitary in the fruit examined.

Distr. Malaysia: Borneo (SW. Sarawak, NW. part of W. Indonesian Borneo).


Notes. This interesting species is known only from the neighbourhood of Kuching, in Sarawak, and from the Singkawang-Benakayang-Mampawah area in the extreme NW. of Western Indonesian Borneo (leg. De Vriese, 1857-61). The curious inflorescences seem to have the power of almost unlimited growth; besides Steonomurus corniculatus quoted above, compare also Knema tridactyla AYR SHAW [Kew Bull. 1939, 543-5 (1940)].

2. Gonystylus areolatus Domke ex AYR SHAW, Kew Bull. 1952, 73 (1952).—Fig. 2.

Shrub? (or small tree?), branchlets robust, 5-10 mm thick, bark fuscous, apparently lax. Leaves very large for the genus, 40-50 by 71/2-101/2 cm, oblong (more rarely oblanceolate-oblong), base rather long-attenuate. = rounded at the apex,
shortly deflexed-acuminate or cuspidate, chartaceous, shortly and sparsely pilose below, glabrous above, obovate-chestnut when dry (or greenish above); midrib robust, terete below, 3 mm thick, narrowly impressed above; nerves very conspicuous, bullately impressed above, sharply prominent below, widely spreading, in narrower leaves almost straight, in wider leaves arching forwards, conspicuously anastomosing 1–3 mm from the margin, laxly disposed (about 30 pairs of primary nerves in a leaf 40 cm long), 1–5 secondary or minor nerves between the primaries, all conspicuously connected by short transverse veinlets forming a beautifully areolate reticulation; petiole short, thick, 15–30 by 5–10 mm, rugose, almost glabrous. *Inflorescence* terminal, narrowly pyramidal-thyrsoid, 10–21 cm long, fulvo-tomentellous; rhachis 3–5 mm thick; branches 1–2½ cm long, spreading or reflexed, many-flowered; pedicels up to 4 cm, straight, spreading, 1–2 mm thick at anthesis. *Calyx* (expanded) 1½–1¼ cm diam., very shortly adpressed-tomentellous outside; segments deltoid-lanceolate, subobtuse, 9–10 mm long, reflexed at anthesis, very densely setulose within. Petals ± 40, subulate, 6–7 mm, glabrous or retrorsely scarce setulose, pubescent (pustules evident in bud, scarcely visible at anthesis). Stamens up to 80; filaments 1 mm; anthers 2 mm, narrowly oblong, caducous-setose. Ovary (?always) 6-locular; style robust, glabrous or setose, with, slightly above the base, 4–7 small, clavate, glabrous 'parastyles' 1–1½ mm; stigma rather large, cylindrical-capitate. Fruit unknown.

**Distr. Malaysia**: Borneo (S. & E. Division).

Ecol. Unknown, but doubtless primary rain-forest.

**Notes.** A most distinct, 'primitive-looking' species, unlike any other. Not the least interesting feature is the development of the 'parastyles', which here give the impression of being actual abortive styles.


Shrub or small tree; branchlets dark brown. *Leaves* elliptic to oblong, 16–30 by 6–10 cm, rounded to cordate at the base, shortly ciliate-acuminate at the apex, chartaceous, glabrous, somewhat glossy, drying a purplish-leaden colour; nervation conspicuous, rather close, widely spreading; midrib not deeply channelled above; petiole robust. 9–12 by 2–4 mm, finely obovate-puberulous. *Inflorescences* subsimple or 2–4-branched. With short, straight, thick, stiff, subfascicled branches, 4–12 cm long, rather thinly obovate-tomentellous. Pedicels elongate, 2½–2¾ cm, slender, adpressed-oboavate-puberulous, rather gradually expanding into the calyx. *Calyx* 8–10 mm long, adpressed-puberulous; sepals lanceolate, 2½–3 mm wide, acute and subacuminate, erect or slightly spreading, the tips slightly recurved. Petals 20–30, subulate, 3–4 mm long, glabrous, pubescent. Ovary 3-locular, with three small pubescent subglabrous 'parastyles'; style pubescent below. Fruit unknown ('green' according to HAVILAND'S collector).

**Distr. Malaysia**: Borneo (SW. Sarawak).

Ecol. Unknown; probably lowland rain-forest; fl. Jan.–Feb.

**Notes.** Distinguished by the large leaves, drying a purplish-leaden colour, and by the rather narrow, subacuminate sepals.


Small, slender tree, 12 m by 20 cm. Wood soft, light. Branchlets dark brown. *Leaves* oblong-oblancoate, base broadly cuneate, apex rounded and shortly cuspidate, 12–24 by 5–9½ cm, chartaceous-coriaceous, glabrous and somewhat glossy above, with sparse scattered obovate hairs below, midrib thinly adpressed pubescent, drying a relatively bright green on both surfaces, or sometimes obovate below, with a distinct narrow dark brown border; nervation very prominent, strongly reticulate, rather dense, midrib rather broadly and shallowly channelled above; petiole robust, 10–13 by 3–4 mm, pubescent below. *Inflorescences* relatively small, stout, 7–8 cm long, with 2–3 very short branches, densely obovate-puberulous when young, thinly so when mature. Pedicels c. 2½ cm, tomentellous. *Calyx* 12 mm long; sepals lanceolate, c. 10 by 4–5 mm, acute and subacuminate, densely tomentellous outside. Petals c. 40, filiform-subulate, c. 5 mm, glabrous, probably pubescent. Stamens c. 40. Style pubescent. Fruit (not seen in mature state) 'irregularly globose' (reste Elmer), up to 6 cm diam., 5-valved.

**Distr. Malaysia**: Philippines (Mindanao).


**Notes.** The important features of this species are the large flowers and the green colour of the leaves on drying, with a narrow brown margin.


Tree, up to 45 by 1 m. *Leaves* exceedingly variable in size and shape, oblong, elliptic, obovate or suboblanceolate, 3–40 by 2–15 cm, base cuneate to rounded, apex acuminate to rounded or even
retuse, chartaceous to coriaceous, drying various shades of ochraceous-brown, slightly (rarely strongly) shagreened above, scarcely so beneath, glabrous; nervation (especially on lower surface) characteristic, consisting of a rather open network of prominent relatively steeply ascending nerves, of uniform thickness, connected by rather frequent short cross-veins of similar thickness, producing a system of irregularly elongate areolae; midrib deeply channelled above; petiole relatively long, up to 2½/2 cm. Inflorescence often almost simple, consisting of an elongate axis up to 20 cm with sessile nodulose fascicles of flowers 1–2 cm apart, but sometimes branched, chartaceous-tenementulous when young, cinereous later. Pedicels elongate, slender, up to 2½/2 cm. Calyx shortly cupular, 6–8 mm long, 10–15 mm diam., sericeous; sepals ovate-deltoid, acute or obtuse, margin often reflexed. Petals 20–40, narrowly subulate, glabrous, epustulate (? sometimes minutely pustulate), 2–3 mm. Style glabrous. Fruit large, globose, up to 7 cm diam., 3–5-valved. Seeds semi-ellipsoid, 4 by 2½/2 cm.

Distr. Nicobar Isl. (Kamorta), teste Kurz. — in Malaysia: widespread, but not recorded from Central & E. Java and the Lesser Sunda Islands.

Ecol. Primary forests at low and medium altitudes, ascending to 1200 m in Sumatra and to 1500 m in the Philippines; fl. Sept., Dec.–April; fr. May–June.

Uses. Wood for small boxes; heartwood for incense.

Vern. Kèllèmbak, Johore, garu, pinang bal (batt, baîk), mèdang ramùn, sirinth khuji, batu radja, Sumatra, pucatntnt, Mentawei, garu kapas, garu hìdung, sèndarèn, bêngang, ki laba, W. Java, garu tjamukka, garu bèttol, mèdang karan, W. Borneo, anuwan, asuta, basilik, lautan-bagio, pamahuan, panakuraring, pandit, sambulan, Philip- pines, nio, Talaud, udin abiri (? akiri), Morotai, bunta, Ceram, runwala, mangèrâl, Aru.

Notes. A very variable and widespread species, characterized primarily by the venation and long pedicels. G. philippinensis ELM. was based upon an exceptionally small-leaved form, superficially resembling G. bancanus, but there is little doubt that it belongs here. The Babuyan Islands, type locality of G. obovatus Merr., represent the northernmost limit of the genus. The imperfectly known G. megacarpus C. T. White (Solomon Isl.) and G. punctatus A. C. Smith (Fiji) may well prove ultimately to be referable to G. macrophyllus.


Tree, 12 by 1½ m. Leaves broadly elliptic, 10–17 by 4½/2–9 cm, rounded at base and apex, or apex sometimes very shortly subapiculate, margin reflexed, rigidly coriaceous, brownish when dry, somewhat shining above, glabrous except for the midrib sparsely puberulous below; midrib narrowly incised above, robust below; nerves rather closely reticulate above, laxer below, anastomosing into a distinct intra-marginal nerve. Inflorescence robust, up to 12 cm long; rachis somewhat flattened, 3–4 mm thick; branches thick, very short, up to 8 mm long, apparently many-flowered at the apex, very minutely ferrugineo-puberulous. Flowers unknown. Fruit globose, indehiscent (?), up to 7½/2 cm diam., pericarp 1½/2–2 cm thick, very woody or almost stony, externally verruculose, pedicel 20 by 7 mm. Seeds cominate-ovoid, up to 3½/2 by 2 cm; testa smooth, somewhat shining, deep brown, scarcely 1 mm thick.

Distr. Malaysia: W. Borneo (SW. Sarawak and adjacent Indonesian Borneo).

Ecol. Probably rain-forest at low altitudes; fr. Feb.–Apr.


Note. The status of this species is uncertain; it may prove to be an extreme form of G. macrophyllus (Miq.) A.S. when the flower becomes known. The exceptionally coriaceous leaves and massive fruits appear, however, to be distinctive.


Small tree. Branchlets ochraceous brown. Leaves elliptic, 12–20 by 5–9 cm, rounded at base, shortly acuminate at apex, chartaceous-coriaceous, glabrous, yellowish-ochraceous when dry, smooth but not shining on both surfaces, not shagreened; venation distinct on both surfaces, moderately close; midrib narrowly prominent above; petiole 12 by 1½ cm, conspicuously channelled above, glabrous. Inflorescences simple, terminal, 12–14 cm long, with very shortly peduncled fascicles of flowers, thinly adpressed-puberulous. Pedicels elongate, slender, 1½/2–2 cm, shortly sericeous. Flowers 6–7 mm long. Sepals narrowly triangular, c. 5 mm long, 2–2½ mm wide at the base, acute, slightly sericeous. Petals about 20, subulate, 4 mm, pubescent, glabrous. Style glabrous. Fruit unknown.

Distr. Malaysia: Borneo (Sarawak).

Ecol. Unknown, but doubtless primary rain-forest.

Notes. Distinguished from all other species by the midrib being prominent above, and by the narrow sepals. The yellowish colour of the leaves on drying, and the pubescent but glabrous petals, are characters shared with G. macrophyllus.


Shrub or tree, trunk up to 60 cm diam. Twigs blackish. Leaves elliptic to oblong, sometimes slightly obovate or panduriform, 12–24 by 4½/2–7½/2 cm, base ± cuneate, rarely almost rounded, apex shortly cuspidate-acuminate, rather thinly chartaceous, dull pale brownish when dry, glabrous except for the sometimes thinly puberulous
midrib below; nervation very fine, dense and parallel; midrib shallowly channelled above or almost flat; petiole 8–12 by 2 mm, puberulous. Inflorescences 10–20 cm long (only 1–5 cm in the type, but doubtlessly not properly developed), subsimple, thinly adpressed-pubescent. Pedicles 1–1 1/2 cm, densely fulvo-velutinous. Calyx 7–8 mm long, velutinous; sepals 5–6 mm long, ovate-lanceolate, subacute. Petals 25–30, subulate, glabrous, epustulate. Style glabrous. Fruit up to 7 cm diam.

Distr. Malayasia: Borneo.

Ecol. Rain-forest, prob. at low altitudes; fl. May, fr. Oct.—March. According to a MS. note by Beccari (in herb. Becc.), the flowers open for a very short time only and are difficult to find in this state.

Notes. A species of doubtful status, known at present only from two flowering collections from Mt Matang in SW. Sarawak, and a fruiting collection from near Sandakan in Br. N. Borneo. The fine, close, parallel venation of the rather thin leaves is the most obvious feature; in this and in its glabrous petals it differs from G. keithii, which it otherwise somewhat resembles.


Shrub or tree, 4 1/2–26 m by 15–90 cm. Bark of twigs blackish-grey. Leaves elliptic-oblong to obovate-lanceolate, 13–24 by 4–9 cm, base broadly cuneate or almost rounded, apex abruptly and shortly cuspidate-acuminate, chartaceous, usually drying conspicuously discolorous, greyish-green above (with a very narrow purplish-brown margin) and pinkish-brown below, practically glabrous throughout; nervation comparatively lax, primary nerves 12–15 pairs, widely patulous, distinctly differentiated from the secondary nerves; petiole 1–1 1/2 cm, rather slender, minutely puberulous or glabrescent. Inflorescences mostly terminal, rather simple, 9–12 1/2 cm long, sparsely puberulous, the short branchlets densely grey-subsericeous. Pedicels slender, up to 2 cm, densely ochraceo-sericeous. Sepals ovate or oblong-ovate, c. 8 by 3–5 mm, densely subsericeous within and without. Petals 20–22, filiform-subulate, c. 5 mm, often uncinate-recurved at the apex, conspicuously white-pustulate within towards the apex, each pustule bearing a short retorse seta. Style glabrous. Fruit (when mature) at least 6 1/2 cm long, rugose. Seed 4 by 2 1/4 cm, smooth, chestnut coloured; calyx persistent, scarcely enlarged.

Distr. Malayasia: Borneo.

Ecol. Evergreen non-inundated rain-forest at 175–345 m but reaching 1500 m on Kemul (Kongkemul) in E. Borneo and on Mt Kinabalu, mostly on clay or sandy clay soil; fl. Oct.—Nov.; young fr. Oct..

Vern. Mahabai binjak, lemjar, gérina, garu tjampaka (and perhaps seriąngun, mèndang kèlik), W. Borneo, kelat, Brunei, palti, nasî-nasî, N. Borneo.

Notes. The leaves usually drying chestnut-brown on both sides and the setulose petals are characteristic of this species. Sometimes the leaves dry a dull greenish-brown above, but the channelled midrib remains yellowish, producing a characteristic effect.


Tree 18–23 m high, with habit of Polyalthia or Garcinia, branchlets dark brown. Leaves elliptic to obovate, 12–26 by 4–10 cm, cuneate at the base, ± rounded or subacute at apex, shortly deflexed-cuspidate, margin conspicuously reflexed, rather firmly coriaceous, glabrous, mostly chestnut-brown on both sides when dry, somewhat shagreened above, but not below; lateral nerves rather numerous, close and conspicuous; petiole 12–15 by 1–3 mm, minutely puberulous when young. Inflorescences terminal, sub-simple, 4–11 cm long, finely adpressed-pubescent or ferruginous-tomentellous. Pedicels 5–12 mm, densely puberulous. Flowers c. 7 mm in diameter, ochraceo-sericeous. Calyx truncate and gibbous at base; sepals ovate-deltoid, 4–5 by 3 mm, subbotuse. Petals 25–30, subulate-filiform, c. 3 mm, glabrous outside, rather densely retrorse-hispid within, epustulate, variously connate below. Style glabrous. Fruit (probably immature) ovoid, 3 1/2–4 cm diam., trilocular; pedicel 3–3 1/2 cm; persistent calyx-segments up to 7 mm long.

Distr. Malayasia: Malay Peninsula (E. Coast), Borneo.

Ecol. Evergreen non-inundated rain-forest at 175–345 m [but reaching 1500 m on Kemul (Kongkemul) in E. Borneo and on Mt Kinabalu], mostly on clay or sandy clay soil; fl. Oct.—Nov.; young fr. Oct..

Vern. Mahabai binjak, lemjar, gérina, garu tjampaka (and perhaps seriąngun, mèndang kèlik), W. Borneo, kelat, Brunei, palti, nasî-nasî, N. Borneo.

Notes. The leaves usually drying chestnut-brown on both sides and the setulose petals are characteristic of this species. Sometimes the leaves dry a dull greenish-brown above, but the channelled midrib remains yellowish, producing a characteristic effect.


Tree, 25 by 1/2 m. Leaves oblong or lanceolate-oblong, 12–20 by 3–5 1/2 cm, cuneate at the base, gradually narrowed at the apex into a 1–1 1/2 cm long acumem, thinly chartaceous, chestnut-brown when dry, glabrous (except occasionally here and there along the midrib below); midrib narrowly impressed above, nerves slender, widely patulous, rather dense, not very conspicuous; petiole 9–12 by 1–2 mm, sparsely puberulous. Inflorescences 8–13 cm long, slender, subferrugineo-tomentellous, with several branchlets, these racemiform, relatively elongate, 1/2–3 cm long; flowers scattered, not nodose-fasciculate; pedicels 11/4–1 1/2 cm, densely tomentellous. Calyx shortly cupuliform, distinctly gibbous-truncate at the base, c. 4 mm long, 6–7 mm very characteristic of this species, as also is the relatively lax venation. The material seen from Indonesian Borneo is all sterile, and is referred here on the basis of these characters alone.
wide, tomentellous; segments ovate-deltoid, obtuse, strongly revolute at anthesis. Petals 20-25, subulate, 2 mm, glabrous, epustulate. Style glabrous. Fruit unknown.

Distr. Malaysia: Borneo (S. & E. Division), Malay Peninsula, Sumatra.

Ecol. Primary rain-forest at 150 m; fl. Nov.

Notes. Probably referable here is a sterile specimen from Kokmoi Forest Reserve, Kedah (Malay Peninsula), and less probably one from Lampong Distr. (S. Sumatra).


Tree, 15—30 m by 60 cm, sometimes with pendulous branches, bark of branchlets dark brown. Leaves ob lanceolate-oblong or rarely oblong, 9-27 by 3½—9 cm, cuneate to rounded at the base, cuspidate to shortly acuminate at apex, chartaceous coriaceous, glabrous except for a few adpressed hairs near the midrib below, glossy in the fresh state, drying a dull purplish-brown or leaden colour (the lower side more brownish); venation slender, parallel, prominent; midrib flat or very slightly raised above, not channelled; petiole 8—17 by 1—3 mm, glabrous. Inflorescences terminal, occasionally apparently axillary, 6—20 cm long, simple or with up to 4 branches, these up to 13 cm, adpressed-pubescent. Pedicels up to 18 mm, densely fulvo-tomentellous. Buds globose, 5 mm diam. before anthesis. Sepals ovate-deltoid, 6—7 by 2½—3½ mm, ochraceo-tomentellous, subacute to subobtuse. Petals c. 30, subulate-filiform, 3—4 mm, glabrous, epustulate. Ovary c. 3 mm long, with 3 small subglobose pubescent 'parastyles' round the base of the style; style glabrous. Fruit subglobose, 4—10 mm diam.; pericarp 7—8 mm thick. Seeds up to 3½ mm diam..


Notes. The colour of the leaves on drying, combined with the flat or slightly raised midrib on the upper surface, distinguishes this species from all others.


Tree, 9—24 m. Branchlets blackish. Leaves elliptic to almost oblong, 10—17 by 3½—8½ cm, broadly cuneate to rounded at base, shortly ciliate-acuminate at apex, margin markedly revolute, chartaceous, drying various shades of dull brown or greenish-brown, strongly shagreened especially above, glabrous above, often rather persistently tomentellous below, especially on midrib;ervation relatively lax and not very conspicuous, patulous to widely spreading; petiole 1—1½(—2) cm by 2½—3 mm. Inflorescences terminal, 8—12 cm long, of 1—3 main branches, each with several short side-branches, densely fulvous-tomentellous. Pedicels 8—14 mm, tomentellous. Calyx 5 mm long; sepal 3 mm long, deltoid-ovate, obtuse or subobtuse. Petals ± 20, filiform-subulate, 4—5 mm. Style glabrous. Fruit (immature) up to 4½ cm long, 3—4-valved.


Uses. Wood (reddish, floats in water) used for house-construction in Negri Sembilan (Mal. Pen.).

Vern. Pokō bata pasir, Negri Sembilan, banit, W. Indonesian Borneo.

Notes. Characterized by the brownish colour of the leaves on drying, their strongly shagreened surface, the tomentellous midrib below, the strongly tomentellous inflorescence, and the small flowers resembling those of G. forbesii and G. maingayi but with less reflexed sepals and twice as many petals.


Tree 20—40 m by 35—85 cm. Branchlets blackish. Leaves elliptic, often almost rhomboid, 4—10(—11½) by 2½—5 cm, base usually markedly cuneate, occasionally slightly rounded, apex mostly cuneate-acuminate or sometimes ± rounded and caudate, rather thinly chartaceous, shagreened on both surfaces, drying usually light ochraceo-brown, glabrous throughout or thinly puberulous below, especially on midrib; nerves slender, crowded, conspicuous below, much less so above, rather more steeply ascending than most spp. (cf. also G. pendulus), midrib narrowly channelled above, or rarely almost flat; petiole slender, 9—11 mm long. Inflorescence 5—15 cm long, considerably branched, shortly cinereo-ochraceo-tomentellous. Pedicels slender, 10—11 mm, tomentellous. Calyx shortly cupular, 4—6 mm long, 6—7 mm diam., tomentellous; sepal ovate-deltoid, 3—5 by 2—3 mm, sub-obtuse. Petals ± 10, ovate-deltoid, acuminate, 1—2 mm long, tomentellous throughout and densely retroverse-setulose within. Style glabrous. Fruit oblong-ellipsoid, 4 cm long, 3—4-valved.


Ecol. Frequent in evergreen non-inundated rain-forest, on sand or clay, as scattered individuals or small groups, from sea level to 1210 m; fl. Sept.—Nov., fr. Nov. & June.
Fig. 3. *Gonystylus velutinus* Airy Shaw. a. Flowering twig, ×3/4. b. bud, ×4. c. flower, ×4. d. ditto, in section, ×4. e. stamen, ×7. f. gynoeicum. ×4. g. fruit, pericarp partly removed, ×3/4. h. dry, dehisced fruit. ×3/4. i. placental tissue with seed, testa with remains of membranous aril ×3/4. j. abnormal juvenile 2-valved, 1-seeded fruit, ×3/4. k. juvenile 3-valved, 1-seeded fruit from top. ×3/4 (g. from 15 T 1 P 17, h–i from 15 T 3 P 812, others from 15 T 1 P 21).

Tree, 23–35 m by 40–70 cm. Branchlets dark brown, densely fulvo-velutinous when young, ultimately glabrescent. *Leaves* elliptic, oblong-elliptic or lanceolate-elliptic, 8–11(–13) by 3½–5 cm, base cuneate to subrotundate, apex shortly and narrowly cuspidate-acuminate, puberulous, evidently shagreened and distinctly glossy above, usually more or less pubescent below, but sometimes only minutely so, densely fulvo-velutinous in the young state, chartacea-coriaceous, obscurely brown or ochraceous when dry; nerves very slender, crowded, parallel, ± prominent on both surfaces; petiole 7–11 by 1–2 mm, densely velutinous. *Inflorescences* terminal and axillary, 7–12 cm long, densely fulvo-velutinous, sparsely branched. *Flowers* small, c. ½ cm diam. when expanded; pedicels 8–10 mm, montellous. *Calyx*-tube depressed-globose, 3 mm diam., rugulose; segments deltoid, c. 3 mm long, acute, strongly revolute at anthesis. *Petals* 7–8, deltoid, acute, 2 mm long, incurved. Style glabrous. *Capsule* lanceolate-oblong, 3½–5½ cm long, very woody; valves 3 (rarely 2), 1½–2½ cm wide, ½ cm thick. Seeds 2½–3 cm long.

**Distr. Malaysia:** Sumatra, Banka, Billiton; probably also Borneo.

**Ecol.** Locally rather common, as isolated trees, in primary rain-forest at very low altitudes, mostly on non-inundated sandy soil, but also noted on clayey swampy ground by creeks, etc., subject to annual inundation: *fl.* Aug.–Oct., *fr.* Dec.–Jan.

**Uses.** Timber for planks and house construction in Sarawak, if this species. Sap said to be irritant.

**Vern.** *Kaya minyak, ulu tapui, biis, Sumatra, durin bêlan, ménamang, Banka, malam, BILLITON; also lêmpong, têbakau puth, bèsiluh, babyngkal, ramin, Borneo, if this species.

**Notes.** Distinguished from *G. maingayi*, of which it might be regarded as a race, by the strongly velutinous indumentum of the young parts, and especially of the inflorescence.


Small tree, 10½ by 12½ cm, with elongate pendulous branches, bark of twigs dark brown. *Leaves* small, oblong-elliptic or almost oblong, 9–11 by 3–4 cm, rounded-cuneate at the base. shortly caudate at apex, chartacea-coriaceous, glabrous above, very shortly adpressed-pubescent below (subsericeous when young), yellowish-grey and narrowly ochraceous-margined above, and ochraceous-brown below, when dry, almost epuncrulate, nervation rather distinct, close, reticulate and steeply ascending; pediole rather stout, 8–10 by 2–3 mm, pubescent. *Inflorescences* small and few-flowered, 2–3 cm long, almost simple, finely adpressed-pubescent or subsericeous. Pedicels elongate, 1–2 cm, sericeous. *Flowers* rather large, cream-coloured, slightly rose-tinged when dry. *Calyx* campanulate, 8 by 10 mm, shortly adpressed-sericeous externally, divided beyond the middle; segments narrowly or broadly ovate, 6 by 2½–4½ mm, obtuse. *Petals* c. 30, narrowly subulate, subterete below, somewhat flattened and subulate.
Fig. 4. Gonystylus bancanus (Miq.) Kurz. a. Twig, × 2/3. b. flower, × 4. c. flower in section, × 4. d. gynoecium, × 6. e. stamens. × 6. f. young fruit, × 2/3. g. ripe fruit with 3 seeds, × 2/3. h. seed. × 2/3
(a Grashoff 766, b-e Endert 281, f-h bb 5317).
above, c. 5 mm long, glabrous, epustulate. Style more or less setose below. Fruit unknown.

Distr. Malaysia: Borneo (SW. Sarawak).

Ecol. Evergreen rain-forest at 360 m; fl. Sept.

Notes. Distinguished from the other small-leaved species by the relatively large flowers with numerous petals.


Tree 18 by 0,6 m. Branches fuscous, glabrous; innovations shortly softly ochraceo-tomentellous. Leaves elliptic-oblong, 6½-15 by 3-6 cm, base mostly rounded, apex abruptly caudate (cauda 6-12 mm long), chartaceous-coriaceous, with a conspicuous narrow thickened margin below, drying a purplish-leaden colour, especially beneath, dull but not shagreened above, sparingly puberulous especially on the midrib below; lateral nerves numerous, conspicuous and rather crowded; petiole 8-10 by 2-3 mm. Inflorescences little branched, up to 10 cm long, softly shortly ochraceo-pubescent. Pedicels up to 6 mm, densely tomentellous. Flowers the smallest known in the genus, 4-5 mm diam. (possibly not quite mature), globose. Sepals ovate-deltoid, 3 by 1½-2½ mm, subacute, finely puberulous outside, densely silky within. Petals about 10, subulate, 2-3 mm, apparently with a few pustules towards the apex. Style 3-4 mm. Fruit unknown.

Distr. Malaysia: Borneo (Sarawak).


Uses. Timber for planks.

Vern. Ramin hitam.

Notes. Distinguished from all other species by its very small flowers, and from all except G. calyphyllyx and G. confusus by the purplish-leaden colour of the leaves on drying. Further collections are very desirable.


Tree, 18-42 m by 30-120 cm, with many kneeroots (pneumatophores). Branchlets blackish-grey, much branched and ‘twiggy’. Leaves elliptic, short-ly oblong-oblancoate or obovate, 4-14½ by 2-7 cm, base broadly cuneate to rounded, apex rounded and shortly acuminate-cuspidate, firmly coriaceous, often conduplicate, margins somewhat undulate and markedly reflexed, quite glabrous, mostly drying a characteristic dull purplish (‘plum’) colour below and chestnut or ochraceous above, appearing rather smooth, but under a lens minutely shagreened; midrib narrowly and deeply channelled above; nervation less conspicuous than in most species, moderately close above, rather lax and not sharply prominent below; petiole 8-18 by 1½ mm, glabrous. Inflorescences (apparently rarely produced) subsimple, up to 9 cm long, minutely adpressedly ochraceo-puberulous. Pedicels up to 1½ cm, puberulous. Calyx shortly cupular. 5 mm long, 5-6 cm wide; sepals deltoid, 2-3 mm long, subacute. Petals 13-20, narrow–lancoate, acuminate, 3 mm long, glabrous. Epustulate. Style rather robust, much contorted, glabrous; stigma rather large, capitulate. Fruit subglobose, 3-valved, valves orbicular-ovate, up to 4 cm long by 3½ cm wide. 3 mm thick. minutely roughened but not rugose. Seeds flattened-ovoid, 28 by 22 by 6 mm.

Distr. Malaysia: SW. Malay Peninsula, SE. Sumatra, Banka, Borneo.

Ecol. Lowland freshwater coastal swamps (‘peat forests’) (? on sandy soil), mostly subject to periodic inundation, but also in non-inundated areas, up to 100 m, sometimes forming pure stands (e.g. Rejang delta. Sarawak); occasionally in inland swamps (Selangor); fl. Feb.–March (buds also noted in May and Oct.), fr. May–June.

Uses. Timber, for planks, barrels, boxes, etc.: cf. THOMAS, Mal. For. 12 (1949) 206. Heartwood used for incense: cf. HEYNE, l.c. Inner bark contains numerous fine, brittle fibres, which break off and irritate the skin.


Notes. A well-marked species, both morphologically and ecologically. The small, rigidly coriaceous leaves, often folded together along the midrib, with much less conspicuous nerves than most species, and usually drying purplish-brown below, are very characteristic. The freshwater swamp habitat appears to be almost unique in the genus.
Fig. 5. Amyxa pluricornis (RDLK.) Domke. a. Flowering branch, with leaf, nat. size, b. sepal, outer surface, $\times$ 6, c. flower, longitudinal section, $\times$ 4, d, d'. petals, $\times$ 18, e, f. stamens from bud, in two views, $\times$ 8, g. gynoecium, showing parastyles, $\times$ 8, h, h'. parastyles, $\times$ 18 (a–h, from Haviland 494, d' and h' from Richards 1604). By courtesy of the Bentham-Moxon Trustees.
2. AMYXA

TIEGH. (Ann. Sc. Nat. VII, Bot., 17, 1893, 248, descr. anat. tantum) ex DOMKE, Bibl. Bot. 27, Heft 111 (1934) 116 et passim, map 1; AIRY SHAW, Kew Bull. 1940, 261 (1940); ibid. 1950, 146 (1950).—Fig. 5.

Medium-sized trees. Leaves alternate, petiolate, elliptic, acuminate, entire. Flowers small, in axillary and terminal, slender, copiously and widely branched thyrses. Bracts subtending main branches of inflorescence often carried up the branch for a short distance. Bracteoles 0. Pedicels articulate at base. Calyx widely cupular, segments 5, ovate-deltoid, imbricate. Petals 10, in pairs alternating with the calyx-segments, narrowly oblong, setulose. Stamens 10, alternating with the petals; filaments very short; anthers hippoceriform. Ovary 3–4-locular, cells with 1 ovule. Style elongate, filiform, contorted; stigma capitulate; 'parastyles' 3–6, short, corniform, erect-divaricate. Fruit a 2-seeded, thin-walled, velutinous, indehiscent (?), shortly stipitate, long-beaked capsule. Seed large, testa thinly coriaceous, smooth, funicle thickened but not expanded into an aril.

Distr. Monotypic, Malaysia; W. Borneo.

Notes. The genus is quite distinct from Gonystylus in its lax venation, diffuse inflorescence, paired petals, 'parastyles' and curious fruit.


Tree, 6–18 by 0,3 m; branchlets slender, dark brown, densely fulvo-tomentellous when very young, later minutely tomentellous or glabrescent. Leaves elliptic to elliptic-oblong, rarely slightly oblong-lanceolate, 6–16½ by 2–6 cm, cuneate to almost rounded at the base, shortly caudate-acuminate at apex, thinly chartaceous, minutely shagreened and densely and minutely impressed-punctate above, almost smooth below, drying various shades of light brown, from reddish to olivaceous, glabrous above and below, or very sparsely puberulous below when young, midrib slender, narrowly impressed above, prominent and shortly puberulous below; primary lateral nerves 5–11 pairs, very slender, lax, patulous; petiole slender, 8–15 mm, densely fulvo-puberulous or tomentellous. Inflorescence up to 27 cm long, often unbranched in lower portion, much branched above, densely ochraceo-tomentellous or shortly adpressed-sericous, branches spreading almost at right angles, up to 8 cm long, each subtended by an almost linear tomentellous bract (up to 7 mm long) which is sometimes carried as much as 1½ cm up the branch, ultimate branchlets loosely subfasciculate. Pedicels slender, 5–10 mm, shortly subsericeous. Calyx shortly and openly cupular, 5–7 mm diam., externally sericeous, glabrous within but setulose at the base; segments ovate, rounded to subacute, ± reflexed at apex. Petals 2–3 mm long, strongly trorse-setulose, setae adpressed, sometimes spreading at apex. Stamens 2mm long. Ovary 2 mm diam., densely setulose. Style 5–6 mm, glabrous or very sparingly pilose below. 'Parastyles' 1–2 mm long, glabrous or very sparingly pilose above. Fruit prismatic-trigonus or tetragonal when young, ellipsoid-oblong when mature (?), with a long cylindrical beak, 5½–6½ cm long (including 2½ cm long beak), 1–2 cm thick, shortly stipitate, densely shorty brown-velvety, traversed by the 3–4 elevate sutures; calyx persistent. Seeds large, oblong-ellipsoid, 3 by ½ by 1 cm, plano-convex; testa thin, but firm and tough, very smooth and glossy; dark brown; funicle thickened, 3½ by 3 mm, trigonous, enlarged into a conical appendage 6 mm long at base of seed; embryo about 25 by 11 by 9 mm; cotyledons thick and fleshy, with numerous oil-duets; radicle conical, blunted; plume not detected.

Distr. Malaysia: Borneo (W. Indonesian Borneo, SW. & Central Sarawak).

Ecol. Primary non-inundated rain-forest at low or medium altitudes; fl. April, May, July, Sept.: fr. July.


Notes. The above record from W. Indonesian Borneo rests on a sterile specimen (bb. 17136) from G. Belengei; the generic attribution is beyond doubt, but the species should be checked in due course from more complete material.

A. taeniocera A.S. must be reduced to synonymy; the supposed differences from A. pluricornis break down upon examination of further material, though the range of indumentum is striking.

The foliage of Amyxa is somewhat reminiscent of Erycibe spp. (Convolvulaceae), in the dried state. The sericeous indumentum of the inflorescence also suggests that of certain Convolvulaceae.
Fig. 6. *Aëtoxylon sympetalum* (Steen. & Domke) Airy Shaw.  
a. flowering twig, × 4/5,  
b. bud, × 7,  
c. young flower, two sepals removed, × 7,  
d. style, × 16,  
e. stamen, × 16 (after bb. 17222, loose leaf after bb. 16646).
AIRY SHAW, Kew Bull. 1950, 145 (1950).—Gonystylus sect. Aetoxyylon AIRY SHAW, Kew Bull. 1947, 10 (1947).—Fig. 6.

Medium-sized tree. Leaves opposite or subopposite, coriaceous, glabrous. Inflorescence an axillary, peduncled, false-umbel. Bracts 0? Flowers long-pedicelled. Calyx cupular, divided to about half-way; segments valvate, slightly reduplicate, equal, setulose within. Corolla represented by a low, entire, slightly fleshy annulus. Stamens 10–15; filaments very short and slender; anthers hippocrepiform. Ovary sessile, ovoid, 3–5-locular, densely setulose. Style elongate, filiform, wiry, contorted, pilose; stigma capitate. Fruit a 1-seeded, rather thin-walled, velutinous, indehiscent, subglobose capsule. Seed large; testa coriaceous, roughened; funicle and aril not seen.

Distr. Monotypic, Malaysia: Borneo.

Notes. The opposite or subopposite leaves (and branching), curious venation, pseudo-umbellate inflorescence, reduplicate-valvate calyx-segments, and annuliform corolla, separate this genus sharply from Gonystylus. The fruit also appears to be of a basically different type.

—Gonystylus sympetalus STEEN. & DOMKE, Notizbl. Bot. Gart. Berlin 12 (1934) 233; DOMKE, Bibl. Bot. 27, Heft 111 (1934) 7, 33, 145, t. 1, f. 3; AIRY SHAW, Kew Bull. 1947, 10 (1947).—Fig. 6.

Tree, 18–35 by 1/4–3/4 m. Bark containing scanty white sap. Branchlets robust, dark brown or blackish, innovations very shortly ochraceo-tomentellous. Leaves obovate, less frequently elliptic-oblong, base rounded to very broadly cuneate, apex rounded and shortly obtusely cuspidate, 5–10(–12) by 21/2–51/2 cm, firmly coriaceous, very glossy when living, rather dull when dry, but smooth, and puncticulate-shagreened above, glabrous, drying ochraceous-brown, margin flat or almost so; midrib rather slender, narrowly impressed above; nervature inconspicuous or quite obscure above, lax and often rather indistinct below, not sharply raised from the mesophyll but sloping gradually into it. As though smoothed off, spreading widely from the midrib but curving strongly forwards and freely anastomosing: the general effect suggesting species of Ficus & Sycomiun, or of Stemonurus (Leacinaeae), e.g. S. scorpoides B. & B.; piticle 6–10 by 1–21/2 mm, shortly tomentellous when young. Peduncles patentulous, patent or even deflexed, straight, 8–30 mm, grooved, tomentellous, gradually expanded upwards, suddenly enlarged at the apex into a nodose-discoid structure 2–3 mm in diam. (rarely itself very shortly branched) bearing the flowers. False umbel 5–6-flowered. Pedicels 8–10 mm long, tomentellous. Flowers cupular, globose-pentagonal in bud, 4–5 mm in diam., tomentellous. Calyx divided about half-way, densely setulose within; segments deltoid, acute, margins slightly reduplicate. Corolline annulus barely 1 mm high, glabrous. Filaments 1 mm long; anthers about 0.8 mm long. Ovary ovoid, 11/2 mm long, narrowed upwards, densely setulose; style about 3 mm long, long-pilose in lower part; stigma clavate-capitate. Fruit (immature) irregularly subglobose, subtuplicate, up to 3 by 2 by 1 cm, shallowly tricostate, verruculose, very shortly brown-velutinous; pericarp 2 mm thick, with copious resin-canals; pedicel 11/2 cm long; calyx persistent, not enlarged. Seed ellipsoid, 23 by 15 by 13 mm; embryo unknown.

Distr. Malaysia: Borneo (W. Indonesian Borneo, SW. Sarawak).

Ecol. Low, level, sandy ground, in primary non-inundated rain-forest, up to 100 m, locally rather common: fl. Dec., fr. March.

Uses. Oil (minjak garu-laka) obtained from heartwood for incense; cf. van Steenis & Domke, i.e. Vern. Kayu bidaroh, kayu laka, garu laka, garu buaja, mėlabajan, Indon. Borneo, ramin batu, Sarawak.

Notes. The general resemblance of the vegetative parts to Stemonurus is striking; this genus is also characterized by umbellately arranged inflorescence branches. The inflorescence of Aetoxyylon appears to represent an extreme simplification and condensation from the Gonystylus type. The corolline annulus is somewhat fleshy, rather than membranous as stated by Domke. Ripe fruiting material of this tree is very desirable, as the interior of the only fruit examined was damaged and it was not possible to interpret the contents of the seed.
XYRIDACEAE (P. van Royen, Leyden)

XYRIS


Mostly perennial, paludose, grass-like herbs with fibrous roots; stembase very rarely thickened, often profusely producing shoots. Leaves basal, distichous on each shoot, ensiform, linear or filiform, sometimes twisted; sheaths with a membranous margin (in Mal. spp.) producing mucilage (?always), with or without a short ligule; limb glabrous or with numerous, small hard papillae, sometimes with a stout nerve in either margin. Flowers ♂, in terminal, few- to many-flowered heads, 3-merous, yellow to white, ephemeral, each in the axil of a conspicuous bract; bracts conchate, imbricate, spirally arranged, lower ones sterile; one to few flowers simultaneously in anthesis. Peduncles scape-like, terete to compressed, sometimes winged or ribbed, glabrous or with numerous hard papillae, at the base with some sheaths provided with a short limb. Bracts entire, ciliate, fimbriate or lacerate, with one complete main nerve and some complete or incomplete longitudinal secondary (descending) nerves, in the apical part mostly with a small minutely-papillose field. Calyx zygomorphic; lateral sepals navicular, with entire, dentate or ciliate crest, wings membranous, entire, glabrous or ciliate; median sepal membranous, spatheliform or cap-shaped, enveloping the corolla, mostly obovate, 1–3(-5)-nerved, pushed out by the corolla in anthesis (?always). Corolla actinomorphic, ephemeral; petals with an orbicular to obovate limb and a long, narrow claw, free, cohering mutually or by the staminodes. Stamens mostly 3 fertile epipetalous inserted on the petals and 3 alternating staminodes, staminodes rarely absent, or all stamens fertile; filaments short; anthers basifix, dehiscing lengthwise extrorsely. Ovary superior, sessile to stipitate (in Australian spp. sometimes with 3 hard swellings at the top), 1- or 3-celled, or incompletely 3-celled. Placentas parietal, central, or basal, with ⊙ ovules; styles filiform, apex 3-fid, stigmas mostly capitate. Fruit shape similar to that of the ovary but larger, loculicidally 3-valved. Seeds ellipsoid to obovoid, often ribbed, with a long funicle.

Distr. Xyridaceae are confined to the tropics throughout the world including the southern parts of North America; east of Malaysia and Australia hitherto only recorded from the Palau group (Korror) and New Caledonia.

Xyridaceae contain only two genera, Xyris and Abolboda; the latter genus possesses blue flowers and is restricted to South America.

Some spp. of Xyris are spread over large areas, e.g. X. capensis, X. complanata, and X. indica. On the whole, however, the species occupy limited areas.

Eccl. Restricted to marshy habitats, often on sandy, acid soils together with Cyperaceae, Eriocaulon, Drosera, Juncus, etc., and on borders of shallow swamps; locally they are often very common or even subgregarious. Single species are common in wet rice-fields, e.g. X. indica, which seems to be almost restricted to this anthropogenic habitat.


The figures show from left to right: basal bract, median bract, lateral sepal(s), with or without ovary, stamen, staminode. In O the basal and median bracts are of the same shape. In G two types of basal bracts are given. In B stamens and staminodes are unknown. In L (X. grandis) staminodes do not occur.

The figures are not drawn on the same scale.
Most spp. occur in the lowland, but several are bound to mountain marshes, e.g. *X. flabellata*, *X. grandis*, and *X. oreophila*.

According to BeuMee (Trop. Natuur 6, 1917, 158) the sheaths of *X. indica* are filled with mucilage which originates from the disintegrating parenchymatic tissue between the vessels of the membranous marginal parts of the sheaths. This phenomenon may, possibly, occur in other species.

BeuMee also observed an undescribed particularity of the anthesis, namely that in the early morning the expanding corolla pushes (and detaches) the cap-shaped median sepal from its insertion and presses it outside the bracts of the head, where it, subsequently, is blown away by the air. This explains why, in herbarium specimens, it is never found in open flowers, and has been termed caducous. In *X. lobbii* it is, for this reason, as yet unknown.

Notes. The term 'descending nerves' used in this revision indicates that the side-nerves running downwards from the midrib of the bracts are incomplete and do not reach the base of the bract: this character has proved to be useful in specific delimitation.

With the length of the staminodes is meant the length of the free part, not including the length over which they are coherent with the claw of the petals.

All Malaysian species belong to § *Euxyris*.

**KEY TO THE SPECIES**

1. Peduncle terete or subterete in the upper part, neither winged nor ribbed when dry.
2. Dried leaves with numerous short, transverse, prominent ribs connecting the longitudinal veins, 5–60 cm by 3–10 mm; top falcate. Sheath 8–30 cm long. Midrib of the bracts with 4–6 descending nerves. Fig. 1 N .......................... 14. *X. indica*

2. Leaves without transverse ribs.
3. Stem-base provided with subglobose tubers between the roots. Bracts with ca 4 complete nerves besides the midrib. Incompletely known species. Fig. 1 B .......................... 2. *X. tuberosa*

4. Lateral sepal ciliate or serrate in the upper half.
5. Leaves linear, twisted, without thickened marginal ribs. Anther-cells produced above the connective, each with 2 acute teeth. Fig. 1 D .......................... 4. *X. borneensis*

5. Leaves ensiform, not or slightly twisted, with distinct thickened marginal ribs.
6. Anther-cells acute. Papillae on median bracts in a narrow quadrangular field in the apical half. Midrib of median bracts provided with ca 14 subcomplete descending nerves. Fig. 11. 9. *X. lobbii*

6. Anther-cells obtusely 2-tipped. Papillae on median bracts in a triangle in the upper third part. Midrib of median bracts provided with 4 partly complete, partly incomplete descending nerves. Fig. 1 H .......................... 8. *X. pauciflora*

4. Lateral sepal entire.
7. Leaves acuminate. Midrib of bracts with 5–10 complete nerves. Anther-cells produced above the connective, acute. Fig. 1 J .......................... 10. *X. oreophila*

7. Leaves obtuse. Bracts with ca 6 complete and ca 2 descending nerves. Anther-cells produced above the connective, 2-tipped. Fig. 1 E .......................... 5. *X. malmei*

1. Peduncle compressed or subterete, with one or more wings or ribs when dry.
8. Dried leaves with numerous short, transversal, prominent ribs connecting the longitudinal veins. Fig. 1 N .......................... 14. *X. indica*

8. Dried leaves without such ribs.
9. Staminodes absent. Upper part of bracts with a small triangular field of small papillae. Head brownish. Fig. 1 L .......................... 12. *X. grandis*

9. Staminodes present.
10. Bracts without a papillate field.
11. Head greenish. Midrib of median bract with 2 descending forked nerves. Leaves 6–18 mm wide. Fig. 1 M .......................... 13. *X. chlorocephala*

11. Head blackish or brown. Midrib of median bract with 6–9 partly complete and partly incomplete nerves. Leaves 2–4 mm wide. Fig. 1 O .......................... 15. *X. capensis* var. schoenoides

10. Bracts with a papillate field.
12. Bracts with a subapical, dorsal, hollow minutely papillate tooth. Fig. 1 K .......................... 11. *X. dajacensis*

12. Bracts without such a tooth, sometimes keeled.
13. Leaves with thickened, in section sometimes hollow tubular margins.
14. Bracts orbicular to 1½ times as long as broad. Crest of lateral sepal lacerate-fimbriate in the upper part. Upper half of anther-cells free. Leaves 10–50 cm long, spreading. Fig. 1 A .......................... 1. *X. complanata*

14. Bracts twice as long as broad. Crest of lateral sepal entire. Anther-cells connate to the apex. Leaves 2½–9½ cm long, equitant. Fig. 10 .......................... 16. *X. flabellata*

13. Leaves without thickened margins.
15. Crest of lateral sepal ciliate to serrate or tuberculate.
16. Median bracts lacerate or ciliate at the top.
17. Crest of lateral sepal densely ciliate-tuberculate.
18. Leaf terete or subterete in section, as is the central tissue. Sheath 2–5 cm, blade 8–25 cm.

16. Median bracts entire and glabrous at the top.

17. Lateral sepals markedly serrate. Fig. 1 H

16. Median bracts entire and glabrous at the top.

16. Median bracts entire and glabrous at the top.

15. Lateral sepals papillate. Anther-cells aculeate. Fig. 1 J

10. X. oreophila

18. Leaf terete or subterete in section, as is the central tissue. Sheath 2–5 cm, blade 8–25 cm. Fig. 1 D

17. Crest of lateral sepals sparsely tuberculate. Fig. 1 G

4. X. bornensis

7. X. papuana

8. X. paucilora

3. X. bancana var. bancana

2. X. tuberosa Ridl., J. Fed. Mal. St. Mus. 10 (1920) 122; Malme, l.c. (1927) 390; l.c. (1929) 385.—Fig. 1 B.

Stembase with globose, pubescent or glabrous tubers up to 8 mm diam. Leaves ensiform, 20–25 cm by 1½–2½ mm, falcate, acute, widened at the base, papillate. Sheaths 6–7 cm. Peduncle 30–40 cm, terete, with numerous black papillae. Head ovoid to globose, 8–10 by 8–10 mm. Bracts elliptic, 6–7 by 3–4 mm, obtuse to truncate, papillate in the upper fourth, with 4–8 complete nerves (incomplete in the basal bracts). Lateral sepals narrow, 4–5 by ca 1 mm, obtuse, crest tapering towards the base. Ovary urceolate, shortly stipitate, 3–5 mm, 2–3 by ca 2 mm.

Distr. Malaysia: Malay Peninsula, 'mainland shores'.

Notes. Differing from all other spp. by stembase tubers. The material is too scarce to judge whether these are a normal feature. In North America X. torta Smith is bulbous, but in this species the stembase itself is thickened and no separate tubers are found between the roots.


var. bancana.
Tufted. Leaves acerose-ensiform, 2–7 cm by ca 1 mm, acute, falcate; sheath 1–1 1/2 cm; basal leaves with a distinct, finely ciliate crest and small, reduced limb; apical leaves similar to the basal ones, with one or two sheaths. Peduncle 10–30 cm by 1 mm or less, terete to subterete, with a few prominent ribs in the upper part, glabrous. Head ellipsoid to subglobose, 2–4 by 1–5 mm. Bracts boat-shaped, elliptic to obovate, 4–5 by 1 1/2–2 1/2 mm, emarginate, central part with numerous papillae over the whole length and slightly crested, with numerous descending nerves; margins membranous. Lateral sepals 3–4 mm long, obtuse, with a ciliate inconspicuous crest; median sepal cap-shaped, minutely tuberculate at the top. Petals 4–5 mm long, limb obovate, ca 2 1/2 mm diam., claw 2–3 mm. Stamens 3 or 6, 1/2–2 mm long; anthers 1–1 1/2 mm long, apex deeply incised; cells with 2 acute tips, base obtuse, emarginate. Staminodes bifid, penicillate, ca 1 1/2 mm long, or absent. Ovary ellipsoid to obovate, obtuse, 3-sided, 3-celled, ca 2 mm by 1 mm. Styles 3-fid, 1–1 1/2 mm, stigmas capitate. Fruit 3–3 1/2 mm long.


**var. lacerata** MALME (Bull. Jard. Bot. Btgz III, 10, 1929, 388, descr.) var. nov.—Fig. 1 C.

Differs from the type-variety in the narrower leaves (1/2–3 1/2 mm wide), the flexuose or spirally twisted peduncle, and the lacerate apical margin of the bracts.

**Distr. Malaysia:** Malay Peninsula.

4. **Xyris borneensis** RENDLE, J. Bot. 37 (1899) 506, pl. 403, f. 11; MALME, l.c. (1927) 390; l.c. (1929) 387.—Fig. 1 D.

Leaves wiry, 8–25 cm by 1/2–1 1/4 mm, twisted, acute, glabrous to scabrous, striate when dry: sheath 2–5 cm, widened at the base up to 6 mm. Peduncle 13–40 cm by ca 1 mm, terete or subterete, with 0 to 3 wings, twisted, scabrous. Head ovoid to ellipsoid, 3–7 by 2–6 mm. Basal bracts triangular, acute, margin membranous, the central part papillate from top to base, 3–3 1/2 by ca 1 1/2 mm. Median bracts coniculate, obovate, 4 1/2–5 1/2 mm by ca 2 1/2 mm with numerous complete nerves, papillate in a quadrangular region in the upper half, apical margin lacerate. Lateral sepals narrow, ca 5 by 1/2 mm, emarginate at the top, crest ciliate at least in the upper half, wings ciliate in the apical part. Median sepal spatheform, membranous, 2 1/2–3 by ca 1 mm, papillate at the top, with one distinct nerve. Petals 7–8 mm long, limb narrowly obovate-elliptic, ca 3 by 2 1/2 mm, claw 4–5 mm long, 1/2 mm wide or less. Stamens ca 1 1/2 mm long; anthers ca 1 mm long, top and base deeply incised, top of the cells with 2 acute teeth, base subobtuse. Staminodes bifid, penicillate, ca 1 mm long. Ovary obovoid, 3-sided, 3-celled, 2–3 by 1–2 1/2 mm. Styles 3-fid, up to 3 mm, 3-sided, branches 1–1 1/2 mm, 3-sided, capitate at the top.


5. **Xyris malmei** VAN ROYEN, Blumea 7 (1953) 307.—Fig. 1 E.

Leaves ensiform, 7–30 cm by 1–2 mm, strigate when dry, subfalcate, obtuse, widened at the base and the margins there sometimes with brown hairs, papillate; sheath 4–7 cm long. Peduncle 20–45 cm by ca 1 mm, terete, but subterete immediately below the head, papillate. Head subglobose to ellipsoid, 7–12 by 3–10 mm. Basal bracts ovate, 4–5 by 2 1/2–3 mm, obtuse, retuse, with 4 descending nerves, papillate in a narrow region in the upper half. Median bracts ellipsoid, 8–9 by 3–4 mm, with ca 6 complete and ca 2 incomplete descending nerves, papillate in a narrow region in the upper third. Lateral sepals 8–9 by ca 1 1/2 mm, obtuse, emarginate, crest narrow, entire. Median sepal cap-shaped, 6 1/2–8 by ca 2 mm, 1-nerved. Petals 15–17 mm long, limb obovate, 8–9 by 5–6 mm, claw 7–8 mm. Stamens 3–4 1/2 mm, anthers 2–2 1/2 mm, deeply incised at the top; cells with 2 acute tips, base obtuse, emarginate. Staminodes 2–3 mm, bifid, penicillate. Ovary obovoid, 3-sided, ca 3 by 1 mm, stipitate. Styles 11–12 mm, 3-fid, 3-sided, branches 3–3 1/2 mm, capitate at the top.

**Distr. Malaysia:** Malayan Peninsula (Kedah Peak), 850–1300 m.

**Notes.** This species has characters in common with *X. bancana*, *X. oreophila* and *X. lobbii*. From *X. lobbii* it differs in the obuse leaves without thickened margins, in the terete to subterete peduncle without ribs, in the narrow entire crest of the lateral sepals and in the top of the thecae. From *X. oreophila* it differs in the divided top and base of the thecae and the narrow papillate field in the apical third of the bracts. It differs from *X. bancana* in the non-ribbed peduncle, in the entire crest of the lateral sepals, and in the relatively longer sheath of the leaf.

6. **Xyris ridleyi** RENDLE, J. Bot. 38 (1899) 505, t. 409, f. 12–16; RIDLEY, Fl. Mal. Pen. 4 (1924) 349; MALME, l.c. (1927) 390; l.c. (1929) 385, 389.—**X. glauccello** MALME, l.c. (1929) 388.—Fig. 1 F. var. ridleyi.

Leaves linear to ensiform, 3–20 cm by ca 1 mm, acute, sometimes shortly spinulose, falcate, twisted, densely papillate; sheath 1–3 cm. Peduncle subterete to compressed, with 2 wings, 10–45 cm by ca 1 mm, twisted, subsaccous or glabrous. Head globose to obovoid, 3–10 by 6–8 mm. Bracts elliptic, 2–3 by ca 1 1/2 mm, obtuse, emarginate, with ca 11 descending or complete nerves, but 3–5 branch-ed descending nerves in the basal ones, sometimes keeled in the upper third, papillate in the upper half, apical margin minutely fimbriate, the most apical bracts with longly fimbriate apical margin. Lateral sepals 3 1/2–6 by ca ca 1 mm, obtuse, emarginate, crest papillate, wings fimbriate along the margin in the upper half. Median sepal spatheform, 3–4 mm long, with one distinct nerve, papillate at the top. Petals 3–6 mm long, limb orbicular, 2–3 mm long, claw ca 3 mm. Stamens 1 1/2–2 1/2 mm, filaments ca 1 mm, anthers ca 1 mm, deeply emarginate at the top, broadly emarginate at the base; cells with 2 acute tips, base obtuse, emarginate, the...
inner lobes shorter than the outer ones. Staninodes 2-fid, 1/2–1 mm, each arm spatulate, shortly fimbriate along the margin. Ovary ovoid, truncate, 3-sided, 1-celled, 3–3 1/2 by 1–2 mm. Styles 3–4 mm long, 3-fid, arms ca 1 mm, their top indistinctly fimbriate margin.


Notes. By the shape of its staminodes this variety is relatively easy to recognize.

**var. penicillata** van royen, Blumea 7 (1953) 309.—Fig. 1 Fa.

Staminodes penicillate.

Distr. Cambodia & Siam.

Note. It is possible that this variety will be found in the Malay Peninsula.

7. **Xyris papuana** van royen, Blumea 7 (1953) 307.—Fig. 1 G.

Leaves linear-ensiform, twisted, obtuse, 20–45 cm by ca 1/2 mm, striate when dry, minutely tuberculate; sheath 1–2 cm long; ligule short, obtuse, 1/2–2 1/2 mm long. Peduncle 20–55 cm, 1/2–3/4 mm wide, suberetate, twisted, with one or more prominent ribs when dry. Head ovoid, 3–8 by 3–6 mm. Basal bracts ovate, 2–3 by 1/2–2 mm, with a few descending nerves, apical margin lacerate. Median bracts obovate, 4–5 by 3–3 1/2 mm, with 14 descending branched nerves, minutely papillate in the apical third, apical margin ciliate. Lateral sepals narrow, 4/1–5 by ca 3/4 mm, obtuse, emarginate, ciliate at the top, crest narrow, with small teeth or entire, wings in the apical part ciliate. Median sepal cap-shaped, ca 3 mm long, with 3 nerves of which 2 are sometimes incomplete. Petals 7–9 mm long, limb cuneate, margin crenulate. ca 3 mm diam., claw 5–6 mm. Staminodes 11/2–2 mm, anthers ca 1 mm, top deeply incised; top of the theca with 1–2 acute teeth, base subobtuse to mucronate. Staminodes 6–7 mm, twice forked, penicillate. Ovary ovoid, 11/2–2 1/2 by ca 4/5 mm, truncate, 3-sided, 3-celled. Style 4–4 1/2 mm, 3-sided, 3-fid. each branch 11/2–2 mm, 3-sided, capitulate at the top.

Distr. Malaysia: Moluccas (Misool, and Tran- gan in Aru Islands) and N. New Guinea (Mt Cyclops).

Ecol. Alang-fields at low alt. (Misool) and mountain summits (Mt Cyclops) at ca 1900 m, fl. July, Oct.

Notes. This species is closely related to X. bancana, X. lobbii, X. ridleyi, and X. borneensis, but its short sheath in relation to the long leaves, the lacerate apical margin of the median bracts, and the numerous descending nerves in these bracts are good distinctive characters.

8. **Xyris pauciflora** Willd. Phytogr. 1 (1794) 2, t. 1, f. 1; NilssoN, l.c. 36; Malme, l.c. (1927) 391; l.c. (1929) 389.—X. pauciflora Willd. var. oryzetorum Miquel, Fl. Ind. Bat. 3 (1855) 529.—Fig. 1 H, 3.

Leaves narrowly linear, 3–25 cm by 1–2 mm, acute to acuminate, striate when dry, sparsely papillate at either side, sometimes restricted to the margin only in mature leaves; sheath 1 1/2–7 cm long with a scabrous keel. Peduncle suberetate, compressed and sometimes with 2 narrow wings, twisted, 4–40 cm by 1–1 1/2 mm. Head ovoid to globose, 3–9 by 2–8 mm. Basal bracts elliptic, 2–4 by 2–3 mm, obtuse, emarginate, papillate along the midrib, with 2 descending nerves; median bracts elliptic to orbicular or obovate, 3–6 by 4–5 mm, obtuse, with 4 partly complete or incomplete descending nerves and a narrow papillate triangle in the upper third, spinulose at the top, margins mem-

Fig. 3. Distribution of *Xyris pauciflora* Willd. in Malaysia.

branous. Lateral sepals curved, 3–5 by 1 1/2 mm, subacute, crest narrow, coarsely serrate, wings unequal, tapering towards the base. Median sepal spathe-like, ca 3 mm long. Petals 6–9 mm long, limb obovate, 2–3 1/2 mm, claw 4–5 mm. Staminodes 1–1 1/2 mm, anthers 1 1/2–3 1/2 by ca 1 1/2 mm; inner loculi of the thecae shorter than the outer ones, obtuse, connective membranously widened. Staminodes 2-forked, penicillate, ca 1 mm long. Ovary obovoid, 3-sided, 2–3 by 1 mm. Style 3-fid, 2 mm long, branches ca 1/2 mm, capitulate.

Distr. Ceylon, India, SE. China, Hainan, Hongkong, and Formosa to N. Australia and Queensland, in Malaysia: Malay Peninsula, N. Sumatra (Toba), West Borneo, Java, and Madura, Celebes (Makassar and Timanup), Philippines (Luzon).

Ecol. In damp, sandy places, in alang-fields, and on sandy padang soils, in Java decidedly in regions subject to a pronounced dry monsoon, in the lowland below 300 m, only on the Toba Plateau at 900 m, fl. April–Oct., Jan.

9. **Xyris lobbii** Rendle, J. Bot. 37 (1899) 506, t. 403, f. 17–24; Malme, l.c. (1927) 390; l.c. (1929) 389.—Fig. 1 I.

Leaves ensiform, 12–40 cm by 3–6 mm, acute, sometimes subfalcate, papillate, with thickened margins; sheath 7–10 cm, slightly widened at the base. Peduncle 40–65 by ca 1 mm, terete, papillate. Head ellipsoidal to globose, 9–12 by 7–12 mm. Basal bracts ovate, 4–4 1/2 by 2 1/2–3 mm, obtuse to sub-truncate, thickened and minutely papillate in a narrow triangle, 1-nerved. Median bracts obovate to elliptic, 6–8 by 4–5 mm, thickened in a narrow triangle from top to base, papillate in a narrow quadrangular field in the apical half, with ca 14 complete nerves. Lateral sepals 6–6 1/2 by 1 1/2–2 mm in the upper part, tapering towards the base, obtuse, emarginate, crest fimbriate in the upper half. Median sepal unknown. Petals 10–12 mm
long, limb cuneate, 2½–5 by 3½–6 mm, margin crenulate, claw 8–9 mm long. *Stamens* 4–4½ mm, anthers 2–2½ mm, obtusely incised at the top; top and base of theca subacute. *Staminodes* twice forked, 9–10 mm, papillate. Ovary obovoid, 3-sided, 3-celled, ca 2½ by 1 mm, truncate, stipitate. Style 3-fid, 5–6 mm, branches ca 3 mm, capitulate at the top.

**Distr.** Siam & S. Burma (*var. burmana*) and Malaysia: Malay Peninsula.

**Notes.** *Var. burmana* MALME is found in S. Burma and Siam and may be found in Malaysia. It differs from the type-variety in the shorter leaves, the relatively longer sheath, and the larger number of nerves in the bracts.

10. *Xyris oreophila* RIDLEY, J. Fed. Mal. St. Mus. 7 (1916) 121; Fl. Mal. Pen. 4 (1924) 349, f. 202; MALME, l.c. (1927) 391; l.c. (1929) 385.—Fig. 1 J.

Medium sized. Leaves ensiform, 7–36 cm by 1–3 mm, acuminate, papillate, mature leaves sometimes glabrous; sheath 3–7 cm long. Peduncle 20–55 cm by ca 1 mm, terete to subterete, with or without one or two ribs, densely papillate. Head ellipsoid to obovoid, 6–14 by 5–12 mm. Basal *bracts* obovate, 3–7 by 1–3 mm, emarginate, slightly keeled, papillate in a narrow ellipsoid field along the midrib, with 4 descending nerves. Median bracts spatulate to obovate, 5–8 by 2–4 mm, subnavicular, obtuse, emarginate, with 5–10 complete nerves, slightly thickened in a narrow, minutely papillated triangle in the apical part. Lateral *sepalas* 6–7 by 1–2 mm, obtuse, emarginate, crest entire. Median sepal cap-shaped, 5 by 1–2 mm, 1-nerved. *Petals* 13–15 mm long, limb obovate, 6–7 by ca 3 mm, claw 7–8 by ½ mm. *Stamens* 11–12 mm, anthers 2–3 by ½ mm, emarginate; top and base of thecae acute, attached to the filament. *Staminodes* forked, penicillate, 1–2 mm. Ovary obovoid to fusiform, 3-sided, 3-celled, ca 4½ by 1 mm. Style ca 4 mm, 3-fid, branches 4–5 mm; stigma undifoliform, papillate along the margin.

**Distr.** Malaysia: Malay Peninsula (Kedah Peak), 900–1300 m, fl. Dec.

**Note.** The bases of the anther-cells are attached to the filament and not free as is depicted by RIDLEY.

11. *Xyris dajacensis* VAN ROYEN, Blumea 7 (1953) 308.—Fig. 1 K.

**Leaves** linear, 5–16 cm by 1–2 mm, acute, often twisted, papillate, sometimes along the margins only; sheath 1–11 cm long, sometimes with a short ligule. Peduncle up to 60 cm by 1½–2½ mm, distinctly compressed but sometimes terete in the basal part, twisted, subscabrous in the upper part, glabrous in the lower part, provided with a few prominent ribs in the upper part. Head ovoid to ellipsoid, 3–10 by 2–7 mm. Basal *bracts* suborbicular, 1–3 by 2–4 mm, papillate at the top only, with 2 complete and 4 incomplete nerves. Median bracts broadly obovate to orbicular, 3–5 by 4½–5½ mm, apex with a hollow papillate prominentulus tooth, entire or emarginate. margins entire to scarios, with 4–6, sometimes branched, complete nerves. Lateral *sepalas* 3–4 by 1–2 mm, acute, with a few teeth in the apical part of the crest. Median sepal ca 3 mm long, spathelliform. Petals 3½–4 mm long, limb obovate-cuneate, 2–2½ by 1½–2 mm, margin crenulate, claw ca 2 mm long. *Stamens* ca 2½ mm, filaments ca ½ mm, abruptly narrowed at the top, anther ca 2½ mm, deeply incised at either end, top and base of the cells obtuse. *Staminodes* penicillate, ca ½ mm. Ovary obovoid, 3-sulcate, 3-celled, 2–3 by 1½ mm. Style 3-fid, 2½–3 mm, with 2 broad membranes and a narrow wing decurrent along the ovary; stigmas leaf-like widened, united in a 3-sided indufibulum.

**Distr.** Malaysia: Br. N. Borneo (Sandakan, Labuan).

**Notes.** This species resembles *X. complanata* but differs from it by the obtuse ends of the anther-cells, the spinulose bracts, and the ribless margins of the leaf. It closely resembles *X. pauciflora* but has a larger region with minute papillae on the bracts, different anthers and leaves with thickened cells in the margins.

12. *Xyris grandis* RIDLEY, J. Linn. Soc. 38 (1906) 332; J. Fed. Mal. St. Mus. 2 (1911) 138; Fl. Mal. Pen. 4 (1924) 347; MALME, l.c. (1929) 392.—Fig. 1 L.

**Leaves** ensiform, acuminate, 50–90 by 1–2 cm, sometimes falcate, distinctly nerved, glabrous; sheath 20–30 cm long, widened and reddish brown or dark brownish at the base. Peduncle 25–60 cm by 3½ mm, 3-sided in the upper part, subterete in the basal part. Head brown, ovoid to subglobose, 1½–2½ by ca 1½ mm. Basal *bracts* navicular, 10–22 by 2½–3½ mm, obtuse, crested. Median bracts ovate-oblong, 8–13 by 3–4 mm, obtuse or emarginate, minutely spinulose, with 4 descending nerves. Lateral *sepalas* 8–9 by ca 2 mm, obtuse, crested, entire. Median sepal spathelliform, 1-nerved, up to 5 by 4 mm. *Petals* up to 15 mm long, limb suborbicular, up to 7 by 3–4 mm, outer margin lacerate, claw 7–8 mm. *Stamens* 3½–2½ mm, anthers brown, 2½–3½ mm: thecae close to each other, each with 2 acute tips and obtuse base. *Staminodes* absent. Ovary ellipsoid, 2½ by 1½ mm, attenuate at the base, 3-sided, 3-celled. Styles 3-fid, 6½–7 mm, branches linear, 3½–4½ mm.


**Notes.** This clearly marked species belongs with *X. chlorocepha* to the most robust representatives in Malaysia.

13. *Xyris chlorocepha* VAN ROYEN, Blumea 7 (1953) 308.—Fig. 1 M.

**Leaves** ensiform, acuminate, 35–65 by 3½–1½ cm, sometimes falcate, distinctly nerved, glabrous; sheath 10–20 cm long, widened and reddish brown or dark brownish at the base. Peduncle 25–65 cm by 3–4 mm, flattened immediately below the head, subterete in the lower part. Head green, 1½ by ca 1½ cm. Basal *bracts* navicular, 7–9 by 2½–3½ mm, obtuse, crested. Median bracts ovate to squamate, 8–13 by 3–4 mm, obtuse or emarginate, minutely spinulose, with 2 twice forked descending nerves. Lateral *sepalas* 8–9 by ca 2 mm, obtuse.
Xyridaceae

Fig. 4. Xyris indica L. var. indica in a rice-field in Krawang (West Java).

Fig. 5. Distribution of Xyris indica L. var. indica in Malaysia.

clop. 30 (1819) no 11, non sensu Pursh, Fl. Am. Sept. (1814) 33 note est X. torfia J. E. Smith, l.c.; Nilsson, l.c. 38; Rendle, J. Bot. 37 (1899) 497; Weinzieher, Flora 106 (1914) 393–432, t. 6 & 7; Festschrif. Inst. Allg. Bot. Univ. Zürich (1914) 43–82, t. 1 & 2; Beume, Trop. Natuur 6 (1917) 155–159, f. 1–10; Backer, Handb. Fl. Java 3 (1924) 4; Oonkruider. Suiker. (1928) 176; Ridley, Fl. Mal. Pen. 4 (1924) 348; Malme, l.c. (1929) 390.—X. calocephalo Miq. Fl. Ind. Bat. 3 (1855) 527.—X. robusta Mart. in Wall. Cat. (1828) no 6087; in Wall. PI. As. t. 3 (1832) 30.—X. capito Hance, J. Bot. 14 (1876) 262.—X. paludosa R. Br. Prod. 1 (1810) 256.—Fig. 1 N. —X. paludosa R. Br. Prod. 1 (1810) 256.—Fig. 1 N. —X. paludosa R. Br. Prod. 1 (1810) 256.—Fig. 1 N. —X. paludosa R. Br. Prod. 1 (1810) 256.—Fig. 1 N. —X. paludosa R. Br. Prod. 1 (1810) 256.—Fig. 1 N. —X. paludosa R. Br. Prod. 1 (1810) 256.—Fig. 1 N. —X. paludosa R. Br. Prod. 1 (1810) 256.—Fig. 1 N. —X. paludosa R. Br. Prod. 1 (1810) 256.—Fig. 1 N. —X. paludosa R. Br. Prod. 1 (1810) 256.—Fig. 1 N. —X. paludosa R. Br. Prod. 1 (1810) 256.—Fig. 1 N. —X. paludosa R. Br. Prod. 1 (1810) 256.—Fig. 1 N.


Crest abruptly narrowing near the top. Median sepal spatheiform, up to 5 by 4 mm. Petals up to 15 mm long, limb suborbicular, up to 7 by 3–4 mm, outer margins lacerate, claw 7–8 mm long. Stamen 3–3½ mm, anthers 2–2½ mm long, yellow, connective widened, membranous; thecae with 2 acute tips, mucronate at the base, inner cells shorter than the outer ones. Staminodes forked, penicillate, 2–2½ mm long, with a short mucro in the fork. Ovary ellipsoid, 2–3 by 1–1½ mm, attenuate at the base, 3-sided, 3-celled. Styles 3-fid, 6½–7 mm, branches linear, 3–4½ mm.

Distr. Malaysia: Central Sumatra (Westcoast, Serasah Bunta near Pajakumbu and Harau Cleft).

Ecol. In the spray of waterfalls and on steep damp walls with seepage water, often rooting in moss, 500 m, fl. March, Aug.

Note. Closely resembling X. grandis but differing in the smaller leaves, the green head, the penduncle which is flattened below the head, the absence of a minutely papillate field on the bracts, the crest of the lateral sepals which abruptly narrow at the top, the presence of penicillate staminodes, in the shorter inner loculi of the yellow anther, and the mucronate base of the anther-cells.

var. indica. Robust perennial. Leaves linear-ensiform, 5–60 by ½–1 cm, top falcate and curved in the mature ones, straight in the juvenile ones, acute to obtuse, glabrous, indistinctly nerved when dry, with numerous short, prominent transverse ribs connecting the nerves; sheath 8–30 cm long. Peduncle 20–80 cm by 1½–3 mm, twisted, compressed to terete, with prominent nerves. Head ovoid to subglobose or ellipsoid, 1½–3½ by 1½–1½ cm. Bracts papryraceous, conchatte, slightly 5-angled to obovate, 5–8 by 5–7 mm, obtuse to truncate, entire or emarginate, with membranous gold-coloured margins, with 4–6 descending nerves, minutely papillate in the upper third. Lateral sepals 5–7 by ca 1 mm, obtuse; crest dentate, sometimes entire, in the apical flowers shorter than the wings and then the apex of the sepals acute. Median sepal cap-shaped, up to 4 by 2½ mm. Petals yellowish to yellow, 8–10½ mm long, cuneate, limb obovate or ovate, 3½–5 by 3–4 mm, margin serrulate, claw 5–6 by ½ mm. Stamen ca 4 mm long; anthers 4-sided, 1½–2 by ¾ mm, top broadly incised, with a short mucro in the incision; thecae acute or mucronate at both sides. Connective membranous. Staminodes penicillate, 2–3 mm long. Ovary obovoid, 3-sided, 2½–3 by 1½–2 mm, 1-celled. Style 3-fid, 2–3 mm long. Fruit 3–4 mm high.

Distr. Ceylon, India, Cochín-China, China and Hainan to Australia, in Malaysia: Sumatra (once...
at Fort de Kock, Westcoast Res.), Java and Madura (most abundant in West Java), Philippines.

Ecol. Almost exclusively restricted to and common in inundated rice-fields, often giving at a certain stage a yellow tinge to the ripening fields, but erratically distributed and absent in adjacent fields (Backer, Krakatao, 1929, 7, footnote), mainly below 250 m, but found at 600 m (Tjibadak, W. Java) and 900 m (Fort de Kock, W. Sumatra), both in everwet and seasonal regions, preferring the lighter soils, acc. to Coert preferring sandy soils in E. Java, throughout the year, but mostly March–June.

Notes. As Linne's description comprised two species, J. E. Smith emended the circumscription by typifying it with the Indian element, at the same time giving a new name and a description of the American element (Rendle, l.c.). A variety occurs in Indo-China.


Fig. 6. Xyris capensis Thunb. var. schoenoides (Mart.) Nilss. in a swamp on Mt Patuha (West Java). Below: leaves and heads of Eriocaulon blumei Koern. (De Voogd, 1939).


Fig. 7. Xyris capensis Thunb. var. schoenoides (Mart.) Nilss. Tuft on swinging moor of Mt Diéng (Central Java) (Polak, 1930),

X. melanocephala Miquel, Fl. Ind. Bat. 3 (1855) 528; Nilsson, l.c. (1892) 42; Malme, l.c. (1927) 392; Malme, l.c. (1929) 391.—X. sumatrana Malme, l.c. (1929) 391–392.—X. semifusca Boer ex Baker, J. Linn. Soc. 20 (1884) 277.—X. novoguineensis Hatusima, Tokyo Bot. Mag. 56 (1942) 422.—Fig. 1 O, 6–9.

Leaves rigid, ensiform, 10–50 cm by 2–4 mm, top falcate, curved, obtuse; sheath 6–16 cm long, crested, ligule 2–25 mm long. Peduncle 20–96 cm by 1½–3 mm, subcompressed, ribbed, with one distinct wing, but with 2 in the upper part, twisted, basal part subvillose and sometimes shining brown.
Head subglobose to obovoid, up to 1 cm diam. Basal bracts orbicular; median bracts narrowly elliptic and shortly spinulose, sometimes broadly boat-shaped. Bracts in either case provided with 6–9 mainly complete, sometimes incomplete nerves, 4–9 by 3–6 mm. Lateral sepals boat-shaped, 6–7 by 1–1½ mm, obtuse to acute, entire, with a narrow crest. Median sepals cap-shaped, 3–4½ by 2 mm, obtuse. Petals yellow or yellowish, limb obovate, 4½–5½ mm long, claw 6–7 mm. Stamens ca 2 mm long, filaments ca ½–1 mm, anthers ca ½ by ½½ mm, obtusely incised at the top, apex of thecae with 2 teeth, base obtuse to mucronate, connective membranously widened. Stamens bidentate, penicillate, ½½–2½ mm. Ovary 3-sided, 1½–2½ mm long, placentas 3 parietal, obovate, 2½ by 2½ mm, style 3-fid, 2½–3½ mm, branches ½½–2½ mm, stigmas infundibuliform, papillate.

Distr. SE. Asia and throughout Malaysia: Sumatra (N. half), Malay Peninsula (Cameron’s Highlands), Java (W. Central). Central Celebes (Lake Posso and Limbung near Masamba), Moluccas (Buru), and New Guinea (Arfak Mts and Morobe Distr.), the species s.l. distributed from Central Africa to Australia.

Ecol. Mountain swamps, stream and lake banks, swinging moors, sometimes rather close to solfatara (Dieng, Gajolands), mostly associated with sedges and Juncus, locally often subdominant by densely set tufts. (600)–900–2500 m, ff. Jan.–Dec.

Notes. In Java on the Dieng-plateau it is sometimes used as an inferior substitute for Fimbristylis in the construction of mats (Heyne, Nutt. Pl. 1927, 427).


16. Xyris flabellata van Royen, Blumea 7 (1953) 308.—Fig. 10.

Small, not tufted. Leaves ensiform, 2½½–9½½ cm by 1½½–2½½ cm, equitant, acute, falcate, with a stout hollow nerve in either margin, minutely papillate; sheath 1½½–7½½ cm long; leaves enveloping the peduncle provided with an obtuse, 5–10 mm long acumen, but without a limb. Peduncle 8–28 cm by 1½½–2½½ mm, subterete, provided with one stout rib, papillate. Head obovoid to ovoid, 5–7 by 3½½–2½½ mm, few-flowered. Basal bracts black,
ovate, 5–6 by 3/2–4 mm, obtuse, distinctly crested, with 4 descending nerves. Median bracts obovate, 6–7 by 21/2–4 mm, crested, black and papillate in the apical part, with 5–6 complete nerves. Lateral sepals obtuse, 5–51/2 by ca 11/2 mm, with an entire, narrow crest. Median sepal cap-shaped, 1-nerved, ca 4 mm long. Petals 8–10 mm long, limb elliptic to orbicular, 31/2–41/2 mm long, claw 41/2–51/2 mm. Stamens ca 2 mm, filament ca 1 mm long; anthers 1–11/2 mm, top retuse, top of the thecae with 2 acute teeth, base mucronate, connective membranously widened. Staminodes bifid, penicillate, 1–2 mm. Ovary fusiform to obovoid, 3-sided, 3-celled, 3–4 by 3/4–11/2 mm. Style 4–5 mm, 3-fid, branches ca 2 mm long, capitate.

Distr. Malaysia: North Sumatra (Gajo Lands).

Ecol. In marshy, low, open vegetation of mountain heaths, typified by Cyperaceae, Eriocaulon, and Patersonia, 2350–3300 m.

Notes. The leaves are typically equitant, forming in the field characteristic 'combs'. They are rather fleshy and have a yellowish-green colour.

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Fig. 10. Xyris flabellata van Royen. Habit, × 3/4, a. basal bract, b. median bract, c. lateral sepals and flower, d. stamen, e. staminode (after van Steenis 8430).

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Excluded

Xyris operculata 'Labill.': Naves, Nov. App. (1880) 268. According to Merrill (En. Philip. 1, 1922, 192) this is a wrong record of this Australian species for the Philippines.
**DROSERACEAE** (C. G. G. J. van Steenis, Leyden)

Small terrestrial or aquatic, insectivorous herbs. Primary root often undeveloped, stembase with adventitious roots, sometimes tuberous. *Leaves* spirally arranged, often in basal rosettes, rarely whorled, provided with sessile or stipitate sticky glands, marginal glands longest, often circinate when young. Stipules mostly present. Inflorescence lateral or terminal, cymose, often circinate. Bracts absent or present. Bracteoles 0; pedicels not articulated. *Flowers* φ, actinomorphic, (in Malaysia) 5-merous. *Sepals* imbricate, persistent, at the base ± connate. *Petals* imbricate, free, thin, veined, marcescent, long persistent. Stamens (in Malaysia) 5, free, alternating with the petals; filaments filiform; anthers extrors; pollen in tetrads. Disk 0. Ovary superior, free; 1-celled; carpels 3–5 with parietal placentas. Styles 3–5, mostly free, simple or divided. Ovules mostly ~. *Capsule* mostly loculicid, 3–5-valved. *Seeds* small, mostly ~, albuminous; embryo straight; cotyledons short.

_Distr._ Of the 4 genera three are monotypic: *Drosophyllum* is endemic in the West Mediterranean, *Dionaea* is endemic in Atlantic N. America, and *Aldrovanda* is found from Europe through Asia to Australia. *Drosera* is predominantly developed in the S. hemisphere, specially in Australia and though distributed almost over the globe, it is absent from many regions.

_Ecol._ The family shows a remarkable display of wide ecological tolerance. In Australia *Drosera* penetrates into the very dry interior but other species occur in the humid tropics, in the temperate, or in the cold zones of the globe. *Aldrovanda* is aquatic. In Malaysia some spp. of *Drosera* are apparently bound to a seasonal climate (*D. indica, D. peltata,* and *D. petiolaris*), others are restricted to a everwet climate (*D. burmanni* & *D. spatulata*). *Droseras* distinctly prefer sandy or otherwise acid, mostly poor, oligotrophic soils.

Notwithstanding this plasticity in tolerance for the genus as a whole, collections of individual species are in Malaysia comparatively few and suitable conditions are apparently scarce even for widely distributed species. Moreover, specimens easily escape attention of collectors by their small size. Collectors are invited to make notes of the colour and structure of the flowers (specially the gynaeceum) on the spot facilitating later identification.

The trapping of small insects is in *Drosera* achieved by the sticky stalked glands of the leaf blades, and their protein substances are digested by the exuded juice.

In *Aldrovanda* a more specialized trapping mechanism is developed for catching crustaceans, diatoms, &c., the functioning of which has recently been reinvestigated by J. Ashida (Mem. Coll. Sc. Kyoto Imp. Univ. B, 9, 1934, 141–244). Sensitibe hairs occur on the thickened inner portion of each leaf half. Through touch or other irritation the leaf halves move with the midrib as axis and are pressed against each other in a fraction of a second, by which movement the incurved margins close the leaf blade which is then transformed into a bladder-like organ. This motion is immediately followed by a second pressure shutting the bladder still closer. Cf. fig. 7. Digestion takes place in the bladder by protein-digesting substances emitted by glands, slowly disintegrating trapped things.

**KEY TO THE GENERA**

1. Terrestrial. Leaves spirally arranged, often condensed into basal rosettes. Leaf blade not articulated, provided with sticky capitate glands (tentacles). Petioles not connate. Flowers rarely solitary.

   1. *Drosera*

1. Submerged aquatic. Leaves in whorls. Leaf blade articulated, without such glands. Petioles connate at the base. Flowers axillary, solitary

   2. *Aldrovanda*

1. **DROSERA**

_Linné._ Sp. Pl. (1753) 281; Gen. Pl. ed. 5 (1862) no 391; _Diels,_ Pfl. Reich Heft 26 (1906) 61.—Fig. 1–5, 7.

Mostly perennial, often stemless, often with a subterranean tuber. *Leaves* with glandular, irritable, capitate tentacles. Stipules present or absent, often split. *Flowers* in simple (or branched), bracteate inflorescences (in extra-Mal. spp. sometimes solitary), white, pink, or purple, 5(–4)-merous. *Sepals* imbricate, connate at the base. *Petals* in Mal. spp. 5, spatulate or obovate, marcescent, after
anthesis contracted and sticking together with the anthers and stigmas as a hood over the ovary and the capsule. *Carpels* 3–5; styles 3–5, free or connate at the base, often divided in various ways.

*Distr.* Ca 90 spp., nearly throughout the world, centering in the S. hemisphere, specially in extra-tropical Australia, absent from large areas in S. Asia, the Near East, the N. & E. parts of Africa and the W. parts of S. America.

*Ecol.* See under the family description.

*Uses.* Among the Igorots the leaves of *D. peltata* are dried and powdered and the powder is placed into the cavity of an aching tooth (QUISUMBING 1951). From Billiton TEYSMANN (Nat. Tijd. N.l. 36, 1876, 223) reported that *D. burmanni* should break up teeth. Acc. to BURKILL (Dict. 1935) Chinese import *Drosera* into the Malay Peninsula for use in pharmacies, but it is unknown for what specific purpose.

*Vern.* Zonnedaiw, *D. sundew*, E. The name is derived from the fact that the leaf glands excrete so much juice that the plants seem covered with dew drops. This holds for the Malaysian species.

**KEY TO THE SPECIES**

1. Leaves in a basal rosette, with stipules.
2. Styles and carpels 5. Leaves nearly sessile, obovate to orbicular
   3. Styles and carpels 3, styles sometimes divided from near the base. Leaves petioloed.
   4. Style-arms 2–4 times forked. Sepals outside fulvous-lanuginose. Petiole contracted at the apex; blade orbicular, concave. Stipules not prominent. entire or the upper half split into subulate segments
   5. Style-arms split near the base into 2 filiform arms. Sepals glandular outside, glabrous. Petiole broader towards the apex into a flat, obovate-spathulate blade. Stipules conspicuous, rufous, 3-fid

1. Leaves cauline, without stipules.
2. Leaves linear. Petiole indistinct. Stem without subterranean tuber. Styles 3, forked at the base into 2 thickened, ascending arms

4. Leaves semi-orbicular, peltate, at the base with 2 caudate, fimbriate elongations. Petiole distinct. Stem originating from a subterranean tuber. Styles 3, towards the apex brush-shaped divided
   5. *D. peltata* 5.


Fig. 2. Distribution in Malaysia of *Drosera burmanni* Vahl.

Rosulate. *Leaves* red or green, appressed to the soil, obovate to orbicular; blade 6–10 by 4–6 mm. Stipules mostly 3-parted, each segment with lanceolate acute lobes. Peduncles 1–3, erect, 4–27 cm, rhachis 1–9/2 cm, 2–25-flowered. Pedicels erect, 1/2–4 mm. *Sepals* oblong, blunt, 2/2–3 mm long. *Petals* white, obovate, ca 4 mm long. Styles 5, at
their apex split into very short lobes. Capsule ca 1/2 mm long. Seeds dark, very fine-scorbulate.

Distr. India to S. Japan, Micronesia (Palau) and N.E. Australia, throughout Malaysia but not yet found in Sumatra and Java. Fig. 2.


Rosulate. Leaves appressed to the soil. Petiole narrow-lanceolate, sometimes subterete, sericeous, narrow, directed towards both ends, constricted below the blade, 1 1/2-2 1/2 (–5) cm; blade orbicular, 2-2 1/2 mm, margin with capitate fimbrata. Stipules not prominent, scarious, unnerved, narrow, entire or split into subulate segments, 8-10 by 3/4–1 mm. Inflorescences densely hairy, peduncle glabrescent. Peduncles 1-2, ascending, 5-12 (–30) cm, pedicels short, recurved after anthesis, 10–35-flowered. Sepals obovate to subspathulate, inside glabrous, 2 1/2–4 by 1 1/2–2 mm. Petals pink to purple, broad-ovate, 7 by 5-5 1/2 mm. Stamens 2 1/2–3 mm long: filaments terete. Styles 3, base forked, apex of each arm with short, repeatedly forked clavate segments. Seeds ellipsoid, shortly mammillate.

Distr. N. Australia in Malaysia: SE. New Guinea (Wassi Kusa). Fig. 5.

Ecol. Periodically wet savannah areas under periodically dry climatic conditions at low altitude, acc. to BRASS one of the first herbs to flower on wet sandy flats near Tarara in Dec. 1936.


Rosulate. Leaves appressed to the soil. Petiole ca 8–10 mm, glabrous at the base; fimbrate towards the apex; blade ca 5 mm diam., often spathulately widening towards the 5 mm large, obovate to spatulate blade. Stipules membranous, rufous, ca 5-7 mm long, mostly 3-fid, segments unequal, ending in a bristle. Peduncles 1–2, ascending, 1–20 cm, towards the apex often glandular-pubescent, 1-15-flowered. Pedicels short, erect, 1/2–3 mm. Petals obovate, cuneate at the base, white or pink, 3 1/2–6 mm long. Stamens 2 1/2–3 mm long. Styles 3, ca 2 1/2–3 mm long, bifurcate from the base, arms simple, ascending, curved, incrasate towards the base. Seeds minute, ellipsoid, dark, very fine granular.

Distr. S. Japan, China, and Formosa to E. Australia, Tasmania, and New Zealand, in Malaysia: N. Sumatra (Gajo Lands), Mal. Peninsula, Br. N. Borneo (Kinabalu), the Philippines (Luzon, Mindoro), and SE. New Guinea (Tarara). Fig. 3.

Ecol. Open mountain heaths, on Mt Kinabalu on damp serpentine rocks, in the Gajo Lands on damp sandy or clayey soils between sedges, under everwet climatic conditions, rarely on wet ground in savannah forest at low altitude, (10–)1200-2800 m. Fl. fr. Jan.–March.

Notes. The Sumatran and Philippine specimens differ slightly from those of Mt Kinabalu by obovate, not acute petals with slight crenulations towards the apex, by broader bracts, and by a scarcely capitulate-glandular inflorescence. The style-arms are sometimes halfway forked for a second time.


Distr. Trop. Africa and Ceylon to Japan and Australia, in Malaysia: not yet found in the Moluccas, in many other islands very scarce. Fig. 3.

Ecol. In periodically wet grasslands, on mud, fallow rice-fields, in Indramaju on bog-iron asso-
ciated with *Fimbristylis dallachyi* F.V.M., locally sometimes abundant, in Java restricted to the regions with a distinct dry monsoon, 10–900 m. *Fl.* Febr.–April (Java), Sept. (N.G.).

*Vern.* *Bintipalo*, Tag.

Note. White-flowered specimens have hitherto not been collected in Malaysia.


![Fig. 4. Drosera peltata J.E.Sm. Island of Sumba (de Voogd).](image)

Fig. 4. *Drosera peltata* J.E.Sm. Island of Sumba (de Voogd).

Stem erect, originating from a small roundish subterranean tuber, thin, glabrous, simple or branched, 10–35 cm. Basal *leaves* rosulate, or reduced, rapidly vanishing. Petiole distinct, 1½–11½ cm long, spreading or recurved; blade peltate, with long tentacles, semilunar with elongated angles, 2–6 mm. *Inflorescences* opposite to or laterally of the leaves, unbranched, 2–10-flowered. *Peduncle* 1–3 cm, rachis 1½–4½ cm. Bracts linear, pedicels erect, 1½–2 cm. *Sepals* ovate to elliptic, glabrous, with fimbriate margin, 2–3 by 1½ mm. *Petals* white, spatulate-obovate, 5–6 by 2–3 mm. *Stamens* 2½–3 mm long. Styles 3, their upper half several times forked, digitately branched, brush-shaped. *Seeds* ovoid, oblong, black, minutely costulate.

*Distr.* Ceylon SE. Asia, China, and Japan, to Australia and Tasmania, in *Malaysia*: East Java (Mts Idjen, Wilis, and Tengger), Lesser Sunda Islands (Bali, Lombok, Timor), S. Celebes, Philippines (Luzon), and New Guinea. Fig. 5.

Ecol. Grassy places, old lavastreams, open grassy slopes in thin pine and *Casuarina* forests, along road-sides as a kremnophyte, on heaths, or on wet peaty soils containing a good deal of sand (Lake Habbema, acc. to Brass), except in the Papuan localities mostly restricted to regions with a pronounced dry monsoon, 800–2400–3225 m. *Fl.* fr. Dec.–June, in Luzon May–July, at Lake Habbema in Aug., on Mt Giluwe in May.


Note. King’s record for the Malay Peninsula is wrong; it was probably based on the assumption that *D. lobbiaana* had been found in the Peninsula; its type came from Moulmein.

2. **ALDROVANDA**

*Linné*, *Sp. Pl.* (1753) 281; *Gen. Pl.* ed. 5 (1862) *no* 390; *Diels*, Pl. Reich Heft 26 (1906) 59.—Fig. 6–7.

Rootless, submersed, floating aquatic plant, with simple or seemingly forked stem. *Leaves* in whorls of 7–9, connate at the base. Blade articulated, upper surface irritable by hairs and provided with glands; petiole swollen, lacunose, the apex
Fig. 6. *Aldrovanda vesiculosa* L. a. Plant, nat. size, b. leaf whorl, blades closed, × 2, c. reduced leaf from flowering whorl without blade, × 3, d. gynaeceum, in section, e. style apex with stigma (after Diels).

bearing subulate dentate segments; blade reniform to orbicular when flattened, reduced in the flowering whorl and sometimes the foregoing one. Flowers solitary, axillary. Pedicels robust, reflexed in fruit. Sepals 5, imbricate, coherent at the base.

**Petals** white, originally calyptrately connivent. Styles 5, filiform, patent, incurved, apex dilitate and penicillate.

**Capsule** 5-valved.

**Distr.** Monotypic, Europe and Asia to Queensland, with many gaps, in *Malaysia* once found in Timor.

**Ecol.** See under the family description.


Stem up to 20 cm. Petiole 3–9 mm, apical subulate segments (1–3–4–6, 6–8 mm long; flattened blade 4–7 by 4½–10 mm. Flowers few; pedicels slightly curved, 1–1½ cm. Sepals ovate-elliptic, to elliptic-oblong, 3–4 by 1½ mm. Petals narrow-elliptic, 4–5 by 1½ mm. Filaments subulate, 3–4 mm; anthers broad. Ovary and capsule subglobose. Seeds mostly 6–8, rarely few, abbreviate-ovoid, black, 1½ by 1 mm.

**Distr.** Central Europe, Caucasus, SE. & E. Asia, to Queensland, in *Malaysia*: Lesser Sunda Islands (Port. Timor: Nikki Nikki Supul swamp), once found.

**Ecol.** Clear, shallow stagnant water apparently poor in lime and rich in organic substance, in Bengal not avoiding brackish water, at low altitude.

Fig. 7. *Aldrovanda vesiculosa* L. a. Open leaf blade from above, b. ditto, in section, c. ditto, first stage of closing, d. ditto, final stage. e–f. Gynaeceum of Drosera, viz of *D. burmannii* Vahl, f. *D. indica* L., g. *D. spathulata* Labill., h. *D. petiolaris* R. Br., all × 6½ (after Ashida, and Diels).
DATISCACEAE (C. G. G. J. van Steenis, Leyden)

Dioecious trees (or tall herbs), often lepidote or hairy. Leaves large, simple, entire or dentate, spirally arranged, palminerved (or compound), often asymmetric. Stipules 0. Flowers actinomorphic, valvate, unisexual, rarely polygamous, in elongate, bracteate, caducous spikes or panicles.—♂ Flowers: sepals 4–9, free and very unequal or connate in a lobed tube, isomerous, in ♂ Tetrameles with a few occasionally additional lobules. Petals free, isomerous or 0. Stamens isomerous and epipetalous, filaments often long; anthers basifix, intrors or latrors, incurved in bud. Rudimentary ovary present or 0.—♀ Flowers: sepals connate above the ovary or free. Petals and rudimentary stamens 0. Styles isomerous, opposite the calyx lobes, mostly inserted on the margin of the calyx, (2-fid, filiform), club-shaped, or with a capitate stigma. Ovary inferior, 1-celled, with 3–8 parietal, alternipetalous placertas. Ovules ∞. Capsule opening at the apex with slits or splitting laterally; pericarp membranous. Seeds ∞, very small, ovate or spindle-shaped; testa punctate or scrobiculate, outer sheet loosely covering the embryo. Albumen 0. Embryo straight, cylindrical.

Distr. Three genera with 4 spp., Datisca (herbaceous) with one sp. in Asia and one in W. Central America, Tetrameles and Octomeles both with one Indomalayan sp.

Ecol. Rain forest (Octomeles) and monsoon forest (Tetrameles) below ± 1000 m.

Uses. Mainly for timber; see under the spp.


Notes. There is no unanimous opinion on the systematic position of the family which has been compared with several others cf. GILG, Pfl. Fam. ed. 2, 21 (1925) 543 and ERDTMAN, Pollen Morph. & Plant Tax. (1952) 144.

KEY TO THE GENERA


1. Octomeles


1. OCTOMELES

MIQUEL, Fl. Ind. Bat. Suppl. (1861) 133, 336; GILG, Pfl. Fam. ed. 2, 21 (1925) 546. —Fig. 1–4.

Colossal, fast-growing, buttressed tree with thick twigs sharply 3-angular at the apex. Flush and inflorescences lepidote, glabrescent. Leaves roundish-cordate, 5–7(–9)-nerved, lower surface with groups of large pitted domatia glands in the axils of the nerves, and very numerous smaller ones on the veins. Petiole long, 5-angled. Flowers sessile, coarse, green, 5–8-merous, thick, spreading, in axillary, sessile or peduncled spikes.—♂ Flowers campanulate; sepals triangular; petals triangular, with a subulate acumen; stamens in bud strongly incurved, with a thick filament and a large kidney-shaped curved intrors anther.—♀ Flowers: apex of the ovary deeply cup-shaped by the thick calyx tube; styles 5–8, inserted in the throat opposite the acute-triangular calyx-lobes, short, thick, applanate, crowned by a thick, capitate stigma. Petals 0. Capsule barrel-shaped, throwing off the irregular-longitudinally torn exocarp + calyx; endocarp pale, horny, obovate, splitting from the top downwards; persistent. Seeds spindle-shaped, produced in immense quantities.
**Datiscaceae (van Steenis)**

**Distr.** Monotypic, Melanesia and Malaysia: absent from Java and the Lesser Sunda Islands. Fig. 2.

**Ecol.** Rain forest, often alluvial and riverine, up to ± 800 m.

**Notes.** The generic name has sometimes been wrongly spelt *Octomelis.*

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Up to 62(–80?) by 1½–2½ (–4?) m; clear bole up to 30 m, crown semi-globular, branching made about in pagoda habit; bark grey, thin, 1½–5 mm diam.; heartwood absent; wood soft, light (SG 0.34). Buttresses up to 5–10 (–15?) by 6 m.

*Leaf blade* 12–30 by 6–23 cm, those of young trees and suckers much larger, margin in juvenile specimens sometimes with a few coarse teeth; nerves rufous, tertiary nerves crossbar-like; petiole 6–30 cm. *Spikes* 20–60 cm. Bracts lanceolate, acute, 2 mm long.—*Flowers* 4–5 by 5 mm. Lobes ovate-triangular, acute, 2 mm long. Petals trian-

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Fig. 1. Young riverine forest on the low banks of the Lower Telen (E. Borneo), of *Octomeles sumatranum* Miqu. and *Nauclea*, over a shrub layer of *Leea* (Endert, 1925).

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Fig. 2. Distribution of *Octomeles sumatranum* Miqu.
gular, 3 mm long, apex thickened, with an incombed subulate appendage forming a descending column in bud. Stamens ca 4 mm, filament thick. anther 2 mm.—♀ Flowers in 8-12 cm long spikes. ca 5 mm long; ovary 1-2 mm high, free calyx tube 2-4 mm high, lobes broadly triangular, ca 1 by 2 mm. Styles 1-2 mm, fleshy, thick, flattened; stigma 1/2 mm high, over 1 mm diam. Fruiting spikes 15-40 cm long, on 10-20 cm long peduncles. Capsule 12 mm long, endocarp splitting from the apex nearly to the base. ca 1 cm long. Seeds ca 1 by 1/4 mm, weighing ca 0.00005 Gr.

Distr. Malaysia: not yet found in the Malay Peninsula, Java, and the Lesser Sunda Islands. Fig. 2.

Ecol. Rain-forest tree, specially common along rivers, up to ± 800 m. Acc. to many explorers (Beccari, l.c.) it is not a genuine constituent of the stable primary rain forest, but more a typical representative of natural secondary and seral riverine alluvial forest, often occurring in gregarious even-aged stands. Koopman & Verhoef (1938, l.c.) summarized ecological and sylvicultural data. They state a 4 years old specimen cultivated at Bogor to have attained a height of 25 m and a diameter at breast height of 47 cm, which shows its very fast growth. They state further that Octomeles is not sensitive to fire. Germination power of collected seeds soon decreases. The size of mature trees is colossal: Steup (Koopman & Verhoef, l.c. 780) found in Celebes the cubic content of one large tree to be 95.2 m³. Acc. to Endert (1927, l.c.) benuwai is a dominant tree of low moist soils in Kutei (E. Borneo), where acc. to Witkamp (1929, l.c.) there are large complexes where it is absolutely dominant in the upper canopy, specially on the reed-grown capes of the big lowland rivers e.g. the Djambajan River. Fig. 1.

Lante-Poole (1925, l.c.) found ilimo near Vanapa, Veimauri, Aroa, Kumusi and all the rivers of the Buna District and the foothills of the Hydrographers Range, but nowhere socially in the Mandated Territory. He says: ‘it occurs scattered in rain forest in damp places, and in pure stands along banks of the big waterways. Wherever a large river like the Vanapa or the Brown has deposited a mass of alluvium, and made new ground, it comes up in a dense mass. These patches of young trees are very conspicuous, not only because they grow to the exclusion of all other trees but because they are even-aged. The tree is very attractive with its symmetrical development of branches and large, drooping leaves. Few of these ilimo groups reach maturity, as the rivers are continually changing their course and floods may sweep the seedling ilimos down to the sea. If ilimo has succeeded in establishing itself and growing for a generation it stands a good chance for reaching maturity. It binds the ground together with a network of roots and it takes a very great flood indeed to tear the soil away. Only an entire alteration in the course of the river can destroy the young trees now. When ilimo was quite young the ground was covered by rushes but is now covered much the same as in rain-forests; some third storey trees have found their way in, but are not numerous. Creepers, lianas and epiphytes are scarce. One 2nd storey

Fig. 3. Tree habit of Octomeles sumatrana Miq. in the Botanic Gardens, Bogor; note the size to be estimated by person at base and large superficial root system (J. C. Koningsberger).

(1) I assume it seeds in the Saccharum spontaneum fringe.
tree, *Vitex cofassus*, is found here and there. The top storey remains pure *ilimo*. In a 3.2 ha patch of over-mature *ilimo* forest were only 10 spp. and in all 62 individual trees, 39 (= 64%) of which were *ilimo*, furnishing 83% of the cubic content. Next in number was *Dractomelum*, 12 trees (= 19%) with 6% of cub. content. The others were *Pometia pinnata*, *Planchnia timoriensis*, *Pterocarpacea indica*, *Pterocymbium*, *Garuga*, and *Terminalia cathapodoides*.

'The natural succession to these even-aged stands is mixed lowland rain-forest, which will have scattered *ilimo* in it, but *ilimo* cannot again regenerate as a pure stand until the forest is destroyed. It depends for that on fresh alluvial soil which must be drained up to allow *ilimo* to spring up.' A typical sepal tree, following low vegetation and preceding mixed lowland rain forest.

Uses. The wood is soft, coarse-textured and brittle, but the timber can only be used under cover where a weak, perishable timber will suffice. The colossal stems are, however, suitable for making large canoes. The timber industry is still interested in it (cf. Mal. For. 14, 1951, 229). In Borneo *Octomeles* represents one of the lofty 'bee-trees'.


### 2. TETRAMELES


Deciduous, buttressed tree. Leaf scars prominent, conspicuous. Leaves roundish, acuminate. entire or dentate, undersurface densely hairy by bulbous-based simple hairs. upper surface subglabrous or sparsely set with simple hairs. Flowers of both sexes subsessile or shortly pedicelled, in fasciculate apical, peduncled, pendent, simple or little branched spikes (♀) or panicles (♂) with tomentose rachis on the apex of thick defoliate twigs, solitary or in twos or threes, 4–5-merous (♀).—♀ Flowers: calyx tube short. lobes oblong to ovate, equal, or unequal, sometimes alternating with a few occasional smaller, narrower appendages in structure similar to the calyx lobes. Petals 0. Stamens 4, opposite the sepals, inserted on the margin of the cup-shaped receptacle. Filaments short or rather long, anthers incurved in bud, 2-celled, extrors ± basifix, at last seemingly peltate. Rudimentary ovary disk-shaped. cross-like, or 0.—♀ Flowers: lower part of the calyx connate with the ovary, slightly 4-angular, glandular, and mostly hairy, upper part cupular, with 4 triangular lobes. Petals and androecium 0. Styles 4–5, erect, opposite the calyx lobes, inserted on the margin of the calyx throat, thickish, persistent, with an obliquely inserted, unilaterally stigmatic, thickened apex. Ovary with 4–5 parietal placentas alternating with the styles. Ovules in several rows. Flat top of the capsule splitting before the styles, the thus formed 4 triangular valves marcescent and curving inwards, leaving a roundish apical pore. Seeds narrow-oblong, slightly flattened.

Distr. Monotypic. SE. Asia through *Malaysia* to New Guinea. Fig. 6. Ecol. Regions with a more or less well pronounced dry season at low altitude.


Large tree, 25–45 m, stem diam. up to 2 m; clear bole long, columnar, 20–35 m, often deeply
Fig. 4. *Tetrameles nudiflora* R.Br. a. Twig with young foliage, × 2/3—♂; b. inflorescence, × 2/3, c. flower, × 4,—♀; d. inflorescence, × 2/3, e. flower, × 4, f. style, × 14, g. fruit, calyx tube with many small, globular and 2 large, flat glands, × 4. (Partly after R. Brown, ♂ after BRASS 8240, ♀ after KOORDERS 1578, fruit after bb 6043).
Flowered, main branches thick, gnarled, rather irregularly placed, little branched, crown thin; buttresses to 5 by 4 m, thin; bark 5–25 mm diam., grey, smooth, dirty-orange yellow in section, white striped; large spreading surface roots (BRAS). Leaf scars 1/2–3/4 cm diam. Leaves broadly cordate-ovate or rounded, acute to acuminate, coarsely dentate to nearly entire, 3–7-nerved, upper surface ± glabrous, lower surface hairy in various degree specially on nerves and veins; tertiary venation crossbar-like; blade 10–26 by 9–20 cm. Petiole terete, 3–7(–20) cm. — Flowers slightly fragrant in 10–20 cm long panicles. Bracts spathulate, hairy, ca 1 mm long. Pedicels glabrous, subsessile, to 1 mm. Calyx 1/2–2 mm high, deeply 4-lobed, basal part cup-shaped, 1/2 mm high; lobes oblong, blunt, with 3 separate lengthwise nerves, entire or 1-2-toothed. Filaments 1/2–3/2 mm, terete, thinner towards the apex. Anthers rounded ca 1/2 mm.

Flowers sessile, 3½–5 mm long, in spikes or panicles 8–20 cm long. Calyx sparsely hairy to subglabrous, tube 2½–3½ mm, fusiform, sometimes provided with a few 1½–1½ mm diam. disk-shaped, sessile, peltate, glands (bb. 6043 from Muna Isl.). Calyx lobes triangular, acutish, 3-nerved, ½–1 mm long. Styles 4 or nor rarely 5, 1–2½ mm, with a central groove on the inner surface, erect or spreading, stigmatic inner side often occupying half their length. Capsule globose-urceolate, 4–5 mm high, prominently 8–10-nerved. Seeds ca 1 mm long.

Distr. Ceylon, Andamans, and SE. Asia, in *Malaysia*: not yet found in Banka, Billiton, Borneo, the Philippines, and the Moluccas. Fig. 6.

Ecol. Restricted to regions with a more or less well pronounced dry season (which accounts for its absence in the everwet areas of West Malaysia), predominantly in deciduous forests, common in teak forest, not social, on dry soils, not fire-resistant, up to ca 500(1000) m. *Fl. fr.* Sept.–Dec. (in the Mal. Pen. fl. Febr.). Flush and flowers appear at the beginning of the wet season.


Uses. Timber, though to be had in large dimensions, is of an inferior quality; it is suitable for temporary buildings, wooden boxes (and matches?) and specially for canoes. Wood light brown-grey; heartwood is not present.

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Fig. 5. Flowering leafless specimen of *Tetrameles nudiflora* R.BR. on slope along the Lake of Bedali (E. Java) with characteristic gnarled main branches (RUTTNER).

Fig. 6. Distribution of *Tetrameles nudiflora* R.BR. with localized Malaysian localities.

Excluded

CONVOLVULACEAE¹ (S. J. van Ooststroom, Leyden, in collaboration with R. D. Hoogland², Leyden)

Herbs or shrubs, sometimes parasitic, usually with twining stems, occasionally prostrate or creeping, or erect, very rarely trees, often with milky juice. Leaves mostly spirally arranged, in parasitic species absent or nearly so, usually petioled; petiole sometimes with extra-floral nectaries. Stipules absent, pseudostipules (leaves of axillary shoot) rarely present. Inflorescences mostly cymose, one- to many-flowered, with mostly opposite or subopposite bracts at the base of the cymes or under the solitary flowers; rarely racemose. Flowers generally hermaphrodite, actinomorphic, rarely slightly zygomorphic, usually 5-merous, rarely 4-merous, various in size and colour, often showy. Sepals usually free, imbricate, with quincuncial aestivation, often persistent, sometimes accrescent in fruit. Corolla sympetalous, of various shapes, often funnel-shaped or campanulate, more rarely rotate, salver-shaped or urceolate; the limb nearly entire or more or less deeply lobed, often contorted-plicate in bud, or valvate or induplicate-valvate. Stamens isomerous, alternating with the corolla-lobes, adnate to the corolla, with usually slender, often filiform filaments and introrse or laterally and longitudinally dehiscing anthers. Pollen smooth or spinulose. Disk mostly present, annular or cupular. Ovary superior, mostly of 2 carpels, 2- or 1-celled, sometimes 4-celled by development of accessory partitions, rarely of 3 carpels and 3-celled; ovules 2 in each carpel, sessile, erect, anatropous. Style 1, often filiform, simple or forked, or 2 free styles, rarely very short or absent. Stigma entire or 2-lobed, rarely 3-lobed. or stigmas 2–4, of various shape, globular or ellipsoid to filiform, sometimes applanate, rarely peltate, kidney-shaped, conical or funnel-shaped. Fruit a capsule dehiscing by valves or circumscissile or irregularly dehiscing, rarely a berry or nut-like. Seeds as many as ovules or fewer; endosperm cartilaginous; cotyledons generally folded, sometimes obscure or absent.

Distr. Ca 55 genera, with ca 1650 spp., widely distributed in the tropical, subtropical and temperate regions of both hemispheres; the greater part of the species in the tropics and subtropics of America and Asia. The larger genera Cuscuta (ca 165 spp.), Convolvulus (ca 250 spp.) and Ipomoea (ca 500 spp.) nearly throughout the range of the family but Convolvulus more in the temperate parts and Ipomoea more in the tropics and subtropics. Other large genera as Evolvulus (ca 100 spp.) and Jacquemontia (ca 120 spp.) nearly confined to America, Argyreia (ca 90 spp.) confined to tropical Asia, Malaysia, and a single sp. in Australia, and Merremia (ca 80 spp.) circumtropical. Several monotypic or small genera in E. Africa, Madagascar, and Australia.

Ecol. By far the greater part of the species are found in localities where they are fully exposed to the sunlight. As far as they do not prefer open fields and similar places, they often occur along edges of thickets and forests. In the primary forest flora representatives of the family are pretty rare.

Some Convolvulaceae take part in covering or entangling other vegetation either or not associated with other vines of Cucurbitaceae, Vitaceae etc. described by van Steenis as ‘vegetable blankets’ (Trop. Natuur 28, 1939, 141–149). Typical instances of this kind are specially found in seral pioneer vegetation, or in thickets and secondary forest, e.g. Merremia peltata (L.) Merr., Ipomoea gracilis R.Br. A typical example of the luxurious festoons of the latter species is found in the fringe of beach-forest of Casuarina equisetifolia on the Island of Krakatoa of which some crowns are spun round like cocoons (fig. 42). Practical use of this habit might be made in plantations, where some Convolvulaceae could be used as a cover crop. They are, however, inferior to the Leguminosae with similar qualities, in being devoid of root nodules containing nitrogen-fixing bacteria.

The flowers are visited by insects and birds for the nectar excreted by the disk. Species of Ipomoea

² In Argyreia (partly) and Erycibe.
sect. Calonyction with long and narrow corolla tubes, of which several fragrant white-flowered species are nocturnal, are visited by long-tongued Sphingidae. The salver-shaped scarlet-coloured corolla of sect. Quamoclit is distinctly fit for honey-sucking colibris; in Java van der Puij observed by both species that sun-birds suck honey by perforating the basal part of the tube (Trop. Natuur 17, 1928, 187; Hong Kong Nat. 5, 1934, 178–179). In Ipomoea pes-caprae Docters van Leeuwen (Ann. Jard. Bot. Btzent 37, 1927, 19–20) found flowers visited by Xylocopa and other Hymenoptera. Flowers of Ipomoea congesta are at Bogor regularly visited by Hesperidae (van Steenis). The flowers of many species remain open for one day only or for a few hours, specially in the morning.


Caulifory is exceptional; it is found in Erycibe ramiflora Hallier f. and in Argyreia muda Ooststr. Convolvulaceae are autotrophic with exception of the parasitic genus Cuscuta. Parasitipomoea formosana Hayata is conspecific with Ipomoea congesta R.BR.

According to Ridley (Dispersal, etc. 1930, 302–307) the seeds of a number of species of Convulvulaceae are undoubtedly widely dispersed by seawater. Among these are Ipomoea pes-caprae (L.) Sweet, I. stolonifera (Cyrril.) Gmel., I. gracilis R.BR., I. tube (Schlechtd.) Don and I. illustris (Clarke) Prain. These species are found along the coast or immediately behind it; some of them are confined to sandy beaches, very rarely they occur more inland. Of others, like Opeclulina turpethum (L.) S. Manso, Merremia peltata (L.) MErr., and Stictocardia tilifolia (Desr.) Hallier f., Ridley also assumes a dispersal by seawater. These species also occur on or near the coast, but they are often found also in more inland localities. The buoyancy of the seeds is due to an unoccupied space inside the testa.

Svedelius (Flora 96, 1906, 231–259) has described 'water-calyces' in Stictocardia tilifolia (Desr.) Hallier f., Opeclulina turpethum (L.) S. Manso, and some other species of Convulvulaceae.

Morph. The climbing capacity of Convulvulaceae is exclusively effected by the twining of the stem which is always to the right (compare p. 300, fig. 4c).


The value of pollen-characters for the subdivision of the family has been described by Hallier (l.c. 517–520).


Uses. Of importance as food plants are Ipomoea aquatica Forsk. and Ipomoea batatas (L.) Lamk, both cultivated throughout the tropics, the former as a vegetable, the latter for its edible tubers (sweet potato).

Several species are used in native medicine, often on account of their purging properties, e.g. Opeclulina turpethum and species of Merremia and Ipomoea. Species of Porana, Jacquemontia, Ipomoea, Mina, and Turbina are grown as ornamental plants; Ipomoea pes-caprae is sometimes planted on sandy coasts as a sand-binder.

Notes. The family Convulvulaceae is subdivided into two subfamilies, viz A. Cuscutoideae containing as only tribe and subtribe I. Cuscutaeae resp. i. Cuscutaeae and B. Convulvoideae containing two tribes, viz II. Convulvulaceae (Psiloconiae Hallier f.) with smooth pollen (subtribes ii–vii) and III. Ipomoeaeae (Echinocotiae Hallier f.) with spinulose pollen (subtribes vii–ix). There is only a small discrepancy in rank and circumscription between this division and that proposed by H. Hallier (Bot. Jahrh. 16, 1893, 567, 582) who described as tribes, the taxa here accepted as subtribes (l.c. 567–585).

The taxa just mentioned are represented in Malaysia as follows:

Subfamily A. Cuscutoideae.


Subfamily B. Convulvoideae.


Collecting and identifying Convulvulaceae.—As appears from the key to the genera it is impossible to identify sterile specimens. In several cases even flowering materials are insufficient for generic identification (e.g. to discriminate between the genera Opeclulina and Merremia or between Ipomoea and Argyreia) and fruits are needed. This results in the disadvantage that a trustworthy key can only be framed on the basis of complete material. The use of the surface structure of the pollen, i.e. whether it is smooth or spinulose, could not be avoided. This looks worse than it really is, as the spinulose surface of the pollen of Ipomoeaeae can mosty be observed with a 10 times magnifying hand lens; however, in other cases a microscope is needed.
Explorers are invited to take care to collect convolvulaceous plants with both flowers and fruits, and to make good notes on the shape and colour of the flower, and also to dry the flowering specimens immediately after collecting as the corollas are in many cases liable to wilt soon.

The shape of the corolla is rather important for identification; it may be convenient to explain the shape-concepts by reference to the figures: \textit{funnel-shaped}: fig. 10, 26, 28, \textit{funnel-shaped to campanulate}: fig. 58, \textit{rotate}: fig. 5, \textit{salver-shaped}: fig. 34, 53, 54, \textit{urceolate}: fig. 56.

\textbf{KEY TO THE GENERA}

1. Leafless, parasitic plants with haustoria. Flowers small, in clusters or short racemes. Corolla mostly with 5 episepalous fimbriate scales inside (Cuscutoideae) \hspace{1cm} 1. Cuscuta
2. Pollen not spinulose (Convolvulaceae).
3. Ovary deeply 2-lobed; styles 2, inserted between the lobes (gynobasic). Flowers small, solitary, axillary. Corolla deeply 5-lobed. Small creeping herbs. Leaves kidney-shaped or cordate-orbicular \hspace{1cm} 2. Dichondra
3. Ovary not deeply 2-lobed; style(s) not gynobasic.
4. Style absent; stigma 1, conical or semiglobular, 5–10-rayed, rarely funnel-shaped in apical centre. Corolla-lobes bifid. Ovary 1-celled. Fruit fleshy or woody, indehiscent. Woody twiners or straggling shrubs, rarely small trees \hspace{1cm} 7. Erycibe
5. Outer 3 or all of the sepals much enlarged in fruit, patent, scarious, reticulately veined, falling off with the fruit. Flowers in racemes or panicles. Corolla-limb subentire or lobed. Style 1, entire or bifid. Woody or herbaceous twiners \hspace{1cm} 6. Porana
6. Styles either enlarged in fruit or not so, remaining attached to the pedicel after dehiscence of the fruit.
7. Styles 2, free or united near the base.
8. Styles united below; stigmas globular to peltate; ovary hairy. Flowers in axillary peduncled cymes. High twiners \hspace{1cm} 4. Bonamia
9. Styles free.
10. Each style forked and with 2 filiform or slightly clavate stigmas. Corolla-limb nearly entire. Bracts not distinctly enlarged in fruit. Small herbaceous plants, never twining. \hspace{1cm} 3. Evolvulus
11. Each style with a kidney-shaped lobed stigma. Corolla-limb deeply 5-lobed. Bracts much enlarged in fruit and scarious. Large woody twiners \hspace{1cm} 5. Neopeltis
12. Style 1, entire, or with 2 minute branches, concealed by the stigmas. Herbaceous twiners or prostrate plants, or woody twiners.
13. Corolla salver-shaped; limb distinctly 5-lobed with bifid lobes; tube fleshy, cylindrical. Stigmas globose \hspace{1cm} 15. Decalobanthus
14. Corolla funnel-shaped or campanulate; limb entire or slightly lobed.
15. Sepals enclosed by two large bracts. Corolla pink, or purple. Stigmas oblong or elliptic, complanate \hspace{1cm} 11. Calystegia
16. Sepals not enclosed by bracts.
17. Hairs on stems and leaves stellate. Corolla blue, lilac, pink or rarely white. Stigmas elliptic, oblong or linear, rarely globose. Leaf-base cordate or truncate, never hastate or sagittate. \hspace{1cm} 8. Jacquemontia
18. Hairs not stellate (or absent).
19. Outer sepals acute or acuminate, much longer and broader than the inner ones. Stems not winged.
20. Outer sepals deciduous on the pedicel. Corolla white. Ovary glabrous; stigmas globular to oblong. Valves of the capsule silvery white and shining inside. Leaves oblong, narrowed towards the base \hspace{1cm} 9. Aniseia
21. Outer sepals not deciduous on the pedicel. 
22. Midpetaline bands distinctly pilose outside. Corolla white or cream-coloured, with or without a purple centre. Ovary hairy; stigmas ovate-oblong, complanate. \hspace{1cm} 12. Hewittia
23. Corolla glabrous or nearly so, pale blue, lilac or rarely white. Ovary glabrous; stigmas elliptic or filiform \hspace{1cm} 8. Jacquemontia
24. Outer sepals not both distinctly longer and broader than the inner ones and acute or acuminate.
25. Stigmas filiform or elliptic.
26. Stigmas filiform. Corolla white or pink. Leaf-base mostly hastate or sagittate \hspace{1cm} 10. Convulvulus
27. Stigmas elliptic. Corolla blue or lilac. Leaf-base truncate, rounded or slightly cordate, not hastate or sagittate \hspace{1cm} 8. Jacquemontia
28. Stigmas gloular.
17. Capsule circumscissile; upper part of the epicarp separating from the lower part and from the endocarp. Corolla white or pale yellow, without purple centre. Stems terete or winged. 14. Operculina
17. Capsule opening by 4 valves or more or less irregularly dehiscent. Corolla white, pale or bright yellow, sometimes with a purple centre. Stems not winged. 13. Merremia
2. Pollen spinulose (Ipomoeae).
18. Corolla broadly or narrowly urceolate, at the base either narrowed into a short tube, or not.
19. Corolla actinomorphic, urceolate, not narrowed at the base into a short tube. Stamens shorter than the corolla. Filaments dilated at their base into a concave scale, arched over the ovary. 18. Lepistemon
19. Corolla ± zygomorphic, narrowly urceolate, at the base narrowed into a short tube. Stamens longer than the corolla. Filaments not dilated into a concave scale. 17. Mina
18. Corolla tubular, campanulate, funnel-shaped or salver-shaped.
20. Calyx in fruit much enlarged, completely enclosing the ripe fruit. Leaf-blades with minute black dots (glands) beneath. 19. Stictocardia
20. Calyx enlarged or not enlarged in fruit, not completely enclosing the ripe fruit. Leaf-blades without black dots beneath.
21. Fruit a thin-walled capsule opening by valves or irregularly dehiscing. Herbaceous or rarely woody twining or prostrate, rarely erect plants. Corolla mostly glabrous outside. 16. Ipomoea
21. Fruit indehiscent; pericarp fleshy or leathery, or more or less woody.
22. Fruit fleshy or leathery, purple, red or yellowish, globose or ellipsoid, not or indistinctly mucronate by the style-base. Seeds glabrous or rarely pilose at the hilum. Corolla outside mostly with hairy midpetaline bands. Woody twiners. 21. Argyrcia
22. Fruit with a thin woody pericarp, ovoid-oblong, distinctly mucronate by the style-base. Seeds puberulent. Corolla glabrous, or sparsely hairy, white. Herbaceous or subwoody twiner.
20. Turbina

1. CUSCUTA

Herbaceous parasites with slender, often filiform, twining, yellow or reddish stems, with haustoria. Leaves reduced to minute scales. Flowers small, mostly in cymose clusters, 5-, rarely 4- or 3-merous. Calyx more or less deeply lobed, or consisting of free sepals. Corolla tubular, urceolate, globose or campanulate; the tube with crenulate or fimbriate epispalous scales inside. Stamens as many as corolla-lobes, inserted on the corolla above the scales; pollen ellipsoid, smooth. Ovary 2-celled, each cell with 2 ovules. Styles 2, distinct, or 1; stigmas globose, subglobose or elongated. Fruit an ovoid or globose, dry or fleshy capsule, opening irregularly, circumscissile, or remaining closed. Seeds 4 or less, glabrous; embryo acotyledonous, filiform, enlarged at one end.

Distr. Cosmopolitan, rather large genus, estimated at ca 165 spp., centering in the Americas, few in Malaysia, not represented in Borneo, the Philippines, Celebes, and the Moluccas.

Vern. Dodder, E, duvelsnaaigaren, warkruid, D.

Note. Rather often confounded with the Lauraceous genus Cassytha which is similar in habit, but easily distinguishable by 3-merous flowers and globular berries.

KEY TO THE SPECIES
1. Styles 2, distinct. Stigmas depressed-globose (Subgenus Grammica).
2. Corolla-lobes obtuse; calyx-lobes not overlapping; corolla-scales short, deeply bifid, with few fimbriae. 1. C. australis
2. Corolla-lobes acute; calyx-lobes slightly overlapping at the base; corolla-scales ovate, not bifid, abundantly fimbriate. 2. C. campestris
1. Style 1, or nearly absent. Stigmas depressed-globose or elongated (Subgenus Monogyna).
3. Style longer than the depressed-globose stigmas; corolla-tube as long as the lobes; corolla-scales represented by narrow wings. 3. C. timorensis
3. Style shorter than the elongate stigmas; corolla-tube 2½–3 times as long as the lobes; corolla-scales ovate to oblong, abundantly fimbriate. 4. C. reflexa
1. Subgenus Grammica


Flowers mostly pedicelled. Styles 2; stigmas mostly globose or depressed-globose; capsule opening by circumcision, or remaining closed.

Note. Yuncker divided this subgenus into two sections, 1. Clistogrammica Engelm. em. Yunck., with indehiscent capsules and 2. Eugrammica Engelm., with circumcisile capsules. Only the first section is represented in Malaysia.


Stems thin, filiform, greenish yellow to orange. Flowers 2-2 1/2 mm long, in compact clusters. Calyx about as long as corolla-tube; lobes ovate to orbicular, obtuse. Corolla white, greenish white or creamy white; lobes slightly shorter than or as long as the tube, broadly ovate or narrower, obtuse or subobtuse, erect or spreading. Stamens slightly shorter than the corolla-lobes; filaments as long as or longer than the anthers. Corolla-scales short, deeply bifid with few long filmbriae. Styles shorter than the depressed-globose ovary. Capsule depressed-globose or obpyriform, 3-4 mm diam., with large interstyal opening, not circumcisile. Seeds 4-3, oval, 1 1/2 mm long, brownish.

Distr. C., S. and E. Asia to Australia, in Malaysia: Sumatra, Malay Peninsula, Java, and New Guinea.

Ecot. According to Yuncker often on Polygonum but also on many other herbaceous plants as Artemisia, Dianthera, Genista, Glycine soja, Lespedeza, Pelargonium, Piper, Xanthium, etc.

In Malaysia also on Baccaurea, Codiaeum, Croton, Dianthera leptostachya Benth., Hygrophila quadrivalvis Nees, Nothopanax scutellarium (Burm.) Merr., Ocimum basilicum L., Piper aduncum L., Pluchea indica Less., Polyscias, Tecoma stans Juss.; 5-500 m.

According to an annotation on a field-label by Milne, in herb. Sing., this species is regarded as a pest and is said to be liable to become dangerous (Malay Peninsula).

Use. The seeds are used in the native medicine-trade; acc. to Vorderman seeds are for this aim introduced from China. Softening properties are attributed to them (Heyne).

Vern. Djamadju, mamadju, madju-madju, tjatjangau, J., majamun, Md., ramat emas, S.

Notes. The dimensions of the corolla-scales are rather variable; in general they are rather obvious; sometimes, however, they are very small and are easily overlooked. Concerning the form and dimensions of the calyx-lobes may be said that in many cases their length and width is rather equal, in others they can considerably vary; the corolla-lobes are, as a rule, obtuse; somewhat acute lobes also occur.


Stems thin, filiform, yellowish. Flowers 2-2 1/2 mm long, in compact clusters. Calyx about as long as the corolla-tube; lobes orbicular, rounded, slightly overlapping at the base. Corolla-lobes
about as long as the tube, broad-triangular, acute, spreading, with erect or inflexed tips. Stamens slightly shorter than the corolla-lobes; filaments as long as or longer than the anthers. Corolla-scales exerted, ovate, abundantly filibrinate. Styles about as long as the depressed-globose ovary. Capsule depressed-globose, 3 mm in diam., with interstlyral opening, not circumscissile. Seeds ca 2, ovate, with one flattened side.

**Distr.** Native of N. America, now cosmopolitan. in Malaysia: W. and M. Java.

**Ecot.** Often on Medicago sativa, Trifolium, and Satureja hortensis, but also on a great number of other herbaceous plants; acc. to Yuncker on Ambrosia, Ammi, Artemisia, Aster, Beta, Bidens, Callistephus, Capsicum, Cirsim, Dianthera, Ipomoea, Pelargonium, Sonchus, Xanthium, etc. (see Van Ooststroom, Ned. Kruidk. Arch. 52 (1942) 166). The specimens from Java on Cinchona, Cosmos, Crotalaria anagrotrides H.B.K., *C. usaramoensis Baker f.*, and Gynura crepidioides Benth.; 1000–1600 m.

**Note.** Mentioned by Van Steenis, Trop. Natuur 29 (1940) 36 and l.c. 30 (1941) 14. The specimen in the latter paper from Tegal Pandjang (W. Java) belongs to *C. reflexa* Roxb.

### 2. Subgenus Monogyna


**Note.** Two sections can be distinguished, *viz.* 1. *Monogynella* Engelm., with the style as long as or longer than the stigmas; and 2. *Callianthe* Engelm., with the style shorter than the stigmas. To the first section belongs as only Malaysian species *C. timorensis*, to the second monotypic section *C. reflexa*.


Stems coarse, up to 2 mm or more in diam., brownish- or yellowish-red. *Flowers* in short racemes on very short pedicels in the axils of broadly triangular obtuse bracts; the common peduncle simple or occasionally branched near the base. *Calyx* cupulate, persistent, lobes orbicular, broadly rounded, overlapping, with more or less unequal edges. *Corolla* yellowish-white, campanulate, 3–3 1/2 mm long, remaining on the developing capsule; lobes as long as the tube, ovate, obtuse. *Crenulate*, erect or reflexed. Stamens sub sessile or filaments much shorter than the anthers, inserted at the sinus. Corolla-scales represented by narrow wings. *Ovary* ovate-conical. Style longer than the depressed-globose stigmas. *Capsule* ovate-oblong, mucronate by the style. *Circumscissile* near the base, 5 mm high, without opening at the top: 1–2-seeded.

**Distr.** Central Africa (acc. to Yuncker) and Malaysia: E. Java (Assembagus) and Lesser Sunda Islands (Timor, Wetar).

**Ecot.** On *Ficus glomerata* Roxb. and other woody plants; the only specimen from Java, at ca 10 m, in a very dry locality. Apparently confined to regions at a pronounced dry season.

**Note.** I did not see African specimens, but Yuncker states that he 'unable to distinguish between the Malayan forms of the species and those examined from Africa.'

### 4. Cuscuta reflexa Roxb. PI. Corom. 2 (1798) 3, t. 104; Yuncker, Mem. Torr. Bot. Club 18 (1932) 259; Ooststr. Blumea 3 (1938) 70.—*C. macrantha* G. Don, Gen. Syst. 4 (1838) 305.—*Fig. 2.*

Stems coarse, up to 2 1/2 mm or more in diam., pale green or yellowish green. *Flowers* in small groups, or in racemes, or in racemes consisting of small flower-groups, sessile or very shortly pedicelled. *Calyx* cupulate, lobes orbicular, obtuse, overlapping, the back verrucose-carinate. *Corolla* creamy or white, campanulate-tubular, 6–10 mm long, at first remaining on the developing capsule; tube 2 1/2–3 times as long as the lobes; lobes narrow-ovate to ovate-triangular, obtuse or subacute, crenate or entire, erect, spreading or reflexed. Filaments very short, inserted just below the sinus. Corolla-scales ovate to oblong, abundantly filibrinate. *Ovary* ovate-conical. Style shorter than the elongate stigmas. *Capsule* globose-conical, circumscissile near the base, 4–or less-seeded; *seeds* 3–3 1/2 mm long, black.

**Distr.** From Afghanistan and Baluchistan and throughout N. India to Yunnan, China, Siam, and Ceylon; in Malaysia: Java, in the E. half of the island, in W. Java only found once on Tegal Pandjang, Mt Papandajan (*cf.* sub *C. campestris*). The identification of specimens from Kedu, Madium and Ponorogo, found between ca 800 and 1400 m, is uncertain, as they have been *coccinea* without flowers.

**Ecot.** On Achyranthes, Adhatoda, Apluda, Aquilegia, Calotropis, Capparis, Carissa, Citrus, Clerodendron, Cocculus, Coffea, Duranta, Fragaria, Lavatera, Melia, Nerium, Parkinsonia, Peristrophe, Thevetia, Viburnum, Zizyphus (Yuncker).


**Vern.** Ulan-ulan, J, from ulo = serpent.
2. DICHONDRA

Forst. Char. Gen. (1776) 39, t. 20; Ooststr. Blumea 3 (1938) 72.—Fig. 3.

Small creeping herbs, glabrous or softly hairy. Leaves mostly small, petioled, kidney-shaped or orbicular-cordate, entire. Flowers small, solitary in the leaf-axils; bracts minute. Sepals 5, free, subequal, often spathulate, herbaceous. Corolla regular, widely campanulate, deeply 5-lobed; lobes induplicate-valvate or slightly imbricate. Stamens shorter than the corolla; filaments filiform; anthers small; pollen smooth. Disk small, cupular. Ovary deeply 2-lobed, each lobe with 2 ovules; styles 2, filiform, gynobasic (inserted between the lobes); stigmas capitate. Capsule 2-lobed; lobes erect, 1- or rarely 2-seeded, indehiscent or irregularly 2-valved. Seeds subglobose, smooth.
Fig. 3. *Dichondra repens* Forst. Habit, nat. size and flower, × 5.

Distr. A small genus of 4–5 species, principally American; one species in the tropical and subtropical regions of both hemispheres.

1. *Dichondra repens* Forst. Char. Gen. (1776) 40, t. 20; Ooststr. Blumea 3 (1938) 73.—Fig. 3.

A small creeping, perennial herb. Stems slender, shortly hairy, rooting at the nodes. *Leaves* long-petioled, kidney-shaped to orbicular, 4–25 mm diam., broadly cordate at the base, broadly rounded or emarginate at the apex, appressedly hairy, especially beneath. *Flowers* axillary, solitary; pedicel mostly shorter than the petiole, filiform. *Sepals* obovate-oblong to spathulate, obtuse, ca 2–3 mm long, hairy on the back and at the margins. *Corolla* shorter to slightly longer than the calyx, deeply 5-lobed, yellowish. Carpels pilose. *Seeds* yellow to brown, glabrous.

Distr. Ubiquist, in the warmer regions of the globe everywhere local; in *Malaysia*: Philippines (Luzon).

Ecol. On dry slopes, _ca_ 1300 m.

Vern. Philippines: *Lutlutud*, Bon., _napolapayag_, Ilk..

Note. The species shows a resemblance in habit with *Merremia emarginata* (Burm. f.) Hallier f., with which it has been confounded in the herbaria.

### 3. EVOLVULUS

**Linné**, Sp. Pl. ed. 2 (1762) 391; Ooststr. Mon. Evolv., Thesis, Utrecht (1934) 19; Blumea 3 (1938) 74.—Fig. 4–5.

Annual or perennial herbs, undershrubs, or shrubs; stems prostrate, ascending or erect, never twining. *Leaves* mostly small, entire. *Flowers* in axillary, mostly peduncled, one- to several-flowered cymes, or solitary, pedicelled or sessile in the leaf-axils, or aggregate in terminal spikes or heads. *Sepals* 5, small, equal or subequal, acuminate, acute or obtuse, not enlarged in fruit. *Corolla* regular, mostly small, rotate, funnel- or salver-shaped, purple, blue or white, rarely yellow; limb sub-entire to distinctly 5-lobed; midpetaline bands often pilose outside. *Stamens* 5, included or exerted; filaments adnate to the corolla-tube, filiform, glabrous, occasionally with a tooth at both sides of the base; pollen globular, smooth. Disk small, cupular, or absent. *Ovary* glabrous or sometimes pilose, 2-celled, each cell with 2 ovules, rarely 1-celled, 4-ovuled; styles 2, filiform, united at the base, or free, each style 2-cleft; stigmas long, terete, filiform or slightly clavate. *Capsule* globose or ovoid, 2–1-celled, mostly 4-valved. *Seeds* 4–1, smooth or minutely verrucose, glabrous.

Distr. Ca 98 spp., all in America from the S. United States to Argentina, two of these also in the Old World, of which the polymorphic *E. alsinoides* (L.) L. occurs with _ca_ 16–17 varieties throughout the tropical and subtropical regions of the globe.


**KEY TO THE VARIETIES**

1. Leaves more or less distinctly in two rows, approximate; internodes up to 4 mm. Stems prostrate, rarely ascending.
2. Indumentum of stems and leaves dense, shining, sericeo-villos, fulvous. Leaves more or less imbricate ... var. philippinensis
2. Indumentum much less dense, not obviously shining. Leaves not imbricate. var. hirsutus
1. Leaves mostly not distinctly in two rows, more remote; internodes mostly longer. Stems mostly ascending, sometimes erect, rarely prostrate.
3. Leaves ca 1 1/2–2 1/2 times as long as broad, obtuse to emarginate at the apex.

**var. hirsutus** (LAMK) OOSTSTR. Mon. Evolv. (1934) 29.—E. hirsutus LAMK, Enc. 3 (1789) 538.

Stems mostly rather stout, prostrate, or sometimes ascending, 7–15(–35) cm, appressed- and patently pilose or almost tomentose in the young parts with more or less ferrugineus hairs. Leaves more or less distinctly in two rows, rather approximate, oblong or ovate-oblong to elliptic, 5–8 by 2 1/2–4 1/2 mm, rounded at the base, obtuse and mucronulate, or acutish at the apex; hairy like the stem, slightly petiolo or sessile. Peduncles at most as long as the leaves, 2–5(–10) mm, hairy like the stems, 1(–2)-flowered. Bracts linear, 1 1/2–2 mm. Pedicels shorter to longer than the calyx. Sepals lanceolate, acuminate, 2 1/2–3 mm, pilose. Corolla 6–8(–10) mm diam.

**Distr. India, Malaya: Anambas Isl., Madura, Philippines (Luzon).**

**Note.** A collection from the Anambas Isl. (HENDERSON 20340) is an intermediate between **var. hirsutus** and **var. decumbens**.

**var. philippinensis** OOSTSTR. Mon. Evolv. (1934) 30.

Much resembling **var. hirsutus** in habit, but differing by the more or less imbricate leaves and by the dense, shining, sericeo-villos, fulvous indumentum. Peduncles usually very short, rarely longer, to 8 mm. Corolla ca 10 mm diam.

**Distr. Malaya: Philippines (Luzon).**

**var. decumbens** (R.BR.) OOSTSTR. Mon. Evolv. (1934) 38.—E. decumbens R.BR. Prod. (1810) 489.—E. lanceaeformis SPANOUGE, Linnaea 15 (1841) 341, nom. nud.—E. gracillimum Miq. Fl. Ind. Bat. 2 (1857) 629.—Fig. 5.

Stems at first erect, afterwards with ascending branches, slender, 30–45 cm, appressed and whether or not patently pilose; internodes (5–) 10–20 mm. Leaves lanceolate to linear-lanceolate, ca 1 1/2–4 mm long. Sepals lanceolate, acute or acuminate, ca 3 mm long, villose. Corolla rotate, 5 1/2–7(–10) mm diam., pale-blue or white. Ovary glabrous. Capsule gloular, glabrous, 4-valved. Seeds 4 or less, black, smooth.

**Distr. Tropical E. Africa, Madagascar, India, Indo-China, S. China, in Malaya: Lesser Sunda Islands (Timor), Philippines (Luzon).**

**Ecol.** The Malayan species of the varieties in dry, open, rocky localities, in dry grasslands, often on limestone, at low and medium altitudes.

**Note.** In Timor and the Philippines both typical specimens and transitions to **var. decumbens** are found. Some collections from E. Java (Surabaja, Grissee) also represent such transitions.


A perennial herb. Stems few to several, prostrate or ascending, slender, with appressed and patent hairs. Leaves oblong, elliptic or spathulate, 7–20 (–25) by 3–10 mm, rounded at the base or attenuate into the short petiole, obtuse or shallowly emarginate and mucronate at the apex, more or less densely appressed-pilose on both sides, or sometimes glabrous above. Peduncles filiform, shorter to much longer than the leaves, hairs appressed, either mixed with patent ones or not, one- to few-flowered. Pedicels as long as or usually longer than the calyx. Bracts linear-subulate to linear-lanceolate, 1 1/2–4 mm long. Sepals lanceolate, acute or acuminate, ca 3 mm long, villose. Corolla rotate, 5 1/2–7(–10) mm diam., pale-blue or white. Ovary glabrous. Capsule gloular, glabrous, 4-valved. Seeds 4 or less, black, smooth.

**Distr. Tropical E. Africa, Madagascar, India, Indo-China, S. China, in Malaya: Lesser Sunda Islands (Timor), Philippines (Luzon).**

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Fig. 5. *Evolvulus alsinoides* (L.) L. var. *decumbens* (R.Br.) Ooststr. a. Habit, $\times \frac{1}{2}$, b. calyx, c. pistil ($b-c$ enlarged).
tions from the Philippines are transitions to var. javanicus; these plants are usually stiffer than typical var. decumbens and the indumentum is more shining and more or less fulvous.


Stems several, erect or ascending, rather stiff, 6–20 cm, densely appressed-pilose, with fulvous, afterwards greyish, more or less shining hairs. Internodes 3–5 mm. Leaves linear or linear-lanceolate, 4–12 by 1–2½ mm, erect or errecto-patent, attenuate towards the base, acute or acuminate at the apex, densely appressed-pilose like the stems. **Peduncles** short, 2–5 mm, pilose like the stems. Pedicels as long as or usually much longer than the calyx, to 7 mm. Bracts subulate, 1 mm. **Sepals** lanceolate, acuminate, 2½–3 mm, appressed-pilose. **Corolla** 8–9 mm diam.

**Distr. Malaysia:** Lesser Sunda Islands (Timor, Wetar), Moluccas (exact locality unknown).

**Notes.** The type of *E. javanicus* Bl. was described from Mt Gedeh (W. Java) by Blume. It is fully identical with specimens of Reinwardt's collection from the Moluccas, and as it is impossible that it has been collected on Mt Gedeh, an erroneous labelling has apparently taken place.

In the Philippines transitions to var. decumbens are found (see there).


Stems several, ascending, 10–20–(45) cm, densely sericeo-villose with appressed and spreading whitish or fulvous hairs. **Leaves** oblong-lanceolate, 8–20 by 3–8 mm, acutish or rounded at the base, acute or obtusish at the apex, subsessile, hairy like the stems, sometimes nearly woolly. **Peduncles** rather stout, 7–15–(25) mm, hairy like the stems, 1(2)-flowered. Pedicels as long as or longer than the calyx. Bracts linear-subulate, 1½–2 mm. **Sepals** lanceolate, acuminate, 2½–3 mm, hairy like the other parts of the plant. **Corolla** 8–9 mm diam.

**Distr. Queensland, in Malaysia:** NE. New Guinea (once collected).

### 4. BONAMIA


Herbaceous or woody twiners, or erect undershrubs. Leaves petioloed, lanceolate, ovate or elliptic, entire, herbaceous or rarely subcoriaceous. **Flowers** axillary, solitary, or in cymes which sometimes form terminal panicles. Bracts mostly small. **Sepals** 5, equal or subequal, rarely very unequal, orbicular to lanceolate, coriaceous or herbaceous. **Corolla** regular, small or medium-sized, campanulate or funnel-shaped, blue or white, with hairy midpetaline bands outside; limb 5-lobed. **Stamens** and styles included, very rarely slightly exserted; filaments adnate to the corolla-tube, glandular-pilose, or glabrous; pollen smooth. Disk small or none. **Ovary** 2-celled, each cell with 2 ovules; style filiform, bifid, or 2 free styles, often unequal in length, rarely 1 style; stigmas 2, globose or peltate, rarely 2-partite, or stigmas 4. **Capsule** globose or ovoid, 2-celled, 2-, 4- or 8-valved. Seeds 4 or less, glabrous or pilose.

**Distr.** Ca 40 species, widely distributed in the tropics of both hemispheres, in **Malaysia** only one species.


**KEY TO THE VARIETIES**

1. Corolla 3–4 cm long, rarely longer. Outer sepals acute to acuminate. Stems and lower leaf-surface with a dense brown or reddish brown tomentum. Finer nervation of the leaves indistinct

   1. **var. semidigynia**

   1. Corolla 4½–5 cm long. Outer sepals less acuminate, often with more distinct nerves. Not so densely tomentose, but covered with short closely appressed paler hairs, especially the stems making the impression of being farinose. Finer nervation of the leaves often more visible by the absence of a dense haircloth.

   **var. farinacea**

**var. semidigynia.—**Fig. 6.

Stems twining, to 15 m, terete, densely brown or reddish brown tomentose. **Leaves** broad- to narrow-ovate, 6½–15 by 4–10 cm, broadly coriaceous or rarely truncate at the base, shortly acuminate to cuspidate at the apex, with an acute or obtusish, mucronulate acumen, tomentose on both sides,
below more densely and more softly than above, the upper surface glabrescent, at last sometimes glabrous; lateral nerves 5-6 on either side of the midrib; petiole 18-35(-60) mm, tomentose like the stem. Peduncles axillary, terete or more or less applanate at the apex, variable in length, 4-14 cm, tomentose. Flowers in a 2-5-flowered umbelliform cyme. Pedicels variable in length,

in Malaysia: Sumatra, Malay Peninsula, W. Java, Borneo (Sarawak), SW. Celebes, Philippines (Culion).

Ecol. Edges of secondary forests, thickets, hedges, waysides, riverbanks, from sea-level to 250 m, rarely up to 600 m.

Vern. Aroj bala, S.

Note. The location of the two specimens collected by KORTHALS in Sumatra appears doubtful.

Besides the typical form HALLIER.f. distinguished two varieties, var. farinacea and var. ambigua, mainly on account of differences in the indument. Full descriptions of these varieties, drafted by HALLIER after living materials in the Botanic Garden at Bogor, Java, may be found in Bull. Herb. Boiss. 5(1897) 817-818.


Not so densely tomentose as var. semidigyna, but covered with short closely appressed hairs of a paler colour, changing from brown into grey; especially the stems making the impression of being farinose. Finer nervation of the sometimes narrower leaves often much more visible by the absence of a dense haircloth. Sepals often somewhat shorter than in var. semidigyna, less acuminate, often with more distinct nerves. Corolla longer, 4½-5 cm.


Ecol. In thickets on the beach and on rocks, in marshy but also in very dry localities, between sea-level and 75 m.


Note. The only specimen collected in Ceram, KORNASSI (exp. RUTTEN) 1274, in Herb. Bogor, Leiden & Utrecht, and a specimen from Celebes, Bonto Parang, RACHMAT (exp. VAN VUUREN) 4, in Herb. Bogor & Leiden, are more or less aberrant; the Ceram plant is characterized by its long pedicels (to 20, or occasionally to 30 mm long), much longer than is generally found; the RACHMAT specimen has the sepals of an aberrant shape; they are not at all acuminate, but are elliptic and obtuse. These plants might be of importance systematically and phytogeographically when more materials should be available and when the aberrant characters should prove to be constant.


Concerning this variety can be stated, that the specimens of it in the Leiden herbarium, all collected by HALLIER in the Botanical Garden of Bogor from one plant, fully agree with HALLIER's fine description. It is, however, more difficult to draw a satisfactory line between var. semidigyna and this variety, than with var. farinacea. It is not impossible that HALLIER is right that we have here a hybrid before us.
5. NEUROPELTIS

Wall. in Roxb. Fl. Ind. ed. Carey & Wall. 2 (1824) 43; Ooststr. Blumea 3 (1938) 80; ibid. 5 (1942) 268.—Fig. 7.

Large woody twiners. Leaves petiolated, elliptic, ovate or oblong, penninerved, entire, chartaceous or coriaceous. Flowers small, in rusty brown tomentose racemes, the racemes axillary or subpaniculate towards the ends of the branches. Bracts initially small, adnate to the pedicel, in fruit much accrescent, broadly elliptic to orbicular, scarious, reticulately nerved, bearing the calyx with capsule near its centre. Bracteoles minute, hairy. Sepals 5, subequal, suborbicular, hardly enlarged in fruit. Corolla regular, rotate to broadly campanulate, white, or reddish, deeply 5-lobed. the lobes induplicate-valvate in bud. Stamens 5, adnate to the corolla-tube, exerted or included; filaments filiform, glabrous or hairy at the base; pollen smooth. Ovary hairy, perfectly or imperfectly 2-celled, 4-ovuled; styles 2, free, short, each with a peltate, lobed or kidney-shaped stigma. Capsule small, glabrous, 1-celled, 4-valved. Seed 1, globose, smooth, glabrous, dull black.

Distr. A small genus of ca 11 species, ca 7 of which in W. tropical Africa from Upper Guinea to Portuguese Congo; and 4 in tropical Asia on the West Coast of India (Kanara, Malabar), and in SE. Asia from Siam, Tenasserim, Indo-China, and Hainan to Malaysia: Malay Peninsula, Borneo.

KEY TO THE SPECIES

1. Corolla-tube inside hairy at the base of the filaments. Styles as long as or shorter than the breadth of a stigma
   1. N. racemosa

1. Corolla-tube inside glabrous at the base of the filaments. Styles much longer than the breadth of a stigma
   2. N. maingayi

1. Neupeltis racemosa Wall. in Roxb. Fl. Ind. ed. Carey & Wall. 2 (1824) 44; Ooststr. Blumea 3 (1938) 81; ibid. 5 (1942) 269, f. 1-2, a-b.—Fig. 7 a-c.

A large woody twiner. Young branches more or less tomentellous with rusty brown hairs, the adult ones glabrous. Leaves elliptic or narrowly-elliptic, sometimes elliptic-oblong, 6-12 by 2-7 cm, acute at the base or shortly attenuate into the petiole, acute or shortly acuminate at the apex, with a blunt, mucronulate top, coriaceous, glabrous above and beneath, or with a few scattered appressed hairs; lateral nerves 7-10 on either side of the midrib, finer reticulate nervation distinctly visible above; petiole ca 10-15 mm long or slightly longer. Inflorescences from the leaf-axils or from defoliate branches, racemose, solitary or 2-4 together, brown-tomentose, shorter than the leaves, 3-6 cm long or slightly longer; pedicels 2-2½ mm. Bract immediately below the sepals, ovate to ovate-lanceolate, with a distinct mucro, 2-3 mm long, in fruit broad-elliptic to orbicular, slightly emarginate and mucronulate at the apex, slightly emarginate or obtuse at the base, glabrous, except along the pedicel and sometimes along the nerves, 3-4½ (-6) cm long. Two outer sepals orbicular or slightly broader than long, 2½-3 mm long, three inner ones broader than long, 1½-2 mm long. Corolla broadly campanulate, ca 5 mm long, deeply 5-lobed, lobes longer than the tube, with incurved, obtuse top, pilose outside. Ovary ovate; stigmas ca 1 mm broad. Capsule subglobose, ca 3½-5 mm high.

Distr. Hainan, Siam, Tenasserim, in Malaysia: NW. Malay Peninsula (P. Penang, Kedah), SE. Borneo (once collected).


2. Neupeltis maingayi Peter ex Ooststr. Blumea 3 (1938) 83; Ooststr. ibid. 5 (1942) 270, f. 1-2, c-d.—Fig. 7 d-f.

A large, woody twiner. To 9 m high. Young branches rusty-tomentellous, the adult ones glabrous. Leaves elliptic to narrow-elliptic, 6-13 by 2½-7 cm, acute or obtuse at the base, short- or long acuminate at the apex with an acute or obtusish, mucronate to subulate top, coriaceous, sometimes more or less bullate, glabrous or nearly so above, and with few scattered appressed hairs beneath, glabrescent, or tomentose (in var. tomentosa). Lateral nerves 6-9 on either side of the midrib, the finer nervation not so distinctly visible above as in N. racemosa; petiole 10-13(-22) mm long. Inflorescences from the leaf-axils, one or few from an axil, racemose, or sometimes ramified and then paniculate, brown-tomentose. 3-13 cm long. Pedicels to 3 mm. Bract immediately below the sepals, ovate to ovate-lanceolate, with a distinct mucro, ca 3-4½ mm long, in fruit broad-elliptic, obtuse or emarginate and mucronulate at the apex, slightly cordate at the base, ca 4-6½ cm long. Sepals 2-2½ mm long; 2 outer ones orbicular, the 3 inner broader than long. Corolla broadly campanulate to rotate. ca 5-6½ mm long, red, white with a red tinge, or white, deeply 5-lobed, lobes longer than the tube, with more or less...
Fig. 7. a–c. *Neuropeltis racemosa* Wall. a. Flowering branch, $\times \frac{2}{3}$, b. corolla-lobes from inside, $\times 4$, c. pistil, $\times 4$.—d–f. *N. maingayi* Peter ex Ooststr. d. corolla-lobes from inside, $\times 4$, e. pistil, $\times 4$, f. capsule with bract, $\times \frac{2}{3}$. 
incurved, obtuse top, pilose outside. Ovary globose; styles ca 1/14 mm long, stigmas 1/2–3/4 mm wide. Capsule ovoid, ca 6 mm high.

Distr. Malaysia: Malay Peninsula (Perak, Selangor, Malacca).

Ecol. In forests, from 30 to 240 m.

Vern. Bunga johol, akar oran merah, Malacca.

Note. The corolla is dark red or white with a red tinge in typical specimens; in a specimen of var. tomentosa it is mentioned as white.

var. tomentosa Ooststr. Blumea 3 (1938) 85; ibid. 5 (1942) 270.

Leaves densely rufous or ferrugineous-tomentose beneath.

Distr. Malaysia: Malay Peninsula (Malacca, Pahang).

6. PORANA

Burm. f. Fl. Ind. (1768) 51, t. 21*, f. 1; Ooststr. Blumea 3 (1938) 85.—Fig. 8–10.

Large woody or herbaceous twiners. Leaves petioled, ovate, mostly coriaceous at the base and palmately nerved, rarely pinninerved, entire, herbaceous. Inflorescences racemose or paniculate, rarely flowers solitary. Bracts leaf-like, or minute and subulate, or none. Sepals 5, small in flower, the 3 outer ones or all in fruit much accrescent, scarious, reticulately veined, spreading, often spathulate, falling off with the fruit. Corolla regular, white, small, campanulate or funnel-shaped, rarely larger and funnel- or salver-shaped; limb subentire or 5-lobed. Stamens and style included, rarely exerted. Stamens 5; filaments adnate to the corolla, filiform, glabrous, or glandular or pubescent at the base; pollen smooth. Disk annular or none. Ovary mostly glabrous, 1-celled, 2-ovuled, or 1–2-celled, 4-ovuled; style 1, simple, or bifid with unequal branches; stigma globose or 2-lobed, solitary, or one on each branch. Capsule small, subglobose to oblong, 2-valved, or indehiscent. Seed usually 1, glabrous.

Distr. More than 20 spp., for the greater part in tropical and subtropical Asia, ca 3 spp. in Africa and adjacent islands, one in Australia, and perhaps one in America.

Note. Peter subdivided the genus into three sections.

1. Euporana Peter (in E. & P. Nat. Pfl. Fam. 4, 3a, 1891, 24) with a bifid style, a 5-lobed funnel-shaped or campanulate corolla and the flowers in panicles; this section is represented in Malaysia by P. volubilis Burm. f..

2. Duperreya (Gaud.) Peter l.c. 24, with an entire style. solitary funnel-shaped or campanulate flowers and narrow leaves; not in Malaysia.

3. Dinetus (Buch.-Ham.) Peter l.c. 25, with an entire style, funnel- or salver-shaped flowers, several-flowered inflorescences and coriaceous leaves; represented in Malaysia by P. racemosa Roxb., the often cultivated P. paniculata Roxb. and by P. spectabilis Kurz.

KEY TO THE SPECIES

1. Corolla ca 21/2 cm long
2. Corolla up to 1 cm long.
3. Style bifid to about the middle. Stamens exerted. All sepals enlarged in fruit
4. Style entire. Stamens included. All sepals or only 3 enlarged in fruit.
5. Style very short, as long as or shorter than the ovary. Corolla shallowly lobed or subentire. Stamens inserted in the corolla-tube at about the same height. Three sepals enlarged in fruit
6. Style longer than the ovary. Corolla deeply 5-lobed. Stamens inserted at different height in the corolla-tube. All sepals enlarged in fruit

1. Porana volubilis Burm. f. Fl. Ind. (1768) 51, t. 21*, f. 1; Ooststr. Blumea 3 (1938) 87.—P. volubilis Burm. f. var. burmanniana Bl. Bijdr. (1825) 723.—P. volubilis Burm. f. var. microcarpa Engl. Bot. Jahrb. 7 (1886) 472.—Fig. 8–9.

A large woody twiner, up to 20 m high; stems to 1 or 2 cm thick; adult branches pale brown or grey, often minutely verrucose; young parts pilose. Leaves ovate, 3–9 by 2–6 cm, mostly broadly rounded or slightly cuneate at the base, acuminate at the apex, with an obtuse, or slightly emarginate acumen; glabrous or sparsely hairy, often shining above, pinnately nerved, with 5–7 nerves on either side of the midrib; petiole much shorter than the blade. 1–3 cm, glabrous or hairy. Flowers fragrant, often in dense lateral and terminal inflorescences, forming large, broad panicles, which are leafy below. Peduncles and pedicels pilose; pedicels ca 3–5 mm. Sepals oblong to obovate, obtuse, ca 4–5 mm long, glabrous except apex and base, or sparsely pilose on the whole surface, all enlarged in fruit, oblong to spathu-
late, or obovate, 7–10 mm long, with 7–8 stronger longitudinal nerves. Corolla deeply 3-lobed, 8–10 mm long, white, glabrous or short-pilose; lobes obtuse, spreading. Stamens exerted, very unequal; filaments much longer than the anthers, inserted near the corolla-base. Ovary glabrous; style bifid with unequal branches; stigmas globose. Capsule broad-ovoid to globose, 3–4 mm long, mucronulate, glabrous. Seed 1, ovoid, ca 2–2½ mm long, purple-brown or black, minutely verrucose.

Distr. Burma and Indo-China to Malaysia: N. Sumatra, Java, Kangean Islands, Lesser Sunda Islands (Bali, Lombok, Sumbawa, Timor), Borneo, Celebes, Philippines (Luzon), Moluccas (Ambon), probably cultivated in the Bismarck Archipelago; also cultivated in India and Siam, the Malay Peninsula and elsewhere in Malaysia.

Ecol. Thickets, edges of forests, teak-forests, from sea-level to ca 200 m, occasionally higher, in Timor up to 750 m. In Java mainly in parts with a pronounced dry season.

Uses. Cultivated in gardens for ornamental purposes. A decoction of the plant is used in stimulating the afterbirth. The leaves represent one of the ingredients used in pressing djambu bagolan in the Principalities where they are also eaten to remove a nasty taste from the mouth.

Vern. Kembang pêngantên, M, widosari, bidhasari, widasantun, pililitan, angkeb, arus arusan, J. bidhasarê, Md, widosari, bila sarê; Kangean, bunga nasi, Ambon, nuit or nui; Timor, akar lapat, N. Borneo; Philippines: kalabonog, kamuras, ilk.; bridal wreath, white corallina, E., schildersverdriet, bruidsbloemen, witte bruids- tranen, D.

Fig. 9. Porana volubilis Burm. f. a. Fruiting branch, × ½; b. fruit with sepals. nat. size, c. pistil.


Stems twining, herbaceous, up to 10 m high, terete, in youth more or less hirsute, afterwards minutely verrucose, or glabrous. Leaves ovate, 2½–10 by 2½–7 cm, deeply cordate at the base, acuminate to caudate at the apex, with a blunt or acute acumen; appressed-pilose on both sides, beneath more densely than above; rarely pubescent to tomentose; palmately nervcd with 7(–9) nerves from the base; petiole shorter than or as long as the blade, pilose to glabrous. Inflorescences paniculate, axillary, more or less widely branched, few- or many-flowered. Lower bracts leaf-like, sessile or shortly petiolcd, stem-clasping, glabrous or pilose; upper bracts subulate. Pedicels much longer than the sepals, 3–6, later to 10 mm long, glabrous or pilose. Sepals equal, linear-lanceolate, 1½–2½ mm long, sparsely pilose, all enlarged in fruit, linear-oblanccolate, obtuse and mucronulate at the apex, attenuate towards the base, up to 18 mm long, but often shorter, with 3 stronger longitudinal nerves, sparsely pilose, especially near the base. Corolla 5-lobed to the middle, ca 1 cm long, white with yellowish tube, glabrous; lobes spreading, rounded. Stamens included; filaments shorter than the anthers, inserted at different height in the corolla-tube. Ovary glabrous; style 1, entire, longer than the ovary; stigma clavate, 2-lobed. Capsule ovoid, 7–8 mm high,
mucronate, glabrous. Seed 1, ovoid, to 6 mm long, brownish-black to black, smooth.

Distr. SE. Asia to S. China, and *Malaysia*: Malay Peninsula (only cultivated), Java, Lesser Sunda Islands (Bali, Lombok, Sumbawa, Timor), SW. Celebes.

Ecol. Thickets, edges of secondary forests, waysides, from 400 to 1800 m, both in regions with and without a dry season.

Vern. *Tjunlar, tjunlar, tjuntu, reuend, srintul, J, kioke, Md, snow-creeper, E, molentjes, D.*

3. *Porana paniculata* Roxb. Pl. Corom. 3 (1819) 31; Ooststr. Blumea 3 (1938) 93.—Fig. 10.

A large woody twiner with greyish tomentellous, almost downy stems. Leaves ovate, 4–9 by 2½–6 cm, cordate at the base, obtuse, acute, acuminate or shortly cuspidate at the apex, hairy on both surfaces, palmately nerved with 5–7 nerves from the base; nerves prominent beneath; petiole 1½–2½ cm. Inflorescences lateral or terminal, paniculate. Flowers smaller than in the preceding species, numerous. Sepals linear, ca 1–1½ mm long, densely tomentellous; three of them much enlarged in fruit. Corolla funnel-shaped, 5–6 mm long, white, the limb shallowly lobed to crenate. Stamens included; filaments about equal in length, as long as the anthers or a little shorter, inserted near the corolla-base at about the same height. Style 1, entire, as long as or shorter than the ovary; stigma globose, lobed. Capsule ovoid-globular, ca 5 mm diam.

Distr. N. India to Upper Burma; cultivated as an ornamental in *Malaysia* and elsewhere in the tropics, occasionally run wild.

Uses. Commonly cultivated in gardens for its dense masses of white flowers; never fruiting in *Malaysia*.

Vern. *Kembang garen, M, bridal creeper, E, schildersverdriet, D.*


A large woody twiner; branches fulvous-tomentose. Leaves ovate-oblong, up to 10 by 4½–5 cm, rounded or shallowly cordate at the base, acute or obtusish at the apex, densely puberulous, especially beneath; petiole 1½–2½ cm. Flowers in lax racemes terminating axillary rather short branchlets. Pedicels ca 5–7 mm. Sepals linear-oblong, ca 5 mm long, fulvous-tomentose; 3 of them enlarged in fruit, 3½–4 cm long, oblong, obtuse, puberulous, 5-nerved at the base. Corolla widely funnel-shaped, nearly 2½ cm long, white, puberulous outside; limb subentire; Style entire, long, filiform; stigma subcapitate. Capsule subglobose, ca ½ cm diam.

Distr. Assam, Burma, Indo-China, and *Malaysia*: Malay Peninsula (Perak), once collected.

Note. The above description is for a consider- able part derived from the literature, as the only Malaysian specimen (Curtis s.n. in herb. Sing.) unfortunately is no longer at hand.

7. *ERYCIBE* (1)

Roxb. Pl. Corom. 2 (1798) 31, t. 159; Choisy, Ann. Sc. Nat. II. 1 (1834) 220; G. Don, Gen. Syst. 4 (1838) 392; DC. Prod. 9 (1845) 463: B. & H. Gen. Pl. 2

(1) By R. D. Hoogland.
Woody climbers or creepers, sometimes straggling shrubs, rarely small trees. Older branches with orbicular to oval lenticels or with longitudinal cork-ridges. Leaves simple, entire, often more or less acuminate at apex; midrib distinctly prominent beneath, nerves and venation otherwise variable. Petiole short, channelled above, usually with some low longitudinal ridges and many small rather sharp transverse ridges. Inflorescences terminal or axillary, paniculate, rarely flowers solitary. Bracts usually minute, caducous. Flowers fragrant. Pedicel usually with 2, sometimes fewer or more, minute caducous bracteoles. Sepals 5, free, usually hairy outside except along in bud covered margins which are glabrous or at least distinctly less hairy for some breadth, always glabrous inside, 2 outer sepals generally different in shape from 2 inner ones, third sepal for one side agreeing with 2 outer ones, for other side with 2 inner ones. Corolla deeply 5-lobed, tubular, glabrous outside, each lobe (petal) with about triangular, outside hairy, midpetaline field, and 2 lateral lobules, glabrous, rather thin, with distinct, mainly longitudinal venation, to rather thick, with indistinct venation (in dried specimens), rarely club-shaped; corolla glabrous inside except in 2. E. praecipua. Stamens 5, inserted slightly above corolla-base, with short, about triangular or laterally concave filament; anther usually obtuse to acuminate at apex, cordate at base, sometimes truncate to retuse at both ends. Pollen smooth. Ovary about ellipsoid, glabrous or partly to completely hairy, 1-celled, with 4 (rarely in a casual flower 5) basal ovules; stigma usually about conical, attached to the ovary in the centre for small diameter, usually with 5 or 10 longitudinal, straight, or slightly contorted ridges, rarely crown-like, funnel-shaped in centre above, attached to the ovary for nearly the whole diameter of the latter. Fruit a berry, generally little fleshy. ellipsoid or, rarely, obpyriform, glabrous, smooth or scurfy, or hairy: one-seeded; seed with plain or strongly folded cotyledons.

Distr. S. Japan (Yakushima), Riu-ku Islands, Formosa, S. China, Indo-China, Siam, Burma, India, Ceylon, throughout Malaysia, and N. Queensland; in New Caledonia probably only introduced; erroneously reported from Micronesia. Fig. 17.

Ecol. In scrub or forests, from low altitude up to ca 1300 m altitude.

An ecologically interesting species of this genus is 12. E. stenophylla which belongs to the rheophytes, i.e. plants which are confined to (mostly) gravelly or rocky beds of streams subject to sudden floods. The narrow, often falcate, leaf-shape of the species confined to this remarkable ecological niche is characteristic and E. stenophylla perfectly fits into this group.

Another ecologically interesting species is the caulif- and ramiflorous 7. E. ramiflora, the single species of the genus showing this feature.

Uses. The branches are sometimes used for binding purposes; medicinal use is unimportant.

Notes. Hallier f. (1897) subdivided the genus into 2 series, Rimosae and Tereticulae, mainly on a count of the structure of the bark (with longitudinal cork-ridges in Rimosae, with lenticels in Tereticulae). In a great number of the species this character is clear and constant, in some species, however, it is difficult to decide to which of the two groups they belong; where necessary these species have been inserted in the key twice. In some species the bark is not known from branches of sufficient age. It is possible that an extensive anatomical analysis will provide a more reliable basis for these two groups. A remarkable feature is that the species in Rimosae are consistently hairy or glabrous as regards the ovary, whereas this character is not constant in several of the species belonging to the Tereticulae.

The Tereticulae are subdivided by Hallier f. into 2 groups on account of the venation on the lower surface of the leaves. In the Venulosae the leaves are reticulately veined beneath, in the Fibrosae they
are rugose by sclerotic fibres, rarely remotely reticulately veined beneath. The venation may, indeed, be a reliable character for identification, though not in *Tereticaulis* only.

A character which I have used but which has not been used previously for specific distinction in *Erycibe* is the structure of the hairs, particularly those from the calyx and the midpetaline fields. The indumentum of the vegetative parts agrees with that of the calyx, though the dimensions may be slightly different. The two main types distinguished are 1) 2-branched hairs, and 2) 3- to many-branched hairs (stellate hairs). In the species with 2-branched hairs a 3-branched one may be found incidentally, similarly a 2-branched hair in some species with stellate hairs. There may be a short common trunk, which is, however, found only in few species with 2-branched hairs. Among the stellate hairs again 2 types can be distinguished: all branches may be of about the same length, or there may be one branch which is distinctly longer and stronger than the others. In some species with hairs of the latter type the difference between the branches is only slight; if necessary these species have been inserted twice in the key. If hairs of the type with one stronger branch are found on the midpetaline field, there is always a rather small number of hairs with subequal branches, mainly along the lateral margins of this field.

Most species are fairly constant in their general features, others are extremely variable (*e.g.* 45. *E. malaccensis* and 20. *E. terminaliflora*). Though in some cases the characters used in the key may hardly seem to warrant specific distinction of separate species, the accepted species have often a marked and constant habit by which they are easily distinguished in the herbarium, though it is extremely difficult to describe this habit clearly.

*Erycibe paniculata* Roxb., has been reported from many parts of the area of the genus. The genuine *E. paniculata* is found only in India.

**KEY TO THE SPECIES**

1. Anthers truncate or repute at the apex; greatest breadth of anther at or above the middle.

2. Stigma funnel-shaped in the centre above, 5-lobed at the margin, attached to the ovary for nearly the whole diameter of the latter.

3. Corolla glabrous inside. Lateral nerves and venation distinctly prominent on both sides. Anthers about as long as broad .......................... 1. *E. sapo*tae

4. Sepals distinctly strigose. Pedicel *ca* 7–15 mm long, with bracteoles inserted in the lower part. Venation invisible or faintly distinct on both sides .................................. 3. *E. pedicellata*

5. Sepals densely strigose or hisrate outside. Pedicel up to *ca* 7 mm long; bracteoles inserted immediately below the flower. Venation generally distinct on both sides.

6. Sepals outside with about equal numbers of 2- and 3-branched, up to 700 μ long hairs. Midpetaline field with 2–5-branched, up to 900 μ long hairs. Corolla *ca* 7 mm long .......................... 4. *E. griflithii*

7. Sepals *ca* 2½–3 mm long, outside with up to 350 μ long stellate hairs. Ovary nearly glabrous. Leaves 4–8-nerved, obovate-oblong to oblong, more densely hairy above than beneath.

8. Sepals completely glabrous outside.

9. Lobules of the corolla about as long as broad or slightly longer, without distinct venation.


12. Younger branches strigose (with 2-branched hairs), very soon glabrescent. Midpetaline field with generally 2-, few 3-branched hairs ........................................ 10. *E. albida*


(1) Flowers of 51. *E. impressa* from Borneo, 52. *E. induta*, and 53. *E. zippelii* both from New Guinea, are unknown.
12. Hairs of midpetaline field 4–9-branched with subequal, up to 250 \( \mu \) long branches.

13. Flowers all solitary, axillary. Leaves ovate to lanceolate, ca 1\( \frac{1}{2} \)-5\( \frac{1}{2} \) by 1–2 cm.

14. Leaves linear-lanceolate, about 8–10 \( \times \) as long as broad.

15. Sepals outside with predominantly or exclusively 2-branched hairs.

16. Leaves rather sparsely to densely appressed-hairy beneath on intervenium, nerves, and midrib; indumentum long-persistent.

17. Inflorescences ca 6–10-flowered, with ca 1\( \frac{1}{2} \)-1 cm long axis. Leaves densely sericeous beneath.

18. Leaves rather sparsely long and thinly strigose beneath.

19. Inflorescences many- (10–80)-flowered, with ca 2–20 cm long axis.

20. Inflorescences terminal and axillary, longer (ca 4–25 cm, 10–125-flowered).

21. Inflorescences axillary, short (up to 5 cm, up to 15-flowered).

22. Inflorescences terminal and axillary, longer (ca 4–25 cm, 10–125-flowered).

23. Leaves 8–12-nerved, about 4\( \frac{1}{2} \)-10 by 2–4\( \frac{1}{2} \) cm.

24. Leaves 5–7-nerved, about 9–15 by 5\( \frac{1}{2} \)-9 cm.

25. Leaves 8–12-nerved, about 4\( \frac{1}{2} \)-10 by 2–4\( \frac{1}{2} \) cm.

26. Leaves 5–7-nerved, about 9–15 by 5\( \frac{1}{2} \)-9 cm.

27. Leaves 8–12-nerved, about 4\( \frac{1}{2} \)-10 by 2–4\( \frac{1}{2} \) cm.

28. Leaves 5–7-nerved, about 9–15 by 5\( \frac{1}{2} \)-9 cm.

29. Leaves 8–12-nerved, about 4\( \frac{1}{2} \)-10 by 2–4\( \frac{1}{2} \) cm.

30. Leaves 5–7-nerved, about 9–15 by 5\( \frac{1}{2} \)-9 cm.

31. Leaves 8–12-nerved, about 4\( \frac{1}{2} \)-10 by 2–4\( \frac{1}{2} \) cm.

32. Leaves 5–7-nerved, about 9–15 by 5\( \frac{1}{2} \)-9 cm.

33. Leaves 8–12-nerved, about 4\( \frac{1}{2} \)-10 by 2–4\( \frac{1}{2} \) cm.

34. Leaves 5–7-nerved, about 9–15 by 5\( \frac{1}{2} \)-9 cm.

35. Leaves 8–12-nerved, about 4\( \frac{1}{2} \)-10 by 2–4\( \frac{1}{2} \) cm.

36. Leaves 5–7-nerved, about 9–15 by 5\( \frac{1}{2} \)-9 cm.

37. Leaves 8–12-nerved, about 4\( \frac{1}{2} \)-10 by 2–4\( \frac{1}{2} \) cm.
34. Leaves rather densely hairy with long-persistent indumentum on whole surface beneath; leaves up to ca 8 by 3½ cm .......................... 28. E. carrii
34. Leaves glabrous beneath or with soon caducous indumentum; if the indumentum is rather long persistent, the leaves are much larger or the indumentum is persistent along the midrib and nerves only.
35. Ovary completely glabrous.
36. Leaves elliptic-oblong to oblong (ca 2-2½ x as long as broad), bullate, when young densely hirsute along the midrib and nerves beneath. Hairs of the calyx and corolla with 250-500 μ long branches ........................................ 29. E. bullata
36. Leaves oblong to lanceolate-oblong (ca 2½-4 x as long as broad), flat, practically glabrous beneath. Hairs of calyx and corolla with 150-250 μ long branches 30. E. crassipes
35. Ovary hirsute, at least the extreme apical part, usually for the upper ½ part to the whole surface.
37. Ovary hirsute for the whole surface .................................. 31. E. nitidula
37. Ovary hirsute for the upper part only, glabrous for the lower part.
38. Hairs of the midpetaline field 2-5-branched, the 2-branched ones well represented, up to 1000 μ long ........................................ 32. E. papana
38. Hairs of the midpetaline field 4-8-branched, 2-branched ones completely absent.
39. Leaves rather large, ca 6½-15 by 2½-6 cm, more or less bullate. Species from the Malay Peninsula ........................................ 33. E. stapfiana
39. Leaves rather small, ca 4-8 by 1½-4½ cm, flat. Species from E. Malaysia.
40. Anthers obtuse at apex. Indumentum beneath soon caducous. 34. E. hellwigii
40. Anthers acute at apex. Indumentum beneath rather long persistent along midrib and nerves. ...................... 35. E. timorensis
32. Hairs of the midpetaline field for an important (usually by far the greater) part with one branch distinctly longer (ca 1½ x or more) and, usually, stronger than the others.
41. Older branches terete, smooth or with rather obtusely round midrib, at most with very low, not-fissured, longitudinal ridges.
42. Lobules of the corolla about 1½-2 x as long as broad .................. 36. E. borneensis
42. Lobules of the corolla at most about as long as broad.
43. Venation distinctly impressed beneath. Midpetaline field in upper part with hairs of which one branch is stronger, in lower part only with hairs with subequal branches. ...................... 37. E. aenea
43. Venation slightly to distinctly prominent beneath. Hairs with one stronger branch equally distributed over the midpetaline field.
44. All sepals glabrous along their margins outside, ciliate along the whole margin. 38. E. macrophylla
44. Sepals glabrous outside only along in bud covered margins; ciliate only along glabrous margins.
45. Calyx outside with hairs with one distinctly stronger (ca 500-750 μ long) branch; indumentum yellowish to orange-brown. Inflorescences axillary, 2-20-flowered, ½-4 cm long. Leaves often more or less hirsute beneath. Nerves usually more or less impressed above .................................. 39. E. citriniflora
45. Calyx outside with equal-branched hairs (branches up to ca 250 μ long); indumentum purplish-brown. Inflorescences terminal or axillary, 5-200-flowered, 1-23 cm long. Leaves (except when very young) glabrous beneath. Nerves rounded raised above. ...................... 40. E. rheedii
41. Older branches with distinct longitudinal cork ridges, usually with longitudinal fissures along them.
46. Ovary glabrous.
47. Leaves 3-4-nerved (rarely a casual 5-nerved leaf). Sepals up to 3 mm long. Inflorescences terminal, many-flowered ...................... 41. E. expansa
47. Leaves 5-10-nerved, if few 4-nerved leaves present then sepals 3.8-5 mm long. Inflorescences usually axillary, rather few-flowered.
48. Lobules of corolla about 1½-2 times as long as broad. Two outer sepals up to 2½ mm long. Inflorescences clustered, without a distinct central axis ...................... 36. E. borneensis
48. Lobules of corolla at most slightly longer than broad. Two outer sepals 2½-5 mm long. Inflorescences, though often short, with a distinct central axis.
49. Sepals sparsely hirsute outside; indumentum distinctly red-tinged (in dried state). Lobules of corolla coherent above the midpetaline field for 1-1½ mm. 42. E. tomentosa
49. Sepals densely hirsute outside; indumentum generally yellowish to, rarely, brownish, never red-tinged (in dried state). Lobules of corolla not or hardly coherent above midpetaline field.
50. Stigma strongly warty. Two outer sepals 3.8-5 mm long. Indumentum on lower side of leaves often rather long persistent ................................ 43. E. grandiflora
50. Stigma smooth or only slightly warty (only with 5 or 10 round longitudinal ridges). Two outer sepals 2½–4 mm long. Indumentum on lower side of leaves soon caducous.

51. Leaves 8–10-nerved. 2 outer sepals 2.5–2.6 mm long. Inflorescences short, 1–2 cm long. Indumentum of sepals brownish (in dried state). Anthers 2.2–2.3 mm long.

**44. E. beccariana**

51. Leaves 4–6(–7)-nerved. Two outer sepals 3–4 mm long. Inflorescences generally longer, 1½–10(–16) cm long. Indumentum of the sepals yellowish (in dried state). Anthers 1.3–1.8 mm long.

**45. E. malaccensis**

52. Stamens acute to obtuse at apex, without distinct sterile acumen.

52. Stamens acuminate at apex, with distinct 0.3–0.7 mm long sterile acumen.

55. Ovary hairy for whole surface. Part of bracts leaf-like, up to 12 mm long.

**47. E. schlechteri**

55. Ovary hairy in the upper, glabrous in the lower part. Bracts minute, up to ca 3 mm long.

56. Indumentum on lower side of leaves long-persistent along the midrib.

**48. E. puberula**

56. Indumentum on lower side of leaves soon caducous.

57. Inflorescences rather many (up to ca 50)-flowered. Corolla ca 5½–6 mm long.

**32. E. papuana**

57. Inflorescences few (up to ca 12)-flowered. Corolla ca 8 mm long.

58. Larger hairs of midpetaline field mainly 2-branched, few of them 3-branched.

**49. E. brassii**

58. Larger hairs of midpetaline field (3–)4–6-branched.

**50. E. subglabra**

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1. **Erycibe sapotacea** HALLIER f. & PRAIN ex PRAIN, J. As. Soc. Beng. 73, 2 (1904) 16; ibid. 74, 2 (1906) 293; RIDL. Fl. Mal. Pen. 2 (1923) 447.—Fig. 11.

Scandent shrub, younger branches strigose, older ones with longitudinal cork-ridges. Leaves coriaceous, elliptic-oblong, 7–20 by 3½–10 cm, 6–10-nerved; obtuse to rounded, often short-acuminate at the apex, obtuse to rounded at the base; glabrous on both sides; with slightly sunken midrib and slightly prominent nerves above; with prominent nerves and venation beneath. Petiole 8–14 mm. Inflorescences axillary, up to 1½ cm, up to 10-flowered. Flowers known only from buds. Pedicel 1–2 mm. **Sepals** 1 & 2 broad-ovate, 2.7 by 3 mm, 4 & 5 transverse-oval, distinctly retuse at apex, 2.5 by 3.2 mm; rather densely strigose outside (hairs 2-branched, up to 400 μ total length). **Corolla** 7½–11½ mm, tube 2½–3½ mm; midpetaline field 3½ by 2½ mm, densely hisurate (hairs (2–)3(–4)-branched, up to 500 μ total length); lobules 2 by 2 mm, rather thick, without distinct venation. **Stamens** inserted 0.7 mm above the corolla-base; filament 1.3 mm long, 0.5 mm broad at base; anther 0.7 mm long, 0.7 mm broad, 0.5 mm thick, truncate at apex and base. **Ovary** 2.8 by 1.7 mm, glabrous; stigma funnel-shaped, not sharply separated from the ovary, 5-lobed at the margin, the lobes recurrent as longitudinal ridges on the ovary. **Fruits** 1 or 2 together, axillary, on strongly thickened, up to 1½ cm long, 3–5 mm thick stalk which is partly pedicel, partly peduncle; fruit ovoid, 45 by 22 mm, acutish at the apex, rounded at the base, probably little fleshy. Cotyledons strongly folded.

**Distr.** Malaysia: Malay Peninsula (Penang Island).

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2. **Erycibe praeclara** PRAIN, J. As. Soc. Beng. 63, 2 (1894) 86; ibid. 74, 2 (1906) 294; RIDL. Fl. Mal. Pen. 2 (1923) 447.—Fig. 12.

**KEY TO THE SUBSPECIES**

1. Leaves (3–)5–11 by (1½–2½)–5 cm, 4–5-nerved. Petiole 5–10 mm. Inflorescences up to 2 cm long. Pedicel 2–5 mm... **ssp. praeclara**

2. Leaves 10–15 by 4½–7½ cm, 5–7-nerved. Petiole 9–15 mm. Inflorescences up to 5 cm long. Pedicel 5–15 mm... **ssp. borneensis**

**ssp. praeclara.**—Fig. 12a–b.

Large climbing shrub, younger branches rather sparsely strigose, older ones with longitudinal cork-ridges. Leaves coriaceous, elliptic-oblong, (3–)5–11 by (1½–2½)–5 cm, 4–5-nerved; obtuse to rounded, often slightly acuminate at the apex, obtuse at the base; glabrous, with slightly sunken midrib and faintly prominent nerves and venation above; glabrous, with slightly prominent nerves and faintly prominent venation beneath. Petiole 5–10 mm. Inflorescences axillary, up to 2 cm, (1–)2–9-flowered. Pedicel 2–5 mm. **Sepals** subequal, broadly ovate or orbicular to transverse-oval, 1.8–2 by 1.9–2.5 mm, sparsely strigose outside (hairs with 2 branches, up to 300 μ total length). **Corolla** 7 mm, tube 1.7–2 mm; midpetaline field 3.5–3.8 by 1.6–2.2 mm, rather densely hisurate outside (hairs with 2(–4) branches, up to 400 μ total length); lobules 1.8 by 1.5 mm, with not or slightly visible venation, entire; coherent above midpetaline field for 1–1.5 mm; shortly villose-hisurate inside from 1.5 to 4 mm above the corolla-base. **Stamens** inserted...
0.7–1.2 mm above the corolla-base; filament 0.3–0.4 mm long, 0.2 mm broad at the base; anther 0.7–0.8 mm long, 0.6–0.7 mm broad near the apex, 0.4–0.5 mm near the base, 0.4–0.5 mm thick, truncate at both ends. Ovary 1–1.2 by 0.9–1.2 mm, glabrous; stigma crown-like with 5- or 10-lobed margin, funnel-shaped in centre above, with 5 or 10 longitudinal ridges. Fruit ellipsoid, 18 by 12 mm, glabrous, smooth. Cotyledons strongly folded.

Distr. Malaysia: Malay Peninsula (Penang, Perak), at 150–600 m.

ssp. borneensis HOOG. Blumea 7 (1953) 315.—Fig. 12c.

Differs from ssp. praecipua by the following characters: Liana, 30 m long; older branches at first with sharp longitudinal ridges, later on with lenticels on these ridges. Leaves 10–15 by 4½–7½ cm, 5–7-nerved. Petiole 9–15 mm. Inflorescences up to 5 cm long. Pedicel 5–15 mm. Sepals 1 & 2 measure 2.8–3 by 2.8–3, sepals 4 & 5 are 2.7–2.8 by 2.8–3.3 mm. Corolla 8 mm; midpetaline field 4.5 by 2.8 mm, densely stellate-hirsute outside (hairs with 3–7 subequal up to 250 μ long branches); lobules 2–2.5 by 1.5–2 mm. Stamens inserted 1.5 mm above the corolla-base; filament 0.5 mm long, 0.3 mm broad at the base; anther 1.2 mm long. Ovary 1.5 mm through.

Distr. Malaysia: Borneo (Kinabalu), once collected, at 1200 m.

3. Erycibe pedicellata RIDL. ex HOOG. Blumea 7 (1953) 315.

Scendent shrub, younger branches sparsely stigroge, older ones with distinct longitudinal cork-ridges. Leaves coriaceous, oblong, 6–12 by 2–4½ cm, 4–6-nerved; obuse to rounded, often slightly acuminate at the apex, obtuse at the base; glabrous except very sparsely stigroge, soon glabrescent midrib on both sides; with slightly sunken midrib, faintly prominent nerves and hardly distinct venation above; with faintly prominent nerves and hardly distinct venation beneath. Petiole 7–12 mm. Inflorescences axillary, about fasciculate, up to 2½ cm, (1–)2–5-flowered. Flowers known only from buds. Pedicel 7–15 mm. Sepals transverse-oval, 2 by 2½ mm, sparsely stigroge outside (hairs with 2 branches, up to 500 μ total length). Corolla 6 mm, tube 2 mm; midpetaline field 2½ by 1.8 mm, rather densely appressed-hairy (hairs with 2 branch subequal up to 450 μ long branches); lobules 2 by 1.3 mm, without distinct venation, entire. Stamens inserted 1.3 mm above the corolla-base; filament 0.3 mm long, ca 0.3 mm broad at the base; anther 0.5 mm long, 0.8 mm broad. 0.4 mm thick, truncate, slightly retuse at apex and base. Ovary 1½ by 1 mm, glabrous; stigma conical, with 5 faint longitudinal ridges. Fruit unknown.

Distr. Malaysia: Borneo (Sarawak), once collected.

Note. The species resembles E. praecipua PRAIN ssp. borneensis HOOG., from which it differs by the glabrous inner side of the corolla, the shape of the anthers (broader than long), and the conical (not funnel-shaped) stigma.

Fig. 12. Erycibe praecipua PRAIN. a. Flowering branch of ssp. praecipua, × 2½, b. 2 corolla-lobes from inside, × 2, c. inflorescences of ssp. borneensis HOOG. × 2½.


Scendent shrub (rarely tree?), up to 30 m long, 15 cm diam., younger branches stellate-hirsute, older ones with longitudinal ridges, often together with small lenticels. *Leaves* coriaceous, elliptic to oblong, ovate-oblong, or obovate-oblong, 7-14 by 2 1/2-8 cm, 5-8-nerved; acuminate at the apex, acute to obtuse or rounded at the base; glabrous, with slightly to faintly prominent midrib, nerves, and venation above; glabrous (or sparsely stellate-hirsute near petiole, glabrescent), with distinctly prominent nerves and distinct, but usually hardly raised venation beneath. Petiole 7-14 mm. *In*
Florescences axillary, sometimes 2 or 3 together, up to 3½ cm, (1–)3–10-flowered. Pedicel (2–)3–6–7 mm, distinctly thickened in fruit. Sepals 1 & 2 broad-ovate or triangular-ovate, 2–3 by 2–3 mm, 4 & 5 transverse-oval, 2–2.8 by 2.7–4 mm, densely stellate-hirsute outside (hairs with 2–3, generally more or less curled, up to 600 μ long branches). Corolla white, 7 mm, tube 1½–2½ mm; midpetaline field 3½–4 by 2½–2½ mm, densely stellate-hirsute (hairs with 2–5 branches, in the larger hairs generally one longer, up to 600 μ long branch); lobules 2–2.5 by 2.5–5 mm, without distinct venation, entire or slightly crenulate, coherent above midpetaline field for ½–1 mm. *Stamens* inserted 1–1½ mm above the corolla-base; anther sessile, 0.4–0.5 mm long, 0.7–0.8 mm broad, 0.5–0.6 mm thick, slightly retuse at apex and base. *Ovary* 1½–2 by 1½–2½ mm, glabrous; stigma conical, with 10 more or less distinct ridges. *Fruit* probably little fleshy, obpyriform, 2½ by 3½ cm, scurfy outside, yellow (once noted) when fresh, greyish brown when dry. Cotyledons strongly folded.

**Distr.** Malaysia: Sumatra, Java, Borneo, Philippines, Maluccas (local in all these islands).

**Ecol.** In forests up to 800 m.

**Vern.** *Alor ilitsiwalli* (Simalur).

**Notes.** *Erycibe maingayi* Clarke was reduced to the present species by *Prain* and *Ridley*. It is, however, specifically distinct, though habitually resembling the present species.

The species is closely related to *E. micranthia Hallier f.*, which has also been reduced to it in recent times; cf. under that species.


Climber, up to 16 m high, 10 cm diam., younger branches densely stigrose, older ones with low cork-ridges, sometimes together with small orbicular lenticels. *Leaves* subcoriaceous, elliptic to oblong, ovate-oblong, or obovate-oblong, 7–12½–(20) by 2½–6½–10 cm, 6½–9-nerved; slightly to distinctly acuminate at the apex, obtuse to rounded at the base; sparsely stigrose, very soon glabrescent, with slightly prominent midrib and nerves and faintly raised venation above; sparsely stigrose, very soon glabrescent, with prominent nerves and faintly prominent venation beneath. Petiole 7–10–(14) mm. *Inflorescences* axillary, sometimes 2 together, 2–4 cm, 5–10–(15)-flowered. Pedicel 2–7 mm, thickened in fruit. *Sepals* 1 & 2 broadly ovate or triangular-ovate, 1.7–2.2 by 1.8–1.9 mm, 4 & 5 transverse-oval, 1.6–2 by 2.4–3 mm, rather densely stigrose outside (hairs with 2 branches, up to 450 μ total length). *Corolla* 5½–6 mm, tube 1½–2½ mm; midpetaline field 2.5–3 by 1.7–2 mm, densely appressed-hairy (hairs mainly with 2, few with 3–4 branches, up to 750 μ total length); lobules 1.5–2 by 1.7–2.2 mm, with nearly invisible venation, entire or faintly crenulate at margin, coherent above midpetaline field for ½½ mm. *Stamens* inserted 1–1½ mm above the corolla-base; anther nearly sessile, 0.4–0.5 mm long, 0.7–0.8 mm broad, 0.5–0.6 mm thick, slightly retuse at apex and base. *Ovary* 1½–2½ by 0.8–1 mm, glabrous or with few appressed hairs in the basal, central, or the upper part; stigma conical, with 5 ridges in the lower part, smooth in upper part. *Fruit* probably little fleshy, obpyriform, 2½ by 14 mm, scurfy outside, yellow (once noted) when fresh, greyish brown when dry. Cotyledons strongly folded.

**Distr.** Malaysia: Sumatra, Java, Borneo, Philippines, Maluccas (local in all these islands).

**Ecol.** In forests up to 800 m.

**Vern.** *Alor ilitsiwalli* (Simalur).

**Notes.** The ovary is hairy except in *Elmer* 12750 (type of *E. lateriflora* ELM.) from the Philippines and *Diepenhorst* 3692 from Sumatra which possess glabrous ovaries.

Except by the characters given in the key, the present species differs from the closely related *E. griffithii* Clarke in the generally laxer inflorescences and the flowers, which are smaller in all parts. The differences are slight, but in view of the general constancy of the characters of the hairs on calyx and corolla it is for the present retained as a species.


Strong and slender creeper or climber, up to 35 m long, stem up to 7½ cm diam., younger branches densely stellate-hirsute, older ones with low cork-ridges and without or with few oval lenticels. *Leaves* rigidly coriaceous, elliptic to obovate, 9–23½ by 5–12½ cm, 12–15-nerved; rounded at the apex. Obtuse to rounded, somewhat coriaceous at the base, with recurved margin; glabrous, with sunken midrib, nerves, and venation above; rather densely villose-hirsute, with slightly raised nerves and slightly sunken to faintly raised venation beneath. Petiole 7–12 mm. *Inflorescences* axillary, sometimes 2–4 together, up to 4 cm, up to 12-flowered. Pedicel 3–5½ mm. *Sepals* 1 & 2 broadly ovate, 6½ by 4½ mm, 4 & 5 transverse-oval, 5 by 6½ mm; densely stellate-hirsute outside (hairs with long and strong, up to 1500 μ long, central branch and 2–5 small, up to 100 μ long, basal branches). *Corolla* dark yellow, 10½ mm, tube 4½ mm; midpetaline field 6 by 4½ mm, densely appressed-hairy (hairs with long and strong, up to 2000 μ long, central branch and 1–3 small, up to 50 μ long, basal branches). Lobules club-shaped, 2½ by 2½ mm, near the apex 1.4 mm broad and 1 mm thick. *Stamens* inserted 2½½ mm above the corolla-base; filament ½½ mm long, 0.8½ mm broad at the base; anther 0.8½ mm long, 0.9½ mm broad, 0.5½ mm thick, obtuse at the apex, slightly coriaceous at the base. *Ovary* 1½½ mm, densely hirsute; stigma conical, warty over the whole surface, with 5 faint ridges. *Fruit* flattened-ellipsoid, 29 by 2½ by 19
mm, densely hirsute with up to 2 mm long hairs. Cotyledons plain.

Ecol. Malaysia: Malay Peninsula (Perak), rare.


Subarborescent, trunk up to 12 cm diam., younger branches stellate-hirsute, older ones with large transverse lenticels. Leaves thick, rigidly coriaceous, obovate-oblong to oblong, 6–14 by 3–6 cm, 4–8-nerved; slightly acuminate at the apex, acute to obtuse (or rounded) at the base; densely stel late-hirsute, soon glabrescent, with slightly prominent midrib and nerves and faintly prominent to indistinct venation above; less densely stellate-hirsute, soon glabrescent, with slightly prominent nerves and faintly prominent to indistinct venation beneath. Petiole 3–5 mm. Inflorescences terminal, in basal part leafy, axillary, or cauleine. Pedicel 2–4 mm; bracteoles up to 3 mm long. Sepals 1 & 2 broadly ovate, 2.3–2.5 by 3.2–3.3 mm, 4 & 5 transverse-oval, 2.5–2.8 by 3.5–3.5 mm, stellate-hirsute outside (hairs with 3–5 subequal, up to 350 μ long branches). Corolla pale yellowish, 7/12–8 mm, tube 2 mm; midpetaline field 5 by 3 mm, densely appressed-hairy (hairs with strong, up to 1000 μ long central branch and 1–3 small, up to 150 μ long basal branches); lobules club-shaped, 2.5 by 1.7 mm, near the apex 1 mm broad and thick. Stamens inserted 1 mm above the corolla-base; filament 0.3 mm long, 0.6 mm broad at the base; anther 1 mm long, 0.7 mm broad, 0.4 mm thick, acuminate (sterile acumen 0.3 mm) at the apex, slightly cordate at the base. Ovary 1.2 by 0.7 mm, glabrous except few hairs immediately below the stigma; stigma conical, warty, without distinct ridges. Fruit unknown.

Distr. Malaysia: Sumatra (E. Coast), known only from a Teysmann-collection, since cultivated at Bogor.

Note. The species is strongly characterized by the shape and peculiar position of the lobules of the corolla, which are found also in E. magnifica Prain. The present species is the only one in the genus from which typically cauleine inflorescences are known.


Large scandent shrub, branches glabrous, older ones with many lenticels. Leaves coriaceous, oblong, 6–18 by 21/2–8 cm, 5–8-nerved; acute to acuminate at the apex, acute to obtuse or rounded at the base; glabrous on both sides; with slightly sunken midrib, slightly prominent to faintly sunken nerves, and faintly prominent to indistinct venation above; with slightly prominent nerves, faintly prominent to indistinct venation beneath. Petiole 8–14 mm. Inflorescences terminal, in basal part sometimes with some leaves, or axillary, 21/2–10 cm, 10–100-flowered. Pedicel 21/2–4 mm. Sepals 1 & 2 orbicular, 3 by 3 mm, 4 & 5 transverse-oval, 2.7–2.8 by 3.2–3.9 mm, glabrous outside. Corolla white or pale yellowish, 12–12.5 mm, tube 2–3 mm; midpetaline field 7–7.5 by 3.5–3.8 mm, densely appressed-hairy (hairs with 2–3(–4) subequal up to 250 μ long branches); lobules 5–6.5 by 5–6 mm, without distinct venation, entire or slightly undulate at margin. Stamens inserted 1–1.5 mm above the corolla-base; filament 0.8–1 mm long, 0.8–0.9 mm broad at the base; anther 2.5–2.8 mm long, 0.9–1 mm broad, 0.5–0.6 mm thick, acuminate (sterile acumen 1 mm) at the apex, cordate at the base. Ovary 2–2.5 by 1.6–1.8 mm, glabrous; stigma conical, with 10 distinct ridges. Fruit ellipsoid, 2 by 1.5 cm, glabrous, smooth.


Ecol. On forested slopes at low altitude; fl. Feb.–May.

Note. Practically glabrous; few short (up to 200 μ long) 2-branched hairs are found on the
Fig. 15. *Erycibe ramiflora* Hallier f. Cauline inflorescences and lateral and apical view of flowers, resp. \( \times 1^{1/2} \) and \( \times 3 \).

branches of the inflorescences and on the basal part of the pedicels only. The indumentum of the midpetaline field is, however, rather dense.


Scandent shrub, branches sparsely strigose, older ones terete, with many lenticels. *Leaves* subcoriaceous, oblong, 8–12/5 by 2/5–5 cm, 4–6-nerved; acuminate at the apex, acute (to obtuse) at the base; glabrous, with slightly sunken midrib, slightly prominent nerves, and faintly prominent venation above; glabrous, with slightly prominent nerves, and faintly prominent venation beneath. Petiole 10–20 mm. *Inflorescences* axillary, 3–9 cm, 3–25-flowered. Flowers fragrant. Pedicel 7–10 mm. *Sepals* 1 & 2 broad-ovate, 3 by 3.2–3.5 mm, 4 & 5 transverse-oval, 3 by 3.8–4 mm, glabrous outside. *Corolla* white, 12–14 mm, tube 3 mm; midpetaline field 6–8 by 3–4 mm, densely appressed-hairy (hairs 2-branched, up to 600 \( \mu \) total length); lobules 5–6 by 4–5 mm, rather thick, without distinct venation, slightly crenate at margin. *Stamens* inserted 1.7 mm above the corolla-base; filament 0.7 mm long, 0.5 mm broad at the base; anther 1.6 mm long, 0.8–0.9 mm broad, 0.6 mm thick, acuminate (sterile acumen 0.6 mm) at the apex, slightly cordate at the base. *Ovary* 1.4 by 0.8–1.3 mm, glabrous in the lower 0.8 mm, hairy in the upper part; stigma conical, with 5 distinct ridges. Fruit unknown.


Ecol. Edge of swamp forest.


Shrub or small tree, up to 6 m by 71/2 cm.
Branches trigose, older ones with faint longitudinal ridges and few oval lenticels. Leaves subcoriaceous, narrowly obovate to obovate or oblanceolate, (9-)14-22(-40) by (3-)4(1/2)-8(-12) cm, 8-12 (-16)-nerved; acute, generally slightly acuminate at the apex, obtuse to broadly acute at the base; glabrous, with sunken midrib, faintly prominent nerves and major venation, and indistinct minor venation above; glabrous with slightly prominent nerves and indistinct venation beneath. Petiole (5-)10-15(-20) mm. Inflorescences axillary, up to 1 cm long, (1-)2-4(-10)-flowered. Pedicel 1-3 mm, with rather broad bracteoles. Sepals 1 & 2 orbicular, 2-3(1/2) by 2-3(1/2) mm, 4 & 5 transverse-oval, 2.2-3(1/2) by 2(1/2)-4 mm, glabrous outside. Corolla white, 12-14 mm, tube 2-4.5 mm; mid-petaline field 4.5-5 by 1.8-2 mm, rather densely appressed-hairy (hairs 2-, few 3-branched, up to 600 μm total length); lobules 3(1/2)-6 by 3-3(1/2) mm, rather thin, with distinct venation, entire or minutely crenate-serrate at the margin, coherent above the mid-petaline field for 1/2 mm. Stamens inserted 0.7-2 mm above the corolla-base; filament 1.5-1.7 mm long, 0.4-0.6 mm broad at base; another 1.5-1.8 mm long, 0.5-0.9 mm broad, 0.4-0.6 mm thick, broadly acute at the apex, coriaceous at the base. Ovary 1.8-2.2 by 0.8-0.9 mm, glabrous; stigma conical, with 5 faint to distinct ridges. Fruit unknown.

Distr. Malaysia: Peninsular Siam, Malay Peninsula.

Ecol. In forests, up to 900 m alt., fl. Sept.-March.

Note. Closely related to E. glomerata Bl., differing primarily by the completely glabrous (except the ciliate margins) sepals.

11. Erycibe leucoxyloides King ex Prain, J. As. Soc. Beng. 73, 2 (1904) 16; ibid. 74, 2 (1906) 292; Riddl. Fl. Mal. Pen. 2 (1923) 446.

Slender low bushy climber, younger branches stellate-hirsute, older ones with longitudinal cork-ridges. Leaves rather thick, ovate to lanceolate, 16-55 by 10-20 mm, 3-5-nerved; rounded-obtuse to acuminate at the apex, rounded to slightly cordate at the base; stellate-hirsute, soon glabrescent, with slightly sunken midrib and indistinct nerves and venation above; stellate-hirsute, soon glabrescent, with faintly prominent to indistinct nerves and indistinct venation beneath. Petiole 1(1/2)-6 mm. Flowers solitary, axillary. Pedicel 2-4 mm with ca 5-10 bracteoles; bracteoles oval (upper ones), 2(1/2) by 2 mm, to lanceolate (lower ones), 2(1/2) by 0.8 mm. Sepals subequal, broadly ovate to orbicular, 3 by 3.3 mm, rather thin, sparsely stellate-hirsute (hairs with 4-5 subequal up to 250 μm long branches), glabrous along all margins outside. Corolla 8 mm, tube 3 mm; mid-petaline field 3 by 1(1/2) mm, rather densely appressed-hairy (hairs with (2-)3-5(-6) branches, one stronger and longer up to 1000 μm long); lobules 3(1/2) by 3 mm, rather thin, with distinct venation, entire. Stamens inserted 0.3 mm above the corolla-base; filament 0.7 mm long, 0.3 mm broad at the base; anther 1.2 mm long, 0.5 mm broad, 0.3 mm thick, acuminate (sterile acumen 0.2 mm) at the apex, slightly cordate at the base. Ovary 0.9 by 0.7 mm, glabrous; stigma conical, with 5 longitudinal ridges. Fruit ellipsoidal, 1(1/2) by 1 cm, glabrous, smooth, green. Cotyledons plain.

Distr. Malaya: Malay Peninsula.

Ecol. Open country, often forming large clumps, up to 1300 m alt.; fl. July-Jan., fr. until Feb.

12. Erycibe stenophylla Hoogli. Blumea 7 (1953) 317.—E. longifolia Becc. Nelle Foresti di Borneo (1902) 403, 524, f. 65, nomen (non E. glomerata var. longifolia Bl.).—Fig. 16.

Large shrub, branches stellate-hirsute, older ones with low longitudinal cork-ridges. Leaves subcoriaceous, linear-lanceolate, slightly falcate, 7-12 by 0.7-1.3 cm, 6-8-nerved; long-acuminate at the apex, acute at the base; glabrous, with

Fig. 16. Erycibe stenophylla Hoogli. Flowering branch, × 1/2.
slightly prominent midrib and nerves and faintly prominent venation above; sparsely stellate-hirsute, soon glabrescent, with slightly prominent nerves and faintly prominent venation beneath. Petiole 4–7 mm. Inflorescences axillary or terminal, up to 1 cm, (1–)2–(3–4)-flowered. Pedicel 1–2 mm. Sepals 1 & 2 oval, 2.4–3 by 2–2.2 mm, 4 & 5 transverse-oval, 2.3–2.5 by 3.4–3.5 mm; sparsely stellate-hirsute outside (hairs with 3–5 subequal up to 200 μ long branches). Corolla 8–9 mm, tube 2-2'/2 mm; midpetaline field 3–3.2 by 1.7–1.8 mm, rather densely hairy (hairs 5–7-branched, one stronger up to 350 μ long branch); lobules 3–3'/2 by 2–2'/2 mm, rather thin, with rather distinct venation, entire. Stamens inserted 0.7 mm above the corolla-base; filament 0.6 mm long, 0.4 mm broad at the base; anther 1 mm long, 0.7 mm broad, 0.5 mm thick, obtuse at the apex, slightly cordate at the base. Ovary 1.2 by 0.7 mm, glabrous; stigma conical, with 5 rather distinct ridges. Fruit unknown.

Distr. Malaysia: Borneo (Sarawak), once collected.

Ecol. The plant was collected in the rapids of the Redjang River; it is a typical rheophyte (narrow, slightly falcate leaves). The species is probably most closely related to E. bornensis (Merr.) Hoogl.


Woody twiner, younger branches rather densely sericeous, older ones with orbicular or oval lenticels. Leaves oblong or ovate-oblong, 8–10'/2 by 3'/2–5 cm, 6–8-nerved; obuse, short-acuminate at the apex, obtuse to rounded at the base; glabrous, with sunken midrib, faintly prominent nerves, and nearly indistinct venation above; densely sericeous over the whole surface, with prominent nerves and slightly prominent venation beneath. Petiole ca 1 cm. Inflorescences axillary, 5–10 mm, 6–10-flowered. Pedicel 2–3 mm. Sepals 1 & 2 orbicular to broad-ovate, 2.4 by 2.6 mm, 4 & 5 transverse-oval, 2.4 by 3.5 mm, rather densely striose outside (hairs 2-branched, up to 250 μ total length). Corolla 10'/2 mm, tube 2 mm; midpetaline field 6'/2 by 3 mm, densely appressed-hairy (hairs 2-branched, up to 500 μ long); lobules 5 by 4–4'/2 mm, rather thick, with faintly visible venation, entire. Stamens inserted 1.2 mm above the corolla-base; filament 0.7 mm long, 0.3 mm broad at the base; anther 1.8 mm long, 0.7 mm broad, 0.5 mm thick, acute at the apex, slightly cordate at the base. Ovary 0.9 by 1.6 mm, rather densely hirsute; stigma conical, with 10 rather distinct ridges. Fruit unknown.

Distr. Malaysia: Philippines (Island of Malamau close to N. Basilan, once collected.)


Creeper, 12–18 m long, branches densely thin-strigose, older ones with rather low longitudinal cork-ridges. Leaves elliptic-oblong, 7–14 by 3'/2–6'/2 cm, 6–8-nerved; obuse and distinctly acuminate at the apex, obtuse and slightly decurrent at the base; densely long-strigose, soon glabrescent, with sunken midrib and nerves and faintly prominent venation above; densely long-strigose in young leaves, rather sparsely so in full-grown ones, indumentum long-persistent, with prominent nerves and slightly prominent venation beneath. Petiole 12–20 mm. Inflorescences axillary, sometimes 2 or 3 together, the longer ones sometimes with some small leaves in the basal part. 2–12 cm, 20–60-flowered; bracts rather large, up to 5 mm long. Flowers known only in bud. Pedicel 1–2 mm. Sepals 1 & 2 oval, 2'/2 by 2 mm, 4 & 5 transverse-oval, 2 by 2'/2 mm, rather densely thin-strigose outside (hairs 2-branched, up to 900 μ total length). Corolla only slightly developed; midpetaline field with 2-branched, up to 1200 μ long hairs. Anthers acuminate at the apex. Ovary glabrous; stigma conical. Fruit unknown.

Distr. Malaysia: Malay Peninsula (Perak), once collected.

Ecol. In dense jungle, ca 150–240 m altitude, clinging to trees.


Climber, branches densely short-sericeous, older ones suberete, with rather many orbicular lenticels. Leaves coriaceous ovate to elliptic, 9–15 by 5'/2–9 cm, 5–7-nerved; obuse, short-acuminate at the apex, obtuse at the base; densely short-sericeous, soon glabrescent, with slightly sunken midrib and nerves and faintly sunken to indistinct venation above; densely short-sericeous (indumentum late caducous), with slightly prominent nerves and faintly to slightly prominent venation beneath. Petiole 15–25 mm. Inflorescences axillary, towards the apex of the branches passing into terminal, (2'/2–)4–25 cm, 10–80-flowered. Pedicel 2–3 mm. Sepals 1 & 2 broad-ovate, 4.3 by 3.8 mm, 4 & 5 transverse-oval, 3.4 by 4.2 mm, rather densely striose outside (hairs 2-branched, up to 250 μ total length). Corolla white, 9 mm, tube 3 mm; midpetaline field 5 by 2.8 mm, densely striose (hairs 2-branched, up to 900 μ total length); lobules 3–3.5 by 1.8–2 mm, rather thick, without distinct venation, slightly crenate at the margin. Stamens inserted ca 1.4 mm above the corolla-base; filament 0.5 mm long, 0.4 mm broad at base; anther 1.8 mm long, 0.9 mm broad, 0.7 mm thick, acute at the apex, slightly cordate at the base. Ovary 1.7 by 1.3 mm, rather densely striose; stigma conical, with 5 distinct ridges. Fruit unknown.

Distr. Malaysia: Borneo (E. Kutei, once collected).

Ecol. In forest along river at low altitude.


A woody twiner, younger branches strigose-hirsute, older ones with rather many oval lenticels. Leaves subcoriaceous, oblong, 4'/2–8'/2 by 1.8–2'/2 cm, 7–8-nerved; acuminate at the apex, acute to obtuse at the base; glabrous, with slightly sunken midrib, slightly prominent nerves and venation
above; glabrous (except the sparsely villose, soon glabrescent basal part of midrib), with prominent nerves and venation beneath. Petiole 5–9 mm. Inflorescences axillary, sometimes 2 or 3 together, 3–40 mm, (1–)3–20-flowered. Pedicel 2–5 mm. Sepals transverse-oval, 1 & 2 1.8 by 2.2 mm, 4 & 5 2 by 2.5–2.7 mm; densely hisurate outside (hairs with 2 branches, rarely a small third branch, up to 900 µ. total length). Corolla pale yellow-green, 51/2 mm, tube 0.8 mm; midpetaline field 3.2 by 2 mm, densely hisurate (hairs with 2–3(–4), generally curled, up to 700 µ. long branches); lobules 2 by 2 mm, rather thick, without distinct venation, entire. Stamens inserted 0.8 mm above the corolla-base; filament 0.5 mm long, 0.3 mm broad at the base; another 1.2 mm long, 0.9 mm broad, 0.7 mm thick, obtuse, slightly truncate at the apex, slightly cordinate at the base. Ovary 0.9 mm by 1 mm, glabrous; stigma conical, with 5 rather distinct ridges. Fruit unknown.

Distr. Malaysia: Br. N. Borneo (Kinabalu), once collected at 1200 m.


Scandent shrub or liana, younger branches densely strigose, older ones with longitudinal cork-ridges and rather many oval lenticels. Leaves subcoriaceous, ovate-oblong to elliptic-oblong, 41/2–13 by 2–61/2 cm, 4–7-nerved; rounded to acute, usually more or less acuminate at the apex, obtuse to rounded at the base; glabrous, with slightly sunken midrib and slightly prominent nerves and venation above; glabrous, with distinctly prominent nerves and slightly prominent to indistinct venation beneath. Petiole 8–12 mm. Inflorescences axillary, 1/2–3 cm, (1–)2–14-flowered. Pedicel 11/2–4 mm. Sepals 1 & 2 broadly ovate, 2–3 by 21/2–3 mm, 4 & 5 transverse-oval, 21/2 by 3 mm; shortly strigose outside (hairs with 2 branches, up to 600 µ. total length). Corolla cream-coloured, 8–9 mm, tube 21/2–31/3 mm; midpetaline field 2.7–3.8 by 1.7–2 mm, densely appressed-hairy (hairs with 2–3(–4) up to 800 µ. long branches); lobules 3.5–4 by 2.7–4 mm, rather thick, with not or only faintly visible venation, entire. Stamens inserted 0.5–0.8 mm above the corolla-base; filament 0.6–0.9 mm long, 0.3–0.5 mm broad at the base; another 1.1–1.3 mm long, 0.6 mm broad, 0.3–0.4 mm thick, acuminate (sterile acumen 0.5–0.6 mm) at the apex, cordinate at the base. Ovary 0.8–1.2 by 0.8–1.1 mm, glabrous; stigma conical, somewhat warty, with 5 distinct ridges. Fruit ellipsoid, 22 by 14 mm, glabrous, smooth. Cotyledons plain.

Distr. Malaysia: Sumatra, Malay Peninsula, Br. N. Borneo (Kinabalu).


Notes. The specimens from Sumatra are distinctly larger in many parts than most specimens from the Malay Peninsula. I do not think, however, that the differences justify the distinction of 2 taxa.

The only specimen known from Borneo (Clements 31860) is a rather poor one with poor inflorescences. Otherwise it fits in perfectly with the small Peninsular specimens.

Prain (1906) and Ridley (1923) reduced the species to E. griffithii Clarke. The most striking differences between the two species are the shape of the stamens and the fruit. Both species have in the herbarium a dark brown, often purple-tinged colour.


Woody climber or small tree, branches sparingly strigose, older ones terete with rather many orbicular lenticels. Leaves coriaceous, elliptic to elliptic-oblong, 8–18 by 4–81/2 cm, 7–9-nerved; acuminate from an obtuse to rounded apex, rounded to broadly acute at the base; glabrous, with slightly to distinctly sunken midrib, faintly sunken nerves, and faintly sunken to faintly prominent venation above; glabrous, with faintly prominent nerves and faintly prominent to indistinct venation beneath. Petiole 9–18 mm. Inflorescences axillary, 1–5 cm, 6–50-flowered. Flowers fragrant. Pedicel 2.5 mm. Sepals 1 & 2 oval to orbicular, 2.3–2.5 by 2.2–2.7 mm, 4 & 5 orbicular to transverse-oval, 2.3–2.5 by 2.7–3.3 mm, rather sparingly to rather densely strigose outside (hairs 2-branched, up to 400 µ. total length). Corolla white, 81/2–9 mm, tube 2–3 mm; midpetaline field 4 by 2.2–2.8 mm, rather densely appressed-hairy (hairs 2-branched, up to 800 µ. total length); lobules 31/2–41/2 by 31/2–41/2 mm, with not too distinct venation, entire, coherent above the midpetaline field for up to 0.4 mm. Stamens inserted 0.8–1.5 mm above corolla-base; filament 0.7–1.2 mm long, 0.4–0.6 mm broad at the base; another 2 mm long, 0.8–0.9 mm broad, 0.5–0.6 mm thick, acute at the apex, cordinate at the base. Ovary 1.2–1.7 by 1.5–1.7 mm, rather densely appressed-hairy; stigma conical, with 10 rather low ridges. Fruit ellipsoid, 30 by 18 mm, glabrous, smooth, orange. Cotyledons plain.

Distr. Chittagong, S. Burma, S. Siam, in Malaysia: only found in Peninsular Siam.

Ecol. In evergreen forest, up to 200 m.


Creeping, up to 20 m long, 7/12 cm diam., younger branches strigose, older ones terete with rather many orbicular lenticels. Leaves subcoriaceous, elliptic-oblong to oblong or ovate-oblong, 7–14 by
3–7 cm, 7–9-nerved; acute to obtuse, slightly acuminate at the apex; oblong to obtuse at the base; glabrous, with slightly sunken midrib, faintly prominent nerves, and indistinct to faintly prominent venation above; glabrous, with slightly prominent nerves and faintly prominent venation beneath. Petiole 8–12 mm. Inflorescences axillary, up to 1/12 cm, (3–6–12–15)-flowered. Pedicel 1/2–4 mm. Sepals 1 & 2 broad-ovate to orbicular or transverse-oval, 2–2.5 by 2.2–2.8 mm, 4 & 5 transverse-oval, 2–2.2 by 3–3.5 mm, rather densely to densely strigose outside (hairs 2-branched, up to 350 µ total length). Corolla pale greenish white, 7–9/2 mm, tube 1/2–3 mm; midpetaline field 3–4 by 2.2–3 mm, densely appressed-hairy (hairs 2-branched, up to 600 µ total length); lobules 3/2–4/2 by 3–3/2 mm, rather thin, with faintly distinct to distinct venation, slightly crenate at margin, coherent above the midpetaline field for 1 mm. Stamens inserted 0.8–1.2 mm above the corolla-base; filament 0.7–1 mm long. 0.4–0.6 mm broad at the base; anther 1–1.9 mm long, 0.6–0.8 mm broad, 0.4–0.5 mm thick, acute at the apex, corollate at the base. Ovary 1–1.5 by 1.3–1.7 mm, rather densely appressed-hairy for whole surface or the upper part only; stigma conical, with 10 rather distinct ridges. Fruit unknown.


Note. The inflorescence was originally described as many-flowered; Prain corrected this later (1896) to 7–12-flowered.


Large climber, branches rather densely to densely strigose-hirsute, older ones subcercate, with rather many orbicular to oval lenticels. Leaves coriaceous, ovate to ovate-oblong or elliptic-oblong, 4½–10–14 by 2–4½(–6) cm, 8–12-nerved; obtuse, short-acuminate at the apex, obtuse at the base; glabrous, shining, with slightly sunken midrib, slightly prominent nerves and major venation, and faintly prominent or indistinct minor venation above; rather sparsely hirsute, glabrescent, with slightly prominent nerves and venation beneath. Petiole 9–14 mm. Inflorescences axillary, towards the apex of the branches passing into terminal, then usually with some small leaves in the basal part, (2½–)4–25 cm, 10–125-flowered, terminal ones up to 250-flowered. Pedicel 3–5 mm. Sepals 1 & 2 broad-ovate or orbicular to transverse-oval, 2.4–3.6 by 2.6–4.2 mm, 4 & 5 transverse-oval, 2.1–3 by 2.8–4 mm, sparsely to densely strigose outside (hairs 2-branched, up to 500 µ total length). Corolla white or yellowish white. 6½–9½ mm, tube 2–2½ mm; midpetaline field 3–4.8 by 1.8–3.3 mm, rather densely to densely strigose (hairs 2-branched, up to 900 µ long); lobules 3–4 by 2½–4 mm, rather thin to rather thick, with no or only faintly distinct venation, slightly crenate, or undulate, or entire at the margin, sometimes coherent above the midpetaline field for up to 0.8 mm. Stamens inserted 0.7–1.5 mm above the corolla-base; filament 0.5–1.3 mm long, 0.2–0.6 mm broad at the base; anther 1.3–2 mm long, 0.5–0.7 mm broad, 0.5–0.7 mm thick, acute to acuminate at the apex (sterile acumen up to 0.2 mm), corollate at the base. Ovary 1.8–3.3 mm, glabrous, or rather sparsely hairy in the upper, glabrous in the lower part, or rather sparsely hairy over the whole surface; stigma conical, with 5 or 10 faint to distinct ridges. Fruit ellipsoid, 8 by 5 mm, light green, glabrous, smooth, or (at least in young stages) with dense appressed indumentum. Cotyledons plain.


Note. The type represents a relatively hirsute form, all other specimens are distinctly less hairy. The species is rather variable, but there is no good character on which it can be divided into more taxa.


Scandent shrub, younger branches densely strigose, older ones with distinct longitudinal cork-ridges. Leaves ovate-oblong, (6–)10–14 by (2½–)4½–6½ cm, 5–7-nerved; obtuse, often slightly acuminate at the apex, obtuse to rounded at the base; sparsely strigose, soon glabrescent, with slightly sunken midrib, faintly prominent nerves, and indistinct or very faintly prominent venation above; rather sparsely short-strigose, soon glabrescent, with prominent nerves and indistinct venation, or at most major venation faintly prominent or minor venation faintly sunken. Petiole 5–12 mm. Inflorescences axillary, towards the end of the branches passing into terminal, 3–10 cm, 25–75-flowered, with minute and few larger (up to 12 by 3½ mm) bracts. Pedicel 1½–4 mm. Sepals transverse-oval, 1 & 2 2.5 by 2.5 mm, 4 & 5 2 by 3 mm, rather densely short-strigose outside (hairs 2-branched, up to 450 µ total length). Corolla 7 mm, tube 2 mm; midpetaline field 4 by 2 mm, rather densely hairy (hairs mainly 2-branched, up to 1250 µ total length); lobules 3 by 2½–3 mm, without distinct venation, entire. Stamens inserted 0.6 mm above the corolla-base; filament 0.8 mm long, 0.4 mm broad at the base; anther 1.5 mm long, 0.7 mm broad, 0.5 mm thick, acuminate (sterile acumen 0.2 mm) at the apex, corollate at the base. Ovary 0.9 by 0.9 mm, glabrous in the lower 0.3 mm, densely hairy in the upper part; stigma conical, with 5 rather distinct ridges. Fruit unknown.

22. Erycibe ramosii HOOG. Blumea 7 (1953) 316.

Scandent, younger branches densely strigose-hirsute, older ones with distinct longitudinal cork-ridges. Leaves elliptic-oblong to oblong, 5–10 by 11/2–4 cm, 7–10-nerved; shortly to long acuminate from an obtuse to acute apex, obtuse to acute at the base; densely strigose-hirsute, soon glabrescent, with slightly sunken midrib and slightly prominent nerves and venation above; densely strigose-hirsute, soon glabrescent, with faintly prominent nerves and major venation, and faintly prominent to indistinct minor venation beneath. Petiole 10–16 mm. Inflorescences terminal or axillary, 2–6 cm, 10–60-flowered. Pedicel 2–3 mm. Sepals I & 2 orbicular, 2.3 by 2.3 mm, 4 & 5 transverse-oval. 2.2 by 3 mm, rather densely appressed-hairy outside (hairs 2-branched, up to 400 µ total length). Corolla 7/12 mm, tube 2 mm; midpetaline field 3.5 by 2.1 mm, rather densely appressed-hairy (hairs 2-branched, up to 700 µ total length); lobules 21/2 by 11/2 mm, without distinct venation, slightly crenulate at margin. Stamens inserted 1.2 mm above the corolla-base; filament 1 mm long, 0.6 mm broad at the base; anther 1.2 mm long, 0.7 mm broad, 0.4 mm thick, acute at the apex, cordate at the base. Ovary 1.4 by 1.5 mm, appressed-hairy over the surface; stigma conical, with 5 faint ridges. Fruit ellipsoid, 20 by 12 mm, glabrescent except few hairs near the apex, smooth. Cotyledons plain.

Distr. Malaysia: Philippines (Luzon, Leyte).


**KEY TO THE SUBSPECIES**

1. Sepals sparsely appressed-hairy outside in central part only; longest hairs ca 700 µ long. *ssp. glomerata*

2. Sepals densely appressed-hairy outside, the 2 outer ones for the whole surface; longest hairs ca 1250–1500 µ long *ssp. angustifolia*

*ssp. glomerata.*—E. glomerata Bl. 1826.—E. glomerata var. longifolia Bl. 1826.

Liana, branches sparsely appressed-hairy, older ones suberecte or with low longitudinal ridges. Leaves subcoriaceous, elliptic-oblong to narrowly oblong, 8–18 by 3½–7½ cm, 6–9-nerved; acuminate from an obtuse to acute apex, obtuse to acute at the base; rather sparsely appressed-hairy, soon glabrescent, with faintly prominent to slightly sunken midrib, faintly prominent nerves, and faintly prominent to indistinct venation above; rather sparsely appressed-hairy, soon glabrescent, with faintly prominent nerves and faintly prominent to indistinct venation, silvery shining beneath. Petiole 1½–1 cm. Inflorescences axillary, up to 1½ cm, (1–)2–15-flowered, forming a dense cluster. Pedicel 1–3 mm, with 2–5 oval or ovate, up to 3 mm long bracts and bracteoles. Sepals subequal, oval to transverse-oval, 3½–3.8 by 2½–4 mm, sparsely appressed-hairy in the central part outside (hairs 2-branched, up to 700 µ total length). Corolla white, 13–13½ mm, tube 3 mm; midpetaline field 4½ by 1½–2 mm, rather densely appressed-hairy (hairs 2-branched, up to 1250 µ total length); lobules 7½ by 3½–3½ mm, rather thin, with rather distinct venation, entire or slightly crenate at the margin. Stamens inserted 0.7 mm above the corolla-base; filament 1½–1 mm long, 0.5–0.6 mm broad at the base; anther 1½–1.2 mm long, 0.7–0.8 mm broad, 0.5 mm thick, acute to obtuse at the apex, cordate at the base. Ovary 1½–1.1 by 1½–1.7 mm, glabrous; stigma conical, with 5 or 10 ridges. Fruit unknown.

Distr. Malaysia: Sumatra, W. Java.

**Vern. Kisimut, S.**


Liana, up to 20 m by 8 cm, younger branches rather densely strigose-hirsute, older ones with distinct longitudinal cork-ridges. Leaves subcoriaceous, oval to oblong, (5–)7–12–16 by (2–)3½–6½(–9½) cm, 5–7(–8)-nerved; rounded to broad-acute, usually short-acuminate at the apex, rounded to broad-acute at the base; glabrous, with distinctly sunken midrib and distinctly to faintly sunken nerves and venation above; glabrous, with...
faintly prominent to faintly sunken nerves and faintly to distinctly sunken venation beneath. *Inflorescences* axillary, sometimes 2 or 3 together, (**1/2**-3-8(-11) cm, (5-)15-40(-60)-flowered. Pedicel **1/2**-4 mm. *Sepals* orbicular to transverse-oval, **1 & 2** 2-3.5 by 2.5-3.7 mm, **4 & 5** 2.5-3 by 2.5-4 mm, rather sparsely to rather densely appressed-hairy outside (hairs 2-branched, up to 800 µ total length). *Corolla* **61/2**-10(-1/2) mm, tube 2-2½ mm; midpedaline field 3.2-5.2 by 2-2.6 mm, rather densely appressed-hairy (hairs 2-branched, up to 1400 µ total length); lobules 3.5-5 by 3-4.2 mm, with no or only slightly distinct venation, grossly dentate at the margin. *Stamens* inserted 0.5-1 mm above the corolla-base; filament 0.7-1.7 mm long, 0.3-0.6 mm broad at the base; anther 1.3-2.0 mm long, 0.5-0.8 mm broad, 0.4-0.5 mm thick, acute-acuminate at the apex, cordate at the base. *Ovary* 1.3-1.6 by 1.2-1.6 mm, glabrous; stigma conical, with 5 rather distinct ridges. *Fruit* ellipsoid, 2 by **1/2** cm, glabrous, smooth. Cotyledons strongly folded.

Distr. S. China (Hainan), Indo-China, Siam, in *Malaysia*: Peninsular Siam.

Ecol. In forests, from low altitude up to 1200 m (Indo-China).

**Vern.** Changsan sapman, hora (Siamese).


Scandent shrub or liana, younger branches rather sparsely stigrose, older ones with longitudinal cork-ridges. *Leaves* ovate to oblate-oblong, (8-)12-19 by (**3/2**-5-10) cm, 5-8-nerved; obtuse to acute, often more or less acuminate at the apex, acute to, usually, obtuse at the base; glabrous, with slightly sunken midrib and prominent nerves and venation above; glabrous, with prominent nerves and slightly prominent venation beneath. Pediole 5-15 mm. *Inflorescences* axillary, sometimes 2 or 3 together, or terminal, (3-)8-18 cm, 30-100- or more-flowered. Pedicel 1-2½ mm. *Sepals* 1 & 2 oval, 2-2½ by 1.7-2 mm, 4 & 5 transverse-oval, 1.8-2 by 2.5 mm, rather densely stigrose outside (hairs 2-branched, up to 600 µ total length). *Corolla* white, yellowish white, or yellow, **5½**-6 mm, tube **1½**-2 mm; midpedaline field 2.4-2½ by 1.8 mm, rather sparsely appressed-hairy (hairs mainly 2-branched, up to 800 µ total length); lobules 1.8-2.3 by 2.5 mm, without distinct venation, entire. *Stamens* inserted ½½ mm above the corolla-base; filament 0.8-1 mm long, 0.4-0.5 mm broad at the base; anther 1.1-1.2 mm long, 0.7-0.8 mm broad, 0.4-0.5 mm thick, obtuse to acuminate at the apex (sterile acumen 0.1-0.4 mm), rounded to slightly cordate at the base. *Ovary* 0.8-1.3 by 0.7-0.9 mm, glabrous; stigma conical, with 10 rather distinct ridges. *Fruit* ellipsoid, 13 by 8 mm, glabrous, red or orange-brown. Cotyledons plain.

Distr. Malaysia: W. New Guinea (not yet found in the Vogelkop).

Ecol. In fringing forest, up to 300 m altitude.

### 26. _Erycibe forbesii_ PRAIN, J. As. Soc. Beng. 73, 2 (1904) 15.

Liana, younger branches rather densely appressed-hairy, older ones with distinct, generally broad, longitudinal cork-ridges. *Leaves* ovate or obovate to oblong, (5-)7-12(-15) by (**2/4**-3-6 (-7½) cm, (4-)5-8-nerved; rather sparsely appressed-hairy, soon glabrescent, with slightly sunken midrib, faintly prominent to faintly sunken nerves, and faintly prominent to indistinct venation above; rather sparsely appressed-hairy, soon glabrescent, with slightly to faintly prominent nerves and venation beneath. Pediole 8-17 mm. *Inflorescences* terminal, downward passing into axillary, sometimes 2 together, (**1½**-3-8 (-12) cm, (5-)10-30(-100)-flowered. Pedicel **1½**-4 mm. *Sepals* 1 & 2 oval to orbicular, 2-4 by 2-3½ mm, 4 & 5 transverse-oval, 1.8-3.2 by 2.2-4 mm, rather densely appressed-hairy outside (hairs 2-branched, up to 900 µ total length). *Corolla* white, 6-9½ mm, tube 2-3 mm; midpedaline field 1.8-4 by 1.3-2.8 mm, rather densely appressed-hairy (hairs 2-branched, up to 1400 µ total length); lobules **2½-4½** by **1½**-3 mm, rather thick, with faintly visible venation, entire to irregularly crenulate at margin, coherent above the midpedaline field for up to 1 mm. *Stamens* inserted ½½-4½ mm above the corolla-base; filament 1.5-1.8 mm long, 0.3-0.7 mm broad at the base; anther 1-2½ mm long, 0.4-0.8 mm broad, 0.4-0.6 mm thick, acuminate (sterile acumen 0.3-0.7 mm) at apex, cordate at the base. *Ovary* 0.8-1.7 by 0.8-1.5 mm, glabrous; stigma conical, with 5 distinct ridges. *Fruit* ellipsoid, 18 by 15 mm, glabrous, smooth in the lower, scurfy in the upper part, or scurfy over the whole surface. Cotyledons strongly folded.

Distr. Malaysia: Sumatra (Lampangs), Java (W. & E.), Kangean Archipelago, Borneo (Balikpapan), and Philippines.

Ecol. In primary forest, at low altitude (up to 600 m).

**Vern.** Kisemut, S.

Note. In the Philippine specimens the fruits are scurfy over the whole surface, in the Javanese ones the lower part is smooth. (The Bornean collection is in flower.) What the taxonomic value of this character is can not yet be decided because of the small number of available specimens, particularly in the intermediate area.


Liana, up to 6 cm thick, younger branches stellate-hirsute with very short dark rufous hairs, older ones with very few orbicular lenticels. *Leaves* coriaceous, shining deep green above, much paler beneath, elliptic-oblong to oblanceolate, ovate-oblong, or obovate-oblong, 7-23 by (**3/2**-12½ cm, 7-10-nerved; rather shortly acuminate from an obtuse apex, (acute to) obtuse to rounded, sometimes slightly cordate at the base; glabrous, with slightly sunken to slightly raised midrib and nerves
and faintly sunken to faintly raised venation above; densely stellate-hirsute, very soon glabrescent, with faintly raised to slightly sunken nerves and distinctly sunken venation beneath; margin often slightly recurved. Petiole 10–22 mm.

Inflorescences terminal, often with some leaves in basal part, or axillary, 2–20 cm, 20–200-flowered. Pedicel 1–21/2 mm. Sepals 1 & 2 broadly ovate, 1.6–2.5 by 1.5–2 mm, 4 & 5 transverse-oval, 1.3–1.9 by 2.2–2.6 mm; rather densely stellate-hirsute outside (hairs with 5–11 subequal, up to 250 μ long branches). Corolla pale yellow or yellow, 6–7 mm, tube 11/2–2 mm; midpetaline field 3.2–3.7 by 1.7–2 mm, densely stellate-hirsute (hairs with 6–12 subequal, up to 250 μ long branches); lobules 2 by 21/2 mm, without distinct venation, entire. Stamen inserted 0.5–0.9 mm above the corolla-base; filament 0.5–0.7 mm long, 0.3–0.5 mm broad at the base; anther 1.2 mm long, 0.4–0.6 mm broad, 0.3–0.4 mm thick, acute at the apex, slightly cor- date at the base. Ovary 1 by 0.8–1.2 mm, glabrous in the lower 0.2–0.4 mm, stellate-hirsute in the upper part; stigma conical, with 10 low ridges. Fruit ellipsoid, 20 by 14 mm, dark brown, yellow, or aurantiaceous, with a dense indumentum of very short stellate hairs. Cotyledons plain.

Distr. Malaysia: Borneo (Br. N. Borneo and E. Indonesian Borneo).

Ecol. In primary and secondary forests at low altitude.

Vern. Tikboi, Sandakan.

28. Erycibe carrii Hoogl. Blumea 7 (1953) 312. Liana, young branches stellate-hirsute, older ones with longitudinal cork-ridges. Leaves subcoriaceous, ovate to ovate-oblong, (2.7–)4.5–8 by (0.9–)1.6–3.5 cm, 6–8-nerved; obtuse to acute or slightly acuminate at the apex, obtuse to rounded at the base; stellate-hirsute, glabrescent, with slightly sunken midrib and slightly prominent nerves and venation above; stellate-hirsute, indumentum long persistent, with slightly prominent nerves and venation beneath. Petiole 6–10 mm.

Inflorescences axillary, sometimes 2 or 3 together, (1–)3–10 cm, (3–)7–50-flowered. Flowers fragrant. Pedicel 2–4 mm. Sepals 1 & 2 oval, 2–2.2 by 1.6–1.9 mm, 4 & 5 transverse-oval, 2–2.2 by 2.5–2.8 mm, rather densely stellate-hirsute (hairs with (2–)4–9(–11) subequal, up to 350 μ long branches). Corolla white, 61/2–7 mm, tube 2 mm; midpetaline field 3 by 1.8 mm, rather densely appressed-hairy (hairs with (2–)3–6 subequal, up to 750 μ long branches); lobules 2.5–3 by 2.8–3 mm, without distinct venation, slightly undulate at the margin. Stamen inserted 11/2 mm above the corolla-base; filament 0.5–0.6 mm long, 0.3 mm broad at the base; anther 1.2–1.4 mm long, 0.8 mm broad, 0.5–0.6 mm thick, acuminate (sterile an- men 0.3–0.5 mm long) at the apex, subcordate at the base. Ovary 0.9–1.0 by 0.8 mm, glabrous for the lower 0.3–0.6 mm, sparsely stellate-hirsute for the upper part; stigma conical, with 5 distinct ridges. Fruit unknown.


Young branches stellate-hirsute, older ones probably with longitudinal cork-ridges. Leaves subcoriaceous, oblong, ovate-oblong, or obovate-oblong, 18–25 by 7'/2–11 cm, 9–12-nerved; shortly acuminate at the apex, acute to obtuse at the base; stellate-hirsute, soon glabrescent, with midrib, nerves, and main venation sunken between the bullate intervenium above; stellate-hirsute, hairs rather long persistent, with prominent nerves and main venation, and invisible minor venation beneath; margin recurved. Petiole 6–16 mm. Inflorescences axillary, up to 2 cm, ±−15-flowered, forming a dense cluster; bracts lanceolate, 3 mm long. Pedicel 3–4 mm; bracteoles lanceolate, 2–2'/2 mm long. Sepals 1 & 2 broadly ovate, 2 by 2.2 mm, 4 & 5 transverse-oval, 1.9 by 2.2 mm, stellate-hirsute outside (hairs 2–3-5-branched, branches subequal or one branch somewhat longer, up to 500 μ long). Corolla 8 mm, tube 2 mm; midpedinal field 3.5 by 1.8 mm, rather sparsely stellate-hirsute (hairs with 3–6 subequal, up to 400 μ long branches); lobules 2.8 by 2 mm, rather thin, with distinct venation, entire. Stamens inserted 1 mm above the corolla-base; filament 1 mm long, 0.4 mm broad at the base; anther 1–1.2 mm long, 0.5–0.7 mm broad, 0.4–0.5 mm thick, broadly acute at the apex, slightly cordate at the base. Ovary 1–1.5 by 0.9–1.2 mm, glabrous; stigma conical, with 10 rather distinct ridges. Fruit unknown.

Distr. Malaysia: Borneo (Kuching, Natuna Islands).

Ecol. In primary forests.

Note. In the collection from the Natuna Islands the sepals are completely glabrous outside, the pedicel is stellate-hirsute under the calyx like in the other collections. I do not think this difference to be of great value in this case.


Scandent, younger branches stellate-hirsute, older ones with longitudinal cork-ridges. Leaves elliptic-oblong, 8–12 by 3'/2–5'/2 cm, 5–7-nerved. Obtuse to rounded, short-acuminate at the apex, obtuse at the base; glabrous, with sunken midrib and slightly prominent nerves and venation above; rather sparsely, along midrib densely stellate-hirsute, glabrescent, with prominent nerves and slightly prominent venation beneath. Petiole 6–10 mm. Inflorescences terminal, downward passing into axillary, 3–20, axillary ones −9 cm, 10–40-flowered. Pedicel 1'/2–4 mm. Sepals 1 & 2 orbicular, 2.4 by 2.4 mm, 4 & 5 transverse-oval, 2.4 by 3.2 mm, densely stellate-hirsute outside (hairs with 4–7 subequal, up to 150 μ long branches). Corolla 7'/2 mm, tube 2 mm; midpedinal field 4 by 2.2 mm, densely stellate-hirsute (hairs with unequal, up to 500 μ long branches); lobules 3 by 3.2 mm, with hardly visible venation, entire. Stamens inserted 0.7 mm above the corolla-base; filament 1 mm long, 0.6 mm broad at the base; another 1.5 mm long, 0.8 mm broad, 0.7 mm thick, acuminate (sterile apex 0.6 mm) at the apex, cordate at the base. Ovary 1 by 1.2 mm, rather densely stellate-hirsute; stigma conical, with 10 rather distinct ridges. Fruit unknown.


Ecol. In forests at 450 m.


Scandent, younger branches stellate-hirsute, older ones with distinct longitudinal cork-ridges. Leaves narrowly ovate, up to 14 by 6'/2 cm, 5–7-nerved; obtuse, very slightly acuminate at the apex, obtuse, slightly deciduous at the base; glabrous, with slightly sunken midrib and slightly prominent nerves and venation above; glabrous, with slightly prominent nerves and venation beneath. Petiole up to 10 mm. Inflorescences axillary, up to 10 cm, up to 50-flowered. Pedicel 1–3 mm. Sepals 1 & 2 oval, 2.7 by 2.3 mm, 4 & 5 transverse-oval, 2 by 2.5 mm, rather sparsely stellate-hirsute outside (hairs with (2–)3–4 subequal, up to 250 μ long branches). Corolla pale yellow, 5'/2 mm, tube 1'/2 mm; midpedinal field 2 by 1.6 mm, rather densely hairy (hairs 2–5-branched, branches sub-
equal or one slightly longer and stronger than the others; total length up to 1000 μ; lobules 2 by 2.4 mm, without distinct venation, entire. *Stamens* inserted 0.5 mm above the corolla-base; filament 1.5 mm long, 0.3 mm broad at the base; another 1.4 mm long, 0.8 mm broad, 0.7 mm thick, acuminate (sterile acumen 0.4 mm) at the apex, corolate at the base. *Ovary* 1.3 by 1 mm, glabrous except few hairs at apex; stigma conical, with 5 distinct ridges. Fruit unknown.

**Distr.** *Malaysia*: SW. New Guinea (Utakwa River), once collected at ca 45 m.

33. *Erycibe stapfiana* *Prain*, *J. As. Soc. Beng.* 58, 2 (1894) 87; *ibid.* 74, 2 (1906) 293; *RIDL.* Fl. Mal. Pen. 2 (1923) 448.

Creeper or climber, up to 30 m long, younger branches densely stellate-hirsute, older ones with small orbicular lenticels. *Leaves* coriaceous, elliptic-oblong to oblong, (3-)51/2-15-17) by (1.8-) 2.5-6-(7 1/2) cm, 4-6-7-nerved; acuminated from an obtuse apex, obtuse to rounded, sometimes minutely corolate at the base; densely stellate-hirsute, soon glabrescent, with slightly sunken to prominent midrib, slightly sunken nerves, and faintly prominent venation above; densely stellate-hirsute, soon glabrescent, with prominent nerves and venation beneath. Petiole 3-7 mm. *Inflorescences* axillary, often 2-4 together, 1-4 (in fruit up to 7) cm, 4-25-flowered. Pedicel 11/2-2 mm. *Sepals* 1 & 2 oval to orbicular, 2.5 by 1.6-2.3 mm, 4 & 5 orbicular to transverse-oval, 1.8-2.2 by 1.8-2.5 mm; rather sparsely stellate-hirsute outside (hairs with 5-8 subequall, up to 300 μ long branches). *Corolla* pale waxy white, 61/2-8 mm, tube 21/2-2 mm; midpetaline field 2.6-4 by 1.6-1.8 mm, rather densely stellate-hirsute (hairs with 5-8 subequall, up to 350 μ long branches); lobules 21/2-3 1/2 by 2-2 1/2 mm, with rather distinct venation, entire or slightly crenate at the margin. *Stamens* inserted 0.7-1.2 mm above the corolla-base; filament 0.7-1 mm long, 0.4 mm broad at the base; another 1.3-1.6 mm long, 0.7-0.8 mm broad, 0.5-0.6 mm thick, acuminate (sterile acumen 0.3 mm) at the apex, corolate at the base. *Ovary* 0.7-1.2 by 0.8-1.3 mm, densely short-stellate-hirsute for the upper part, glabrous for lower 0.2-0.7 mm; stigma conical, with 5 distinct ridges. *Fruit* obpyriformal, 38 by 22 mm, dark brown or dark reddish brown, with dense very short indument. Cotyledons plain.

**Distr.** Peninsular Burma, *Malaysia*: Malay Peninsula (Perak, Pahang).

**Ecol.** In dense jungle up to 1200 m.


Scandent shrub or large liana, younger branches stellate-hirsute, older ones with longitudinal cork-ridges. *Leaves* subcoriaceous, elliptic to ovate or oblong, (21/2-4-8-11) by (1-)2-4 1/2- (-6-) 1/2 cm, 5-7-nerved, rounded to obtuse, rarely to acuminate at the apex, obtuse to rounded, sometimes slightly cordate at the base; rather densely stellate-hirsute, soon glabrescent, with sunken midrib, faintly sunken to faintly raised nerves, and indistinct to faintly raised nerves above; densely stellate-hirsute, soon glabrescent, with faintly sunken to slightly raised nerves and venation beneath. Petiole 4-10 mm. *Inflorescences* axillary, sometimes 2 together, 11/2-12 1/2 cm, 10-50-flowered. Pedicel 11/2-4 mm. *Sepals* 1 & 2 oval to orbicular, 1.7-1.8 by 1.7 mm, 4 & 5 orbicular, 1.6 by 1.6 mm, to transverse-oval, 1.5-1.6 by 2-2.2 mm, densely stellate-hirsute outside (hairs with 4-7 subequall, up to 300 μ long branches). *Corolla* 5-6 mm, tube 1.2-2 mm; midpetaline field 2.5 by 1.8-2 mm, rather densely stellate-hirsute (hairs with 4-8 unequal branches, the largest up to 700 μ long); lobules 1.7-2.8 by 1.6-2 mm, without distinct venation, entire, sometimes coherent above the midpetaline field for up to 1 mm. *Stamens* inserted 0.7 mm above the corolla-base; filament 0.6 mm long, 0.3 mm broad at the base; another 0.7-0.9 mm long, 0.5 mm broad, 0.4 mm thick, obtuse at the apex, corolate at the base. *Ovary* 0.9 by 0.7 mm, glabrous in the lower 0.4-0.6 mm, stellate-hirsute for upper part; stigma conical, with 5 distinct and 5 low ridges. *Fruit* oval, 15 by 13 mm, orange-red or bronze-yellow. Cotyledons plain.

**Distr.** *Malaysia*: E. New Guinea.

**Ecol.** In forests from sea-level up to 700 m.


Woody climber, younger branches densely stellate-hirsute, older ones with distinct longitudinal cork-ridges. *Leaves* elliptic-oblong to oblong or ovate-oblong, 4-10 1/2 by 1.8-3.6 cm, 6-8-nerved; acuminate from an obtuse to acute apex, obtuse to rounded at the base; densely stellate-hirsute, soon glabrescent, with slightly sunken midrib and faintly to distinctly prominent nerves and venation above; densely stellate-hirsute, glabrescent (indumentum rather long persistent along midrib and nerves), with prominent nerves and venation beneath. Petiole 5-7 mm. *Inflorescences* axillary, 2-12 cm, 5-25-flowered. Pedicel 1-2 mm. *Sepals* transverse-oval, 1 & 2 2-2.3 by 2.4-2.5 mm, 4 & 5 1.9-2 by 2.3 mm, densely stellate-hirsute outside (hairs with 4-7 subequall, up to 250 μ long branches). *Corolla* 6 1/2 mm, tube 2 mm; midpetaline field 3 1/2 by 2 mm, rather densely appressed-hairy (hairs 4-6-branched, branches subequall or one faintly longer and stronger, up to 550 μ long); lobules 2.5 by 2.7 mm, rather thin, with faintly distinct venation, faintly crenulate at margin, coherent above midpetaline field for 0.8 mm. *Stamens* inserted 0.6 mm above the corolla-base; filament 1.2 mm long, 0.4 mm broad at the base; another 1 mm long, 0.5 mm broad, 0.4 mm thick, acute at the apex, faintly corolate at the base. *Ovary* 1.2 by 0.9 mm, glabrous for the lower 0.8 mm, stellate-hirsute for the upper part; stigma conical, with 10 distinct ridges. Fruit unknown.


Key to the varieties

1. Leaves 9–22 by 31/2–9 cm. Sepals very sparingly stellate-hirsute outside (branches of the hairs up to 200 μ long) . . . var. borneensis
2. Leaves 8–12 by 21/2–5 cm. Sepals rather densely stellate-hirsute outside (branches of the hairs up to 500 μ long) . . . . var. collina

var. borneensis.

Shrub or small tree, up to 5 m by 71/2 cm. younger branches densely stellate-hirsute, older ones terete, with very few orbicular lenticels, sometimes with some longitudinal slightly corky ridges. Leaves subcoriaceous, oblong, 9–22 by 31/2–9 cm, 6–8-nerved; acumen from an obtuse apex, obtuse to acutish at the base; rather sparingly stellate-hirsute, soon glabrescent, with slightly sunken midrib, faintly sunken nerves, and indistinct venation above: rather densely stellate-hirsute, glabrescent, with slightly prominent nerves and faintly prominent to indistinct venation beneath. Petiole 5–10 mm. Inflorescences axillary, up to 2 cm, (1–)2–12-flowered. Pedicel 1–2 mm. Sepals 1 & 2 orbicular, 2.2–2.3 by 2.2–2.3 mm, 4 & 5 transverse-oval, 2.2–2.3 by 2.6–2.8 mm, 1 & 2 very sparingly stellate-hirsute (hairs with 3–6 subequal, up to 200 μ long branches), 4 & 5 glabrous outside. Corolla 8–81/2 mm, tube 2 mm; midpetaline field 3.2–4 by 1.6–1.9 mm, rather sparingly stellate-hirsute, in the lower part (1–2 mm) only along the margin (hairs 3–4–7–8–branched, branches subequal or, usually, one stronger and longer, up to 500 μ long); lobules 3.2–4 by 2–2.5 mm, rather thin, with slightly distinct venation, entire. Stamens inserted 0.8–1 mm above the corolla-base; filament 1–1.2 mm long, 0.4–0.5 mm broad at the base; anther 1–1.3 mm long, 0.6–0.8 mm broad, 0.5 mm thick, acute to obtuse at the apex, slightly cordate at the base. Ovary ovoid, 1.1–1.7 by 1–1.7 mm, glabrous; stigma conical, with 5 distinct and 5 rather low ridges. Fruit unknown.

Distr. Malaysia: Borneo (mainly collected in Br. N. Borneo).
Ecol. In lowland forest.

var. collina Hoogl. Blumea 7 (1953) 310.

Shrub-like tree. up to 12 m by 30 cm. Leaves 8–12 by 21/2–5 cm. Sepals rather densely stellate-hirsute outside (branches up to 500 μ long). Distr. Malaysia: Borneo (Mt Kinabalu in Br. N. Borneo and Mt Irekan in Sarawak).
Ecol. In forests from 600 to 1200 m.

Note. Var. collina differs slightly from var. borneensis by the characters given above. The leaves are usually rather silvery shining (like in E. glomerata Bl.) in var. collina. A single intermediate not localized Bornean collection is MOTLEY 6.


Liana, up to 50 m by 10 cm, young branches stellate-hirsute, older ones rather smooth with few to many orbicular lenticels. Leaves coriaceous, elliptic-oblong to oblong, ca 6–15 by 21/2–7 cm, 4–6–(7–)nerved; acumen at the apex, obtuse to rounded at the base; glabrous, with slightly sunken midrib, nerves, and major venation, usually indistinct minor venation above; glabrous, with slightly sunken to slightly prominent nerves and distinctly sunken venation beneath; margin slightly recurved. Petiole 5–8 mm. Inflorescences axillary, 1–4 cm, (1–)2–5–(10–)flowered. Flowers very fragrant. Pedicel 1 mm. Sepals 1 & 2 about orbicular to transverse-oval, 2–2.3 by 2.5–2.8 mm, 4 & 5 transverse-oval, 2–2.5 by 3–3.5 mm, densely stellate-hirsute outside (hairs with 5–11 subequal, up to 300 μ long branches, pale brown when dry). Corolla light or bright yellow, 7–81/2 mm, tube 2–21/2 mm; midpetaline field 3.3–4 by 2.3–2.4 mm, lower part stellate-hirsute (hairs with 5–10 subequal, up to ca 250 μ long branches), upper part appressed-hairy (hairs with 4–8 branches, one distinctly longer and stronger, up to 750 μ long) lobules 3.4 by 2.8–3.5 mm, entire, coherent above the midpetaline field for 1/2 mm. Stamens inserted 0.7–0.8 mm above the corolla-base: filament 0.6–0.7 mm long, 0.5–0.7 mm broad at base; anther 0.8–1 mm long, 0.6–0.8 mm broad, 0.4 mm thick, acuminate (sterile acumen 0.2 mm) at the apex, slightly cordate at the base. Ovary 1 by 1–1.3 mm, glabrous or shortly hirsute at the extreme apex; stigma conical, with 10 ridges. Fruit ellipsoid or oboypyriform with rounded apex and base, 24 by 17 mm, with scurvy surface. Cotyledons plain.

Distr. Malaysia: Sumatra and Malay Peninsula.
Ecol. In open jungle up to 750 m.
Vern. Langsat hutan, Pahang (= woodland Lansium).
Uses. Medicinal use is unimportant (cf. Burkhill, i.e.).


Climbing shrub, younger branches stellate-hirsute, older ones with few orbicular lenticels. Leaves coriaceous, ovate-oblong to obovate-oblong, (10–)14–20 by 6–9 cm, 6–7–(8–)nerved, obtuse to acute, short-acuminate at the apex, rounded to obtuse, rarely acute at the base; rather densely stellate-hirsute, soon glabrescent, with slightly prominent midrib, nerves, and venation above; rather densely stellate-hirsute, glabrescent, with prominent nerves and faintly prominent to indistinct venation beneath. Petiole (6–)10–16 mm. Inflorescences terminal or axillary, 11/2–12 cm, 5–50-flowered. Pedicel 11/2–5 mm. Sepals trans-
verse-oval, 1 & 2 2-2.3 by 3-3.5 mm, 4 & 5 2.3-2.8 by 3.5-4.8 mm, rather sparsely stellate-hirsute (hairs with 4-8 subequal, up to 300 μ long branches) in basal part outside, all glabrous along margins. *Corolla* 9-11 mm, tube 2½/3-3 mm; midpetaline field 5-6 by 2.6-3.7 mm, densely appressed-hirsute (hairs with 4-8 branches, one distinctly stronger and longer, up to 600 μ long); lobules 4-4½ by 4-5 mm, rather thin, with rather distinct venation, crenulate at margin. *Stamens* inserted 1-1½/2 mm above the corolla-base; filament 0.8-1 mm long, 0.5-0.7 mm broad at base; anther 1.7-2 mm long, 0.6-1 mm broad, 0.4-0.5 mm thick, acute to acuminate at the apex (sterile part 0.3-0.6 mm), cordate at the base. *Ovary* 1-1½ by 1.2-1.8 mm, glabrous or densely short-hirsute; stigma conical, with 10 distinct ridges. *Fruit* ellipsoid, 22 by 14 mm, glabrous or rather sparsely short-appressed-hairy. Cotyledons plain.

Distr. Lower Burma, S. Siam, in *Malaysia*: Malay Peninsula (Kedah, Penang).

Ecol. At low altitudes up to 300 m. Vern. *Kion, kokit*, Peninsular Siam.


Large climber or creeper, up to 20 m long, rarely a small, crooked tree, younger branches stellate-hirsute, older ones with few orbicular lenticels. *Leaves* thick subcoriaceous, elliptic-oblong to oblong or obovate-oblong, (7½/2–)12–24 (–30) by (3½/2)5½/2–10–14 cm, (5–)7–11/2–14 mm, rather shortly acuminate from an obtuse apex, obtuse to rounded or slightly cordate at the base; glabrous, with faintly prominent midrib, nerves, and venation above; sparsely stellate-hirsute, soon glabrescent, with prominent nerves and slightly prominent venation beneath. *Petiole* 8–15 mm. *Inflorescences* terminal, often with some leaves in basal part, downward passing into petiole 1–23 cm, 5–200-flowered. Pedicel 1½/2–5 mm. *Sepals* 1 & 2 broadly ovate to orbicular or transverse-oval, 2.3–3.2 by 2.4–2.2 mm, 4 & 5 transverse-oval, 1.8–3.1 by 2.5–4.5 mm, rather densely stellate-hirsute outside (hairs with 3–4(–6)–8 subequal, up to 250 μ long branches). *Corolla* white or cream-coloured, 7–9 mm, tube 2–3 mm; midpetaline field 3–4 by 1.8–2.8 mm, rather densely stellate-hirsute (hairs with (3–)4–6–8 branches, subequal, up to 200 μ long, or one stronger branch up to 400 μ long); lobules 2.2–3.5 by 2.2–3.5 mm, rather thick, without distinct venation, slightly crenate at margin. *Stamens* inserted 0.8–1.2 mm above the corolla-base; filament 0.7–1 mm long, 0.5–0.8 mm broad at the base; anther 1.9–2.5 mm long, 0.7–0.9 mm broad, 0.5–0.6 mm thick, acuminate (sterile acumen 0.3–0.8 mm) at the apex, cordate at the base. *Ovary* 1–2 by 0.8–2 mm, glabrous or lower part glabrous, upper part stellate-hirsute; stigma conical, with 10 distinct ridges. *Fruit* ellipsoid, 20 by 12 mm, dirty yellow-brownish or blue, glabrous or with some stellate hairs near apex. Cotyledons plain.


Ecol. In scrub, young forest, or swampy forest at low altitudes (100–250 m).

Uses. Medicinal use is unimportant (cf. Burkull)

Note. E. macrophylla Hallier f. is a closely related species; cf. under that species.


Woody climber, younger branches stellate-hirsute, older ones with distinct longitudinal cork-ridges. Leaves oval to elliptic-ovate, 2½–8 by 1½–5 cm, 3–4(–5)-nerved; obtuse to acute, often slightly acuminate at the apex, obtuse to rounded, sometimes minutely cordate at the base; rather sparsely stellate-hirsute, glabrescent, with slightly sunken midrib and slightly raised nerves and venation above; stellate-hirsute, indumentum rather long persistent, with slightly prominent nerves and venation beneath. Petiole 3–7 mm. Inflorescences terminal, usually with some leaves in the basal part, upward often with reduced leaves along the axis, 4–30 by 1½–10 cm, 10–250–flowered. Flowers fragrant. Pedicel 1–2 mm. Sepals oval, 2.6–3 by 2.2–2.5 mm, densely stellate-hirsute outside (hairs with 3–5 branches, subequal or one longer up to 500 μ long). Corolla white, 7½–9½ mm, tube 2½ mm; midpetaline field 3.5–4.5 by 2–2.4 mm, densely appressed-hairy (hairs mainly 3-branched, few with 2 or more branches, generally one stronger, up to 900 μ long branch); lobules 2.8–4 by 2.5–3.5 mm, rather thick, without distinct venation, entire. Stamens inserted 1 mm above the corolla-base; filament 0.7–0.8 mm long, 0.3–0.4 mm broad at the base; anther 1.5–1.7 mm long, 0.8 mm broad, 0.7 mm thick, acuminate at the apex (sterile acumen 0.6–0.7 mm), slightly cordate at the base. Ovary 0.8 by 1 mm, glabrous; stigma conical, with 5 distinct ridges. Fruit ellipsoid, 12 by 6 mm, glabrous. Cotyledons plain.

Distr. Lower Burma (from Moulmein S. wards), Peninsular Siam, Nicobar Islands, in Malaysia: Malay Peninsula (N. part, S. to Penang).

Ecot. In scrub at low altitude.

Vern. Lin sua, sai lua, yan pao kün, Peninsular Siam.

Uses. The stems are used by fishermen for ropes (Tavoy).

Note. A closely related species, not found in Malaysia, is E. pugnacens (Clarke) Prain from Northern Burma (Chittagong to Moulmein). Northern Siam, and the Andaman and Nicobar Islands. The only record of the present species from the Nicobar Islands is a badly labelled old fragmentary specimen.


Key to the varieties

1. Leaves ovate-, elliptic- or obovate-oblong, 5–14(–18) by 2½–5½(–8½) cm, 5–8-nerved. Sepals outside with 2–5-branched hairs with subequal, up to 500 μ long branches. Midpetaline field with hairs with one stronger, up to 1500 μ long branch . . . var. tomentosa

2. Leaves ovate or ovate-oblong, 4–9 by 1½–4 cm, 5–6-nerved. Sepals outside with 2–4-branched hairs with one stronger, up to 1000 μ long branch. Stronger branch of hairs of midpetaline field up to 2000 μ long . . . var. hirsuta

var. tomentosa.—E. tomentosa Bl. 1826.—E. princeps Wall. ex Choisy 1834.—E. canptobotrya Mio. 1861.—E. purivfolia Hallier f. 1897.—Fig. 18.

Creeper, climber, up to 25 m long, or shrub, up to 3 m high, younger branches densely stellate-hirsute, glabrescent, older ones with distinct longitudinal cork-ridges. Leaves ovate-oblong, elliptic-oblong, or obovate-oblong to oblong, 5–14(–18) by 2½–5½(–8½) cm, 5–8-nerved; broad-acute to rounded, usually distinctly acuminate at the apex, obtuse to rounded, usually slightly cordate at the base; densely stellate-hirsute, soon glabrescent, with slightly sunken midrib and faintly prominent to, rarely, slightly sunken nerves and venation above; densely stellate-hirsute, glabrescent, with slightly prominent nerves and slightly to faintly prominent venation beneath. Petiole 3–5(–6) mm. Inflorescences axillary, near the apex of the branches passing into terminal, 1–4, terminal ones up to 7 cm long, 3–15(–25)-flowered. Pedicel 1½–3 mm, with small rather broad caducous bracteoles. Sepals 1 & 2 orbicular to transverse-oval, 3.5–4.8 by 3.7–5 mm, 4 & 5 transverse-oval, 3.5–4 by 4.2–5 mm, rather sparsely stellate-hirsute outside (hairs with 2–5 subequal, up to 500 μ long branches). Corolla white, 7–9 mm, tube 2½–3 mm; midpetal-
Fig. 18. Erycibe tomentosa Bl. var. tomentosa.—a. Flowering branch, × 3/4, b. fruiting branch, × 3/4, c. flower from aside, × 2, d. one of two outer, e. one of two inner sepals, × 4, f. corolla-lobes from inside, × 3, g. ovary, lateral view, × 7/2, h. stigma, apical view, × 7 1/2, j. ovary, longitudinal section, × 7 1/2, k. fruit, transverse section, × 2.
ine field 3.7–4.3 by 2.2–2.8 mm, densely appressed-hairy (hairs 2–4-branched with one stronger and longer, up to 1500 μ long branch) with generally (in dry state) ± orange coloured hairs; lobules 2.7–3.2 by 3–4 mm, rather thick, without distinct venation, slightly crenate at margin, coherent above the midpetaline field for 1–1 1/2 mm. Stamens inserted at 0.8–1.2 mm above the corolla-base; filament 1–1.4 mm long, 0.4–0.5 mm broad at the base; anther 1.3–2 mm long, 0.6–0.8 mm broad, 0.4–0.5 mm thick, acute to acuminate at the apex, cordinate at the base. Ovary 1–1.2 by 1.3–1.5 mm, glabrous; stigma conical, with 5 distinct ridges. Fruit ellipsoid to ovoid, 12 by 7 mm, glabrous, smooth, orange to red, at maturity black. Cotyledons plain.

Distr. Malaysia: Sumatra, Malay Peninsula, W. Java, Madura, Kangean Islands, Borneo, Philippines (Leyte).

Ecol. In scrub or forest, up to 1200 m altitude.


Uses. The long slender stems are strong enough to be used for binding fences.

var. hirsuta (HALLIER f.) HOOG. stat. nov.—E. hirsuta HALLIER f. 1913.—E. dolichotricha MERR. 1934.

Differs from var. tonentosa by the following characters:

Leaves smaller, ovate-oblong or ovate, 4–9 by 11 1/2–4 cm, 5–6-nerved. Sepals outside with 2–4-branched hairs, with one stronger up to 1000 μ long branch. Stronger branch of hairs of midpetaline field up to 2000 μ long.

Distr. Malaysia: Sumatra (E. Coast), Malay Peninsula (Singapore), Borneo, up to 1000 m.

Note. The two varieties have often a marked different habit. The hairs of the younger branches agree with those of the outer side of the sepal, and give in var. hirsuta the branches a strongly hirsute appearance. A few collections are more or less intermediate between the two varieties.

43. Erycbe grandiflora ADEL.B. in HOOG. Blumea 7 (1953) 313.

Scandent shrub or liana. Branches densely stellate-hirsute, older ones with longitudinal cork-ridges. Leaves subcoriaceous, ovate to ovate-oblong or oblong, 5–18 by 11 1/2–7 cm, 4–7-nerved; obtuse to acute, usually more or less acuminate at the apex, obtuse to rounded, sometimes slightly cordate at the base; sparsely stellate-hirsute to nearly glabrous, glabrescent, with slightly sunken midrib and slightly prominent nerves and venation above; stellate-hirsute on the interveinum, rather densely so on the midrib and nerves, rather soon glabrescent, with slightly prominent nerves and venation beneath. Petiole 5–7 mm. Inflorescences axillary, near the end of the branches sometimes passing into terminal, then often with some leaves in basal part, 11 1/2–4 (–10) cm, 8–50-flowered. Pedicel 11/2–4 mm. Sepals orbicular to transverse-oval, 3.8–5 by 4–5 mm, rather densely stellate-hirsute outside (hairs with 3–6 subequal, up to 500 μ long branches). Corolla creamy white, light yellowish, or light greenish, 9–10 mm, tube 3–4 mm; midpetaline field 4.3–5 by 2.8–3.2 mm, rather densely appressed-hairy (hairs usually with strong central branch, up to 1300 μ long, and 1–3 smaller basal branches); lobules 3.2–3.5 by 2.5–4 mm, without distinct venation, slightly crenulate or undulate at the margin. Stamens inserted 0.8–1.2 mm above the corolla-base; filament 0.8–1 mm long, 0.5–0.6 mm broad at the base; anther 1.6 mm long, 0.6–0.8 mm broad, 0.5–0.7 mm thick, narrowly acute at the apex (sterile for 0.2–0.6 mm), cordinate at base. Ovary 0.8–1 by 1.7–1.8 mm, glabrous; stigma conical, with 5 densely warty ridges. Fruit ovoid, 11/2 by 1 cm, glabrous, smooth, bright red. Cotyledons plain.


Ecol. In second growth scrub vegetation (Biak), at low altitude.

44. Erycbe beccariana HOOG. Blumea 7 (1953) 310.

Liana, younger branches rather sparsely stellate-hirsute, older ones with longitudinal cork-ridges. Leaves subcoriaceous, elliptic to elliptic-oblong, 9–15 by 4–7 1/2 cm, 8–10-nerved; slightly acuminate at the apex, obtuse to rounded, sometimes slightly cordate at the base; glabrous, with slightly sunken midrib and prominent nerves and venation above; sparsely stellate-hirsute, soon glabrescent, with prominent nerves and slightly prominent venation beneath. Petiole 8–13 mm. Inflorescences axillary, 1–2 cm, 6–12-flowered. Pedicel 2–4 mm. Sepals transverse-oval, 1 & 2 ca 2.5 by 3–3.2 mm, 4 & 5 2.7–2.8 by 4.5–5 mm, stellate-hirsute outside (hairs with 3–5 subequal, up to 400 μ long branches). Corolla 8 1/2 mm, tube 2 1/2 mm; midpetaline field 4 by 3 mm, densely appressed-hairy (hairs 4–6-branched, often one branch stronger, up to 700 μ long); lobules 3.6 by 3 mm, without distinct venation, undulate at the margin. Stamens inserted 1–1 1/2 mm above the corolla-base; filament 1.5–1.7 mm long, 0.5–0.6 mm broad at the base; anther 2.2–2.3 mm long, 0.9–1 mm broad, 0.8 mm thick, acuminate (sterile acumens 0.5–0.6 mm) at the apex, slightly cordate at the base. Ovary 1–1.1 by 1.8 mm, glabrous; stigma conical, with 5 rather distinct and 5 faint ridges. Fruit ellipsoid, 22 by 9 mm, glabrous, smooth. Cotyledons plain.


—E. celebica HALLIER f. in ELBERT, Sunda-Exp. (1912) 286. nomen.
Creeper or climber, up to 30 m, or scandent shrub, up to 3 m, younger branches densely stellate-hirsute, older ones with distinct longitudinal cork-ridges. Leaves ovate to elliptic or oblong, 5-16 by 21/2-61/2 cm, 4-6(-7)-nerved; obverse to rounded, generally distinctly acuminate at the apex, obverse to rounded, sometimes slightly cordate at the base; densely stellate-hirsute, soon glabrescent, with slightly sunken midrib and slightly prominent nerves and venation above; densely stellate-hirsute, soon glabrescent, with prominent nerves and venation beneath. Petiole 5-10 mm. Inflorescences axillary, sometimes 2 together, 3-9 cm, 10-40-flowered. Pedicel 1'-4 mm. Sepals transverse-oval, 1 & 2 2-2.5 by 2.3-3.2 mm, 4 & 5 1.8-2.3 by 2.1-3 mm, rather densely stellate-hirsute outside (hairs with 3-8 subequal, up to 300 μ long branches), Corolla cream-yellowish, 61'2-81/2 mm, tube 11/2-2 mm, midpetaline field 3-5 by 2-2.8 mm, rather densely stellate-hirsute (hairs with 4-8 branches, usually one stronger and longer, up to 850 μ long); lobules 2.3-3.5 by 2.4-3 mm, with rather distinct venation, entire. Stamens inserted 0.7-0.8 mm above the corolla-base; filament 0.7-1.2 mm long, 0.3-0.5 mm broad at the base; another 0.8-1 mm long, 0.5-0.7 mm broad, 0.3-0.5 mm thick, obverse at the apex, slightly cordate at the base. Ovary 0.7-1.3 by 0.8-1 mm, glabrous for lower 0.5-0.7 mm, short-hirsute in the upper part; stigma conical, with 5 ridges. Fruit unknown.

**Distr.** Malaysia: E. New Guinea.

Ecot. In forest at 600 m (once noted).

47. **Erycibe schlechteri** Pilger, Bot. Jahrb. 59 (1924) 85.

Scandent, younger branches densely stellate-hirsute, older ones with longitudinal cork-ridges. Leaves ovate-oblong to oblong, 5-9 by 2.4-3.3 cm, 4-6-nerved, obverse to acute, slightly acuminate at the apex, obverse to rounded at the base; rather densely stellate-hirsute, soon glabrescent, with very slightly sunken midrib and indistinct to faintly prominent nerves and venation above; densely stellate-hirsute, rather late glabrescent, with prominent nerves and slightly prominent venation beneath. Petiole 4-6 mm. Inflorescences crowded near the end of the branches. about 3 in the axil of each of the one or two upper leaves. 4-8 cm, 20-40-flowered, with small leafy bracts up to 12 by 5 mm along the main branch. Flowers known only in old bud stage. Pedicel 1-3 mm. Sepals 1 & 2 obovate, 3 by 2.7 mm, 4 & 5 transverse-oval, 2.6 by 3.2 mm, densely stellate-hirsute outside (hairs 4-6(-7)-branched, branches subequal, sometimes one stronger, up to 700 μ long branch). Corolla (not fully expanded) 6 mm, tube 1'/2 mm, midpetaline field 2.5 by 1.8 mm, densely appressed-hairy (hairs with 3-4 branches, generally one branch distinctly longer and stronger, up to 1250 μ long); lobules 2.2 by 2 mm, without distinct venation, entire. Stamens inserted 0.5 mm above the corolla-base; filament 0.3 mm long, 0.5 mm broad at the base; another 1.5 mm long, 0.6 mm broad, 0.4 mm thick, acuminate (sterile 0.3 mm) at the apex, cordate at the base. Ovary 0.8 by 1.3 mm, densely stellate-hirsute over the whole surface; stigma conical, with 5 ridges. Fruit unknown.

**Distr.** Malaysia: NE. New Guinea.

48. **Erycibe puberula** Hoogland Blumea 7 (1953) 316.

Liana, younger branches stellate-hirsute, older ones with longitudinal cork-ridges. Leaves elliptic-oblong to oblong, 6-14 by 3-8 cm, 6-7-nerved, densely stellate-hirsute, rather soon glabrescent, with prominent nerves and venation beneath. Petiole 5-10 mm. Inflorescences axillary, sometimes 2 together, 3-9 cm, 10-40-flowered. Pedicel 1'-4 mm. Sepals transverse-oval, 1 & 2 2-2.5 by 2.3-3.2 mm, 4 & 5 1.8-2.3 by 2.1-3 mm, rather densely stellate-hirsute outside (hairs with 3-8 subequal, up to 300 μ long branches), Corolla cream-yellowish, 61'2-81/2 mm, tube 11/2-2 mm, midpetaline field 3-5 by 2-2.8 mm, rather densely stellate-hirsute (hairs with 4-8 branches, usually one stronger and longer, up to 850 μ long); lobules 2.3-3.5 by 2.4-3 mm, with rather distinct venation, entire. Stamens inserted 0.7-0.8 mm above the corolla-base; filament 0.7-1.2 mm long, 0.3-0.5 mm broad at the base; another 0.8-2 mm long, 0.5-0.7 mm broad, 0.3-0.5 mm thick, obverse at the apex, slightly cordate at the base. Ovary 0.7-1.3 by 0.8-1 mm, glabrous for lower 0.5-0.7 mm, short-hirsute in the upper part; stigma conical, with 5 ridges. Fruit unknown.

**Distr.** Malaysia: E. New Guinea.

Ecot. In forest at 600 m (once noted).
obtuse, often slightly acuminate at the apex, obtuse at the base; glabrous, with slightly prominent midrib and faintly prominent nerves and venation above; densely stellate-hirsute on midrib and nerves, glabrescent on nerves, glabrous on the interveinum, with sharply prominent nerves and slightly prominent venation beneath. Petiole 8–15 mm. **Inflorescences** axillary, near the end of the branches sometimes passing into terminal, (2½–)4–10 cm, (10–)25–80-flowered. Pedicel 1–4 mm. **Sepals** 1 & 2 orbicular, 2.5 by 2.5 mm, 4 & 5 transverse-oval, 2.2 by 2.7 mm, densely stellate-hirsute outside (hairs with 5–8 subequal, up to 200 μ long branches). **Corolla** 6 mm, tube 2 mm; midpetaline field 2.5 by 1.8 mm, rather densely stellate-hirsute (hairs with 3–5 branches, usually one stronger and longer, up to 450 μ long); lobules 2 by 2½–3 mm, without distinct venation, crenulate at the margin. **Stamens** inserted 1½ mm above the corolla-base; filament 0.8 mm long, 0.4 mm broad at the base; anther 1.2 mm long, 0.7 mm broad, 0.4 mm thick, acuminate (sterile acumen 0.5 mm) at the apex, cordate at the base. **Ovary** 0.7 by 1.2 mm, lower half glabrous, upper half slightly stellate-hirsute; stigma conical, with 5 more or less distinct ridges. **Fruit** ellipsoid, 18 by 10 mm, glabrous except few hairs near the apex. Cotyledons plain.

**Distr. Malaysia:** NW. New Guinea (twice collected near Bernhard bivouac).

**Ecol.** In forest, 50 and 1200 m altitude.


Liana, young branches stellate-hirsute, older ones with distinct longitudinal cork-ridges. **Leaves** rather thin, elliptic-oblong to ovate-oblong, 7½–16 by 4–6½ cm, 4–7-nerved; obtuse at the base, slightly acuminate at the apex; stellate-hirsute, soon glabrescent, with sunken midrib and slightly prominent nerves and venation above; stellate-hirsute, soon glabrescent, with prominent nerves and venation beneath. Petiole 7–11 mm. **Inflorescences** axillary, 1–2½ cm, 8–12-flowered. Pedicel 2½–4 mm long. **Sepals** subequal, transverse-oval, 2.7 by 3.5 mm, stellate-hirsute outside (hairs with 3–5 subequal, up to 400 μ long branches). **Corolla** waxy yellow, 8 mm, tube 2½ mm; midpetaline field 4 by 2 mm, densely appressed-hairy (hairs mainly 2–, few 3-branched, up to ca 1250 μ total length); lobules 3.8 by 3 mm, without distinct venation, entire. **Stamens** inserted 0.8 mm above the corolla-base; filament 1 mm long, 0.6 mm broad at the base; anther 1.8 mm long, 1 mm broad, 0.7 mm thick, acuminate (sterile acumen 0.5 mm) at the apex, cordate at the base. **Ovary** 1.4 by 1.1 mm, lower 0.8 mm glabrous, upper 0.6 mm stellate-hirsute; stigma conical, with 10 ridges. **Fruit** unknown.

**Distr. Malaysia:** SE. New Guinea (Lower Fly River), once collected.

**Ecol.** Liana in canopy layer of rain-forest at low altitude.


Scendent shrub, younger branches rather densely stellate-hirsute, soon glabrescent, older ones with distinct longitudinal cork-ridges. **Leaves** elliptic to oblong, 6–13 by 2½–6½ cm, 5–7-nerved; obtuse to acute, usually slightly acuminate at the apex, obtuse to rounded, sometimes slightly cordate at the base; glabrous on both sides; with slightly sunken midrib and slightly prominent nerves and venation above; with prominent nerves and venation beneath. Petiole 6–12 mm. **Inflorescences** axillary, sometimes 2–(3) together, 1½–6 cm, 5–50-flowered. Pedicel 2–4 mm. **Sepals** 1 & 2 orbicular to transverse-oval, 3–3½ by 3–4 mm, 4 & 5 transverse-oval, 3–3½ by 4–4½ mm, rather sparsely to rather densely stellate-hirsute outside (hairs with 3–8 subequal, up to 500 μ long branches). **Corolla** yellow, 8 mm, tube 2–3 mm; midpetaline field 2.8–3.5 by 2.5 mm, densely appressed-hairy (hairs 2–3–6–9) branched with generally one stronger, up to 1000 μ long branch); lobules 3–3½ by 3 mm, rather thick, without distinct venation, faintly crenulate at margin. **Stamens** inserted 0.8–1.3 mm above the corolla-base; filament 0.7–1 mm long, 0.8 mm broad at the base; anther 1.9–2 mm long, 0.8–1 mm broad, 0.5–0.6 mm thick, acuminate at the apex (sterile acumen 0.5–0.6 mm), cordate at the base. **Ovary** ellipsoid, 1.2 by 1.7–2.2 mm, glabrous for the lower 0.3–0.4 mm, appressed-hairy for the upper part; stigma conical, with 5 distinct and 5 faint ridges. **Fruit** ellipsoid, 1.7 by 1.1 mm, glabrous except for some hairs at the extreme apex, smooth. Cotyledons plain.

**Distr. Malaysia:** Moluccas (Ceram, Ambon).

**Ecol.** Seashore (once noted).


Liana, up to 45 m long, older branches with distinct longitudinal cork-ridges. **Leaves** coriaceous, elliptic-oblong, 7–12 by 3–5 cm; acuminate from an obtuse to broad-acute apex, obtuse at the base; glabrous on both sides; with slightly sunken midrib, nerves, and venation above; with slightly sunken nerves and venation beneath. Petiole 7–14 mm. **Inflorescences** axillary, few-flowered (1–3-fruited), up to 1½ cm long. Flowers unknown. Fruiting pedicel 6–10 mm. **Sepals** (in fruit) transverse-oval, 4 by 5 mm, sparsely strigose outside (hairs 2-branched, up to 400 μ total length), **Fruit** ellipsoid, 17 by 12 mm, glabrous, lower ½–3½ part smooth, upper ½–3½ part scurfy. Cotyledons plain.

**Distr. Malaysia:** Br. N. Borneo (Mt Kinabalu), once collected.

**Ecol.** On edge of jungle at ca 1000 m altitude.


Large liana, younger branches stellate-hirsute, older ones with longitudinal cork-ridges. **Leaves** elliptic-oblong, 6–12 by 3½–6½ cm, 4–5-nerved, obtuse to subacute, slightly acuminate at the apex, obtuse at the base; rather densely stellate-hirsute, soon glabrescent, with slightly sunken midrib, faintly sunken nerves, and indistinct venation...
above; densely stellate-hirsute, later on floccosely glabrescent; indumentum long-persistent along the midrib and nerves, with prominent nerves, faintly prominent major venation, indistinct minor venation beneath. Petiole 5–12 mm. Inflorescences axillary, sometimes 2 together, up to 6 cm, ca 10-flowered. Flowers unknown. Sepals (in fruit) 4–6 mm. Transverse-oval, 1 & 2 2.2–2.5 by 3–3.2 mm, 4 & 5 2.2–2.5 by 3–3.7 mm, rather densely stellate-hirsute (hairs with 3–5 subequal, up to 250 μ long branches). Fruit ovoid, 7 by 5 mm, glabrous except for some short stellate hairs near the apex.


Excluded

E. paniculata Roxb. has been reported from Malaysia several times. This species, however, is restricted to India and close surroundings and has never been collected in Malaysia. All records of it appear to refer to other species.

E. paniculata var. coccinea F. M. Bail. [E. coccinea (F. M. Bail.) Hoogl.] is endemic in Northern Queensland. It is recorded from New Guinea (Queensl. Agric. J. 23, 1909, 219). I have not seen the specimen on which this record has been based, but I doubt whether it belongs to E. coccinea.

8. JACQUEMONTIA

CHOSY, Mém. Soc. Phys. Genève 6 (1833) 476; OOSTSTR. Blumea 3 (1939) 267.—Fig. 19–20.

Herbaceous or woody twiners, rarely erect, generally hairy with stellate hairs, very rarely glabrous. Leaves mostly petioled, variable in size and shape, often cordate, entire, rarely dentate or lobed. Flowers in axillary, mostly peduncled, umbelliform or capititate cymes, with or without an involucre, rarely in scorpioid cymes, or solitary, or in dense terminal spikes or heads. Bracts small, linear to lanceolate, or larger and foliaceous. Sepals 5, equal, or more or less unequal, often with larger outer ones. Corolla regular, medium-sized or small, funnel-shaped or campanulate, blue, lilac, pink, or rarely white, with 5 distinctly marked midpetaline bands, limb 5-toothed or nearly entire, rarely 5-lobed. Stamens and style included. Stamens 5, filaments adnate to the corolla, filiform. Pollen smooth. Disk small or none. Ovary 2-celled, each cell with 2 ovules; style 1, simple, filiform; stigmas 2, mostly elliptic or oblong and complanate, rarely linear or globose. Capsule globose, 2-celled, 4- or usually 8-valved. Seeds 4 or less, smooth or minutely papilllose, glabrous or velutinous, the dorsal edges often with a narrow scarious wing.

Distr. Ca 120 spp., the greater part of which in tropical and subtropical America; a few spp. also in the tropical and subtropical parts of the Old World.

Note. The genus can be subdivided into 4 sections, of which the Cymosae Meissn. (Fl. Bras. 7, 1869, 292, 294) are represented in Malaysia.

KEY TO THE SPECIES

1. Leaves oblong or lanceolate, narrowed at the base, shortly petioled
2. Outer sepals longer than inner ones, attenuate or acuminate towards the acute apex (in one variety subbotuse).
3. Stigmas filiform. Bracts small to minute, 5 mm long or less. Corolla ca 1 cm long.
4. J. browniana

1. Leaves ovate, cordate, broadly rounded or truncate at the base; petiole well-developed, slender.
2. Petiole 5–12 mm. Inflorescences axillary, sometimes 2 together, up to 6 cm, ca 10-flowered. Flowers unknown.
3. Sepals (in fruit) 4–6 mm. Transverse-oval, 1 & 2 2.2–2.5 by 3–3.2 mm, 4 & 5 2.2–2.5 by 3–3.7 mm, rather densely stellate-hirsute (hairs with 3–5 subequal, up to 250 μ long branches).
4. Fruit ovoid, 7 by 5 mm, glabrous except for some short stellate hairs near the apex.
5. Petiole 6–10 mm. Inflorescences axillary, sometimes 2 together, up to 6 cm, ca 10-flowered. Flowers unknown.
6. Sepals (in fruit) 4–6 mm. Transverse-oval, 1 & 2 2.2–2.5 by 3–3.2 mm, 4 & 5 2.2–2.5 by 3–3.7 mm, rather densely stellate-hirsute (hairs with 3–5 subequal, up to 250 μ long branches). Fruit ovoid, 7 by 5 mm, glabrous except for some short stellate hairs near the apex.
4. Two outer sepals ovate-lanceolate to ovate, attenuate to the base, acuminate at the apex (in var. philippinensis the outer sepals subacute, cuspidate or mucronulate; not distinctly acuminate).

1. J. paniculata

2. J. pilosa

3. J. tomentella

4. Two outer sepals broadly ovate, cordate or rounded at the base, acute to short-acuminate at the apex

3. J. pilosa

2. J. pilosa

5. Outer sepals shorter than inner ones, or sepals subequal in length, obtuse.

6. J. blanchetii

5. Outer sepals shorter than inner, glabrous. Ovary glabrous. Stigmas broadly elliptic to orbicular.

KEY TO THE VARIETIES

1. Three outer sepals elliptic to elliptic-oblong, obtusish, cuspidate to mucronulate, not distinctly acuminate at the apex.

var. philippinensis

1. Three outer sepals ovate-lanceolate to ovate, acuminate at the apex.

2. Leaves glabrous, or short-pilose and glabrescent above and beneath. var. paniculata

2. Leaves mostly densely tomentose, finally glabrescent. var. tomentosa

var. pilosa.—Fig. 19.

A herbaceous twiner. 1/4-2 m; young specimens erect or decumbent. Stems terete, slender, young parts mostly hairy, and mostly glabrescent. Leaves ovate or ovate-oblong, 2-8 by 1 1/2-5 cm, more or less cordate or rounded to truncate at the base, mostly acuminate and mucronulate at the apex, or sometimes acute to obtuse, glabrous or shortly pilose and glabrescent above and beneath; lateral nerves 5-8 on either side of the midrib, arcuatly connected near the margin; petiole slender, 1-6 cm long, finely pilose. Peduncles variable in length, a few mm to several cm, more or less pubescent. Flowers in a loose to very dense few to many-flowered umbelliform cyme. Pedicels filiform, pubescent, 3-6 mm, longer in fruit. Bracts small, subulate. Sepals pilose or nearly glabrous, unequal; 3 outer ones, of which the third is often more or less oblique, ovate-lanceolate to ovate. 5-7 mm long, attenuate towards the base, acuminate to long-acuminate at the apex, with a more or less waved acumen, herbaceous, or the third one with a scarious margin at one side; 2 inner ones shorter, 3-4 1/2 mm long, with a broad-ovate to orbicular basal part with scarious margins, acuminate at the apex. Corolla funnel-shaped. 8-10 mm long, lilac, pale blue, or pink, often paler to white at the base, or entirely white, 5-lobed, glabrous, or with a few hairs at the mucronulate top of the lobes. Filaments subequal, pubescent at their broadened base. Ovary glabrous. Stigmas filiform. Capsule 3-4 mm in diam., brown, 8-valved, the valves lanateolate, aceae. Seeds 4 or less, 1 1/2-2 mm long, brownish yellow to purplish black, minutely verrucose, glabrous, the angles with a very narrow scarious wing.

Distr. Tropical East Africa, Madagascar and adjacent islands to SE. Asia, tropical Australia, and New Caledonia; throughout Malaysia (not yet collected in Borneo).

Ecol. Thickets, secondary forests, teak-forests, grassy places, alang-fields, hedges, waysides, often on dry soil, from sea-level to 600-(880) m.


Notes. The degree of pubescence is markedly variable; the indument of the inflorescences is often denser than that of the other parts. The sepals are slightly unequal in length; the three outer ones, of which the third one is often oblique at the base, are ovate-lanceolate to ovate, acuminate at the apex and attenuate towards the base. In some specimens from E. Java, and the Kangean Islands, the outer sepals are broader than is commonly found; such specimens closely resemble J. zollingeri.

A specimen from the island of Salajar (S. of Celebes, Teysmann 13885) has an erect habit: it is in the fruiting stage, flowers and leaves are lacking; the younger branches seem to have been densely tomentose. It might represent a distinct variety, as has been supposed already by Hallier; until more complete material is available a definite opinion is postponed.


(1) According to Merrill, Sp. Blane. (1918) 326.
Much like *J. paniculata* but the whole plant covered with a dense yellowish brown tomentum, finally glabrescent.

**Distr.** N. Australia and Queensland, in **Malaysia:** Lesser Sunda Islands (Sumba, Timor).

15 (1898) 42.—*J. paniculata* (Burm. f.) Hallier f. var. multivalvis Ooststr. Blumea 3 (1939) 274.

Much like *J. paniculata* but the whole plant covered with a dense yellowish brown tomentum, finally glabrescent.

**Distr.** N. Australia and Queensland, in **Malaysia:** Lesser Sunda Islands (Sumba, Timor).

**Fig. 19.** *Jacquemontia paniculata* (Burm. f.) Hallier f. var. paniculata. Left: flowering specimen; right: fruiting branch, × 1/3.

E. New Guinea, Philippines (Apo Island in Mindoro Strait).

**Ecol.** In grass-fields, on rocks, from sea-level to ca 1200 m.

**var. philippinensis** Ooststr. Blumea 3 (1939) 274.

Differs from *var. paniculata* by the three outer sepals which are elliptic to elliptic-oblong, obtusish, cuspidate to mucronulate, not distinctly acuminate at the apex, herbaceous; two inner sepals slightly broader, with scarios margins; peduncles filiform and mostly thinner than in *var. paniculata*.

**Distr.** **Malaysia:** Philippines (Luzon).

**Note.** This variety varies from short-tomentose to nearly glabrous.


**Key to the varieties**

1. Stems, leaves and inflorescences pubescent to tomentose . . . . . . var. zollingeri

1. Stems and leaves sparsely pilose to glabrescent; inflorescences densely tomentose. var. jonkeri

**var. zollingeri.**

A herbaceous twiner, ligneous in the basal parts, pubescent to short-tomentose. Stems terete, glabrescent. **Leaves** ovate, 3–5½ by 2–3½ cm, cordate at the base, acute or short-acuminate at the apex, pubescent to short-tomentose; lateral nerves 7–8 on either side of the midrib; petiole 1–1½ cm. **Peduncles** axillary, rather short, 2–15 mm, pubescent to short-tomentose, cymosely branched, few to several-flowered. Bracts subulate, the lower to 5 mm long, the upper much shorter. **Sepals** very unequal, the two outer ones broad-ovate, 7 mm long, cordate or rounded at the base, acute to short-acuminate at the apex, herbaceous, pubescent to tomentose; sepal 3 semi-ovate, 6½ mm long, acute, partly herbaceous, partly scarios, two inner sepals lanceolate, 4½ mm long, acute, hairy near the apex, for the rest glabrous. **Corolla** funnel-shaped, 9–11 mm long, pale lilac, shallowly 5-lobed, glabrous. Filaments pubescent at their insertion. **Stigmas** filiform. **Capsule** 8-valved. **Seeds** 4, ca 2 mm long, black, minutely verrucose, glabrous, the angles with a very narrow scarios wing.

**Distr.** **Malaysia:** E. Java (Mt Baluran in Besuki), Lesser Sunda Islands (Bali, Sumbawa, Timor).

**Ecol.** Thickets, from sea-level to ca 30 m.

**Note.** This species is closely related to *J. paniculata*; it might possibly be better to consider it merely as a variety of that species. Both show a great resemblance in habit as well as in the shape and size of the leaves and inflorescences. The main difference is found in the shape of the sepals. Typical *J. zollingeri* has the same short and dense tomentum as *J. paniculata* var. tomentosa.

**var. jonkeri** Ooststr. Blumea 3 (1939) 276.

Stems, leaf-blades and petioles sparsely pilose to glabrescent; peduncles, pedicels and sepals densely tomentose. Peduncles 2–5 mm long. **Corolla** white.

**Distr.** **Malaysia:** Lesser Sunda Islands (Timor).
3. **Jacquemontia tomentella** (Miq.) Hallier f. Versl. 's Lands Pl.-tuin Btzg 1895 (1896) 126; Ooststr. Blumea 3 (1939) 276.—Lettosmia tomentella Miq. Fl. Ind. Bat. Suppl. (1861) 360.—Fig. 20.

**KEY TO THE VARIETIES**

1. Sepals 5–6 mm long. Corolla ca 15 mm long. Hairs minute, with 7–13 rays. var. tomentella

1. Sepals 3–4 mm long. Corolla 8–10 mm long. 2. Hairs of two kinds, for the greater part with 7–13 rays like in var. tomentella, the others with 8–10 rays, one of which is much longer and erect . . . . var. heteroradiata

2. All hairs of the same kind.

3. Hairs with 7–13 rays . . . var. micrantha

3. Hairs with 3–4(–5) rays . var. tomentosa

var. tomentella.

A large, woody twiner to 12 m high. Stems terete, angular upwards, the younger parts densely puberulent with minute stellate (7–13-rayed) pale yellowish brown hairs, making the impression of being farinose, adult parts glabrescent, fistulose. Leaves ovate, 6–14 by 4–10 cm, rounded or slightly cordate at the base, acuminate at the apex, stellately puberulent like the stems, paler beneath than above, glabrescent above; lateral nerves 6–7 on either side of the midrib, prominent beneath; secondary nerves parallel; petiole 2–4½ cm, puberulent like the stems, longitudinally grooved above. Peduncles axillary, puberulent like the stems, shorter or longer than the leaves, corymbose branched above; flowers in dense umbelliform inflorescences, forming large, more or less unilateral panicles at the end of the branches. Pedicels 3–6 mm. Lower bracts sometimes foliaceous, upper ones much smaller. Sepals about equal in length, 5–6 mm; two outer ones ovate, obtuse, three inner ones broad-ovate to orbicular, concave, all puberulent outside and with minute glandular dots, glabrous inside. Corolla funnel-shaped, 14–15 mm long or more, pink or white, with 5 densely pilose midpetaline bands. Filaments with dilated, pilose base. Ovary pilose; style pilose near the base; stigmatic lobes thick, nearly globular, wrinkled. Capsule unknown.

**Distr.** Malaysia: Sumatra (W. Coast), Djambi. W. Borneo.

**Vern.** Akar kumiet, Sum. W. Coast, lehu-lehu, Djambi.

**Note.** All parts of the plant are covered with a dense pubescence consisting of very small scale-like stellate hairs, with 7–13 short rays.

var. micrantha Hallier f. Bot. Jahrb. 49 (1913) 377; Ooststr. Blumea 3 (1939) 277.—Fig. 20.

Stellate hairs similar to those in var. tomentella, but of a more silvery greyish colour. Flowers smaller. Sepals 3–4 mm long. Corolla 8–10 mm long, red-purple, rose-pink, or white. Capsule ovoid, mucronate, ca 8 mm high, brown; valves 4, lanceolate, acute, hairy at the top. Seeds 4, or often less, brownish black, glabrous.

**Distr.** Malaysia: Sumatra (E. Coast), Borneo. Ecol. Edges of secondary forests; forming dense masses over exposed low undergrowth; below 300 m.

**Vern.** Akar gulaun, Sum. E. Coast, ampur, W. Borneo, djelaang, SE. Borneo, pangubao, Br. N. Borneo.

var. heteroradiata Ooststr. Blumea 3 (1939) 277.

Like var. micrantha, but the stellate hairs of two kinds, for the greater part as in var. micrantha, otherwise with 8–10 rays, one of which is much longer and erect.

**Distr.** Malaysia: SE. Borneo.

var. tomentosa Ooststr. Blumea 3 (1939) 278.

Like var. micrantha, but the stellate hairs with 3–4, occasionally with 5 rays; rays longer than in var. micrantha; hairs often differing in size, often larger ones mixed with smaller. The indument on the lower surface of the leaves is often much denser than on the upper surface; sometimes the upper surface is nearly glabrous.

**Distr.** Malaysia: Borneo (Sarawak).

Stems erect or ascending, simple or slightly branched, softly tomentose or villose, with rust-coloured hairs, as well as the foliage and inflorescences. Leaves oblong or lanceolate, 21/2-5 by 1/2-1 cm, or the upper ones smaller, narrowed at the base, obtuse or acute at the apex; petiole very short. Peduncles mostly shorter than the leaves, 1-3-flowered. Pedicels short, 1-4 mm. Bracts minute, subulate. Outer sepals ovate-lanceolate, ca 7-10 mm long, rather acute, softly villose or nearly glabrous; inner ones a little shorter. Corolla campanulate, ca 2 cm long, pink. Stigmatic lobes broadly ovate, recurved. Capsule 6-8-valved. Seeds glabrous. (Description partly after Brown, Bentham and Bailey, l.c.c.)

Distr. N. Australia, Queensland, Jervis Island (Torres Straits), not yet found in New Guinea proper.


A glabrous or sparsely hairy twiner. Leaves ovate to broad-ovate, 21/2-9 by 2-7 cm, cordate to truncate at the base, acuminated at the apex; petiole 1/2-4 cm. Peduncles long and slender. Flowers in a few- to many-flowered umbelliform cyme. Bracts much longer than in J. paniculata, linear, lower ones 5-10 mm. Two outer sepals ovate, 7-10 mm long, long-acuminate; third sepal oblique, semi-ovate; two inner sepals much shorter, ovate to lanceolate, acuminate. Corolla blue or blue-purple, white at the base, rarely entirely white, mostly larger than in J. paniculata, 11/2-2 cm long, limb ca 2 cm broad. Stigmas elliptic.

Distr. Subtropical and tropical America; elsewhere, incl. Malaysia, cultivated in the tropics as an ornamental.


A glabrous or sparsely hairy twiner, adult stems lignescent, 11/2-3 m. Leaves ovate or ovate-oblong, 4-8 by 2-4 cm, cordate at the base, acuminated at the apex; petiole 1-3 cm. Peduncles long and slender, 5-10 cm. Flowers in 3-12-flowered umbelliform cymes. Bracts minute. Sepals glabrous; two outer ones ovate to elliptic, 4-6 mm long, obtuse; three inner ones longer, more oblong, 5-71/2 mm long, obtuse. Corolla blue or violet, the midpetaline bands paler outside, ca 21/2-3 cm long. Stigmas broadly elliptic to orbicular.

Distr. Tropical S. America, in Malaysia cultivated as an ornamental.

Note. Sometimes cultivated under the erroneous name J. martii Choisy.

9. ANISEIA


Prostrate or twining herbs. Leaves petiolated, linear, oblong, lanceolate, ovate or elliptic, often mucronulate. Flowers on axillary peduncles, in one- to few-flowered cymes. Sepals 5, herbaceous, acuate or acuminate, unequal, the 3 outer ones much larger than the inner, often decurrent on the pedicel, enlarged in fruit. Corolla regular, broadly tubular to funnel-shaped, with 5 well-limited hairy midpetaline bands outside, limb 5-toothed or nearly entire. Stamens and style included. Stamens 5, filaments adnate to the corolla, filiform; pollen smooth. Disk small or absent. Ovary glabrous, 2-celled, each cell with 2 ovules; style 1, simple, filiform; stigmas 2, thick, globular or oblong. Capsule ovoid or globose, glabrous, 2-celled, 4-valved. Seeds 4 or less, trigonous or globose, black.

Distr. A small genus of at most ca 5 spp. confined to tropical and subtropical America with the exception of one, which also occurs in the tropics of the Old World.


Stems herbaceous, twining or prostrate, rooting in the basal parts (always?), to 11/2 m long, terete, finely striate or smooth, appressed-pilose or gla-
brous. Leaves narrowly to broadly oblong 3½-7 (-11) by 3¾-3(-5) cm, attenuate towards the base, obtuse, truncate or emarginate, and mucronulate at the apex. rarely acute, glabrous or sparsely pilose above, sparsely pilose or rarely glabrous beneath; petiole short, ½-2 cm. Peduncles 1- or sometimes 2-3-flowered, shorter than the leaves, 2-5 cm long, more or less densely pilose, often denser towards the top. Pedicels shorter than the outer sepals, 5-7 mm or slightly longer, appressed-pilose. Bracts small, narrow-lanceolate to subulate, acute. Sepals reticulately veined, the 3 outer ones 12-20 mm long, sparsely pilose outside; sepal 1 & 2 ovate, acute and mucronulate at the apex, rounded, slightly corolate or acute at the base, and shortly decurrent on the pedicel; sepal 3 lanceolate, more or less falcate, shortly decurrent; two inner sepals 10-13 mm long, ovate to lanceolate, acute or acuminate at the apex, not decurrent at the base; outer sepals enlarged in fruit, scarious, 2-2½ cm long. Corolla funnel-shaped, 2-3 cm long, white; limb shallowly 5-lobed; midpetaline bands hairy, with a hairy micro; connecting fields glabrous. Filaments hairy at the base. Capsule ovoid, valves oblong, acute, brown outside, silvery white and shining inside. Seeds 4 or less, 5-6 mm diam., minutely pilose on the sides, woolly at the edges.

Distr. Pantropic, throughout Malaysia: not yet known from the Lesser Sunda Islands.

Ecol. In marshy grasslands, freshwater swamps, marshy thickets, along river-banks, edges of pools, at low altitudes.

Use. Used as a vegetable in the Malay Peninsula and in Borneo.

Vern. Akar ulan putih, akar lidah patong, Mal. Pen., bagu serut, Djambi, karut, Palembang, hat bijawak, W. Kutai, m(w)anaring-i-lawaan, wa-naring pante, Manado, imerpar, dro, Neth. N. Guinea.

Fig. 21. Anisea martinicensis (Jacq.) Choisy. Left: flowering branch; right: fruiting branch, x ¼.

10. CONVOLVULUS


Annual or perennial, prostrate, erect or twining herbs, or erect undershrubs or shrubs; hairs simple or rarely with 2 arms. Leaves entire, or rarely more or less deeply lobed, often spathulate and attenuate into the petiole, or more or less hastate or sagittate at the base. Flowers on axillary peduncles, in one- to few-flowered cymes or in dense involucrate heads. Sepals 5, equal or subequal, obtuse or acute. Corolla regular, medium-sized or small, campanulate or funnel-shaped, white, pink, blue or yellow, with 5 often not well-defined midpetaline bands; limb shallowly lobed or subentire. Stamens and style included. Stamens 5; filaments adnate to the corolla, often unequal, filiform; pollen smooth, ellipsoid. Disk annular or cup-shaped. Ovary 2-celled, each cell with 2 ovules; style 1, simple, filiform; stigmas 2, filiform. Capsule 2-celled, usually 4-valved. Seeds 4 or less, often verruculose, mostly glabrous, black or brown.

Distr. A large genus of ca 250 spp. or more, in the temperate and subtropical regions of both hemispheres, rarer in the tropics; one species in Malaysia.

A perennial herb. Stems prostrate or twining, glabrous or sparsely pubescent. *Leaves* ovate-oblong to lanceolate, 1½–5 by 1–3 cm, mostly hastate or sagittate at the base, obverse and mucronulate at the apex, often more or less secund; petiole shorter than the blade. *Pedicules* axillary, 1- or sometimes 2-5- to more-flowered, shorter to longer than the leaves. Pedicels much longer than the calyx. Bracts linear, ca 3 mm long. *Sepals* 3½–5 mm long, slightly unequal, 2 outer ones a little shorter, oblong-elliptic, obtuse, slightly ciliate; inner ones nearly orbicular, obtuse or slightly retruse, more or less distinctly mucronulate. *Corolla* broadly funnel-shaped, ca 2 cm long, white or pink, or white with pink or red midpetaline bands, or pink with red or white midpetaline bands. Stamens slightly unequal, filaments with a broadened base, papillate at the margins. Ovary glabrous. *Capsule* ovoid-globose, 5–8 mm long, glabrous. Seeds 4, dark brown or black, 3–4 mm long.

**Distr.** Widely distributed in the temperate parts of both hemispheres, rarely in the sub-tropics and the tropics, in *Malaysia*: local on Mt Tengger-Smeru (1927) at 2100 m, apparently introduced.

**Ecol.** In waste places, cultivated land, along roadsides and railways.

** Vern.** Bindweed, *E. akkerwinde, D.*

**Excluded**

*Convovulus sphacoerostigma* CAV. Icon. 5 (1799) 54, t. 481 (= *Jacquemontia hirsuta* CHOISY) has been mentioned by CAVANILLES from Mindanao and from Mexico. According to MERRILL (Philip J. Sc. 10, 1915, Bot. 193; En. Philip. 3, 1923, 359) the Mindanao record was based either on an erroneously localized specimen (Malaspina Expedition), or on an erroneously identified one.

II. **CALYSTEGIA**


Prostrate or twining, perennial herbs. *Leaves* petioled, mostly glabrous, often sagittate to hastate, with rounded, angular or lobed basal lobes. *Flowers* on axillary, peduncled, one- or rarely few-flowered cymes. Bracts 2, mostly large, ovate or elliptic, embracing the calyx, persistent. *Sepals* 5, subequal, ovate to oblong, acute or obtuse, herbaceous. *Corolla* regular, medium-sized or large, glabrous, campanulate to funnel-shaped, white or pink (rarely yellowish), outside with 5 distinct midpetaline bands; limb shallowly lobed or subentire. *Stamens* and style included. Stamens 5, adnate to the corolla-tube; filaments subequal; pollen globular, smooth. Disk annular. *Ovary* 1-celled or imperfectly 2-celled, 4-ovuled; style 1, simple, filiform; stigmas 2, mostly oblong or elliptic, complanate. *Capsule* ovoid or globose, 4-valved. Seeds 4, smooth or verrucose, black.

**Distr.** Ca 25 spp. in the warm and temperate regions of both hemispheres; one species in *Malaysia*, possibly only as a casual weed.


Probably a perennial herb. Stems slender, prostrate or twining, glabrous. *Leaves* glabrous, oblong to triangular, 1½–4–7½ by 1½–2–2½ cm, the base cordate or sagittate, the basal lobes rounded and entire, or angular to 2-lobed; the apex obtuse or slightly emarginate; petiole shorter than or nearly as long as the blade. *Pedicules* axillary, 1-flowered, 2–5 cm long. Bracts elliptic, 6–8 mm long, obtuse. *Sepals* oblong, obtuse, mucronulate, glabrous, the outer ones ca 6–7½ mm long, the inner ones somewhat shorter. *Corolla* campanulate, ca 2 cm long, pinkish purple, limb subentire. Filaments dilated at the base. Ovary glabrous; stigmas elongate. *Capsule* ovoid, sub-acute, ca 7½ mm long, glabrous. Seeds glabrous.

**Distr.** Abyssinia, S. Asia (from Punjab and Afghanistan to N. and E. Bengal) and E. Asia (China, Amurland, and Japan), in *Malaysia*: Malay Peninsula (Penang), once collected, acc. to PRAIN possibly only a casual weed.

**Excluded**


This species, mentioned by MIQUEL, BOERLAGE, and KOORDERS for Java, does not occur in *Malaysia*. 

March 1953] **Convolvulaceae** (van Ooststroom) 437
12. HEWITTIA


A twining or prostrate pubescent herb. Leaves petioled, entire, angular or lobed, usually cordate at the base. *Flowers* on axillary peduncles, in one- to few-flowered cymes. Bracts 2, oblong or linear-lanceolate, acuminate, inserted at some distance of the calyx. *Sepals* 5, usually acute, herbaceous; the 3 outer ones large, ovate, accrescent in fruit; the 2 inner ones much smaller. *Corolla* regular, medium-sized, campanulate to funnel-shaped; limb shallowly 5-lobed. *Stamens* and style included; filaments adnate to the corolla-tube, filiform with a dilated base; pollen smooth. Disk annular. *Ovary* hairy, 1-celled, or imperfectly 2-celled at the top, 4-ovuled; style 1, simple, filiform; stigmas 2, ovate-oblong, complanate. *Capsule* 1-celled, more or less distinctly 4-valved. Seeds 4 or less, dull black.

**Distr.** Monotypic, distributed through the tropics of the Old World, throughout *Malaysia* to Polynesia.


**Stems** herbaceous, slender, 1–2 m long, prostrate or twining, more or less densely pubescent, glabrescent, angular, occasionally rooting. *Leaves* ovate to broad-ovate, 3–12 by 4–10 cm, cordate or sometimes truncate at the base, the basal lobes entire or angular, sometimes spreading and then the blade more or less hastate; apex acuminate, acute or obtuse, mucronulate; leaf-surfaces appressed-pilose with short hairs, especially beneath, or nearly glabrous; petiole 1–6 cm long, pubescent. **Peduncles** shorter to longer than the petioles, 1–10 cm, pubescent, upwards often more densely so. Pedicels very short, up to 3, in fruit up to 5 mm long. Bracts oblong-lanceolate or narrower, 1½–1⅔ cm long. **Sepals** more or less hairy outside and along their margins, unequal, the three outer ones much larger than the inner, broadly to narrowly ovate, 9–15, afterwards to 17 mm long, acute or obtusish; sepal 3 more or less oblique; two inner sepals ovate with a broadened and scarcely margined base, 7–7½ mm long; nerves of sepals prominent in fruiting stage. **Corolla** pale yellow or white, mostly with a purple centre, 2–2½ cm long, with 5 pilose midpetaloid bands; limb with very short, rounded, emarginate, mucronulate lobes. Filaments with a minutely papillose base. **Capsule** depressed-globose to more or less quadrangular, mucronate, ca 8 by ca 10 mm, patently pilose. Seeds 2–4, glabrous, except the pubescent hilum, 5–6 mm long.

**Distr.** Tropical Africa (S. to Natal), tropical
Asia (India, Ceylon, Indo-China, N. to China), Polynesia, throughout Malaysia.

Ecol. Open grasslands, thickets, hedges, teak-forests, grassy dikes and waysides, waste places, at low and medium altitudes, both in regions with a feeble and with a pronounced dry season, from sea-level to 1400 m.

Vern. Kanet, sembanjan, lawatan, J, uwi malojon, Manado; Philippines: banaiyan, palupasagig, P. Bis., dinukdikto, Ig., panggipanggi, Sulu.

13. MERREMyA


Herbs or shrubs, usually twining, but also prostrate or erect herbs or low erect shrubs. Leaves mostly petioled, variable in shape and size, entire, dentate, lobed or palmately or pedately partite or compound (rarely very small and subulate). Flowers axillary, solitary, or in axillary few- to many-flowered variously ramified inflorescences, large, medium-sized or small. Bracts usually small. Sepals 5, usually subequal, elliptic to lanceolate, acute or acuminate, or ovate to orbicular, obtuse or emarginate, concave, in several spp. enlarged in fruit. Corolla regular, funnel-shaped or campanulate, mostly glabrous, white, or yellow to orange, mostly with 5 distinctly nerved midpetaline bands; limb slightly 5-lobed. Stamens 5, included; anthers often contorted; filaments filiform, often broadened at the base, often unequal; pollen smooth. Ovary 2- or 4-celled, rarely incompletely 2-celled, 4-ovuled; style 1, simple, filiform, included; stigma 2-globular. Disk often annular. Capsule generally 4-valved or more or less irregularly dehiscing; 4-1-celled. Seeds 4, or less by abortion, glabrous, pubescent or villose, especially at the margins.

Distr. Ca 80 spp. Widely spread in the tropical countries of both hemispheres.

Use. Several species are used in native medicine.

KEY TO THE SPECIES

1. Leaves palmately 5–7-lobed to palmately compound, with 5 leaflets.

2. Peduncles glandular in the upper part, the glands sometimes mixed with patent bristly hairs. Sepals narrow-ovate to oblong, obtuse, to 8 mm long. Corolla 2½ cm long or less, pale yellow, or whitish. Leaves palmately compound, with 5 leaflets.

3. Peduncles glabrous or hairy, not glandular.

4. Leaves palmately compound; leaflets 5, entire.

5. Outer sepals glabrous, 7½–8½ cm long, ovate to ovate-oblong, obtuse. Corolla to 5 cm long.

11. M. disecta

8. M. quiniquefolia

1. Leaves entire, crenate, or at most 3-lobed.

7. Pedicels with a thick, lobed ring immediately below the calyx. Sepals obovate to broadly elliptic or...
orbellar, obtuse or retuse, to 15–18 mm long. Corolla ca 4 cm long

7. Pedicels without a thick, lobed ring at the apex.

8. Leaves peltate (occasionally with exception of the leaves of the inflorescences).

9. Sepals (15–)18–25 mm long. Corolla 4 1/2–6 cm long, yellow or white

10. Midpetaline bands of the corolla pilose outside, or only at their top.

11. Corolla pilose at the upper portion of the midpetaline bands, 2–3 1/2 cm long, white, or yellow to orange. Sepals broad-elliptic to orbicular, rounded to emarginate, 5–8 mm long.

1. M. similis

11. Midpetaline bands of the corolla densely sericeous outside. Corolla ca 2 cm long, white or yellow. Outer sepals orbicular to transverse-elliptic, broadly rounded to emarginate, 5–7 mm long, inner ones transverse-elliptic

13. M. umbellata

10. Corolla entirely glabrous outside, sometimes with minute glands.

12. Peduncle very short or nearly absent. Flowers in axillary clusters or solitary in the leaf-axils. Pedicels short, 2–4 mm; sepals hairy on the back and fimбриate along the margins. Corolla 10 mm long, or less. Leaves kidney-shaped to broadly ovate. Prostrate herb.

5. M. emarginata

12. Peduncles longer.

13. Sepals 10 mm long or mostly shorter.

14. At least the inner sepals acute, attenuate-acuminate into a slender point. 6. M. tridentata


15. Twining or prostrate herbs, rarely woody plants. Midpetaline bands with distinct dark lines, at least in the dried state.

16. Sepals slightly unequal in length; outer ones broadly obovate to orbicular, or broadly spatulate, distinctly concave.

17. Outer sepals mostly hairy, 4–7 mm long, broadly obovate to orbicular, emarginate, not or slightly mucronulate; inner ones 6–8 mm. Corolla 1 1/2–2 cm long (in var. splendens 3–3 1/2 cm), yellow. Capsule depressed-globose, valves coarsely wrinkled. Petiole generally without tubercles

1. M. gemella

17. Outer sepals generally glabrous, 3 1/2–4 mm long, broadly obovate to spatulate, broadly notched at the apex and distinctly mucronulate; mucro directed outwards; inner sepals to 5 mm long. Corolla ca 1 cm or less, yellow. Capsule depressed-globose or broadly conical, slightly 4-angular, less coarsely wrinkled. Petiole often with small tubercles.

2. M. hederacea

16. Sepals unequal in length: outer ones shorter, elliptic to oblong-elliptic or oblong, less concave or flat.

18. Outer sepals elliptic, 3–4 mm long, inner ones oblong or elliptic, 4 1/2–6 mm long. Peduncles filiform. Bracts minute, 1–2 mm. Leaves variable, linear to oblong or ovate, rounded, truncate, cordate or hastate at the base. Capsule broadly ovoid to globular, smooth.

3. M. hirta

18. Outer sepals oblong or oblong-elliptic, 4 mm long, inner ones broadly ovate to orbicular, 6 mm long. Peduncles thicker. Bracts larger, to 4 mm long. Leaves ovate, cordate at the base. Capsule subglobose, valves reticulately wrinkled

4. M. dichotoma

15. Larger woody twiners. Midpetaline bands without distinct dark lines.

19. Two outer sepals broadly oblong, ca 7 mm long, three inner ones broadly elliptic to orbicular, 8–9 mm long. Corolla 1 1/2 cm long, yellow (or sometimes white?). Nerves 5–6 on either side of the midrib

19. M. clemensisana

19. Sepals broadly elliptic to orbicular, outer ones 9–10 mm long. Corolla 2–2 1/2 cm long, yellow. Nerves 7–10 on either side of the midrib

20. M. korthalsiana

13. Sepals longer than 10 mm.

20. Sepals at most 12 mm long, outer ones broadly elliptic, inner ones broadly elliptic to orbicular. Corolla ca 2 1/2 cm long. Flower-buds conical, acute. Leaves ovate, cordate at the base; nerves very prominent beneath. Woody twiner; stems lenticellate.

18. M. crassinervia

20. Sepals longer, 15 mm or more. Corolla 5 cm long or more.

21. Corolla 7–8 cm long, white. Sepals ca 25–30 mm long, the outer ones broadly ovate to broadly elliptic, inner ones narrower. Stems smooth

15. M. mammosa

21. Corolla smaller, ca 5 1/2–6 cm long, yellow.

22. Leaves orbicular to broadly ovate, with (6–)8–11 nerves on either side of the midrib, more or less bullate. Sepals elliptic to broadly elliptic, 15–22 mm long. Stems woody, distinctly lenticellate

16. M. borneensis

22. Leaves ovate, with 6–7 nerves on either side of the midrib, not bullate. Sepals oblong or elliptic-oblong, 25–28 or the inner ones to 30 mm long. Stems woody, sparsely lenticellate.

17. M. pulchra

Flower-buds oblong, ovoid or globular. obtuse; midpetaline bands in the dried state with 5 dark lines; flowers rather small or small.


**KEY TO THE VARIETIES**

1. Corolla 11/2—2 cm long . . . var. gemella
2. Corolla 3—31/2 cm long . . . var. splendens

**var. gemella.**

A twining or prostrate herb. Stems slender, to 3 m long, with rather long, curled, more or less appressed to hairless, especially at the nodes, afterwards glabrescent, sometimes already glabrous in youth; prostrate stems often rooting both at the nodes and internodes. Leaves usually ovate or broad-ovate, rarely narrow-ovate to oblong in outline, more rarely nearly kidney-shaped, 21/2—12 by 11/2—10 cm, broadly cordate or rarely more or less sagittate at the base, acuminate or gradually attenuate at the apex, with obtuse or acute, sometimes slightly retuse, mucronulate top; in the kidney-shaped leaves with a broadly rounded apex; leaf-margin entire or coarsely crenate to dentate, sometimes 3-lobed; surfaces glabrous or pilose on the nerves beneath or occasionally on both sides, or pilose on both sides over the whole surface; petiole shorter than or as long as the blade, 11/2—6 (—10) cm, appressed-pilose, rarely minutely tuberculate. **Pedicules axillaries, with short curled hairs, or glabrous, 21/2—10 (—16) cm, cymosely branched at the apex. Pedicels 3—6 mm long, appressed-pilose. Bracts minute, caducous. Flower-buds ovoid to globose, obtuse. Sepals thinly coriaceous with scariosus margin, slightly unequal. concave, broadly obovate to orbicular, emarginate and mostly mucronulate at the apex, outer ones 4—7 mm, inner ones 6—8 mm long (in poorly developed specimens sometimes only ca 4 mm), outer more or less pilose or sometimes glabrous, inner glabrous or nearly so, all slightly enlarged in fruit. Corolla campanulate to funnel-shaped, 11/2—2 cm long, glabrous. yellow; limb slightly 5-lobed, lobes shallowly emarginate and mucronulate. Filaments hairy at the base. Ovary glabrous. **Capsule** depressed-globose, coarsely wrinkled in dry specimens, glabrous, ca 7 mm high, 2-celled. Seeds 4—1, dark grey or brownish puberulent, trigonous, or globose when only one seed has been developed.

**Distr.** SE. Asia to tropical Australia, throughout **Malaysia.**

**Ecol.** In thickets, on hedges, in grasslands, in tea-forests, along railroad tracks, on dikes of rice-fields, often on moist soil, from sea-level to 250 m.


**var. splendens** Oostristr. Blumea 3 (1939) 302.

Corolla longer than in the typical form, to 3—31/2 cm long.

**Distr.** Malaysia: SE. New Guinea (Lake Daviambu on the Middle Fly River).

**Ecol.** River-banks, lake-shores, reed-swamps. on grass and borders of undergrowth of rain-forest.
A twining or prostrate herb; the prostrate specimens rooting at the nodes or sometimes at the internodes. Stems slender, smooth or minutely tuberculate, glabrous or sparsely hirsute, especially at and above the nodes. Leaves ovate in outline, 11/2-5 by 11/4-4 cm, broadly cordate at the base, mostly obtuse and mucronulate at the apex; margin entire or crenate to shallowly or deeply 3-lobed; surfaces glabrous or sparsely hairy; petiole slender, 1/2-6 cm, with a few small tubercles, especially in the basal half. Peduncles thicker than the petioles, shorter than or exceeding the leaves. 1-10 cm, mostly glabrous, smooth or occasionally minutely tuberculate. Flowers one or few to several.

Fig. 24. a-b. Merremia umbellata (L.) Hallier f., a. seed of ssp. umbellata, b. seed of ssp. orientalis (Hallier f.) OostSTR., × 5. c-d. Merremia hederacea (Burm. f.) Hallier f., c. seed of f. pubescens OostSTR., d. seed of f. barbata OostSTR., × 5.

in the latter case the first ramification of the peduncle dichasial, the subsequent ones often monochasial. Pedicels 2-4 mm, smooth or minutely tuberculate. Bracts narrow-ovobovate, mucronulate, 3 mm long, caducous. Flower-buds oblong to broadly elliptic, obtuse. Sepals glabrous or occasionally slightly pilose on the back and along the margins, concave, broadly obovate to spatulate, broadly notched at the apex, distinctly mucronulate, the mucro directed outwards; two outer sepals 31/2-4 mm, inner ones to 5 mm long. Corolla campanulate, 6-10(-12) mm long, yellow, outside glabrous, inside with long hairs near the hairy base of the filaments. Ovary glabrous. Capsule broadly conical to depressed-globular, somewhat 4-angular, ca 5-6 mm high, 4-valved, the valves transversely or reticulately wrinkled, less coarsely than in M. gemella. Seeds mostly 4, short-pubescent or nearly glabrous over the whole surface, or with longer hairs at the hilum and along the edges, sometimes also on the sides (see below), 21/2 mm long.

Distr. Tropical Africa, Mascarene Islands, tropical Asia from the Himalaya southwards to Ceylon and eastwards to Burma, Southern China, Indo-China and Siam, to Queensland, and the Carolines (Yap), throughout Malesia, also in Christmas Island.

Ecol. In thickets, in open grasslands, and on sand-banks, from sea-level to 50 m.

Use. A poultice of the leaves, with turmeric and broken rice, is used upon chapped hands and feet. Animals eat the plant; even if given nothing else, may thrive on it (BURKIL).

Vern. Ramijło, Djambji, aroj djoyton gëđë, tatapajan, S. hawatan, J. këllëmbët, W. Borneo.

Note. On account of the pubescence of the seeds two forms can be distinguished:

f. pubescens OostSTR. Blumea 3 (1939) 307.

Seeds shortly pubescent or nearly glabrous over the whole surface, or with only some slightly longer reddish brown hairs at the hilum and the margins. — Fig. 24c.

f. barbata OostSTR. Blumea 3 (1939) 307.

Seeds shortly pubescent, the hilum and the margins with long hairs; sometimes these long hairs are also found on the sides. — Fig. 24d.

These forms can only be distinguished when ripe seeds are available. As the type specimen described by BURMAN, and preserved at Geneva, has no ripe seeds, it is impossible to decide to which of the two forms it belongs.


KEY TO THE VARIETIES

1. Inner sepals oblong or elliptic-oblong, obtuse.

var. hirta

1. Inner sepals broadly elliptic to subquadrate, truncate to retuse and mucronulate at the apex.

var. retusa

var. hirta.— Fig. 25.

A twining or prostrate herb; the prostrate specimens rooting at the nodes or sometimes at the
internodes. Stems slender, 20–50 cm long, filiform, sparsely patently hirsute or glabrous. Leaves very variable in form, linear, linear-oblong, oblong-lanceolate, oblong to ovate-oblong or ovate, occasionally orbicular to subquadrate; the narrow leaves 3–6 by 1/3–1 cm, 5–12 times as long as broad, the broad ones 11/2–4 1/2 by 4/5–21/2 cm, 1–5 times as long as broad, rounded, truncate, more or less cordate or hastate at the base with small or large, obtuse, spreading or parallel basal lobes, obtuse to slightly emarginate and mucronulate at the apex, the surfaces glabrous or sparsely hairy beneath and along the margins, sometimes also above, rarely the indumentum is more developed, especially on stems, petioles, leafblades and basal part of peduncles; petiole short, (1–) 3–8(–20) mm. Peduncles filiform, variable in length, 1–71/2 cm, glabrous or with a few hairs near the base. Flowers 1 to few, mostly up to 4, in some specimens to 8; the ramifications of the peduncle monochasial (racemelike and unilateral), or the first ramifications dichasial and the subsequent ones monochasial. Pedicels 3–5 mm, glabrous. Bracts ovate, obtuse, 1–2 mm long, glabrous, persistent. Flower-buds oblong to elliptic, obtuse. Sepals glabrous, unequal, the 2 outer ones shorter, elliptic, obtuse, 3–4 mm long, the 3 inner oblong or elliptic-oblong, obtuse, 41/2–6 mm long; sepals slightly enlarged in fruit, to 6–7 mm, with more or less prominent nerves. Corolla broadly funnel-shaped, 11/2–2 cm long, pale-yellow or whitish, glabrous, midpetaline bands in dried state with distinct dark nerves. Filaments hairy at the base; anthers spirally twisted. Ovary glabrous, 2-celled. Capsule broadly ovoid to globular, with a thin papery wall, smooth, glabrous, crowned by the base of the style, ca 6 mm long; 1-celled, 4-valved. Seeds 4 or less, dark brown or black, glabrous or sparsely floccose at the margins and the hilum.

Distr. India to Southern China, Siam, and tropical Australia, throughout Malaysia.

Ecol. In open grasslands, along waysides, in dry rice-fields, from sea-level to 1100 m.

Vern. Rebbha teng-ketteng, Md.

var. retusa Ooststr. Blumea 3 (1939) 311, f. 2, X–Z.—? Ipomoea hepaticifolia BLANCO, Fl. Filip. ed. 2 (1845) 72; see note.

Differs from var. hirta by having the inner sepals broader, broadly elliptic to subquadrate, with a truncate to retuse, mucronate apex, and the outer ones elliptic, obtuse to acutish, mucronulate. Leaves oblong, 4/5–21/2 cm long, hastate at the base, with entire or 1–2-dentate lobes, obtuse to subretuse and mucronulate at the apex. Peduncles short, to 1 cm long, 1- or sometimes 2–3-flowered.


Note. The specimen MERRILL, Sp. Blanc. 679 from Luzon (prov. of Bulacan, Angat), was distributed by that author as an illustrative specimen of Ipomoea hepaticifolia BLANCO. See MERRILL, Sp. Blanc. (1918) 324. On account of BLANCO's short and incomplete description it is, however, impossible to verify MERRILL's opinion.

4. Merremia dichotoma Ooststr. Blumea 3 (1939) 311, f. 1, b–c.—Fig. 26.

Stems twining, slender, minutely tuberculate; sparsely hirsute or glabrescent or glabrous. Leaves ovate, 4–7 by 21/2–31/2 cm, cordate at the base with rounded basal lobes, gradually attenuate towards the obtuse mucronulate apex, entire, glabrous; lateral nerves 8–10 on either side of the midrib; petiole 11/2–21/2 cm, glabrous or sparsely hairy towards the apex. Inflorescences glabrous, 6–15 cm long, peduncles terete, smooth, 4–7 cm, 1–3 times dichasially ramified at the apex, the ultimate ramifications monochasial, all with oblong to ovate, concave, 2–4 mm long, persistent bracts. Pedicels 5–6, in fruit to 8–9 mm long. Flower-
buds obtusish. Sepals glabrous, unequal, 2 outer ones shorter, 4 mm long, oblong to oblong-elliptic, obtuse, mucronulate, inner ones 6 mm long, broadly ovate to orbicular, obtuse or subretuse. Corolla broadly funnel-shaped, ca 18 mm long, white, glabrous, inside below the hairy base of the filaments with a pair of infurcated appendage at the apex. Ovary glabrous. Capsule subglobose, mucronate, ca 7 mm high, 2-celled, 4-valved; valves reticulately wrinkled. Seeds 2 in each cell, ca 3½ mm long, dull black, pubescent, villose at the edges.

Distr. Malaysia: Lesser Sunda Islands (Central Timor, only once collected on the S. coast near Kolbano).

Vern. Kudat, Timor.


A perennial herb. Stems prostrate, rooting at the nodes, sparsely hairy and glabrescent, 30–75 cm long, the adult parts sometimes warty. Leaves kidney-shaped to broad-ovate, 1½–2½(-3½) cm long, cordate at the base with a broadly rounded sinus and rounded basal lobe, obtuse to broadly rounded or slightly emarginate at the apex, coarsely crenate or entire, glabrous or sparsely appressed pilose; petiole about as long as the blade or shorter, 1½–2½(-3½) cm long, shortly hairy or minutely verrucose. Flowers axillary, solitary, or in 2–3-flowered cymose clusters; peduncle very short to nearly absent. Pedicels 2–4 mm. Bracts small, ovate to linear, acute, hairy. Flower-buds globose, obtuse. Sepals ovate to orbicular or subquadrate, the outer ones 2½–3 mm long, obtuse with a ciliate and distinctly mucronate tip, the inner ones 3–4½(-6) mm long, deeply emarginate, all more or less hairy on the back and long ciliate at the margins. Corolla tubular-campanulate, 5–9 mm long, glabrous, yellow with a paler base, the midpetaline bands distinctly 5-nerved and suffused purple outside; the limb slightly 5-lobed; corolla hairy inside at the hairy base of the filaments. Ovary glabrous. Capsule subglobose, 5–6 mm diam., longitudinally sulcate, glabrous, brownish black or black, crowned by the thickened smooth base of the style, at the base enclosed by the sepals. Seeds 4 or less, ca 2½ mm long, grey-brown, glabrous, dotted.

Distr. Tropical Africa, tropical Asia, in

Malaysia: Java, SE. Borneo, Celebes (Donggala, Pasui), the Lesser Sunda Islands (Timor, Sumba-wa), and the Philippines (Luzon). According to MERRILL (Sp. Bl. 1918, 324) the species has all the appearance of being an introduced one in the Philippines, as it occurs only in the settled areas.

Ecol. Restricted to regions with a rather strong to very strong dry season, on rather heavy soils, in fields and open grasslands, along railroad and in waste places, from sea-level to 200 m.

Use. In the Philippines the leaves and tops in decoction are sometimes used as a diuretic, and in Java for coughs.

Vern. Embun, pégogon utan, paschaga-utan-ketjil, J; Philippines: bato-bato, Tag., kupit-kupit, I.

Note. There is a certain resemblance of the vegetative parts with those of the Umbellifer Centella asiatica Urb. The species has sometimes been confused in the herbaria with Dichondra repens Forst.

2. Section Streptandra


Flower-buds ovoid or conical, mostly acute; midpetaline bands in the dried state often with 5 dark lines; flowers of moderate size or large.

KEY TO THE SUBSPECES

1. Outer sepals mostly obtuse to emarginate at the apex, inner ones attenuate-acuminate with an acute apex. Corolla 10–12 mm long. Filaments inserted ca 1\(\frac{1}{2}\) mm above the corolla-base. Leaves mostly obtuse, truncate or emarginate at the apex .... ssp. tridentata

1. All sepals attenuate-acuminate to the apex with an acute point. Corolla 12–20 mm long. Filaments inserted ca 3 mm above the corolla-base. Leaves mostly attenuate towards the acute apex .... .... ssp. hastata

ssp. tridentata.—M. tridentata Hallier f. ssp. genuina Ooststr. Blumea 3 (1939) 315, f. 2, J-N.—M. tridentata Hallier f. var. genuina Hallier f. ex Ooststr. l. c. 315, pro syn.—Fig. 27 b’-h”.

A prostrate herb. Stems 10–80 cm long, angular, glabrous, several from a stout perpendicular root. Leaves glabrous, linear (or in some specimens nearly filiform), linear-oblong to oblanceolate, spathulate or subquadrate, 4–20(–30) by (1\(\frac{1}{2}–\)1\(\frac{3}{4}\)–)2(–6) mm, base not or slightly broadened, truncate to hastate, basal lobes as far as present spreading or parallel, with 1 tooth or with a few teeth, leaf-margin above the base entirely or slightly crenate to dentate, apex obtuse, truncate or emarginate and mucronulate to tridentate (occasionally part of the leaves has the apex acute and mucronulate); petiole 1\(\frac{1}{2}\)–2 mm or nearly absent. Flowers in 1–2(–3)-flowered cymes. Peduncles axillary, 4\(\frac{1}{2}–\)1\(\frac{3}{4}\)–2(–2) cm long, glabrous or pubescent near the base. Pedicels 4–8 mm long, glabrous, angular, thickened above in fruit. Bracts minute, oblong, mucronulate. Flower-buds narrowly conical, acute. Outer sepals mostly shorter than inner, 3–4 mm long, oblong, obtusish, obtuse to emarginate, mucronulate; inner ones 4–6 mm long, lanceolate, attenuate-acuminate into a slender point; occasionally the outer sepals are more acute at the apex, more rarely the outer as well as the inner sepals are obtuse and mucronulate (so in specimens from India). Corolla funnel-shaped, 10–12 mm long, glabrous, completely yellow, yellowish white or white, or with a purple centre. Filaments inserted ca 1\(\frac{1}{2}\) mm above the corolla-base, glabrous or sparsely hairy at the slightly dilated base. Ovary glabrous. Capsule ovoid, 4–5 mm long, 4-valved, pericarp papery, glabrous, straw-coloured. Seeds 4 or less, 2–2\(\frac{1}{4}\) mm long, dull black, glabrous.

Distr. Tropical Africa, Mascarene Islands, tropical Asia from Bengal and Central Provinces southwards to S. India and Ceylon, eastwards to Malaysia: Malay Peninsula, Anambas Islands, Riouw Archip., Banka, SW. Celebes (once near Pasui), and S. Moluccas (Aru Islands).

Fig. 27. Merremia tridentata (L.) Hallier f., a. Flowering and fruiting branches of ssp. hastata (Desr.) Ooststr., nat. size, b’-h” leaves of ssp. tridentata, nat. size.
Hallier f. Bot. Jahrb. 16 (1893) 552.—Fig. 27a.

A herbaceous twiner, occasionally prostrate. Stems one or several from a stout perpendicular root, 60–200 cm, slender, more or less angular to subulate, glabrous. Leaves mostly glabrous, narrowly oblanceolatus to all subalate, root, Hallier f.

One-nearly acute, 25–80(-100) mm, more or less contracted above the base, with more or less stem-clasping, obscurely to sharply dentate basal lobes, leaf-margin above the base entire or indistinctly undulate, blade gradually attenuate towards the distinctly mucronulate, sharply acute, or obtuse or rarely emarginate apex; petiole nearly absent or very short, 1–3 mm. Flowers in one- to few-flowered cymes. Peduncles axillary, 1–8 cm long, thin, glabrous, or mostly pubescent near the base. Pedicels as long as or longer than the calyx, glabrous, angular, 6 mm long or longer, thickened above in fruit and to 15 mm long. Bracts minute, subulate. Flower-buds narrowly conical, acute, the tips of the sepal more or less curved outwards. Sepals equal in length or the outer ones a little shorter, (5–)6–7–(10) mm long, glabrous, all lanceolate to ovate-lanceolate, attenuate-acuminate into a sharp, slender point, the margin of the sepals narrowly scarious, undulate. Corolla funnel-shaped, 12–20 mm long, glabrous, wholly pale yellow or white, or with a purple to chocolate brown centre. Filaments inserted ca 3 mm above the corolla-base, sparsely hairy at the slightly dilated base. Ovary glabrous. Capsule globose to ovoid, 4-valved, pericarp papyraceous, glabrous; dehisement often persistent after dehiscence. Seeds 4 or less, 2½–3 mm long, dull black or dark-grey, glabrous.

Dist. Tropical East Africa, tropical Asia from the Khasia Hills and Bengal southwards to Ceylon, eastwards and southwards to China, Hong Kong, Formosa, and tropical Australia, throughout Malaysia.

Ecol. On rather light soil, in open grasslands, climbing on grasses and other low herbaceous plants and shrubs, in waste places, along waysides, in alang-fields, teak-forests, from sea-level to 1200 m.

Uses. The leaf is made into poultice and applied to the head in cases of jungle-fever (Mal. Pen.).


Notes. The subspecific epithet hastata, although based on Convolvulus hastatus DESR. (1789, non FORSK. 1775) is maintained as provided under art. 81 of the Code, and is treated as a new name in this rank.

Blume, Bijdr. (1825) 721, and several authors after him incorrectly used the name Ipomoea filicaulis (VAHL) BL. for this taxon. Others have mentioned it as Ipomoea angustifolia JACQ. Both names are synonyms of Merremia tridentata (L.) Hallier f. ssp. angustifolia (JACQ.) OOSTSTR. Blumea 3 (1939) 323, note. For more detailed data see I.c. 322–324.

7. Merremia quinquefolia (L.) Hallier f. Bot. Jahrb. 16 (1893) 552; OOSTSTR. Blumea 3 (1939) 324.—Ipomoea quinquefolia LINNÉ, Sp. Pl. (1753) 162.—Convolvulus quinquefolius LINNÉ, Syst. ed. 10 (1759) 923.—Fig. 28.

A herbaceous twiner. Stems slender, glabrous or sparsely to densely hirsute with patent hairs. Leaves palmately compound, with 5 leaflets; leaflets glabrous, sessile or shortly petiolulate, oblong or narrow-oblong to lanceolate, or sometimes still narrower, 2½–6 by ½–2 cm, attenuate towards both ends, acute or obtuse and mucronulate at the apex, the margins coarsely dentate to undulate or nearly entire; petiole 2–5(–9) cm, thin, glabrous or with a few patent hairs. Inflorescences axillary, to ca 12 cm long. Peduncles shorter than the petioles, 4–7 cm, glandular towards the apex, the glands sometimes mixed with patent bristly hairs, 1-flowered or cymosely 3–5-flowered; branches of cyme glandular. Pedicels glabrous or with a few glands near the base, 5–7, sometimes to 15 mm long, in fruit to 15–20 mm.

Fig. 28. Merremia quinquefolia (L.) Hallier f. Flowering branch, nat. size.
and thickened at the apex. Bracts narrow-triangular, acute, ca 1½ mm long. Flower-buds ovoid, acute. *Sepals* narrow-ovate to oblong, obtuse, mucronulate, glabrous, subequal in length, or the outer ones shorter; outer sepals 4–6, inner 6–8 mm long, slightly enlarged in fruit. *Corolla* funnel-shaped, 18–25 mm long, glabrous, pale yellow or whitish. Filaments inserted ca 3–4 mm above the base of the corolla, shortly pubescent at their dilated base; anthers spirally twisted. Ovary glabrous. *Capsule* globose, straw-coloured, 4-celled, 4-valved; valves ca 9 mm long. Seeds 4, ca 4½ mm long, black or greyish black, shortly hairy with appressed curled hairs.

Distr. Tropical America, in *Malaysia* cultivated and occasionally run wild, introduced before 1840. Ecol. A very rapid grower, in a short time covering all other plants; perhaps of some value as a cover-crop.

*Vern.* *Rau tjangsa*, *Ternate*.


Stems twining, slender, glabrous, or more or less hirsute with long, spreading hairs. *Leaves* palmately compound, with 5 leaflets; leaflets mostly glabrous, linear, lanceolate or narrowly oblong, 2½–3½ mm by ⅛–⅜ cm, obtuse or obtusish and mucronulate at the apex, narrowed towards the base, entire; petiole 1–1½ cm, glabrous or hirsute. *Peduncles* axillary, shorter to longer than the leaves, glabrous, or hirsute near the base, mostly 1-flowered. Pedicels glabrous, 8–9 mm long. Bracts ovate, acuminate, ca 3–4 mm long. *Sepals* ovate to ovate-oblong, obtuse, glabrous; two outer ones 7½–8½ mm long; three inner ones longer, ca 10–13 mm. *Corolla* campanulate to funnel-shaped, up to 5 cm long, white or pale pink. Filaments inserted ca 6–7 mm above the base of the corolla. Ovary glabrous, 2-celled. *Capsule* ca 12 mm long, ovoid, somewhat acuminate. Seeds glabrous. (Description partly after ROBERT BROWN, BENTHAM, and BAILEY, II, cc.).

Distr. N. Australia, Queensland, in *Malaysia*: New Guinea (NE. New Guinea; Yule Island; Jervis Island), Philippines (Luzon). Also mentioned from Burma and S. China, but it is not quite certain that these specimens are conspecific.

9. *Merremia tuberosa* (L.) RENDLE in Fl. Trop. Afr. 4, 2 (1905) 104; OOSTSTR. Blumea 3 (1939) 325.—*Ipomoea tuberosa* LINNÉ, Sp. Pl. (1753) 160, non Lour. 1790.—*Convolvulus pantchoilatus* BLANCO, Fl. Filip. (1837) 96.—*Ipomoea tuberosa* L. var. obiganta HASSK. Retzia 1 (1855) 69.—*Oerculina tuberosa* MEISSN. in MANT. Fl. Bras. 7 (1869) 212.—Fig. 29.

A glabrous perennial twiner. Stems from a large subterranean tuber, robust, terete, finely striate. *Leaves* orbicular in outline, 6–16 cm long and as broad, palmately divided to far below the middle; segments 7, oblong-lanceolate, acuminate at the apex, narrowed to the base, entire, the middle segment larger than the lateral ones; petiole 6–18 cm, slender. *Peduncles* axillary, few- to several-flowered, terete or more or less planate to the apex, 4–15 cm long. Pedicels 15–18 mm, clavate, in fruit to 5 cm. Bracts triangular, ca 2 mm long. Two outer *sepals* 23–25 mm long, ovate to broadly ovate, obtuse, distinctly minutely mucronate; three inner ones narrower, oblong; *sepal* 3 about as long as the two outer ones; two inner *sepals* ca 21–22 mm long; all *sepals* in fruit to 5–6 cm long, enclosing the capsule. *Corolla* funnel-shaped, ca 3½ cm long, glabrous, yellow. Anthers twisted. *Capsules* 4- or less-seeded; the 4-seeded ones subglobose to depressed-globose, ca 3½ cm diam., the less-seeded ones ellipsoid, ellipsoid-globose or oblique-ellipsoid, with a smaller diameter; the thin, straw-coloured pericarp splits more or less irregularly and moreover loosens circumcisate at its base. Seeds ca 17 mm long, black, with a black pubescence on the sides and with somewhat longer black hairs along the margins, glabrescent.

Distr. Probably of tropical American origin; distributed through tropical Africa, the Mas-

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*Fig. 29. Merremia tuberosa* (L.) RENDLE. Flowering branch, capsule, and seed, × 1½.
careden Islands, India, Ceylon; in Malaysia cultivated and rarely escaped.

Ecol. From sea-level to ca 600 m. Corolla open in the early morning.

Vern. Aroy kawoyang, S.

Note. Though the capsule-wall loosens as a whole at its base from the receptacle and forms in this way a kind of 'operculum', it is completely different from that, found in *Operculina*. In the latter the wall shows two distinct layers; the outer of these, the exocarp, is fleshy in the upper part forming a circumscissile lid (*operculum*), while the scarious endocarp remains entire, to split at length irregularly.


Stems twining, slender, terete, hisurate with yellow-brown patent hairs. Leaves palmately compound, with 5 leaflets; leaflets appressed-pilose on both surfaces, sessile, elliptic or elliptic-oblong, 2/2-10 by 1-4 cm, acute at the base, acute or acuminate at the apex, entire; petiole slender, as long as or longer than the blade, 2/2-12 cm long, patently hisurate. *Peduncles* axillary, few to several-flowered, 5-24 cm long, patently hisurate like the 10-25 mm long pedicels. Bracts lanceolate, 2-4 mm long, caducous. Three outer *sepalas* 15-25 mm long, ovate-lanceolate, acute or acuminate, densely hisurate; two inner ones slightly shorter, ovate, acute, glabrous. *Corolla* funnel-shaped, 2/2-3/2 cm long, glabrous, white. Anthers spirally twisted. Ovary glabrous, 4-celled. *Capsule* globose, glabrous, 4-celled, 4-valved. Seeds 4, glabrous.

Distr. Circumtropical, in Malaysia perhaps formerly cultivated.


Stems twining, slender, terete, striate, patently hisurate with yellowish hairs, the adult parts woody, glabrescent and warted. Leaves palmately divided nearly to the base, with 5-7 lanceolate, mucronulate, coarsely dentate to irregularly pinnately lobed segments, glabrous or hairy on the veins beneath, the middle segment 2/2-10 by 1/2-3 cm, the lateral ones smaller; petiole 2/2-7 cm, patently hisurate like the stems. *Peduncles* axillary, one to few-flowered, 5-10 cm long, patently hisurate, glabrescent in the upper portion. Pedicels 1/2-2 cm long, thickened towards the calyx, glabrous, minutely verrucose on the apex. Flower-buds narrow-ovoid, acute. *Sepals* subequal, 2-21/2 cm long, ovate-lanceolate, acute, mucronulate, glabrous, herbaceous with narrow scarious margin, enlarged and coriaceous in fruit. *Corolla* funnell-shaped, 3-31/2 cm long, white with a rose-purple throat; the limb with 5 distinct bands. Anthers spirally twisted. Ovary glabrous, 2-celled. *Capsule* globose, glabrous, 2-celled, 4-valved. Seeds normally 4, glabrous, black.

Distr. Probably indigenous only in America from the Southern United States to Argentina and Uruguay, elsewhere in the tropics and in Malaysia cultivated as an ornamental and occasionally escaped.

Vern. Noon-flower, E.


A larger twiner. Stems terete, the older ones striate, 2-4 mm, glabrous or patently hisurate with white or fulvous hairs. Leaves orbicular in outline, 5-18 by 5-16 cm, cordate at the base, palmately 5-7-lobed; lobes broad-triangular to lanceolate, more or less acuminate or acute to obtuse at the apex and mucronulate, mostly not contracted at the base or sometimes slightly so, coarsely dentate to crenate, or subentire, sparsely to densely hairy on both sides, more densely beneath than above, or glabrous above; petiole 2-15 cm, occasionally longer, patently hairy or glabrous. *Peduncles* axillary, 1-3 or several-flowered, shorter or longer than the petiole, 1-15 cm or more, patently hisurate. Pedicels 8-20 mm, hisurate like the peduncles, thickened towards the apex, clavate in fruit. Bracts subulate, 11/2-2 mm. Flower-buds narrowly-ovoid, acute. *Sepals* oblong to ovate-oblong, obtuse or acutish, mucronulate, the outer ones more or less hisurate, glabrescent, the inner ones glabrous, all with glandular pellucid dots, 12-20 mm long, in fruit to 20-25 mm and then thick, subulate, whitish inside and with many glandular pits. *Corolla* funnel-shaped, 4-6 cm long, glabrous, bright-yellow, paler towards the base; the limb with 5 obtuse lobes, midpetaline bands distinctly 5-nerved. Anthers spirally twisted. Ovary glabrous. *Capsule* subglobe, ca 12 mm high, papery, straw-coloured, 4-valved. Seeds 4 or less, 6-7 mm long, dull black or blackish-brown, glabrous.

Distr. From India and Ceylon to Indo-China and the Andamans, throughout Malaysia.

Ecol. Both in regions with a feebie and in those with a rather strong dry season, in open grasslands, thickets, and hedges, along fields, in teak-forests, along edges of secondary forests, on river-banks and waysides, from sea-level to ca 900 m.

Use. It is used for poulticing, and an infusion is drunk for high fever (Burkll).

3. Section Xanthips


Flower-buds ovoid, obtuse or subacute; midpetaline bands indistinctly defined, never with dark lines; flowers of moderate size.


Stems herbaceous, or the older parts woody, the young parts with a white milky juice, twining or prostrate and rooting, slender, 1-3 m, or slightly strigate, softly pubescent or glabrescent to glabrous. Leaves variable in shape and size, 4-12 cm by 1-6½-9 cm, ovate, ovate-oblong or oblong, more or less cordate at the base or rounded to truncate, the basal lobes rounded or angular, sometimes hastate; more or less acuminate at the apex with obtuse, mucronulate tip; lower surface sparsely to densely covered with short, soft, greyish or whitish hairs; upper surface mostly less densely hairy to glabrous: lateral nerves 5-7(9) on either side of the midrib; tertiary nerves many, subparallel; petiole pubescent or glabrous, variable in length, 1½-6 cm. Peduncles axillary, mostly short, 1-4, rarely to 7 cm long, mostly densely pubescent, mostly cymosely branched at the apex with short branches; cymes mostly few- to many-flowered, umbelliform, rarely 1-flowered. Pedicels mostly longer than the calyx, sparsely pubescent to glabrous. Bracts minute, lanceolate or orbicular, rounded or emarginate, mucronulate, 5-7(8) mm long, the inner ones scarious at the margin, all glabrous or the outer ones sparsely pilose, often pectinately erose and slightly enlarged in fruit. Corolla funnel-shaped, 2-3, sometimes to 3½ cm long, white or yellow to orange, glabrous except for the upper parts of the midpetaline bands; limb slightly lobed. Anthers straight. Ovary glabrous or sparsely hairy at the top. Capsule ovoid to conical, mucronate by the style-base, glabrous or sparsely hairy at the top. 10-12 mm high, ca 8 mm diam., 4-valved, valves lanceolate to narrow-ovate, splitting from the base. Seeds 4 or less, ca 5 mm long, densely hairy with long soft patent hairs.

Distr. Tropical East Africa, the Seychelles, India, Ceylon, eastwards to China, Indo-China, Siam and Queensland; throughout Malaysia. Fig. 30. The ssp. umbellata (var. orientalis HALLIER f.) occurs in America from Mexico to Paraguay, in the West Indies and in tropical W. Africa. See further under Notes.

Ecol. In thickets, along edges of forests, in grasslands, along fields, along waysides, from sea-level to ca 1100 m.

Uses. The young leaves may be mixed with vegetables and eaten. The pounded leaves may be used as a poultice for burns and scalds. They are used as poultices for sores in the Moluccas (BURL; HEYNE).


Fig. 30. Merremia umbellata (L.) HALLIER f. ssp. orientalis (HALLIER f.) OOSTSTR. Distribution of specimens with yellow to orange and with white corollas. y: corolla yellow or orange; (y): corolla rarely yellow or orange; w: corolla white, (w) corolla rarely white.
Notes. The specimens from Malaysia belong to *ssp. orientalis* with the exception of a specimen from Depok, W. Java (Koorders 31153) which most probably represents *ssp. umbellata.*—Fig. 24a. This subspecies is of a more robust habit, with larger leaves, the peduncles are longer, and generally more flowered, the flowers are larger, sepals 7–10 mm long; corolla always yellow; moreover, the capsule is subglobose instead of ovoid to conical (ca 15 mm diam.), with broader, ovate valves, and the seeds are not so long villose, but pubescent to short-tomentose and only with slightly longer hairs at the margins. Another specimen, mentioned by the present author in Blumea 3 (1939) 341, collected by Keulemans, appears to have been found in Ilha do Principe (Prinsen- eiland), off the Westcoast of Africa (cf. Bull. Bot. Gard. Btgz III, 18, 1950, 466).

*ssp. umbellata* has a yellow corolla; the majority of the specimens of *ssp. orientalis* in the eastern part of Malaysia have white flowers; completely or partially yellow to orange ones are found in the western part of this region, although white corollas also occur there. Fig. 30. In *M. petiata* (L.) MERR. there is a remarkably conform parallel variation in the colour of the corolla: the majority of the specimens in the western part of Malaysia have yellow flowers, whereas in the eastern part the corolla seems to be constantly white. Fig. 31.

4. Section Hailale

**Hallier f.** Bot. Jahrb. 49 (1913) 379; OOSTSTR. Blumea 3 (1939) 342.

Closely related to *sect. Xanthips:* Mostly large woody twiners. Inflorescences corymbose, often forming terminal panicles; lower bracts often foliaceous. Flowers of moderate size or large. Buds ovoid or narrow-ovoid, acute or acutish, rarely subglobose. Midpetaline bands mostly not with distinct dark lines.


**KEY TO THE VARIETIES**

1. Branches, petioles and peduncles glabrous or nearly so. Leaves glabrous . . var. boisiana
2. Branches, petioles, peduncles and leaves more or less densely greyish or fulvous pubescent. var. *sumatrana*

var. *boisiana.*

A large woody twiner; branches terete or slightly striate, fistulose, glabrous, greyish brown to brownish black. *Leaves* broad-ovate to orbicular, 8–14 by 7–12 cm, cordate to truncate at the base, acuminate to cuspidate at the apex, glabrous; midrib and 7–9 lateral nerves on either side prominent beneath, impressed above, secondary nerves parallel, prominulous beneath, slightly impressed above, tertiary nervation finely reticulate, prominulous above; petiole to 7 cm long, glabrous or sparsely pubescent near the apex. *Inflorescences* axillary, corymbose, ramified at the apex, several-flowered; peduncle terete and glabrous in the basal part, more or less planate and pubescent to the apex, 9–13 cm long. Pedicels slightly thickened towards the calyx, sparsely pubescent, to 8(–12) mm. Bracts narrow-triangular, 1–1½ mm long, caducous, the lower ones sometimes foliaceous. Flower-buds subglobose. *Sepals* subequally in length or the outer ones slightly shorter, 5–7 mm long, concave, glabrous or the outer ones slightly pubescent; outer sepals orbicular to transverse-elliptic, rounded or slightly retuse at the apex, inner ones transverse-elliptic. *Corolla* broadly funnel-shaped to campanulate, ca 22 mm long, yellow (in the Tonkin specimen), or white (in the *Sumatrana* one); midpetaline bands securiceous outside. Filaments curved at the dilated papilllose base; the corolla inside with two longitudinal hairy lines below the place of insertion of each filament; anthers straight, finally twisted. Ovary glabrous. *Capsule* (acc. to GAGNEPAIN) ovoconical, 4-valved, glabrous, castaneous at the base, yellow upwards.

**Distr.** Indo-China (Tonkin), in Malaysia: Sumatra (East Coast).

**Ecol.** Edge of clearing, ca 900–1050 m.

Note. The specimen from Sumatra (Yates 975) is almost entirely identical with the type (Bois 138) from Tonkin; the lower surface of the leaves of the Tonkin specimen is, however, somewhat more glaucous than in that from Sumatra. The specimen BECCARI 3594, from Borneo, mentioned by GAGNEPAIN, belongs to *M. crassivernia* OOSTSTR.

var. *sumatrana* Ooststr. Blumea 3 (1939) 344.

Differ from *var. boisiana* by the grey to fulvous pubescent, afterwards glabrescent branches, petioles, peduncles, and pedicels, by the leaves being densely greyish pubescent on both sides, and becoming glabrous above.

**Distr.** Malaysia: Sumatra (East Coast: Sibolangit).

**Ecol.** In young forest and thickets, ca 500–600 m.

Note. Specimens of this variety are to 20 m high; the leaves may reach a length of 20 cm and 16 cm diam., petiole to 10 cm long, inflorescences 8–16 cm long.

A glabrous twiner with subterranean, fusiform to globose, fasciculate, ca 10–25 cm long tubers, containing a white milky juice. Stems annual, terete, brown, finely striate in the older parts. Leaves broad-ovate to orbicular or sometimes broader than longer, 6–12 by 4½–12(–15) cm, cor- date at the base, abruptly acuminate at the apex, with a narrow, obtuse, mucronulate acumen; margin entire or slightly undulate; lateral nerves 7–9 on either side of the midrib, 3–4 of them from near the base; secondary nerves many, parallel; tertiary nervation reticulate; petiole slender, to 6, or sometimes to 10 cm long or more. Inflorescences axillary. Peduncle terete, or angular near the apex, 3–15 cm, 1–3 or sometimes more-flowered. Pedicels thickened and angular towards the apex, 12–15 mm. Bracts linear-lanceolate or lanceolate, 7–10 mm long, membranous, caducous. Flower-buds narrow-ovoid, acute. Sepals concave, about equal in length, 24–30 mm long, the 3 outer ones broad-ovate to broad-elliptic, obtuse, mucronulate, the inner ones narrower and less obtuse. Corolla broadly funnel-shaped, 7–8 cm long, white, glabrous but with minute glands outside; mid-petaline bands distinctly nervced. Base of the filaments decurrent with a row of hairs on either side; anthers spirally twisted. Ovary glabrous. Capsule enclosed by the persistent calyx. Seeds 8 mm long, greyish to black, with long brownish hairs along the margins.

Distr. India, Indo-China, Andamans, in Malaysia: cultivated in Java, formerly also in Bali, the Moluccas, and the Philippines (acc. to Rumphius); occasionally escaped (Madura).

Use. The tubers are edible, they are also used as a native anti-diabetes remedy; and in affections of the throat and the respiratory organs, or in cases of lung-tuberculosis.

Vern. Bidara upas, M, widara upas, wirodj, blanar, J, rabèt belading, Md, ubi sufu, Moluccas, bangkuwang, Bali (Rumphius), haidalé, Ambon (Rumphius, Heyne), angcoa, Philip. (Rumphius).


A large woody quite glabrous twiner, stems ca 2 cm diam.. Branches terete, fistulose, pale to dark brown, warty by pale lenticels. Leaves more or less bullate, orbicular, or rarely ovate, (5–)8–22 by (3½)–6–18 cm, cordate at the base, cuspidate at the apex with a long and narrow mucronulate acumen, sometimes acuminate and less distinctly cuspidate; midrib and (6–)8–11 curved lateral nerves on either side prominent beneath, secondary nerves parallel, prominent beneath; tertiary nerves reticulate, conspicuous; petiole 4–11 cm. Inflorescences axillary. Peduncle 6–12 cm long, several-flowered, lenticellate, cymosely branched towards the apex. Pedicels 1½–3 cm, angular, thickened above, especially in fruit. Bracts caducous. Flower-buds ovoid to oblong, acute. Sepals elliptic to broad-elliptic, obtuse to slightly emarginate at the apex, mucronulate, (15–)18–22 mm long, the two outer ones leathery, the inner ones more or less membranous, all slightly accres- cent in fruit. Corolla campanulate to funnel-shaped, 5½–6 cm long, yellow, outside glabrous, inside papillose below the base of the filaments. Filaments glabrous; the corolla inside above the insertion of the filaments with a semicircular thickening. Ovary glabrous, 4-celled. Capsule ovoid, ca 12 mm high, mucronate, glabrous, black. Seeds oblong-ovoid, ca 6–7 mm long, pale, ap- pressed-pilose.

Distr. Malaysia: Malay Peninsula (Tringganu), W., NW. and N. Borneo.


Most probably a large twiner, quite glabrous. Branches terete, greyish brown, with sparse, pale lenticels. Leaves ovate, 7–11 by 5–6½ cm, cordate at the base, abruptly acuminate at the apex, with an acute, ca 1 cm long acumen; midrib and 6–7 lateral nerves on either side slightly impressed above, prominent beneath; secondary nerves nearly parallel, slightly prominent above, flat beneath; tertiary nerves indistinctly reticulate; petiole sul- cate above, 1½–2½ cm long. Inflorescences ca 8–20 cm long, racemously ramified; peduncle ca 3–6 cm, terete, lower branches 3–7, upper 2½–5 cm long, 1-flowered. Pedicels 1½–2½ cm, angular and thickened towards the apex. Sepals thinly coriaceus, or the inner ones membranous, equal in length or the outer ones slightly shorter, 25–30 mm long, oblong to elliptic-oblong, obtuse at the apex and mucronulate. Corolla broadly funnel-shaped, ca 6 cm long, glabrous.

Distr. Malaysia: Borneo (N. Sarawak); a speci- men collected in the Philippines by G. T. Lay, without indication of the exact locality (Herb. Brit. Mus.) seems to be conspecific.

Note. The type specimen from P. Muara, Brunei Bay, in Herb. Singapore, possesses one open flower, glued upon the sheet; therefore I could not examine details.


A woody quite glabrous twiner. Branches terete, solid or fistulose, greyish brown, warty by pale lenticels. Leaves ovate to broadly ovate, 7–13 by 3½–9 cm, cordate at the base, attenuate or slightly acuminate towards the obtuse or acutish apex; margin entire or slightly undulate; midrib and 8–10 curved lateral nerves on either side impressed above, prominent beneath; secondary nerves parallel, like the reticulate tertiary ones slightly impressed above, prominent beneath; petiole nar- rowly sulcate above, 1½–5 cm long. Inflorescences axillary, up to 20–30 cm long, widely corymbose, many-flowered, lower branches in the axis of small caducous leaves, upper ones in the axis of minute bracts. Peduncle 7–11(–17) cm, terete. Pedicels up to 15 mm, slightly
angular. Flower-buds conical, acute. Sepals sub-equal in length, 11–12 mm long, the two outer ones elliptic, rounded and mucronulate at the apex, concave, subcoriaceous; 3 inner ones broadly elliptic to orbicular, rounded and mucronulate at the apex, and with membranous margins. Corolla funnel-shaped, ca 2–2 1/2 cm long, glabrous, the limb shallowly lobed. Filaments papilllose at the margins of the dilated base. Ovary glabrous.

Distr. Malaysia: Borneo (Sarawak).


A woody twiner. Branches terete, slightly striate, glabrous or pubescent towards the apex, minutely warty by pale lenticels. Leaves ovate to broadly ovate, 5–14 by 3–10 cm, rounded at the base, gradually attenuate or shortly acuminate towards the obtuse mucronate apex, glabrous; midrib and 5–6 curved lateral nerves on either side impressed above, prominent beneath; secondary nerves nearly parallel, promonilusous on both sides or indistinct above; tertiary nerves reticulate, prominent above, flat beneath; petiole 1–3 cm, narrowly sulcate above, glabrous. Inflorescences axillary, more or less secund, to 12 cm long, corymbose branched at the apex, many-flowered; peduncles to 8 cm, terete, glabrous or pubescent towards the apex; branches of the inflorescences short, pubescent. Pedicels 12–16 mm long (in fruit 25–35 mm), glabrous or pubescent at the base, slightly thickened and subangular at the apex. Lower bracts foliaceous, to 3–5 cm long, upper ones subulate, ca 1 1/2 mm long. Flower-buds ovoid, acute to obtusish. Sepals glabrous, two outer ones subcoriaceous, broadly oblong, rounded at the apex, ca 7 mm long, three inner ones broadly elliptic to orbicular, retuse at the apex, 8–9 mm long, subcoriaceous in the middle portion, and with membranaceous margins. Corolla campanulate to broadly funnel-shaped, ca 1 1/2 cm long, yellow (or sometimes white?), glabrous, limb hardly lobed, crenulate(?). Dilated base of the filaments curved, and papilllose at the margins; anthers straight. Ovary glabrous. Capsule ca 12–13 mm high, straw-coloured, 4-, or by splitting of the valves, more-valved; valves at the apex with a sharp incurved tooth. Seeds ca 6 mm long, densely covered with long blackish brown or greyish brown soft hairs.

Distr. Malaysia: Borneo (Sarawak).

Ecol. Scandent in thicket and open forests.


A large woody twiner. Stems terete or obtusely angular, substricate, greyish brown when dry, glabrous or slightly pubescent in the younger parts; the adult stems fistulose, to 7 mm diam. Leaves broadly ovate or orbicular, 6–15 by 4–14 cm, broadly cordate or truncate at the base, abruptly acuminate or cuspidate at the apex with a narrow, acute, 1–1 1/2 cm long acumen, glabrous and dull or more or less shining above, paler beneath and there pubescent on the nerves or glabrous; midrib and 7–10 lateral arcuate nerves on either side often subimpressed above, prominent beneath; secondary nerves subparallel, promonilusous above, prominent beneath; tertiary nerves reticulate, promonilusous above; petiole 2 1/2–6 cm long, subtrinate and slightly sulcate above, glabrous or sparsely hairy in the groove. Inflorescences axillary, corymbose branched at the apex, to 20 cm long, secund, or often forming a more or less umbelliform panicle at the end of the branches; peduncle to 12 cm, pubescent or glabrous, longitudinally striate; primary branches many, in the axils of foliaceous bracts, pubescent, 1 1/2–4 cm long, cymose at the apex with several flowers. Pedicels 12–20 mm long, pubescent. Upper bracts small, linear-subsulate, 2 1/2–4 mm, pubescent. Flower-buds ovoid, acutish. Sepals black when dry, shining, broad-elliptic or orbicular, broadly rounded at the apex, mucronulate or not so, outside glabrous, inside with many minute resinous dots, equal in length or the outer ones slightly shorter, 9–10 mm long. Corolla broadly funnel-shaped or campanulate, 2–2 1/2 cm long, yellow, shallowly lobed, outside glabrous, inside with some hairs below and between the bases of the filaments. Filaments papilllose at the margins of the slightly broadened base; anthers straight, glabrous. Ovary glabrous.

Distr. Malaysia: Borneo (Indonesian Borneo, Sarawak).

Ecol. Mostly in secondary forests, between 150 and 300 m.


A large twiner, to 30 m high, covering whole trees, rarely procumbent. Stems from a large subterranean tuber, terete, fistulose or pithy, containing a milky juice, glabrous, or hairy at the base of the petioles, the thickest parts striate. Leaves peltate, broadly ovate to orbicular or even broader than long, 7–30 by 7–30 cm, rounded or slightly retuse at the base (the leaves of the inflorescences sometimes cordate at the base and not or indistinctly peltate), acuminate or abruptly cuspidate at the apex, with an acute and mucronulate acumen; glabrous on both surfaces or slightly hairy beneath along the nerves, rarely on the whole surface; lateral nerves 7–10 on either side of the midrib; secondary nerves many, parallel; finer nervation reticulate; petiole shorter or longer than the blade, 3–20 cm long or more, glabrous. Inflorescences to 40 cm long, widely corymbose, several- to many-flowered; peduncles axillary,
1–2 in a leaf-axil, stout, terete. Pedicels 11/2–21/2 cm, thickened and angular at the apex, in fruiting stage clavate and to 5 cm. Bracts caducous. Flower-buds narrow-ovoid, acute. Sepals (15–) 18–25 mm long, equal in length or the outer ones slightly shorter; three outer sepals broad-ovate, subcoriaceous; two inner ones narrower, ovate-oblong, thinner, all mucronulate at the obtuse apex. Corolla broadly funnel-shaped, 41/2–6 cm long, yellow or white, limb shallowly lobed. Filaments dilated and hairy in the basal part; corolla inside above the insertion of each filament with a semicircular thickening; anthers spirally twisted, hairy. Ovary glabrous. Capsule 4-celled, 4-valved; valves splitting longitudinally into several segments. Seeds 4, densely yellowish to dark-brown tomentose and long-villosous.

Distr. Madagascar, Mascarenes, Seychelles, N. & E. tropical Australia, Polynesia; throughout Malaysia. Fig. 31.

Fig. 31. Merremia peltata (L.) Merr. Distribution of specimens with yellow, and with white corollas. y: corolla yellow. (y): corolla rarely yellow; w: corolla white, (w): corolla rarely white.

Ecol. Edges of primary and secondary forests. clearings, thickets, from sea-level to ca 700 m.

Uses. The tubers are reputed edible, but may cause purging. The Sundanese use it for stomach-ache. The juice of the stems is taken for coughs, diarrhoea, and worms; and is used for sore eyes. Rumphius states that the juice of the stems may be applied to fresh wounds, and dropped into sore eyes. The leaves are used for washing the hair, and are applied as poultices on sore breasts, ulcers, and wounds (Burkill; Heyne). In the Philippines the stems are sometimes used for tying purposes (Brown, Quisumbing).


Note. Yellow-flowered specimens appear to be restricted, with a few exceptions, to W. Malaysia, whereas white-flowered ones occur in E. Malaysia. Fig. 31. A similar distribution of the flower-colour is found in 13. M. umbellata. Fig. 30.


A large woody twiner; stems, inflorescences and lower surface of the leaves, especially the nerves greyish pubescent to villose (or plant quite glabrous: var. glaberrima Ooststr.). Stems stout, terete or slightly flattened, to 5–7 mm diam. Leaves peltate, broadly ovate to orbicular, 6–25 by 5–21 cm, rounded to slightly retuse at the base, more or less abruptly acuminate at the apex, with a narrow and acute acumens; lateral nerves 8–10 on either side of the midrib, curved at the margin; secondary nerves many, parallel, tertiary nerves reticulate; petiole shorter to longer than the blade, 3–20 cm or more, glabrous or sparsely pubescent. Inflorescences 7–25 cm long. solitary or in pairs in the leaf-axils, more or less secund; peduncles terete or flattened at the apex, pubescent and glabrescent like the stems, patent, corymbose branched from ca 5–15 cm above the base, several-flowered. Pedicels 7–15 mm long, angular, striate, sparsely hairy or glabrous. Bracts caducous, lower ones sometimes foliaceous, not peltate. Flower-buds ovoid, acute or obtusish. Sepals broadly elliptic to elliptic-oblong, 9–13(–15) mm, outer ones concave, obtuse, glabrous, subcoriaceous, longitudinally striate outside; inner ones thinner, obtuse or slightly emarginate, glabrous, all slightly enlarged in fruit. Corolla funnel-shaped to campanulate, 3–31/2 cm long, white, except for the blackish grey basal outer parts, outside minutely granulose-glandular; limb indistinctly lobed, with ciliate margin. Filaments sparsely papillose at the margins of the broadened base; the corolla inside above the base of each filament with a semicircular thickening. Anthers twisted, villose. Ovary glabrous. Capsule subglobose to broadly conical, 13–14 mm diam., 2-celled, pericarp splitting into several valves; valves striate outside. Seeds 4, short-pubescent, brownish black, margins bearded with long brown hairs; seeds 5–61/2 mm long.

Distr. Malaysia: Borneo (Indonesian & Br. N. Borneo).

Ecol. Thickets, in recently cleared land in rather wet places.

Note. Closely related to M. peltata and mainly different by its smaller flowers, of which the corolla is granulose-glandular outside.

var. glaberrima Ooststr. Blumea 3 (1939) 359, f. 3, d–m. Like the typical form of the species, but quite glabrous.

Distr. Malaysia: Borneo (Indonesian Borneo, Sarawak).
5. Section Wavula

OOSTSTR. Blumea 3 (1939) 266, 359.

Closely related to sect. Xanthips. Flower-buds ovoid to narrow-ovoid or oblong, subacute; midpetaline bands not with distinct dark lines. Inflorescences subumbelliform. Flowers moderate to large. Pedicels immediately below the calyx with a ring of small thick lobes.


A twiner. Stems terete, smooth or finely striate, fistulose. 2½–4½ mm diam., the young parts densely grey or rusty farinose, pubescent or short-tomentose, glabrescent. Leaves broadly ovate to orbicular, 8½–20 by 8–20 cm, broadly coriaceous at the base, abruptly acuminate at the apex with a narrow acumen; densely short-tomentose on both sides in youth with short curled hairs, afterwards the upper surface glabrescent, finally with some scattered white hairs mainly along the nerves, the lower surface with a dense, short, rusty or greyish brown tomentum; lateral nerves 7–10 on either side of the midrib, curved at the margin, secondary nerves many, parallel, all distinctly prominent beneath; tertiary nervation reticulate; petiole 3–17 cm, pilose like the stems, glabrescent. Inflorescences axillary; peduncle to 30(–60) cm, terete, pilose like the stems, glabrescent, branched close to the apex; branches ca 1 cm long or slightly longer. Pedicels gradually thickened to the apex, with a thick lobed ring immediately below the calyx, farinose, glabrescent towards the apex, 2–3 cm, in fruit erect, 4–4½ cm. Bracts elliptic, 2–2½ mm long, glabrous inside, short-tomentose outside, caducous. Flower-buds narrow-ovoid to oblong, acute. Sepals concave, thin-coriaceous with a membranous margin and with glandular dots, obovate to broad-elliptic or orbicular, obtuse, or the outer ones slightly retuse, mucronulate, to 15–18 mm long, the innermost a little shorter; the calyx enclosing the fruit as a cup, with sepals to 20 mm long. Corolla broadly funnel-shaped, ca 4 cm long, white with a tinge of red, slightly 5-lobed, nearly glabrous, only with a few hairs at the top of the midpetaline bands. Filaments pilose at the somewhat broadened base; the corolla-tube inside with two hair lines below the base of each filament. Anthers twisted, glabrous. Ovary glabrous. Capsule ovoid, ca 15–18 mm long, 4-valved; the soon loosening outer layer of the valves brownish-black, afterwards the valves are straw-coloured outside, white inside. Seeds 6 mm long, black; sparsely tomentose and densely villose.


Ecol. In thickets and secondary forests at low and medium altitudes.

Vern. Bulakán, buwákán, P. Bis..

Note. MERRILL assumes this species to be conspecific with Convolvulus distillatorius BLACO. If this is accepted the correct name for the species would be Merremia distillatoria (BLCO) MERR.. However, in my opinion, this identity is not quite certain.

14. OPERCULINA

S. MANSO, Enum. Subst. Bras. (1836) 16; OOSTSTR. Blumea 3 (1939) 361.—Fig. 32–33.

Large, herbaceous twiners, the stems, peduncles, and petioles often winged. Leaves petioled, entire, angular or digitate, often coriaceous at the base. Flowers large, in one- to few-flowered axillary, peduncled cymes. Bracts often large, caducous. Sepals 5, large, pergameneous to coriaceous, mostly glabrous, often ventricose, often enlarged in fruit and ultimately with an irregularly lacerate margin. Corolla regular, broadly funnel-shaped or campanulate, white or yellow, glabrous, or with midpetaline bands hairy outside. Stamens 5, included; filament adnate to the corolla-tube, filiform; anthers large, often at length spirally twisted; pollen ellipsoid, smooth. Disk annular. Ovary glabrous, 2-celled, each cell with 2 ovules; style simple, filiform, included; stigma biglobular. Capsule large, dry; epicarp circumscissile in or above the middle, the upper part of it (operculum, lid) more or less fleshy, separating from the lower part and from the endocarp; this scarious, at length splitting irregularly. Seeds 4 or less, large, trigonous or globular, glabrous, or pilose along the edges, often dull black.

Distr. Ca 20 spp. in the tropics of both hemispheres.
Fig. 32. a–b. *Operculina turpethum* (L.) S. Manso. a. Flowering branch, × 2/3, b. infructescence, × 2/3.—c–d. *Operculina brownii* Ooststr., c. young capsule, × 2/3, d. capsule with operculum, × 2/3.

Perennial twiner with long fleshy much branched roots. Stems 2–4 mm high, narrowly 3–5-winged, sulcate or angular, glabrous or sparsely short-pilose, mainly at the nodes; young parts sometimes more or less tomentose. Leaves vary in shape, orbicular, broadly ovate, ovate-lanceolate or lanceolate; broad leaves 5½–15 by 4–14 cm, narrow ones 5½–7½ by 1–2½ cm; base cordate, sometimes hastate, apex acuminate, acute or obtuse to rounded, rarely slightly emarginate, mucronulate; margin entire or sometimes coarsely dentate to shallowly lobed; upper surface glabrous or appressed-pilose, lower surface pubescent; midrib and 8–11 nerves on either side prominent beneath; petiole terete or sometimes winged, 2½–7½ cm. Inflorescences cymose one- to few-flowered; peduncles 2–18 cm long, terete or sometimes winged like the stems, glabrous or pubescent. Pedicels angular, 12–15 mm or those of the central flower up to 35 mm long, pubescent, in fruit clavate and up to 40 mm. Bracts oblong or elliptic-oblong, mucronulate, 1½–2 cm long, pubescent, caducous. Sepals ovate or broadly ovate, acute or shortly acuminate, outer ones 1½–2½ cm long, pubescent outside, inner ones ca 2 cm long, glabrous or nearly so; calyx in fruit broadly cup-shaped, up to 6 cm diam. Corolla broadly funnel-shaped, 3–4½ cm long, white or white with yellowish base, glabrous or sometimes with minute yellowish glands outside. Filaments sparsely pubescent below. Capsule depressed-globose, 1½ cm diam. Seeds 4 or less, 6 mm diam., glabrous, dull black.

Distr. Trop. E. Africa, Mascarenes, Seychelles; S. & SE. Asia to trop. Australia and Polynesia, in Malaysia: not yet recorded from Sumatra, extremely rare in Borneo; recently introduced in the Malay Peninsula. Introduced in the West Indian Islands. Fig. 33.

Uses. The bark of the roots is used as a purgative; the stems are used for tying purposes (Philippines).

Vern. Indian jalap, turpeth-root, E, aroj daatang benēr, S, sampar-kèdông, sampar-kèbō, balaran, rajaden, J, langwi, Sumbawa, non loli, Timor; Philippines: bangbangau, laplapus, II., burdakan. S. L. Bis., kamokamotihan, Tag. ...

1. O. turpethum
2. O. brownii

3. O. riedelianiana

Fig. 33. *Opeculina turpethum* (L.) S. MANSO. Distribution in Malaysia.
Fig. 34. Decalobanthus sumatranus OOSTSTR. Flowering branch, $\times \frac{1}{2}$, and flower, nat. size.

long (only one examined), white, glabrous. Capsule 3½-4 cm diam., enclosed by the large cup-shaped calyx. Seeds ca 15 mm long, glabrous, dull black.

Distr. Australia (N. Territory, N. Queensland), Thursday Island, likely to occur in the dry savannah regions of S. New Guinea.


Plant glabrous. Stems twining, robust, terete, more or less woody, fistulose or with pith. Leaves broadly ovate to orbicular, sometimes obtuse or rarely narrowly obtuse, occasionally contracted about the middle, 8-18 by (3-)6-15 cm, broadly cordate at the base or in narrow leaves sometimes slightly cordate to truncate, more or less abruptly acuminate at the apex, with acute mucronulate point; often reddish brown when dry; nerves ca 7-8 on either side of the midrib; petiole thin, slender, 2-10 cm. Inflorescences one- to several-flowered. Peduncles shorter or longer than the pedioles, 2-11 cm, terete at the base, applanate upwards. Pedicels 1-2(-3) cm long, clavate above, much thickened in fruit. Bracts oblone, 10-15 mm long, scarious. Sepals about equal in length, orbicular, broadly rounded or shallowly emarginate at the apex, 13-17 mm long, in fruit up to 20 mm; calyx in fruit cup-shaped and enclosing the capsule. Corolla broadly funnel-shaped, 4-5 cm long, pale yellow or rarely white; midpetaline bands densely sericeo-pilose outside. Filaments pubescent at the base as is the corolla inside below their insertion. Capsule 2½-3 cm diam.; seeds ca 7 mm long, dull black, with 2 pilose-papillose edges.


Ecol. Thickets, edges of secondary forests, hedges, at low altitudes.


15. DECALOBAUTHUS

OOSTSTR. Blumea 2 (1936) 99, f. 1; ibid. 3 (1939) 370.—Fig. 34.

Prostrate, glabrous herb, with slender stems. Leaves petioled, ovate, entire. Inflorescences axillary, peduncled, cymosely 1-3-flowered. Sepals 5, large, equal in length, or the outer ones a little shorter. ovate or elliptic, obtuse or shallowly emarginate at the apex. Corolla regular, medium-sized, yellow, salver-shaped, with a fleshy long and narrowly obconical to cylindrical tube; limb 5-lobed; lobes bifid, their middle portion thicker than the oblong, obtuse lobules. Stamens 5, included; filaments flattened, adnate to the corolla-tube; pollen smooth. Disk cylindrical,
slightly lobed. *Ovary* glabrous, 2-celled, each cell with 2 ovules; style 1, simple, filiform, included; stigmas 2, globose, papilllose. *Fruit* unknown.

Distr. Monotypic, endemic in *Malaysia*.

1. *Decalobanthus sumatranus* Oostr. Blumea 2 (1936) 99, f. 1; *ibid*. 3 (1939) 370.—Fig. 34.

Herb with prostrate, thin, terete stems. *Leaves* ovate or narrowly ovate, 4–6 by 2–4 cm, truncate or slightly retuse at the base, gradually attenuate towards the obtusish mucronulate apex; midrib and 6–7 nerves on either side prominent on both sides; petiole 10–17 mm. *Inflorescences* axillary, 1–3-flowered; peduncles 1½–3½ cm; pedicels slightly angular, thickened at the apex, 1–1½ cm. *Sepals* equal in length or the exterior ones a little shorter, up to nearly 20 mm long, concave; two outer ones ovate, shallowly emarginate, indistinctly mucronulate, coriaceous; three inner ones elliptic, coriaceous, with membranaceous margins. *Corolla* salver-shaped, yellow; tube narrowly obconical to cylindrical, fleshy, up to 2½ cm long; limb 5-lobed, the lobes reflexed (or patent?), bifid with oblong, obtuse, ca 5–5½ mm long lobules. Filaments inserted ca 6½ mm above the corolla-base. *Ovary* glabrous, 2-celled. Disk cylindrical, slightly lobed. *Fruit* unknown.

Distr. *Malaysia*: Sumatra (Djambi). Ecol. The only collection known was found along a wayside, on an open sunny place on weathered tuft, 60 m.

16. **IPOMOEA**

Linné, Sp. Pl. ed. 1 (1753) 159; Gen. Pl. ed. 5 (1754) 76; Ooststr. Blumea 3 (1940) 481.—Quamoclit Moench, Meth. (1794) 453 ("Quamoeilit").—Batatas Choisy, Mém. Soc. Phys. Genève 6 (1833) 434.—Pharbitis Choisy, l. c. 438.—Calonyction Choisy, l. c. 441.—Exogonium Choisy, l. c. 443.—Fig. 35–55.

Herbs or shrubs, usually twining, sometimes prostrate, floating, or erect. *Leaves* mostly petiolate, variable in shape and size, entire, lobed or divided. Petiole sometimes with pseudostipules (small leaves of the axillary shoot) at its base. *Inflorescences* mostly axillary, cymose, one- to few- or many-flowered, the cymes rarely paniculate; bracts various. *Flowers* large, medium-sized or small. *Sepals* 5, herbaceous or subcoriaceous, variable in shape and size, glabrous or hairy, persistent, often more or less enlarged in fruit. *Corolla* regular, or rarely slightly zygomorphic, usually funnel-shaped, or campanulate, more rarely tubular or salver-shaped, purple, red, pink, white or yellow; limb shallowly or rarely deeply 5-lobed; mid-petaline bands well-defined by 2 distinct nerves. *Stamens* 5, mostly inserted near the base of the corolla-tube, included or rarely exerted; filaments filiform, often dilated at the base, often more or less unequal in length; pollen globular, spinulose. Disk annular. *Ovary* usually 2-, or sometimes 4-celled, 4-ovuled, rarely 3-celled, 6-ovuled, glabrous or hairy; style 1, simple, filiform, included, rarely exerted; stigma capitate, entire or often 2-, rarely 3-globular. *Fruit* a globose or ovoid capsule, mostly 4- or rarely 6-valved, or splitting irregularly. *Seeds* 4–6 or less, glabrous or hairy.

Distr. A large genus of ca 500 spp., widely spread in the tropical and subtropical regions of both hemispheres.

Many species inhabit large or very large areas; still some of them are rare in *Malaysia*, e.g. 26. *I. diversifolia*. This phenomenon even occurs in species which are confined to the sandy sea-beach, as 22. *I. stolonifera*. A few species occupy apparently very local areas of distribution, as 16. *I. ochroleuca* which is endemic in Timor, and 17. *I. stibaropoda* which is hitherto only known from the Salajar Islands (S of Celebes).

Ecol. As a rule species of *Ipomoea* are restricted to the tropical lowland and hills, the highest locality recorded being about 1650 m altitude, or cultivated 13. *I. batatas* still higher. But further their distribution is usually not bound to special ecological niches. As is the case with the family generally, the representatives are heliophilous, hence they occur in great quantities along forest edges, in secondary forest, and in thickets which they may occasionally cover with a 'vegetable blanket' in conjunction with representatives of the *Cucurbitaceae*, *Vitaceae*, *Passifloraceae*, etc. (fig. 43).

Some species are restricted to the sandy beach, or nearly so, as 20. *I. pes-caprae*, 22. *I. stolonifera*, and 40. *I. tuba*. Specially the first species often plays a predominant part in the beach-vegetation where it is commonly associated with *Vigna*, *Canavalia*, and *Spinifex*. However, *I. pes-caprae* also occurs in-
land: some of these inland spots have been considered to represent relict localities, but, as they are situated mainly along roads and railways, dispersal through anthropogenic transport seems to be the main cause of this phenomenon. The highest locality recorded of it is along roadsides in Central Celebes at ca 200 m (see the instructive discussion by Boorberg, Hand. 7e Ned.-Ind. Nat. Wet. Congr. 1935 (1936) 403, on the inland occurrence of the species in Java and Bali). Flowers and fruits are produced in these inland spots.

Most Ipomocas grow both under everwet and seasonal climatic conditions. However, there are some species distinctly restricted to regions subject to a pronounced dry monsoon, as I. eriocarpa, 2. I. plebeja, 3. I. polymorpha, and 27. I. graminea. They prefer savannah-country and grassfields (fig. 36, 37, 39).

Uses. Many species are used as ornamentals; quite a few have been imported for that aim from the New World. As food plants the most important are 19. I. aquatica and 13. I. batatas. The former is an excellent, palatable vegetable. The sweet potato is an important food plant; it is a cultigen from the New World, brought to Malaysia by the Portuguese in post-Columbian time. This origin is still reflected in several vernacular names, e.g. in 'ubi kasteda' (tuber of Castile) and many names derived from it. It is now the main starch food of the mountain Papuans who grow it in many varieties. Some species are used in native medicine.

**KEY TO THE SPECIES**

1. Sepals distinctly awned at or below the apex; awn straight or curved. Corolla salver-shaped with a long and narrow tube. Stamens and style mostly exserted.
2. Corolla rather small, 3-4½ cm long, scarlet, rarely pure white. Outer sepals 2-4½ mm long (awn exclusive), inner ones 3-6 mm (awn exclusive).
3. Leaves pinnately parted into numerous linear or filiform segments, rarely less deeply pinnately cut. 31. I. quamoclit

3. Leaves not pinnately cut; ovate to orbicular, cordate at the base; margin entire or lobed. 30. I. angulata

2. Corolla larger, white or purplish. Outer sepals 5-12 mm long (awn exclusive), inner ones 7-15 mm (awn exclusive).
4. Corolla white; tube not or slightly widened above, 7-12 cm long; limb rotate. Stamens and style exserted. 28. I. alba
5. Corolla purplish, the tube distinctly widened above, 3-6 cm long, the limb funnel-shaped to rotate. Stamens and style not or scarcely exserted. 29. I. muricata

1. Sepals obtuse, acute or acuminate, whether or not mucronulate but not distinctly awned at or below the apex. Corolla mostly funnel-shaped, or campanulate, sometimes salver-shaped. Stamens and style mostly included, sometimes exserted. (When leaves pinnately cut, see 31. I. quamoclit).
6. Corolla large, 10 cm long or longer, salver-shaped with a long and narrow tube, white, or with greenish or reddish midpetaline bands. Sepals obtuse. Seeds hairy. Large twiner.
7. Stamens inserted near the mouth of the corolla-tube. Sepals subequal or outer ones slightly longer than inner, 12-18 mm long. 39. I. aculeata

8. Stamens inserted near the base of the corolla-tube. Outer sepals slightly or much shorter than the inner ones.
9. Outer sepals much shorter than inner ones. Leaves mostly 5(3-7)-lobed, rarely entire. Corolla white, or with reddish midpetaline bands, 11-14 cm long. Stamens exserted. 41. I. trichosperma

10. Outer sepals mostly slightly shorter than inner ones. Leaves mostly entire. Corolla white with greenish bands, 9-12 cm long. Stamens included. 40. I. tuba

5. Corolla large, medium-sized, or small, mostly funnel-shaped or campanulate, 10 cm long, or mostly shorter, rarely salver-shaped, in the latter case not longer than ca 7 cm. Sepals obtuse, acute or acuminate. Seeds hairy or glabrous. Large to small twiners, or prostrate or erect plants.

8. Sepals entirely glabrous (sometimes mucruricata).
9. Sepals at least 14 mm long, the outer ones with lanceolate to broadly lanceolate base, long- and gradually attenuate towards the apex. 6. I. congesta

9. Sepals not long- and gradually attenuate towards the apex, mostly shorter.
10. Ovary densely to sparsely hairy. 13. I. batatas

10. Ovary entirely glabrous.

11. Stamens exserted.
12. Leaves entire, linear. 27. I. graminea
12. Leaves entire, ovate to orbicular. Corolla funnel-shaped, yellow. Outer sepals not very concave, ovate to oblong, subacute, 5-6 mm long. 17. I. stibaropoda

12. Leaves deeply palmately lobed. Corolla salver-shaped, red or red-purple. Outer sepals distinctly concave, elliptic or ovate-elliptic, obtuse, 7-10 mm long. 34. I. hirsulfalae

11. Stamens included.

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(1) Or segments less numerous, ca 3-7 on either side of the midrib, linear or linear-lanceolate.

31a. I. × sloteri
13. Leaves palmately lobed to palmately compound.
14. Leaf-segments cut to the base. Pseudostipules (small leaves of the axillary shoot) often present. Sepals 4–6½ mm long, not very concave; outer ones ovate, obtuse or acutish, inner ones broader ........................................ 24. I. caitäca
15. Leaves palmately lobed to or mostly beyond the middle, not to the base. No pseudostipules.
16. Stems twining. Sepals concave, rounded at the apex, at least the inner ones orbiculate; the outer ones occasionally somewhat narrower; sepal not mucronulate.
17. Plant entirely glabrous or very sparsely pubescent with simple hairs. 32. I. digitata
18. Stems prostrate, rooting at the nodes. Inner sepal oblong to elliptic-oblong, distinctly mucronulate.
19. Leaves herbaceous, thin, the middle lobe acute or subacute. Corolla pink or purple.
21. Leaves fleshy, the middle lobe obtuse or emarginate. Corolla white or yellowish with a purple centre. No subterranean tubers. Plant of sandy sea-shores. 22. I. stolonifera
22. Leaves mostly broader; midrib and lateral nerves not parallel. Corolla mostly funnel-shaped, rarely salver-shaped.
23. Corolla 7 cm or longer; at least the inner orbicular sepal 9–12(–18) mm long.
24. Leaves with 3–4 nerves on either side of the midrib. Plant more or less tomentose with stellate hairs, or glabrescent to glabrous, except at the nodes. Corolla ca 7 cm long. ........................................ 33. I. asterophora
25. Leaves and narrowly linear; midrib and lateral nerves nearly parallel. Corolla salver-shaped, white. Outer sepal elliptic, ca 6 mm long, inner ones oblong to ovate-oblong, 7–10 mm ........................................ 27. I. graminea
27. Corolla with 3–4 nerves on either side of the midrib. Plant more or less tomentose with stellate hairs, or glabrescent to glabrous, except at the nodes. Corolla ca 7 cm long. ........................................ 33. I. asterophora
28. Leaves with 10–15 nerves on either side of the midrib. Plant glabrous, or pubescent with simple hairs. Corolla up to 10 cm long ........................................ 36. I. illustris
29. Corolla mostly smaller, not exceeding 5 cm, or rarely longer, but then the inner sepal not orbicular, but narrower, 4½–6 mm long, and with distinct pale margins (see 23. I. tricolor).
30. Large woody glabrous twiner; stems stout. Flowers in axillary panicles. The primary branches racemose, the ultimate partial inflorescences cymose. Leaves ovate, slightly cordate to truncate at the base; lateral nerves 11–14 on either side of the midrib. Corolla ca 2½–3½ cm long. Seeds with long silky hairs ........................................ 38. I. sumatrana
31. Smaller, mostly herbaceous twiners with thinner stems, or prostrate plants, glabrous or hairy. Flowers in few- to several-flowered peduncled, axillary cymes, or solitary in the leaf-axils.
32. Corolla salver-shaped, up to 3–3½ cm long, pale lilac or white, with a purple centre. Peduncles stout, thickened towards the apex, often applanate. Outer sepal 4–6 mm long. Seeds short-tomentose, often with longer hairs along the edges .... 18. I. maxima
33. Corolla funnel-shaped.
34. Corolla up to 2½ cm long, white or pale yellow, with a purple centre. Peduncles thin, filiform. Outer sepals 3–4 mm long. Seeds puberulent ........................................ 15. I. obsea
35. Corolla 3 cm long or longer.
36. Plants of marshy places or aquatic, mostly with trailing and rooting, or floating, thick, soft, fistulose or spongy stems. Leaves with truncate, cordate, sagittate or hastate base. Outer sepal 7–8 mm long, ovate-oblong. Corolla pink or pale-lilac, often with a purple centre, rarely white, 3–5 cm long ........................................ 19. I. aquatica
37. Terrestrial plants with twining or trailing stems; not as in I. aquatica.
38. Stems mostly twining. Leaves mostly herbaceous, attenuate towards the apex, acute or acuminate, sometimes obtuse.
39. Corolla yellow. Seeds tomentose. Sepals oblong or ovate-oblong, obtuse to truncate or slightly emarginate at the apex, subequal, 5–6½ mm long. 16. I. ochroleuca
40. Corolla pink, blue or purple. Seeds glabrous, puberulent or pilose along the edges only.
41. Sepals without a distinct micro, subequal, 4½–6 mm long, not very concave, carinate, green with pale margins. Corolla blue or paler with white tube. 23. I. tricolor
42. At least the outer sepals distinctly mucronulate. Outer sepals mostly shorter than the inner, 6–10 mm, inner ones 8–12 mm, concave, not carinate. Without a distinct pale margin. Corolla pink or purple, rarely white.
30. Outer sepals oblong, acute, mucronulate, inner ones elliptic, obtuse, with less distinct mucro. Corolla 4–6 cm long. Filaments sparsely pubescent nearly to the top; longest ca 17 mm. Pedicels 5–12 mm.  12. I. tiliacea

30. Outer sepals oblong to elliptic, acutish or obtuse, inner ones elliptic to orbicular, obtuse to emarginate, all distinctly mucronulate at or slightly below the apex. Corolla 3–4½ cm long. Filaments pubescent in the basal half; longest ca 6–7 mm. Pedicels 10–25(–40) mm.  14. I. gracilll

27. Stems trailing and mostly rooting at the nodes, rarely twining, mostly thick.

31. Leaves subcoriaceous or fleshy, mostly obtuse to broadly rounded, or emarginate at the apex. No subterranean tubers.

32. Corolla white or yellowish, with a purple centre. Leaves small, fleshy, very variable in shape often on the same plant, linear, lanceolate, oblong or ovate, obtuse or emarginate at the apex, obtuse or truncate or subcordate at the base; or leaves 3–5-lobed.  22. I. stolonifera

32. Corolla pink or purple. Leaves larger, subcoriaceous, kidney-shaped, orbicular, elliptic, ovate or quadrangular to oblong, broadly rounded or emarginate at the apex.

33. Leaves kidney-shaped, with broadly rounded apex; base cordate. Sepals unequal, the outer ones shorter, all elliptic-oblong.  21. I. asarifolia

33. Leaves orbicular, elliptic, ovate or quadrangular to oblong, emarginate at the apex; base truncate, rounded, subcuneate, or sometimes subcordate. Sepals subequal or the outer ones slightly shorter; outer sepals ovate or elliptic, inner ones broader.  20. I. pes-caprae

31. Leaves herbaceous, attenuate towards the acute or obtuse apex. Leaf-margin entire or angular (or lobed). Subterranean tubers present.  13. I. batatas

8. Sepals hairy on the outer surface, or fimbriate at the margins.

34. Flowers in the leaf-axils; pedicules very short, or absent. Length of corolla not exceeding 1½ cm.

35. Erect or ascending herb. Leaf-base acute, attenuate into the petiole. Corolla glabrous, ca 1½ cm long.  3. I. polymorpha

35. Twining or prostrate herbs. Leaf-base cordate. Midpetaline bands outside at least pilo towards the apex.

36. Ovary and capsule hairy. Pedicels none or very short, to 3 mm. Outer sepals linear-acuminate from an ovate base. Corolla pink or purple, ca 7–9 mm long.  1. I. eriocarpa

36. Ovary and capsule glabrous. Pedicels 5–7 mm. Outer sepals linear-acuminate from a broadly triangular, slightly cordate to truncate base. Corolla white, ca 9–13 mm long.  2. I. plebeia

34. Peduncles mostly longer, well-developed. Corolla 1½ cm long, or mostly longer.

37. Flowers aggregate at the end of the peduncle, involucrate by large bracts.


37. Flowers whether or not aggregate at the end of the peduncle, not distinctly involucrate.

39. Sepals with stellate hairs.  33. I. astrophora

39. Sepals not stellately hairy.

40. Sepals 4 mm long or less. Corolla white or pale yellow with a purple centre.  15. I. obscura

40. Sepals 5 mm long or longer.

41. Outer sepals orbicular, broadly rounded at the apex.


42. Outer sepals 5–6 mm long. Corolla with puberulent tube and midpetaline bands. Ovary puberulent. Nerves 7–9 on either side of the midrib.  37. I. crassicaulis

41. Outer sepals narrower, mostly acute, sometimes subobtuse.

43. Corolla with sericeous midpetaline bands outside. Seeds villose.  35. I. riparia

43. Corolla glabrous outside. Seeds puberulent or glabrous, sometimes pilose at the hilum or at the edges only.

44. Sepals long-attenuate, or long and linear-acuminate at the apex, herbaceous.

45. Sepals nearly linear, attenuate towards the acute apex, hirsute at the base, glabrous in the upper portion, 8–15 mm long. Corolla up to 3 cm long. Stems and peduncles filiform.  7. I. decaisnei

45. Sepals lanceolate or linear-lanceolate at the base, with a long and linear acumen, or long-attenuate towards the apex; length of sepals ca 15 mm or more. Corolla 5–8 cm long. Stems and peduncules thicker.

46. Outer sepals lanceolate at the base with a long and linear acumen, patently hirsute in the basal portion, ca 17–25 mm long. Corolla 5–6 cm long.  5. I. nil

46. Outer sepals lanceolate to broadly lanceolate at the base, long and gradually attenuate.
towards the apex; hairs of sepals appressed (or sepals glabrous). Sepals ca 14–22 mm long. Corolla 5–8 cm long .................. 6. I. congesta

44. Sepals acute or subobtuse, often mucronulate, not long-attenuate towards the apex, herbaceous, membranaceous, or coriaceous.

47. Outer sepals herbaceous, oblong, acute, 10–15 mm long, patently hirsute in the basal portion. Corolla 5–6 cm long, mostly purple-blue, with reddish midpetaline bands, the tube paler to white .................. 4. I. purpurea

47. Sepals coriaceous or membranaceous, not or indistinctly patently hirsute in the basal portion, fimbriate at the margins. Corolla smaller.

48. Plant cultivated for its edible subterranean tubers, sometimes escaped from cultivation. Stems mostly prostrate and rooting at the nodes, thick. Leaves broad-ovate to orbicular in outline, cordate or truncate at the base, entire or angular to palmate 3–5(–7)-lobed. Corolla pale violet, 3–4½ cm long .................. 13. I. batatas

48. No tubers. Stems mostly twining, thinner.

49. Ovary glabrous. Sepals glabrous outside, sparsely fimbriate at the margins only. Filaments sparsely pubescent nearly to the top .................. 12. I. tiliacea

49. Ovary hairy.

50. Corolla small, ca 1½–2 cm long. Flowers aggregate; branches of the cyme very short. 10. I. trifida

50. Corolla longer, to 3 cm. Inflorescences laxer; branches of the cyme longer. 11. I. trifida

1. Section Calycanthemum


Small, mostly annual, rarely perennial pilose herbs. Stems prostrate, erect, or rarely twining. Leaves cordate or subblattate, elliptic, ovate, oblong or lanceolate, entire, or rarely pinnately lobed. Sepals ovate or lanceolate, acute, their base often broadened or auriculate. Corolla mostly small, rarely larger, mostly white or pink, sometimes purple. Seeds mostly shortly tomentose.

1. Ipomoea eriocarpa R.Br. Prod. (1810) 484.—

Convolvulus hispidus VAHL, Symb. Bot. 3 (1794) 29.—I. hispida R. & SCH. Syst. 4 (1819) 238, non Zuccagni 1809; OOSTSTR. Blumea 3 (1940) 490. —I. sessiliflora ROTH, Nov. Pl. Sp. (1821) 116.—

I. hortiflora MIQ. Fl. Ind. Bat. 2 (1857) 611.—

Fig. 35–36.

Stems herbaceous, slender, twining or prostrate, 1–2 m long, retrorsely to patently pilose. Leaves mostly lanceolate to oblong- or linear-lanceolate, 2½–6 by 1½–1½ cm, sometimes ovate-lanceolate to ovate, 2½–9 by 1½–5½ cm, cordate at the base with rounded sinus and basal lobes, long-attenuate to acuminate towards the apex, with an acute or obtuse mucronulate point, sparsely pilose on both surfaces or more densely beneath; nerves 7–8 on either side of the midrib; petiole shorter than or as long as the blade, 3½–8 cm, pilose. Inflorescences axillary, sessile or with a short peduncle, much shorter than the petiole, cymosely 1–3- or sometimes more-flowered. Flowers sessile or pedicels very short, to 3 mm. Bracts pilose, linear or lanceolate, lower ones

![Fig. 35. Ipomoea eriocarpa R.Br. Branch with flowers and capsules, × 1/2.](https://example.com/figure35)
3–8 mm, upper ones shorter. Sepals pilose, about equal in length. 7–8 mm, linear-acuminate from an ovate base, the inner ones slightly narrower than the outer. Corolla tubular to funnel-shaped, little exceeding the sepals, 7–9 mm long, pink or purple, darker inside, the tube and the pilose midpetaline bands paler without. Stamens and style included; stamens inserted near the corolla-base, filaments glabrous, the base excepted. Ovary hairy; style hairy at the base. Capsule broadly ovoid to globular, ca 5–6 mm diam., shorter than the sepals, hairy, crowned by the hairy style-base, 2-celled, 4-valved. Seeds 4, ca 2½ mm long, glabrous, minutely reticulate.

Distr. Tropical Africa, Madagascar, and tropical Asia to North Australia, in Malaysia: not yet collected in the Malay Peninsula, Borneo, and the Moluccas. Fig. 36.

Ecol. Open grasslands, grassy waysides, thickets, hedges, fields, occasionally in secondary forests, on periodically dry soil; in regions with a fairly pronounced dry season; from sea-level to 1300 m.

Vern. Slawatan, J.


Fig. 37. Ipomoea plebeia R.Br. Distribution in Malaysia. The arrow indicates a presumably introduced occurrence.

slender, shorter to longer than the blade, 1–6 cm, hairy. Inflorescences axillary, sessile or with a short peduncle, much shorter than the petiole, 1–2, sometimes 3-flowered. Pedicels slender, 5–7 mm, hairy. Bracts small, ca 2–2½ mm long. Sepals hairy, equal in length, 7–8 mm, 2 outer ones long- and linear-acuminate from a broadly triangular slightly cordate to truncate base; 2 inner ones much narrower at the base. Corolla tubular to funnel-shaped, little exceeding the sepals, ca 9–13 mm long, white; midpetaline bands pilose towards the top. Stamens and style included;
stamens inserted near the corolla-base, filaments glabrous, the base excepted. Ovary and style glabrous. ***Capsule*** broadly ovoid to globular, ca 7 mm high, little shorter than the sepals, glabrous, crowned by the style-base. 2-celled, 4-valved. Seeds 4, ca 4–4 1/2 mm long, shortly brown to grey-tomentose and sometimes with longer white hairs along the margins.

**Distr.** Queensland and **Malaysia**: Java, Kangean, Lesser Sunda Islands (Lombok, Sumbawa, Timor), S. Celebes, Philippines (Luzon, only one record from Bontoc subprov.: VANOVERBERGH 1410). Fig. 37.

Ecol. Grasslands, dry thickets, in regions subject to a pronounced dry season, from sea-level to 600 m: rare.

Note. Though *I. biflora* (L.) Pers., described from China, is the oldest name I prefer that of *R. Brown* as the identity of the former seems doubtful to me (cf. Blumea 3, 1940, 493).

### 3. Ipomoea polymorpha R. & Sch. Syst. 4 (1819)254: OOSTR. Blumea 3 (1940) 493.—*I. heterophylla* R.Br. Prod. (1810) 487, non ORTEGA 1800.—**I. pumila** Spanoghe, Linnaea 15 (1841) 341.—**Convolulus** noilaceflorus Zipp. ex Spanoghe l.c., pro syn.—**Convolulus defloratus** Choisy in Zoll. Syst. Verz. 2 (1854) 130, 132.—Fig. 38–39.

Herbaceous annual. Stems erect, 8–60 cm high, simple, or branched from the base with patent or ascending branches; young parts densely pilose, adult parts less densely so to glabrous. Leaves narrowly elliptic, elliptic-oblong, obovate or oblanceolate, 1/2–7/12 by 1/2–3 cm, mostly attenuate towards both ends; base acute, attenuate into the petiole, apex acute or obtuse to rounded, mucronulate; margin entire, undulate or coarsely dentate, occasionally irregularly pinnatifid with few segments, or lyrate with a large, ovate or elliptic entire or coarsely dentate terminal segment and small triangular to hastate basal ones; glabrous or sparsely pilose; nerves 5–6 on either side of the midrib; petiole shorter than the blade.

![Fig. 39. Ipomoea polymorpha R. & Sch. Distribution in Malaysia. The species also occurs in NE. New Guinea: Morobe District.](image)

1/2–3 cm, sparsely pilose. Flowers axillary, solitary. Peduncle and pedicel very short or absent. Bracts linear-filiform, ca 1 cm long, long hairy. Sepals with a distinct midrib, hairy, 8–10 mm long, long-acuminate; outer ones ovate-lanceolate, entire or with 1 or 2 teeth at the margin, inner ones lanceolate. **Corolla** tubular-funnel-shaped, ca 1 1/2 cm long, red-purple, darker inside, rarely white, glabrous. Stamens and style included; filaments hairy at the base. Ovary and style glabrous. **Capsule** globular, 4–6 mm high, shorter than the calyx, glabrous, straw-coloured, 2-celled, 4-valved. Seeds 4, ca 2 1/2–3 1/4 mm long, with a mottled brownish or greyish black pubescence.

**Distr.** Abyssinia, ?India, Indo-China, and Formosa to NE. Australia, in **Malaysia**: E. Java, Madura, Lesser Sunda Islands (Sumba, Flores, Timor), Philippines (Luzon). NE. New Guinea & Thursday Island. Fig. 39.

Ecol. Grasslands, grassy waysides, fields, sandy plains, dunes, in the lower parts of the islands with a strong dry monsoon, on hard or stony soil, in sunny localities, from sea-level to ca 100 m.

**Vern.** Camarin, Iloko (Philippines).

### 2. Section Pharbitis


Annual, or rarely perennial, high-twinning, rarely small herbs. Stems mostly hispid or lanate, very rarely glabrous. Leaves cordate, entire, 3-lobed, or palmately 5–7-lobed, rarely oblong or lanceolate, hispid or villose, sometimes white-lanate beneath, very rarely glabrous. Flowers mostly showy. Sepals herbaceous, oblong, lanceolate or linear, often hirsute, very rarely glabrous. **Corolla** mostly reddish or purple, funnel-shaped or rarely tubular, subentire. Seeds glabrous, puberulent, or shortly arachnoid.

#### 1. Subsection Chorisanthae


Flowers axillary, solitary, or in lax axillary dichasia, rarely aggregate. Leaves
distinctly cordate, entire, or 3-lobed, or palmately 5-lobed, never oblong or lanceolate.


Herbaceous annual. Stems twining, with short hairs mixed with longer retrorse bristles. Leaves broadly ovate or orbicular in outline, entire or 3-lobed. 4–15 by 2½–12 cm, cordate at the base with broadly rounded basal lobes, shortly acuminate at the apex; upper and lower surface with short bristly hairs; petiole 2–15 cm, retrorsely hirsute. Inflorescences axillary; peduncle shorter or longer than the petiole, with retrorse bristles, 3–18 cm, one- to few-flowered at the apex. Pedicels 8–15 mm, recurved in bud, afterwards erect, finally recurved again, in fruit up to 20 mm. Bracts linear or filiform, to 7 mm long. Sepals about equal in length, ca 10–15 mm, in fruit to 20 mm, three outer ones herbaceous or sepal 3 with a narrow scarious margin, oblong, slightly narrowed at the base, acute at the apex, with bristly, patent hairs in the basal portion, glabrous towards the apex; two inner ones herbaceous with narrow scarious margins, linear-oblong to linear, acute. Corolla funnell-shaped, 5–6 cm long, glabrous; limb inside purple-blue with reddish mid-rib and veins, outside often paler; tube much paler to white. Stamens and style included; filaments at the base with long hairs. Ovary glabrous, 3-celled. Capsule globular, glabrous, 3-celled, with thin straw-coloured wall. Seeds 6 or less, glabrous or sparsely pilose at the hilum.

Distr. Native in America from New Mexico & Virginia as far S. as Argentina and Uruguay, in Malaysia occasionally cultivated in gardens for ornamental purposes, but showing no tendency to become naturalized.

Vern. Morning glory, E, dayschone, dagbloem, purperwinde, D.


Herbaceous annual or perennial. Stems twining, or sometimes prostrate, retrorsely hirsute. Leaves broadly ovate to orbicular in outline, entire or 3-lobed. 4–14 by 3–12 cm, cordate at the base, acuminate at the apex; upper and lower surface with few to many more or less appressed hairs; petiole 3–16 cm, retrorsely hirsute. Inflorescences axillary; peduncle 2½–12 cm, hirsute like the stem, one- to several-flowered at the apex; flowers in a small umbellate cyme. Pedicels 5–10 mm, with retrorse hairs. Bracts linear to filament, 5–8 mm long. Sepals herbaceous, about equal in length, 17–25, afterwards to 28 mm long, patently hirsute especially in the basal portion; sometimes the bristy hairs are mixed with shorter and softer ones; outer sepals with a lanceolate, inner ones with a narrow-lanceolate base, all with a long and linear acumem. Corolla funnell-shaped, ca 5–6 cm long, glabrous, pale blue or bright blue, paler without, afterwards red or reddish purple, rarely the corolla is white. Stamens and style included; base of filaments with curled hairs. Ovary glabrous. Capsule ovoid to globular, mucronate by the base of the style, ca 1 cm diam., glabrous, mostly 3-valved and 3-celled. Seeds ca 5 mm long, black, grey-puberulent.

Distr. Circumtropical, throughout Malaysia, but not yet found in Borneo.

Ecol. Waysides, hedges. thickets. grasslands, from sea-level to 1300 m; also cultivated in gardens for ornamental purposes. Flowers closing before noon.

Use. The seeds are said to be purgative.

Vern. Arew, djotang bodas, S, teleng, J, bulakán, kamokamotihan, Tag.

Note. Several authors have wrongly considered the Malaysian specimens conspecific with the North American Ipomoea hederacea (L.) JACQ. See HALLIER f. Jahrb. Hamb. Wiss. Anst. 16, 1898, Beih. 3 (1899) 42; Ooststr. Blumea 3 (1940) 499.

var. limbata (LINL.) BAILEY, Gentes Herb. 1, 3 (1923) 135.—Pharbitis limbata LINDL. J. Hort. Soc. 5 (1850) 33; mentioned by BOERLAGE, Handl. Fl. Ned. Ind. 2 (1899) 511 as I. limbata, is a cultivated variety with the corolla deep violet-purple edged with white.


Herbaceous. Stems twining or sometimes prostrate and then sometimes rooting at the nodes, more or less densely retrorsely pilose. Leaves broadly ovate to orbicular in outline, entire or 3-lobed. 5–17 by 3½–16 cm, cordate at the base, shortly or long-acuminate at the apex; lower surface often densely, upper surface less densely pilose with short, soft, appressed hairs, sometimes the lower surface sericeo-tomentose; petiole 2–18 cm long, retrorsely hairy. Inflorescences axillary; peduncle (1½)4–20 cm, more or less densely and
retrorsely pilose like the stem, few- to several-flowered at the apex. Flowers in a dense umbellate cyme with very short branches. Pedicels 2–5(–8) mm. Bracts linear to filiform, occasionally broader and foliaceous. Sepals herbaceous, about equal in length, 14–22 mm, especially near the base with rather soft, appressed hairs, or nearly glabrous, not with patent bristly hairs as in I. nil; outer sepals with a lanceolate to broadly lanceolate base, inner ones with a narrower base, all long and gradually linear-acuminate. Corolla funnel-shaped, 5–8 cm long, glabrous, bright blue or bluish purple, afterwards more reddish purple or red, the tube much paler to whitish. Stamens and style included; base of filaments with curled hairs. Ovary glabrous. Capsule not seen in Malaysian specimens.

Distr. Circumtropical, throughout Malaysia, but not yet collected in Borneo.

Ecol. Waste places, road-sides, thickets, hedges, edges of secondary forests, occasionally on sandy sea-shores; from sea-level to 1650 m; also cultivated in gardens for ornamental purposes (see note).

Vern. Bungah, Sumatra, pitur, Manado, apukung'a, Talaud, loboké ma dorooë, Halmahera, bulakan, Sulu.

Note. Ipomoea leari Pant. Bot. Mag. 6 (1839) 267, which is sometimes found cultivated for ornamental purposes, is a very closely related species or only a variety of I. congesta. It has the leaves thickly clothed with a whitish pubescence beneath; the corolla is of a deep purplish blue colour, with lighter midpetaline bands.


A herbaceous annual (Decaisne). Stems twining, almost filiform, glabrous or sparsely pilose with long patent hairs. Leaves broadly ovate, ovate or triangular, (1 1/2–)3–9 by (1–)1 1/2–7 cm, cordate at the base with rounded basal lobes, shortly or long-acuminate at the apex with an acute or obtuse, mucronulate acumen; upper and lower surface sparingly or sometimes densely pilose; petiole shorter than the blade, (1 1/2–)4–1 1/2 cm, with sparse patent hairs. Inflorescences axillary; peduncle mostly rather short, 1 1/2–4 cm, patently pilose, few-flowered at the apex; flowers in an umbellate cyme. Pedicels 5–9 mm, in fruit 10–17 mm. Bracts linear or filiform, the lower ones to 9 mm long, with sparse patent hairs. Sepals herbaceous, subequal, 8–15 mm long, linear, attenuate towards the acute apex, patently hairy in the lower
half, the hairs with thickened base, glabrous towards the top. *Corolla* funnel-shaped, ca 2–2½ cm long, glabrous, violet. Stamens and style included; filaments hairy at the base. Ovary glabrous. *Capsule* globular, mucronate by the style-base, with a thin straw-coloured pericarp, ca 7–8 mm high, 4-valved. Seeds 4–4½ mm long, black, finely puberulent, mottled brownish and greyish.

2. Subsection Cephalanthae


Flowers in dense capitate, involucrate, peduncled inflorescences; outer bracts mostly large.

8. *Ipomoea pes-tigridis* LINNÉ, Sp. Pl. (1753) 162; *OOSTSTR.* Blumea 3 (1940) 504.—*I. hepaticaefolia* LINNÉ, l.c. 161.—Fig. 40.

Herbaceous annual. Stems twining, or sometimes prostrate, slender, 1½–3 m long, patently hairy with rigid hairs. *Leaves* orbicular or transversely elliptic in outline, 3–7½ by 2½–10 cm, palmately divided nearly to the base with (3–)5–7 (–9) segments; segments oblong to elliptic-oblong or elliptic, attenuate or slightly acuminate towards both ends, mostly rather densely hairy with appressed to patent hairs; petiole 1½–10 cm, hairy like the stem. Inflorescences axillary; peduncle 2–18 cm, hairy like the stem, with an involucrare, cymose, few-flowered head at the apex. Outer bracts oblong to linear-oblong, 1½–3 cm, inner ones smaller. *Sepals* herbaceous, slightly unequal in length, 7–12 mm, lanceolate or the inner ones narrow-lanceolate, long-haired. *Corolla* funnel-shaped, ca 3–4 cm long, white, the midpetaline bands sparsely hairy. Stamens and style included; filaments glabrous. Ovary glabrous. *Capsule* ovoid, ca 8 mm high, 1-celled, 4-valved. Seeds 4, sparsely grey-tomentose, 4 mm long.


Herbaceous annual. Stems twining, 1½–1,8 m long, slender, retrorsely short-pilose. *Leaves* ovate or broadly ovate, 2–7 by 1½–5½ cm, broadly cordate at the base with rounded basal lobes, attenuate to slightly acuminate towards the apex, pilose, beneath sometimes more densely than above; nerves 4–6 on either side of the midrib; petiole thin, 1½–10 cm, pilose like the stem.
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Inflorsecences axillary; peduncles 2–4.5 cm, pilose like the stem; flowers in a few- to several-flowered dense head, enclosed by a large foliaceous boat-shaped bract, 2½–4 cm long, with 2 cusps; other bracts much smaller, oblong or elliptic, obtuse. Sepals herbaceous, 3 outer ones oblong-spathulate to oblong, obtuse. 10 mm long, 2 inner ones narrower, lanceolate with a long and slender point, 9 mm long, all long pilose along the margins, and outside and inside especially in the upper part. Corolla salver-shaped, ca 3 cm long, pink with darker centre, or violet; tube narrow, cylindrical, ca 2 cm long, glabrous except near the top, limb with sparsely pilose midpetaline bands. Stamens and style included; filaments inserted half-way the corolla-tube, glabrous, the base excepted.

Ovary glabrous. Capsule small, globose. Seeds glabrous or thinly pubescent.

Distr. Tropical E. Africa, Mascarene Islands, continental tropical Asia from India to China, Indo-China and Hainan, in Malaysia: Malay Peninsula (Perlis), Banka, Java, Borneo, and the Philippines (Cotol). Ecol. Dry open places, grassy waysides, from sea-level to 400 m. Vern. Bissur hutang, Banka.

Note. Several authors have considered this species as being conspecific with the African I. involucrata BEAUVC. (See van Ooststr. Blumea 3, 1940, 509, note). BAKER & RENDLE, Fl. Trop. Afr. 4, 2 (1905) 150, 151, 152, have rightly distinguished them as two distinct species.

3. Section Batatas


Leaves petioled, distinctly cordate or pandurate or 3-lobed or palmately 5-lobed, glabrous, or appressed-hairy. Flowers mostly small, axillary, in long- or short-peduncled umbellate cymes, rarely solitary; flower-buds conical, often acute. Sepals subcoriaceous, often oblong or lanceolate, acute, with ciliate margins, further often glabrous, often attenuate from a stiff pale base into a herbaceous green, recurved acumen, rarely obtuse, or entirely glabrous. Corolla funnel-shaped, entire, pink or white, 1½–5 cm long, glabrous. Ovary often hirsute. Seeds glabrous.

10. Ipomoea triloba LINNÉ, Sp. pl. (1753) 161; Ooststr. Blumea 3 (1940) 509.—Convolvulus dentatus BLACNO, Fl. Filip. ed. 1 (1837) 89, non Vahl 1794 (acc. to Merrill).—I. blancoi Choisy in DC. Prodr. 9 (1845) 389.—Fig. 41.

Herb with twining or sometimes prostrate stems, 1–3 m long, glabrous or sparsely hairy, mainly at the nodes. Leaves broadly ovate to orbicular in outline, rarely narrower, 2½–8 by 2–7 cm, entire, coarsely dentate to more or less deeply 3-lobed, base cordate, basal lobes rounded or angular to lobed, upper and lower surface glabrous or sparsely pilose; petiole slender, 3–10(–18) cm, glabrous, or sometimes minutely tuberculate. Inflorsecences axillary; peduncle shorter to longer than the petiole, 1–10(–12) cm, slightly thicker than this, glabrous, angular, minutely verrucose towards the apex, 1-flowered or cymosely few- to several-flowered; branches of the cyme very short, flowers aggregate. Pedicels more or less angular, minutely verrucose, glabrous, 2½–8 mm. Bracts minute, lanceolate-oblong. Sepals slightly unequal, 7–8(–10) mm long, the outer ones a little shorter, oblong to narrowly elliptic-oblong, obtuse or acute, mucronulate, glabrous or sparsely hairy on the back, the margins always distinctly fimbriate; inner sepals somewhat broader, elliptic-oblong, acute, mucronulate, glabrous or sparsely hairy. Corolla funnel-shaped, ca 18–20 mm long, glabrous, pink or pale red-purple, sometimes with

Fig. 41. Ipomoea triloba L. a. Flowering branch, × ½. b. Fruitting branch. × ½. c. Pistil.
a darker centre, the limb with short obtuse, mucronulate lobes. Stamens included, filaments hairy at the base. Ovary hairy. Capsule subglobose, 5–6 mm high, apiculate by the base of the style, bristly hairy, 2-celled, 4-valved. Seeds 4 or less, 3½ mm long, glabrous.

**Distr.** Native of tropical America, now a circumtropical weed; throughout *Malaysia*.

**Ecol.** Grasslands, thickets, hedges, waste places, waysides, fields, also in savannah-forests and occasionally on sandy sea-shores, from sea-level to 750 m. Flowers closing before noon.


Much resembling the preceding species. Mainly differing in the short-pilose stems, petioles, leaf-blades, peduncles and pedicels, the thinner pedicels, the longer branches of the cymose *inflorences* with less aggregate flowers, the paler, in dry specimens straw-coloured calyces with more densely pilose sepalis, the margins of which bear less stiff hairs. Moreover the sepals often have a longer, needle-shaped micro, whilst the outer ones are often distinctly shorter than the inner. *Corolla* mostly longer than in *I. triloba*, to 3 cm long, red-purple with a darker centre.

**Distr.** Native of Tropical America; in *Malaysia* sometimes as a garden-escape in Java.

**Ecol.** Occasionally cultivated in gardens and run wild in thickets and hedges up to 300 m.

**Vern.** *Djéndjéng*, J.

**Note.** The Javan plants almost match South American specimens in the Rijksherbarium, Leyden, identified by HALLIER as *I. trifida*. As appears from his notes HALLIER saw the type of *Convolvulus trifidus* H.B.K. from Venezuela in the Berlin Herbarium. The leaves of *I. trifida* have been described as 3-lobed; those of the Javan plants and of the above-mentioned specimens from South America are entire.


Stems twining, slender, several metres long, glabrous or hirsute, ligneous. Leaves ovate, 5–15 by 3–10 cm, cordate at the base, acuminate, with an acute or obtuse mucronulate acumens. mostly entire, glabrous or appressed-pilose; petiole slender, 3–7 cm. *Inflorences* axillary; peduncles solitary or in pairs, as long as, or often longer than the petiole. 4–15 cm, cymosely few- to several-flowered. Pedicels 5–12 mm. Bracts minute, narrow-lanceolate. Sepals glabrous or sparsely fimbriate at the margins, nearly equal in length or the outer ones shorter; outer sepals oblong or ovate-lanceolate, acute, mucronulate, 5–10 mm long, inner ones elliptic, acutish or obtuse, often with a less distinct mucro, to 10 mm long. *Corolla* funnel-shaped, ca 4–6 cm long, glabrous, pink or purple, often with a darker centre, or rarely white. Stamens and style included; filaments sparsely pubescent nearly to the apex. Ovary glabrous. *Capsule* globose, 2-celled, 4-valved. Seeds 4, glabrous or pilose along the edges.

**Distr.** Tropical America, West tropical Africa (Cameroons, I. do Principe); in *Malaysia*: North Moluccas (Karakelong), NW. New Guinea.

**Ecol.** River-banks, clearings in secondary forests, up to ca 100 m.

**Vern.** *Bariwuan’a*, Talaud.


Herb with subterranean fusiform or elongate tubers. Stems prostrate or ascending, or occasionally twining, 1–5 m long, much branched, more or less angular, or terete, rooting at the nodes, glabrous or hairy, green or tinged with purple. *Leaves* broadly ovate to orbicular in outline, 4–14 by 4–11 cm, entire, angular, or more or less deeply palmately 3–5–(7)-lobed, the lobes from broadly ovate to linear-oblong; base of leaf broadly cor- date to truncate; upper and lower leaf-surfaces glabrous or sparsely hairy; petiole 4–20 cm. *Inflorescences* axillary; peduncle stout, angular, glabrous or hairy like the stem, shorter to much longer than the petiole, 3–18 cm, cymosely 1- to few- or several-flowered. Pedicels 3–12 mm. Bracts acute, 2–3 mm long, caducous. *Sepals* equal in length or the inner ones longer; outer ones oblong or elliptic-oblong, 7–8 mm long, inner ones elliptic-oblong to ovate-oblong, to 9–12 mm long, all acute or acutish, distinctly mucronulate, wholly glabrous or pilose on the back and fimbriate. *Corolla* campanulate to funnel-shaped, gradually attenuate towards the base, ca 3–4½ cm long, glabrous, pale violet. Stamens and style included; filaments glabrous, the hairy base excepted. Ovary hairy or sometimes glabrous. *Capsule* ovoid, 4- or less-celled, rare, or absent in Malaysian specimens. Seeds glabrous.

**Distr.** Cultivated throughout the tropical and subtropical regions of both hemispheres.

**Ecol.** Cultivated throughout *Malaysia*, and occasionally wild as a relic of cultivation; at low and medium altitudes; in Java sometimes up to 2200 m (KOORDERs).

**Uses.** Cultivated for its edible tubers. The young leaves are used as a vegetable; young shoots are eaten as a salad, and are also used for poulticings.

**Vern.** Këladi, këladiék, ubi këludi, Mal. Pen., gadon, piék, képi priests, T. Sum., ubi dýawa, ubi týýa, Sum. E. Coast, katólo, ubi dýolah, u. katólo, u. pélo, Minangk., sítílo, Lampons, kólédék, kétela, kétela rambat, télá, J, huwi boldé, huwi...

Note. A large number of varieties is found in cultivation, mainly distinguished on account of the leaf-shape and the size, form and colour of the tubers. The tubers may be red, purple, orange, pale yellow, or white.

Caterpillars of Herse convolvuli L. feed on the leaves of this species.


A glabrous or sometimes sparsely hairy littoral plant. Stems prostrate and rooting (always?) or twining, thin, slender, herbaceous, or becoming woody with age. Leaves membranaceous or often thicker, broadly ovate to oblong in outline, occasionally orbicular to kidney-shaped, variable in size, 1–10 by 1–7½ cm; margin entire or slightly undulate to angular, or more or less deeply 3-lobed; apex acute, obtusish, obtuse or more or less refulent, mucronulate; base cordate, basal lobes rounded, or occasionally lobed; upper and lower surface of leaf-blade glabrous or nearly so; petiole thin, 1½–7 cm. Inflorescences axillary; peduncles mostly short, 1–3(9) cm, glabrous, one- to few-flowered. Pedicels mostly longer than the calyx, 10–25(40) mm long, glabrous. Bracts minute, narrow, 1–2 mm long, caducous. Outer sepals shorter than the inner ones, oblong-elliptic or elliptic, acute or obtuse, 6–10 mm long, inner ones elliptic to orbicular, 8–12 mm, all mucronulate with the mucro at the top or somewhat lower, all glabrous and concave; outer sepals thinly coriaceous, inner ones thinner with membranous margins. Corolla funnel-shaped, 3–4½ cm long, with the rather narrow tube gradually narrowed towards the base, glabrous, pink or pink-purple, often darker near the base inside. Stamens and style included; filaments glabrous in the upper, and hairy in the lower half. Ovary glabrous. Capsule depressed-globose, crowned by the style-base, ca 9 mm diam., 2-celled. Seeds 4, glabrous, black, ca 3½–4 mm long.

Dist. Coasts of the Indian and Pacific Ocean: Madagascar and adjacent islands, India, Ceylon, Indo-China, throughout Malaya, eastwards to N. Australia and the Pacific Islands; according to Hallier f. also in Mexico & West Indies.

Ecol. On sandy beaches and in thickets near the sea-shore, occasionally covering large trees; from sea-level to ca 15 m.

Use. The species is useful as a sand-binder.

Fig. 43. Ipomoea gracilis R Br. in a bay on the beach of the eastern part of the Island of Krakatao twining round trees of Casuarina equisetifolia L. which appear like elongate cocoons (DOCTERS VAN LEEUWEN).

4. Section Leiocalyx


Plants mostly glabrous, rarely with hairy stems, more rarely with hairy leaves or sepals. Leaves mostly petioled, very variable in form. Flowers peduncled, axillary, solitary or in subumbellate dichasia. Sepals variable, mostly oblong or lanceolate, often verrucose or cristaite on the back. Corolla mostly red or purple, rarely white or yellow, glabrous, or rarely farinose or pubescent outside, mostly subentire. Seeds mostly glabrous, rarely velutinous or with bearded edges.

15. Ipomoea obscura (L.) Ker-Gawl. Bot. Reg. 3 (1817) t. 239; Ooststr. Blumea 3 (1940) 519.—Convolvulus obscurus LINNÉ, Sp. Pl. ed. 2 (1762) 220.—I. solanifolia (non L.) BURM. f. Fl. Ind. (1768) 49.—I. insularis BL. Cat.'s Lands Pl.-tuin (1823) 50.—Fig. 44.

Stems twining or prostrate, 1–2 m long, thin and slender, glabrous or patentily hairy, sometimes almost lanate, the older parts ligneous. Leaves ovate to orbicular, or almost kidney-shaped, 2–10 by 2–9 cm; margin entire or slightly undulate, base cordate with rounded basal lobes; apex attenuate or acuminate with acute to obtuse, mucronulate top; glabrous or sparsely pilose on both sides with short, appressed hairs, or only fimbriate along the margins; petiole long, slender, up to 9 cm, glabrous or sparsely hairy. Inflorescences axillary; peduncles thin, almost filiform, 1–14 cm, glabrous or sparsely pilose, one- to few-flowered. Pedicels much longer than the calyx, ca 1–2 cm, minutely verrucose, glabrous or very sparsely hairy, thickened towards the top in fruit. Bracts minute, narrow, acute, 1–2 mm long. Sepals subequal or the two outer ones slightly shorter, acute, mucronulate, 3–4 mm long, glabrous or sometimes pubescent; outer sepals ovate, with narrow, white margins, the middle portion thicker, minutely verrucose; inner ones broadly ovate, thinner; sepals often reflexed in fruit. Corolla funnel-shaped, ca 2–2½ cm long, white or pale yellow with darker midpetaline bands, and with a dark purple centre. Stamens and style included; filaments very unequal in length, hairy at the base. Ovary glabrous. Capsules on reflexed pedicels, broadly ovoid, crowned by the style-base, 7–8(–9) mm high, straw-coloured, 2-celled, 4-
valved. Seeds 4, black, finely grey-puberulent, ca 4–4 1/2–(5) mm long.
Distr. East tropical Africa, Mascarene Islands, tropical Asia, throughout Malaysia to N. Australia and Fiji.

Ecol. Grasslands, thickets, hedges, thin forests, waysides, waste ground, occasionally on sandy soil near the sea, from sea-level to 1300 m.

Fig. 44. Ipomoea obscura (L.) Ker-Gawl. Flowering and fruiting branch, × 1/2.

Uses. The leaves, together with those of Argyreia mollis, are used against sores (HEYNE).

Vern. Ki papésun, S. indjén-indjéan, malingan, tingkil, J. kaloh bibi, Celebes; Philippines: kus-kusípa, bang-bańgau, lloko, panggi-panggi, Sulu; for more local names see Blumea 3 (1940) 523.

16. Ipomoea ochroleuca SPANOGE, Linnaea 15 (1841) 340 ('ochroleueca'); MIQ. Fl. Ind. Bat. 2 (1857) 614 ('ochroleacea'); OOSTSTR. Blumea 3 (1940) 523 ('ochroleueca').

Stems twining, thin, slender, glabrous or very sparsely, shortly and patently pilose; old stems with yellow, lacerate bark. Leaves ovate to broadly ovate, 3 1/2–8 by 2 1/2–7 cm, cordate at the base with rounded lobes, shortly to long-acuminate at the apex, with acute or obtusish mucronulate point; mostly glabrous on both sides, the margins sometimes shortly fimbriate; petiole thin, 1–4 cm. Inflorescences axillary, peduncles thin, 3 1/2–5 cm, glabrous or with very short patent hairs, one- to several-flowered, cymosely branched. Pedicels much longer than the calyx, 1 1/2–3 cm, smooth, glabrous or hairy like the peduncle, thickened towards the apex in fruit. Bracts minute, oblong or triangular. Sepals equal in length, 5–6 1/2 mm long, oblong to ovate-oblong, with attenuate, broadly rounded to truncate, slightly emarginate, mucronulate apex, glabrous; outer sepals with thick centre and thin, pale margins, inner ones thinner. Corolla widely funnel-shaped, ca 4 cm long, sulphur-yellow, glabrous, the pubescent apical parts of the midpetaline bands excepted. Stamens and style included; filaments unequal in length, hairy at the base. Ovary glabrous. Capsules on reflexed pedicels, broadly ovoid, crowned by the style-base, 10–11 mm high, straw-coloured, 2-celled, 4-valved, at the base with the reflexed sepals. Seeds 4, black, shortly brownish tomentose, ca 6 mm long.

Distr. Malaysia: Lesser Sundas Islands (Timor). Ecol. On rocks near the sea; according to Mrs WALSH restricted to that habitat.

17. Ipomoea stibaropoda OOSTSTR. Blumea 3 (1940) 524.

Stems herbaceous, twining, slender, glabrous or sparsely pilose. Leaves broadly ovate to orbicular, 3 1/2–6 by 3–6 cm, deeply cordate at the base, with rounded lobes, shortly acuminate at the apex, glabrous on both sides but shortly pilose near the entire, fimbriate margins; petiole 2–2 1/2 cm, glabrous or sparsely hairy near the base. Inflorescences axillary; peduncles short, 1/2–1 1/2 cm, terete, glabrous or sparsely pilose, 1–2-flowered. Pedicels much longer than the calyx, thick, glabrous, 15–18 mm long, at first erect. in fruit turned down, thickened, and up to 20–28 mm. Sepals equal in length, 5–6 mm long, rather thick, glabrous, mucronulate, outer ones ovate-oblong, acutish, with very narrow scarious margin, inner ones broader, to orbicular, rounded at the apex, with broader scarious margin. Corolla funnel-shaped, ca 4 1/2 cm long, yellow. Stamens exserted; filaments shortly pilose at the base. Ovary glabrous. Young capsule ovoid, mucronate, glabrous.

Distr. Malaysia: S. Celebes (Salajar Islands). Ecol. The only specimen known was found on limestone rocks.

18. Ipomoea maxima (L. f.) DON ex SWEET, Hort. Brit. ed. 2 (1830) 372; OOSTSTR. Blumea 3 (1940) 525.—L. sagittaefolia BURM. f. Fl. Ind. (1768) 50, t. 18, f. 2.—Convolulus maximus LINNÉ f. Suppl. (1781) 137.—L. sepioria KOEN. ex ROXB. Fl. Ind. ed. CAREY & WALL. 2 (1824) 90.—L. verrucosa Bl. Bijdr. (1825) 718.—?Quamoclit sagittaefolia CHOISY in DC. Prod. 9 (1845) 335; MERR. Philip. J. Sc. 19 (1921) 375.—L. subtilirobana MIQ. Fl. Ind. Bat. 2 (1857) 615.—Fig. 45–46.
A herbaceous perennial. Stems few to several from a stout perpendicular root, twining or prostrate, 1-2\(\frac{1}{2}\) m long, patent hirsute to glabrous. Leaves broadly ovate, orbicular or kidney-shaped, (1-)2\(\frac{1}{2}\)-6 by (1-)2-5 cm, mostly deeply cordate at the base, or sometimes slightly cordate to truncate with rounded or rarely angular basal lobes, attenuate towards the apex, or more or less abruptly acuminate with obtuse or acuicate mucronulate acumen; the surfaces glabrous but with minute hairs along the margins above, often with purple margin or with purple spots, the margin entire or slightly angular; petiole often shorter than the blade, 1-3 cm, glabrous, with some minute hairs, or minutely verrucose. Inflorescences axillary; peduncle thick, often planate, minutely verrucose towards the top, 1\(\frac{1}{2}\)-12 cm; few- to several-flowered; flowers aggregate in an umbellate cyme. Pedicels verrucose, 3\(\frac{1}{4}\)-1 cm. Bracts minute, persistent. Sepals equal in length or the interior ones slightly longer, 4-6 mm, glabrous, elliptic-oblong, obtuse, mucronulate, the minute micro somewhat below the apex; outer sepals verrucose, coriaceous with thinner margins.

Corolla about salver-shaped, pale lilac, pink, or nearly white, with a purple centre, 2-3 cm long, the limb 1\(\frac{1}{4}\)-2\(\frac{1}{2}\) cm diam. with shortly apiculate lobes. Stamens and style included; filaments glabrous, except the dilated base. Ovary glabrous. Capsule depressed-globular, ca 6-7 mm high, glabrous, 2-celled, 4-valved. Seeds 4, covered with a dense, very short, pale greyish or white tomentum, and often with some longer arachnoid hairs along the edges.

Distr. Tropical Asia, from India and Ceylon, Indo-China, Hainan, Formosa, Siam to Queensland; Malaysia: Sumatra (E. Coast), Malay Peninsula, Java, SW. Celebes, the Lesser Sunda Islands (Lombok, Sumba, Flores, Timor), and Neth. S. New Guinea (Merauke). Fig. 46.

Ecol. In moist, often somewhat saltish localities, near salines, on beaches, but also in moist grasslands, in fields, thickets, hedges, waste grounds and along waysides, from sea-level to 50 m. In Malaysia not found on the beaches bordering the Indian Ocean, but apparently almost confined to the clays of muddy seas.

Vern. Akar kangkong bulu, M, tjémplingan, J. Notes. Some authors (see Blumea 3, 1940, 528, note 1) consider this to be conspecific with I. sagittafolia BüRM. f., the type of which is unfortunately not to be found at Geneva. If they are right, Burman's name has priority.

A specimen from Timor (leg. Mrs Walsh, in Herb. Bog. and Herb. Mus. Brit.) has the leaves ovate-oblong with a sagittate base.


Herbaceous, perennial or sometimes annual.
Fig. 47. *Ipomoea aquatica* FORSK. in gregarious development among lowland forest dying off on account of flooding in the ever-changing delta of the Djenemaedja River, S. of Palopo, SW. Celebes.

(see notes). Stems mostly thick, hollow or spongy, rooting at the nodes, up to 2 or 3 m, trailing on moist soil or mud, or floating on water, occasionally thinner, trailing or twining; glabrous or hairy at the nodes. *Leaves* glabrous, variable in shape and size, even on the same plant, ovate, triangular, ovate-oblong, lanceolate or linear, 3–15 by 1–9 cm, truncate, cordate to sagittate or hastate at the base, with rounded or acute to acute, entire or dentate basal lobes, acute or obtuse to retuse and mucronulate at the apex; leaf-margin above the basal lobes entire or coarsely dentate; petiole 3–20 cm, glabrous. *Inflorescences* axillary; peduncle 1–12 cm, glabrous, cymosely one- to few-flowered. Pedicels longer than the calyx, 2–6½ cm, glabrous. Bracts minute, narrow, acute. *Sepals* equal in length or the outer ones a little shorter, glabrous, with thin pale margins; outer ones ovate-oblong, obtuse, minutely mucronate or blunt, 7–8 mm long, inner ones ovate-elliptic, minutely mucronate, ca 8 mm long. *Corolla* funnel-shaped, (2½–)3–5 cm long, glabrous, pink or pale lilac, often with a purple centre, rarely entirely white. Stamens and style included; filaments hairy at the base. Ovary glabrous. *Capsule* ovoid to globose, ca 8–10 mm high, glabrous. Seeds 4 or less, densely greyish pubescent or sometimes glabrous.

*Distr.* Circumtropical, throughout *Malaysia*. Ecol. In moist, marshy or inundated localities, in shallow pools, ditches, wet rice-fields, forming dense masses; also along waysides, wild and cultivated, from sea-level to 1000 m. The species is easily propagated by cuttings.

Fig. 47A. *Ipomoea aquatica* FORSK. on a dense submerged growth of *Hydrilla verticillata* PRESL in the Lake of Lamongan, E. Java (RUTTNER).
Uses. An excellent palatable vegetable, especially the young shoots and leaves. Also used as 'fish-food' and in medicine. In the Malay Peninsula it is very general to feed it to pigs (Burkill; Heyne).


Notes. According to Backer, the species is perennial, or sometimes, in unfavourable localities, annual. There is a form in cultivation growing in dry places and another one growing in water; in the Malay Peninsula they are distinguished as kangkong darat and kangkong paya, the former are grown in beds, the latter in ponds. Ochse & Bakhuizen van den Brink mention two forms, viz: kangkung biasa, S, with dark green leaves and stems, and lilac flowers, and kangkung nagi, S, with yellow-green leaves, yellowish stems, and white flowers.

Hochreutiner (Candollea 5, 1934, 186) states that a specimen preserved at Geneva, is the type of I. sagittaefolia Burm. f.. This specimen is I. aquatica Forsk. It is not the type of I. sagittaefolia Burm. f. as the specimen does not match Burman's picture and description and, moreover, the sheet carries only Houttuyn's handwriting.


KEY TO THE SUBSPECIES

1. Leaves deeply 2-lobed, with rounded lobes; leaf-base cuneate to attenuate into the petiole. Outer sepals ca 9 mm long, inner ones ca 13 mm. Corolla ca 6'/2 cm long. **ssp. pes-caprae**

1. Leaves emarginate or sometimes truncate at the apex; truncate, rounded, shortly attenuate to subcuneate or slightly cordate at the base. Outer sepals 5–8, inner ones 7–11 mm long. Corolla 3–5 cm long. **ssp. brasiliensis**


Perennial, with a thick taproot. Stems long-trailing and rooting at the nodes, or occasionally twining, 5–30 m long, terete, angular, or flattened, glabrous, containing a milky juice. Leaves often secund, ovate, obovate, elliptic, orbicular, or transverse-elliptic to kidney-shaped, or quadrangular to oblong, 3–10 by 3–10'/2 cm, truncate, rounded, shortly attenuate to subcuneate or slightly cordate at the base, emarginate or sometimes truncate at the apex, mucronulate, rather thick and firm, glabrous; midrib below with two glands at the base of the blade; lateral nerves 8–10 on either side of the midrib; petiole up to 12–17 cm, glabrous. Inflorescences axillary, secund; peduncles 3–16 cm, stout, angular or flattened, glabrous, cymosely one- to several-flowered. Pedicels longer than the calyx, glabrous, 12–30–(45), in fruit up to 45–70 mm. Bracts small, ovate-lanceolate, 3–3'/2 mm long, caducous. Sepals subequal or the outer ones slightly shorter; outer sepals ovate to elliptic or broadly elliptic, 5–8 mm long, distinctly 3–5-nerved; inner ones broader, to orbicular and concave, 7–11 mm long, all obtuse and mucronulate,
Fig. 49. *Ipomoea pes-caprae* (L.) Sweet ssp. brasiliensis (L.) Ooststr. On the beach of the Island of Leiden, Bay of Djakarta (Docters van Leeuwen).

Glabrous, subcoriaceous. *Corolla* funnel-shaped, 3–5 cm long, glabrous, pink, reddish purple or violet, darker inside at the base, rarely entirely white. Stamens and style included; filaments hairy at the base. Ovary glabrous. *Capsule* globular to depressed-globular, ca 12–17 mm high, glabrous, 2-celled, 4-valved. Seeds 4, black, densely brownish tomentose, 6–10 mm long.

**Distr.** Circumtropical, the common subspecies throughout Malaysia.

**Ecol.** On and immediately behind sandy seashores, occasionally in the interior, along waysides, ditches and canals, from sea-level up to 600 m.

**Uses.** The seeds are said to be a good remedy for stomach-ache and cramp. In E. Malaysia the leaves are made into poultices, which are used to ripen boils and applied to swellings, wounds, ulcers, *etc.* The juice of the stems is used in the Island of Nusa Kembangan (S. Java) as a medicine against bites and stings of fishes. The species may be useful as a sand-binder (Burkill; Heyne).

Fig. 50. *Ipomoea pes-caprae* (L.) Sweet. Left: leaf of ssp. pes-caprae; right: leaf of ssp. brasiliensis (L. Ooststr. × 1/2.
Fig. 51. Ipomoea stolonifera (Cyrill.) J. F. Gmel. in the early morning on the beach of the Island of Madura, E. Java; during the previous night a crab has inspected the bud and left a track (Jeswiet).


ssp. pes-caprae.—Convolvulus pes-caprae LINNÉ, Sp Pl. (1753) 159.—I. biloba FORSK. Fl. Aeg.-Arab. (1775) 44.—I. pes-caprae Sweet var. biloba (FORSK.) HALLIER f. ANN. R. Istit. Bot. Roma 7 (1898) 231.—I. pes-caprae (L.) SWEET ssp. pes-caprae (L.) OOSTSTR. Blumea 3 (1940) 538.—Fig. 50.

Differs from the preceding subspecies in the shape of the leaves and the dimensions of calyx and corolla. Leaves in the average smaller, deeply 2-lobed, with rounded lobes, cuneate at the base or attenuate into the petiole. Outer sepals ca 9 mm long, inner ones ca 13 mm long. Corolla ca 6½ cm long.

Distr. Somaliland, tropical Asia, and Malaysia: W. Sumatra (Batu Islands), Krakatao, and Malay Peninsula (Penang, probably only cultivated in the Botanic Gardens). Ecol. Sandy beaches.


Herbaceous perennial, much resembling I. pes-caprae. Stems prostrate or sometimes twining, thick, terete or angular. Leaves orbicular to kidney-shaped, 3½—8 by 3½—10 cm, cordate at the base with rounded lobes, broadly rounded at the apex, not or slightly emarginate, mucronulate; petiole rather thick, with a deep, longitudinal groove above, 3—9 cm long, smooth or minutely muricate. Inflorescences axillary, often together with an axillary leafy shoot; peduncles angular, shorter to slightly longer than the pediöle, 2—5½ (—10) cm, cymosely one- to few-flowered, at least the central flower with a pedicel much longer than the calyx, 14—24 mm. Sepals unequal, the outer

A glabrous perennial. Stems trailing, rooting at the nodes, to 5 m long, terete, glabrous. Leaves fleshy, very variable in shape, often of various forms on the same plant, linear, lanceolate, ovate or oblong, with entire or undulate margin, obtuse, truncate or cordate at the base, obtuse or emarginate to 2-lobed at the apex, or the blade is 3-5-lobed with a lanceolate to ovate or oblong, large middle-lobe and smaller lateral ones; blade 1½-4(-6) by 1-3(-5) cm; petiole ⅓-4 cm. Inflorescences axillary; peduncle short, 12-15 mm, 1- or occasionally 2-3-flowered. Pedicels 8-15 mm, in fruit up to 25 mm. Bracts minute, linear, 2-3 mm long. Sepals unequal, inner ones 10-15 mm long, outer ones shorter, all oblong, acutish or obtuse, mucronulate, glabrous, subcoriaceous. Corolla funnel-shaped, 3⅓-5 cm long, glabrous, white, pale yellow inside and with a purple centre. Stamens and style included. Filaments hairy at the base. Ovary glabrous. Capsule globose, ca 1 cm high, smooth, 2-celled, 4-valved. Seeds 4 or less, ca 8 mm long, short-tomentose and with longer hairs along the edges.

Distr. Tropical and subtropical countries of both hemispheres, in Malaysia: apparently rare, Malay Peninsula, Madura Island and the Philippines (Cagayan and Babuyan Islands). Fig. 52.

Ecol. Sandy sea-shores, dunes, from sea-level to 5 m. Use. It might be of some service as a sand-binder.


A herbaceous, glabrous twiner, with terete stems. Leaves ovate, 3½-7 by 2½-6 cm, cordate at the base, long-acuminate at the apex with an acute, mucronulate acumen; petiole 1½-6 cm. Inflorescences axillary; peduncles as thick as the stems, terete, fistulose, 3-9 cm, cymosely branched at the top. Pedicels much longer than the calyx, 15-18, afterwards up to 25 mm. Bracts minute, triangular. Sepals subequal, narrowly triangular to ovate-lanceolate, gradually narrowed towards the apex, 4½-6 mm long, green with white margins, carinate on the back. Corolla funnel-shaped, 4-6 cm long, glabrous, in bud red with a white tube, in anthesis bright sky-blue with a paler or white tube. Stamens and style included, filaments very unequal, glabrous. Ovary glabrous. Capsule ovoid, ca 8-10 mm long, mucronate by the style-base, pale straw-coloured, 2-celled, 4-valved; dissepiment persistent. Seeds 4, nearly 5 mm long, black, minutely puberulent.

Distr. Mexico, Central America, West Indies, tropical South America, elsewhere cultivated and perhaps occasionally escaped, in Malaysia only known from the Malay Peninsula (as a garden escape), and Timor, where it is locally frequent in the N. central portion of the island, at 400 m.

Vern. Non liti, Timor.


A glabrous twiner (or occasionally prostrate). Root tuberous. Stems more or less tuberculate or smooth. Leaves ovate to orbicular in outline, 3-10 by 3-10 cm, palmately cut to the base into 5 lanceolate or ovate-lanceolate to ovate or elliptic, basally and apically acuminate entire segments with acute or obtusish mucronulate apex; the basal pair of segments usually again lobed or parted; petiole 2-6 cm, often with pseudostipules (small leaves of the axillary shoot) at its base. Inflorescences axillary; peduncle ⅓-7 cm, cymosely one- to few-flowered; pedicels 12-20 mm; bracts minute. Sepals glabrous, subequal or the exterior ones slightly shorter, 4-6½ mm, often minutely tuberculate without, with pellucid dots and with pale, scarious margins; outer ones ovate, obtuse to acutish, mucronulate, inner ones broader, obtuse, mucronulate. Corolla funnel-shaped, 4½-6 cm long, white with a purplish-red tinge on both surfaces and purplish-red towards the base only on the inner surface, occasionally entirely white. Stamens and style included; filaments pilose at the base. Ovary glabrous. Capsule subglobose, 10-12 mm high, smooth, 2-celled, 4-valved. Seeds 4 or less, ca 5-6 mm long, densely short-tomentose and with long silky hairs along the edges.

Distr. Widely distributed in tropical Africa and Asia; cultivated and naturalized elsewhere, in Malaysia cultivated and/or run wild in the Malay Peninsula, Java, Borneo, Moluccas, Philippines, New Guinea, and the Bismarck Archipelago.

Ecol. Cultivated; wild, in waste places, thickets, hedges, etc.

Vern. Railway creeper, E, tatampajan, M, patula hutan, Sandakan, aurora, Spanish.
Note. *I. cairica* has been mentioned by several authors under the name of *I. pulchella* Roth, which is, however, another species, differing *i.e.* by its much smaller, ca 1½ cm long, corolla.


A glabrous annual. Stems slender, trailing, or sometimes twining. Leaves orbicular in outline, 1–3 cm long and broad, digitate, with 5 coarsely dentate to deeply and irregularly, once or sometimes twice pinnatifid segments; the teeth or lobes of the segments mostly acute; the middle segment larger than the lateral ones, ovate, oblong, lanceolate or oblanceolate in outline, the two basal segments sometimes 2-lobed again; petiole mostly shorter than the blade, 3–8(–20) mm, with pseudo-stipules (small leaves of the axillary shoot) at its base. Inflorescences axillary; peduncles mostly shorter than the leaves, 1–3½ cm long, narrowly 2-ulate, cymose 1–3-flowered. Pedicels 4–5(–7) mm, at first erect, in fruit bent downwards. Bracts lanceolate, entire, small, 1½–3 mm long, acute, or sometimes larger and palmately laciniate like the leaves (var. *acuta* Choisy in DC. Prod. 9, 1845, 384). *Sepals* subequal, ca 4 mm long, oblong or elliptic, minutely cuspidate, thinly coriaceous, verruculose on the back. *Corolla* funnel-shaped, small, ca 12 mm long, white. *Capsule* globose, ca 7–8 mm diam., glabrous, 3-celled. Seeds 6, ca 1½ mm long, densely greyish-tomentose.


26. *Ipomoea diversifolia* R.Br. Prod. (1810) 487; Ooststr. Blumea 3 (1940) 545.— *Pharbitis laciniata* Dalz. in Hook. J. Bot. 3 (1851) 178.— *I. laciniata* Clarke in Hook. f. Fl. Br. Ind. 4 (1883) 200.—Fig. 52.

A glabrous annual. Stems slender, trailing or twining. Leaves orbicular in outline, 1–2½(–5) cm diam., digitate, with 5 coarsely and irregularly dentate to pinnatifid segments, the two basal of which sometimes bifid, the central segment larger than the lateral ones, all narrow-oblong to oblanceolate in outline; petiole mostly shorter than the blade, 3–12(–15) mm long, with pseudo-stipules. Inflorescences axillary; peduncles mostly shorter than the leaves, 7–20 mm long, angular or flattened, mostly 1-, sometimes to 3-flowered. Pedicels 8–12(–18), in fruit to 15(–20) mm, erect, also in fruit. Bracts linear-lanceolate, small, ca 3 mm long, very acute. *Sepals* subequal or the inner ones slightly longer, 6–10 mm long, elliptic or narrowly-elliptic or oblong-lanceolate, cuspidate or acute, the back more or less carinate and mucricated. *Corolla* tubular to funnel-shaped, small, 5–6 mm long, white, purple inside at the tube. Stamens and style included. *Capsule* subglobose, 8–10 mm diam., glabrous. Seeds short-tomentose.

Distr. India to NE. Australia, in *Malaysia*: Philippines (Luzon: Ilocos Norte). Fig. 52.

Ecol. In grasslands at low altitudes.


A glabrous twiner. Stems slender. Leaves linear, 4–14 cm long or still longer, 2–5 mm broad, obtuse, mucronulate; petiole 4–10 mm; midrib and lateral nerves nearly parallel. Peduncles 1-flowered, 3–5 mm, in fruit up to 12–15 mm. Pedicels 6–9 mm, in fruit up to 15–18 mm. *Sepals* unequal, the inner ones longer; outer sepal elliptic, ca 6 mm long, inner ones oblong or ovate-oblong, 7 and 8–10 mm long, somewhat longer in fruit, all obtuse, and mucronulate at the apex. *Corolla* salver-shaped, white, ca 4 cm long (according to Bentham up to 7½ cm long). Filaments inserted near the corolla-base (perhaps slightly exserted), hairy at their base. Ovary glabrous. *Capsule* ovoid-globose, ca 8 mm high, glabrous. Seeds greyish.


Ecol. In open savannah-land and in savannah-forests, climbing up grasses etc., ca 15–150 m. Flowers opening in the evening.

5. Section Calonyction


Annual or perennial herbaceous twiners, mostly glabrous; stems often muricately. Leaves cordate, sometimes angular, herbaceous. Flowers axillary, solitary, or often in a cincinnus or in a dichasial cyme, nocturnal. Sepals herbaceous to membranaceous, glabrous or sometimes hirsute, long-aristate or rarely blunt, subequal or the exterior ones smaller. Corolla large, actinomorphic or slightly zygomorphic, white, pink or lilac. Glabrous, salver-shaped, the tube long, narrow-cylindrical or rarely widened above the middle. Stamens and style often exerted. Ovary glabrous, 2-celled or rarely 4-celled, 4-ovuled. capsule 4-valved, 4-seeded. Seeds large, glabrous, dull.


A glabrous or rarely pubescent annual or perennial twin, containing a white milky juice. Stems herbaceous or ligneous at the base, slender, terete, to 5 m high, smooth or sometimes muricately. Leaves ovate or orbicular in outline, rarely oblong to oblong-oblong, 6–20 by 5–16 cm, the margin entire, or 3-lobed or on the same plant, cordate at the base with a broad or narrow rounded sinus and with broadly rounded or sometimes angular lobes, acuminate at the apex with an acute or obtuse, mucronulate acumen; petiole slender, 5–20 cm. Inflorescences axillary, one to several-flowered; the flowers in a cincinnus, rarely dichasial; peduncle stout, terete, 1–24 cm. Pedicels 7–15 mm, much thickened and clavate in fruit and then up to 25–30 mm. Bracts small. caducous. Sepals subcoriaceous, elliptic, glabrous, unequal, the 2 or 3 outer ones shorter, 5–12 mm and with a long, thick, recurved or patent awn, 4–9 mm long, the inner ones longer, 8–15 mm, muriculate, with a much shorter and thinner mucro, 2–3 mm long; sepals often reflexed in fruit. Corolla opening after sunset, fragrant, salver-shaped, white with greenish bands; the cylindrical to slightly angular tube 7–12 cm long, suddenly expanding into a 11–14 cm broad rotate limb. Stamens and style exerted; stamens inserted in the upper part of the corolla-tube; filaments glabrous. Ovary glabrous. Capsule ovoid, muriculate, 2½–3 cm high, glabrous, 2-celled, 4-valved. Seeds 4, glabrous, yellowish white to brown or black, 10–12 by 7–9 mm.

Distr. Circumtropical; originally in tropical America, in Malaysia cultivated in gardens and run wild.

Ecol. Widely distributed in the settled areas at low and medium altitudes; cultivated and run wild in thickets, hedges, along waysides and edges of forests.

Uses. Often cultivated in gardens for its nocturnal, fragrant flowers. The young leaves are eaten as a vegetable (according to HEYNE): the dried flowers (sundal malam, sédép malam) are used in pies and in kimlo (Chinese vegetable soup) (according to OCHSE).

Vern. Béring runbi, trulak, andor simar gan-dung 2, Sumatra, terulak, M, terong kori bodas, sundal malam, areu kutjubung, S, kurulak, klurak.

CONVOLVULACEAE

J. teja, Alor, bunga pareh, Celebes, pitur, Minah., Philippines: kalakamőte, malakamőte, kamakamotihan, Tag., Bis., kakaluit, Gad., pekepeket, Bont., moonflower, good-night flower, E., nachtschone, D.

Notes. Hallier f. (Bull. Herb. Boiss. 5, 1897, 1037 & 1038) distinguishes two varieties, each subdivided into two subvarieties, on account of J. the leaf-shape and 2. the absence or presence of a pubescence. The varieties appear to be of little systematic value as there are many specimens of which the leaves are partly entire and partly 3- to 5-lobed. By far the greater part of the specimens from Malaysia is glabrous; pubescent specimens are very rare.


A glabrous or nearly glabrous twiner, containing a white milky juice. Stems herbaceous, annual, terete or angular, muricate. Leaves broadly ovate to orbicular, 7-18 by 6½-15 cm, cordate at the base with wide or narrow sinus and broadly rounded lobes, acuminate at the apex with an acute or obtuse, mucronulate acumen; petiole 4-12 cm, muricated or smooth. Inflorescences axillary, one- to few-flowered; peduncles muricated, 3-6 cm. Pedicels 10-20 mm or longer, smooth, thickened towards the calyx, very thick in fruit. Bracts oblong, acute, ca 8 mm long, scarious. Sepals about equal in length; two outer ones oblong to ovate, ca 6-7 mm long, more or less plicate at the top and attenuate into a thick suberect awn, 4-6 mm long; three inner ones ca 7-8 mm long, obtuse or slightly emarginate, distinctly awned, awn ca 4 mm; sepals in fruit patent, Afterwards reflexed. Corolla opening at night. glabrous, long funnel- to salver-shaped, pale bluish-purple. ca 5-7½ cm long, with a narrow, cylindrical, ca 3-5 cm long tube; tube widened above at the place of insertion of the filaments; limb funnel-shaped to rotate, 5-angular. Stamens and style not or scarcely exserted; stamens inserted in the upper part of the corolla-tube; filaments with some short hairs at the base. Ovary glabrous. Capsule ovoid, ca 18-20 mm high. 2-celled, 4-valved. Seeds 4. glabrous, black, ca 9-10 mm long.

Distr. From Mexico to Colombia and Brazil, the West Indies, tropical Africa and adjacent islands to India, China, and Japan, in Malaysia cultivated in the Philippines.

Uses. Cultivated as an ornamental. In the Philippines the seeds are used as a remedy against snake-bites; they are also said to be purgative (Brown, Quisumbing).

Vern. Pipita de tonkin. Philip., tonkin, tuukin, Tag..

6. Section Quamoclit


Annual (or perennial?) heraceous twiners, mostly glabrous. Leaves cordate, often angular or palmately 3-5-lobed, rarely deeply pinnately divided. Flowers mostly axillary, often in a dichasium consisting of two scorpioid cymes or in a real dichasium, rarely solitary. Sepals heraceous to membranaceous, small, glabrous, obtuse, mostly aristate below the apex, subequal or the exterior ones shorter. Corolla small or medium-sized, often slightly zygomorphic, often bright red, rarely yellow or white, glabrous, salver-shaped, the tube cylindrical or widened upwards, the limb patent. Stamens and style exserted. Usually decinate. Ovary glabrous. 4-celled, 4-ovuled. Capsule 4-celled, 4-valved. 4-seeded. Seeds glabrous or rarely puberulent, dull-black.


An annual twiner. Stems heraceous, terete or slightly angular, often contorted, 2-5 m high, glabrous or sparsely pilose. Leaves mostly glabrous, ovate or broadly ovate to orbicular in outline, 3-15 by 3-10 cm, cordate at the base, acuminate and mucronulate at the apex, the margin entire, angular, coarsely dentate or obscurely to deeply 3-lobed, the middle lobe narrowed towards the base; petiole shorter or longer than the blade, 3-12 cm, glabrous or sparsely pilose. Inflorescences lateral or terminal, few to several-flowered, 10-35 cm long; peduncle often longer than the petiole,
3-20 cm, terete or angular, glabrous or pubescent, cymosely branched at the top; first ramification mostly dichasial, subsequent ones monochasial; flowers and fruits on erect pedicels. Pedicels angular, 5-7 mm or longer, in fruit up to 8-12 mm, that of the central flower up to 15 mm. Bracts minute, 1/2-2 mm, triangular, mucronulate. Sepals oblong-rectangular with broadly obtuse or truncate apex and with a large straight or slightly curved awn inserted immediately below the top; outer sepals 2-21/2, inner ones ca 3 mm long (awn excluded); awn 3-4 mm; sepals in fruit patent, afterwards reflexed. Corolla glabrous, salver-shaped, scarlet, the tube 3-4 cm long, narrowed towards the base, slightly curved; the limb patent, up to 2-21/2 cm diam.; Stamens and style exerted; filaments slightly unequal, glabrous. Ovary glabrous. Capsules on erect pedicels, globose, 5-7 mm high, glabrous, 4-celled, 4-valved: the dissepiments persistent, pellucid, with a thickened circular margin. Seeds 4, ca 4 mm long, black, densely pubescent.

Distr. Native of tropical America, now circumtropical; in Malaysia cultivated and run wild.

Ecol. Cultivated in gardens for ornamental purposes; run wild in waste places, fields, grasslands, thickets and thin forests, up to 1200 m.

Vern. Bunga wolanda, M, ajong ajong, areuj tjatjabean, S, rajutan, sanggo langit, J, kardinaalsbloem, D.

Note. Several authors have confounded this with the N. American I. coccinea L. (see VAN OOSTSTR. Blumea 3 (1940) 555, note). For a discussion of the differences between the two species see HALLIER f. Bull. Herb. Boiss. 7 (1899) 415.


An annual glabrous twiner, rarely prostrate. Leaves ovate or oblong in outline, 2-10 by 1-6 cm, pinnatifid to the midrib, with (8-10-18 pairs of linear to filiform patent segments, the inferior of which are often bifid; rarely the leaves are less deeply incised (var. pectinata (HALLIER f.) OOSTSTR.); petiole 8-40 mm, at the base often with pseudo-stipules. Inflorescences axillary, cymosely one- to few-flowered; peduncles mostly exceeding the leaves. 11/2-10(-14) cm. Pedicels much longer than the calyx, (5-9-20 mm, thickened and clavate in fruit. Bracts minute, deltoid, acute. Sepals slightly unequal, outer ones shorter. verruculose outside; all oblong to oblong-spathulate, obtuse, mucronulate somewhat below the apex; outer sepals (mucro excluded) 4-41/2 mm, inner ones (mucro excluded) 5-6 mm long; mucro 3/4-1 mm; margins of sepals pale. Corolla glabrous, salver-shaped, red or sometimes white (var. albiflora G. DON. Gen. Syst. 4, 1838, 260; OOSTSTR. Blumea 3, 1940, 556), the tube 21/2-31/2 cm long, slightly narrowed towards the base; straight: the limb expanded, 11/2-2 cm diam., 5-lobed with acutish, mucronulate lobes. Stamens and style exerted; filaments hairy at the base. Ovary glabrous. Capsules ovoid, obtuse, 6-8 mm long, often crowned by the thickened base of the style, 4-celled, 4-valved, with longitudinally splitting valves, the dissepiments persistent, pellucid, with a thickened circular margin. Seeds 4, ovoid-oblung, 5-6 mm long, blackish-brown, marmorate by tufts of minute hairs.

Distr. Circumtropical, in Malaysia cultivated and run wild throughout the region.

Ecol. Cultivated in gardens as an ornamental plant; run wild in waste places, hedges, thickets, thin forests and along edges of cane and rice-fields, up to 1200 m.

Use. In the Philippines the leaves are prepared in poultices and employed as a remedy for bleeding haemorrhoids.

Vern. Bunga kali-tali, sangga langit, M, katilan, ratjik bumi, rintik bumi, S, sēri kading, Brun.}

(1) I. quamoclit LINNÉ var. pectinata (HALLIER f.) OOSTSTR. nov. comb.—Quamoclit pinnata BOJ. var. pectinata HALLIER f. Versl.'s Lands Pl.-tuin 1895 (1896) 131.
According to House a hybrid between *I. coccinea* L. and *I. quamoclit* L. differing from the latter by: Leaves deltoid-ovate in outline, pectinately lobed to beyond the middle with ca 3-7 linear or linear-lanceolate, acuminate lobes on either side of the midrib; middle segment broadest, basal ones shortest and sometimes again lobed. Corolla salver-shaped, 4-5 cm long, crimson.

Note. Originally cultivated by Mr Sloter of Columbus, Ohio. In *Malaysia* occasionally found as an ornamental (Malay Peninsula, Java).

### 7. Section *Eriospermum*


Perennial plants, very variable in habit, pubescence, leaves and flowers. Flower-buds rarely acute, mostly obtuse, often globular. Sepals mostly obtuse, often orbicular, convex, rarely flat or acute. Seeds with long-bearded edges, further glabrous or rarely the whole surface villose.


**KEY TO THE VARIETIES**

1. Leaves palmately divided to or mostly beyond the middle . . . . var. *digitata*

1. Leaves entire or shallowly lobed.

*var. eriosperma*—**Fig. 55.**

A large perennial twiner, sometimes prostrate. Roots tuberous. Stems terete, glabrous. Leaves glabrous, orbicular in outline, 6-14 by 6-16 cm, palmately divided to or mostly beyond the middle; base more or less cordate or truncate, segments (3-)7(-9), lanceolate to ovate, entire, acuminate with an acute or blunt, mucronulate top; petiole smooth or minutely muricate, 3-10 cm long. Inflorescences axillary; peduncles generally longer than the pedicels, terete but often angular near the top, glabrous, cymosely branched, few- to many-flowered, 2½-20 cm. Pedicels longer than the calyx, terete, minutely muricated, glabrous, 9-25 mm long. Flower-buds globular. Sepals equal in length or the outer ones shorter, all orbicular or the outer ones oblong to broadly elliptic, obtuse, concave, coriaceous, 6-12 mm long, pale green, glabrous. Corolla pale reddish-purple, the tube darker inside, funnel-shaped, the tube cylindrical, narrowed at the base, the limb patent; corolla 5-6 cm long, limb 5-7 cm diam.; Stamens and style included, filaments hairy at the base. Ovary glabrous. Capsule ovoid, obtuse, 12-14 mm high, glabrous, 2-celled, 4-valved. Seeds 4, black, with long woolly-sericeous easily detaching hairs.

Distr. Circumtropical; throughout *Malaysia*. Ecol. In thickets on the beach, but also in the interior, in waste places, thicket, hedges, savan-

![Fig. 55. *Ipomoea digitata* L. in the Botanic Gardens, Singapore (Henderson).](image)
Flora Malesiana [ser. 1, vol. 4]

Flora is (Malay ginate, lateral purplish towards

Note.

Distr.

Stems

190
cultivation.

hairs

only,

broadly

nodes,

laterally

nodes

hairy

twining,

Inflorescences

angular,

apparently

2

—

3

THE

Hallier/.".


KEY TO THE VARIETIES

1. Leaves densely covered with stellate hairs on both surfaces; stems with similar hairs mainly at the nodes . . . . var. asterophora

1. Leaves with stellate hairs below on the nerves only, or entirely glabrous; stems with similar hairs over the whole surface or only at the nodes. var. subglabra

var. asterophora.

Stems twining, terete, stellately hairy mainly at the nodes, glabrescent. Leaves broadly ovate to orbicular, 7–16 by 7½–12 cm, broadly cordate at the base, attenuate to shortly acuminate at the apex with a broadly triangular, obtuse to slightly emarginate, mucronulate acumen; margins entire, slightly undulate or more or less deeply lobed with 1–2 broad or narrow triangular obtuse lobes on either side, stellately hairy on both surfaces; lateral nerves strongly curved, 3–4 on either side of the midrib, 2–3 of which rising from the leaf-base; petiole with stellate hairs, glabrescent, 3–8 cm long. Inflorescences axillary; peduncles terete or slightly angular, ca 6–15 cm long, 2–6– or sometimes more-flowered, stellately hairy to glabrous. Pedicels slender, longer than the calyx, 1–2 cm. Bracts minute, caducous. Sepals slightly unequal, outer ones elliptic, 7–9 mm long, inner ones orbicular, 9–10 mm long, all concave with rounded apex, subcoriaceous, glabrous or the outer ones sparsely hairy with stellate hairs. Corolla pale purplish or purplish white, darker purple inside towards the base, campanulate to funnel-shaped, ca 7 cm long, glabrous. Stamens and style included; filaments hairy at the base. Ovary glabrous.


Ecol. River-banks, up to 100 m.

var. subglabra Ooststr. Blumea 3 (1940) 563.

Differs from var. asterophora by the much less dense to almost lacking indument; the stems may be stellately hairy over the whole surface but specimens with nearly glabrous stems are also found; such almost glabrous stems still bear a few stellate hairs at the nodes. Leaves with stellate hairs below on the nerves only, or entirely glabrous; pedicels stellately hairy to glabrous.

Distr. Malaysia: West New Guinea; a fragmentary specimen (TEYSSMANN 12114) collected in SW. Celebes (near Pangkadjene) may belong to this variety.

Ecol. As in var. asterophora.


A large, glabrous twiner. Stems terete, the adult parts woody, lenticellate. Leaves orbicular in outline, 5–20 by 5–20 cm, deeply palmately lobed to beyond the middle or to the base into 3–5 segments; middle segment mostly much larger than the lateral ones, ovate, elliptic or elliptic-oblong, mostly attenuate towards both ends, acuminate at the apex with acute or obtuse, mucronulate point; lateral segments ovate-lanceolate to linear-lanceolate; margins of segments slightly crisped, entire or coarsely dentate to crenate; petiole shorter than the blade. 2½–13 cm. Inflorescences axillary, 8–30 cm long, few- to several-flowered; peduncle 1½–14 cm, widely cymosely branched. Pedicels as long as or longer than the sepals, 8–15 mm. Sepals subequal or the outer ones slightly shorter, elliptic or ovate-elliptic, obtuse, concave, 7–10 mm long, green at the base, for the rest red-purple or purplish black. Corolla red or red-purple, salver-shaped, the tube slightly angular, somewhat narrowed to the base, ca 4 cm long, ca 1 cm diam.; limb ca 4–4½ cm diam., 5-lobed with rounded lobes. Stamens and style exerted; filaments pale purple, densely villous at the base; style white, stigma dark purple, ovary glabrous.

Distr. Native of the West Indian Islands, cultivated throughout the tropics, also in Malaysia. Use. Cultivated in gardens for ornamental purposes.

Vern. Red Stephanotis, E. rode Clematis, rode Stephanotis, D.

Note. Caterpillars of Euchromia horsfieldi Moore feed on the leaves of this species.


A perennial hairy twiner. Stems terete, densely short-pilose with soft whitish hairs. Leaves broadly ovate to orbicular, 5–15 by 4–12 cm, broadly
cordate at the base, acuminated at the apex with an acute or obtuse mucronulate point, densely pilose beneath, much more sparsely so and gla-brescent above; nerves 7–9 on either side of the midrib; petiole slender, 3–12 cm, pilose like the stem. Inflorescences axillary: peduncle terete, 2–14 cm long, pilose like the stem, often glabrous or nearly so in the basal portion, cymosely one-to few-flowered with very short branches; flowers consequently subumbellate. Pedicels pilose, mostly longer than the calyx, 3½–1½ cm, in fruit up to 2 cm. Sepals equal in length, 3½–1 cm, the 2 outer ones elliptic-oblong, acute, shortly pilose, the inner ones broader, ovate-elliptic, less acute. Corolla pink or purple with a darker centre, funnel-shaped, basally constricted, 4–5 cm long, with sericeous hairs on the midpetaline bands outside. Stamens and style included. Filaments hairy at the flattened base. Ovary glabrous. Capsule globose, 12 mm diam., glabrous. 2-celled. 4-valved. Seeds 4, ca 6 mm long, white-villos.</p> <p>36. Ipomoea illustris (Clarke) Prain, Beng. Pl. 2 (1903) 735; Ooststroom. Blumea 3 (1940) 566.—I. campanulata auct. div. non L. 1753.—I. campanulata L. var. illustris Clarke in Hook. f. Fl. Br. Ind. 4 (1883) 211.</p> <p>A woody twiner, rarely prostrate and rooting. Stems longitudinally wrinkled to angular, glabrous or pubescent. Leaves ovate to orbicular, sometimes ovate-oblong, 6–16 by 3½–14 cm, shallowly cordate to truncate at the base, acuminated at the apex with a short or long and narrow, acute or obtusish, mucronulate acumen; margin entire or undulate; surfaces glabrous or lower surface pubescent; nerves 10–15 on either side of the midrib; petiole slender, 3–10 cm, glabrous or pubescent. Inflorescences axillary: peduncle stout, 1–8 cm long, glabrous or rarely pubescent, cymosely one-to several-flowered. Pedicels 1⅓–2½ cm, in fruit to 3 cm, angular, thickened towards the calyx, glabrous or rarely pubescent. Sepals slightly unequal, glabrous or rarely pubescent, coriaceous, with pale thinner margins, orbicular with rounded apex; outer ones 7–10(–15), inner ones 10–12(–18) mm long, in fruit up to 14–15 and 18 mm or still longer. Corolla reddish purple with a darker centre, paler without, sometimes pale purplish or rarely white, tubular to funnel-shaped, up to 10 cm long, contracted at ca 1½ cm above the base. Stamens and style included. Filaments hairy at the base. Ovary glabrous. Capsule ovoid, ca 1½ cm long, brown, 2-celled, 4-valved. Seeds 4, ca 8–9 mm long, black, with long silky hairs along the margins. </p> <p>Distr. India, Ceylon, Indo-China, Siam, An-damans, in Malaysia: Sumatra, Malay Peninsula, Java, Borneo, Celebes, Lesser Sunda Islands (Bali), Moluccas (Ceram), New Guinea (Papua), Philippines (Luzon). Ecol. Sea-shores, and in thickets and along edges of forests near the sea. up to 25 m. Vern. Olor bulb uding, Simalur, bllan, Japan (Pekalongan), budokkin, Minah.</p> <p>Note. This species is generally known both in systematic literature and in herbaria under the name of I. campanulata LINNÉ. However, the type of I. campanulata L. is conspecific with the Malva-cea Thespesia populnea (L.) SOLAND., as appears from LINNAEUS'S description and herbarium (see Hallier f. Med. Rijksherb. Leiden no 1, 1910, 26; VAN OOSTSTROOM Blumea 3, 1940, 568; KERR, Kew Bull. 1941, 18). The synonym Adanome RHEEDE, mentioned by LINNAEUS under I. cam-panulata most probably belongs to Stictocarida tilifolia (DESR.) HALLIER f..</p> <p>37. Ipomoea crassicaulis (BENTH.) B. L. ROBINS-ON, Proc. Amer. Acad. 51 (1916) 530: Ooststroom. Blumea 3 (1940) 569.—Batatas crassicaulis BENTH. Voy. Sulph. (1844) 134.—I. fistulosa MART. ex CHIOY in DC. Prod. 9 (1845) 349.</p> <p>A shrub, 1–2½ m high, erect or ascending, or sometimes twining, and to 5 m high. Branches thick, terete to angular, fistulose or solid, containing a white milky juice, the adult parts lenticellate, pale greyish, the younger parts densely puberulent, glabrescent. Leaves ovate or ovate-oblong, 6–25 by 4–17 cm, cordate to truncate at the base, acuminated at the apex, with an acute or obtuse, mucronulate acumen; young leaves densely puberulent on both surfaces, adult ones puberulent below, mainly on the nerves, glabrous or nearly so above; midrib below with 2 small glands at the base of the leaf-blade; lateral nerves 7–9 on either side of the midrib, secondary nerves many, parallel; petiole slender, 2½–15 cm. Inflorescences axillary and terminal; peduncle stout, terete, 5–15 cm long, puberulent or glabrous, cymosely several-to many-flowered. Pedicels longer than the calyx, puberulent. Bracts minute, ovate, obtuse, caduous. Sepals subequal or the outer ones slightly shorter, 5–6 mm long, orbicular, broadly rounded, puberulent: calyx with 5 nectaries between the sepal-bases. Corolla pink or pale lilac, inside often dark purple towards the base, tubular to funnel-shaped, 7½–9 cm long, limb 8–12 cm diam.; tube constricted close to the base; tube and midpetaline bands minutely puberulent outside, connecting fields glabrous or nearly so. Stamens and style included. Filaments very unequal, hairy at the dilated base. Ovary and basal part of the style puberulent. Capsule ovoid, mucronate, 1½–2 cm long, pale brown, finely puberulent in the basal portion, incompletely 4-celled, or 2-celled, 4-valved. Seeds 4 or less, black, their whole surface sericeo-villos.
Distr. Native of America, from Mexico, Florida and the West Indies S. as far as Brazil and Paraguay, in Malaysia cultivated and run wild occasionally.

Ecol. Escaped from cultivation and naturalized at low altitudes along rivers, canals, sometimes on the beach; locally abundant.

Use. Cultivated as an ornamental plant; the leaves are eaten as a vegetable by the Madurese. Vern. Klémun, kankungan, ila, daun krank-kungun, J.

Note. In exposed situations the plant is shrub-bush, but twines up if under shade (Furtado in Herb. Singapore). It is sometimes found in cultivation under the erroneous name *I. carnea* Jacq.


A large, woody, glabrous twiner. Stems terete or angular, fistulose, greyish brown. Leaves oval or rarely broadly ovate, 6–12 by 5–10 cm, slightly cordate or truncate at the base, obtuse or acute to shortly acuminate at the apex; lateral nerves prominent beneath, 11–14 on either side of the midrib; petiole slender, 4–10 cm. Inflorescences axillary, 6–18–30 cm long, paniculate, one or two times racemosely branched, the ultimate partial inflorescences cymose; large inflorescences with leaflike bracts at the base of the lowest branches; peduncle under the lowest branch ca 3–6 cm long. Pedicels longer than the calyx, 6–10 mm. Outer sepals broadly ovate, obtuse, ca 3½–4½ mm long, coriaceous, slightly shorter than the inner ones; inner sepals orbicular, broadly rounded, ca 4½–5 mm long, coriaceous with scarious margins. Corolla white or slightly tinged with pink, tubular to funnel-shaped, 2½–3½ cm long, glabrous; tube ca 5–6 mm wide; midpetaline bands with many minute, dark, glandular lines. Stamens and style included. Filaments sparsely pilose at the dilated base. Ovary glabrous. Capsule ovoid, subacute, ca 7½ mm long. Seeds 4, with long, silky hairs.

Distr. Siam and Malaysia: Sumatra (only known from the type loc., Sungei Pagu, W. Coast), Malay Peninsula (Perlis, Kedah, Penang, Perak, Pahang), Java (Salatiga); perhaps also in the Lesser Sunda Islands (Sumbawa, Timor?).

Ecol. Probably in thickets, up to 1000 m.
Vern. Akar kétjimbang, Sumatra.

Note. The majority of the specimens have been found in the Malay Peninsula. In Sumatra and in Java the species appears to be very rare. The specimen Mrs Rensch 619, from Sumbawa, in Herb. Bog. is somewhat aberrant; it has the stems minutely warty, the peduncles thinner and few-flowered, and the corolla white with a dark red centre. Elbert 3740, also from Sumbawa, in Herb. Leyden, a sterile specimen, is perhaps conspecific and so is a specimen from Timor, collected by Wiley & Smith s.n. in Herb. Brit. Mus.


**KEY TO THE VARIETIES**

1. Plant glabrous or nearly so. **var. aculeata**
2. Plant softly pubescent, or short-tomentose. **var. mollissima**

**var. aculeata**

A glabrous or nearly glabrous twiner, to 10–15 m, occasionally prostrate. Stems woody, grey or pale straw-coloured, often thickened at the nodes, terete to angular, smooth or mucrinated with small curved hooks. Leaves ovate to orbicular, entire or rarely 3-lobed, 5–14 by 3–10 cm, cordate to truncate at the base, if cordate with a narrow to very broad sinus and rounded basal lobes, acuminate at the apex, with a short or long and narrow, acute or obtusish, mucronate acumen; lateral nerves 5–6 on either side of the midrib; petiole slender, 2½–8(–12) cm, smooth or sometimes with some acute warts. Inflorescences axillary, one to few-flowered; peduncle short, 2–10(–15) mm. Pedicels terete or angular and thickened towards the calyx, 7–15 mm, in fruit clavate and to 20 mm, recurved in bud, afterwards erect, finally recurved again. Sepals coriaceous, broadly elliptic or orbicular, rarely narrower, broadly rounded to emarginate at the apex and minutely mucronate, 12–18 mm long, in fruit to 20 mm, the inner ones mostly somewhat shorter than the outer and with a narrow scarious margin. Corolla white, greenish outside, opening at night, fragrant, valver-shaped, 14–17 cm long, tube long and narrow. Stamens and style exserted. Filaments inserted at the mouth of the tube, hairy at their base. Ovary glabrous. Capsule enclosed by the sepals, ovoid, mucronate, ca 15 mm long, 2-celled, 4-valved, with more or less lacerate valves. Seeds 4, densely grey-woolly, 6–8 mm long.


Ecol. In thickets and thin forests, from sea-level to 700 m.

Use. The pulverized top of the plant is used in the Karolands, Sumatra, as a medicine against boils.

Vern. Waren tan tan, Karo-Batak, klorak, S.

Note. The type of *Calonyction mollisssimum* Zoll. var. glabrior Miq. is a transition between this var. and the next one, as to the density of the indumentum.


Diffs from *var. aculeata* in being pubescent or short-tomentose.
Distr. Possibly in continental Asia (Silhet, Pegu, and Tenasserim), in Malaysia: M. & E. Java, Madura, Lesser Sunda Islands (Lombok, Sumbawa, Timur, Aor), and Philippines (Luzon).

Ecol. In thickets and thin forests, from sea-level to 700 m.

Use. The leaves are used as a purgative and as a substitute for soap (HEINE).

Vern. Unuk-uluk, S, rabet kalorak, klorak, Md.


A glabrous twiner. Stems woody, straw-coloured in dry specimens, terete or angular, often longitudinally wrinkled, smooth or rarely mucrinated. Leaves orbicular or ovate, 5–16 by 5–14 cm, deeply cordate at the base, with rounded or rarely angular lobes, acuminate at the apex, with obtuse, mucronulate tip; lateral nerves 7–8 on either side of the midrib, secondary nerves parallel, tertiary nervation distinctly reticulate (in dry specimens the secondary and tertiary nervation often pellucid); petiole 3½–16 cm. Inflorescences axillary, one-to few-flowered; peduncle terete, variable in length, 3½–7–(12) cm. Pedicels angular, 1½–3 cm long, thickened to clavate in fruit. Sepals orbicular, with broadly rounded to emarginate, mucronulate apex, equal in length or the inner ones slightly longer, outer ones 15–20 mm, inner ones 18–25 mm long, all coriaceous, the inner ones somewhat thinner; sepals enlarged in fruit, at first enclosing the capsule as a cup, afterwards reflexed against the pedicel, 20–30 mm long. Corolla white, with greenish bands, opening at night, salver-shaped, 9–12 cm long, tube cylindrical, 7–8 cm, limb ca 8–10 cm in diam.. Stamens and style included. Filaments inserted near the base of the corolla-tube, hairy at their base. Ovary glabrous. Capsule globular, 2–2½ cm long, glabrous, pale-brown, 2-celled, 4-valved. Seeds 4, black, densely short-tomentose and with longer (to ca 3 mm) sericeous hairs along the edges, 1 cm long.

Distr. Tropical America, East tropical Africa, Mascarene Islands, and tropical continental Asia to Polynesia, throughout Malaysia.

Ecol. On the beach and in thickets near the sea. Use. Used on the Sula isl. as a remedy in maldies resulting from pregnancy.

Vern. Alor bawo alas, Simalur, tattampajan bēsar, M, mingumbai botti, bot bot, Sula, ganga-mielke, W. New Guinea, laubating, Sulu, bulacan, Tag.

Note. This species has often been identified with I. grandiflora (L. f.) LAMK, Tabl. Enc. 1 (1791) 467 (= Convulvulus grandiflorus L. f. Suppl. 1781, 136). From the description of the latter it is evident that the specimen of KÖNIG, described by LINNÆUS f. belongs to another species. The pubescent stems and petioles as described by LINNÆUS f. are never found in I. tuba. HALLIER f. (Jahrh. Hamb. Wiss. Amt. 15, 1898, 45; & Med. Rijksherb. Leiden no 1, 1911, 25) considers Convulvulus grandiflorus L. f. con-specific with Stictocordia tiliifolia (DESR.) HALLIER f.

A specimen from Ternate, BEGUN 1655, in Herb. Bog. has the seeds long hairy at the margins and otherwise glabrous.


A glabrous twiner. Adult stems woody, pale brown, terete, smooth or minutely verrucose; young branches green. Leaves orbicular or transverse-elliptic in outline, 6–12 by 6–12 cm, (3–)5(–7)-lobed mostly far beyond the middle, the middle lobe elliptic or lanceolate, 5–8 by 2–5 cm, attenuate towards both ends, acuminate at the apex with a narrow, acute or obtuse, mucronulate acumens; the lateral lobes slightly smaller, obliquely ovate to lanceolate, long-acuminate, the basal lobes much smaller; leaf-base cordate with broadly rounded sinus; rarely the leaf-margin is entire or coarsely dentate; petiole slender, 4½–12 cm. Inflorescences axillary, one-flowered, or dichasial or partly monochasial and few-flowered; peduncles 2–14 cm, terete, smooth. Pedicels more or less angular, thickened towards the calyx, 15–30 mm long. Sepals pale green, very unequal, the outer ones much shorter than the inner; sepals 1 & 2 coriaceous, broadly elliptic to orbicular, broadly rounded at the apex, mucronulate, 8–12 and 10–18 mm long; inner sepals coriaceous with scarious margin; sepal 3 broadly elliptic to orbicular, broadly rounded, mucronulate, ca 16–25 mm; sepals 4 & 5 broadly elliptic, rounded and mucronulate, ca 20–30 mm. Corolla white with red-dish midpetaline bands, or entirely white, salver-shaped, 11–14 cm long, tube long and narrow, 8–9 cm, limb ca 10 cm diam.. Stamens and style exserted. Filaments inserted near the base of the corolla, hairy at their base. Ovary glabrous. Capsule broadly ovoid to globose, 2½–3 cm long. Seeds 7–9 mm long, densely brown-tomentumose.
and with long (10–12 mm) brownish sericeous patent hairs along the edges.

**Distr. Malaysia:** Java, Celebes (Salajari and Buton Isl.), Lesser Sunda Islands (Sumbawa, Timor, Alor).

Ecol. In thickets, hedges and thin forests, near the beach and in the interior; from sea-level to 400 m.

**Vern. Aroi uwat guling, S. tropongau, J. nachtschone, D.**

**Cultivated only**

Mentioned for Malaysia only on the basis of a single cultivated specimen:


**Distr. Native of Mexico and Central America.** Merrill mentions a cultivated specimen from the Philippines (Luzon).

**Vern. Suma-neg-nagisit, Iloko.**


**Distr. Tropical Africa and India.** Formerly cultivated in the Botanic Gardens, Bogor, Java. **Vern. Aroy kawojing, S.**

**Insufficiently known**

**Ipomoea reflexa** Spanoghe, Linnaea 15 (1841) 341; Ooststr. Blumea 3 (1940) 581.

Described from the island of Rotti.

**Doubtful**


Fawcett in Forbes, Wander. (1885) 511, mentions a specimen from Timor, collected near Kupang by Wiles & Smith. It is unlikely that the West Indian *I. repanda* occurs in Timor. There is, however, a possibility that Fawcett referred to a specimen Wiles & Smith s.n. in Herb. Brit. Mus., that most probably belongs to *Ipomoea sumatrana* (Miq.) Ooststr.

**Excluded**

**Ipomoea aspera** Vatke, Linnaea 43 (1880–82) 508; Ooststr. Blumea 3 (1940) 582.


**17. MINA**


Herbaceous twiner. **Leaves** petiolod, entire or mostly palmately lobed. **Flowers** in axillary, peduncled, few- to several-flowered cincinni or double cincinni, often secund; pedicels short; Bracts minute. **Sepals** 5, subequal, herbaceous, distinctly awned, not enlarged in fruit. **Corolla** suddenly widened above a short narrow tubular basal part; limb long-urceolate to tubular, subangular, slightly curved, with a slightly constricted 5-toothed mouth. **Stamens** and style long-exserted. Filaments inserted at the top of the narrow basal tubular part of the corolla; pollen globose, spinulose. **Disk** annular. **Ovary** glabrous, 4-celled, each cell with 1 ovule; style 1, simple, filiform; stigmas 2. capitulate. **Capsule** 4-celled, 4-valved. **Seeds** 4 or less, glabrous.

**Distr.** Monotypic, Mexico to Central and S. America, introduced in Malaysia.


Perennial, glabrous twiner. Stems 2–5 m, slender, terete. **Leaves** broadly ovate in outline, 6–15 cm long and nearly as broad, cordate at the base, entire or mostly 3-lobed; lobes acuminate, the middle lobe constricted below. the lateral ones with some coarse teeth or often again lobed; petiole 3–10 cm. **Inflorescences** up to 35 cm long (peduncle included); flowers in single or double cincinnal cymes, secund; pedicels 4–8 mm; bracts minute. **Sepals** oblong, 5–6 mm long, the 2–3 mm long awn included. **Corolla** at first red, afterwards pale yellow or whitish, the narrow basal part 5–8 mm, the slightly curved widened limb 17–20 mm long, the teeth mucronulate. **Stamens** and style finally
twice as long as the corolla: filaments pubescent towards the base. Disk shallowly 5-lobed. Ovary glabrous. Capsule broadly ovoid, 6–8 mm long.

Distr. Mexico to Central and S. America, cultivated in other tropical and temperate regions. Ecol. Cultivated for ornamental purposes (Malay Peninsula, Java), above 200 m.

18. Lepistemon


Herbaceous or woody twiner, usually hairy. Leaves petioled, ovate to orbicular, often cordate at the base, entire to 3- or 5-lobed, herbaceous. Flowers in dense, axillary, sessile or shortly peduncled cymes. Bracts small, caducous. Sepals 5, subequal, herbaceous or subcoriaceous, acute or obtuse, hairy or glabrous. Corolla regular, rather small, yellowish-white, urceolate, with a shortly 5-lobed limb; midpetaline bands hairy outside. Stamens and style included. Filaments inserted near the base of the corolla, dilated in their basal portion into a large concave scale, arched over the ovary; pollen globular, spinulose. Disk large, annular or cupular. Ovary glabrous or hairy, 2-celled, each cell with 2 ovules. Style 1, very short; stigmas 2, capitate. Capsule 4-valved, with 4 or less glabrous or puberulous seeds.

Distr. Ca 10 spp. in tropical Africa, Asia, Australia, and Malaysia.

key to the species

1. Sepals ovate to lanceolate, acuminate or acute, 5–7½ mm long, herbaceous. 1. L. binectariferum
2. Sepals ovate to orbicular, obtuse or emarginate, 2–2½ mm long, margin membranaceous.

2. L. urceolatum


key to the varieties

1. Sepals with long patent fulvous or brownish hairs.
2. Ovary glabrous... var. binectariferum
3. Ovary hairy... var. borneense
1. Sepals with much shorter, less patent greyish hairs.
3. Ovary glabrous... var. eymae
3. Ovary hairy... var. trichocarpum var. binectariferum.

Herbaceous twiner, 1–3 m high: stems densely patently or retrorsely brown pilose. Leaves broadly ovate, 5–18 by 5–15 cm, deeply cordate at the base, acuminate and mucronulate at the apex; margin entire or irregularly dentate with one or more large teeth or shallowly to deeply 3–5-lobed, with acute or acuminate lobes; appressed-pilosely on both sides, young leaves (occasionally also the adult ones) nearly tomentose with a golden-brown tomentum; petiole 2½–16 cm, hairy like the stem. Flowers in few- to many-flowered, axillary, cymose clusters, much shorter than the pediole. Peduncle short or absent. Pedicels up to 7 mm, glabrous or sparsely pilose. Bracts small, caducous. Sepals subequal or the inner ones a little shorter, ovate to lanceolate, acuminate or acute, 5–7½ mm long, herbaceous, with long patent hairs outside; not or slightly enlarged in fruit. Corolla urceolate, 12–15 mm long, white or yellowish white; tube inflated, contracted above, shortly hairy above and on the midpetaline bands of the limb; limb patent with 5 short lobes. Scales at the base of the filaments concave, papillate outside. Disk 5-lobed. Ovary glabrous. Capsule globose to ovoid, 6–8 mm high, mucronate, 4- or less-seeded. Seeds 3–4 mm long, glabrous, black.

Distr. SE. Asia (Assam, Burma, Indo-China, Hainan); in Malaysia: Malay Peninsula, Sumatra, Java.

Ecol. Thickets, edges of secondary forests, waysides, occasionally in hedges, or as a weed in plantations, 25–1100 m.

Use. Acc. to Boerlage the root is edible (Palabuan Ratu).

Vern. Akar bulu, akar santen, Sum. W. Coast, areui bulu, wawalukan, S, samparkidung, bonglu, gamet kebo, tjaonun, J.
var. borneense Ooststr. Blumea 5 (1943) 343.

As var. binectariferum, but the ovary hairy.


Sepals with greyish, much shorter and less patent hairs than in var. binectariferum. Ovary hairy. Seeds puberulous (acc. to Gagnepain).

Distr. E. Malaysia: Celebes, Moluccas (Kei Isl.), Philippines (Luzon, Mindanao), and ?Hainan.

Ecol. Thickets, waysides at low and medium altitudes.


Stems twining, 2–5 m high, young parts densely hairy with retrorse hairs, later on glabrescent and woolly. Leaves broadly ovate to orbicular, rarely narrower, 5–16 by 3–14 cm, cordate or more or less truncate at the base; basal lobes entire and broadly rounded, or with a large tooth or nearly hasteate; acuminate and mucronulate at the apex; lower surface sparsely to densely hairy with short appressed hairs, or sometimes tomentose, upper surface mostly less hairy, glabrescent; petiole 3–11 cm, hairy like the stem. Flowers in few- or mostly in many-flowered, more or less dense, axillary, cymose clusters, much shorter than the petiole. Peduncle short or almost absent. Pedicels 3–7 mm, in fruit up to 14 mm, more or less pilose. Sepals subequal, slightly concave, broadly ovate to orbicular, obtuse or shallowly emarginate, 2–2½ mm long, hairy or glabrous. Corolla urceolate, 10–12 mm long, creamy white, glabrous outside or with some hairs in the upper part; tube inflated, contracted above; limb shortly 5-lobed. Scales at base of filaments smaller than the preceding species, concave, shortly pilose outside. Disk shallowly 5-lobed. Ovary glabrous. Capsule globose, 8–10 mm diam. Seeds 4 mm long, puberulous, greyish-black.

Distr. Tropical Australia, Solomon Isl., Bismarck Arch., in Malaysia: Celebes, Moluccas (Talaud Islands, Buru, Ceram), New Guinea.

Ecol. In thickets and secondary forests, in more or less moist localities, 5–1250 m.

Vern. Libu-libu, S. Celebes, kep, onugo, arra, NE. New Guinea, a laklakisa, New Ireland.
19. STICTOCARDIA


Woody or herbaceous, mostly pubescent twiners. Leaves petioled, ovate to orbicular, mostly cordate at the base, entire, the lower surface with many minute glands (black dots in dried specimens). Flowers in axillary, peduncled, one- to many-flowered cymes. Bracts small, caducous. Sepals 5, equal in length or slightly unequal, ovate, elliptic or orbicular, obtuse to emarginate, subcoriaceous, often with thinner margins, much enlarged in fruit. Corolla regular, large, funnel-shaped, red or purple; midpetaline bands often somewhat pilose outside and with minute glands like the leaves. Stamens and style included. Filaments filiform, inserted near the corolla-base; pollen globular, spinulose. Disk annular. Ovary glabrous, 4-celled, each cell with 1 ovule; style 1, simple, filiform; stigma biglobular. Fruit enclosed by the much enlarged calyx, globular; dissepiments with two wings at the surface of the fruit; pericarp thin, disrupting irregularly from the dissepiments and their wings, so that 4 openings become free (giving a lantern-shaped fruit), through which the 4 pubescent seeds are visible.

Distr. Ca 6–7 species, circumtropical.

KEY TO THE SPECIES

1. Outer sepals distinctly cordate at the base, basal lobes up to 2 mm long . 4. S. cordatosepala
2. Outer sepals rounded at the base.
3. Stems, leaves and inflorescences very sparsely pubescent or glabrous. Leaves 8 cm long or more, long and narrowly acuminate at the apex, deeply cordate at the base . 3. S. discolor
4. Outer sepals distinctly cordate at the base, basal lobes up to 2 mm long . 1. S. tililifolia
5. Stems, leaves and inflorescences densely pubescent to tomentose. Leaves smaller, attenuate to slightly acuminate at the apex, more or less deeply cordate to truncate at the base. 2. S. neglecta

1. Stictocardia tililifolia (Desr.) Hallier f. Bot. Jahrb. 18 (1894) 159 ("tililifolia"); Ooststr. Blumea 5 (1943) 346, f. 1, g–h.—Ipomoea campanulata LINNÉ, Sp. Pl. (1753) 160, only as to the syn. Adamboe Rheeoe (cf. VAN OOSTSTROOM. Blumea 3 (1940) 568).—Convolvulus grandiflorus LINNÉ f. Suppl. (1781) 136, non Jacq. 1776.—Convolvulaceae desr. in Lamk, Enc. 3 (1789) 544.—Ipomoea grandiflora LAMK, Tabl. Enc. 1 (1791) 467 (cf. VAN OOSTSTROOM. Blumea 3 (1940) 577).—Ipomoea pulchra BL. BJÖDR. (1825) 716.—Argyreia tililifolia WIGST. J. 4, 2 (1850) 12, t. 1358.—Stictocardia campanulata MERR. PHILIP. J. SC. 9 (1914) Bot. 133.—Argyreia campanulata ALSTON in TRIM. FL. CEYL. Suppl. (1931) 201.—Fig. 57c–f.

A large woody twiner, young stems terete, pubescent, finally glabrescent. Leaves broadly ovate to orbicular, 6–20 by 5–20 cm, cordate at the base, shortly acuminate with a mostly obtuse, mucronulate apex; upper and lower surface more or less densely pubescent or nearly glabrous; lower surface with minute black dots (glands); nerves 7–8 on either side of the midrib; petiole 3–14 cm. Inflorescences axillary, 1–3-flowered; peduncle mostly shorter than the petiole, 1/2–7/2 cm, pubescent. Pedicels as long as or longer than the calyx, 10–35 mm, pubescent. Bracts minute, caducous. Sepals orbicular with a rounded or shallowly emarginate apex, subequal or the inner ones slightly shorter, 12–18 mm long, pubescent or glabrous, much enlarged in fruit, and up to 4 or the inner ones up to 5 cm long. Corolla funnel-shaped, 8–10 cm long, reddish purple with a darker centre, limb 8–10 mm diam., midpetaline bands pilose or glabrous and with minute black glands. Filaments hairy at the base. Ovary glabrous. Capsule enclosed by the enlarged, finally weathered sepals, globose, 2–3 1/2 cm diam. Seeds ca 8–9 mm long, black or dark brown, pubescent.

Distr. Circumtropical, throughout Malaysia, not yet recorded from N. Guinea.

Ecot. On and behind the seashore, in thickets, hedges, and secondary forests, sometimes also in the interior, up to ca 900 m.


Stems twining, terete, densely short-pilose or the young parts tomentose, finally glabrescent and lignescent. Leaves ovate to broadly ovate, 4–8 by
Fig. 57. a–b. Stictocardia cordatosepala Ooststr. a. Flowering branch, × $\frac{1}{2}$, b. sepals 1–5, × $\frac{2}{3}$.
—c–f. Stictocardia tiliifolia (Desr.) Hallier f. c. flowering branch, × $\frac{1}{2}$, d. sepals 1–5, × $\frac{4}{5}$, e. calyx enclosing the fruit, × $\frac{1}{2}$, f. fruit, opened, lateral view, × $\frac{1}{2}$.
3–7 cm. more or less deeply cordate or subtrumpate at the base, attenuate to acuminate towards the acutish, mucronulate apex, densely short-pilose or the young ones tomentose on both sides, entirely green, or reddish beneath; nerves 7–8 on either side of the midrib; petiole 2–7 cm, shortly pilose. Inflorescences axillary, 1-flowered or cymosely branched. 2–4-flowered; peduncle 1/2–5 cm, in fruit up to 8 cm long, pilose like the stems. Pedicels (5–)10–18 mm, shortly pilose. Bracts minute, caducous. Sepals subequal in length or the outer ones shorter, densely short-pilose to tomentose outside; two outer ones broadly ovate, elliptic or orbicular, shallowly emarginate at the apex, 8–11 mm long, three inner ones broadly elliptic, ca 10 mm long, the margins tinctivate towards the shallowly emarginate apex; all sepals much enlarged in fruit, up to 3–3 1/2 cm long. Corolla tubular to funnel-shaped, ca 5–6 cm long, violet, darker to the centre, the limb shortly pilose outside. Filaments slightly pilose at the base. Ovary glabrous. Capsule enclosed by the enlarged sepals, subglobose, ca 1/2 cm diam. Seeds 7–8 mm long, shortly tomentose.


Ecol. In thickets up to ca 900 m.

Vern. Non laku, lolo, Timor.


Stems twining, thin, slender, sparsely pubescent or glabrous. Leaves ovate, 8–15 by 4–7 1/2 cm, base deeply cordate, apex acuminate, with long and narrow, obtuse or acutish, mucronulate acumen, sparsely and minutely pubescent on both sides, more densely on the nerves beneath, or nearly glabrous; lower surface reddish; nerves 7–10 on either side of the midrib; petiole 4–7 cm. Inflorescences axillary, 1–2-flowered; peduncle thin, 2–5 cm long, sparsely pubescent or nearly glabrous. Pedicels longer than the calyx, slender, 15–30 mm.

Bracts minute, caducous. Sepals subequal, 9–11 mm long, the outer ones orbicular to broadly elliptic, rounded at the apex, sparsely pubescent outside, shortly ciliate in the upper part; interior ones broadly elliptic. Corolla funnel-shaped, probably 6–8 cm long; midpetaline bands sparsely pilose outside and with minute black glands, or glabrous. Capsule unknown.

Distr. Malaysia: Lesser Sunda Islands (Timor).

Note. The species can be distinguished from S. tiliifolia mainly by the much more slender stems and peduncles, the smaller flowers and the long-acuminate leaf-blades with a red lower surface.

4. Stictocardia cordatosepala Ooststr. Blumea 5 (1943) 351, f. 1, a-c.—Fig. 57a–b.

Stems twining, young parts shortly pilose, soon glabrescent to glabrous, afterwards lagenescent. Leaves broadly ovate to orbicular, 6–12 by 5–12 cm, broadly cordate at the base, attenuate to shortly acuminate at the apex with an obtusish, mucronulate acumen, glabrous or nearly so and green above, glabrous or shortly pilose on the nerves, minutely glandular and reddish beneath; 6–7 nerves on either side of the midrib; petiole 3–9 cm. Inflorescences axillary, 1-flowered, or cymosely 2–3-flowered; peduncle 1–9 cm long, glabrous or shortly pilose mainly towards the apex. Pedicels 10–35 mm, sparsely short-pilose. Bracts oblong, obtuse, 3–5 mm long, caducous. Sepals slightly unequal in length; two outer ones orbicular to transverse-elliptic, 12 mm long, rounded to shallowly emarginate at the apex, cordate at the base with 2 mm long, fimbrate basal lobes; three inner ones orbicular, 8–9 mm long, rounded at the base, all sparsely pilose or glabrous, the shortly ciliate apex excepted. Corolla funnel-shaped, probably ca 6 mm high, violet; midpetaline bands with minute glands outside; margin tincturate. Filaments shortly pilose at the base. Ovary glabrous. Capsule unknown.

Distr. Malaysia: Lesser Sunda Islands (Lombok).

Ecol. In thin forest, on loamy soil, 350–700 m.

Note. Distinguished by the remarkably cordate base of the sepals.

20. TURBINA


A genus closely related to Ipomoea, different by the indehiscent ovoid-oblong fruits, with a thin woody pericarp. Seed mostly 1, puberulous. Sepals narrow-oblong to oblanceolate, obtuse, in fruit not or slightly enlarged, spreading, with a thick central part and thinner, pale margins.

Distr. Two spp. (or probably more, still under Ipomoea) in tropical America.


A herbaceous or subwoody, mostly glabrous twiner. Leaves mostly ovate, 3–10 by 2–7 cm, cordate at the base, acuminate at the apex, entire;
petiole 1½–7 cm. Flowers in few- to many-flowered axillary, 2–10 cm peduncled cymes, often united into panicles. Pedicels as long as the calyx or longer, 1–1½ cm. Bracts minute. Sepals narrow-ovate to oblong, obtuse, inner ones 10–12 mm long, outer shorter, all with a thinner pale margin, spreading and not or slightly enlarged in fruit. Corolla campanulate, ca 2–3 cm long, white, with a yellowish centre, glabrous or sparsely pilose on the distinctly limited midpetaline bands. Stamens and style included. Ovary glabrous. Fruit ovoid-oblong, ca 1 cm long, mucronate by the style-base. Seed mostly 1, ca 5 mm long, puberulent.

Distr. Tropical America, introduced here and there in the Old World, in Malaysia naturalized in the Philippines (Luzon).

Ecol. Thickets and secondary forests, at low altitudes.

21. ARGYREIA


Mostly woody twiner. Leaves petioled, variable in shape and size, entire, hairy to glabrous. Inflorescences axillary, cymose, few- to many-flowered, loose or compact to capitate; bracts minute or large; flowers large, medium-sized, or small. Sepals 5, herbaceous or subcoriaceous, variable in shape and size, often hairy outside, mostly glabrous inside, persistent, slightly or sometimes much enlarged in fruit, in the latter case often red inside. Corolla regular, campanulate, funnel-shaped, or tubular, purple, red, pink, or white; limb nearly entire to deeply lobed, with 5 well-defined, mostly hairy midpetaline bands outside and glabrous connecting fields; in deeply lobed corollas the lobes consisting of a hairy midpetaline band with 2 narrow glabrous wings over the whole length, or with 2 glabrous lobules at the top. Stamens 5, inserted on the corolla, included or exserted; filaments filiform, often dilated at the base; pollen globular, spinulose. Disk annular or cupular, entire or shallowly 5-lobed. Ovary 2- or 4-celled, 4-ovuled, glabrous or hairy; style 1, simple, filiform, included or exserted; stigma biglobular. Fruit an ellipsoid or globose, fleshy, leathery, or mealy berry. Purplish, red, orange, or yellowish. Seeds 4 or less, glabrous, rarely pilose at the hilum.

Distr. A genus of ca 90 species in tropical continental Asia, and in Malaysia; one sp. [A. souterri (BAILEY) DOMIN] in Queensland. A. queenslandica DOMIN, also described from Queensland, belongs to Stictocardia. Fig. 59.

Note. For a discussion of the delimitation of the genus against Rivea and the inclusion in it of Lettsomia and Moorcroftia, see Blumea 5 (1943) 353–356.

KEY TO THE SPECIES

1. Limb of corolla entire or shallowly lobed (sect. Ptyanthus G. DON).
2. Bracts soon caducous, small or rarely large, occasionally a casual foliaceous bract in the cyme.
3. Leaves deeply cordate at the base, densely white-tomentose beneath, glabrous or nearly so above.
   Bracts large and broad, outer ones ovate to oblong or elliptic, long and narrowly acuminate.
4. Corolla glabrous outside.
   5. Inner sepals broadly ovate. Corolla ca 5½ cm long. Minor nervation of leaves distinctly reticulate beneath. Peduncle 5–7 cm long, on leafy branches ........................................... 14. A. linggaensis
   6. Inner sepals elliptic-orbicular. Corolla ca 3½ cm long. Minor nervation subparallel, not distinctly reticulate. Peduncle 1–2½ cm long, on defoliate branches ........................................... 13. A. nuda

3. Leaves not deeply cordate at the base. Bracts smaller to minute.
4. Corolla glabrous outside.
   5. Inner sepals broadly ovate. Corolla ca 5½ cm long. Minor nervation of leaves distinctly reticulate beneath. Peduncle 5–7 cm long, on leafy branches ........................................... 14. A. linggaensis
   6. Inner sepals elliptic-orbicular. Corolla ca 3½ cm long. Minor nervation subparallel, not distinctly reticulate. Peduncle 1–2½ cm long, on defoliate branches ........................................... 13. A. nuda

(1) With the collaboration of R. D. HOOGLAND.
(2) Flowers of 42. A. celebica, 43. A. crispa, 44. A. paucinervia, 45. A. samarensis are unknown. 46. A. robinsonii is also insufficiently known. These species are, therefore, not inserted in the key.
6. Outer sepals lanceolate or narrowly lanceolate, distinctly acute.
7. Outer sepals patently hirsute. Leaves elliptic or elliptic-oblong. Corolla ca 2 cm long. 15. A. adpressa
7. Outer sepals thinly white sericeous. Leaves broadly ovate to orbicular. Corolla ca 7 cm long. 16. A. hookeri
6. Outer sepals oblong, ovate or elliptic, obtuse, rarely acutish, not patently hirsute.
8. Lower surface of leaves covered by a dense haircloth.
9. Sepals equal or subequal in length.
10. Stamens and style much shorter than corolla; corolla 5 cm long or more. Lower surface of the leaves densely sericeous, silvery white or pale fulvous . 1. A. mollis
10. Stamens and style about as long as or longer than corolla; corolla smaller, ca 3 cm long or less.
11. Outer sepals broadly elliptic. Lower leaf-surface densely pubescent to tomentose with short, curled hairs, upper surface glabrescent . 5. A. walshae
11. Outer sepals ovate or oblong. Leaves appressed-sericeous above, sericeo-tomentose beneath.
6. A. sumbawana
9. Outer sepals distinctly longer than inner ones.
12. Outer sepals 8–9 mm long, oblong, obtuse or slightly emarginate, shortly tomentose on both sides. Peduncles much exceeding the perianth . 3. A. bifrons
12. Outer sepals 12–18 mm long, oblong, acutish or obtusish, sericeo-tomentose outside, glabrous inside except for the apical portion. Peduncles as long as or shorter than the perianth.
4. A. nitida
8. Lower surface of the leaves glabrous or sparingly strigillose.
13. Outer sepals (10)–15–18 mm long. Peduncles much shorter than the perianth. Corolla 4–4½ cm long . 2. A. reinwardtiana
13. Outer sepals at most up to 10 mm long. Peduncles usually longer than the perianth (if shorter: corolla up to 2½ cm long and outer sepals ca 4 mm long; see 8. A. philippinensis).
14. Two inner sepals cucullate, afterwards (always?) deeply emarginate by tearing of the apex; two outer sepals slightly longer than inner ones . 12. A. cucullata
14. Inner sepals not cucullate, afterwards not emarginate; two outer sepals equal to or slightly shorter than inner ones.
15. Filaments entirely glabrous.
16. Sepals all broadly ovate, at least the two outer ones sparsely strigose outside. Peduncles slender . 10. A. penangiana
16. Two outer sepals broadly ovate, two inner ones transverse-elliptic, all densely and shortly appressed-pilose to tomentose outside. Peduncles stout . 11. A. scortechinii
15. Filaments pilose at the base or glandular-papillosum throughout.
17. Filaments pilose at the base only. Peduncles short, 1½–2 cm. Sepals ca 4 mm long, outer ones with some scattered hairs on their middle portion or glabrous. 8. A. philippinensis
2. Bracts persistent, large.
18. Sepals with long, hirsute acumen, the latter at least as long as the lower part of the sepal.
18. A. maingayi
18. Sepals at the apex obtuse, acute or shortly acuminate.
19. Outer bracts elliptic or ovate to narrowly lanceolate. Peduncles stout.
20. Outer sepals 15 mm long or more, lanceolate to ovate-oblong, acuminate, long patently hirsute.
17. A. capitata
20. Outer sepals 8 mm long or less.
21. Outer sepals ovate, obtuse or shortly apiculate, densely appressed-pilose outside.
21. Outer sepals ovate, sharply acute to acuminate, glabrous or more or less appressed-pilose outside . 20. A. sorsogonensis
1. Limb of corolla distinctly 5-lobed to 5-parted (sect. Schizanthus G. Don).
22. Lobes of corolla ovate to oblong, outside with a more or less hairy midpetaline band and with a thin glabrous wing on each side along the whole length.
23. Inflorescences capitate, with obovate to spathulate or orbicular, truncate, outside densely tomentose, subpersistent bracts. Flowers sessile or nearly so. Stems, lower leaf-surface and inflorescences white, greyish or pale brown tomentose . 35. A. osyrensis
23. Inflorescences not capitate. Bracts mostly soon caducous. Flowers pedicellate. Indumentum of stems and leaves whether or not tomentose.
24. Two outer sepals ovate to orbicular, two inner ones broader, orbicular to transverse-elliptic.
25. Leaves strigillose above.
26. Leaves with a minute crisp pubescence beneath. Pedicels 1–2 mm long. Corolla-tube 2½–3½ mm, lobes 5½–6 mm long


29. Leaves glabrous above, usually sparsely strigose on midrib.

30. Leaves glabrous on both sides or nearly so. Inflorescences up to 6-flowered.

31. Leaves distinctly hairy beneath. Inflorescences usually more-flowered.

32. Outer sepals 6–7 mm long, densely light fulvous-tomentose, as are the whole inflorescences.

33. A. rubicunda

34. Outer sepals up to ca 4½ mm long, strigose as are the whole inflorescences.

35. Corolla-lobes ca 5 mm long, ovate

36. Corolla-lobes ca 15 mm long, ovate-oblong.

37. Outer sepals ca 4½ mm long, like the rest of the inflorescence densely strigose with long, stiff hairs. Lower leaf-surface strigose, green.

38. A. kunstleri

39. Outer sepals ca 4½ mm long, like the rest of the inflorescence strigose-tomentose, with much shorter, less stiff hairs. Lower leaf-surface with less stiff, less appressed, slightly curled hairs, purple

40. A. discolor

41. Two outer sepals broadly ovate to ovate-oblong, inner ones not distinctly different in shape.

42. Filaments entirely glabrous.

43. Corolla-lobes ca 4 mm long, ovate. Outer sepals broadly ovate, rounded at the apex. Corolla hairy inside above the base of the stamens. Leaves ovate.

44. A. ooststromii

45. Corolla lobes ca 9 mm long, ovate-oblong. Outer sepals ovate-triangular, attenuate towards the apex. Corolla glabrous inside. Leaves oblong to narrow-oblong, with subparallel margins.

46. A. oblongifolia

47. Filaments with hairs or stalked glands at the base, or over their whole length.

48. Lateral nerves 10–11 on either side of midrib. Both surfaces of leaves strigose, more densely beneath than above.

49. A. glabra

50. Lateral nerves 7 or less on either side of midrib.

51. Lower surface of leaves densely light yellowish sericeous. Peduncle short, up to 2 cm long; up to 5–6, usually 1-flowered.

52. A. courneri


54. A. kunstleri

55. Minor nervation distinctly prominent beneath. Lateral nerves 4–5 on either side of midrib.

56. Outer sepals sparsely strigose outside, ca 7½ mm long. A. reticulata var. reticulata

57. Minor nervation much less prominent beneath, almost flat. Lateral nerves 6–7 on either side of midrib. Outer sepals densely greyish or whitish appressed-pilosé outside, 5–6 mm long. A. luzonensis

22. Lobes of corolla linear, hairy outside and with 2 glabrous lobules at the apex only.

23. Outer sepals distinctly acuminate.

24. Outer sepals obtuse, at most minutely apiculate.

25. Upper surface of leaves distinctly hairy.

26. Bracts lanceolate or narrower, acuminate, pubescent on both sides.

27. Bracts broadly obovate, rounded to truncate at the apex, glabrous inside.

28. A. barnesii

29. Upper surface of leaves glabrous or at most with some hairs on the midrib.

30. Bracts linear to filiform, 8–12 mm long, soon caducous. Leaves glabrous above; sparsely appressed-pilosé beneath.

31. Filaments papillosé at the base.

32. A. apoenis

33. Bracts minute, 1–2 mm long, soon caducous.

34. Both surfaces of leaves glabrous or with some hairs on the nerves beneath. Outer sepals slightly longer than inner ones. Filaments pubescent.

35. A. boholensis

36. Lower surface of leaves more or less densely appressed-pilosé; upper surface glabrous or with some hairs on the midrib. Outer sepals slightly shorter than inner ones. Filaments glabrous.

1. Section Ptyxanthus


Corolla entire or shallowly lobed. Stamens and style mostly included.


Stems twining, up to 10 m high; young parts densely appressed-pilose with whitish or pale fulvous hairs, glabrescent, occasionally more or less farinose. Leaves elliptic to narrowly oblone, sometimes ovate or lanceolate, 4–15 by 1½–7 cm, base acute or attenuate into the petiole, or round-ed; apex acute, shortly acuminate or obtuse, mucronulate, upper surface densely to sparsely appressed-hairy or glabrous, mostly with exception of the nerves; lower surface mostly densely sericeo-tomentose, with silvery white or pale fulvous hairs; nerves 9–18(–20) on either side of midrib; petiole 1–6 cm, appressed-pilose. \textit{Peduncle} shorter to slightly longer than the petiole, 1½–2½(–4½) cm, hairy, 1–5, rarely more-flowered. Pedicels 5–15 mm, angular, hairy. Bracts obovate-oblong, obtuse, caducous. \textit{Sepals} about equal in length, 2 outer ones broadly elliptic, obtuse, 8–10 mm long; sepal 3 and 4 elliptic to elliptic-oblong, obtuse to slightly emarginate; inner sepal oblong, slightly emarginate; all sepals densely sericeo-lanate outside, glabrous inside, in fruit enlarged, patent, red or purplish inside. \textit{Corolla} funnel-shaped to campanulate, 5–6½ cm long, pale violet or pink with white base, or rarely entirely white; limb shallowly lobed; midpetaline bands with long, appressed hairs. \textit{Stamens} and \textit{style} much shorter than corolla; filaments pilose at the base. Ovary glabrous, 4-celled. \textit{Fruit} subglobose, ca 8–10 mm diam., red or orange red, 4- or less-seeded. \textit{Seeds} ca 5 mm long, black.

\textbf{Distr.} Siam. Lower Burma, Andaman Isl., in Malaysia: Sumatra, Malay Peninsula, Java, Madura, Kangean Arch., and Bali.

\textbf{Ecol.} In secondary forests, thickets, teak-forests, alang-fields, along roadsides, occasionally in hedges, from sea-level to 1500 m.

\textbf{Use.} In Java a decoction of the root, along with \textit{Callicarpa}, \textit{Anethum}, and \textit{Alyxia} is taken as a stomachic. The leaves serve as a poultice for boils, etc. The stems are sometimes used for tying purposes (Burfili; Heyne).

\textbf{Vern.} Arenji tatapajan, arenji kujapu, podol landak, tatajan gedé, khui, S, kénál sapi, kemaron, kelanawat, rambatan, tulpan, uluk uluk, J, rabet po-sepo, sepo-sepoan, Md, butetulupan, Bali.

\textbf{Notes.} Specimens from the Malay Peninsula cited by Prain under the names \textit{A. obtusifolia} Lour. and \textit{A. championi} Clarke certainly belong here. Most probably \textit{A. obtecta} Clarke belongs to the synonyms of the species; if so, the area would include Siam, Lower Burma, and the Andamans.

In most specimens from the Malay Peninsula the leaves are relatively narrower than in those from the Malay Islands.


Stems twining; young parts sparsely pilose with short, appressed, whitish hairs, glabrescent. Leaves ovate, ovate-oblong, or elliptic-oblong, 5½–17 by 3–10 cm; rounded, truncate, or subcordate at the base; attenuate or acuminate and mucronulate at the apex; upper surface glabrous or nearly so, lower surface sparsely to rather densely pilose with short, appressed, straight hairs; midrib and 8–10 nerves on either side prominent beneath, minor nervation reticulate beneath; petiole 2–5 cm, appressed-pilose. \textit{Peduncle} distinctly shorter than the petiole, 1–2½ cm, rather densely pilose, 2- to few-flowered. Pedicels 3–5 mm, hairy like the peduncle. Bracts linear to oblong, 8–15 mm long, appressed-pilose beneath, glabrous or nearly so above, caducous. \textit{Sepals} unequal, outer ones longer than inner, with ± undulate margins; 2 outer ones ovate or orbicular, acutish to obtuse, (10–)15–18 mm long, outside densely sericeous, sometimes less densely so towards the apex, inside glabrous or nearly so; sepal 3 narrow-elliptic to ovate, obtuse, (7–)13 mm long; two inner sepals ovate-oblong, elliptic, or ovate, obtuse, (7–)8–9 mm long, densely whitish sericeous outside, sometimes with glabrous but ciliate margins; sepals enlarged in fruit. outer ones up to 20 mm long, red inside. \textit{Corolla} funnel-shaped, ca 3–4½ cm long, purplish pink; limb shallowly lobed; midpetaline bands sericeous just as the upper portion of the tube. \textit{Stamens} and \textit{style} nearly as long as the corolla; filaments with pilose base. Ovary glabrous, 2-celled. \textit{Fruit} depressed-globose (always?), 7–10 cm long.
mm diam., 2–4-seeded. Seeds ca 5½ mm long (ripe?).

Distr. Malaysia: Lesser Sunda Islands (Timor). Ecol. A specimen collected near Soé, S. Middle Timor, was growing between limestone rocks at 850 m.

Note. The type of Ipomoea reinwardtiana Bl. has the outer sepals acutish at the apex, in other specimens they are sometimes partly or all obtuse to rounded. It is not impossible that the specimen from Timor mentioned by Choisy under A. setosa Choisy [Mém. Soc. Phys. Genève 6 (1833) 425; in DC. Prod. 9 (1845) 332] belongs to this species [See Blumea 5 (1943) 361].


Stems twining; young parts densely pubescent to farinose. Leaves ovate, 5–10 by 3½–6½ cm; base truncate to emarginate, apex acute to shortly acuminate; upper surface densely and appressedly grey or olive-green sericeous, lustrous, lower surface densely and shortly crisped-tomentose, paler and dull; midrib and 10–14 lateral nerves on either side prominent beneath; petiole short, 1–2 cm, densely and shortly tomentose. Peduncle much exceeding the petiole. 6–10 cm, angular or sulcate when dry, shortly tomentose, umbracellate cymose at the apex, many-flowered. Pedicels (of young flowers) up to 5 mm. Bracts oblong to narrowly spathulate, densely short-pubescent to tomentose on both surfaces, 6 mm long, caduceous. Sepals unequal, densely pubescent to tomentose on both sides; two outer ones oblong, obtuse or slightly emarginate, 8–9 mm long, sepal 3 a little shorter and narrower, obtuse. ca 6½ mm long, two inner sepals broadly elliptic, obtuse. 5 mm long. Corolla funnel-shaped (only young flowers seen), bright violet. the midpetaline bands sericeous, for the rest glabrous. Filaments pilose at the base. Ovary glabrous, 2-celled. Fruit unknown.

Distr. Malaysia: Lesser Sunda Islands (Lombok).

Ecol. Twining on trees and shrubs: the only specimen known at 5–10 m.

Note. The young flowers of the type specimen do not permit a close examination of the corolla, stamens and pistil.


Stems twining, terete, appressed-hairy, glabrescent. Leaves oblong, narrowly ovate, ovate, or elliptic, 6–12 by 2½–9 cm, rounded at the base, acute and mucronulate at the apex, appressed-sericeous on both sides, but much more densely beneath than above, and silvery shining; nerves about 6–8 on either side of midrib; petiole much shorter than blade, 6–40 mm. Peduncles axillary, very much shorter than leaves, 5–10 mm long, densely appressed-pilose. 1–3-flowered. Pedicels much shorter than sepals, 4–6 mm. Bracts of lateral flowers lanceolate, 3–4 mm long. Sepals unequal in length; two outer ones ca 12–18 mm long, oblong, acutish or obtusish, with more or less crisped margin, densely appressed-sericeo-tomentose outside, sparsely hairy near apex inside; sepal 3 falcate, ca 12 mm long; two inner sepals broad-ovate, acuminate, ca 9–10 mm long. Corolla funnel-shaped to campanulate, up to 8 cm long, pale purple with white throat; limb slightly lobed; midpetaline bands with long appressed hairs, connecting fields and basal portion of corolla glabrous. Stamens and style included; filaments pilose at the base. Ovary glabrous, 4-celled. Fruit globular, purplish-red, at its base with the patent, enlarged concave sepals, which are purplish red inside. Seeds 4, ca 5 mm long, glabrous except the pilose hilum.

Fig. 59. Distribution of Argyreia in Malaysia. The figure above the line indicates the total number of species, the figure under the line that of endemic species.


Ecol. In thickets and secondary forests at low and medium altitudes (MERRILL).

Vern. Baging-kastila, Tag., bulakan, bulakan, P. Bis.

Note. Closely related to A. mollis; differs chiefly in the shape and size of the sepals with much shorter and more appressed hairs. A. purpuricarpa ELM. based on fruiting specimens from the island of Palawan, seems to be identical.


Stems twining, glabrous or sparsely short-pilose to farinose. Leaves broadly ovate or ovate, 5–16 by 2½–13 cm; base rounded or slightly emarginate. apex acute or slightly acuminate, mucronulate; upper surface sparsely appressed-pilose, glabrescent, lower surface densely pubescent to tomentose with short curled hairs; midrib and 9–12 lateral nerves on either side prominent beneath; petiole up to 10 cm long, shortly pubescent. Inflorescences umbellately-cymose, 4–12(–20)-flowered; peduncle
shorter than or as long as petiole, dirty white or greyish to fulvous tomentose as are the pedicels and the sepals outside. Pedicels 3-6 mm long, thickened at the apex. Bracts lanceolate to linear, tomentose beneath, glabrous above, caducous. Sepals subequal, broadly elliptic, obtuse, 6-8 mm long, outside tomentose, inside glabrous and brown. Corolla tubular to funnel-shaped, 2-2 1/4 cm long, the limb shallowly lobed; midpetaline bands and upper portion of tube sericeous. Stamens and style slightly exerted; filaments pilose at the base. Ovary glabrous, 2-celled. Fruit unknown.

Distr. Malaysia: Lesser Sunda Islands (Timor).

Ecol. The type specimen has been collected at 800 m; according to the collector Mrs. Walsh, the species is rather frequent in Timor.


Stems twining, young parts densely appressed-pubescent to farinose, pale fulvous, adult parts farinose to glabrous. Leaves ovate, 6-13 by 3-8 1/2 cm; base slightly emarginate to truncate or shortly attenuate into the petiole, apex shortly acuminate, acute, and mucronulate; upper surface densely appressed-sericeous, lower surface densely and shortly sericeo-tomentose, pale fulvous; midrib and 9-14 lateral nerves on either side prominent beneath, slightly impressed above; petiole 2 1/2-6 cm, densely and shortly pilose. Peduncle slender, exceeding the petiole, 3-11 cm, umbellately cymose at the apex, densely pubescent to farinose as are its branches and the pedicels. Pedicels 4-8 mm. Bracts minute, ovate-lanceolate, acute, densely pubescent outside, subglabrous inside, caducous. Sepals equal or the inner ones slightly shorter, outside densely pubescent, inside sparsely so to glabrous, two outer ones ovate-triangular, ovate-oblong, or oblong, obtuse, 5 1/2-6 1/2 mm long; sepal 3 narrowly elliptic to oblong, slightly oblique. 5 1/2-6 1/2 mm long; two inner sepals ovate to ovate-triangular, attenuate towards the obtuse apex, 5-6 mm long. Corolla tubular to funnel-shaped, ca 2 1/2 cm long, pink to pale reddish purple; limb shallowly lobed, soon reflexed; midpetaline bands and upper portion of tube sericeous. Stamens and style exerted. Filaments densely pilose at the base. Ovary glabrous, 4-celled. Fruit unknown.

Distr. Malaysia: Lesser Sunda Islands (Sumbawa).

Ecol. The species has been collected in dry thickets at 50 m and in open places at 500 m.

Note. The shape of the sepals appears to be rather variable. In the type specimen they are ovate-triangular to ovate-oblong, in other collections they are narrower.


Stems twining, up to 10 m high, densely whitish or fulvous tomentose, containing a milky viscid juice (Wight). Leaves large, ovate to orbicular, 10-30 cm or more by 8-25 cm or more, base deeply cordate, apex obtuse, acute or shortly cupuldate, mucronulate; upper surface glabrous or nearly so, lower surface densely white, greyish or fulvous sericeo-tomentose, shining; midrib and 11-16 nerves on either side prominent beneath, minor nerves many, parallel; petiole shorter than or as long as the blade, tomentose. Flowers in a subcapitate cyme at the end of a stout peduncle, this up to 20 cm long or longer, tomentose. Pedicels short, angular. Bracts large, ovate to oblong or elliptic, with long and narrow acumen, softly pilose outside, glabrous inside, 3 1/2-5 cm long, caducous. Sepals equal in length or the inner ones slightly shorter, all densely whitish tomentose outside, glabrous inside. Two outer sepals broadly elliptic, obtuse or acutish, up to 15 mm long; three inner ones broadly elliptic to orbicular, obtuse, ca 10-12 mm long. Corolla large, tubular to funnel-shaped, ca 6 cm long, pink-purple; limb shallowly lobed; midpetaline bands and tube with exception of the most basal part densely sericeolananate outside. Stamens and style included. Filaments pilose at the base. Ovary glabrous, 4-celled. Fruit globose, apiculate, ca 2 cm diam., yellowish brown, nearly dry.

Distr. Native in India from Assam and Bengal to Belgaum and Mysore; cultivated in other tropical countries and occasionally escaped; in Malaysia cultivated as a garden plant.

Vern. Arepi bohol kēboh, S, hojas de seda, sedang-dahan, Philip., elephant creeper, E.


Stems twining, terete, longitudinally wrinkled in dry state, very sparsely appressed-pilose, glabrescent, pale greyish-brown. Leaves ovate to oblong-oblong, oblong-lanceolate or narrowly lanceolate, 7 1/2-12 1/2 by (1 1/2-4) 7 cm, rounded to truncate at the base, or in narrow leaves acute to cuneate; acuminate or attenuate towards the acute apex; glabrous on both sides except for a few scattered hairs, mainly along the nerves and especially beneath; nerves 5-7 on either side of the midrib; secondary nerves parallel; petiole 1 1/2-6 cm, very sparsely pilose like the stems and the peduncles. Peduncle axillary, short, 1/2-2 cm, cymose branched at the apex, few-flowered. Pedicels 2 1/2-5 mm, sparsely hairy. Bracts triangular, small, 1-2 mm long. Sepals about equal in length, ca 4 mm long; two outer ones ovate-elliptic; inner ones broader, all obtuse; outer ones with some scattered hairs on their middle portion or glabrous. Corolla tubular, ca 1 1/2-2 1/2 cm long, white; limb very shortly lobed; midpetaline bands with appressed hairs outside, for the rest glabrous. Dilated
base of filaments with hairs along the margins. Ovary glabrous, 2-celled. *Fruit* ovoid, ca 12 mm long, on a pedicel 5–8 mm long.

**Distr.** Malaysia: Philippines (Luzon, Catanduanes Isl.).

**Ecol.** In damp forests at low altitudes (Merrill).


Stems twining, terete, pale greyish brown, lenticellate; young parts appressed-pilose, soon glabrous. *Leaves* oblong to ovate-oblong, 5–12 by 1 1/2–6 cm, obtuse or acutish at the base, attenuate towards the obtusish or acute, mucronulate apex, or slightly acuminate, glabrous above except for the midrib, sparsely appressed-pilose and glabrescent beneath (occasionally densely hairy beneath); nerves 5–8 on either side of the midrib; petiole 1 1/2–5 cm. *Peduncles* axillary, 5–10 cm, sparsely appressed-pilose, lenticellate, cymosely branched at the apex, few- to several-flowered. Pedicels sparsely appressed-pilose, more densely so near their base (occasionally hairy over the whole length), 7–12 mm, in fruit up to 25 mm long, at that time nodding, and slightly curved at the base, gradually thickened towards the apex. *Sepals* subequal or outer ones a little shorter; two outer sepals oblong to ovate-oblong, 6–6 1/2 mm long, sparsely appressed-pilose; sepal 3 ovate, 6–6 1/2 mm long, with one thin glabrous margin; two inner sepals broadly ovate to triangular, ca 7 mm long, with two glabrous margins. *Corolla* broadly funnel-shaped, white; limb subentire, *ca* 4 1/2–5 mm diam.; *stamens* 4–5, *filaments* in 2 bands, *anthers* 2-celled, *style* 1 1/2–5 cm, *stamens* and *style* included. Filaments dilated at the base, glabrous. *Fruit* ovoid, 2-celled. *Fruit* ovoid, ca 15 mm long, pink, 1-seeded.

**Distr.** Malaysia: Malay Peninsula (Perak, Pulau Penang).

**Ecol.** In forests from low altitude to 1700 m.


Stems twining, to 4 m, rather densely and shortly stigose or stigrose-hirsute to nearly glabrous. *Leaves* ovate to broadly ovate, 4–11 by 2 1/2–7 cm, rounded or slightly cordate at the base, acute to slightly acuminate at the apex; upper surface glabrous, lower surface stigrose-hirsute, most densely so on midrib and nerves, to nearly glabrous; midrib and 6–7 nerves on either side prominent beneath; minor nervation reticulate, rather distinct beneath; petiole slender, 1–4 1/2 cm, hairy like the stem. *Peduncles* axillary, terete, 2–15 cm, hairy like the stem, but slightly more densely so, cymosely 2–25-flowered. Pedicels *ca* 3 mm long, in fruit up to 1 cm, hairy. Bracts triangular, *ca* 3 mm long, hirsute beneath, caducous. Two outer *sepals* broadly ovate, with rounded apex, *ca* 5–5 1/2 mm long, densely and shortly appressed-pilose outside; two inner ones transverse-elliptic, *ca* 5 1/2–6 mm long, with two broad glabrous margins, sepal 3 with one glabrous margin. *Corolla* funnel-shaped, *ca* 25 mm long; pale pink to nearly white outside, mauve or deep magenta inside; tube not distinct from upper part; limb shallowly lobed; midpetaline bands hirsute, connecting fields and basal portion of corolla glabrous. Filaments glandular-papilllose throughout. Ovary glabrous, 2-celled. *Fruit* ellipsoid, up to 12 mm long, with 1 ellipsoid seed.

**Distr.** Malaysia: Philippines (Luzon).

**Note.** Specimens collected by Mrs CIEMENS (no 50) in Mindanao (Camp Keithby, Lake Lanao) in the U.S. Nat. Herb., *ditto* (s.n.) in Herb. Bog., formerly referred to this species (*c.f.* Blumea 5, 1943, 379, note) appear to be specifically distinct; the specimens are too imperfect for a full description.


Stems twining, to 3 m, sparsely strigose-hirsute when young, soon glabrescent. *Leaves* ovate to broadly lanceolate, 6–20 by 2 1/2–11 cm, rounded or slightly cordate at the base, acute or slightly acuminate at the apex, upper surface glabrous, lower surface sparsely strigose when young, soon glabrescent; midrib and 7–8 nerves on either side prominent beneath, minor nervation usually inconspicuous; petiole slender, 1 1/2–5 cm, hairy like the stem. *Peduncles* axillary, terete, very slender, longer than the petioles, 2 1/2–20 cm, sparsely strigose when young, soon glabrescent, cymosely (1–)3–15-flowered. Pedicels 5–15 (in fruit 20) mm long. Bracts linear-lanceolate, *ca* 5 mm long, slightly hirsute beneath, caducous. *Sepals* subequal, broadly ovate, *ca* 4–5 mm long; outer two with obtuse, inner three with rounded apex, strigose outside; sepal 3 with one, sepals 4 and 5 with two glabrous margins. *Corolla* funnel-shaped, *ca* 20–35 mm long, bright purple within, paler outside; tube broad, not manifestly distinct from upper part of corolla; limb subentire; midpetaline bands hirsute outside, connecting fields glabrous. *Stamens* and *style* included. Filaments dilated at the base, glabrous. *Fruit* glabrous, 2-celled. *Fruit* ovoid, *ca* 15 mm long, pink, 1-seeded.

**Distr.** Malaysia: Malay Peninsula (Perak, Pahang).

**Ecol.** As far as known only at *ca* 1300–1500 m. *Vern.* *Akur tokal*, Mal. Pen.

12. *Argyreia cucullata* OOSTR. Blumea 5 (1943) 366, f. 2, k–m.

Stems twining, up to 5 m; young parts shortly hairy, later glabrescent to glabrous. *Leaves* ovate or narrowly elliptic, 4–10 by 2–6 cm, base rounded, apex acutish, obtuse or slightly acuminate, mucronulate, margins subrevolute; upper surface glabrous or with hairs on midrib; lower surface shortly pilose with laxly appressed hairs; midrib
and 6–8 nerves on either side prominent beneath; petiole 1–2(–6) cm, shortly pilose. *Peduncles* in the axes of the upper leaves, exceeding the petioles, 2–5(–15) cm, sparsely pilose to glabrous, sulcate or angular, unambitiously cymose at the apex, many-flowered. Pedicels 2–3 mm, thickened towards the apex. Bracts oblong or linear, crisp, lower ones ca 1 cm (or longer, up to 2 cm), caducous. *Sepals* glabrous or sparsely short-pilose outside, 2 outer ones broadly ovate to ovate-oblong, not or slightly crisp, rounded (or obtuse) at the apex, with inflexed margins, ca 7–9(–10) mm long; sepal 3 broader, 5–6 mm long; 2 inner sepals ca 5–5½ mm long, strongly concave and cinculate, finally deeply emarginate at the apex (always?). *Corolla* campanulate to funnel-shaped, ca 3 cm long, violet, paler to white at the margin, shallowly lobed, lobes soon reflexed; midpetaline bands sub-hirsute, rest of corolla glabrous. *Stamens* and *style* included. Base of filaments thickened, glabrous. Ovary glabrous, 2-celled. *Fruit* ellipsoid, apiculate, ca 17 mm long, pink. 

**Distr. Malaysia:** Sumatra, East Coast (Mt. Sibajak, Petani Valley; Karo Uplands). 

**ECOL.** Moist thickets, edges of virgin forests. 850–1300 m. 

Note. A discussion of the variability is given in the original publication.


Stems twining, leafless at flowering-time, terete or slightly angular, with some appressed hairs in youth, glabrescent, more or less warty (lenticellate). *Leaves* ovate-oblong (or ovate), 11–15(–17) by 5–6(–12) cm, base rounded, in young leaves broadly cuneate, apex shortly acuminate; glabrous, the nerves excepted; midrib, ca 4(–6–7) mm nerves on either side and subparallel minor nervation prominent beneath; petiole up to 6(–10) cm long, shortly appressed-pilose, sulcate. *Inflorescences* in the axils of fallen leaves on the main stem or on lateral branches; in the first case umbellately cymose, 4–8 or up to 20-flowered. In the second case also umbellately cymose, and moreover contracted into a panicule. *Peduncles* 10–24 mm long, flattened towards the apex, appressed-pilose. Pedicels 4–7 mm or in the central flower up to 10 mm, at the base densely, towards the apex more sparsely pilose. *Sepals* glabrous or sparsely pilose at the base outside; two outer ones ovate, rounded or slightly retuse at the apex, ca 6 mm long; sepal 3 slightly oblique, elliptic-ornicular, ca 6–6½ mm long, with one thinner margin; two inner sepals elliptic-orbicular, ca 6½ mm long, with two thinner margins. *Corolla* funnell-shaped, ca 3½ cm long, glabrous outside, white, pink or violet towards the limb; limb shallowly lobed, ca 4–4½ cm diam. *Stamens* and *style* included. Filaments pilose at the base. Ovary glabrous, 4-celled. *Fruit* ovoid or ellipsoid, ca 12–14 mm long, violet or crimson. 

**Distr. Malaysia:** N. half of Sumatra (Mt Talakmau, Upper Bila plain, Asahan). 

**ECOL.** In forests, high climbing; flowers and fruits in the basal parts of the stem; 600–900 m. 


Plant entirely glabrous, or with some appressed hairs in the leaf-axes and on the petioles and the nerves. Stems twining, branches terete or striate. *Leaves* oblong, ovate, or ovate-elliptic, 10–16 by 4–9 cm, rounded, truncate or slightly cordate at the base, acute to shortly acuminate, mucronulate at the apex; midrib, 5–7 acutate nerves on either side of it, and reticulate minor nervation distinctly prominent beneath; petiole 2–6 cm, sulcate. *Peduncles* axillary, straight or curved, 5–7 cm, subangular, cymosely branched at the apex, 1–5-flowered. Pedicels 4–7 mm long. Two outer *sepals* ovate, acutish, ca 5 mm long; three inner ones slightly longer, up to 6 mm long, broadly ovate, obtuse, with thinner margins. *Corolla* funnell-shaped, ca 5½ cm long, glabrous outside; red; limb subentire. *Stamens* and *style* included. Filaments shortly pilose at the base. Ovary glabrous. *Fruit* unknown. 

**Distr. Malaysia:** Lingga Arch., Sumatra (East Coast). 

**ECOL.** Edges of forests, 20–30 m. 

Note. The leaves of the specimens from P. Singkep (Lingga Arch.) are ovate or ovate-elliptic; those of the Sumatran specimen are oblong.


Stems twining, up to 20 m. young parts brown pilose to hirsute, glabrescent. *Leaves* elliptic or elliptic-oblong, 4–13 by 2–8 cm, base rounded or slightly cordate, apex obtuse or acutish to very shortly acuminate, more or less densely and loosely appressed-pilose to striigillose on both sides or upper surface more sparsely striigillose. the indumentum more or less shining, surface of older leaves more or less rough; midrib and 9–11 nerves on either side prominent beneath, nerves parallel, straight at first, curved near the margin; petiole 1½–2½ cm, hairy like the stem. *Peduncles* 2½–11 cm, hirsute; *flowers* at the end in a dense, capitate or umbelliform cyme with hairy branches. *Pedicels* 2–3 mm long, hairy. Bracts linear-lanceolate, acute, caducous. Two outer *sepals* linear-lanceolate, acute, 10–12 mm long, hirsute outside, glabrous or nearly so inside; three inner *sepals* shorter. lanceolate, gradually attenuate towards the apex, respectively 8–10, 6½–8 and 5½–7 mm long, hirsute outside but with glabrous margins, glabrous inside. *Corolla* funnell-shaped, 2–3 cm long, white with reddish purple bands: inside of throat and tube violet; limb almost entire; midpetaline bands with long, patent hairs. forming a kind of pencil in bud; rest of corolla glabrous. Filaments thickened and glabrous at the base. Ovary glabrous, 2-celled. *Fruit* elliptipsoid, 16 by 12 mm, reddish

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purple, at base with the irregularly spreading and reflexed sepals.

Distr. Siam, in Malaysia: Sumatra (East Coast), Malay Peninsula.

Ecol. In thickets and thin forests, 350-800 m.


Stems twining, robust, terete, greyish-strigillose. Leaves broadly ovate to orbicular, 8-18 by 8-18 cm, shallowly cordate to truncate at the base, shortly acuminate, mucronulate at the apex, glabrous or nearly so above, sparingly hairy beneath, more densely so on the nerves; midrib and 9-11 nerves on either side prominent beneath; minor nerves many, subparallel; petiole shorter than the blade, 4-7 cm, hairy like the stem. Peduncles 8-28 cm, hairy like the stem, cymose branched at the apex with several to many flowers, the larger ones bearing below the terminal cyme 1 or 2 lateral ones in the axis of small, ovate to broadly ovate leaves. Pedicels shorter than sepals, 5-8 mm, terete, greyish appressed-hairy. Bracts lanceolate or oblong-lanceolate, attenuate towards the base, acute at the apex, lower ones 10-18 mm long. Sepals lanceolate, acute, with recurved tips; three outer ones 10-12 mm long, inner ones ca 9 mm, thinly white sericeous outside and inside near the apex. Corolla tubular to funnel-shaped, ca 7 mm long, pink purple, dark purple inside; midpetaline bands hairy outside, rest of corolla glabrous. Filaments pilose at the base. Ovary glabrous, 4-celled.

Distr. From Nepal and Sikkim to Assam, Pegu and the Andaman Islands, in Malaysia: in the neighbourhood of Bogor (Java) as an escape from the Botanic Gardens.


Stems twining, up to 10 or 15 m high, young parts patently brown or fulvous hairy, occasionally appressed-pilose with softer hairs. Leaves ovate to orbicular, rarely oblong-lanceolate, occasionally slightly contracted in the middle, 7½-18 by 4-13 cm, base shallowly to deeply cordate, apex acuminate; brown or fulvous-hirsute on both sides with patent to appressed hairs; nerves 13-18 on either side of midrib, straight at the base, curved near the margin; petiole slender, 5-16 cm long, mostly patently hirsute. Peduncles rather stout, 3-30 cm, patently hirsute. Flowers in a dense, capitate cyme. Bracts persistent, outer ones elliptic to narrowly lanceolate, acute at both ends, ca 1½-4 cm long, brown or fulvous-hirsute outside and at the margins, glabrous inside except at the apex; upper bracts narrower. Pedicels very short or none. Sepals lanceolate or ovate-oblong to oblong, acuminate, patently hirsute outside; 3 outer ones 15-17 mm long, 2 inner ones 12 mm. Corolla funnel-shaped, 4½-5½ cm long, reddish purple, pale violet or pink, often paler without and towards base, rarely entirely white; limb subentire, midpetaline bands hirsute outside. Stamens and style included. Filaments glandular-pilose at the base, the corolla inside with long hairs between their bases. Ovary glabrous, 2-celled. Fruit globose, 8 mm diam., with leathery wall, orange red, reddish or brownish, 4- or less-seeded.

Distr. Bengal to Indo-China, southwards to Siam, the Andaman Islands, and Malaysia: Sumatra. Malay Peninsula, Java, Madura.

Ecol. Thickets, secondary forests, edges of forests, teak-forests, roadsides, open grounds, from sea-level to 1700 m.

Use. The stems are used as binding material for bundles of firewood (Sumatra: Karo Uplands).

Vern. Akar tapah rusa, akar temiang, akar tulang baku, akar lana bulu, Mal. Pen., akar bulu or babulu, Sumatra, areuj bulu, areuj bulu areu, areuj bi bulu, S. kotong, djamet, klarak, J. For more local names see Blumea 5 (1943) 370.

Notes. The density of hairiness varies considerably: mostly the hairs are rather stiff and bristly, sometimes they are softer, more silky and more or less appressed to the stems, pedicels and leaf-surfaces. Such specimens are found in Sumatra as well as in Java and Madura; however, they seem to be more common in Sumatra. The shape of the bracts also greatly varies; the outer ones may be elliptic to narrowly lanceolate.

For a discussion of the synonyms Lettsomia capitata, L. peguensis, and L. stricta, see Blumea 5 (1943) 370, and 7 (1952) 184.


Stems twining, patently fulvous-hirsute when young, later on glabrescent. Leaves ovate, rarely elliptic-oblong or obovate, 9-20 by 3½-11 cm; rounded at the base or shortly attenuate into the petiole, acuminate at the apex; upper surface glabrous or nearly so, lower surface strigose-hirsute on the nerves only; midrib and 5-6 nerves on either side prominent beneath, minor nervation reticulate, rather prominent beneath; petiole 1½-5 cm, sparsely patent- to appressed-hirsute. Peduncles axillary, stout, terete, 1½-5 cm long, patently hirsute. Deeply longitudinally grooved when dry; flowers in a dense, capitate cyme at the end of the peduncle; diam. of capitulum 5-9, with the corollas up to 17 cm, in poorly developed specimens smaller. Outer bracts broadly ovate to narrowly lanceolate, obtuse to acute at the apex, rounded at the base; 2½-4 cm long, rather sparsely fulvous-hirsute to nearly glabrous outside and at the margins, glabrous inside; upper bracts smaller and narrower. Pedicels very short or none. Sepals ovate-oblong, long-acuminate, three outer ones 11-15 mm long, of which the
acumen 6-9 mm, long-hirsute outside, the basal part glabrous; two inner ones 9–13 mm long. *Corolla* funnel-shaped with distinct tube, 4½–6 cm long, white with pink, red, crimson or purple stripe on the middle of each lobe; limb subtenture, midpetaline bands hirsute, connecting fields glabrous. *Sliameus* and *style* included. Filaments glan- dul-pilose at the base. Ovary glabrous, 2-celled. **Fruit** ovoid, ca 12 mm long, pink, 1-seeded.  
**Distr.** Malaysia: Malay Peninsula.  
**Ecol.** Jungle, swamps and edges of rivers, up to 1000 m.  
**Uses.** The slightly sweet fruits are said to be edible; **Alvins** states that a decoction of the roots may be used externally for pains in the bones. 
**Vern.** Akar bunga batang, akar sennulat, akar tērong tērong, akar ulan gajah, akar sapta utan, akar kēlupas, akar tentērong, Mal. Pen. 
**Note.** As is the case in *Argyrea* ridleyi and *A. capitata* the shape of the bracts varies a great deal; in some specimens they are narrowly lanceolate, 30 by 3 mm, but mostly they are broader, up to broadly ovate, with a relatively small number of intermediates. 

19. *Argyrea* ridleyi (**Prain**) **Prain** ex **Ooststr.** Blumea 5 (1945) 370; **Hoogl.** Blumea 7 (1952) 185.—**Lettsomia** ridleyi **Prain**, J. As. Soc. Bengal 63, 2 (1894) 98.—**Lettsomia** ridleyi **Prain** var. velutina **Prain**, l.c. 99. 
Stems twining, densely hairy with fulvous, appressed hairs. **Leaves** ovate or elliptic, or the upper ones elliptic-oblong, 7½–18 by 3½–13 cm, base rounded, or shortly attenuate into the petiole; apex acuminate to cuspidate, with a narrow, acute and mucronulate acumen; upper surface glabrous or nearly so, lower surface rather densely hairy with patent or loosely appressed hairs, more densely so on the nerves; midrib and 6–9 nerves on either side prominent beneath, minor nervation reticulate, rather prominent beneath: petiole 2½–8 cm, hairy like the stem. **Peduncles** mostly shorter than or as long as the petiole, rarely longer. 1–18 cm, hairy like the stems; flowers in a broad, capitate, 8–10-flowered cyme. Bracts large, ovate to lanceolate, acuminate, 2–3 cm long, glabrous and purple inside, almost tomentose outside; upper bracts smaller and narrower. Pedicels very short. Two outer **sepal**s ovate, sharply acute to acuminate, glabrous, hairy below the apex, or over the whole surface, 6–7 mm long, three inner ones elliptic to broad-elliptic, obtuse, **ca 5½** mm long, glabrous; sepal 3 sometimes with a few hairs near the apex. *Corolla* funnel-shaped, **ca 3** cm long, white or pinkish; limb shallowly lobed; midpetaline bands hirsute outside. Ovary glabrous, 2-celled. **Fruit** ovoid, ca 13 mm long, pink.  
**Distr.** Malaysia: Malay Peninsula, Riuow and Lingga Archipelagos.  
**Ecol.** In the Malay Peninsula locally in damp forests up to ca 600 m.  
**Vern.** Akar simpis, akar saga molek, akar tērong, Mal. Pen. 
**Notes.** **Prain's** var. velutina differs from *var. typica* (**Prain**, l.c. 98) by its somewhat smaller leaves and by being more densely hirsute. The differences do not make the impression to be of great importance, and may be due to differences in age or habitat. 

Stems twining, terete, solid, very sparsely pilose, light to dark brown. **Leaves** narrowly ovate to oblong, 7–15 by 3–6 cm, rounded at the base, gradually attenuate towards the acute. mucronulate apex, sparsely strigillose or glabrous above, subglabrous beneath or sparsely strigillose on the nerves; nerves **ca 8** on either side of the midrib; petiole 3½–7 cm, strigillose. **Peduncles** axillary, up to 18 cm long, strigillose. Flowers in a few-flowered cyme with long-persistent, oblong-lanceolate, acute, sparsely appressed-pilose, 15–22 mm long bracts, inserted at the base of the pedicels. Pedicels 2–3 mm long, densely appressed-pilose. **Sepals** 7½–8 mm long; two outer ones ovate, obtuse or shortly apiculate, densely greyish appressed-pilose outside, glabrous inside; sepal 3 slightly broader, obtuse, with one glabrous margin; two inner sepals broad-ovate, obtuse, with two glabrous margins. *Corolla* funnel-shaped (only seen in bud); limb subtenture, slightly undulate; midpetaline bands sericeous, connecting fields and basal portion of corolla glabrous. Ovary glabrous, 2-celled. **Fruit** unknown.  
**Distr.** Malaysia: Philippines (Luzon).  
**Ecol.** In light woods among shrubbery at 300 m. 

21. *Argyrea* sphaerocephala (**Prain**) **Hoogl.** Blumea 7 (1952) 183.—**Lettsomia** sphaerocephala **Prain**, J. As. Soc. Beng. 73, 2 (1904) 19. 
Stems twining, terete, sparsely strigose. **Leaves** narrowly ovate, 5–10 by 2½–4 cm, rounded at the base, acute or slightly acuminate at the apex, sparsely strigose on both sides; midrib and 5–6 nerves on either side slightly prominent beneath; petiole 1–3½ cm, sparsely strigose. **Peduncles** axillary, thin, terete, up to **ca 20** cm long, ½–1 mm diam., sparsely strigose; flowers in a dense, **ca 30**-flowered capitate cyme. Pedicels 3–4 mm. Outer bracts transverse-elliptic, **ca 2½** by 3 cm, hirsute outside, sparsely so inside, innermost bracts ovate-spathulate, **ca 5** by 3 mm. **Sepals** ovate, **ca 4** mm long, two outer ones obtuse, sepal 3 rounded, two inner ones retuse at the apex; outer sepals hirsute near the apex only, inner ones in the central part only. *Corolla* infundibuliform-campanulate (**Prain**), 2½ cm long (**Prain**), pink; limb probably subtenture, midpetaline bands hirsute, connecting fields and lower portion of corolla glabrous. Filaments glabrous. Ovary glabrous, 2-celled. **Fruit** unknown.  
**Distr.** Malaysia: Malay Peninsula (Perak).  
**Note.** The collections of this remarkable species only contain flower-buds. The species is easily recognized by the capitate inflorescences with large bracts at the end of the long and slender peduncle.
2. Section Schizanthus


Corolla distinctly 5-lobed to 5-parted. Stamens and style mostly exerted.


KEY TO THE VARIETIES

1. Two outer sepals ca 7½ by 4 mm; two inner ones ca 7 by 5 mm, all broadly acute at the apex. var. reticulata

1. Two outer sepals ca 4 by 3 mm, broadly acute at the apex; two inner ones ca 4 by 4½ mm, rounded, mucronate at the apex. var. microcalyx

var. reticulata.

Stems twining. to 10 m, terete, sparingly strigose. Leaves ovate to broadly lanceolate, 5½–10 by 2½–4½ cm, obtuse to rounded at the base, slightly acuminate at the apex, upper surface sparingly strigose, glabrescent. Lower surface sparsely strigose: midrib and 4–5 nerves on either side prominent beneath; minor nervation reticulate, rather conspicuous beneath: petiole slender, 1–3 cm, strigose. Peduncle axillary, terete, 2–9 cm long, strigose, cymose 3–15-flowered. Pedicels ca 7–9 mm long. Bracts linear-lanceolate, ca 5 mm long, strigose beneath, caducous. Sepals ovate, two outer ones ca 7½ by 4 mm, two inner ones ca 7 by 5 mm, broadly acute at the apex, all sepals rather sparsely strigose, sepal 3 with one, two inner sepals with two broad glabrous margins. Corolla funnel-shaped, ca 20–25 mm long, waxy white, pale blue inside; tube distinct, ca 7½ mm long, glabrous: limb distinctly 5-lobed: lobes ca 10 mm long, midpetaline bands hisurate outside with a glabrous wing on either side along the whole length. Stamens and style about as long as corolla. Base of filaments dilated, with glandular hairs. Ovary glabrous, 2-celled. Fruit ovoid, ca 15 mm long, magenta, 1-seeded.

Distr. Malaysia: Malay Peninsula (Perak, Pahang, Selangor).

Ecol. In open bamboo-forest and in cleared places, 150–1400 m.

var. microcalyx Hoogl. Blumea 7 (1952) 191.

Differs from var. reticulata by the smaller calyx; two outer sepals ca 4 by 3 mm, broadly acute at the apex; two inner sepals ca 4 by 4½ mm, rounded, mucronate at the apex.

Distr. Malaysia: Malay Peninsula (Selangor).

Ecol. Forest-edges.

23. Argyreia ooststromii Hoogl. Blumea 7 (1952) 189, f. 1, a-g.

Stems twining, young parts fulvous-strigose with partly slightly patent hairs. Leaves ovate, 6–14 by 3½–8½ cm, rounded or slightly cordate at the base, acute or slightly acuminate at the apex, upper surface glabrous, but sparsely strigose on midrib, lower surface strigose on midrib and lateral nerves, sparingly so on the intervenium; midrib and 5–8 nerves on either side prominent beneath, minor nerve reticulate, rather inconspicuous; petiole short, 1–4½ cm long, hairy like the stem. Upper inflorescences forming a rather lax panicle, composed of more or less long-peduncled cymes, leafless or with a few small leaves; lower ones axillary. Peduncles terete, longer than the petioles, 3–16 cm long, hairy like the stem, cymose ca 25-flowered. Pedicels ca 3 mm long, hairy. Bracts ovate, ca 5 mm long, rounded, often slightly split at the apex, hisurate beneath, caducous. Sepals subequal in form, broadly ovate, rounded at the apex, ca 4 mm long, fulvous-hisrate, sepal 3 with one, two inner sepals with two glabrous margins. Corolla funnel-shaped, ca 13 mm long, white, tube violet mauve, dark purple inside; limb distinctly 5-lobed, lobes ovate, ca 4 mm long; midpetaline bands hisurate with a glabrous wing on either side along the whole length, basal portion of corolla glabrous; inside sparsely hisrate above the base of the stamens. Filaments with dilated base, glabrous. Ovary glabrous, 2-celled. Fruit (unripe?) ovoid, ca 12 mm long, pink, 1-seeded.

Distr. Malaysia: Malay Peninsula (Kelantern and Trengganu).

Ecol. Edges of secondary forest.


Stems twining, to 15 m or more, terete, strigose. Leaves ovate, 3½–7 by 2–4 cm, obtuse or rounded at the base, acuminate at the apex; upper surface glabrous except the strigose midrib, lower surface densely light-yellowish sericeous; midrib and 5–6 nerves on either side prominent beneath, minor nerve reticulate, inconspicuous; petiole 1–2½ cm, strigose. Peduncles axillary, terete, short, 10–18 mm, densely sericeous, cymose 1–5-flowered, usually 1-flowered. Pedicels ca 4–6 mm, sericeous. Bracts lanceolate, ca 4 mm long, sericeous, caducous. Sepals broadly ovate, broadly acute to rounded at the apex, densely sericeo-tomentose outside, one margin of sepal 3 and both margins of sepals 4 and 5 less densely hairy or partly glabrous; three outer sepals ca 8½ mm; two inner ones ca 6½ mm long. Corolla funnel-shaped, ca 2½ cm long, pale pinkish white outside, rose-pink inside; tube not distinct; limb distinctly 5-lobed, lobes ovate-oblong, ca 15 mm long; midpetaline bands hisurate upwards with a glabrous wing along the whole length, rest of corolla glabrous. Filaments dilated and glandular hairy at the base. Ovary glabrous, 2-celled. Fruit unknown.

Distr. Malaysia: Malay Peninsula (Pahang).

Stems twining; young branches terete, very shortly greyish appressed-pilose, adult ones angular, glabrescent. Leaves oblong to narrowly oblong with subparallel margins, 5–10 by 11/2–3 cm; rounded at the base; attenuate towards the obtuse, mucronulate apex; chartaceous or thinly coriaceous, on both sides sparsely appressed-pilose in youth, soon glabrous; midrib prominent beneath; nerves 7–8 on either side hardly conspicuous; minor nervation inconspicuous; petiolar 11/2–3 cm long, slender, shortly appressed-pilose. Inflorescences axillary, pilose like the branches; peduncles straight, patent erect, 21/2–7 cm long, umbraculiform at the apex with 2–5 branches. Pedicels 2–3 mm. Bracts minute, occasionally a foliaceous bract in the cyme. Sepals subequal, shortly appressed-pilose outside; two outer ones ovate-triangular, three inner ones broadly ovate-triangular, all attenuate towards an acutish apex. Corolla funnel-shaped, ca 15 mm long, deeply 5-lobed, white; tube ca 5–6 mm long, gradually widened towards the limb, glabrous; lobes oblong-ovate, ca 9 mm long; midpetaline bands sericeous outside, margins glabrous. Filaments glabrous. Ovary glabrous, 2-celled. Fruit ovoid, up to 15 mm long (mature?), nodding, reddish.

Distr. Malaysia: Borneo (W. Kutai).

Ecol. In primary forest, ca 1600 m.

26. Argyreia glabra Choisy in Zoll. Syst. Verz. 2 (1854) 128, 130; Ooststr. Blumea 5 (1943) 373, as to the name only; ibid. 7 (1952) 174.—Rivea glabra Hallier f. Bull. Herb. Boiss. 6 (1898) 714.

Stems twining, shortly appressed-pilose. Leaves ovate, 5–8 by 2–4 cm; base rounded, apex acute; appressed-pilose on both sides with short, rigid hairs, more densely beneath than above; midrib and ca 10–11 nerves on either side prominent beneath; minor nerves indistinct beneath; petiole 1–11/2 cm, pilose like the stems. Peduncles in the upper leaf-axilis, angular, ca 5 cm long, densely appressed-pilose with short, fulvous hairs, as are the branches of it and the pedicels, umbraculiform, few, to several-flowered. Pedicels up to 5 mm long. Bracts ovate, obtuse, ca 4–5 mm long, densely appressed-pilose. Sepals densely appressed-pilose with fulvous hairs; three outer ones ovate-elliptic, obtuse, ca 6 mm long; two inner ones ovate, rounded, a little shorter. Corolla 5-fid; tube at least 10 mm long, widened above, glabrous; lobes ovate, ca 15 mm long, patent to reflexed; midpetaline bands sericeous. Filaments dilated and densely pilose at the base. Ovary glabrous, 2-celled. Fruit unknown.

Distr. Malaysia: Lesser Sunda Islands (Lombok).

Ecol. In forests.


Stems twining, terete, in dry state longitudinally wrinkled, sparsely appressed-pilose, greyish-brown. Leaves broadly to narrowly ovate, or oblong, 7–18 by 31/2–13 cm, truncate or subcordate at the base, attenuate or acumenate at the apex, glabrous above, or with some scattered hairs, sparsely pilose with appressed hairs beneath; nerves 6–7 on either side of midrib; minor nervation reticulate with subparallel secondary veins; petiole 11/2–(4–8) cm, sparsely appressed-pilose. Peduncles axillary, slender, 7–20 cm, sparsely appressed-pilose, or more densely so towards the apex, cymosely branched at the apex, with many (rarely few) flowers in an umbraculate cyme. Pedicels 1–2 mm, densely appressed-pubescent. Bracts lanceolate to narrowly oblong, obtuse, 3–7 mm long, appressed-pubescent outside, caducous. Sepals equal in length or outer ones a little shorter, ovate-oblong, obtuse, sometimes acutish, ca 5–6 mm long, densely greyish or whitish appressed-pilose outside; sepal 3 with one thin glabrous margin; two inner sepals with two thin glabrous margins. Corolla funnel-shaped, ca 21/2–3 cm long, reddish; limb distinctly 5-lobed, ca 4 cm diam.; lobes ovate, midpetaline bands appressed-sericeous, their tips penicillate, tube and margins of lobes glabrous. Filaments glandular-papillos. Ovary glabrous, 2-celled. Fruit globose, ca 1 cm or slightly more in diam., purple or pinkish red; sepals slightly enlarged in fruit, inner ones with red margins; fruiting pedicels up to 8 mm, but often shorter; seed 1, globose.


Ecol. Common in thickets and forests, especially along mountain streams at low and medium altitudes, ascending to 1500 m (MERRILL).

Use. The stems are used for tying purposes (ELMER).

Ver. Basiliad, sabaltukan, Tag., deno(k)dokto, Ig., tanud-taukd, Neg., Philippino wire, E.


Stems twining, up to 30 m, young parts fulvous-strigose, sometimes with additional, short, slightly patent hairs. Leaves ovate to broadly ovate, 6–15 by 3–10 cm, obtuse to rounded and often shortly attenuate at the base, acumenate at the apex; upper surface glabrous except on the midrib, lower surface densely to sparsely fulvous-hirsute, mostly so on the nerves; midrib and 7–11 nerves on either side prominent beneath, minor nervation reticulate, inconspicuous; petiole 1–5 cm, hairy like the stem. Peduncles axillary, terete, longer than petioles, 5–20 cm, hairy like the stem, cymosely 3–30-flowered. Pedicels ca 3 mm. Bracts linear-lanceolate, ca 5 mm long, slightly hirsute beneath, caducous. Sepals unequal, two outer ones broadly ovate with rounded apex, ca 41/2 mm
long, hirsute at least in the basal half outside; two inner sepals transverse-elliptic, ca 6 mm long, often incised at the apex, most deeply so in fruit, glabrous outside or sparsely hirsute at the base. *Corolla* funnel-shaped, 15–18 mm long, whitish or pinkish outside, bright red inside; tube broad, limb distinctly 5-lobed, lobes ovate, ca 5 mm long; midpetaline bands hirsute with a glabrous wing on either side along the whole length. Filaments dilated at the base, glabrous. Ovary glabrous, 2-celled. Fruit ovoid, ca 15 mm long, deep red, 1-seeded.

**Distr. Malaysia:** Malay Peninsula.

**Ecol.** Open jungle, up to 700 m.


Stems twining, densely tomentose as are the petioles and the inflorescences, with light fulvous hairs. *Leaves* elliptic or sometimes ovate-elliptic, 8–16 by 4–10 cm, base rounded, apex shortly acuminate, or obtuse with a short acumen, thinly coriaceous, glabrous above or slightly hairy on the midrib, short-pilose to tomentose beneath, more densely so on the nerves; midrib and 7–9 nerves on either side prominent beneath; petiole short and stout, up to 5 cm. *Peduncles* axillary, slender, terete, 8–15 cm, in fruit up to 20 cm, cymose branched at the apex, several- to many-flowered; cyme 6–12 cm diam. Bracts small, caducous. Pedicels 2–4 mm long, thick. Two outer *sepals* strongly concave, orbicular or slightly broader than long, rounded at the apex, 6–7 mm long, densely light fulvous tomentose outside, glabrous inside; sepal 3 transverse-elliptic, 6 mm long, outside tomentose with one glabrous margin; two inner sepals transverse-elliptic, 6 mm long, outside densely sericeous with two glabrous margins. *Corolla* funnel-shaped to campanulate, deeply 5-lobed, pink (*Prain*); lobes ovate-oblong (?), with lanceolate, densely hairy midpetaline bands and glabrous margins. *Fruit* ovoid, ca 14 mm long, pinkish white (*Griﬃth*); oblong or ovate-oblung (?), with lanceolate, densely hairy midpetaline bands and glabrous margins. *Fruit* ovoid, ca 14 mm long, pinkish white (*Griﬃth*); oblong or ovate-oblung (?), with lanceolate, densely hairy midpetaline bands and glabrous margins. Fruit ovoid, ca 8 mm high, ca 12–13 mm diam., tomentose outside.

**Distr. Malaysia:** Malay Peninsula (Negri Sembilan, Malacca).

**Vern.** Akar péra bèntak, akar sago molék.


Stems twining, glabrous or nearly so. *Leaves* ovate to elliptic, 6–12 by 31/2–81/2 cm, thinly coriaceous; base rounded or slightly retuse, apex obtusish or acutish or shortly acuminate, glabrous on both sides or nearly so; midrib prominent beneath, sulcate above; nerves 5–8 on either side, not or ± distinctly prominent beneath, minor nerves parallel, distinctly visible beneath; petiole rather short, 11/2–4 cm, glabrous or nearly so. *Peduncle* terete, often curved at its base, 3–15 cm, glabrous or shortly appressed-pilose, mainly towards the apex, umbellately cymose, up to 6-flowered. Pedicels as long as or longer than the calyx, 5–9 mm, in fruit 10–18 mm, strongly appressed-pilose. Bracts at base of cyme linear, up to 12 mm long, sparsely pilose, upper ones shorter. *Sepals* slightly unequal, sparingly appressed-pilose with very short hairs; 2 outer ones ovate-triangular, obtuse, ca 5 mm long, 3 inner ones orbicular to transverse-elliptic with rounded to emarginate apex; sepal 3 with one, sepals 4 and 5 with two narrow, glabrous, reddish margins, all 6–61/2 cm long. *Corolla* deeply 5-lobed (only one not fully expanded corolla could be examined), white, tube ca 5–6 mm long, lobes oblong, ca 12–13 mm long, consisting of the midpetaline band with a narrow, thin, glabrous wing on either side along the whole length; midpetaline band glabrous except for the apical portion. Filaments sparsely pilose at the base; ovary glabrous, probably 2-celled. *Fruit* ellipsoid, ca 15 mm long, its base enclosed by the cupular calyx.

**Distr. Malaysia:** Sumatra.

**Vern.** Akar dédaun kétjil, Palembu.

31. *Argyreia erinacea* Ooststr. Blumea 5 (1943) 374, f. 3, F–g; ibid. 7 (1952) 175.

Stems twining, tall; young branches densely set with appressed or subappressed, greyish or fulvous, strigillose hairs, glabrescent. *Leaves* ovate to elliptic, sometimes narrower, 7–13 by (21/2–) 41/2–11 cm, subcoriaceous; base rounded to truncate or slightly retuse to subcordate, apex obtuse to shortly acuminate, mucronulate; upper surface glabrous or sparsely strigillose on midrib and basal lateral nerves, lower surface strigillose; midrib and 6–7 nerves on either side prominent beneath; minor nervation indistinct; petiole 21/2–6 cm, strigillose. *Peduncles* axillary, 3–11 cm, densely strigillose, unambellately cymose at the apex. Pedicels up to 4 mm. Bracts minute, caducous. Two outer *sepals* broadly ovate-triangular, obtuse, ca 41/2 mm long, densely strigillose; sepal 3 orbicular, 5–6 mm long, strigillose, one glabrous margin excepted; two inner sepals orbicular to transverse-elliptic, rounded at the apex, ca 5 mm long, strigillose, the broad lateral margins excepted. *Corolla* deeply 5-lobed, white with pale purple inside; tube ca 6–7 mm long, glabrous; lobes oblong or ovate-oblong, up to 17 mm long; midpetaline bands sericeo-strigillose, margins glabrous. Filaments with thickened glabrous base. Ovary glabrous. 2-celled. *Fruit* ellipsoid, obtuse, up to 12 mm long, red; seed 1. Fruiting pedicels and branches of cyme reflexed.

**Distr. Malaysia:** Borneo (Mt Kinabalu).

**Ecol.** In forests, 850–1500 m.

32. *Argyreia micrantha* Ooststr. Blumea 5 (1943) 375, f. 3, a–e.—**Fig. 60a–b.**
Stems twining, up to 12 m high; young branches densely pilose with appressed pale greyish, fulvous or olivaceous, very short and stiff hairs, making the impression of being farinose. Leaves ovate-oblong to elliptic-oblong, 7–12 by 2 1/2–6 cm, chartaceous; base rounded, apex acute to acute-acuminate, mucronulate, olive-coloured beneath in dry state, much darker above, sparsely strigillose on both sides, glabrescent; midrib and 7–9 nerves on either side prominent beneath; minor nervation indistinct; petiole 2–3 1/2 cm, pilose like the branches. Peduncles axillary, straight, patently erect, terete, 3–12 cm, pilose, unimbricated cymose at the apex, with 3–6 branches. Pedicels 2 1/2–5 mm, angular to sulcate, pilose. Bracts caducous. Sepals equal, ca 3 mm long, shortly pilose outside; two outer ones broadly ovate-triangular to suborbicular, obtuse; sepal 3 broadly triangular to orbicular, obtuse, with one glabrous margin; two inner sepals transverse-elliptic, broadly rounded at the apex, their lateral margins glabrous. Corolla deeply 5-lobed, purple; tube cylindric, ca 4–5 mm long, glabrous; limb ca 2 cm diam.; lobes oblong, ca 8–10 mm long, reflexed; midpetaline bands sericeo-strigillose, margins glabrous. Stamens white; filaments inserted at the mouth of the tube, glabrous at the base. Ovary glabrous, 2-celled. Fruit unknown.

Distr. Malaysia: Bornoe (Mt Kinabalu). Ecol. In the jungle, at ca 1500 m.

Note. The infructescence and fruit described in Blumea 5 (1943) 376 appear to belong to 31. *A. erinacea Ooststr.*

33. *Argyrea discolor* Ooststr. Blumea 7 (1952) 175.

Stems twining; branches terete, densely and more or less appressed pilose with short, fulvous hairs. Leaves ovate, 6–8 by 3–5 cm, subcordate at the base, attenuate towards the obtusish apex, subcoriaceous, upper surface green, glabrous or with some strigillose hairs on the midrib; lower surface purple, sparsely pilose with slightly curved hairs, more densely so on the midrib and the 6–7 nerves on either side; petiole 2–2 1/2 cm, sulcate above, pilose like the branches. Inflorescences axillary, densely unimbrellately cymose at the apex; peduncle 4–7 cm, strigose-tomentose as are the branches of it, the pedicels and the minute bracts; pedicels 1–3 mm. Sepals strigose-tomentose outside, two outer ones broadly ovate-triangular, obtuse, ca 3 1/2 mm long; sepal 3 orbicular to transverse-elliptic, ca 4 mm long, with one glabrous margin; two inner sepals orbicular to transverse-elliptic, ca 4 mm long, with two glabrous margins. Corolla 5-partite, purple, paler tipped; tube ca 6 mm long, glabrous; lobes ovate-oblong, obtuse, up to ca 17 mm long; midpetaline bands sericeous, margins glabrous; filaments inserted at the mouth of the tube, with thickened base. Ovary glabrous, 2-celled. Fruit unknown.

Distr. Malaysia: Br. N. Bornoe. Ecol. At ca 1500 m.

34. *Argyrea cinerea* Ooststr. Blumea 5 (1943) 374, f. 3, n.s.—Rivea glabra Hallier f. var.; Koorders, Minah. (1898) 545.

Stems twining, up to 15–20 m high; young branches densely pale greyish pubescent or shortly tomentose as are the petioles, peduncles and inflorescences; adult branches glabrescent. Leaves elliptic-oblong, elliptic or ovate-oblong, 6–13 by 3 1/2–10 cm; at the base rounded, slightly cordate, or slightly contracted into the petiole; narrowed towards the obtusish, obtuse, or shortly apiculate, mucronulate apex; upper surface strigillose, lower surface with very short, crisped hairs; midrib and 9–12 nerves on either side prominent beneath, flat or slightly sulcate above; minor nervation reticulate; petiole 1 1/2–6 cm. Peduncles axillary, much exceeding the petioles, straight or slightly curved, 4 1/2–15 cm, umbrellately cymose at the apex, with 3–5 branches. Pedicels 1–2 mm. Lower bracts oblong-lanceolate, 7–15 mm long, upper ones 2–3 mm. Two exterior sepals broadly ovate-triangular or semi- orbicular, obtuse to rounded, three interior ones orbicular to transverse-elliptic;
all 2½–3 mm long, densely pale greyish pubescent to shortly tomentose outside. sepal 3 with one, sepal 4 and 5 with two glabrous lateral margins. *Corolla* small, deeply 5-lobed, white; tube cylindrical, 2½–3½ mm long; lobes oblong, ca 5½–6 mm long, reflexed; midpetaline bands sericeous outside, margins glabrous. Filaments inserted at the mouth of the tube, at the base flattened and with a few very short hairs. Ovary glabrous, 2-celled. *Fruit* ellipsoid, up to 9 mm long, reddish purple.


Ecol. In forests at 300–400 m.


Stems twining, terete, densely white, greyish or pale brown tomentose. *Leaves* ovate or broadly ovate, 4–12 by 4–10 cm; base cordate, apex sub-acute; lower surface densely tomentose to shortly lanate, upper surface less tomentose (or glabrous); midrib and 7–11 nerves on either side rather prominent beneath; petiole 2–5 cm, tomentose, grooved. *Peduncles* 2½–6 cm, densely tomentose; flowers in a capitate inflorescence at the end of the peduncle. Pedicels very short or none. Bracts broadly obovate to spatulate or orbicular, truncate, ca 8–12 mm long, tomentose outside, glabrous inside, subpersistent. Two outer *sepal* obovate to spatulate, obtuse, 9–10 mm long; sepal 3 oblong, obtuse, ca 8 mm long; two inner sepal oblong, obtuse. 5½–6 mm long, all tomentose outside and glabrous inside. *Corolla* tubular-campanulate, 12–15 mm long, deeply 5-lobed, pink; tube 6–7 mm long, glabrous; lobes narrowly ovate, emarginate, ca 8 mm long, with a hairy midpetaline band and narrow glabrous margins. *Stamen* and style exerted; filaments dilated and hairy at the base. Ovary glabrous, 2-celled. *Fruit* globose, 6–8 mm diam., red, 2–1-seeded, surrounded by the enlarged concave sepal, which are red within; seeds subglobose.


Ecol. In dry open places.

Note. The name *Argyria aggregata* (Roxb.) Choisy, Mém. Soc. Phys. Genève 6 (1833) 427, under which name this species has been mentioned by van Ooststrroom in Blumea 5 (1943) 380, refers to specimens with a glabrous upper leaf-surface. Such specimens appear to be confined to the Deccan Peninsula. They are, most probably, not specifically distinct.


Stems twining, up to 5 m high, more or less densely and shortly appressed-pilose, later on glabrous. *Leaves* ovate-oblong, ovate or elliptic, 6½–16 by 3½–10 cm, base rounded or slightly cordate, apex obtuse to acute; subcoriaceous, glabrous above, or with some hairs on midrib, more or less densely appressed-pilose beneath; midrib and 6–10 nerves on either side prominent beneath; petiole 2–10 cm. pilose like the stems. *Peduncles* 5–20 cm, pilose like the stems, cymosely ramified at the apex, many-flowered. Pedicels 1–4 mm, in fruit up to 10 mm. Bracts minute, 1–2 mm long, caducous, rarely a casual foliaceous bract in the cyme. Two outer *sepal* ovate-triangular, obtuse, 5 mm long, appressed-pilose outside or partly glabrescent. glabrous inside; sepal 3 orbicular or somewhat transverse-elliptic, 5–6 mm long, appressed-pilose with one glabrous margin, two inner sepals transverse-elliptic, strongly concave, 5–6½ mm long, appressed-pilose with 2 glabrous margins, *Corolla* deeply 5-lobed, pinkish purple; tube cylindrical. ca 6 mm long, glabrous, lobes linear or linear-lanceolate, reflexed, ca 16–18 mm long, appressed-sericeous outside, at the apex with 2 small glabrous lobules. Filaments with a large tooth at the glabrous base. Ovary glabrous, 2-celled. *Fruit* ellipsoid, ca 15 mm long, pink.

Distr. Malaysia: Sumatra.

Ecol. Thickets, secondary and primary forests, 360–800 m.

Note. The density of the indumentum of stems, lower surface of leaves and inflorescences appears to be variable; it varies from densely pilose or nearly tomentose to nearly glabrous.

37. *Argyria caudata* Ooststr. Blumea 5 (1943) 379, f. 3, h–m.—Fig. 60c–d.

Stems twining, up to 10 m high; branches terete, shortly greyish tomentose, solid. *Leaves* narrowly ovate to ovate-lanceolate, or ovate to elliptic, 7–16 by 2–12 cm; base rounded, or slightly cordate, apex acuminate. often with a linear acumen, or shortly cuspipdate; lower surface more or less densely pilose with short, soft hairs, upper surface less densely pilose with more stiff hairs; midrib and 9–10 nerves on either side prominent beneath; minor nervation more or less distinct; petiole 2–8 cm long, shortly tomentose. *Inflorescences* approximate at the end of the branches in an elongate, narrow panicle; peduncles 1–8 cm. tomentose. Pedicels 4–5 mm, angular, thickened in fruit. Bracts lanceolate or narrowly lanceolate, apex cuspate. Two outer *sepal* broadly ovate to elliptic, shortly to long and narrowly acuminate. 8–10 mm long; sepal 3 ovate, shortly acuminate, ca 7½–9 mm long; two inner sepals ovate to elliptic, obtuse, but shortly cuspipdate, ca 6–7 mm long, all pilose outside, glabrous inside. *Corolla* deeply 5-lobed, rose-purple; tube ca 8 mm long, glabrous; lobes linear, ca 18–20 mm long, appressed-sericeous to striigilloses outside, winged towards the apex with glabrous wings. Filaments thickened and verrucose at the base. Ovary glabrous, 2-celled. *Fruit* ellipsoid or subglobose, ca 10–12 mm long, purple-red.

Distr. Malaysia: Borneo.

Ecol. In the jungle, 800–1500 m.

Stems twining, terete or upwards slightly angular, glabrous, pale greyish-brown. Leaves ovate or ovate-oblong, 4–10 by 1½–7 cm, rounded or very slightly cordate at the base, acute to shortly acuminate at the apex, thinly coriaceous, in dry state greyish or olivaceous, glabrous, or with a few hairs on the nerves, mainly on the midrib beneath; nerves 8–10 on either side of the midrib; petiole 2–3½ cm, glabrous. Peduncles in the upper leaf-axils, cymosely 1–3–5–flowered, 2–7½ cm, glabrous or with some hairs. Pedicels of central flower ca 8–10 mm, of lateral flowers often shorter, glabrous. Bracts narrowly triangular, with incurved apex, ca 2 mm long, glabrous. Sepals glabrous, coriaceous; 2 outer ones broadly ovate-triangular, obtuse, 5 mm long, sepal 3 broadly ovate, obtuse, 5 mm long, with one broad thin margin; two inner sepals broader than long, broadly rounded, concave, ca 4 mm long, with two broad thinner margins. Corolla with deeply divided limb; lobes linear, reflexed and twisted, ca 18 mm long, densely sericeous outside, at the apex with 2 triangular glabrous lobules; tube cylindric, ca 8 mm long, glabrous. Filaments geniculate near their thick, broadened base, pubescent. Ovary glabrous, 2-celled. ‘Young fruits oblong-ellipsoid, glabrous, ca 1 cm long’ (MERRILL).

Distr. Malaysia: Philippines (Bohol).

Ecol. In openings in the forest and along streams, 300–600 m.

Note. A fruiting specimen collected in Luzon, Bicol of Tayabas, Kinatutakan, by ORO, For. Bur. 30672. Herb. N.Y., much resembles this species, but has the sepals appressed-pilose outside; fruit ellipsoid, 12-14 mm long, pink.


KEY TO THE VARIETIES

1. Bracts lanceolate, acuminate. Sepals 7–8 mm long
2. Bracts linear, with a long and linear to filiform acumen. Sepals ca 5 mm long

var. barnesii

Stems twining, terete, young parts densely pubescent to tomentose, adult parts glabrescent. Leaves ovate-oblong, ovate or broadly ovate, 6–18 by 3½–13 cm, rounded or cordate at the base, shortly to long-acuminate or caudate and mucronulate at the apex, more or less densely and softly pilose to tomentose on both sides, sometimes nearly glabrous above; nerves 7–9(–12) on either side of the midrib; petiole 2–5 cm, densely pubescent. Peduncles axillary, 2–14 cm long, one-to many-flowered, pubescent like the stem. Pedicels much shorter than or nearly as long as the sepals, elongated in fruit. Bracts lanceolate, acuminate, lower ones ca 1–2 cm long, pubescent on both sides. Sepals nearly equal in length, 7–8 mm long; two outer ones ovate to broadly elliptic, obtuse or mucronulate, pubescent to tomentose outside; sepals 3 broadly elliptic to orbicular, obtuse or truncate, with one glabrous margin; two inner sepals orbicular, emarginate, with two glabrous margins. Corolla 5-parted, lavender; lobes linear, ca 20 by 3–4 mm, densely sericeous outside towards the base, at the apex with 2 triangular glabrous lobules; tube ca 9 mm long, glabrous. Filaments with a tooth above the base, glabrous. Ovary glabrous, 2-celled. Fruit ellipsoid, up to 1½(–2) cm long, purple, at the base enclosed by the slightly enlarged sepals; seed 1, ellipsoid, 1 cm long.


Ecol. In forests at low and medium altitudes forming tangled masses over the tops of trees and larger shrubs.

Use. The stems are used for tying purposes.

Vern. Quahal, guahal, lg.

Note. The density of the indumentum is extremely variable in this species; the leaves are densely tomentose on both surfaces or much less pilose to glabrous above and sparsely pilose beneath; the same is found in the density of the indumentum on stems and inflorescences.


Sepals smaller, 5 mm long. Corolla-lobes glabrous in their basal portion instead of pilose to the base. Bracts narrower, linear, with a long and linear to filiform acumen.


Ecol. In forests, 600 m.

Vern. Cawilan, kaullilan, Man.


Stems twining, sparsely appressed-pilose, glabrescent. Leaves ovate, 6–10 by 3½–6 cm, base truncate or slightly cordate, apex acute to acuminate, upper surface glabrous, lower appressed-pilose, especially along the nerves; nerves 6–8 on either side of the midrib; petiole 2–3 cm, appressed-pilose. Peduncles in the upper leaf-axils, up to 9 cm long, appressed-pilose towards their apex with yellowish-grey hairs; cymes umbellate, few-flowered. Pedicels 2–4 mm, rather densely appressed-pilose. Bracts 8–12 mm long, linear to filiform, with a narrow acumen, hairy beneath, glabrous above. Sepals nearly equal in length, ca 6½ mm long, densely appressed-pilose outside; 2 outer ones elliptic-oblong, obtuse, mucronulate; sepals 3 broader, with one glabrous margin; two inner sepals broadly ovate to orbicular, with two glabrous margins. Corolla 5-parted, whitish outside, purplish or violaceous inside; tube ca 11 mm long, glabrous; lobes linear, recurved and twisted, ca 24 by 3 mm; midpetaline bands sericeous outside towards the apex, and there with two gla-
brous wings. Filaments with slightly dilated, thick, pilose base. Ovary glabrous, 2-celled. Fruit unknown.

Ecol. In forests, ca 450 m, forming dense tangled masses.
Vern. Dalumosp, Bag..

Note. Closest related to 39. A. barnesi and possibly only a variety of that species.


Stems twining, densely appressed-pilose to tomentose, with fulvous hairs. Leaves narrowly ovate or ovate, 8–17 by 3½–9 cm, rounded at the base, attenuate towards the acute or acuminate apex; lower surface densely appressed-pilose with straight or slightly curved hairs, or almost tomentose in youth, upper surface less densely hairy with more rigid hairs; midrib and 8–10 nerves on either side distinctly visible on both sides: petiole 3–8 cm, grooved, pilose like the stem. Peduncles axillary, terete, rather slender, 4–10 cm, densely pilose; flowers in a small, dense, more or less capitate cyme; branches of cyme very short. Pedicels 2–4 mm. Bracts persistent, broadly obovate, rounded to truncate at the apex, ca 10–12 mm long, densely appressed-pilose outside, glabrous inside. Sepals connate, elliptic-oblong, obtuse; two outer ones ca 8 mm long, outside pilose like the bracts, inside glabrous; sepals 3 slightly oblique, ca 7 mm long, outside pilose with one glabrous margin; two inner sepals ca 6½ mm long, nearly glabrous. Corolla deeply 5-fid, pink, the lobes with white tips; tube ca 5 mm long, glabrous; lobes linear, ca 17 mm long, densely hairy outside, with 2 glabrous lobules at the apex. Filaments inserted at the mouth of the tube, glabrous. Ovary glabrous, 2-celled. Fruit unknown.


42. Argyreia celebica Ooststr. Blumea 5 (1943) 377, f. 2, f-g.—Fig. 61b.

Stems twining, 15–25 m high; branches terete, greyish brown, glabrous. Leaves oblong-lanceolate to narrowly ovate-oblong, 7–14 by 3½–5½ cm; rounded or shortly attenuate at the base; gradually attenuate towards the acutish apex, glabrous on both sides; midrib prominent beneath, nerves 6–7 on either side prominent beneath, curved; minor nervation indistinct; petiole 1½–4½ cm, glabrous. Peduncles straight or slightly curved, 2½–9 cm, glabrous, with 2–4, sometimes with more fruits at the apex. Fruiting pedicels up to 10 mm long, slightly angular or sulcate, thickened and often curved towards the apex. Sepals below the fruit broadly ovate-triangular or semi-ombilicular, equal, ca 3–4 mm long, appressed-pilose outside, the reddish margins of sepals 3 and 4 excepted. Fruits often nodding, ellipsoid, up to 1½ cm long (mature?), red; seed 1, ellipsoid.

Ecol. In primary forests and in clearings, 500–1000 m.
Vern. Kunit, pahanap, Manado.

43. Argyreia crispa Ooststr. Blumea 7 (1952) 172, f. 1.—Fig. 61a.

Stems twining, densely pilose with short, sub-patent hairs as are the petioles and the inflorescences. Branches terete or subangular towards the apex. Leaves ovate to ovate-oblong, 8–13 by 4–8 cm, subcordate at the base, acute or obtusish at the apex, glabrous above, pilose beneath, mainly on the nerves; midrib flat above or slightly impressed, prominent beneath, 5–7 nerves on either side prominulous beneath, minor nervation indistinct; petiole 2–6 cm, terete at the base, more or less flattened towards the apex. Fruiting peduncles 8–22 cm long, terete, corymbose branched at the apex. Pedicels 3–5 mm. Bracts caducous. Fruiting sepals unequal; three outer ones ovate, obtuse, ca 10 mm long, pilose outside, glabrous inside, with strongly crisped margins; two inner sepals ovate-oblong, obtuse. ca 8–9 mm long, flat or slightly concave, outside pilose in the middle portion, and with broad glabrous margins. Fruit ellipsoid, 12–14 mm long, purplish-red; seed 1, ellipsoid.

Distr. Malaysia: N. Sumatra.
Ecol. Edges of, and in, first growt hjungle, 1000–1200 m.

Note. See under 46. A. robinsonii (Ridley) Ooststr.

44. Argyreia paucinervia Ooststr. Blumea 6 (1950) 347, f. 1, a.—Fig. 62.

Stems twining, young parts appressed-pilose, soon glabrous, pale fulvous or greyish. Leaves oblong or narrowly oblong to lanceolate, 10–16 by 2–4 cm, acutely attenuate to cuneate at the base, gradually attenuate towards the obtusish apex, in youth very sparsely pilose beneath with short, appressed hairs, afterwards glabrous; glabrous above; midrib and 3–4 nerves on either side rather flat above and beneath; nerves ascending at sharp angles; petiole 1–2½ cm, with some short, appressed hairs, or glabrous. Fruiting peduncles in the upper leaf-axils, 2–3 cm long, with some appressed hairs, glabrescent, cymosely branched at the apex, with divaricate branches and 3–5 fruits. Bracts linear or narrowly spathulate, obtuse, 20–25 mm long (these bracts not inserted at the base of the branches of the cyme, but at the base of the pedicles). Fruiting pedicels 2–4 mm long. Sepals equal in length, ca 6–7 mm long; three outer ones ovate, obtusish at the apex; two inner ones broadly ovate, obtuse to emarginate or irregularly dentate at the apex, all sparsely appressed-hairy in the middle portion, or glabrous. Fruit globose, ca 1 cm diam., red; seed 1, globose.

Ecol. Forest slopes, ca 1000 m.

45. Argyreia samarensis Ooststr. Blumea 6 (1950) 347, f. 1, b.—Fig. 61c.

Stems twining; young parts hirsute, glabrescent, pale fulvous. Leaves broadly to narrowly ovate, (5–)9–14 by (2½–)4–9 cm, base broadly rounded to subcordate, apex acute or slightly acuminate; sparsely hirsute on both sides; midrib 8–11
Fig. 61. a. *Argyreia crispa* Ooststr., fruiting branch, × 1/2, and fruit, × 21/2, b. *A. celebica* Ooststr., fruiting branch, × 1/2, c. *A. samarensis* Ooststr., fruiting branch, × 1/2.
nerves on either side slightly prominent beneath; petiole much shorter than blade, 2-5 cm, hirsute. *Fruiting peduncles* axillary, 4-10 cm long, hirsute, cymosely branched at the apex, bearing 3-8 fruits. Bracts caducous. *Fruiting pedicels* 5-10 mm long, hirsute, thickened above. Two outer *sepals* elliptic, obtuse, 9 mm long, hirsute outside; sepal 3 orbicular with rounded apex, 8 mm long, hirsute, with one glabrous margin; two inner sepals orbicular, rounded to slightly emarginate, 8 mm long, hirsute, with two glabrous margins. *Fruit* ellipsoid or ovoid, ca 18 mm long; seed 1, ellipsoid, ca 15 mm long.

**Distr.** Malaysia: Philippines (Samar).


A twiner with appressed-hairy stems. *Leaves* lanceolate to ovate, 6-12 by 21/2-71/2 cm, rounded or obtuse at the base, subacute at the apex, thinly coriaceous, glabrous above, appressed-hairy beneath; lateral nerves 8 on either side of the midrib, prominent beneath; petiole 1-8 cm, hairy. *Peduncles* 4-18 cm long, hairy. Cymes lax, many-flowered, 1-4 cm long. *Pedicels* 5 mm long. Bracts minute, ovate, acute. *Sepals* oblong, truncate, 4 mm long, glabrous. *Corolla* with a short, glabrous, campanulate, 8 mm long tube; the lobes sericeous outside, glabrous inside, white to purple, reflexed and oblong. Stamens long exserted, filaments filiform, anthers oblong; style slightly shorter than the stamens, stigma capitate (Ridley).

**Distr.** Malaysia: Sumatra (W. Coast). Ecol. At 900 m.

Note. The type of this species is unknown to me. The specimens BANGHAM 840 and 1134 from N. Sumatra, mentioned by MERRILL (Contr. Arn. Arb. 8, 1934, 145) as conspecific, belong to 43. *A. crispa* Ooststr.

**Doubtful**

*Argyreia malabarica* Choisy, A. nellygherya Choisy, and *A. populifolia* Choisy, mentioned by FERNANDEZ-VILLAR, Novissima Appendix (1880) 139, do not occur in the Philippine Islands.


MIQUEL, Fl. Ind. Bat. 2 (1857) 586 mentions a specimen collected in the Moluccas by REINWARDT. This specimen is unknown to me; it is very doubtful that the species occurs in the Moluccas.


It is very doubtful that this species occurs in the island of Timor.

*Rivea hypocrateriformis* Choisy and *Rivea ornata* Choisy, both mentioned for Malaysia by BOERLAGE, Handl. Fl. Ned. Ind. 2 (1899) 513, do not occur there.

**Excluded**

SONNERATIACEAE (concluded)
SONNERATIACEAE AND OTHER MANGROVE-SWAMP FAMILIES,
ANATOMICAL STRUCTURE AND WATER RELATIONS
(C. A. Reinders-Gouwentak, Wageningen)

The question whether tidal and non-tidal members of a family have a separate wood anatomical structure would be examined best in such genera as embrace both types. The sequel to this examination, whether any such differences are connected with peculiarities in the water relations of the plants, should be examined in the same way. There are, however, few genera that comprise both littoral and inland species. In some of these genera, *Excoecaria*, *Ixora* and *Dolichandrone*, wood anatomical data can be compared but water relations among the species have not been examined nor are comparative data from the nearest relatives available.

According to MOLL & JANSSONIUS the mangrove-swamp species possess more vessels per mm² with a larger total area on cross section and the pores are mostly distinctly smaller than in the nearest related inland species. However, data on area JANSSONIUS did not record.

*Excoecaria agallocha* L. has 7–14 vessels per mm² of cross section with a diameter up to 80 μ, whereas these data in *E. virgata* Zoll. & Mor. are 3–6 per mm² and 40–150 μ. The total area occupied in the tidal species by the water conductive tissue is said to be larger than in the non-tidal *E. virgata*. The same relations are found among *Ixora paludosa* Boerl. [KOORDERS & VALETON 8 (1902) 156] and the other Javanese *Ixora* species (MOLL & JANSSONIUS, JANSSONIUS, PANSHIN, PEARSON & BROWN). As regards *Dolichandrone spathacea* (L. f.) K. Schum. and inland species from India, the tidal species *D. spathacea* has 4–6 vessels per mm² with a diameter of 40–150 μ (MOLL & JANSSONIUS, JANSSONIUS) or 9–12 per mm² and 120–130 μ (PANSHIN). In the inland species [D. atrovirens Sprague (= D. crispa Seem.), D. falcata Seem., D. arcuata C. B. Clarke] the vessel number is scanty to rather scanty and the diameter has been classified as small (GAMBLE) which data do not differ appreciably from those found in the tidal species.

With regard to the tidal and non-tidal genera in the same families, JANSSONIUS found the said tendency. The data e.g. for the tidal genus *Sonneratia* and the inland genus *Dnabanga* are 35–40 against 4–5 per mm² and the diameter is 35–175 μ against 130–400 μ respectively. JANSSONIUS also found these relations among genera of the Combretaceae (cf. PANSHIN) and the Meliaceae but less conspicuously in the latter family. Vessels are extremely numerous in *Aegiceras* with 200 per mm² and less so in the other *Myrsinaceae* where 100 or less and 140 at the utmost have been found. An exception is formed by *Heritiera littoralis* Dry., which species with 5,1 vessels/mm² and a pore diameter of 100–175 μ (CHATTAWAY, DEN BERGER) does not differ markedly from the other genera of the Sterculiaceae.

As regards the Rhizophoraceae JANSSONIUS's data seem to point to vessels being more numerous and smaller in the tidal tribe but the data have not been quite confirmed by MARCO.

The tidal species in which the vessel number per cross section is less than 15 per mm² with the exception of *Heritiera* are characterized by thinner-walled libriform fibers with wider lumina (PANSHIN).

The same differences have been recorded between two tidal species of *Sonneratia* of which *Sonneratia apetala* Ham. in the Delta forests of Bengal at a river mouth grows in less salty localities than *Sonneratia griffithii* Kurz. *Sonneratia apetala* has 18–32 vessels per mm² with a diameter of 135–150 μ against the data 34–50 and 85–100 μ in *Sonneratia griffithii* Kurz (PEARSON & BROWN). JANSSONIUS, however, did not find these facts in *Sonneratia alba* J. E. Smith from the outer fringe and *Sonneratia caseolaris* (L.) Engl. from the inner zone of the mangrove swamp formation (Fl. Mal. I, 4, p. 280; TROLL & DRAGENDORFF) in Java, both species showing the same vessel number.

However, in the non-tidal genus *Markhamia* (*M. platycalyx* (Bak.) Sprague; *M. stipulata* Seem. = *Dolichandrone stipulata* Benth. in PEARSON & BROWN) even more vessels have been reported than in the tidal genus *Dolichandrone* (PEARSON & BROWN, HARRIS & EGGELING).
Discrepancy among data such as in the *Bignoniaceae* and in the *Rhizophoraceae* can be attributed to variations due to the place of taking samples in the tree. This statement is supported by the following example. In *Bruguiera gymnorrhiza* Lamk. Pearson & Brown report 40–62 vessels per mm² with a maximum tg diameter of 115–135 μ whereas Janssionius found 25 vessels and a maximum diameter of 115 μ. These facts may mean that the latter author did not examine mature wood. Consequently, future investigators would do well to eliminate the influence of different age and of different height in the tree.

Summarizing the data it may be concluded that there is in the tidal species a tendency towards increase of the number of vessels and the total area of water conductive tissue in the cross section and a tendency towards decrease of the vessel diameter. Not justified seems to be JANSsionius’s suggestion that the variation in number of vessels per unit area in 3 species of *Bruguiera* might be correlated with the different number of every month inundations (De Haan). Cf. Panshin for data on *Bruguieras*.

The anatomy of leaf and stem shows structural features that are called xeromorphic by Mullan and non-xeromorphic by Schmueli. Walter & Steiner avoid using the terms.

**Succulent leaves** are a common feature and induced by the presence of a distinct hypodermal aqueous tissue which in *Someratia* even forms an inner layer of many cells [Walter & Steiner, Mullan (a, c, d)]. In leaves that are immersed during high tide the layer is 3–5 times as thick as at a higher level in the tree and it is almost absent in plants grown in fresh water in botanical gardens. Succulency appears to be a response to the presence of chloride in the medium (Walter & Steiner, van Eyk, see also review by Uphof).

Under mesophytic conditions the salt excreting glandular hairs developed feeibly [Mullan (b)] and salt incrustations failed to appear on the leaves of the plant studied (*Acanthus ilicefolius* L.).

As regards water relations: transpiration, osmotic pressure and suction force have been studied. Transpiration in mangroves and in halophytes in general appears to be low (Walter & Steiner, Walter (b), Adriani, Schmueli) as it was once supposed to be by Schimper, and by no means considerable (see Walter & Steiner, footnote p. 106) as von Faber’s data seemed to suggest (von Faber, Uphof). Transpiration in *Someratia* and other typical mangrove trees if expressed in mg/g fresh weight or in mg/unit leaf area (Walter & Steiner) is equal to or even lower than the water loss in glykophytic tropical trees (Stocker) or in the mesophytes studied by Pisek & Cartellieri (a). Comparative data from the nearest relatives are not available. In recent ecological work in other plant associations transpiration per m² of soil area is studied [Pisek & Cartellieri (b)].

Although not being as high as it was originally thought, the osmotic value in the cells of the leaves is always higher than in the soil or in the sea water. Walter & Steiner with the kryoskopic method found that *Someratia alba* J. E. Smith has an osmotic value of about 32 atms whereas in the soil and in the sea water this value fluctuates between 20 and 25 atms. Similar data have been recorded for other tidal genera. Blum using the plasmolytic method found ca 50 atms in the same (?; ‘*albida*’) species. Sen Gupta (a) with the kryoskopic method found the osmotic values in *Rhizophora* and other mangrove trees in India to be somewhere between those of Walter & Steiner and of Blum. No data are available about the osmotic pressure of related non-tidal species or genera but it is a well known fact that the glykophytes (except some xerophytes) do not show such high values. Such tidal species as are not obligate halophytic (cf. Benecke & Arnold) show lower osmotic values if they are grown artificially in glykophytic conditions (Bogor Botanical Gardens). Blum in the upper epidermis of the leaf of *Someratia caseolaris* (L.) Engl. (*S. comoda*) calculated the pressure to be 22 atms whereas in the natural habitat this value was 27 atms. The same conditions prevail in connection with the salinity of the natural habitat, the higher value being found in the seaward zone. Walter & Steiner found the osmotic pressure in *Avicennia marina* (Forsk.) Vierh. var. typica Bakh. ranging from 35–46 atms. Sen Gupta (a) is confirming this statement for all species studied by him with the only exception of *Excoecaria agallocha*.

In this species the higher value of 43 atms has been found in the brackish
water with the lower osmotic value, whereas in a more salty habitat 26 atms were calculated. No explanation has been presented for this apparently exceptional case.

Sen Gupta (b) studied the annual variation of osmotic values and found low values at the time of flowering and fruiting.

It seems now well agreed that von Faber's data of 60–160 atms are overrated and due to methodic errors.

Cooper & Pasha and Blum are bringing data on the *suction pressure* values of mangrove swamp plants [see also Walter (a)]. In the lower littoral zone where the sea water always covers the ground suction pressure did not vary with the tides and in *Rhizophora conjugata* was found to be 33 atms. In plants growing in brackish water in the vicinity of river mouths e.g. in *Sonneratia caseolaris* (*S. acida*), there is a difference of about 5 atms, the higher value (27 atms) being found during high tide against 23 atms at low tide. Contrarily, in plants from more saline localities, as in *Sonneratia alba* (*S. albida*), the higher value of 40 atms has been found during low tide and the lower one of 34 atms at high tide. The difference between suction pressure at a level of 8 m in the tree and substratum was found by Blum to be *ca* 20 atms. Blum for purposes of comparison studied suction pressure in trees of the rain-forest and found values of 15,1 atms and 0,3 atms in leaf and soil. Only one tree species has been mentioned by name: *Excoecaria agallocha* which species is not an inland species but a mangrove plant and as such is not the right example to illustrate differences in suction pressure in the rain-forest soil.

Cooper & Pasha found high osmotic values and suction force values with little difference between the two figures. An increase was found from July to October [60–80 atms].

Summarizing physiological and anatomical data we may conclude that succulency, formation of glandular hairs, osmotic pressure and suction force values are to a certain extent depending on environmental conditions. Further research about the water balance especially about the saturation deficit of mangrove tree species and related inland species will have to be awaited (cf. Rouschal; Crafts et al.). The smaller diameter of the pores in the mangrove tree might be advantageous as in such narrow vessels the rupture of the water column may be hampered. Whether the larger area of water conductive tissue in the tidal species would be advantageous also, depends on physical properties that cannot be discussed here. The anatomical data, however, will have to be verified in connection with the variations resulting from wood samples taken in different annual rings and at different heights in the tree.

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FLORA MALESIANA
PENTAPHRAGMATAEAE (H. K. Airy Shaw, Kew)

Airy Shaw, Kew Bull. 1941, 233 (1942); Lemée, Dict. Descr. Suppl. 9 (1951) 201.

Perennial ± succulent herbs, often somewhat woody and procumbent and rooting at the base, often clothed with branched multicellular hairs; habit sometimes recalling certain Gesneriaceae (Cyrtandra, etc.). Leaves alternate, simple, mostly ± asymmetrical, sinuate-denticulate or subentire, ± fleshy, petiolate, exstipulate. Inflorescences axillary, cymose, often scorioid, acropetal, solitary or 2–3 together in each axil. Bracts usually rather large and membranous. Flowers hermaphrodite (rarely unisexual), actinomorphic (calyx excepted), shortly pedicelled or sessile. Calyx-tube campanulate or linear-cylindric, adnate to the ovary by means of 5 longitudinal septa formed by the continuation of the filaments, leaving 5 deep nectariferous pits below the petals; lobes 5, imbricate, mostly membranous, persistent, unequal (2 larger and 3 smaller), coloured (mostly whitish). Corolla inserted at the apex of the calyx-tube, variously gamopetalous or less frequently choripetalous, ± campanulate, mostly fleshy or cartilaginaceous, occasionally delicate in texture, persistent, segments or petals 5 (rarely 4), valvate (sometimes induplicate), often reflexed at the apex. Stamens 5, alternipetalous, shortly adnate to the corolla (when gamopetalous); filaments persistent; anthers ovate, oblong or linear, introrse, basifixed, dehiscing by slits. Ovary inferior, 2-locular; placentas axile, bifid, multi-ovulate; style short, thick, simple; stigma massive, oblong-cylindric, often strongly 5-ribbed. Ovules very minute, very numerous, pendulous, anatropous, with 1 integument. Fruit baccate, indehiscent. Seeds minute, ovoid; testa reticulate, brown; embryo minute; albumen copious.

Distr. One genus. From Lower Burma, Indo-China and Kwantung, throughout Malaysia to Central New Guinea–Java and the Lesser Sunda Islands excepted. Fig. 1.

Ecol. Damp primary rain-forest, often on rocks by streams, up to 4000 m.

Uses. Unimportant, as vegetable or medicine.

Notes. The family is a very isolated one. It is possible that there may be a remote connection with the Campanulaceae, with which it has long been associated, but the anatomy (see Metcalfe in Airy Shaw, l.c.) shows strong affinities with that of the Begoniaceae—an affinity also suggested by the asymmetrical leaves—and the habit recalls some of the Gesneriaceae (cf. Cyrtandra, Epithema, etc.) and even Rubiaceae (Argostemma). It is not at present possible to suggest a satisfactory place for the family in any recognized system.

Ridley (l.c. infra) states that ‘plants with double flowers occur in most, if not all, the species’ (of the Malay Peninsula). I cannot confirm this; I have never observed double flowers in Pentaphragma.

1. PENTAPHRAGMA

Wall. ex G. Don, Gen. Syst. 3 (1834) 731; A. DC. Prodr. 7 (1839) 495; Miq. Fl. Ind. Bat. 2 (1857) 568; Benth. & Hook. f. Gen. Pl. 2 (1876) 558; Clarke in Hook. f. Fl. Br. Ind. 3 (1881) 437; Baillon, Hist. Pl. 8 (1886) 323–4, 358; Schönländ in E. & P. Nat. Pfl. Fam. 4, 5 (1889) 60; Boerl. Handl. 2 (1891) 257; King & Gamble, J. As. Soc. Beng. 74, 2 (1905) 55; Ridley, Fl. Mal. Pen. 2 (1923) 202; Lemée, Dict. Descr. 5 (1934) 134; op. cit. Suppl. 9 (1951) 201.

For characters see family description. Pentaphragma Wall. ex DC. Mon. Camp. (1830) 95, a superfluous name for Secaevola, is a nomen nudum and is discarded.
Fig. 1. Distribution of the genus *Pentaphragma*. In each island or island group the figure above the line indicates the number of endemic species, the figure below the line the number of species which are known from more than one island or island group. The corresponding figures from SE. Asia, outside Malaysia, have been derived from literature and are questionable, as the material on which they are based has not yet been revised.—Ed.

**Distribution.** About 25 spp. known, with main concentration in Borneo, where many more probably remain to be discovered. It is noteworthy that there are only 7 known Malaysian species which do not include Borneo as at least part of their known area: *P. begonifolium* (northern Malay Peninsula, extending into Lower Burma and Peninsular Siam); *P. bartlettii* (Sumatra); *P. combretiflorum* (Natuna Isl.); *P. mindanaense* (Philippines); and the three large-flowered species, *P. grandiflorum*, *P. platyphyllum*, and *P. lanuginosum* (Philippines—Moluccas—New Guinea).

**Key to the Species**

1. Stems with conspicuous raised lines or ridges, not caused by shrinkage in drying, running down from the decurrent leaf-bases (inflorescence not distinctly scorpoid).
5. Leaves not thick and leathery (or if thickish, other characters not as above), mostly papery or membranous when dry. Bracts always ± membranous.
6. Flowers unisexual (or only known), delicate in texture. Calyx-tube elongate. Petals very delicate, lingulate, free. Leaves almost symmetrically ovate, subcordate at the base, rounded at the apex. *P. tenuiflorum.*
7. Flowers 6. Corolla ± fleshy or cartilagineous (except in *P. jaherii*). Leaves not cordate or subcordate (except in *P. platyphyllum*).

7. Corolla delicate in texture (segments free or almost so, externally pubescent). Stem dwarf, 5 cm. (Leaves thickish).

8. Leaves conspicuously cordate at base (± hirsute below, up to 28 by 20 cm. Inflorescence large, lax, ± hirsute). Sepals large, rounded, the larger ones 2—2½ by 1½ cm. 2. P. platysphyllum

9. Leaves not (or only slightly and occasionally) cordate at base. Sepals mostly smaller, if as long or longer, then proportionately narrower.


11. Leaves usually or more distinctly ovate or obovate, often ± recurved at apex. Similar to P. hirsfieldii, but flowers twice as large.

12. Flowers 5—8 (rarely 10) mm long. Inflorescences usually strongly scorioid.

13. Calyx-tube 3—8 mm long. Calyx-tube not more than 2 cm long.


15. P. jaherii

16. Calyx-tube cylindrical or ellipsoid or fusiform-lanceolate, 10—15 mm long, shortly pubescent. Inflorescence scorioid or subscorioid. Flowers usually more numerous.

17. Sepals inconspicuous, recurved, oblong, 2—3 cm long, not constricted at base, flat. Inflorescence shortly scorioid when young, later becoming lax and elongate.

18. P. horsfieldii

19. P. acuminatum

20. P. platysphyllum

21. P. angustifolium

22. P. viride

(1) Most segregates of the presumed hybrid P. x ellipticum POULS. will also key out here.


Stem usually robust, up to 2½ m high and 1 cm thick, glabrous or sparingly pubescent. Leaves ± obliquely elliptic, up to 45 by 20 cm, cuneate at base, shortly acuminate or apiculate at apex. Shallowly denticulate or serrate at margin, membranaceous when dry, glabrous above, finely puberulous to glabrescent below; nerves c. 6 pairs; petiole up to 10 cm, glabrous or puberulous. Inflorescences arising mostly singly from 1—4 upper axils, shortly subscorioid when young, becoming lax and elongate at anthesis, up to 6

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(rarely 10) cm, long- or short-peduncled. Bracts very variable, sometimes small and inconspicuous, sometimes large, lanceolate or elliptic, up to 3 by 1 cm. Flowers extremely variable, 31/2-91/2 cm long. Calyx-tube subcylindric or very narrowly obconic, 3-81/2 cm by 1-4 mm, very gradually attenuate below into the pedicel (and indistinguishable from it until fruit develops), sometimes conspicuously 5-ridged, glabrous or puberulous. Sepals very variable, from linear-oblong, 12 by 2 mm, acuminate, to ovate, 29 by 14 mm, subacute or rounded, white. Corolla fleshy, choripetalous or almost so, segments elliptic-ovobovate, 8-12 by 3-5 mm, rounded or acute, glabrous, ± erect, often recurved at apex, yellow. Filaments c. 1 mm; anthers c. 2 mm. Style about 2 mm; stigma oblong, 3 by 2 mm, 5-ridged.

Distr. Malaysia: Philippines, Moluccas (Batjan, Ceram, Buru), New Guinea.

Ecol. Damp primary rain-forest at low and medium altitudes (up to 1000 m), on limestone as well as sandstone; fl. & fr. throughout the year.

Uses. A recent Philippine collector suggests (in sched.) that the flowers are sufficiently showy to render the plant suitable for ornamental purposes.

Vern. Bugaong, handanata, pitun, saling-bangung, Philippines, nina kope, Ceram.

Notes. Examination of a rather extensive series of specimens from the Philippines and W. New Guinea, and of a smaller number from the Moluccas, has convinced me that it is at present impossible to recognize more than one, very variable, species within this group. Certain local trends are perceptible, such as great elongation of the hypanthium, reduction of indumentum and narrowing of sepals in New Guinea, and rounding of sepals and greater development of pubescence in the Philippines, but the variations seem to be quite continuous and uncorrelated, and it is impossible to fix lines of demarcation between the three species hitherto recognized. Kurz's somewhat neglected species provides the earliest name for the group in the aggregate.

The eastern limit of the species in New Guinea appears almost to coincide with the boundary of Indonesian territory, since, although it has been collected many times to the west of this line, the only evidence for its occurrence east of it rests upon two specimens from the Fly River, collected both by d'Albéris in 1877 (in Herb. Beccari) and by Brass in 1936 (cited by Merrill & Perry, l.c., 1941).


Stem robust, up to 50 cm long, densely crispate-pubescent on the younger parts. Leaves large, broadly ovate to elliptic-ovate, slightly oblique, up to 28 by 20 cm, base cordate, apex very shortly triangular-cuspidate, subacute, margin rather distantly and shallowly denticulate, papyraceo-chartaceous when dry, glabrous above, thinly crispate-strigose below (densely when young), especially along the nerves; nerves 5-6 pairs; petiole up to 10 cm. Inflorescences apparently arising singly in 2-3 upper axils, pubescent, up to 8 cm long. Bracts narrowly oblong, to 1 cm. Pedicels about 11/2 cm. Calyx-tube slender, elongate, up to 3 cm, terete or obscurely angled, ± pubescent. Sepals elliptic, the two larger 2-21/2 by 11/2 cm, the remainder about half as large, rounded, white. Petals oblong to narrowly oblong-obovate, c. 10 by 5-6 mm, rounded, fleshy.


Ecol. Primary rain-forest along small streams at low altitudes; fl. May.

Notes. Distinguished from the closely related P. grandiflorum and P. lanuginosum principally by its cordate-based leaves.


Stem robust, but of unknown stature, 7-12 mm thick in upper part, shaggy. Leaves obliquely obovate, 25-35 by 12-17 cm, base cuneate, apex rounded to subacute, usually very shortly apiculate-acuminate, margin denticulate often revolute, membranous when dry, glabrous above, shortly hispidulo-pubescent below, ± conspicuously crispsulo-shaggy along the midrib and larger nerves; nerves c. 6 pairs; petiole robust, 3-51/2 cm by 4-8 mm, strongly crispsulo-shaggy. Inflorescences arising singly from 1-2 upper axils, at first subscorpioid, soon becoming lax and elongate, 10-12 cm long, 10-20-flowered; peduncle 11/2-2 cm, rhachis up to 7 cm, both shaggy. Bracts broadly ovate to oblong, acute, 10-15 by 3-10 mm, membranous, puberulous on the back. Flowers large, up to 6-7 cm long. Calyx-tube elongate, very narrowly obconic, very gradually widened upwards, 4-5 cm by 3-5 mm, crispsulo-flocose. Sepals narrowly or broadly ovate, 13-17 by 4-12 mm, acute, membranous, sparsely crispsulo-flocose on the back, otherwise glabrous. Corolla apparently choripetalous, or exceedingly shortly gamopetalous, fleshy, ± crispsulo-flocose outside; segments oblong-elliptic, c. 12 by 5 mm, subacute, margins flexed. Filaments ± 2 mm; anthers linear, ± 3 mm, acute. Style thick, 2-3 mm; stigma cylindric, 5-ribbed, 3 by 11/2 mm.

Distr. Malaysia: Moluccas (Sula Islands: Taliabu); once collected.

Notes. Distinguished from the closely related P. grandiflorum and P. platyphyllum by the dense shaggy indumentum.


Stature unknown, probably 60 cm or more; stems robust, up to 12 mm thick, fistular, glabrous, glossy, dark red when dry, conspicuously costate-winged from the long imbricate-decurrent petiole-bases, wings 1-2 mm wide. Leaves broadly ovate to broadly elliptic, slightly oblique, 17-22 by 8-111/2 cm, ± rounded to broadly cuneate at base, broadly acute at apex, passing into a cusp or short acute acumen, margin rather coarsely crenate-dentate, firmly papyraceous when dry, glabrous above, densely shortly hispidulo-pubescent below; nerves 3-5 pairs; petiole (free part)
anthers oblong, 2 mm. Style very short, stigma 3 mm long, cylindric-pentagonal. Fruit turbinate-obovoid, 10 by 5–6 mm, densely crispate.

**Distr. Malaysia:** Malay Peninsula, Borneo (NE. Sarawak & Mt Kinabalu), Philippines (Palawan).

Ecol. Primary rain-forest, and upper dwarfed forest, 1500–2700 m; fl. & fr. March–April, June–September, December. Apparently not infrequent on Kinabalu.

Notes. The form described by Ridley as *P. grande* differs from the type of *P. aurantiacum* in its apparently more opaque and thickly coriaceous leaves, with shorter hairs on the lower surface. This form has, however, also been gathered on Mt Kinabalu (between Kamburangan and Paka, 2700 m, CLEMENS 28999), and as it appears to show no significant differences in floral structure it seems preferable to consider it for the present as a form of *P. aurantiacum*.

The range in flower colour is noteworthy, various collectors giving it as bright red with green sepal, orange, salmon yellow with green throat, yellow, and dirty white. It is possible that this sequence corresponds to the progressive age of the flowers.

The species is characterized by its generally robust habit and short, non-scorpiod inflorescences of large, somewhat turbinate, densely crispate-pubescent flowers.


Stem robust, up to 90 by 1.2 cm, sparsely puberulous above, otherwise glabrous, sometimes conspicuously lenticellate. Leaves obliquely ovate, 11–22 by 6–13 cm, cuneate to truncate-rounded at base, very shortly cuspitate-acuminate at apex, margin closely undulate-denticulate, often reflexed and then appearing entire, membranous and somewhat translucent when dry, glabrous above, scantly hispidulous-pubescent below; nervules 2–4 pairs, usually densely crista-crispulo-pubescent below; petiole 2–6 cm, glabrous or glabrescent. Inflorescences 1–3 on each stem, from the upper axils, 2–8-flowered; peduncle 5–8 cm, pubescent. Lower bracts broadly ovate, about 10 by 7 mm, acute, coarsely papillate, upper ones smaller and narrower. Flowers large, nearly 2 cm long, very shortly pedicelled. Calyx-tube turbi-nate-obovoid, 8–10 mm long, densely crispate-pubescent. Sepals broadly or narrowly oblong, 6–8 by 2–5 mm, obtuse, reticulate-nerved, crispulo-pubescent outside, almost glabrous within. Corolla 2–2½ cm across when expanded, slightly or scarcely fleshy, sympetalous for 1½ or more, very sparsely puberulous outside, segments broadly obovate, 7–8 mm wide, subacute, junction of adjacent segments marked internally by double thickened suture. Filaments flattened, 3 mm long:


Stem robust, up to 60 cm high, mostly glabrous or glabrescent and lenticellate, but sparsely crispate-pubescent on the young parts. Leaves broadly elliptic to broadly ovate, slightly oblique, 11–24 by 5½–13 cm, cuneate-attenuate at base, acute and very shortly acuminate or cuspidate at apex, obtusely sinuate-denticulate or undulate-serrate, glabrous above, shortly and sparsely hispidulous-pubescent below, more densely so on the nerves; nerves 3–4 pairs; petiole 2½–5 cm, shortly hispidulous or glabrescent. Inflorescences robust, shortly scorpioid, arising singly (? rarely 2 together) from 1–5 upper axils, 3–6 cm long, rather densely and shortly crispate-pubescent; peduncle 5–10 mm. Lower bracts oblong-ovate, up to 2 by 1 cm, membranous, minutely hispidulous, upper ones gradually diminishing in size. Pedicels 0–2 mm long. Flowers large, c. 2 cm long at anthesis, but rapidly elongating to c. 3 cm in fruit. Calyx-tube narrowly fusiform-lanceolate, c. 10 by 2–3 mm, attenuate above, shortly pubescent. Sepals large, membranous, oblong-elliptic, c. 13–15 by 3–8 mm, round-ed-obtuse, erose-denticulate, sparsely to densely crispate-pubescent outside. Corolla 6–7 mm long, gamopetalous to c. 1½, segments ± lanceolate or narrowly triangular, c. 3 mm wide at base, apex acute, spreading but not usually strongly reflexed, ± fleshy. Stamens about 3 mm long; anthers oblong, apparently often abortive. Style thick, 2–3 mm; stigma oblong, pentagonal, 2 mm long. Fruit ellipsoid, 15–20 by 3–5 mm, ± crispate-pubescent.

Stem 10–20 cm long, ± prostrate. Leaves broadly elliptic to ovate, slightly oblique or almost symmetrical, 8–25 by 5–13 cm, base cuneate or rounded or slightly truncate-cordate, apex rounded or subacute, margin usually very closely sinuate-denticate-crenulate, sometimes revolute and then apparently subentire, glabrous above, rather furfuraceous below (occasionally glabrescent between the nerves), coriaceous-fleshy when dry, mostly grey-olive above, pale ochraceous beneath; nerves 3–7 pairs; petiole 21/2–13 cm, mostly elongate. Inflorescences arising singly or in pairs from upper axils, capitate, not or scarcely scorpioid, 11/2–4 cm in diam., 6–10-flowered; peduncle up to 1 cm, sometimes almost absent. Bracts broadly elliptic, mostly herbaceous, the lowest 10–18 by 6–7(–12) mm, acute. Flowers 1–2 cm long, or sometimes up to 3 cm. Calyx-tube obovoid or ellipsoid, 8 by 2–3 mm, or sometimes narrowly fusiform, up to 2 cm by 3–4 mm, angled. Sepals elliptic, very unequal, 8–13 by 3–6 mm, subacute. Corolla gamopetalous, 7–10 mm long, tube urceolate-campanulate, 4–7 mm long, segments revolute, 21/2–3 mm wide. Stamens 4 mm long; anthers subulate. Style thick, stigma pentagonal-cylindric 2–3 by 1 mm. Fruit ellipsoid, up to 15 by 7 mm.

Distr. Malaysia: Malay Peninsula (Trengganu, Pahang), Borneo.

Ecot. Primary rain-forest up to 1800 m; fl. & fr. March, June–Sept., Nov., Dec.

Notes. The thick, fleshy-coriaceous, often densely crenulate-denticate leaves, and the subsessile inflorescences of few, rather large flowers, with large, firm, not or scarcely membranous bracts, are characteristic of this species. The more or less prostrate stem, often long-petioled leaves, and capitate, subsessile inflorescence, are suggestive of some of the Gesneriaceae-Cyrtandroideae. The species has been described from almost a dozen collections, and shows some variation; it is possible that the material from SE. Borneo may even be distinct, but it seems preferable for the present to include it within the species.


Stature unknown; stems robust below, up to 9 mm thick, smooth, glabrous except for the sparsely crisulo-pubescent young parts, leafy. Leaves very broadly elliptic or obovate-elliptic, hardly asymmetrical, 13–19 by 7–131/2 cm, base cuneate-attenuate, rarely ± rounded, sometimes slightly unequal-sided, apex very broadly cuspidate-acuminate, margin very shortly undulate-denticulate, thinly papery in texture when dry, glabrous above, very shortly and sparsely papillose-hispidulous or almost glabrous below, quinquplinerved or rarely sepultinerved; petiole 3–51/2 cm, slender, glabrous. Inflorescences arising singly or two together from 4 of the upper axils, shortly or rather elongate-scorpioid, 1–31/2 cm long, 4–20-flowered, flowers elongate, arranged very regularly, parallel, recalling the inflorescence of some Combretum; peduncle 7–8 mm long, crispulo-puberulous; bracts small in proportion, ovate, 5–7 by 3–5 mm, the lowest one sometimes larger, up to 12 mm long, membranous, ciliolate, puberulous on the back; pedicels none. Flowers 1 1/2–2 cm long. Calyx-tube at first almost cylindric, then narrowly fusiform-lanceolate, almost rostrate, 11–13 by 1–3 mm, ± pentagonal, striate, sparsely puberulous. Sepals oblong-ovate or oblanceolate, 4–5 by 1–4 mm, rounded, membranous, puberulous on the back. Corolla campanulate, gamopetalous for more than 1/2 (later more deeply split), 6 mm long, 5 mm wide, sparsely or rather densely crispulo-puberulous outside, segments oblong or ovate, erect, suborbiculate on the back, acute or subacute and recurved at apex. Filaments 21/2 mm; anthers narrowly linear-lanceolate, 11/2 mm, acutely apiculate. Style 2 mm; stigma oblong, pentagonal, 2 mm long. Mature fruit not seen; young fruit fusiform-lanceolate, 13 by 4 mm. Seeds dark chestnut, apparently completely immersed in placental tissue.

Distr. Malaysia: Natuna Islands (Bunguran): twice collected.

Ecot. Stated to be frequent in primary forest at ca 600 m; fl. April–May.

Notes. The almost symmetrical, broadly elliptic leaves, and subscorpioid cymes of elongate parallel flowers, render this a very distinct species.


Stems up to 50 cm by 5–10 mm, conspicuously crisulo-pubescent in younger parts. Leaves obliquely elliptic-lanceolate or elliptic-ovate or almost regularly elliptic, 15–23 by 6–9 cm, broadly cuneate at the base, narrowed to the obtuse apex, entire or most obscurely undulate-crenate, membranous, glabrous above, sparsely crisulo-puberulous below (rather densely on the nerves); nerves 4–5 pairs; petiole 2–3 cm long, pubescient. Inflorescences arising 1–3 together from 1–3 upper
axils, shortly scorpioid when young, elongating and scarcely scorpioid at anthesis, up to 10-12-flowered, 2-5 cm long including 1-11/2 cm long pubescent peduncle. Bracts inconspicuous, elliptic or subspatulate, 7-10 by 3-4 mm, obtuse, membranous, ciliate. Pedicels 1-2 mm. *Flowers* 8-10 mm long. Calyx-tube obconic or oblong or ellipsoid, attenuate into the pedicel, 6-8 by 3-4 mm, crispulo-puberulous. *Sepals* small and inconspicuous, oblong, 2-3 by 1-2 mm, membranous, obtuse, puberulous, recurved. *Corolla* shortly and widely campanulate, 3-4 mm long, fleshy, gamopetalous for 1-2 mm; segments deltoid, 2 mm long, 11/2-2 mm wide at base, acute, ± erect. Filaments c. 2 mm; anthers not seen. Style very short and thick; stigma conical-pileiform, 1.3 mm diam. *Fruit* broadly ellipsoid, 9 by 5 mm.

**Distr. Malaysia:** Philippines (Mindanao); twice collected.


Notes. The small recurved sepal and erect, acute, deltoid corolla-segments, suggesting a 5-pointed crown, are characteristic of this species.


Stem up to 70 cm high, upper part ± hispidulopilos, the young parts rather densely crispate-pubescent. *Leaves* broadly ovate or broadly elliptic, slightly oblique, 18-25 by 9-12 cm, rounded to cuneate-attenuate at base, ± rounded or narrowed and very shortly cuspidate-acuminate at apex, margin closely crenulate, often ± bullate, glabrous above, very shortly and rather densely hispidulo-puberulous below; nerves c. 5 pairs; petiole 27/2-41/2 cm, hispidulous. *Inflorescences* small, subglobose-captate, arising singly or in pairs from 2-3 upper axils, 11/2-21/2 cm diam., often dark brown when dry, very shortly pedunculate. Lower bracts ovate, acute, c. 10 by 5 mm, papillospe- llose-puberulous on the back. Pedicels almost none. Calyx-tube obconic, c. 5-6 by 3-4 mm, shortly crispate-puberulous. *Sepals* very broadly ovate-elliptic or suborbicular, 4 by 2-4 mm, slightly constricted at the base, broadly rounded at the apex, margins quite entire and slightly reflexed and hence subconvex, glabrous, or puberulous on the back towards the base. *Corolla* c. 4 mm long, shortly (1 mm) gamopetalous, slightly fleshy, segments deltoid, acute, erect, 2 mm broad at base, margins slightly thickened and slightly involute below the apex. Stamens not seen. Style c. 1 mm; stigma discoidally expanded. *Fruit* ellipsoid-ovoid, c. 10 by 5 mm.

**Distr. Malaysia:** Sumatra; several times collected.

Ecol. Damp places and tuff cliffs in primary forest, up to 1850 m; fl. & fr. April-May, Nov.—Dec.

Notes. Characterized by the elongate stem, frequently bullate leaves, rather small subglobose inflorescences often drying dark brown, entire, glabrous, suborbicular sepals, and erect, deltoid-acute corolla-lobes.

11. **Pentaphragma decorrens** AIRY SHAW, Kew Bull. (1953) 244.

Stem 15-20 cm by 4-6 mm, smooth, glabrous, marked with 4-5 conspicuous raised lines from the decurrent petiole-bases. *Leaves* broadly ovate-elliptic, slightly oblique, 20-21 by 9-11 cm, cuneate-attenuate at base, narrowed and acute (sometimes shortly subacuminate) at the apex, margin very obscurely denticate or subentire, rather thick in texture, quite glabrous; nerves 4-5 pairs; petiole 11/2-21/2 cm by 2-4 mm, apparently acutely keeled on the back, glabrous, conspicuously decurrent. *Inflorescence* apparently single on each stem, arising from an upper axil, not or scarcely scorpioid. 3-4 cm long, 10-12-flowered, glabrous except for the ciliolate bracts and sepals. Lower bracts 12-14 by 4-7 mm, elliptic, acuminate, subentire or sparsely ciliolate, submembranous, the upper ones smaller and more strongly ciliolate. Peduncle c. 11/2 cm. Pedicels almost absent. Calyx-tube shortly ellipsoid-ovoid, 5 by 2-3 mm, ± angled, glabrous. *Sepals* subspatulate-elliptic, 4-5 by 21/2-2 mm, not very unequal, rounded at apex, erose-ciliolate, separated by rounded sinuses. *Corolla* known only from buds and damaged open flowers, apparently almost chori petalous; segments elliptic-ovobate, 3-4 by 11/2-2 mm, thinly petaloid in texture (not fleshy), the margins ± induplicate-valvate in bud, apparently soon falling or broken off. Stamens known only from the bud: filaments very short; anthers ovate, apiculate, 1-11/2 mm long. Style very short; stigma shortly pentagonal-cylindric, c. 1 mm long. *Fruit* shortly oblong, 8 by 4 mm.

**Distr. Malaysia:** Borneo (Sarawak); several times collected.

Ecol. Unknown, but doubtless rain-forest; fl. Aug.

Notes. Very distinct in the raised decurrent lines on the stem (the only other known species showing this feature being the very different *P. insigne* AIRY SHAW) and in the petaloid texture of the apparently almost free corolla-segments, which are more or less induplicate-valvate in bud.


Stem 10-20 cm long, slender, glabrous. *Leaves* subfalcately elliptic or ovate, 11-18 by 5-61/2 cm, cuneate-attenuate at base, subacute, subacuminate and acute at apex, margin undulate-serrate, very thin in texture, quite glabrous; nerves 2-4 pairs; petiole very slender 1.3-2 cm. *Inflorescences* arising singly from the 1-3 uppermost axils, 6-12-flowered, rather lax, not scorpioid at anthesis, 2-3 cm diam.; rhachis up to 11/2 cm; peduncle 5 mm, minutely rametaceous-hispidulous. Bracts linear-spatulate (except for the lowest which is elliptic-oblong), c. 10 by 1-2 mm, attenuate at the base into a 2-3 mm long petiole, obtuse or emarginate at apex, membranaceous, glabrous. Pedicels slender, 2-3 mm, glabrous. *Flowers* 8-10 mm long, glabrous. Calyx-tube narrowly ellipsoid, 4-5 by 1-2 mm. *Sepals* spatulate-oblong, 5-6 by 11/2-2 mm, obtuse or retuse, erect or slightly
patent, less unequal than in most species. *Corolla* 4–5 mm long, gamopetalous to beyond the middle; segments oblong-ovate, 1.3 mm wide, subobtuse, erect, recurved at apex. Filaments c. 2 mm; anthers oblong, 1 mm. Style 11/2 mm; stigma thickly pentagonal-discoïd, 1 by 0.8 mm, 5-lobulate. *Fruit* ellipsoid, 7–8 by 3–4 mm, attenuate at base. 

**Distr. Malaysia**: Borneo (Sarawak); twice collected.

Ecol. Unknown, but probably primary rain-forest; fl. & fr. August.

**Notes.** In foliage scarcely distinguishable from *P. acuminatum* AIRY SHAW, but differing strongly in the lax inflorescence with elongate rachises, conspicuous linear-spatulate upper bracts, and elongate oblong-spatulate sepals.


Stem c. 10 cm high, glabrescent below, crispate-setulose. *Leaves* obliquely broad-ovate, 13–19 by 8–11 cm, rather broadly cuneate at base, almost rounded at apex and narrowed into a very short subacute cusp (sometimes almost absent), very obscurely shallowly sinuate-crenulate, glabrous above, shortly pubescent on the nerves below; nerves 2-4 pairs; petiole slender, 2–3 cm, glabrescent. *Inflorescences* arising singly from 1–2 of the upper axils, shortly and densely scorpioid, 21/2–3 cm long, c. 12–14-flowered, peduncle 5–10 mm. Lower bracts broadly elliptic-ovate, c. 8 by 6–8 mm, membranous, pubescent, the upper ones smaller. Pedicels almost none. Calyx-tube ellipsoid, 3 by 11/2 mm, pubescent. *Sepals* 5, obovate or spatulate-ovoblate, c. 5 by 2–3 mm, obtuse, membranous, hispidulous, ciliolate. *Corolla* segments 4, rarely 5, almost free or very shortly connate at base, unguiculate-spatulate, the 'claw' erect, broadly oblong, 2 mm, the 'limb' ± spreading or recurved, ± flat or somewhat twisted, broadly elliptic, 3 by 21/2 mm, subacute, margin quite entire and conspicuously pale when dry, as though cartilaginous. Filaments slender, 1 mm, anthers linear, 2 mm. Stigma sessile or sub sessile, thickly pelliform or subcerebriform or excavated at the summit, 1 by 11/2–2 mm. *Fruit* ellipsoid, 8–10 by 3–4 mm, sparsely pubescent.

**Distr. Malaysia**: N. Borneo; twice collected.


**Notes.** Very distinct in its usually 4-merous corollas, almost free unguiculate-spatulate petals with flattish spreading pale-margined limb, and (?) always sub sessile pelliform stigma.


Stem 15 cm by 7 mm, glabrous except for the young parts. *Leaves* elliptic-ovate or ovate, 91/2–16 by 7–10 cm, truncate-rounded or subcordate at base, obtuse or ± rounded at apex, margin very closely and finely undulate-crenulate, rather thick, glabrous above, minutely and remotely hispidulous below, nerves densely crispulo-puberulous; nerves 3–4 pairs; petiole 4–6 cm. *Inflorescences* apparently arising up to 4 together from 3–4 upper axils, ca 4-flowered, apparently weak. *Flowers* elongate, congested at the apex of the 11/2–2 cm long peduncle. Bract at middle of peduncle oblong-elliptic, 10–12 by 5 mm, shortly acuminate, bracts subtending flowers broadly ovate-elliptic or spatulate-elliptic, 15 by 9 mm or 15 by 6–7 mm or 10–11 by 3 mm, acute or rounded, papilllose or glabrous on back, margin ciliolate. *Flowers* apparently dioecious, males only known, erect (?), 21/2 cm long. Calyx-tube elongate, cylindric, 1.6–1.9 cm by 2–3 mm, very shortly and sparsely pilose. *Sepals* ovate-elliptic or oblong-elliptic, 8–9 by 3–5 mm, rounded or obtuse, minutely sparsely ciliolate, membranous. *Petals* free, lingulate, 8–9 by 11/2–1.8 mm, obtuse, delicate or 'pellolid' in texture, ± induplicate-valvate in bud. Stamens very short: filaments 1–11/2 mm; anthers oblong, slightly incurved, thick, 2 mm. No trace of ovary or style. Female flowers and fruit unknown.

**Distr. Malaysia**: Borneo (Sarawak); once collected.

Ecol. Unknown, but doubtless rain-forest; fl. May.

**Notes.** This is the only dioecious *Pentaphragma* known. The free petals, of delicate texture and with infolded margins in bud, resemble in these respects those of *P. decurrens* and *P. jaerii*, but are longer and narrower in proportion, and the three species are not otherwise similar. More ample material of *P. tenuiflorum* is very desirable.


Stem dwarf, 5 cm by 3–4 mm, ± densely crispulo-puberulous above. *Leaves* subfalcately ovate-lanceolate, 71/2–9 by 31/2–41/2 cm, rounded or subcordate at base, gradually narrowed into the subobtuse or subacute apex, margin narrowly revolute, apparently entire but probably actually very minutely crenulate, thickish in texture, distinctly rounded-papilllose below, glabrous except for the nerves sparsely puberulous below; nerves 3–5 pairs; petiole slender, 8–13 by 2 mm, puberulous. *Inflorescences* apparently solitary on each stem, arising from a subterminal axil, compact, scarcely evidently scorpioid, 2 cm diam.; peduncle 1 cm, pubescent. Bracts rather large in proportion, broadly ovate or suborbicular, up to 10 by 8 mm, membranous, crispulo-puberulous, conspicuously laciniate-ciliate or fasciculate-pilose on the margin. *Flowers* 9–12 mm long. Calyx-tube campanulate or oblong-ovoid, 4–6 by 3–4 mm, puberulous. *Sepals* very unequal: smallest one oblong-elliptic, 4 by 11/2 mm, largest suborbicular, 4–5 mm diam.; remainder intermediate; all membranous, crispulo-puberulous, cero-ciliate. *Petals* free (or possibly arising from a membranous annulus?), elliptic-oblong, 4 by 11/2 mm, delicate in texture, margins inflexed, subcucullate at apex, crispulo-puberulous on back. Filaments 11/2 mm; anthers linear, 1 mm. Style broadly conical, 1 mm long; stigma conical, 1 mm long.

**Distr. Malaysia**: Central Borneo, once collected.
Pentaphragmataceae

Notes. Spirit material is particularly necessary for the proper examination of species with delicate corollas, such as this. *P. jaheri* differs from the other two known Malaysian species possessing this character, *P. decurrens* and *P. tenuiflorum*, especially in the unusual feature of the petals being externally pubescent. In these features, however, it agrees with *P. gamopetalum* Gagnep., of Annam, a species differing in its taller habit, larger, thinner, dentilicate leaves and larger flowers. Gagnepain appears to have misinterpreted the corolla of *P. gamopetalum* (cf. Fl. Gen. I. C. 3, 1930, 696, f. 79, 1-2). Dissection of the type showed 5 free or almost free, delicate, narrowly oblong-elliptic petals, as in *P. jaheri*, *P. decurrens* and *P. tenuiflorum*.


Stem 10-25 cm long, simple or rarely with 1 or 2 branches, thinly crispate-floccose, especially above. Leaves very 'begonia-like', exceptionally asymmetrical, obliquely ovate to obliquely lanceolate or oblong or even obliquely reniform or subcylindrical, 10-30 by 6-13 cm, base rounded or cordate on the longer side, strongly excised-concave on the shorter side, apex narrowed to a very short acute acumen or cusp, margin strongly and sharply but shallowly serrate, sparingly crispate-puberulous below (densely so when young), glabrous above; nerves flabellately arranged, straight or little curved; petioles 2-4 cm, crispate-puberulous. Inflorescence terminal or subterminal (rarely lower), solitary (very rarely 2-4) on each stem, at first dense and scorpioid, ultimately lax and almost straight, 4-5 cm long; peduncle 1-2 cm, crispate-floccose, often bearing a ± leafy bract midway. Bracts subtending the flowers orbicular-ovoid, rounded at apex, membranous, 5-9 mm long. Flowers biseriate, 8-9 mm long. Calyx-tube obovate, 4-5 by 3 mm, sparsely pilose. Sepals unequal, ovate to orbicular, 2-2 1/2 mm long, margins often revolute, membranous, pilose or glabrescent on both surfaces. Corolla shortly (1 mm) gamopetalous, 3 mm long, slightly fleshy, glabrous, segments spathulate-ovoid, rounded, erect, recurved at apex. Filaments 1 mm; anthers ovate, shortly acuminate, 1 mm long. Stigma massive, cylindric-pentagonal, 1 mm long. Fruit ellipsoid, 8-9 by 3-4 mm.

Distr. Lower Burma, Peninsular Siam; in Malaysia: northern part of Malay Peninsula.

Ecol. Evergreen rain-forest, often on rocks by streams, up to 600 m; fl. Feb.-April (June-Aug. in Siam).

Vetn. Salang suang (?) = balong ayam, Perak.

Uses. Poultice from roots applied to swellings.

Notes. *P. begonioides*, the type-species of the genus, is immediately recognizable by its exceptionally oblong leaves. The superior ovary shown in the dissected flower in the illustration in Ridley's Flora (i.c.) is, of course, erroneous.


Stem of unknown length (tops only collected), up to 1 cm thick, glabrescent or sparingly crispat-sectulose above. Leaves obliquely elliptic or ovate or obovate, 8-20 by 5-10 cm, cuneate-attenuate at base, apex rounded and shortly apiculate or narrowed and shortly acuminate, margin undulate-dentilicate, glabrous above, almost glabrous below except for some short setulae on the midrib, sparsely sectulose below when young, thin in texture; midrib sometimes rather broad towards base; main nerves 2-4 pairs; petiole 2-3 cm, glabrescent to rather densely and shortly crispate-sectulose. Inflorescences borne singly in the uppermost 1-2 axils, capitate to scorpioid, 10-30-flowered, dense and compact, 2-4 cm long; peduncle 7-8 mm, sectulose. Bracts membranous, the lower ones broadly elliptic-ovate, 10-13 by 7-10 mm, glabrous. Flowers 10-15 mm long. Calyx-tube ellipsoid, 7 by 3 mm, gradually narrowed below into the short pedicel (which elongates later). Sepals obovate, 4-7 by 2-3 1/2 mm, rounded or retuse, close-dentilicate. Corolla 3-4 mm long, gamopetalous to about 1/3-1/2, fleshy; segments ovate, obtuse to subacute, recurved at apex. Filaments 11/2-2 mm; anthers linear-oblong, 11/2 mm, connivent round stigma. Style thick, 2 mm, narrowly upwards; stigma discoid-capitatus, 5-lobulate, 11/2 mm, diam., 1 mm thick. Fruit ellipsoid-ovoid, 8 mm.

Distr. Malaysia: Borneo (Sarawak, Brunei, N. Borneo).


Notes. There is little that is distinctive in the foliage of this species; but the inflorescence sometimes suggests a luxuriant, coarse edition of that of *P. horsfeldii*, the flowers being about double the size of the latter. The luxuriant condition, described by Gagnepain as Francfleurya hosel (later transferred to Pentaphragma), is not specifically separable from *P. viride* Staaff & Green.

*) The combination was not validly published here, since the genus Pentaphragma was not described until 1834 (by G. Don, i.c.).
Fig. 2. Pentaphragma begoniifolium (Roxb. ex Jack) Wall. ex G. Don. a. Habit, $\times \frac{1}{2}$, b. flower, $\times 2$, c. corolla, d. stamen, e. style (after Jack).—P. grandiflorum Kurz. f. Flower, $\times \frac{3}{4}$, g. style, $\times 3$, h. stamen, $\times 3$ (Pulle 406).—P. aurantiacum Staff. i. Flower, $\times 1\frac{1}{4}$, j. style, $\times 1\frac{1}{2}$ (Clemens 28999).

Very variable. Stem 10–50 cm long, simple, ± crispate-floccose above. Leaves only slightly asymmetrical, broadly ovate to obliquely elliptic-oblong, 10–30 by 4–12(–20) cm, base cordate to cuneate, apex acute to obtuse, margin strongly denate-serrate to entire, frequently reflexed, glabrous and shining above, ± crispate-floccose below (usually densely so when young), at least on the nerves, but sometimes almost glabrous; nerves 2–4 pairs, steeply ascending; petiole 11/2–8 cm, ± crispate-floccose or glabrescent. Inflorescences arising singly or more often 2–3 together from the upper (1–5) leaf axils, dense, many-flowered, scorpioid, short or long, 1–7 cm, peduncle ± 1 cm. Bracts orbicular to obovate, 5–8 mm long, ciliolate. Flowers biseriate, 5–8 mm long. Calyx-tube obovoid, 3–4 by 2 mm, pilose. Sepals unequal, scarcely 2 mm long, pilose, margins reflexed. Corolla very shortly (scarce 1 mm) gamopetalous, 3 mm long, glabrous; segments oblong or spatulate-obovate, erect, recurved at apex. Filaments 1½ mm, slender, sometimes sigmoid; anthers oblong, 1 mm. Stigma ovoid-oblong, 1 mm. Fruit ovoid or obovate, 5 by 3–4 mm.


Ecol. Evergreen rain-forest. 

Vern. *Daun djiar kretêh* (këretêh), së’tabel (Lingga).

Uses. *Bübennemeier* states *in sched.* that an infusion of leaves, and especially roots, is used for venereal disease, and leaves are laid on the stomach for constipation in small children, in Lingga. According to Furtado the leaves are eaten as a vegetable in Perak.

Notes. It is difficult to account for the extra-ordinarily mixed populations apparently occurring in the southern part of the Malay Peninsula and in the Lingga Archipelago, except on the assumption of extensive hybridization between two or more species. The solution here suggested is purely tentative; it is evident that these populations can be adequately interpreted only in the field.


Heterogeneous populations showing various combinations of the characters of the putative parents.


Ecol. Evergreen rain-forest.

Notes. The true limits of this species are at present quite uncertain. On the assumption, however, that the complex of forms here placed under *P. × ellipticum* Poulsen represents a hybrid swarm between *P. acuminatum* A.S. and another species, one may postulate for *‘pure’ P. horsfieldii* a plant, crispate-pubescent throughout, with large, broadly ovate, subentire, long-petioled leaves and dense, scorpioid, many-flowered inflorescences. A close approach to such a plant is in fact made by several specimens from the Malay Peninsula that have been currently referred to *P. scortechinii*, and I would propose therefore provisionally to regard these as being for practical purposes *‘pure’*. There is, however, no evident break between them and the presumed hybrids with *P. acuminatum*.

It is noteworthy that the only collection seen from Borneo that appears to be referable to this species (Sarawak: Mt Lambia, 29 May 1895, HAVILAND & HOSE 2027, in Herb. Mus. Brit. is) markedly heterogeneous. It consists of five ‘snip-pets’, each bearing one or two leaves with (in four cases) their subtended inflorescences and very short lengths of stem. In three of the pieces the leaves are entire, and the inflorescences quite glabrous, while in the other two the leaves are sinuate-dentate and the inflorescences densely crispate-pubescent. This may well be part of another hybrid swarm, such as is postulated for *P. × ellipticum* Poulsen.

The leaves of a gathering from Sumatra bore on their margins a growth of the moss *Distichophyllum cuspidatum* DOZY & MOLK. (*det. van der Wijk*).


Stem 12–30 cm long, glabrous, or sometimes ± furfuraceo-puberulous on the young parts. Leaves rather small, obliquely ovate to (more often) ovate-lanceolate, 8–15 by 3–5 cm, base decurrent-cuneate, more rarely ± rounded, apex gradually attenuate-acuminate, margin very short-ly obtusely undulate-dentate and often revolute, glabrous above or (especially on the nerves) sparsely and minutely puberulous or very minutely granulose-papilllose, mostly thin in texture; nerves 2–3 pairs, little curved; petiole 1–2½ cm, slender, glabrous or sparsely furfuraceo-puberulous. Inflorescences arising singly or in pairs from the 1–4 middle or upper (but not uppermost) leaf-axes, small, capitate, not scorpioid, c. 1 cm diám., 2–10-flowered, peduncle c. 5 mm, glabrous. Bracts glabrous, the lowest ovate-lanceolate, 7 by 3 mm, acute, the upper ones decreasing...
rapidly in size. Flowers c. 1 cm long. Calyx-tube 5–6 by 3–4 mm, glabrous. Sepals c. 3 by up to 2 mm, obtuse. Petals c. 3 by almost 2 mm, obtuse or slightly cucullate, reflexed. Stamens c. 1 1/2 mm long; anthers oblong. Style thick, 1–1 1/2 by 1 mm; stigma very thick, 1.25 by 1.25 mm. Fruit ellipsoid, 7–8 by 4–5 mm, glabrous.

Distr. Malaysia: Borneo; several times collected.

Fig. 3. Pentaphragma spatulisepalum A.S. a. Habit, × 2/5, b. flower, × 2 1/2 (J. C. MoultOn s.n., SING.).—P. combretiflorum A.S. c. Habit, × 2/5, d. flower, × 2 (BUNNEMEIJER 5821).

Ecol. Primary rain-forest up to 1500 m; fl. & fr. Aug.–Oct.

Notes. It is tentatively suggested that this species may represent one parent of the presumed hybrid swarm here referred to P. × ellipticum Poulsen. Its almost completely glabrous condition, the gradually acuminate, shallowly sinuate-dentate leaves, and the small, few-flowered inflorescences, are characteristic.
STYLIDIACEAE († D. F. Van Slooten, Amsterdam)

The family consists of 5 genera, if Donatia Forst., of which the systematic position is not at all certain, is included. Four genera are confined to Australia, Tasmania, New Zealand and the Magellan region of South America. Stylidium is almost entirely Australian, but a few spp. occur in Malaysia, Ceylon, and continental SE. Asia.

I. STYLIDILUM


Small, annual or perennial herbs, often with glandular hairs. Leaves small, alternate, cauline or radical-rosulate (or verticillate), simple, entire, exstipulate. Inflorescences terminal. Flowers 9, zygomorphic, usually cymose or racemose. Calyx gamosepalous; segments 5, the 2 anterior ones often adnate into a bifid lobe. Corolla generally conspicuous, sympetalous, irregular. 5-merous, often with a paracorolla formed by coronal or gland-like appendages in the throat; segments free or 2 or 4 of them connate, the fifth developed as a labellum usually smaller than the other segments. Stamens 2, lateral, the filaments entirely adnate to the style into an elongate, usually exserted and geniculate column, which is sensitive and mobile at its base; anthers extrorse, sessile just below the stigma, 2-celled. Ovary inferior, 2-celled or partly 1-celled by an imperfect septum; ovules usually numerous. Capsule dehiscent; seeds very small.

Distr. About 120 spp., all but 8 being confined to Australia. Of these 8, four are Asiatic and entirely extra-Australian, one species, S. kunthii Wall. ex DC., being known from India only. The fifth species, S. schizanthum F.v.M., occurs in N. Australia and in Papua. S. alsinoides R.Br. is found from Queensland to Celebes and the Philippines. S. uliginosum Sw. occupies a disjunct area, viz Queensland, Hong-kong, south coast of China. Hainan, and Ceylon. Probably it will be collected in the future in Peninsular India, Indo-China, and in Malaysia where it was not recorded so far. S. pedunculatum R.Br. occurs in N. Australia and the S. Moluccas.

Ecol. From sea-level up to 1100 m (or 1500 m: S. graminifolium Sw.), usually in uliginose, peaty, swampy, muddy or inundated and temporarily desiccated localities, near wells, along water-courses, and on rice-fields after the harvest, but also often on loamy or humous soils as well as on loose sand or on comparatively dry habitats, even on barren gravelly soil or on rocks; on flat open grass-lands as well as among open brushwood, sometimes in Eucalyptus-stands, in flat land or on hills. In Australia the main flowering season seems to be September to January.

Notes. Often graceful of habit, usually with brightly coloured flowers. Not cultivated.

KEY TO THE SPECIES

1. Stem thickish, up to 3 cm, bearing an apical, dense tuft of narrow-lanceolate, mucronate leaves 1/2–1 cm long. Peduncles leafless, filiform, 1-flowered. Capsule 7–8 mm long. 6. S. pedunculatum
2. Leaves either cauline or in a basal rosette, not mucronate. Inflorescences at least 2-flowered.
3. All corolla segments free, the posterior one bifid. Appendages of the corolla-tube small but distinct.
4. Caly laxly glandular hairy. Labellum inserted below the margin of the corolla-tube. 5. S. schizanthum
5. Calyx gamosepalous; segments 5, the 2 anterior ones often adnate into a bifid lobe. Corolla generally conspicuous, sympetalous, irregular. 5-merous, often with a paracorolla formed by coronal or gland-like appendages in the throat; segments free or 2 or 4 of them connate, the fifth developed as a labellum usually smaller than the other segments. Stamens 2, lateral, the filaments entirely adnate to the style into an elongate, usually exserted and geniculate column, which is sensitive and mobile at its base; anthers extrorse, sessile just below the stigma, 2-celled. Ovary inferior, 2-celled or partly 1-celled by an imperfect septum; ovules usually numerous. Capsule dehiscent; seeds very small.

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Notes. Often graceful of habit, usually with brightly coloured flowers. Not cultivated.
Flowers very small, sessile. Calyx thinly sprinkled with glandular hairs or glabrous; tube (ovary) very narrow, about 10 mm long; two of the segments connate into a slightly bifid lobe. Corolla very small, white (or violet?), very sparingly glandular hairy; tube hardly longer than the calyx lobes; appendages of the throat minute though distinct; segments free, the posterior ones bifid, the anterior segments much smaller; labellum very small, subulate. Capsule linear, up to 2 cm long.


Vern. Sakkar ni sarampitis, Toba.

Notes. Mildbraed stated that the corolla was white, though S. roseum Kurz is considered by him to be conspecific.


Annual, erect, slender, 5–20 cm high. Stem slender, simple or in the upper part with erecto-patent branchlets, glabrous, leafy. Leaves alternate along the stem, sessile, very thin, ovate, subacute, c. 7 mm long and 5 mm wide, the floral leaves opposite (every pair consisting of one leaf and one bract), attenuate. Inflorescences very lax, many-flowered. Flowers sessile in the axil of the leaf-like bracts. Calyx sparsely sprinkled with glandular hairs; tube very short; segments linear, subacute, the 2 anterior ones connate into a bifid lobe. Corolla very small, rose-coloured, glabrous; tube about as long as the calyx-lobes; appendages of the throat hardly visible; segments free, the posterior ones bifid, subspathulate-oblong, up to 2 mm long, the anterior bifid equal, 1 mm long, subretuse, slightly notched at the top; labellum very small, subdeltoid, acuminate, without appendages. Column much exerted, geniculate, up to 3½ mm long. Capsule narrowly linear, 1½ cm long.

Distr. Malaysia: W. Central Java (Indramaju). Ecol. In the forest-section Indramaju it grows...
in periodically moist places of grass-fields at 20–30 m, under seasonal conditions, together with the next species; locally common. Unlike *S. tenellum* it seems to be a species of the lowlands.

3. **Stylium javanicum** SLOOT. Bull. Jard. Bot. Btzg III, 14 (1937) 173, f. 3.—Fig. 3.

Annual, erect, slender, up to 20 cm high. Stem thin, in the upper part with erect-patent branchlets, glabrous, leafy. Leaves alternate along the stem, sessile, ovate, subacute, 7–8 mm long, 4–5 mm wide, the floral leaves opposite (leaf and bract), broadly ovate or elliptic-lanceolate, subacutely attenuate, smaller than the cauline leaves. **Inflorescences** cymose, many-flowered. Flowers sessile in the axil of the leaf-like bracts. **Calyx-tube** (ovary) 12–13 mm long; segments linear, the 2 anterior ones conenate into a slightly bifid lobe. **Corolla** small, white with a fine violet streak passing into white, tube about half as long as the calyx-lobes, appendages of the throat absent; segments 2–3 mm long, not free, 4 of which being conenate into 2 bifid lobes separated by a deep incision; labellum sub-3-angular or suborbicular, without appendages. Column little exerted, 2–3 mm long. **Capsule** linear, 10–22 mm long.

**Distr.** N. Australia and Queensland, in Malaysia: S. New Guinea (vicinity of Merauke and near Wuroi), SW. & SE. Celebes, and the Philippines.

Ec. In New Guinea it was found on a sandy ridge in the shadow of grass, and on damp savannah ridges, 0–30 m, growing luxuriantly, in Celebes on roadsides and rice-fields up to 950 m. **Note.** The species was recorded for the Philippines by MERRILL (En. Philip. 3, 1923, 591) but I have not seen specimens from that area.


Annual, erect, in all parts glabrous and without glandular hairs, up to 35 cm high. Stem repeatedly branched from the base, 5-angular to 5-costate, whitish or green, turning carmine. Leaves variously coloured, alternate or distichous along the stem, sessile, broadly ovate, cuneate or subrounded at the base, 7–8 mm long and wide, the floral appendages of the throat not seen; segments oblong, not free, 4–41/2 mm long, attenuate or abruptly acuminate, 4 of the segments conenate into 2 bifid lobes, separated by a deep incision; labellum minute, deltoid-ovoid, without appendages. Column much exerted, geniculate, c. 5 mm long. **Capsule** linear, glabrous, c. 11/2 cm long.

**Distr.** Malaysia: W. Central Java (Indramaju), Lesser Sundas Islands (E. Sumba).

Ec. Periodically wet grass-fields, under seasonal conditions, locally common, in Java at 20–30 m, in Sumba in a marsh at 500 m.


Annual, erect, very slender, up to 35 cm high. Stem slender, leafless or with a single linear leaf, sparingly furnished with very short glandular hairs. Leaves petiolated, subulate, obovate-subspathulate, usually 5 mm long or less; petioles half as long as the blades. **Inflorescences** large, very lax, cymose, many-flowered. Flowers (sub)sessile; bracts minute, lanceolate. **Calyx-tube** and lobes very laxly glandular-hairy; tube (ovary) filiformous, 7–10 mm long; lobes obovate-subspathulate, 2–21/2 mm long, the 2 anterior ones somewhat larger and conenate almost up to the very top. **Corolla** pale yellow (BRASS), 5 mm long, tube glabrous or very laxly glandular-hairy, about as long as the calyx-lobes; appendages of the throat 2, broad and distinct; between the anterior and posterior segments with a conspicuous glandular corpusculum; segments not free, the posterior ones 2–3 mm long, conenate about half their lengths, bifid, forming together a 4-fid whole with unequal lobes, the anterior segments smaller, equal, dissected at the top, the lobes linear; labellum small, lanceolate-ovate, long-acuminate, inserted below the margin of the tube, without appendages. Column geniculate, 5–6 mm long. **Capsule** narrow, 1 cm long or less.

**Distr.** N. Australia, in Malaysia: SE. New Guinea (Fly River area).

Ec. Once found on grey soil on a savannah ridge at 30 m, and once in dense turf on wet grasslands.

**Notes.** Closely related to *S. lobuliflorum* F.v.M., a herb of c. 12 cm height, with rose-coloured flowers and with a connective exceeding the anthers with a bifid apex. The Brass-numbers from Papua (5796 and 7825) have the anterior calyx-lobes...
almost entirely connate and not two-thirds their length.

6. Stylidium pedunculatum R.Br. Prod. (1810) 571; DC. Prod. 7 (1839) 337; Benth. Fl. Austr. 4 (1869) 28; Bailey, Queensl. Fl. (1900) 890; Mildbraed, Pil. R. Heft 35 (1908) 39; Bailey, Compr. Cat. Q. Pl. (1912) 282, f. 249.—Candollea pedunculata F.v.M. Syst. Cens. (1882) 86; Sec. Syst. Cens. (1889) 145; Britten, Ill. Cook’s Voy. 2 (1901) 53, t. 170c (after type).—St. bryoides F.v.M. Fragm. 6 (1867) 91.—Fig. 4.

Glabrous, ?perennial. Stems single or 2 together, c. 2–3 cm high, at the base with a few small leaves, at the top with a dense tuft of crowded leaves. Blades sessile, narrow-lanceolate, 5–10 by 2–3 mm; midrib distinct, margins nerve-like thickened and rough by distinct papillae, apex mucronate by hyaline hair-like cells, mucro sometimes forked. Peduncles 3–8 from the tuft, 1-flowered, exceedingly thin-filiform, terete, c. 2–3 cm. Flower subtended by 2 tiny, narrow, acute bracts 1/2 mm long. Fruit obliquely patent, linear, terete, with 2 longitudinal ribs, 7–8 by 1/2 mm, splitting from the top downwards with 2 valves; dissepiment 1/8 mm broad.


Fig. 5. Localities of Stylidium pedunculatum R.Br.


Note. The cited Malaysian material came at hand Sept. 1953 and I am responsible for the identification, description, and figure. This species is apparently rare (fig. 5). Mr. J. H. Kern, who was so kind to compare the Malaysian material with the type sheets of Brown and Mueller in respectively the Brit. Museum and the Royal Botanic Gardens, Kew, could only locate the following specimens in these herbaria: N. Australia: Port Essington, Armstrong 597 (K); N. Queensland: Endeavour River, Banks & Solander a. 1770 (BM, type of S. pedunculatum L.), Cunningham 103 (BM); Rockingham Bay, Dallachy (K, type of S. bryoides).—van Steenis.
Trees, shrubs or lianas, rarely subherbaceous. Glands (in Mal. spp.) often present on the leaf-bases or petioles, and in lower marginal crenations. Indumentum of simple hairs, glandular hairs or multicellular hairs secreting calcium oxalate and forming scales, or present beneath the cuticle making the surface of the leaf minutely verruculose and sometimes pellucid-punctate. Leaves opposite, verticillate, spiral, or alternate, petioled (rarely sessile), exstipulate, simple, almost always entire. Flowers ♂ or ♀ and ♂ in the same inflorescences, usually protogynous, usually actinomorphic, rarely slightly zygomorphic, in axillary or extra-axillary elongated or subcapitate spikes or racemes or in terminal and sometimes axillary panicles. Receptacle (calyx-tube) usually in two distinct parts, the lower receptacle surrounding and adnate to the inferior ovary and the upper receptacle produced beyond to form a short or long tube terminating in the calyx-lobes, the latter sometimes poorly developed. Calyx-lobes 4 or 5 (rarely 6–8) or almost absent, sometimes accrescent (Calycopteris). Petals 4 or 5 or absent, conspicuous or sometimes very small, inserted near the mouth of the upper receptacle. Stamens usually twice as many as the petals, borne inside the upper receptacle usually in two series, exserted or included; anthers dorsifixed, usually versatile (or rarely adnate to the filaments). Disk intrastaminal, usually present, hairy or glabrous. Style usually free (attached for part of its length to the upper receptacle in Quisqualis). Ovary inferior (semi-inferior in the West-African genus Strephonema), unilocular, with usually 2 (sometimes 2–6) pendulous, anatropous ovules of which only 1 usually develops. Fruit (botanically a pseudocarp) very variable in size and shape, fleshy or dry, usually indehiscent, often variously winged or ridged, 1-seeded. Albumen absent.

Distr. 18 genera with c. 450 spp. in the tropics and subtropics: 2 are circumtropical (Combretum and Terminalia), and are much the largest genera, 1 is confined to North Australia and Queensland (Macropteranthes), 2 confined to tropical Asia (Finetia and Calycopteris), 3 occur in Asia and Africa (Anogeissus, Lumnitzera, and Quisqualis), 1 is confined to Madagascar (Calopyxis), 3 are confined to tropical Africa (Giiera, Pteleopsis and Strephonema), 2 occur in tropical Africa and tropical America (Conocarpus and Laguncularia) and the remaining four (Buchenavia, Bucida, Ramatuela and Thiloba) are confined to tropical and subtropical America.

Ecol. Species of Terminalia are important constituents of both primary and secondary forests, more especially in the lower regions, only a few species reaching an altitude of about 2000 m. Combretum species are common lianas especially along banks of rivers and margins of forests. Two species of Lumnitzera play an important rôle in the mangrove-formation (a formation to which the genera Lumnitzera and Laguncularia are both confined). Terminalia catappa is a common constituent of the littoral forest, on the sandy beach-ridge or on rocky shores along eroding coasts. Most species are insect-pollinated.

According to RIdley (Disp. 102, 210) dispersal of the fruits is frequently through water agency, either sea-water (Lumnitzera, Terminalia catappa) or freshwater of streams and rivers (flat-fruited and drupaceous-fruiting Terminalia spp. and Combretum spp. with narrow-winged or angled type of fruit). Quisqualis fruits are buoyant in both fresh and sea-water. In many other species of Combretum and Terminalia the fruits are provided with thin, papery wings and are dispersed by wind; their size probably prevents them from reaching great distances.


For review of research on mangrove anatomy and water relations see: Fl. Mal. 1, 4 (1953) 513, for growth ring development in connection with bud burst (Terminalia catappa L.): COSTER, Ann. Buitenzorg 37 (1927) 116. JANSSENSON (Blumea 6, 1950, 407) points out that the family has many features in common with other families and suggests that its wood structure indicates affinity especially with the Leguminosae and Sapindaceae and bears some relation to the Meliaceae.—C.A.R.—G.
Uses. Some Terminalia species produce fairly good timber but in general the wood is rather soft and inferior. The fruits of this genus are often edible. A few species are planted as ornamental trees and some Combretum species are grown as stove plants in temperate countries. Quisqualis indica is often planted in gardens as an ornamental climber and a decoction of its fruits has been used as a vermicide. The wood of Lumnitzera spp. is sometimes used for fencing and local building purposes.

Notes. The family is related to the Rhizophoraceae and to the Myrtaceae. It was founded by R. Brown (Prod. 1, 1810, 351) and delimited much as at present. Hooker f. (in Benth. & Hook. f. Gen. Pl. 1, 1867, 683) profoundly modified this conception of the family by including the genera Illgera, Gyrocarpus and Sparattanthellium, plants with quite a different facies which are now placed in the Hernandiaceae. For an account of the relationships between the genera of Combretaceae see Exell (J. Bot. 69, 1931, 113).

Three main evolutionary tendencies are observable in the family or can at least be reasonably postulated:
1) A gradual elongation of the upper receptacle, especially in Combretum, and reaching its highest development in Quisqualis, making pollination only possible by long-tongued insects.
2) A congestion of the flowers in densely-flowered spikes or racemes accompanied often by reduction in the size of the petals.
3) Distribution by means of winged fruits (though riverine species often have water-borne fruits and many species of Terminalia have edible fruits presumably dispersed by animals).

These three tendencies seem to have been to some extent independent of each other and the combination of 2 and 3 provides a spatial problem, that of allowing for the expansion of the wings of the fruit in a congested inflorescence. This problem has received various solutions in the family such as reduction of the wings to two or three (Terminalia spp.), interspersal of♂ and♀ flowers (Pteleopsis and Terminalia), the fitting together of the fruits into a cone-like structure (Conocarpus) etc.

For a general account of the anatomy and pharmacology of the Combretaceae see Holtermann, ‘Beiträge zur Anatomie der Combretaceen’ (Christiania, 1893) and Leffèvre, ‘Contribution à l'étude anatomique et pharmacologique des Combretacées’ (Lons-Le-Saunier, 1905).

The main precursors of this revision were written by the late D. F. van Slooten in his ‘Bijdragen tot de kennis der Combretaceae en Flacourtiaceae van Nederlandsch Indië’ (Utrecht, 1919)—henceforth cited as Bijdr. Combr.—and in Bull. Jard. Bot. Buitenzorg III, 6 (1924), both dealing only with the species occurring in Indonesia. I am deeply indebted to him for putting his manuscript notes at my disposal.

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**Fig. 1.** Diagrams to illustrate the key to the genera.

- **a.** Receptacle with calyx-lobes in Combretum latifolium, **b.** receptacle with calyx-lobes and 2 adnate bracteoles in Lumnitzera racemosa, **c.** vertical section of receptacle in Combretum latifolium showing inferior ovary, free style and upper (hairy) free part of disk inserted at apex of lower portion of upper receptacle, **d.** vertical section of flower of Quisqualis indica showing adnation of style to upper receptacle, **e.** fruit of Calycophyllum floribunda showing accrescent calyx-lobes.

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**KEY TO THE GENERA**

1. Receptacle without adnate bracteoles (fig. 1a). Leaves opposite, verticillate, or alternate.
2. Petals present (in Malaysian species).
3. Style not adnate to the inner wall of the upper receptacle (fig. 1c). Leaves often scaly. **1. Combretum**
4. Style adnate for part of its length to the inner wall of the upper receptacle (fig. 1d). **2. Quisqualis**
5. Petals absent. Leaves not conspicuously scaly.
6. Calyx-lobes not accrescent

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1. Calyx-lobes very conspicuous, accrescent, persistent at time of fruiting (fig. 1e). **4. Calycophyllum**
2. Receptacle with two adnate bracteoles (fig. 1b). Leaves alternate. Petals present. Trees of the mangrove formation

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5. Lumnitzera
1. COMBRETUM


Trees, shrubs or (probably always in Malaysia) woody climbers, very rarely subherbaceous. Leaves opposite, verticillate or rarely alternate, usually petiolate, almost always entire, glabrous or hairy, often conspicuously scaly and often with domatia. Petiole sometimes persisting after the fall of the leaf forming a thorn. Flowers usually 3, actinomorphic or more rarely somewhat zygomorphic, 5- or 4-merous, in elongated or subcapitate, axillary or extra-axillary spikes or racemes or in terminal or terminal and axillary often leafy panicles, glabrous or hairy, often scaly. Receptacle (calyx-tube) glabrous or hairy, often scaly, sometimes glandular usually clearly divided into a lower part (lower receptacle) surrounding and adnate to the ovary, and an upper part, varying from patelliform to elongate infundibuliform, terminating in the calyx-lobes. Upper receptacle sometimes visi- }
is correlated with dispersal by water as reported by Ridley (Disp. 102, 210) for C. trifoliatum and C. tetrалophum, which he characterizes as riparian climbers.

Uses. Combretum spp. are of no economic importance in Malaysia but some introduced species are grown in gardens as ornamental climbers of which the most beautiful one is C. grandiflorum Don.

Notes. The flowers shrink appreciably on drying and measurements in the descriptions have been taken as far as possible from boiled up specimens. Species of Malpighiaceae often mistaken, when in fruit, for species of Combretum can be distinguished by the superior ovary and bifid hairs. Wingless fruits of Combretum can be distinguished from those of Terminalia by the absence of a sclerenchymatous layer in the pericarp so that they are easily cut across while those of Terminalia are usually somewhat or very resistant. Fruits of C. trifoliatum are sometimes mistaken for those of Quisqualis indica.

Fig. 2. Diagrams to illustrate the key to the Combretum species.—a. Fruit of C. trifoliatum with 5 narrow wings, b. fruit of C. goldieanum with 5 broad wings, c. fruit of C. acuminatum with 4 narrow wings, d–e. spikes of C. punctatum ssp. squamosum and ssp. punctatum, f–g. shape of upper receptacle (u.r.) and lower receptacle (l.r.) in C. tetrалophum and C. sundacum.

KEY TO THE SPECIES

1. Flowers 5-merous. Fruit narrowly or broadly 5-winged.
2. Leaves usually 3–4(-5)-verticillate. Upper receptacle shallow-cupuliform, less than 1 mm long. Wings of fruit narrow, stiff, 3 mm broad (fig. 2a) .............. 1. C. trifoliatum
2. Leaves opposite. Upper receptacle elongate-infundibuliform, 6–7 mm long. Wings of fruit thin, flexible, 6–7 mm broad (fig. 2b) ......... 2. C. goldieanum
1. Flowers 4-merous. Fruit narrowly or broadly 4-winged.
3. Branchlets and inflorescences with dense or rather sparse papillose or shortly stalked glandular hairs (in addition to a pilose indumentum) .............. 3. C. nigrescens
3. Branchlets and inflorescences not glandular but sometimes scaly.
4. Calyx-lobes deltoid or broadly ovate, sometimes scarcely developed, not more than 1 mm long (in dried specimens).
5. Fruit narrowly 4-winged or 4-rigid (fig. 2c).
6. Rachis nearly glabrous. Upper receptacle campanulate. Petals very small. Fruit 31/2-61/2 cm long, 4. C. acuminatum
6. Fruit broadly 4-winged with thin, flexible wings.
7. Leaves densely covered with greyish-white scales nearly contiguous on the lower surface of the leaf.
8. Flowers in elongated spikes (fig. 2d). Leaves usually broadly elliptic. 5. C. punctatum subsp. squamosum
8. Flowers in subcapitate spikes (fig. 2e). Leaves usually lanceolate or narrowly elliptic. 5. C. punctatum subsp. punctatum
7. Leaves only sparsely scaly, scales never contiguous.
9. Flowers 2–4 mm long from the rachis to the tips of the calyx-lobes. Lower receptacle not more than 1 mm long (in dried specimens) .......... 6. C. porterianum
9. Flowers 4–8 mm long from the rachis to the tips of the calyx-lobes. Lower receptacle 11/2 mm long or longer.
10. Leaves nearly glabrous or pubescent only on the nerves beneath.
11. Leaves with individually conspicuous golden-brown or reddish-brown scales on the lower surface .......... 7. C. yunnanense
11. Leaves without individually conspicuous scales, coriaceous. Inflorescences ferrugineous-pubescent or tomentellous. (Fruit unknown.) .............. 8. C. borneense
10. Leaves densely pubescent or tomentellous on the lower surface .......... 9. C. tetrалophoides
4. Calyx-lobes triangular to elongate-triangular, at least 1 1/2 mm long, usually 2 mm long or longer. Flowers 7-10 mm long from the rhachis to the tips of the calyx-lobes.

12. Tubular basal portion of the upper receptacle only about 1-1 1/2 times as long as broad (fig. 2f) and separated from the lower receptacle (ovary) by a somewhat constricted portion. Petals usually equalling or exceeding the calyx-lobes. Fruit with 4 narrow, stiff wings or ridges.  

10. C. tetralophum

12. Tubular basal portion of the upper receptacle 2-3 times as long as broad (fig. 2g) or whole upper receptacle narrowly infundibuliform. Petals shorter than the calyx-lobes. Fruit broadly 4-winged.

13. Spikes more or less elongated. Upper and lower receptacle and rhachis of inflorescence with a finely velutinous indumentum concealing any scales.  

11. C. latifolium

12. C. sandaicum

13a. Intermediates (from Luzon) between the two preceding species (latifolium × sandaicum).

12a. C. confusum


Climbing or scrambling shrub, 2-5 m. Young branchlets appressed pubescent-pubescent, usually glabrescent. Leaves usually 3-4-5-verticillate, coriaceous or subcoriaceous, elliptic to lanceolate, usually subglabrous above, glabrous below except for domatia and an occasional pubescent pubescence along the midrib, 8-16 by 3-5 1/2 cm, normally acute and mucronulate at the apex (rarely rounded), usually slightly rounded at the base, nerves 6-8 pairs; petiole ferrugineous appressed-pubescent, eventually glabrescent, nigrerescent and rather shiny when old, 4-7 mm long. Inflorescence a terminal or axillary panicule 8-20 cm long of spikes 2-5 cm long. Flowers 5-merous white or yellowish-white, sweet-scented, protogynous, mostly in whorls of 3. Lower (ovary) densely cinereous- or fulvous-sericeous, 1-1 1/2 mm long; upper receptacle shallow-cupuliform, cinereous- or fulvous-sericeous, 1/2-1 mm deep and 3-3 1/2 mm across, with 5 ovate-triangular calyx-lobes 1 by 1 1/2 mm. Petals 5, narrowly ellipsoid, densely pubescent, 1-1 4 by 0.2-0.4 mm. Stamens 10, filaments 4-5 mm long, anthers 1/2 mm long, exerted. Disk glabrous inside with densely barbate margin. Style 5 mm long. Fruit sessile, narrowly ellipsoid, glabrous, shiny black-brown, (2 1/2-3-3 1/2 by 1-1 2 cm with (4-5-6 rigid wings 3-4 mm broad. Dist. Burma, Siam, Laos, Cambodia, Cochinchina, throughout Malaysia: not yet recorded from the Philippines, Moluccas, and the Lesser Sunda Islands (except Bali), in Java only along the north coast. Fig. 3.

Ecol. In lowlying frequently flooded areas, along banks of rivers and lakes, in bush or forest, borders of teak-forest, on limestone (Celebes) or alluvial river-clay both under evervet and seasonal conditions; fruit dispersed by water; fl. May-Nov.

Uses. RIDLEY (cf. Burkill, Dict. 645) records the fruits as a vermifuge for Ascaris and Greshoff demonstrated a saponin in them (Kew Bull. 1909. 406). EDELING recorded the fruits as edible near Djakarta but this may be incorrect.


Notes. Collectors mostly give this species as a scrambling shrub but it has occasionally (perhaps incorrectly?) been described as a small tree and RIDLEY (loc.) says it is a 'big climber'.


Scandent shrub. Young branchlets cinereous, glabrescent. Leaves opposite, petioled, oblong-elliptic, acuminate at the apex, rounded at the base, minutely pubescent above, densely lepidote

Fig. 3. Localities of Combretum trifoliaturn Vent. in Malaysia.
below but individual scales not conspicuous, 7–15 by 4–10 cm, sericeous when young, eventually glabrescent except for domatia. Spikes axillary, 6–8 cm long, occasionally branched. Flowers 5-merous, red, sessile. Lower receptacle (ovary) densely sericeous, 3–4 mm long; upper receptacle elongate-infundibuliform, appressed-pubescent, 8–9 mm long with 5 broadly deltoid calyx-lobes which are no more than blunt teeth at the apex of the tube. Petals 5, obovate-elliptic to oblong-lanceolate, 2 1/2 by 1 1/2 mm, pubescent outside, glabrous inside. Stamens 10; filaments dark red, exerted for 13–14 mm beyond the mouth of the tube, 5 attached at the margin of the disk and 5, alternating with the former, attached 3 mm from the base of the upper receptacle; anthers red, oblong, 1.2 by 0.8 mm. Disk cupular, c. 1 mm deep, barbate on the margin. Style 23 mm long, exerted for 14 mm beyond the mouth of the tube. Fruit broadly elliptic to suborbicular in outline, up to 2 1/2 by 2 cm with 5 thin, flexible wings up to 8 mm broad.


Ecol. Little known. Fide White (l.c.) 'this rambling scendent shrub is very common about Port Moresby and with its bright red flowers is quite a conspicuous feature in the vegetation'. The elongation of the upper receptacle makes it only suitable for pollination by fairly long-tongued insects; the fruits are of the broadly winged wind-distributed type.

Note. Both F. von Mueller and van SLOOTEN have rightly pointed out the resemblance between this species and various African species of Combretum but it has not been identified with any African or Madagascar species so that its claim to be indigenous in New Guinea can scarcely be denied. I would myself relate it to the Indian species C. pilosum ROXB. (sect. Trichopetalae ENGL. & DIELS, mainly African).

Specimens from Port Moresby collected by FORBES and GOLDIE possess larger flowers and fruits than specimens collected by BRASS and LISTER TURNER from Rigo District and Kappa Kappa respectively; but the difference does not seem to be greater than that commonly met with in the species of this genus when enough material is available to show the range of variation.


Large climber up to 10–20 m. Young branchlets with a fulvous-patent-pilose (rarely appressed pilose) indumentum interspersed with glandular hairs, sometimes with the long patent hairs very few and the glandular hairs much denser. Leaves opposite, papyraceous, narrowly elliptic or narrowly oblong-elliptic, sparsely pilosulous above or nearly glabrous except for appressed hairs towards the base of the midrib, rather sparsely appressed-pilose or nearly glabrescent below, up to 13 by 41/2 cm, acuminate at the apex, cordate (rarely cuneate) at the base; nerves 6–10 pairs; petiole patent-pilose often glabrescent, 2–8 mm long. Inflorescence a terminal or axillary panicle, 10–15 cm long, ultimate branches slender. Flowers white or greenish-white, 4-merous, sessile. Lower receptacle (ovary) pubescent or pilose, 1 mm long; upper receptacle cupuliform, viscid, puberulous, 1 1/2 by 3 mm with triangular, acute calyx-lobes, 3/4 by 1 mm. Petals 4, elliptic, pubescent, 1 1/2 by 0.8 mm. Stamens 8, exerted; filaments 3–3 1/2 mm long; anthers 3/4 mm long. Disk small, densely pilose. Style 3 1/2–4 mm long. Fruit 1 1/2–3 1/2 by 1.3–2 cm, glandular or glabrous, oblong-elliptic in outline with 4 membranous wings 4–6 mm broad and with the withered flower sometimes remaining attached to the apex of the fruit until the latter is mature or nearly so.

Distr. Siam, in Malaysia: SW. Sumatra, Malay Peninsula, Br. N. Borneo.

Ecol. In dense or open jungle from sea-level to 150 m.

Uses. The leaves are used in Pahang for poultering wounds.


Note. The amount of indumentum is very variable some specimens having densely pilose branches and inflorescences while others are very glabrous with sparse long hairs.

C. adenophorum SLOOT., known only from one collection (FORBES 3100, SW. Sumatra), differs only in having cuneate leaf-bases. Further collecting is likely to provide intermediates.

COMBRETACEAE

(1923) mm (1877)
ally scaly, 5.
Christmas with often (ovary) occasionally of acuminate ed surfaces, opposite, densely puberulous, ferrugineous-scaly
contiguous oblanceolate, 227.
usuall
ly or occasionally of terminal panicles of spikes, ferrugine-
scale and pubescent or nearly glabrous. Bracts very small, soon deciduous. Flowers yellowish, 4-merous, sessile. Lower receptacle (ovary) densely scaly, otherwise glabrous, 1-1½ mm long. Upper receptacle campanulate, scaly, outside glabrous, 2-3 mm long, inside pubescent, terminating in 4 deltoid calyx-lobes about 1 mm long. Petals 4, yellow, narrowly elliptic, very small, often less than ½ mm long, occasionally up to 1½ mm long. Stamens 8, exserted, 5-7 mm long. Disk cupular, about 0.8 mm deep, glabrous, hairy on the margin. Style ½-1½ mm long. Fruit densely scaly, especially when young. Tomentellous or puberulent, eventually glabrescent, ½-2½ by 1-2 cm, usually slightly narrowed at each end with 4 (rarely 5) longitudinal, rounded (occasionally sharp) ridges.


Ecol. Along the coast in low-lying frequently flooded areas, along rivers and in secondary forests at low altitudes.

Uses. A decoction of the leaves is used medicinally for tape-worm.

Vern. Areuj balingbing, areuj takul takal minjak, S. kalengd d i d i, SW. Celebes.

Note. Fruits probably water-borne (see note under C. trifoliatum).

Forbes 3250, from Sumatra, identified by E. G. Baker as this species (J. Bot. 52, Suppl., 1924, 35), is Lophopetalum oblongifolium King.


Climbing shrub or liana. Young branchlets densely ferrugineous or cinereous-scaly, individual scales usually very conspicuous. Leaves opposite, subcoriaceous, densely scaly on both surfaces, individual scales usually conspicuous, lanceolate, ovate-lanceolate, narrowly elliptic or broadly elliptic to almost suborbicular, occasionally narrowly elliptic, usually about 7½ by 4-7 cm (up to 18 by 11 cm in specimens from Burua) usually abruptly acuminate at the apex and rounded at the base; petiole 5-12 mm. Inflorescence a terminal panicle of elongated or pseudo-capitate spikes, the latter up to 7 cm long; rhachis densely cinereous or ferrugineous-scaly. Flowers yellowish, fragrant, sessile, 4-merous. Lower receptacle (ovary) 1½-2 mm long, densely ferrugineous-scaly otherwise glabrous. Upper receptacle 3½-5 mm long measuring to the tips of the calyx-lobes, densely ferrugineous-scall, lower part, containing the disk, infundibuliform, upper part cupuliform, terminating in 4 deltoid calyx-lobes less than 1 mm long. Petals 4, obovate, narrowly elliptic or oblanceolate, unguiculate, about 1½ mm long, glabrous. Disk infundibuliform, margin free for about 1 mm, barbate. Stamens 8, filaments ½ mm long, anthers 0.6 mm long. Fruit usually suborbicular, sometimes pyriform in outline, very variable in size and shape, sparsely scaly (densely when young), 1½-2½ by 1½-2½ cm, with 4 thin, flexible wings, up to 1 cm broad.

Distr. India, Burma, Siam, Indo-China, and Malaysia: SW. Sumatra, Malay Peninsula, Java (W. half), Billiton, Borneo (SE. and Sarawak), and Philippines. Fig. 4.


Leaves lanceolate, ovate-lanceolate or narrowly elliptic. Inflorescence a terminal panicle of pseudo-capitate spikes. Petals obovate, unguiculate.

Distr. Malaysia: SW. Sumatra (Bencoolen), Java (W. half), and SE. Borneo.

Ecol. In submontane forest and bush, usually 1000-1600 m.

Vern. Areuj mëngandë, kë konëng, ojëd djañå, S. marambat, Bencoolen.

Note. This subspecies, nomenclaturally the typical one, is a submontane subspecies clearly separated altitudinally from the more widespread, lowland subsp. squamosum.

Leaves broadly elliptic to almost suborbicular, occasionally narrowly elliptic. Inflorescence a terminal panicle of elongated spikes. Petals narrowly elliptic or lanceolate, unguiculate.

Distr. India, Burma, Siam, Indo-China, and Malaysia: Malay Peninsula, Billiton, Borneo (Sarawak), and Philippines.

Ecol. Woody climber in bush and secondary forest at low altitudes.


Scendant shrub. Young branchlets at first tomentellous, soon glabrescent. Leaves opposite, chartaceous, elliptic or narrowly elliptic, sparsely pubescent or glabrous, densely uniformly scaly and also usually with whitish rather sparse individually conspicuous scales or rather faintly visible scales on both surfaces, up to 14 by 7 cm, usually acuminate; petiole tomentellous or sparsely scaly, 1/2–1 cm. Inflorescence of axillary spikes c. 5 cm long or a terminal panicle of spikes c. 20 cm long; rhachides tomentellous or densely puberulous, sparsely and rather inconspicuously scaly. Bracts 1 1/2 mm long. Flowers probably yellowish-white, sessile. Lower receptacle (ovary) densely ferrugineous-scaly, 1 1/4 mm long, somewhat constricted at the top. Upper receptacle 2 1/2 mm long to the tips of the calyx-lobes, cupuliform at the top, terminating in the deltoid calyx-lobes, 1/2 mm long, with an infundibuliform basal part containing the disk, rather densely ferrugineous-lepidote, otherwise nearly glabrous. Petals 4, yellow, obovate, 3/4 mm long, emarginate at the apex, glabrous. Stamens 8; filaments 3 mm long; anthers 1/2 mm long. Disk infundibuliform, margin free for about 0.3 mm, glabrous inside, bearded on the margin. Style 2 mm. Fruit suborbicular in outline, 2 1/2–3 1/2 by 2 1/2–3 1/2 mm, ferrugineous-scaly with 4 flexible wings 1 cm broad.

Distr. Bengal?, Assam?, Yunnan, and Malaysia: Sumatra, Malay Peninsula, and NW. Borneo.

Ecol. Little known. It grows up to 1600 m in Yunnan and may be a submontane species in Malaysia.

Note. The name C. chinense Roxb. ex Don has to be typified by a specimen in Herb. Lambert, collector unspecified, cited by Don and the conception given to the species by Don seems to differ in important respects from the original C. chinense Roxb. nom. nud. As I am uncertain whether C. chinense Roxb. ex Don applies to the species here described, to C. porteriunum Wall. ex Craib. or possibly to a species not represented in Malaysia, I have had to treat the name, at least for the present, as a nomen obscurnum.


Woody climber. Young branchlets tomentellous, soon glabrescent. Leaves opposite, coriaceous, elliptic, narrowly elliptic, ovate-elliptic or suborbicular, somewhat shiny above, distinctly scaly above, scales spaced, not marginally contiguous. Densely scalily below so scales not individually conspicuous, otherwise glabrous, 10–15 by 4–7 cm, abruptly acuminate at the apex, rounded or subcordate at the base; petiole 5–7 mm, at first pubescent, glabrescent. Inflorescence an ample terminal or auxiliary panicle up to 20 cm long, ultimate spikes 3–4 cm long. Bracts filiform, 2 mm long. Rachis fulvous-pubescent. Flowers sessile, 4-merous. Lower receptacle (ovary) 2–3 mm long, densely scalily, scales marginally contiguous, otherwise glabrous. Upper receptacle shortly in-
fundibuliform at the base, cupuliform at the apex with 4 acute, broadly triangular calyx-lobes, rather densely and conspicuously scaly, otherwise glabrous, 2/3-3 by 2.2 mm measuring to the tips of the calyx-lobes. Petals 4 oblongolate, shortly clawed, glabrous, 13/4 by 3/4 mm. Stamens 8, exerted, filaments 3/2-4.2 mm. Disk pilose with a shallow free margin. Style 5 mm. Fruit unknown.

**Distr.** Malaysia: Borneo (Sarawak). Fig. 4. Note. Probably related to *C. tetralophum* Clarke but only 3 collections are known and no fruits have yet been collected.


Climbing shrub. Branchlets at first fulvous-tomentellous, later glabrescent. Leaves papyraceous, opposite, elliptic or oblong-elliptic, sparsely pubescent above, densely pubescent or almost tomentose beneath and densely scaly but individual scales not conspicuous, 6-11 by 4-5 cm, bluntly acuminate at the apex, cuneate at the base; nerves 5-8 pairs; petiole 3-5 mm, tomentellous. Inflorescence fulvo-tomentellous, a terminal or axillary panicle of spikes. Bracts linear, pubescent, 2 mm long, soon deciduous. Flowers sessile, 4-merous. Lower receptacle (ovary) densely ferrugineous-scaly, 2 mm long, somewhat constricted above the ovary. Upper receptacle densely ferrugineous-scaly, shortly and broadly infundibuliform at the base, c. 1 mm long, cupuliform at the apex and terminating in 4 broadly triangular calyx-lobes. Petals 4, linear-lanceolate, glabrous, 1-11/2 mm long. Stamens 8, exerted. Disk small, densely pilose. Fruit broadly elliptic to obovate in outline, scaly but scales not very conspicuous, retuse at the apex and with a short, 1/2 mm long stipe at the base; wings 4 thin, flexuous c. 1 cm broad.

**Distr.** Malaysia: Lesser Sunda Islands (Flores: Laranjutka), once collected. Fig. 4.


Liana climbing to a considerable height or scandent shrub. Young branchlets ferrugineously-scaly, soon glabrescent. Leaves opposite, papyraceous to chartaceous, elliptic, often shiny above, densely scaly but scales not individually conspicuous, otherwise nearly glabrous except for some pubescence, nearly always present, on the midrib at the base of the lower surface of the leaf, 6-15 (20) by 3-6 (11) cm, usually slightly or distinctly acuminate at the apex and cuneate or rounded at the base; nerves 6-8 pairs; petiole 3-10 mm long, scaly and often somewhat pubescent. Inflorescences scaly and pubescent, of lateral spikes and terminal panicles of spikes, spikes rarely more than 2-3 cm long and often subcapituliform. Flowers 4-merous, sessile, yellow, greenish yellow or greenish white, sweet-scented, 4/2-7/11/2 mm long measuring to the tips of the calyx-lobes. Lower receptacle (ovary) 2-21/2 mm long, densely ferrugineous-scaly, otherwise glabrous, constricted at the apex; upper receptacle cupuliform at the apex, 1 by 3 mm, with 4 triangular acute calyx-lobes, basal portion containing the disk broadly infundibuliform, 11/2 by 1 mm, densely ferrugineous-scaly, otherwise usually glabrous. Petals 4, glabrous, oblongolate, 21/2-3 by 0.8 mm. Stamens 8; filaments 4-41/2 mm long; anthers 11/2 mm long. Disk well-developed with a short free margin, densely pilose so that the flowers appear barbate within. Style 6 mm long. Fruit ovoid or ovoid-ellipsoid in outline, densely scaly, 21/2-3.8 by 1.2-1.8 cm with 4 stiff, narrow, sharp-edged wings or ridges, along which it eventually dehisces.

**Distr.** Indo-China, Siam, Caroline Islands, in *Malaysia*: Sumatra, Malay Peninsula, Java, Borneo, Celebes, New Guinea; not recorded from Philippines. Fig. 4.

Ecot. In mangrove swamps and in fringing forests along banks of rivers in lowland regions. Fruit probably dispersed by water. Uses. The fruits are used as a vermifuge but perhaps by confusion with those of *C. trifoliatum* or *Quisqualis indica*.

**Vern.** Akar aru, E. Borneo, songsong haras, susun haras, M. tingting, Celebes.

**Notes.** One specimen, EVANGELISTA 897 (A), from BR. N. Borneo, Labuan River, has much shorter and broader calyx-lobes; so that the flowers resemble those of *C. yunnanense*, but the leaves are undoubtedly those of *C. tetralophum*. Leaf-galls caused by a gall-mite are described by DOCTERS VAN LEEUWEN (Zoocccid. Neth. E. I. 1926, 402, f. 749).

Liana. Young branchlets scaly when very young, otherwise usually glabrous often reddish in colour. *Leaves* opposite, chartaceous to subcoriaceous, usually broadly elliptic or ovate-elliptic, sometimes suborbicular or elliptic, rarely narrowly elliptic (sucker shoots?) rather sparsely conspicuously scaly when young, when mature densely lepidote (under high magnification) but individual scales not conspicuous, otherwise glabrous, domatia often present but not hairy, 8–20 by 4–13 cm, often acuminate at the apex, acumen up to 1 cm long, cuneate or rounded at the base; petiole scaly when young, soon glabrescent, 7–20 mm long. *Inflorescence* a terminal or axillary panicle up to 20 cm long, of elongated 5–8 cm long spikes or occasionally an unbranched lateral spike, densely and finely velutinous. Bracts very small and soon caducous. *Flowers* greenish-white (occasionally pink?), 4-merous, subsessile. *Lower receptacle* (ovary) finely velutinous, 2½–3½ mm long. Upper receptacle finely velutinous narrowly tubular, 5–6 mm long, somewhat expanded at the apex and terminating in 4 narrowly triangular acute *calyx*-lobes 3 by 2 mm. *Petals* 4 suborbicular, glabrous, 2 by 2 mm, slightly emarginate at the apex and very shortly unguiculate at the base. Stamens 8 inserted at the margin of the disk; filaments 3½ mm long; anthers 0.8 mm long. Disk narrowly infundibuliform, margin thickened, free for about 1½ mm, pilose. Style 8–8½ mm, rather stout. *Fruit* suborbicular (rarely obovate) in outline, 2–3 cm diam., with 4 thin, flexible wings,viscid-glandular especially on the body less so on the wings, shortly stipitate; stipe c. 2 mm long.

Distr. India, Ceylon, Burma, Indo-China, Siam, throughout Malaysia, the Moluccas and New Guinea excepted. Fig. 5.

Ec. Widespread along margins of forest and in secondary forest, from sea-level up to 1000 m (divide BACKER), but most records are below 500 m.

*Vern.* Areunj mundung djalo, areunj tijkupa, S. londo, klundo, klondo, ojod klondo, ojod lundo, J. balinbing balinbing, Bajau, lamutagi, SW. Celebes; Philippines: suksukung, Tagb., dalipog.


Scandent shrub or liana up to 30 m. Young branchlets usually densely ferrugineous-scaly, otherwise glabrous or nearly so. *Leaves* opposite, chartaceous or papyraceous, usually broadly elliptic, sometimes nearly suborbicular, densely scaly but individual scales usually not very conspicuous in dried specimens (but occasionally conspicuous), often minutely verruculose on the upper surface, up to 15 by 10 cm (usually c. 11 by 7 cm in Herb.), acuminate at the apex (rarely rounded, rarely caudate), rounded or obtuse at the base; petiole up to 2 cm long, often rather slender, usually densely (sometimes sparsely) ferrugineous-scaly, glabrescent. *Inflorescence* a terminal panicle of capituliform spikes or racemes, rachis densely covered with reddish, goldenbrown or greyish scales, otherwise usually glabrous. Bracts subtending the flowers, filiform, 1–2 mm long, soon caducous. *Flowers* greenish-white, 4-merous, subsessile. *Lower receptacle* (ovary) densely scaly otherwise glabrous, 3 mm long. Upper receptacle densely scaly otherwise glabrous or nearly glabrous, narrowly tubular, 5 mm long, somewhat expanded at the apex and terminating in 4 triangular acute *calyx*-lobes 2½ by 1½ mm, often reflexed in mature flowers. *Petals* 4 obovate to suborbicular, glabrous, 1½–2 by 1–2 mm, slightly unguiculate. Stamens 8 inserted at the margin of the disk; filaments 3 mm; anthers 0.8 mm long. Disk narrowly infundibuliform, margin

Fig. 5. Distribution of *Combretum*: 11. *latifolium*, 12. *sudaicum*, 12a. *confusum*.
free for about \( \frac{1}{2} \) mm, rather densely pilose. Style 8 mm. Fruit suborbicular in outline, somewhat glutinous, especially when young, with 4 thin flexible wings up to \( 1\frac{1}{2} \) cm broad, not conspicuously lepidote; stipe 2–3 mm.

**Distr.** Siam and Malaysia: Sumatra, Malay Peninsula, Java, Borneo. Fig. 5.

**Ecol.** Climbing shrub or liana of open bush and edges of forest from sea-level to c. 250 m.

**Uses.** It has been used as a cure for opium-craving but is probably of little real value, the supposed effect now being considered mainly psychological.

**Vern.** Akar gambir, akar gēgambir, kait-kait, pugar tanar, M, bajit djaha, Lampong, sung-sung ajēr, Borneo.

**Note.** This species is very close to *C. latifolium* differing mainly in the capituliform spikes and in the scaly but otherwise glabrous inflorescences. The relationship between these species parallels that between *C. punctatum* and *C. squamosum* but is somewhat less close, as a
difference in the form of the inflorescence is correlated with a difference in indumentum (except for a few specimens which may be hybrids: see C. confusum). Hence C. latifolium and C. sundaeicum have been maintained as separate species while C. squamosum and C. punctatum are considered to be only subspecifically distinct.


Similar to the last species in leaf characters but with inflorescences intermediate between those of C. latifolium and C. sundaeicum, the ultimate spikes being slightly more elongated than in the latter species. The flowers are scaly like those of C. sundaeicum but the rhachides and peduncles of the inflorescence are densely pubescent or tomentellous, much as in C. latifolium.

Distr. Malaysia: Philippines (Luzon). Fig. S.

Note. The three gatherings known are all from Luzon and may represent a hybrid between C. latifolium and C. sundaeicum. Neither supposed parent is now known in Luzon but C. latifolium occurs in Palawan and C. sundaeicum in Sarawak.

Cultivated species

The following species are in cultivation in various Malaysian gardens: C. assimile Eichl., C. coccineum (Sonn.) Lamk. (C. purpureum Vahl), C. flagrocarpum Clarke, C. grandiflorum Don, C. paniculatum Vent. (C. platanum Hook.), C. pilosum Roxb., C. quadrangularare Kurz, and C. roxburghii Spreng. (C. decandrum Roxb.).

Of these the more attractive and widely grown species are: C. coccineum, C. grandiflorum and C. paniculatum. C. grandiflorum has occasionally established itself as an escape from cultivation in Penang.

Excluded species as


Combretum sexalatum Merr. Philip. J. Sc. 1 Suppl. 3 (1906) 212 pro parte quoad fl. fruct. = Aspidopteris elliptica Juss. (Malpigh.).

2. QUISQUALIS


Woody climbers. Leaves opposite or subopposite, entire, glabrous or hairy; petioles partly persisting after the fall of the leaf, their bases forming thorns. Flowers ♀, actinomorphic or slightly zygomorphic, 5-merous, in elongated, terminal or axillary bracteate (occasionally branched) spikes. Receptacle (calyx-tube) hairy or nearly glabrous, divided into a lower part (lower receptacle) surrounding and adnate to the ovary and a tubular to narrowly tubular upper part (upper receptacle) terminating in the calyx-lobes, the latter part caducous. Calyx-lobes 5, triangular, sometimes with filiform tips. Petals 5, rather large for the family and much exceeding the calyx-lobes, enlarging during anthesis. Stamens 10, biseriate, inserted inside and near the mouth of the upper receptacle. Anthers versatile. Disk narrowly tubular or absent. Style adnate for part of its length to the inner wall of the upper receptacle. Ovules 2–4; funicles sometimes papillose. Fruit dry, oblong, narrowed at both ends, deeply 5-sulcate between the longitudinal wings. Seed 1, longitudinally sulcate.

Distr. About 17 spp. of which 8 occur in tropical and South Africa, 8 in tropical Indo-Malaysia and 1, Q. indica, cultivated throughout the tropics, is probably indigenous both in tropical Africa and tropical Indo-Malaysia.

The Malaysian species belong to the following sections:
sect. Sphalanthus (Jack) Exell (Q. conferta and Q. parvifolia), and
sect. Euquisqualis Exell (Q. indica and Q. sulcata).

Ecol. Woody climbers along river-banks and margins of forests, mostly at low altitudes.
Uses. Q. indica is cultivated as an ornamental climber and the fruits are used as a vermifuge.

Notes. The genus as here delimited is separated from Combretum by the adnation of the style to the upper receptacle tube. For a full account of this question see Exell, l.c.
KEY TO THE SPECIES

1. Petals less than 5 mm long. Upper receptacle (calyx-tube) not more than 2-5 cm long.
2. Upper receptacle (calyx-tube) 18-25 mm long. Branchlets tomentellous or pubescent. 1. Q. conferta
3. Upper receptacle (calyx-tube) about 10 mm long. Branchlets glabrous or nearly glabrous. 2. Q. parvifolia
4. Petals 7 mm long or longer in mature flowers (up to c. 20 mm). Upper receptacle (calyx-tube) 4-8 cm long.
6. Q. sulcata
7. Upper receptacle (calyx-tube) up to 8 cm long. Indumentum very variable but branchlets never quite glabrous. Ovules 3-4.
8. Q. indica


Young branchlets appressed-pubescent or tomentellous. Leaves opposite, papyraceous, elliptic, oblong-elliptic or obovate-oblong, glabrous except for domatia on the underside and a few hairs on the midrib, minutely verruculose above and beneath, 8-16 by 3½-6 cm, acuminate at the apex and rounded (or sometimes very slightly cordate) at the base; nerves 5-6 pairs; petiole tomentellous, more or less glabrescent, 7-9 mm. Spikes terminal and axillary (occasionally branch-ed), 6-12 cm long. Branchlets narrowly elliptic, acuminate appressed-pubescent, 5-8 by 1½-2 mm. Flowers red or white (? turning colour during the day as in Q. indica), sessile, actinomorphic or slightly zygomorphic. Lower receptacle (ovary) sericeous, 3½-4 mm long; upper receptacle narrowly tubular, pubescent, 18-25 mm long, slightly expanded at the apex, basal part slightly swollen at one side. Calyx-lubes with recurved filiform tips, 2-3 mm long. Petals oblong or elliptic, pubescent, 4 by 1.8 mm (about 2½/2 mm long in dried specimens). Longer stamens opposite the calyx-lubes with filaments 3½/2 mm long, shorter ones inserted higher in the upper receptacle opposite the petals with filaments 2 mm long; anthers 0.8 mm long. Disk narrowly tubular, slightly zygomorphic, glabrous, 10 by 1½ mm without free margin and not very clearly differentiated.

Style adnate to the upper receptacle for 20 mm, upper part free, 6 mm. Ovules 3. Fruit elliptic to ovate-elliptic in outline, 2-2½ by 1.8 cm with 5 thin, but rather stiff wings 6-7 mm broad, shortly stipitate, sparsely pubescent, somewhat viscid. 

Distr. Indo-China, Siam, in Malaysia: Malay Peninsula (and Sumatra?, cf. Jack). Fig. 7.

Ecol. Presumably a forest-climber. Uses. Apparently used indifferently with Q. indica as a vermifuge according to Burkill (Dict. 1860); leaves or roots are used. Vern. Kayu sumang, selimpas, sumang, akar dani, rëdani, Mal. Pen.

Notes. This species is said to have been collected by William Jack in Sumatra and a specimen, without precise locality, is in the Delessert Herbarium at Geneva and must be considered as the type. The species has never been collected again in Sumatra.

The ‘disk’ mentioned in this and the following species is not such an obviously independent structure as in most species of Combretum and Terminalia but rather a thickened portion of the basal part of the upper receptacle presumably secretory in function.


Branchlets very slender, glabrous or nearly so. Leaves minutely verruculose above, glabrous except for domatia and some pubescence on the midrib beneath, ovate-oblong, ovate-elliptic or elliptic, acuminate at the apex, rounded or subcordate at the base, 3-10 by 1½-5 cm; nerves 3-4 pairs, rather prominent beneath; petioles 4-6 mm, glabrous. Spurs short, terminal or lateral with rhachides 6-10 mm long. Flowers ‘dirty mauve’. Lower receptacle (ovary) appressed-pubescent 2 mm long; upper receptacle tubular. 10 by 2½/2 mm, slightly swollen at one side in the basal part containing the disk, appressed-pubescent outside, glabrous inside. Calyx-lubes triangular, acute, 2 by 0.8 mm, tips ± filiform but only 1½-1 mm long. Petals ovate, appressed-pubescent. 2 by 1½ mm. Filaments of longer stamens 2 mm, shorter ones 1½ mm; anthers 1½ mm long. Disk infundibuliform, c. 2 mm long, not very clearly differentiated. Style adnate for 8 mm to the upper receptacle; free part 2½/2 mm. Ovules 2. Fruit not known.

Distr. Malaysia: NW. Malay Peninsula (Langkawi Islands). Fig. 7.
Fig. 8. *Quisqualis indica* L. with flowers and fruits, $\times \frac{2}{3}$.

Notes. Clearly closely related to the preceding species but smaller in all its parts and with only 2 ovules in the ovaries of the few flowers available for dissection. The relation between this species and *Q. conferta* is almost the same as that between *Q. sulcata* and *Q. indica*.


Young branchlets reddish, glabrous. *Leaves* opposite, obovate or elliptic shortly acuminate at the apex, subcordate or rounded at the base, nearly glabrous, except for domatia on underside, minutely verruculose above, 10–19 by $4\frac{1}{2}$–8 cm; petiole 1.2–2 cm, glabrous, sulcate. Spikes shortly and densely hairy, terminal and axillary, 7–9 cm long. *Lower receptacle* (ovary) densely appressed-pubescent, 5–6 mm long; upper receptacle narrowly tubular, somewhat expanded at the apex with short appressed-pubescence on the outside and longer patent hairs within. *Calyx-lobes* broadly ovate, $1\frac{1}{2}$ mm long. *Petals* oblong,
puberulous, rounded at the apex and rounded or slightly cuneate at the base, 12 by 6 mm. Filaments of longer stamens 9 mm, inserted opposite the calyx-lobes in the upper part of the upper receptacle, filaments of shorter ones 8 mm, inserted near the base of the petals c. 2 mm higher in the tube of the upper receptacle than the longer series; anthers 0.8 mm long. Style attached to the inside of the tube of the upper receptacle to within 2 mm of the attachment of the longer stamens at which it becomes free, free part 13 mm. Ovules 2. Fruit ellipsoid in outline, 3–3½ by 1.2–1.4 cm with 5 narrow stiff wings, at first appressed-pubescent, later glabrescent.

**Distr.** Malaysia: Lesser Sunda Islands (P. Watet), Saileroy group (P. Kalao Toa, halfway Flores-SW.Celebes), and SW.Celebes (Maros). Fig. 7.

Ecol. Possibly on coral limestone, in Watet in Eucalypt savannah, 0–50 m, fl. March–May.

**Notes.** Owing to lack of material I have not been able to verify van Slooten’s statement that this species has only 2 ovules, compared with 3 to 4 in *Q. indica*. If this distinction is true, in combination with the glabrousness of the twigs and the rather shorter upper receptacle it should be sufficient to maintain *Q. sulcata* as a good species. The difference given by van Slooten in the shape of the petals proves on examination to be scarcely significant. Moreover, *Q. indica* is so variable as regards indumentum that the glabrous twigs in *Q. sulcata* could be regarded as no more than the end-point of a series of diminishing hairiness.


Climbing to the left (MEUSEE). Young branchlets tomentose, villous, pilose, appressed-pubescent or sparsely pubescent, rarely sparsely glandular. Leaves opposite or subopposite (said to be sometimes partly alternate, spiral or ± whorled—see Sims and MEUSEE, *Ilucc*), papyraceous, elliptic or elliptic-oblong, varying from tomentose to nearly glabrous, with domania sometimes present, minutely verruculous on the upper surface, 5–18½ by 2½–9 cm, acuminate or sometimes subacute at the apex, rounded or subcordate at the base; nerves 5–6 pairs; petiole varying from tomentose to nearly glabrous, ½–2 cm; petiolar thorns sometimes up to ½ cm. Spikes terminal and axillary, 2–10 cm long, sometimes forming a leafy panicula. Bracts lanceolate-acuminate or elliptic, 6–10 by 2–3 mm. Flowers pleasantly scented. Lower receptacle sericeous, 3–4 mm long; upper receptacle narrowly tubular, slightly expanded at the apex, outside varying from tomentose to nearly glabrous. Calyx-lobes deltoid or shortly triangular, 1–2 mm long, tips acute but scarcely filiform. Petals oblong, white, 6–8 mm, finally turning dark red, 10–20 by 3–6 mm, somewhat rounded and very shortly unguiculate at the base, imbricate in bud, sparsely pubescent. Filaments 7–7½ mm long, longer ones attached c. ¾ mm lower in the receptacle-tube than the shorter ones. Style adnate to the inner wall of the upper receptacle, upper part free for 15 mm. Ovules 3–4. Fruit dark-brown, ovate-elliptic in outline, usually appressed-pubescent, 2½–4 by ¾ to 1½ cm with 5 rather stiff wings.

**Distr.** Widespread in the tropics of the Old World and widely planted in many tropical countries, throughout Malaysia. Fig. 7.

Ecol. A large climber along margins of primary forest, along river-banks, in thickets and in secondary forest; from sea-level to c. 100 (–300) m. Specimens maintain themselves by root-suckers and stools.

**Uses.** Much grown as an ornamental climber in tropical gardens. In India and Malaysia fruits are often used as vermifuge; for this purpose they are picked half-ripe, when they are bitter, pulped in water and the liquid drunk. Seeds from ripe fruits may also be used. When ripe they taste like coconut (BURK. Dikt. 1860). In Java the root is used as a vermifuge, or in E. Malaysia an extract from the mature leaves. Though many experiments have been carried out it is surprising that no active chemical substance has yet been isolated (cf. QUISUMBING, Medic. Pl. Philip. 1951, 654).

Very young shoots are used as a vegetable in Java (OCHSE, Veg. D. E. 1, 1931, 106).

Notes. *Q. indica* varies very greatly as regards its form of growth and indumentum. This led Rumphius to observe (op. cit. 72) ‘Haec planta mihi Latine Quis qualis vocatur, acsi juxta Belgicum Hoedanig denominata esset, atque hoc nomen ipsi inposui ob multispecie, quas subit, mutationes, & variabilem formam’ (See also Sims, I.c.).

The petals are white when the flowers open in the early morning and gradually turn red as the day advances. The flowers are adapted for pollination by only very long-tongued insects; fruiting specimens are rare from many localities.

A leaf-gall due to the gall-mite *Eriophyes quisqualis* Nol. has been recorded on the species (Docters van Leeuwen, Zooccc. N. I. 1926, 403). Several experienced collectors have expressed the opinion that *Q. indica* is indigenous in tropical Africa and not merely an escape from cultivation.

3. TERMINALIA


Trees, often of great stature, frequently buttressed. Branching often sympodial. Leaves usually spirally arranged, often crowded in pseudo-whorls at the ends of the branchlets, usually petiolate, entire, glabrous or hairy, often minutely verrucose and pellucid-punctate due to aggregations of calcium oxalate crystals, rarely with canal-like mucilaginous cavities, often with domatia, frequently with 2 or more glands at or near the base of the lamina or on the petiole. Flowers actino-
morphic 5-merous (rarely 4-merous) usually in axillary spikes with ♂ flowers towards the apex and ♀ flowers towards the base, more rarely in terminal or terminal and axillary panicles; ♂ flowers stalked, stalks resembling pedicels but corresponding to the lower receptacle with abortion of the ovary; ♀ sessile. **Receptacle** (calyx-tube) glabrous or hairy, divided into a lower part (lower receptacle) surrounding and adnate to the ovary and often narrowed above it and an upper part, often scarcely developed, expanding into a shallow cup terminating in the calyx-lobes. **Calyx-lobes** deltoid, ovate or triangular. **Petals** absent. Stamens usually 10, exserted; anthers dorsifix, versatile. Disk intrastaminal, usually barbate or densely pilose, occasionally glabrous or nearly glabrous, rarely little developed. Style simple, free, exserted. **Ovary** completely inferior, unilocular with 2 (rarely 3 or 4) pendulous ovules. **Fruit** (pseudocarp) very variable in size and shape, often fleshy and drupe-like, sometimes dry and leathery or corky, often 2–5-winged, usually with an at least partially sclerenchymatous endocarp (thus distinguishing it from the fruit of *Combretum*).

**Distr.** About 200 spp. throughout the tropics fairly equally distributed between tropical Asia, extending to northern Australia and Polynesia, tropical Africa and tropical America.

**Ecol.** The Malaysian species are mainly large evergreen or semideciduous trees of rain-forests, teak-forests, swamp forests and riverine forests. Some species are littoral and most occur at low altitudes, a few reaching 1600–2000 m. A number of species have fruits which are corky or contain air-chambers adapting them for distribution by water.

**Wood anat.** See under the species.

There is a marked tendency in Malaysian *Terminalia* spp. towards a crown habit, described and figured by **Corner** as *pagoda trees*. **Corner** says (Wayside Trees of Malaya p. 30):—‘Their striking shape depends not only on the spacing of the limbs on the trunk but on their own peculiar branching whereby the leaves are set together in upturned posses to form mats of foliage, there being one such mat for each tier of the crown: and, because this branching is typical of the genus of the *kêtapang*, we have called it *Terminalia-branching.*’ This is caused by sympodial growth. The pagoda habit is most conspicuous in saplings (fig. 18) and often disappears in the older trees as the branches droop at the ends and the crown is filled out. It has, however, often been mentioned in field notes as characteristic, for example in the following species: *T. archboldiana*, *T. cômamansai*, *T. hypargyrea*, *T. solomonensis*, and *T. subspathulata*.

As to bark characters only one species is remarkable, viz *T. brussii* in which the bark comes off in long, loose strips, so that the general appearance is reminiscent of some species of *Eucalyptus* and *Tristania*.

Most species possess a ‘normal’ leaf-size, some have large leaves, viz *T. adenopoda*, *T. catappa*, *T. darlingii*, *T. kaernbachii*, *T. zollingeri*, the largest-leaved of all being *T. copeandelii* (up to 40 by 18 cm).

Most species occur in rain-forest, a few are apparently confined to semi-arid conditions, e.g. *T. crossfolia*, *T. microcarpa*, and *T. insularis*.

Deciduous species are, as far known: *T. bellirica*, *T. calamansai*, *T. canaliculata*, *T. catappa*, and *T. papuana*. This character is not correlated with occurrence in a monsoon climate.

**Corner** (I.c. p. 192) says that species in the Malay Peninsula seem to be deciduous and flower after the new leaves have developed, but both the frequency with which they shed their leaves and the season differ markedly.

**Uses.** A considerable number of species provide useful timber. The fruits of some are edible and those of others are used for tanning and dyeing, especially the various species known collectively as *Myrobalans*.

**Notes.** The sections proposed in the genus are not entirely satisfactory and no useful purpose would be served by trying to fit the Malaysian species into them without a worldwide revision.

Apart from small differences in size and indumentum, the flowers of *Terminalia* are remarkably uniform in structure and offer few features of diagnostic value. The fruits, on the other hand are extremely variable and it is essential to use them for the making of keys. As the latter, and in the main the descriptions of the species, have perforce to be drawn up from dried material, the shapes and dimensions must necessarily be misleading to those who use the *Flora* with living specimens. Fleshy pericarps shrivel to a mere skin and except where information has been available from collectors’ notes, the object described and measured is often merely the *endocarp* or *stone* of the fruit.

Too much attention should not be paid to the length of the lower receptacle in the descriptions for it begins to swell and to lengthen as the fertilized ovum develops. Only descriptions made from material at comparable stages of development would have diagnostic validity.

In comparing flowering and fruiting specimens and matching them up, a process not yet fully com-
pleted in this genus, it is perhaps superfluous to point out that when the lower receptacle is glabrous in the flowering stage a hairy fruit cannot result from it; but when the lower receptacle is sericeous the fruit, after swilling, will be at first appressed-pubescent. This indumentum may wear off as the fruit matures though traces of it can often be seen in furrows or near the base.

Some explanation of the ‘pellucid punctuation’ of the leaves is advisable. Aggregations of crystals of calcium oxalate cause minute warts usually on the upper and occasionally on the lower surface of the leaf. When held up to the light the leaf appears more or less pellucid-punctate. In very young, thin leaves these characters will not have developed: while as the leaf thickens with age they frequently disappear so that their diagnostic value is limited and their presence or absence in a description may be misleading and too much importance should not be attached to them.

A number of species, especially from Sumatra, Borneo, Celebes and New Guinea are still very insufficiently known. Sterile or imperfect material in herbaria shows that there are a number of new ones yet to be described; while several of those here enumerated may eventually be united when more collections have been made.

Finally, several species are very variable and have had to be inserted in more than one place in the key; so that when it seems uncertain which way to go it is possible to hope that either road will lead to the desired destination.

**SYNOPSIS OF THE SPECIES**

in an attempted natural classification

**Series A.**—Flowers in terminal panicles probably all ♀. Leaves with a tendency to be opposite or sub-opposite. Species mainly of Indo-Malaysian distribution or affinity, approaching most nearly the genus Combretum.

**Subseries (a).** Fruits winged.
- Fruit small, 2-winged, wings broader than long ........................................ 1. T. myricarpa
- Fruit 2-winged, wings longer than broad ...................................................... 2. T. brasiil
- Fruit usually 3-winged ........................................ 3. T. triperta
- Fruit usually 4-winged ...................................................... 4. T. polyantha

**Subseries (b).** Fruits not winged. ‘Myrobalans’
- Fruit ellipsoid (fig. 14) ...................................................... 5. T. citrina
- (Fruit unknown) ...................................................... 6. T. creaghii

The introduced species T. chebula also comes here.

All succeeding series have spirally arranged leaves and all except series L. have flowers in axillary spikes usually ♀ towards the apex and ♂ towards the base.

**Series B.**—Fruit 2-winged, broader than long (*i.e.* wings extended laterally). Species of Indo-Malaysian affinity.
- Fruit pubescent ...................................................... 7. T. calamansanai
- Fruit glabrous ...................................................... 8. T. subspathulata

**Series C.**—Fruit laterally compressed usually longitudinally circumalate or circum-ridged. Mainly endemic species confined to East Malaysia.

**Subseries (a).** Leaves spathulate to obovate, coriaceous. Species from the Philippines, Celebes, and New Guinea.

**Subseries (b).** Leaves narrowly elliptic to obovate, often silvery or rufous-sericeous especially when young. Endemic New Guinea species, except no 19 which is widespread in the Archipelago and no 20 which extends to the Solomon Islands.

**Series D.**—Leaves obovate, subcordate at the base. Fruit usually compressed, circumalate or circum-ridged. Littoral species of Tropical Asia-N.Australia-Polynesia distribution .................. 24. T. catappa

**Series E.**—Leaves obovate, usually coriaceous, not subcordate at the base. Fruit relatively small, ± laterally compressed. Littoral species of Polynesian Polynesia distribution
- Fruit considerably compressed, c. 2 cm long (fig. 14) .......................... 25. T. samoensis
- Fruit little compressed, c. 1½ cm long. Leaves sparsely appressed-pubescent 26. T. crassifolia
- Fruit little compressed, 1½—2 cm long. Leaves densely, softly pubescent at time of flowering. 27. T. insularis

**Series F.**—Leaves typically broadly elliptic to suborbicular, sometimes with petioles nearly as long as the lamina. Fruit subglobose to broadly ellipsoid, little compressed, often 5-ridged, tomentellous. Species of Indo-Malaysian distribution, also known as a ‘Myrobalan’ (fig. 14) .................. 28. T. bellirica
Series G.—A probably heterogeneous group of species with ellipsoid (not compressed) fruits with sclerenchymatous endocarp, about 2½–7 cm long. Leaves rarely more than 25 cm long, usually not exceeding 20 cm. Species mostly endemic to Malaysia.

29. T. macadamii (fig. 14), 30. T. solomonensis, 31. T. kangeanensis (fig. 14), 32. T. celebica (fig. 14), 33. T. beccarii, 34. T. soembarwana (fig. 14), 35. T. nitens (fig. 22), 36. T. lunquistii (fig. 22), 37. T. plagata (fig. 22), 38. T. pellucida (fig. 22), 39. T. papuana (fig. 22), 40. T. zollingeri (fig. 24).

Series H.—Fruit subglobose or ellipsoid with a spongy, fibrous or corky pericarp. Leaves not more than 20 cm long. Sumatra, Malay Peninsula, Borneo and Philippines. Species of Indo-Malayan affinities.

Fruit 3½–5 cm long. Leaves up to 19 cm long (fig. 22, 25)..

41. T. foetidissima

Fruit 3½/2 cm in diam. subglobose. Leaves up to 7 cm long (fig. 22) .

42. T. molii

Fruit 6–7 by 4½/2 cm. Leaves up to 8 cm long (fig. 22).

43. T. phellocarpa

Series I.—Leaves often very large, up to 40 cm long, lateral nerves often numerous and prominent.

Fruit up to 17½ cm long (T. kaernbachii). Malaysian-Melanesian species.

Fruit 3½–6 cm long. Lateral nerves 15–40 pairs (fig. 29) ..

44. T. copelandii

Fruit up to 8–17½ cm long. Lateral nerves 10–18 pairs (fig. 29) .

45. T. kaernbachii

(Fruit unknown, perhaps belongs here) ..

46. T. adenopoda

Series J.—Leaves manifestly canaliculate showing distinct striae on the upper surface when viewed with a lens. The affinity may be with series G ..

47. T. canaliculata

Series K.—Leaves small, obovate, coriaceous, 3–7 cm long. Fruits small, 8 by 7 mm (perhaps immature). A New Guinean species of doubtful affinity ..

48. T. archboldiana

Series L.—Flowers in pseudo-capitulae. Species endemic to New Guinea ..

49. T. capitulata

Unplaced.—Known only from leaves ..

50. T. oxyphylla

KEY TO THE SPECIES

1. Leaves without linear translucent mucilage canals clearly visible on the upper surface of the leaves, though sometimes pellucid-pectinate.

2. Flowers in axillary spikes or terminal panicles (not pseudo-capitulae).

3. Fruit (including wings) broader than long.

4. Fruit (including wings) usually c. 1 cm broad (occasionally up to 1.6 cm). Flowers in terminal panicles ..

1. T. myriocarpa

4. Fruit (including wings) at least 2 cm broad. Flowers in axillary spikes or, more rarely, in terminal panicles.

5. Fruit finely pubescent or tomentellous, especially on the body, less so on the wings

7. T. calamansanai

5. Fruit glabrous when mature. Leaves glaucous beneath ..

8. T. subpathulata

3. Fruit orbicular or ovate in outline, or longer than broad, variously winged or ridged, or not winged, terete or flattened.

6. Upper receptacle and calyx remaining attached to the apex of the developing fruit. Leaves usually oblong, rounded at the base with 20–35 pairs of lateral nerves. Flowers in terminal and axillary panicles ..

2. T. brassii

6. Upper receptacle and calyx early deciduous.

7. Fruit 3–5-winged (not merely at the apex). Flowers in panicles.

8. Fruit 3-winged, 1½–2 cm long. Flowers 1–1½ mm in diameter ..

3. T. triptera

8. Fruit 4–5-winged (exceptionally 3-winged), 1½ cm long. Flowers 1½–2 mm in diameter.

4. T. polyantha

7. Fruit not 3–5-winged (except occasionally at the apex only), either circumbalate, with 2 wings generally confluent at the apex and usually also at the base or without wings (though sometimes ridged or angled).

9. Fruit longitudinally circumbalate (sometimes not completely so at the base or apex) usually laterally compressed. Wing sometimes as narrow as 2–3 mm but clearly more than a mere ridge or angle (border-line cases will be found in both halves of the key). Two or three additional longitudinal ridges sometimes present.

10. Leaves not subcordate at the base.

11. Fruit not (or very rarely) more than 2½ cm long (up to 2.7 cm in T. microcarpa).

12. Fruit glabrous when mature.

13. Fruit ovate in outline ..

9. T. kjellbergii

13. Fruit suborbicular in outline, emarginate at the apex ..

10. T. surigaensis

12. Fruit pubescent.
14. Fruit suborbicular in outline, somewhat emarginate at the apex. Leaves up to 26 cm long, much narrowed at the base ............................................. 11. T. darlingii
14. Fruit flattened ellipsoid. Leaves c. 12 cm long (fig. 14) ............................................. 19. T. microcarpa
11. Fruit 3 cm long or longer.
15. Fruit suborbicular or very broadly elliptic in outline.
16. Fruit not more than 3 cm long ............................................................... 11. T. darlingii
16. Fruit 7½ by 6 by 3 cm, resembling a diminutive tortoise in shape ............................................. 12. T. slooteniana
15. Fruit elliptic or ovate in outline.
17. Mature fruit glabrous.
18. Fruit elliptic or narrowly elliptic in outline.
19. Wings of fruit 5–7 mm broad. Leaves narrowly obovate or spatulate. 13. T. supitiana
19. Wings of fruit 1–3 mm broad, sometimes scarcely developed.
20. Fruit 3½ cm long. Receptacle sericeous. Leaves up to 10 cm long (fig. 14) ............................................. 16. T. oreadum
20. Fruit 5½–7 cm long. Leaves up to 20 cm long (fig. 14) ............................................. 14. T. clemensae
18. Fruit ovate to broadly elliptic in outline, up to 3½ cm long. Receptacle glabrous. Leaves elliptic or obovate-elliptic, usually shiny above (fig. 14) ............................................. 15. T. steenisiana
17. Mature fruit pubescent or tomentellous.
21. Leaves fulvous-pubescent on the nerves beneath (fig. 14) ............................................. 17. T. sepicana
21. Leaves rufous-tomentellous on the nerves beneath ............................................. 18. T. rubiginosa
10. Leaves usually subcordate at the base, obovate, with a short, thick petiole; deciduous.
24. T. catappa

9. Fruit not winged, sometimes with 2–5 longitudinal ridges.
22. Fruit laterally compressed so that, in dried specimens the longer axis of the transverse section is at least 1½ times the shorter axis. (In fresh specimens the endocarp or 'stone' should be measured.)
23. Fruit 1–2 cm long (occasional fruits reaching 2½ cm).
24. Fruit glabrous, the sclerenchymatous endocarp containing many small air-spaces. Leaves obovate or broadly obovate (fig. 14) ............................................. 25. T. samoensis
24. Fruit pubescent or sericeous (if pubescent with traces of indument remaining). Leaves elliptic to obovate-elliptic.
25. Endocarp of fruit densely sclerenchymatous without air-chambers. 19. T. microcarpa
25. Endocarp of fruit with radial plates of sclerema separated by large air spaces.
26. Leaves with up to 12 pairs of lateral nerves, typically elliptic (fig. 14). 20. T. complanata
26. Leaves with up to 16 pairs of lateral nerves, typically obovate-elliptic. 23. T. longespicata
23. Fruits more than 2 cm long.
27. Leaves not subcordate at the base. Fruit 2–4 cm long.
28. Leaves obovate or narrowly obovate.
29. Young parts rufous-tomentose, sometimes glaucous beneath ............................................. 41. T. floetidissima
29. Young parts silvery or rufous-sericeous. Leaves not glaucous beneath (fig. 14). ............................................. 21. T. hypargyrea
28. Leaves oblong, elliptic or oblanceolate.
30. Leaves with up to 16 pairs of lateral nerves, rufous-tomentose, -tomentellous or -pubescent (fig. 14, 16) ............................................. 23. T. longespicata
30. Leaves with 6–12 pairs of lateral nerves.
31. Fruit suborbicular in outline, sometimes beaked.
32. Leaves appressed-pubescent beneath. Lateral veins regularly parallel, sharply ascending and usually about 4–8 mm apart ............................................. 20. T. complanata
32. Leaves with a dense, silky, red, silvery or golden indument (sometimes glabrescent when mature). Lateral nerves less regularly parallel than in the preceding species.
33. Bracts of inflorescence 2–3 mm long. Indument of leaves and inflorescences silvery or golden (in dried specimens). Leaves obovate to elliptic ............................................. 21. T. hypargyrea
33. Bracts of inflorescence 4–6 mm long. Indument of leaves and inflorescences golden-red to red (in dried specimens). Leaves narrowly elliptic or narrowly obovate-elliptic ............................................. 22. T. sagerensis
31. Fruit elliptic in outline ............................................. 16. T. oreadum
27. Leaves usually subcordate at the base. Fruit usually more than 4 cm long. 24. T. catappa
22. Fruit terete or nearly terete in transverse section or if somewhat laterally compressed then the longer axis of the transverse section less than 1½ times the shorter axis.
34. Flowers in panicles. Leaves often opposite or subopposite.
35. Leaves coriaceous shiny, with numerous conspicuous parallel tertiary veins on lower surface. (Fruit unknown.) ............................................. 6. T. creaghii
35. Leaves without conspicuous parallel tertiary veins on the lower surface (fig. 14) 5. T. citrina
34. Flowers in axillary spikes.
36. Fruit not more than 5 cm long.
37. Fruit not more than 1 1/2 cm long.
38. Leaves softly and densely pubescent at time of flowering, 8-17 cm long. 27. T. insularis
38. Leaves sparsely appressed-pubescent or glabrous.
39. Leaves 6-13 cm long. Fruit 1-1 1/2 cm long. Branchlets rather stout. 26. T. crassifolia
39. Leaves 3-9 cm long. Fruit 1 cm long. Branchlets slender. 48. T. archboldiana
37. Fruit 2-5 cm long.
40. Leaves usually subcordate at the base.
41. Lateral nerves 8-13 pairs. Inflorescences 8-20 cm long. 24. T. catappa
41. Lateral nerves 18-30 pairs. Inflorescences often more than 30 cm long. 44. T. copelandii
40. Leaves not subcordate at the base.
42. Fruit tomentellous. Petioles 3-6 cm long (fig. 14). 28. T. bellirica
42. Fruit glabrous or sparsely hairy.
43. Mature leaves fulvous or rufous-tomentose at least on the nerves below.
44. Fruit over 4 cm long. Leaves narrowly obovate or narrowly obovate-elliptic.
44. Fruit 2 1/2-3 cm long. Leaves elliptic or broadly elliptic (fig. 14). 29. T. macadamii
43. Mature leaves not tomentose beneath (except sometimes on the petioles when young).
45. Leaves elliptic or obovate-elliptic, greatest breadth usually between 1/2 and 2/3 of distance from base to apex.
46. Flowers sericeous outside.
47. Fruit subglobose 3 1/2 by 3 cm (fig. 22). 42. R. molii
47. Fruit ellipsoid.
48. Fruit 1 1/2-2 times as long as broad.
49. Petioles 3 1/2-5 cm long, usually with 2 glands near the centre. Fruit 3 1/2-4 cm long (New Guinea and Solomon Isl.). 30. T. solomonensis
49. Petioles 2-3 cm long; glands obsolete or rather inconspicuous at the base of the lamina. Fruit 2 1/2-3 1/2 cm long (Java, Kangean Arch.) (fig. 14). 31. T. kangeanensis
48. Fruit 2 1/2-3 times as long as broad, sclerenchyma of endocarp stellate in transverse section (fig. 14).
46. Flowers glabrous outside.
50. Petiole 2 1/2 cm long. Leaves not shiny above, up to 14 by 7 1/2 cm. (Fruit unknown; position perhaps here). 33. T. beecearii
50. Petiole not more than 2 cm long. Leaves ± shiny above.
51. Fruit 3-3 1/2 cm long. Leaves up to 20 by 11 cm, somewhat shiny above (fig. 14).
34. T. soembawana
51. Fruit up to 5 cm long. Leaves up to 15 by 9 cm.
52. Fruit not verrucose. Leaves very shiny above. 35. T. nitens
52. Fruit verrucose. Leaves not very shiny above, glutinous beneath (fig. 22).
36. T. lundquistii
45. Leaves narrowly obovate to obovate or oblanceolate, usually rounded at the apex (though often also apiculate), greatest breadth within the apical third of the leaf.
53. Flower-buds glabrous (calyx-teeth, upper receptacle and lower receptacle glabrous on the outside).
54. Leaves not minutely verruculose on the upper surface, usually intensely shiny above and drying (in the specimens seen) a dark chocolate brown (fig. 22).
35. T. nitens
54. Leaves usually minutely verruculose on the upper surface when adult; upper surface of leaf (when dried) dull or somewhat shiny.
55. Leaves up to 20 by 11 cm. Lateral nerves 9-13 pairs. 34. T. soembawana
55. Leaves rarely more than 12 cm long (occasionally up to 17 by 9 cm). Lateral nerves 5-10 pairs.
56. Petiole sericeous. Reticulation prominent on the upper surface of the leaf (fig. 22). 37. T. plagata
56. Petiole glabrous. Reticulation not very prominent on the upper surface of the leaf (fig. 22). 38. T. pellucida
53. Flower-buds hairy, especially on the lower receptacle (fig. 22, 25). 41. T. foetidissima
36. Fruit more than 5 cm long.
57. Leaves subcordate at the base.
58. Lateral nerves 8-13 pairs. Inflorescences 8-20 cm long. 24. T. catappa
58. Lateral nerves 18-30 pairs. Inflorescences up to 30 cm long (fig. 29). 44. T. copelandii
57. Leaves not subcordate at the base.
59. Mature leaves rufous-tomentose on the nerves beneath, up to 30 cm long.
60. Petiole about 5 mm long. Fruit 4 1/2-7 1/2 cm long (fig. 24). 40. T. zollingeri
60. Petiole usually 15-30 mm long. Fruit 8-17 cm long (fig. 29). 45. T. kaernbachii
59. Mature leaves nearly glabrous.
Leaves nearly glabrous up to 35 by 12 cm. Lateral nerves 14–17 pairs.

46. T. adenopoda

Leaves glabrous, crowded at the ends of the branches, narrowly elliptic up to 20 by 6½ cm. 50. T. oxyphylla


Large, evergreen tree. Young branchlets tomentellous sometimes rapidly glabrescent. Leaves subopposite, at first tomentellous or appressed-pubescent, often glabrescent when mature, oblong-oblong-elliptic or oblong-lanceolate, 8–20 by 2–8 cm, pointed at the apex, rounded or subcordate at the base; nerves up to 20–30 pairs; petiole tomentellous often glabrescent, relatively short and thick, 3–4(–7) mm, often 1 or 2 conspicuous glands (sometimes stalked) at the apex of the petiole or at the base of the lamina. Flowers small, sessile, numerous, 4, protogynous, in large terminal fulvous-tomentellous panicles; bud subglobose, nearly glabrous towards the apex. Lower receptacle (ovary) sericeous, 3/4–1 mm long; upper receptacle nearly glabrous, cupuliform, 0.8 by 0.8 mm. Calyx-lolobes deltoid, 1/2 mm long. Filaments glabrous, 1½ mm; anthers ½ mm long. Disk poorly developed. Style glabrous, 2 mm. Fruit fulvous-sericeous, body compressed-ellipsoid or obscurely trigonal, 3–4 by 1½–2½ mm, expanded laterally into 2 thin pubescent transversely oblong wings, 2–4 by 5–6 mm, with occasional rudimentary development of a third wing.

Distr. India (Sikkim, Assam), Upper Burma, China (Yunnan), Indo-China, in Malayan: N, Sumatra. Fig. 10.

Ecol. Primary forests, 1000–2000 m.


Uses. The timber is said to be excellent, the wood being white and hard.

Vern. Sêntaloun, Gajo.

Note. GRIFFITH 407 (BM) has a printed label 'Malacca' but a specimen in Herb. van HEURCK, which may well be the same collection, is labelled 'Khasiya'. The species is not recorded in botanical works on the Malay Peninsula. The fruits are smaller than those of T. paniculata Roth with which it can easily be confused.

2. Terminalia brassii EXELL, J. Bot. 73 (1935) 134.

Large, flange-buttressed tree, up to 50 m. Bark scaly brown. Young branchlets tomentose or nearly glabrous. Leaves alternate or sometimes subopposite, subcoriaceous, varying from tomentose to nearly glabrous, narrowly oblong, narrowly oblong-elliptic, oblong-elliptic or elliptic 5–9 by 3–6 cm, usually gradually narrowed and pointed at the apex (sometimes rounded) rounded or subcordate at the base; nerves 20–35 pairs; petiole tomentose-pubescent or glabrous 5–10 mm, with 2 conspicuous, glabrous suborbicular glands at or near the apex. Flowers pale green sessile in terminal and axillary panicles 8–13 cm long; rachis tomentose. Lower receptacle (ovary) tomentose 1½–2 mm long elongating to 5–8 mm before the wings develop; upper receptacle cupuliform 1 by 1½ mm, persistent; calyx-lolobes scarcely developed. Filaments 2½–3½ mm; anthers 0.3 mm long. Disk rather fleshy, pilosulous. Style glabrous, 2½ mm. Fruit pubescent suborbicular, obovate or ovate in outline, 1½ by 0.8–1.3 cm, with 2 well-developed thin flexible wings and 3 rudimentary ones, crowned at the apex by the remains of the persistent calyx.

Distr. Solomon Islands (Yabel, San Christobal, Bougainville) and New Britain. Fig. 10.

Ecol. A large tree of lowland and riverine rain-forest.

Uses. The sapwood is pale brownish-yellow, porous, straight-grained, somewhat stringy and of medium weight (according to E. P. HOLMES). It is probably not in commercial use.

Notes. The bark comes off in long, loose strips so that the general appearance is reminiscent of some species of Eucalyptus or Tristania. Young trees often send out stiff, horizontal adventitious roots high above the ground.


Small tree, 3–10 m. Young branchlets sometimes pubescent at first, soon becoming glabrous. Leaves alternate or subopposite, chartaceous or papyraceous sparsely pubescent beneath or glabrous, rather obscurely minutely verruculose on the upper surface and obscurely pellucid-punctate, ovate, ovate-elliptic, elliptic or obovate, usually slightly acuminate, acute or blunt at the apex, rounded or cuneate at the base, 3–8 by 1½–2½ cm; petiole pubescent often glabrescent, slender, 5–10 mm. Flowers cream, protogynous, apparently all 4, in terminal and axillary panicles 2½–4 cm long; rachides densely pubescent. Bracts pubescent, filiform, 1 mm. Lower receptacle (ovary) glabrous, 0.8 mm long, upper receptacle shallowly cupuliform glabrous, 1½ by 1 mm, with broadly ovate calyx-lolobes 0.6 mm long. Filaments glabrous, 3 mm; anthers 0.3 mm long. Disk densely pilose. Style glabrous, 2½ mm. Fruits 3-winged, 10–20 by
COMBRETACEAE

Fig. 10. Distribution of Terminalia series A: 1. myriocarpa, 2. brassii (localities indicated) 3. tripæra, 4. polyantha, 5. citrina, 6. creaghii.

6–12 mm, glabrous or nearly glabrous, often somewhat oblique.

Distr. Siam, Indo-China, in Malaysia: NW. Malay Peninsula (N. Kedah: Langkawi Islands and Alor Star). Fig. 10.

Ecol. A small tree common on limestone in the Langkawi Islands, also on quartzite and shale, up to 100 m.

Vern. Tan, tau, titau.

Notes. This species is closely related to T. polyantha Presl. The fruits of the latter are usually 4–5-winged but one specimen (SULIT PHN 7444 from Luzon) has all the fruits 3-winged and approaches T. tripæra very closely. The differences between the two species as far as can be ascertained from the material available are:

T. polyantha:—Fruits usually 4-winged, rarely 2-winged, 3-winged or 5-winged, 0.8–1.1 cm long, symmetrical. Flowers 1/2–2 mm in diam.

T. tripæra:—Fruits always 3-winged, 1–2 cm long, usually somewhat asymmetrical. Flowers 1.3–1.5 mm in diam.

T. obliqua Craib from Siam is also closely related and scarcely specifically distinct from T. tripæra.


Small tree. Young branchlets slender, at first pubescent, soon glabrescent. Leaves alternate or subopposite, chartaceous or papyraceous, sometimes tomentose when very young, usually sparsely pubescent or glabrous, sometimes tomentose on the midrib and principal nerves beneath, minutely verrucose above, rather obscurely pellucid-punctate, ovate, ovate-elliptic, elliptic or suborbicular, 3–8 by 1/2–5 cm, usually somewhat acuminate and acute at the apex, cuneate to rounded at the base; nerves 6–8 pairs; petiole tomentose or pubescent, 5–10 mm. Flowers sessile, probably all 5, in terminal and axillary panicles 3–10 cm long; rhachides densely patent or appressed pubescent. Bracts minute, caducous. Lower receptacle (ovary) viscid, glabrous, 1–2 mm long; upper receptacle cupuliform glabrous or nearly glabrous outside, pubescent inside, 1–1 1/2 by 1 1/2–2 mm. Calyx lobes very short, pubescent on the margins. Filaments glabrous 3 mm; anthers 0.4–0.5 mm long. Disk pilose. Style glabrous, 3 mm. Fruit usually glabrous, generally 4-winged (rarely 2-, 3- or 5-winged), elliptical or suborbicular in outline, 8–15 by 7–12 mm (incl. wings).

Distr. Indo-China, in Malaysia: Philippines (Luzon, Mindoro). Fig. 10.

Ecol. A small tree of dry thickets and secondary forests at low and medium altitudes.


Uses. Wood employed for general house construction and for parts protected from the weather. Relatively rare (Reyes l.c.).


Notes. T. montalbanica was a manuscript name distributed with ELMER 17420 from Montalban, Luzon. It has rather larger flowers than typical T. polyantha and a pubescent upper receptacle. There is only the single gathering cited.


Tree 20–30 m by about 70 cm. Young branchlets rufous-pubescent or rufous-villos (especially in seedlings), glabrescent or retaining their indumentum for a considerable time. Leaves papyraceous or chartaceous, opposite, subopposite or alternate, rufous-sericeous or rufous-pubescent to almost glabrous, sometimes pellucid-punctate, elliptic, narrowly elliptic or obo-long-elliptic, 3–14 by 1.8–
6½ cm, usually acutely acuminate at the apex and rounded or broadly cuneate at the base; nerves 9–12 pairs usually rather closely spaced; domatia absent or inconspicuous; petiole appressed-pubescent or glabrous, 5–20 mm, 2 glands often present at or near the apex. *Flowers* sessile, yellow, all 4’, in terminal panicles; rhachides Rufous-tomentose or pubescent. Bracts filiform, 2 mm long, very caducous. *Lower receptacle* (ovary) 1–1½ mm long, sericeous or shiny and almost glabrous; upper receptacle shallow-cupuliform, ½ by 2 mm, nearly glabrous. Filaments glabrous, 2/½–3 mm; anthers 0.3 mm long. Disk barbate. Style glabrous 1½–2½ mm long. *Fruit* ellipsoid to subglobose, 5-angled, glabrous, 20–30 by 8–20 mm (when dried), endocarp shaped like a 5-pointed star in cross-section.

**Distr.** India, Burma, Indo-China, Siam throughout Malaysia, New Guinea possibly excepted. Fig. 10.

Ecol. Forests at low and medium altitudes, in the Malay Peninsula and the Philippines often along the seashore, often planted inland.


**Uses.** The wood is used for door-posts, beams and planks, boats and masts. In Indo-China beautiful furniture is said to be made from it. Tannin is extracted from the fruits and the bark gives a blue dye. The fruits are similar to and often mistaken for the commercial myrobalans (*T. chebula Retz.*).


**Notes.** I have treated this as a widespread variable species for there are numerous intermediates between the small-leaved, small-fruited Philippine specimens (‘*T. comintana*’) and the large-leaved, larger-fruited specimens from Sikkim and Bengal.

**BRASS & VERSTEEGH 14019 (A, BM), a sterile specimen from Bernard Hard Camp (Idenburg River in Netherlands New Guinea) may be this species. Otherwise there is no record from New Guinea. This is a very *Combretum*-like species of *Terminalia* and if the records from the Malay Peninsula (*Burr. l.c. 2140–2141*) are correct it is sometimes a sprawler or semi-climber.

6. *Terminalia creaghii* RIDL. Kew Bull. (1934) 493. Tree or (?) climber. Young branchlets minutely, densely pubescent and viscid. Leaves subcoriaceous opposite and decussate, shining, glabrous, narrowly elliptic or elliptic-oblong, 6–14 by 2½–6 cm, acuminate at the apex, cuneate or somewhat rounded at the base; nerves 5–8 pairs; domatia absent or inconspicuous; numerous conspicuous parallel tertiary veins on the lower surface; petiole glabrous, viscid, 6–8 mm. *Flowers* sessile in terminal panicles, rhachides pubescent. Bracts pubescent, 1½ mm long. *Lower receptacle* (ovary) glabrous, viscid 1½ mm long; upper receptacle cupuliform 1½ by 3½ mm, glabrous. *Calyx*-lobes scarcely developed. Stamens 10–12; filaments glabrous, 3–4 mm; anthers 0.8 mm long. Disk pilose. Style glabrous, 5 mm. *Fruit* unknown.

**Distr.** Malaysia: NE. Borneo. Fig. 10.

Note. This species, described from a single collection made by Governor Creagh in British North Borneo, is a puzzle. In general appearance the plant is more like a *Combretum* than a *Terminalia* but I cannot identify it with any known species of the former genus. There are certainly no petals but the flowers are abnormal (several have an extra number of stamens) and appear to have suffered from an insect attack. The leaves seem to be truly opposite as in *Combretum*. The ovary is quite inferior, 1-locular with usually 4 pendulous ovules so there is little doubt that the species is at least in the right family. Discovery of the fruit would show whether it is a true *Terminalia*, perhaps near *T. citrina* or an apetalous *Combretum*, near *C. acuminatum* or *C. borneense*. The absence of any trace of scales inclines me to think that the balance of evidence is for *Terminalia*.


A medium-sized or large, deciduous tree, 8–30 m or more. Young branchlets tomentellous, appressed-pubescent or nearly glabrous. Leaves spirally arranged and somewhat crowded towards the ends of the twigs, subcoriaceous or chartaceous, usually subtomentose or pubescent, especially on the lower surface when young, frequently becoming glabrous when mature but often retain-
Fig. 11. *Terminalia calamansanai* (BLANCO) Rolfe. Six trees by the road from Kodiang to Changlun, Kedah (Corner). Courtesy Government Printer Singapore.
ing some pubescence beneath, usually somewhat shiny above, narrowly to broadly elliptic or occasionally obovate, 9–20 by 3–9 cm, usually acuminate rarely rounded at the apex, cuneate at the base, usually minutely verruculose on both surfaces, sometimes manifestly pellucid-punctate but usually only very obscurely so; nerves 4–7 pairs, rather widely spaced, reticulation clearly visible and sometimes rather prominent below; petiole tomentose, appressed-pubescent or glabrous, 1–4 cm, often with 2 glands varying in position from the middle to near the apex. Flowers cream or greenish-yellow, buds globular, protogynous, sessile in axillary spikes 6–20 cm long; rachis tomentose or tomentellous. Bracts 1½–2 mm long, soon deciduous. Lower receptacle (ovary) 1–2 mm long, tomentose or sericeous; upper receptacle shallow-cupuliform 1 by 2½ mm, sericeous. Calyx-lobes deltoid, 1 mm long, tomentose outside and rather less densely so within. Filaments glabrous, 2–2½ mm; anthers ½ mm long. Disk, barbate. Style glabrous, 1½ mm. Fruit with 2 broad wings, very variable in size and shape, overall dimensions 1–3 by 2–10 cm, fruit-body trigonal, pubescent, velutinous or tomentose, wings pubescent 1–2 by 4–4 cm.

Distr. Burma, Indo-China, Siam, in Malaysia: N. Malay Peninsula (from Alor Star northwards and in Langkawi Islands), Borneo? (sterile material only), Philippines, SW. Celebes (Pangkajene), and New Guinea (Papua). Fig. 12.

Ecol. A medium-sized tree (described as a tall tree in Papua) shedding its leaves towards the end of the year and growing on limestone cliffs (Langkawi Isl.), in lowland forest and by roads and ricefields in Kedah and Perlis where it is one of the commonest trees. Fl. Aug.–Dec. in the rainy season, fr. Dec.–April during the dry season, easily recognizable from its rather small-leaved, flat-topped crown, sparsely decked with the bright yellow withered leaves (Corner, l.c.). In the Philippines it is also abundant in primary forests. Apparently a species confined to areas subject to a dry season.


Uses. The wood is employed for foundation piles; seldom sawn into lumber or used for construction as it is not durable (Reyes l.c.).


Notes. The Asiatic Terminalias with two laterally extended wings to the fruit have caused no little difficulty in classification, as well be seen from the complicated synonymy. I found no clear-cut distinctions in the shape of the fruit and decided finally to recognize only two Malaysian species: a ‘northern’ species (T. calamansain) with pubescent fruits, extending from Burma and Indo-China down to the North of the Malay Peninsula and through the more northerly islands as far as Papua; and a ‘southern’ species (T. subspathulata) with glabrous fruits and glaucous leaves extending from the Malay Peninsula to Sumatra, Java and Borneo. Both species may occur in Borneo.


A large tree up to 45 m, with tall spreading branches. Young branchlets at first rufous-appressed-pubescent soon becoming glabrous. Leaves spirally arranged and somewhat crowded towards the ends of the twigs, coriaceous or subcoriaceous, glossy green above, glaucous underneath, glabrous, oblanceolate or subspathulate, 4–14 by 1½–5 cm, rounded and shortly acuminate, acute or obtuse at the apex, narrowly cuneate at the base; nerves 8–10 pairs, reticulation rather prominent; petiole glabrous 2–3½ (–5) cm, glands absent or inconspicuous. Flowers greenish or yellow, buds globular, sessile, in axillary spikes 6–20 cm long, rachis densely rufous-appressed-pubescent. Bracts absent or very early caducous. Lower receptacle (ovary) 2 mm long, rufo-sericeous; upper receptacle shallow-cupuliform, sericeous, 1 by 2 mm. Calyx-lobes deltoid 0.8 mm long, densely appressed-pubescent. Filaments glabrous, 2½ mm; anthers 0.4 mm long. Disk barbate. Style 3 mm, pilose. Fruit broadly 2-winged. Light yellow, pubescent when very young but soon becoming glabrous, overall dimensions 2–3.3 by 3½–5½ cm, wings usually confluent at apex and base so that the fruit is circumsulate.

Distr. Malaysia: Sumatra, Malay Peninsula

Fig. 12 Distribution of Terminalia series B: 7. calamansain, 8. subspathulata.

Tree, 15 m. Young branchlets rather thick, 4–5-angled near the apex, at first fulvous-sericeous-tomentose but very soon becoming glabrous. Growth sympodial. Leaves coriaceous, spirally crowded at the ends of the branchlets, sparsely sericeous-pilose when young, soon becoming shiny and glabrous, minutely verruculose above, narrowly obovate-Spathulate, obovate-elliptic or narrowly elliptic, 5–20 by 2–7½ cm rounded or obtuse at the apex, rounded or subcordate and 2-glandular at the base; nerves 11–12 pairs; petiole thick, 3–5 mm, at first fulvous-tomentose soon glabrescent. *Flowers* sessile in axillary spikes up to 17 cm long; rhachis rather stout, minutely appressed-pubescent or almost glabrous. Bracts filiform, 1½ mm long. *Lower receptacle* (ovary) fulvo-sericeous 3½–4 mm long; upper receptacle cupuliform, 3–3½ by 5–5½ mm, outside viscid almost glabrous, inside sericeous-pilose with glabrous ovate-acuminate calyx-lobes about 3 mm long. Filaments glabrous 12–13 mm; anthers 1 mm long. Disk almost glabrous. Style glabrous, 11 mm. *Fruit* ovate in outline, glabrous, 2½ by 1 cm, 2-winged, wings 5 mm broad.


Ecol. Medium-sized tree in swamps, 300–400 m.


Tree. Young branchlets very thick, at first sparsely appressed-pubescent soon glabrous. Leaves subcoriaceous, spirally arranged, crowded at the end of the branchlets, glabrous, narrowly spatulate or narrowly obovate-elliptic, 10–13 by 3½–4½ cm, rounded at the apex, cuneate at the base, somewhat shiny above; petiole 5–7 mm. with 2 conspicuous glands at or near the apex. *Flowers* sessile in axillary spikes about 10 cm long; rhachis glabrous. Bracts (not seen) caducous. *Lower receptacle* (ovary) 4–5 mm long; glabrous; upper receptacle cupuliform glabrous 3–4 by 4–6 mm. Calyx-lobes glabrous, deltoid, 2 mm long. Filaments glabrous, 10–12 mm long; anthers 0.8 mm long. Disk glabrous or nearly glabrous. Style glabrous, 11–12 mm. *Fruit* glabrous, suborbicular in outline, 1.6–2 cm in diameter, circuminate, usually emarginate at the base and apex.


Ecol. Along streams at low altitudes.


Tree. Young branchlets very thick, sparsely pubescent or glabrous. Leaves subcoriaceous or chartaceous, spirally arranged in dense clusters at the ends of the branchlets, subsessile or shortly petiolate, shining, glabrous or appressed-pubescent mainly on the midrib and principal veins and sometimes on the lamina, minutely verruculose above, obscurely pellucid-punctate, spatulate, 15–26 by 6–9½ cm, rounded at the apex, narrowly cuneate at the base and decurrent into the short thick petiole; petiole 5–7 mm, or sometimes scarcely developed, with two large subopposite glands at the apex or at the base of the lamina. *Flowers* large for the genus in axillary spikes c. 12 cm long; rhachis appressed-pubescent. Bracts narrowly elliptic, 10–15 mm long, fulvo-sericeous, persistent. *Lower receptacle* (ovary) 2 mm long, fulvo-sericeous; upper receptacle cupuliform, about 5 by 7 mm, nearly glabrous. Calyx-lobes deltoid about 2 mm long. Filaments glabrous, 15 mm; anthers 0.3–0.4 mm long. Disk sparsely pilose or nearly glabrous. Style 17 mm, glabrous. Fruit circuminate suborbicular or broadly obovate in outline, 1.7–3 by 1.7–2½ cm. tomentellous or appressed-pubescent.

Distr. Malaysia: Philippines (Luzon. Samar). Fig. 13.

Ecol. Primary forests at low altitudes.


Uses. The wood is used for house posts, beams, joists, and general framing work. Not plentiful (REYES s.c.).

Vern. Pagat-pagat, Neg.

Note. This differs from *T. surigaensis* in the fulvo-sericeous lower receptacle (ovary), rhachis and fruit.

12. *Terminalia slooteniana* EXELL, Blumea 7 (1953) 323.

Tree, 25 m. Young branchlets thick, glabrous, sympodial. Leaves coriaceous spirally arranged and crowded at the ends of the branchlets, glabrous, shiny above, minutely verruculose above and below, spatulate, oblanceolate or narrowly obovate-elliptic, 10–20 by 4–8 cm, rounded at the apex, narrowly cuneate at the base and decurrent into the petiole; nerves 9–12 pairs; petiole glabrous, 1–2 cm, with two glands (sometimes inconspicu-
Flora Malesiana


Large tree 20–50 m. Young branchlets symподial, glabrous or nearly glabrous. Leaves subcoriaceous, spirally arranged and rather crowded at the ends of the branchlets, glabrous or sparsely minutely appressed-pubescent, rather inconspicuously minutely verruculose above, narrowly elliptic, 3–15 by 1.2–5 cm, blunt or pointed at the apex, cuneate at the base and decurrent into the petiole, nerves 9–11 pairs; petiole 5–10 mm, glabrous, with 2 glands (sometimes inconspicuous) near the apex. Flowers white, sessile, in short axillary spikes, 3–5 cm long; rhachis glabrous. Bracts filiform, 1 mm. **Lower receptacle** (ovary) glabrous, 2⅓ mm long; upper receptacle glabrous or appressed-cupuliform, 1 by 3 mm. **Calyx-lobes** deltoid, 1⅓ mm long. Filaments glabrous, 2⅓ mm; anthers ⅓ mm long. Disk densely pilose. **Fruit** red when ripe, glabrous, when dried compressed-ellipsoid, 2⅓–3⅓ by 1⅓–2.6 by 0.8–1.2 cm, longitudinally circumalate with a rigid wing 2–3 mm broad, sometimes with 2–3 additional longitudinal ridges, sometimes flat on one face and convex on the other, showing in cross-section a rather thick, irregularly elliptical band of sclerenchymatous tissue and little or no alveolar tissue.

Distr. **Malaysia:** New Guinea (Papua: Nakeo District and Kanosia). Fig. 13.

Ecol. A common tree in lowland rain-forest. Note. The fruit is said to be fleshy when ripe.

14. **Terminalia clemensae** Exell, Blumea 7 (1953) 324.—Fig. 14.

Tree. Leaves coriaceous, shiny above, glabrous, elliptic, 20 by 8 cm, rounded or shortly acuminate at the apex, cuneate at the base; nerves 12–14 pairs; petiole glabrous, 1⅓–2 cm. **Flowers** not known. **Fruit** very woody, probably appressed-pubescent when young (traces of indumentum remain) almost glabrous or glabrous when mature, compressed ovoid-ellipsoid or compressed ellipsoid, 6–7 by 3–4 by 1⅓–1.8 cm, narrowly circumalate, wing rigid, 4 mm broad, showing in cross-section an irregular mass of sclerenchyma enclosing a few small scattered air-chambers.

Distr. **Malaysia:** NE. New Guinea (Morobe). Fig. 13.

Ecol. In forests, 650–950 m.

Note. Nothing more is known of this species, which was collected from a fallen branch. Judging from the fruits it appears to be a very distinct species.

15. **Terminalia steenisiana** Exell, Blumea 7 (1953) 327.—T. cf. ‘foveolata’ Exell, Brittonia 2 (1936) 138.—Fig. 14.

Tree 10–15 m. Bark grey-brown. Wood hard, brown. Young branchlets at first appressed-rufous-pubescent, soon becoming glabrous, sympodial in growth. Leaves subcoriaceous, crowded at the slightly thickened apices of the branchlets, shiny and glabrous above, only very obscurely verruculose, opaque, elliptic, obovate-elliptic, obovate or oblanceolate, 8–13 by 2⅓–6 cm, rounded, obtuse or shortly acuminate at the apex, cuneate at the base; nerves 6–10 pairs, domatia rather inconspicuous, occasionally with a few hairs; petiole glabrous in mature leaves, 1–2 cm. **Flowers** white, in axillary spikes 6–8 cm long; rhachis glabrous when mature. Bracts filiform, 1 mm, glabrous, early caducous. **Lower receptacle** (ovary) glabrous, 2⅓ mm long; upper receptacle glabrous or appressed-cupuliform, 1 by 3 mm. **Calyx-lobes** deltoid, 1⅓ mm long. Filaments glabrous, 2⅓ mm; anthers ⅓ mm long. Disk densely pilose. **Fruit** red when ripe, glabrous, when dried compressed-ellipsoid, 2⅓–3⅓ by 1⅓–2.6 by 0.8–1.2 cm, longitudinally circumalate with a rigid wing 2–3 mm broad, sometimes with 2–3 additional longitudinal ridges, sometimes flat on one face and convex on the other, showing in cross-section a rather thick, irregularly elliptical band of sclerenchymatous tissue and little or no alveolar tissue.

Distr. **Malaysia:** New Guinea (Papua: Nakeo District and Kanosia). Fig. 13.

Ecol. A common tree in lowland rain-forest. Note. The fruit is said to be fleshy when ripe.

16. **Terminalia oreadum** Diels, Bot. Jahrb. 57 (1922) 429.—Fig. 14.

Large tree, up to 40–50 m, buttressed to 2 m. Bark pale brown, wood pale yellow. Young branchlets fulvous-sericeous, later glabrescent. Leaves subcoriaceous, spirally arranged along the branchlets, minutely appressed-pubescent, later glabrescent, broadly to narrowly elliptic, 3–9 by 1–4 cm, slightly acuminate or blunt at the apex, cuneate at the base; nerves 5–8 pairs with glabrous domatia in their axes; petiole at first appressed-pubescent eventually glabrescent, 5–12 mm. **Flowers** (only immature ones seen) sessile, ellipsoid in bud, in axillary spikes 5 cm long; rhachis fulvous-sericeous. Bracts hairy, filiform, 2⅓ mm, soon caducous. **Lower receptacle** (ovary) 1⅓ mm long, fulvous-sericeous, upper receptacle fulvous-sericeous, cupuliform, 1 by ⅓ mm. **Calyx-lobes** triangular, c. 1 mm long. **Fruit** very sclerenchymatous, with a few scattered air-spaces, sericeous when young, glabrescent, flattened-ellipsoid, 3⅓ by 1⅓–2 cm, narrowly circumalate, wing c. 1 mm broad, sometimes with 2 additional ridges near the apex.

Distr. **Malaysia:** East New Guinea. Fig. 15.

Tree up to 50 m, butressed to 2½/2 m, with spreading crown. Bark brown or grey, inner bark pink or brownish-red, sapwood straw-coloured, inner wood light brown. Young branchlets at first densely appressed-pubescent or appressed-pilose later glabrescent. Leaves spirally arranged along the branchlets, chartaceous or subcoriaceous, at first densely appressed-pubescent, later glabrescent, obscurely pellucid-punctate when young, opaque when older, elliptic, obovate-elliptic or oblone-elliptic, 6–15 by 3–7½ cm, blunt or rounded, sometimes shortly acuminate or apiculate at the apex, cuneate at the base; nerves 7–9 pairs, domatia present, sometimes hairy; petiole at first tomentellous or appressed-pubescent, later glabrescent, 8–14 mm. Flowers sessile in axillary spikes up to 4 cm long; rachis densely sericeous. Bracts hairy, filiform, 1 mm, early caducous. Lower receptacle (ovary) sericeous, 1 mm long; upper receptacle scarcely developed. Calyx-lobes triangular, 0.8 mm long. Filaments glabrous, 1½–2 mm; anthers 0.3 mm long. Disk bzarbate. Style glabrous, 1½ mm. Fruit reddish-purple, densely appressed-pubescent when young and retaining at least some indumentum when old, compressed ellipsoid, pointed at the apex, circulate with a narrow wing or ridge 1–2 mm broad and 2 or 3 accessory ridges also developed, especially towards the apex, 4–5 by 2½–3 by 1½–2 cm when dried; endocarp hard and very sclerentomatous in cross-section, air-spaces poorly developed in a ring round the loculus.

Distr. Malaysia: NE. New Guinea (Sepik and Morobe District) and New Britain. Fig. 15. Ecol. Rain-forest at low and medium altitudes. Uses. The wood is said to be very soft. The fruit is said to be edible and to exude a red dye.


Large tree up to 35 m high. Young branchlets rufous-tomentose or rufous-appressed-pubescent, becoming glabrous, somewhat symподial in growth but not always markedly so. Leaves spirally arranged and crowded at the apices of the branchlets, rufous- or fulvous-tomentellous when young and remaining so on the nerves below and sometimes also on both surfaces of the leaf-blade, sometimes rather inconspicuously minutely verruculose on the upper surface, obovate obovate-elliptic or narrowly obovate-elliptic, 5–10 by 2½–5½ cm, usually rounded at the apex and cuneate at the base; nerves 9–13 pairs, rather closely spaced; petiole rufous or fulvous-tomentose 4–13 mm. Flowers yellow, sessile, buds globose, in axillary spikes 4–9 cm long; rachis rufous-tomentose. Bracts filiform fulvous-pubescent, 1½–2½ mm. Lower receptacle (ovary) rufous-tomentose, 1–2 mm long; upper receptacle densely pubescent, shallow-cupuliform ½ by 1 mm. Calyx-lobes ovate, 1 mm long. Filaments glabrous 2½ mm; anthers 0.3–1½ mm long. Disk pilose. Style glabrous 3–4 mm long. Fruit densely appressed-pubescent somewhat glabrescent when old, broadly elliptic in outline, 5 by 3½ cm, laterally compressed, surrounded by a thick narrow wing 2 mm broad, with 3 additional ridges developed especially towards the apex where the fruit appears sub-5-winged.

Distr. Malaysia: Moluccas (N. Halmaheria: Tobelo, and Aru Islands), New Guinea. Fig. 15. Ecol. Fairly common in primary forest at low altitudes.

Vern. Karou, mambang.


Tree 10–40 by 2 m. Young branchlets at first fulvous-sericeous soon glabrescent, usually not markedly symподial. Leaves papyraceous or chartaceous spirally arranged along the branchlets usually not markedly crowded at the apices, at first densely sericeous-pilose some appressed hairs usually remaining on both surfaces in old age but sometimes becoming glabrous, minutely verruculose above and below, usually pellucid-punctate at time of flowering later becoming opaque. elliptic, oblone-elliptic, or broadly elliptic or sometimes very narrowly elliptic on sterile shoots, 6–15(–32) by 2–7(–11) cm, acuminate or
apiculate at the apex, cuneate at the base; nerves 7–13 pairs; domatia usually present but not hairy; two rather inconspicuous glands usually present near the base of the leaf-blade; petiole appressed-pubescent or appressed-pilose, sometime glabrescent, usually relatively long and slender, 1½–3¼ cm. Flowers sessile, in axillary spikes 6–12 cm long, rachis fulvous-tomentose. Bracts hairy, filiform. 2–3 mm. Lower receptacle (ovary) densely sericeous, 1½–2 mm long; upper receptacle very shallow, scarcely developed. Calyx-lobes pubescent, ovate-triangular, 1–1½ mm long. Filaments glabrous, 2 mm; anthers 0.3–0.4 mm long. Disk barbate. Style glabrous, 1½ mm. Fruit plum-like, smooth, dark red, fleshy, edible, flat-ellipsoidal, 10–20 (–25) by 6–12 mm, often verrucose, usually apiculate at the apex and narrowly (sometimes obscurely) circumsulate, endocarp very sclerenchymatous.

**Distr. Malaysia**: throughout the area but apparently absent from the Malay Peninsula, perhaps in Sumatra (record based on sterile material only). Fig. 15.

**Ecol.** A usually tall tree common in both primary evergreen and in seasonal deciduous forests (e.g. teak-forest in Java), up to 800 m.


**Uses.** The fruits (fleshy pericarp) are edible and are also used in lotions for the eye and skin. The wood is light brown and not very durable when exposed to the weather or in contact with the ground. A durable wood for interior work. Used for furniture and cabinet making; a good wood for ship planking (Reyes Lc. & p. 372).


**Notes.** From duplicates distributed from Paris there is little doubt that *T. microcarpa* is the oldest name for the well-known species usually known as *T. edulis Blanco*.


Large buttressed tree with spreading crown, up to 50 m. Bark grey, yellow-brown or reddish-brown (according to different collectors), wood yellow. Young branchlets slender, at first rufous-sericeous, eventually glabrescent. Leaves chartaceous to coriaceous, spirally arranged, dispersed along the branchlets, at first rufous- or golden-appressed-pubescent, usually glabrescent. Shiny above, minutely verruculose and below, usually markedly pellucid-punctate, typically elliptic or narrowly elliptic, sometimes oblong-elliptic, rarely obovate, 5–10 by 2–4 cm, acuminate or shortly acuminate at the apex, cuneate at the base; nerves 9–12 pairs (occasionally more), rather prominent and somewhat closely spaced: petiole slender, at first appressed-pubescent, soon glabrescent, 1½–2 cm, usually with two glands near the centre or towards the apex. Flowers sessile, pale green, in lateral spikes 3–10 cm long; rachis rufous- or fulvous-tomentose. Bracts hairy, filiform, recurved, 2 mm, soon caducous. Lower receptacle (ovary) sericeous, 1½ mm long; upper receptacle scarcely evident. Calyx-lobes triangular. 1½ mm long. Filaments very slender, glabrous, 2½–3 mm; anthers 0.2 mm long. Disk barbate. Style glabrous, 3 mm. Fruit dull purple, suborbicular in outline and laterally compressed or broadly flattened-ellipsoid, sericeous at first and usually retaining some traces of indumentum, 1.8–2.2 by 1.4 by 1.7 cm, very narrowly circumsulate, often apiculate at the apex, in cross-section showing a few radial plates of sclerenchyma separated by large air-spaces.

**Distr. Malaysia**: New Guinea, New Britain, and Solomon Islands (Guadalcanal). Fig. 15.

**Ecol.** In rain-forests up to 1400 m, sometimes dominant in riverine swamp-forest, fairly widespread in New Guinea.

**Uses.** The wood is said to be tough and fibrous and to contain a yellow dye.

**Vern.** Naroàngap, Papua (Yalu), doana, Papua, kwisik, Sepik.


Large spur-buttressed tree; wood pale yellow. Young branchlets silvery- or golden-reddish-sericeous, retaining some indumentum for a considerable time. Leaves chartaceous to coriaceous,
Flora Malesiana

Flora by 2-2

considerable

mm

Lower pilose, punctate, sparsely

spikes, at often appressed-pilose

sericeous pink, may (3-3½

species to chyma specimens much

brous quoad sympodial

elliptic, persisting thickened, apex,

punctate Bull.

spikes Ecol.

Distr.

Malaysia: E. New Guinea (Papua: Soger Region and Kanosia). Fig. 15.

Ecol. Swamp forests at low altitude. Fruits adapted to water-dispersal.

Note. This may prove to be conspecific with T. hypargyrea K. Schum. & Laue, but with the small amount of material at present available it seems advisable to maintain it as a distinct species.


Tree 15-35 m, buttressed. Bark grey-green to brown, resinous; wood straw-yellow or dark yellow. Young branchlets rufous-tomentose or rufous-tomentellous, retaining some indumentum for a considerable period. Leaves chartaceous, spirally arranged along the branchlets, at first rufous- or golden-sericeous later glabrescent above except for the midrib but remaining rufous-tomentose or rufous-tomentellous beneath, especially on the nerves, not conspicuously verruculose or pellucid-punctate, elliptic, narrowly elliptic, obovate-elliptic, narrowly obovate-elliptic or obolean, 5-12 by 2½-6 cm, usually acuminately rounded at the apex, cuneate to rounded at the base, sometimes with 2 rather inconspicuous glands; nerves 8-16 pairs, rather closely spaced and prominent beneath; domatia not conspicuous; petiole rufous-tomentose later glabrescent, 7-15 mm. Flowers sessile in axillary spikes 5-17 cm long; rhachis rufous-tomentose. Bracts hairy, filiform, recurved, 2½ mm. Lower receptacle (ovary) rufous-tomentose, 2 mm long, somewhat narrowed at the apex; upper receptacle rufous-tomentose, shallow-cupuliform, 1 by 1½ mm. Calyx-lobes tomentose or pubescent, ovate, 1 mm long. Filaments glabrous, 3 mm; anthers 0.2 mm long. Disk pilose. Style glabrous, 1½ mm. Fruit rufous-tomentose broadly compressed-ellipsoid 20-28 by 12-19 by 6 mm when dried, very narrowly circulate, beaked at the apex, showing large air-spaces in cross-section.

Distr. Malaysia: New Guinea (fairly widespread). Fig. 15.

Ecol. A large tree, sometimes dominant, in riverine lowland, swamp forest. The fruits are clearly adapted to water-dispersal.

Uses. The timber appears to be of little use. The fleshy part of the fruit is eaten by the natives.

Vern. Karija, karo, kihim.'
Fig. 16. *Terminalia longespicata* SLOOT. a. Flowering branch, × 1/3, b. part of spike, × 8, c. bud in section, × 20, d. flower, × 12 (after VAN SLOOTEN).

Deciduous tree, 10–35 m. Wood brown or reddish, rather heavy and close-grained. Young branchlets thickened, densely sericeous-tomentose or pubescent fairly quickly glabrescent. Leaves chartaceous or papyraceous, spirally arranged and crowded at the ends of the branches, spreading, usually shiny and glabrous but occasionally appressed-pubescent or tomentose especially on the lower surface, minutely verruculose above and below, typically obovate sometimes elliptico-obovate or even elliptic, rounded or shortly acuminate at the apex and somewhat narrowed below the middle to a subcordate base usually with 2 glands, 8–25 (~38) by 5–14 (~19) cm, varying considerably in size and shape (see notes); usually with c. 6–9 pairs of rather widely spaced nerves; domatia often present, some more hairy; petiole thick, usually sericeous-pubescent, 5–15 (~20) mm. Seed-leaves transversely elliptic or kidney-shaped. Flowers white or whitish, sessile in axillary spikes 8–16 cm long, in which the majority of the flowers are usually #, a few # flowers only being present

Fig. 17. Terminalia catappa L. Tuft of leaves with inflorescences (CORNER). Courtesy Government Printer Singapore.
towards the base; rhachis usually appressed-pubescent, sometimes glabrous. Bracts c. 1 mm long, early caducous. Lower receptacle (ovary) sericeous or glabrous, usually 2–4 mm long, occasionally up to 7 mm long; upper receptacle usually nearly glabrous, shallow-cupuliform, 1⅓ by 3 mm. Calyx-lobes ovate-triangular, 1–1⅓ mm long. Filaments glabrous, 2 mm; anthers ⅓ mm long. Disk barbate. Style glabrous, 2 mm. Fruit a usually glabrous, reddish, yellowish or greenish drupe, ovoid or ellipsoid, more or less laterally compressed or scarcely compressed, circumalate with a stiff rigid wing c. 2 mm broad or wing obsolete and scarcely conspicuous, very variable in size, 3½–7 by 2–5½ cm, cultivated races often having conspicuously larger fruits than the wild plants.

Distr. Tropical Asia, N. Australia and Poly-
nessia, commonly planted in the tropics, in
*Malaysia*: throughout the area although apparently rather rare on the mainland of Sumatra and in Borneo.

Ecol. Sandy or rocky beaches 0-5 m altitude, a typical constituent of the *Barringtonia* formation. *Van der Pijl* (Trop. Nat., Jub. no, 1936, 97-99) observed regular dispersal of *kètapatang* fruits through fructivorous bats all over Meeuwen Island (SW Java) and elsewhere and found chewed kernels under trees where they devour their fruits. He concludes that they are distinctly diplochorous, viz dispersed both by sea-water and by bats. This is confirmed by *Docters van Leeuwen* for Krakatau Island. *T. catappa* was also found in the beach-forest of the newly formed Anak Krakatau *(cf. Van Borsum Waelkes*, Trop. Nat. 32, 1950, 42-43).


Uses. Often planted in avenues as a shade-tree, for which it is suitable because of its very regular shape. The timber is reddish and of good quality and is used for house- and boat-building, carts, planks, etc. The kernel of the fruit is edible and contains a colourless, fatty oil similar to almond oil. The bark contains tannin used as an astrigent in dysentery and thrush. The leaves act as a sudorific and are applied to rheumatic joints. Bark and leaves are used for tanning leather.


Notes. This very well-known tree is a characteristic feature of the tropical urban landscape for it is one of the commonest avenue trees. The branches come off in regular tiers giving the species a curiously regular appearance.

The tree sheds its leaves all at once, quite suddenly, usually twice a year (January or February and July or August). Unlike most tropical trees, the leaves turn first yellow, then vivid red before falling giving a well-marked 'autumn colour'.

As is perhaps to be expected in a frequently planted species with an edible kernel, the fruits show great variation in size, colour and shape and there has apparently been some selection in cultivating large-fruited races. This variation has made it difficult to place the species in the key, where it has to appear several times and it is still possible that atypical specimens may escape correct identification. It has been necessary to use as a determining character the subcordinate base to the leaf which is clear enough in the great majority of specimens. In young plants, however, and probably on branches of rapid growth leaves with a cuneate base and petioles longer than normal can be found and closely simulate leaves of other species of the genus. Specimens from Timor and neighbouring islands seem to be particularly atypical in this respect and in the absence of fruits their determination is doubtful. A normal leaf-specimen, even in the absence of fruits, can be distinguished from nearly all other species of *Terminalia* by the obovate leaves, with comparatively few lateral nerves, considerably narrowed towards the base, where the lamina is clearly subcordinate and not deciduous into the rather short, thick petiole.

25. *Terminalia samoensis* Rechinger, in Fedde, Rep. 4 (1907) 229.—Fig. 14.

Tree. Bark hard, grey, scaly. Young branchlets fairly thick, fulvous-tomentose eventually glabrescent with sympodial growth. *Leaves* chartaceous, papyraceous or membranaceous, spirally arranged and somewhat crowded towards the ends of the branchlets, pubescent above, more densely so on the midrib, pubescent to tomentose beneath, obovate, broadly obovate, broadly elliptic or suborbicular, 6-20 by 4½-12½ cm, rounded at the apex and usually at the base, usually (but sometimes obscurely) minutely verruculose above, manifestly, though not very conspicuously, pellucid-punctate; nerves 7-10 pairs; petiole fulvous-tomentose, 1-3½ cm. *Flowers* greenish-white, sessile, in axillary spikes 6-11 cm long; rhachis fulvous-tomentellous or pubescent. Bracts pubescent, filiform, 1 mm, early caducous. *Lower receptacle* (ovary) glabrous or sparsely pubescent, 4-5 mm long, much constricted above the ovary; upper receptacle glabrous, shallow-cupuliform 1½ by 4 mm. *Calyx*-lobes glabrous, ovate-triangular, 1½ mm long. Filaments glabrous, 3 mm; anthers 0.4 mm long. Disk pilose. Style glabrous, 2 mm. *Fruit* glabrous, fleshy and red when ripe, compressed-ellipsoid or compressed-ovoid, 1.7-2.2 by 1-1.3 cm; pericarp of dried fruit showing in cross-section an inner sclerenchymatous layer c. 0.7 mm thick, surrounded by a middle layer c. 1-2 mm thick with many small air-spaces, followed by an outer layer of corky consistency. *Distr.*, *Polynesia* (Samoa, Gilbert Isl., Ellice Isl., Marshall Isl.), Melanesia (Solomon Islands: Owa Raha), in *Malaysia*: New Ireland (Kavieng) and Celebes (Miangas Island). Fig. 19.

Ecol. A littoral species growing on coral limestone in Miangas Isl. The fruits are probably water-borne.

*Vern.* *Salise*.

Notes. *T. saffordii* Merr. from Guam with
glabrous inflorescence, slightly smaller fruits and shorter petioles may prove to be the same species when more material is available, but the name T. samoensis has priority.


Small tree, 6–8 m. Young branchlets rather thick, appressed-pubescent, later glabrescent, growth sympodial. Leaves subcoriaceous to coriaceous, spirally arranged and crowded at the ends of the branchlets, glabrous above, rather obscurely verruculose, sparsely appressed-pubescent beneath, especially towards the base of the midrib, ovate, 6–11 by 3½–7½ cm, rounded and often shortly apiculate at the apex, cuneate at the base with 2 glands near the base of the midrib; nerves 3–8 pairs, rather widely spaced except at the base; domatia often present, usually hairy; petiole appressed-pubescent, fairly stout, 5–18 mm. Flowers sessile in axillary spikes 9–11 cm long; rachis appressed-pubescent. Bracts not seen, presumably early caducous. Lower receptacle (ovary) densely sericeous, 1½ mm long; upper receptacle sparsely appressed-pubescent, shallow-cupuliform, 3 by 1 mm. Calyx-lobes deltoid, 1½ mm long. Filaments glabrous, 3–3½ mm; anthers 0.7–0.8 mm long. Disk barbate. Style glabrous, 2 mm. Fruit appressed-puberulous, when mature only very sparsely so, when ripe ‘dark purple, somewhat compressed, 1½ by 1 cm’ when dried slightly compressed ellipsoid, apiculate, 12–13 by 7–8 mm, endocarp showing in cross-section a central sclerenchymatous zone surrounded by a zone honey-combed with air-spaces.

Distr. Malaysia: South New Guinea (Papua: Mababuan). Fig. 19.

Ecol. Common in savannah-forest substage and in light rain-forest on granite slopes, apparently under semi-arid climatic conditions.

Note. The fruits are among the smallest known of the drupaceous type in Malaysia.


Tree. Branchlets stout, somewhat swollen at the tips. Leaves spirally arranged, ± crowded at the apices of the branchlets, fairly densely pubescent above, densely and softly pubescent beneath at time of flowering, losing most of their indumentum in old age, not verruculose or punctate, obovate or obovate-cuneate, 8–17 by 4½–9 cm, usually rather abruptly acuminate at the apex and cuneate at the base, nerves 6–9 pairs; petiole at first pubescent later glabrescent, 3½–4½ cm. Flowers (ex descr.) in densely flowered spikes 8–17 cm long. Lower receptacle (ovary) densely sericeous 2 mm long. Calyx-lobes sparsely pilose outside, deltoid. Filaments 5 mm. Disk barbate. Fruit sparsely pubescent, ellipsoid or ovoid, scarcely compressed, 1½–2 by 0.9–1 cm.

Distr. Thursday Island, expected to occur in South New Guinea. Fig. 19.

Note. I have not seen the type but two fragments in the British Museum Herbarium, E. Cowley 30 and an unnamed collector, both from Thursday Island, must be this species. The only discrepancy is in the length of the petioles, which is 3½ to 4½ cm in the specimens seen while they are 1–2½ cm long in the original description. The length I have given fits in much better with C. T. White’s key character ‘leaves three or four times as long as the petiole’.


—Fig. 14, 20.

A deciduous tree, 25–50 by 2 m, with large buttresses. Young branchlets thick, at first densely, later sparsely, rufous-appressed-pubescent. Leaves at first papryaceous later subcoriaceous or coriaceous, spirally arranged along the branchlets or crowded at the ends of the branchlets, sometimes whorled, rufous-sericeous when very young, soon becoming glabrous or almost glabrous, usually
Fig. 20. *Terminalia bellirica* (Gaertn.) Roxb. Tree near Kuala Trengganu, Malaya (Corner 1937).
conspicuously minutely verruculose above and less conspicuously so beneath,pellucid-punctate for a time but eventually opaque, typically broadly elliptic or obovate-elliptic, sometimes narrowly oblong-elliptic and narrowly oblong-obovate in seedlings, 4-18 by 2-11 cm, rounded or obtuse or sometimes acuminate at the apex, rounded, obtuse or cuneate at the base; nerves usually 6-8 pairs, rather widely spaced; domatia usually absent or inconspicuous; petiole at first pubescent soon glabrescent, generally long in relation to the lamina, usually c. 3 cm but sometimes up to 9 cm. *Flowers* sessile, yellowish, buds subglobose, in axillary spikes 3-15 cm long; rhachis rufous- or fulvous-appressed-pubescent. Bracts absent or very early caducous. Lower receptacle (ovary) densely sericeous or tomentellous, 1½-2 mm long; upper receptacle shallow-cupuliform, 1 by 4 mm, sericeous. *Calyx*-lobes recurved, deltoid, 1½ mm long. Filaments glabrous, 3 mm; anthers 0.8 mm long. Disk rufous- or fulvous-barbate. Style glabrous, 4 mm. *Fruit* densely and finely velutinous or sericeous, subglobose to broadly ellipsoid when dried, 2-2.8 by 1.8-2.2 cm, usually with 5 well-marked longitudinal ridges, endocarp densely selerenchymatous, with no trace of air-spaces; exocarp hard, 1-2½ mm thick when dried, dark in section.

**Distr.** Ceylon, India, Burma, Indo-China, Siam, in *Malaysia*: Malay Peninsula, Sumatra (East coast Res., Palembang, Lampongs), Java, N. Borneo (Sandakan), Lesser Sunda Islands (Bali, Weter), Central Celebes (Wataipi) and Moluccas (Ambon & Key Islands). *Fig. 21.*

**Ecot.** Deciduous tree, remaining leafless, however, for only a short period, on periodically dry soils in deciduous monsoon forest, also in rain-forests on red soil. In Java mainly in Central and East Javan teak-forests, mostly at low altitudes but up to 600 m in Java.


**Uses.** There are conflicting accounts as to the durability of the timber but in *Malaysia* it is not considered of much value, although said to be good for firewood and charcoal. In *Indo-China*, however, it is used for making wheels and its durability is said to be improved by immersion in water. The fruit is one of the commercial myrobalans used for tanning leather, for a black dye (together with sulphate of iron), to economize in the use of indigo and for making ink. The unripe fruit is purgative and the ripe fruit astringent, being extensively used in *India* for dropsy, hæmorrhoids and diarrhoea. In *Java* the fruits are sold with the seeds removed as ‘djalawè’ in native pharmacies. The kernels can be eaten but are somewhat dangerous as they produce a narcotic effect. The tree also yields an insoluble gum in considerable quantity. For further details see [Burkill (l.c.)], Heyne (l.c.), and Pearson & Brown (l.c.).


29. **Terminalia macadamii** EXELL, Blumea 7 (1953) 324.—*Fig. 14.*

**Tree** c. 40 m by 80 cm. Bark green. Wood creamy, porous. Young branchlets rufous-tomentellous and retaining their indumentum for a considerable time. **Leaves** spirally arranged along the branches, chartaceous, at first densely rufous-tomentellous, later glabrescent above but retaining their indumentum especially on the nerves and reticulation beneath, rather obscurely minutely verruculose above, pellucid-punctate, elliptic or more rarely obovate-elliptic, 8½-18 by 3½-9 cm, usually somewhat acuminate at both apex and base; nerves 9-12 pairs, domatia not conspicuous; petiole rufous-tomentellous, 1-3 cm. *Flowers* unknown. *Fruit* tomentellous when young becoming glabrous when mature, oblong-ellipsoid, usually scarcely compressed, 2½-3½ by 1.3-1½ cm, rather obscurely longitudinally ridged, showing in cross-section a selerenchymatous inner layer extended radially in spike-like projections.

**Distr.** Malaysia: New Guinea (Papua: Milne Bay). *Fig. 22.*

**Ecot.** Rain-forest at low altitude.

**Uses.** The wood is described as ‘creamy and porous’.

**Vern.** Muru muru widi.


Buttressed tree, 15-30 m, with flatly spreading, whorled branches. Bark brown, wood yellow. Young branchlets rather stout and very early glabrescent although the terminal buds are serious. **Leaves** papyraceous, spirally arranged along the branchlets or sometimes whorled, glabrous somewhat shiny and rather conspicuously minutely verruculose on both surfaces, manifestly pellucid-punctate, elliptic, narrowly elliptic, obovate-elliptic or oblong-elliptic, 12-24 by 6½-9 cm, acuminate at the apex, cuneate at the base; nerves 9-14 pairs; domatia absent or inconspicuous; petiole glabrous, 3½-5 cm, usually with 2 glands near the centre. *Flowers* sessile, cream, brown or yellow, in axillary spikes 7-14 cm long; rhachis appressed-
Fig. 22. Fruits of *Terminalia* numbered to correspond with the species in the text; a fruit of each species and its cross-section; all from herbarium material; loculus and hollows black, sclerenchyma white, alveolar tissue dotted; nat. size.—35. *T. nitens* (ELMER 18410), 36. *T. lundquistii* (LUNDQUIST 105), 37. *T. plagata* (RAMOS & EDANO 44338), 38. *T. pellucida* (ELMER 13241), 39. *T. papuana* (BRASS & VERSTEEGH 12542), 41. *T. foetidissima* (ELMER 18058), 42. *T. moli* (MOL 207), 43. *T. phellocarpa* (NGADIMAN SF 34743).
pubescent. Bracts pubescent, filiform, 2½ mm. Lower receptacle (ovary) densely tomentose or sericeous, 1½—3 mm; upper receptacle sericeous, shallow-cupuliform, 1 by 2½ mm. Calyx-lobes hairy outside glabrous within, ovate-triangula, often recurved, 2—2½ by 1½ mm. Filaments glabrous, 3½ mm; anthers 0.7 mm long. Disk barbate. Style glabrous 3½—5 mm. Fruit black when ripe, appressed-pubescent when young, glabrous when mature, elliptoid, slightly compressed, 3½—4 by 2—2½ by 1.8 cm, apiculate, showing in cross-section a thick sclerenchymatous band with rather irregular spoke-like projections and included in the sclerenchyma a layer near the centre containing dispersed air-chambers.

Distr. Solomon Islands (Guadalcanal, Malaita and Isabel Islands), in Malaysia: E. New Guinea (Papua: Lower Fly River; Morobe and Budsonbora). Fig. 23.

Ecol. Rain-forest, also in secondary grassland, from sea-level to 300 m.

Uses. The fruit is said to be eaten by the natives.

31. Terminalia kangeanensis SLOOT. Bull. Jard. Bot. Btgg III, 6 (1924) 35, fig. 4.—Fig. 14.

Medium-sized tree. Young branchlets fairly stout at first with appressed fulvous or golden pubescence, later glabrescent. Leaves papyraceous or chartaceous, spirally arranged and crowded at the ends of the branchlets, appressed-pubescent when young, soon glabrescent, usually conspicuously minutely verruculous above and manifestly pellucid-punctate, sometimes (or perhaps more correctly at some stages) not verruculous and opaque, obovate, obovate-elliptic or elliptic, 10—17 by 5—9½ cm, rounded, obtuse or shortly acuminate at the apex, cuneate at the base; nerves 8—12 pairs, with glabrous or only slightly hairy domatia in their axils; petiole at first appressed-pubescent, eventually glabrescent, 2—3 cm. Flowers sessile, in axillary spikes 8—12 cm long; rhachis appressed-pubescent. Bracts not seen. Lower receptacle (ovary) densely sericeous 2½ mm long, narrowed at the apex then expanding into the shallow-cupuliform appressed-pubescent upper receptacle, 1 by 3 mm. Calyx-lobes ovate, triangular appressed-pubescent outside, glabrous inside, 2 by 2 mm. Filaments glabrous, 4 mm; anthers 0.4 mm long. Disk pilose. Style glabrous, 4 mm. Fruit glabrous when mature, ellipsoid, only slightly compressed, 2½—3½ by 1.3—1½ cm, rather obscurely longitudinally ridged, showing in cross-section a band of sclerenchymatous tissue round the loculus with about 5 spoke-like projections with rather large honey-combed air-chambers lying between them.

Distr. Malaysia: Java (Karmoindjawa Islands?, N of Semarang), Kangean Arch. (N of Bali—Lombok). Fig. 23.

Ecol. Tree growing along the shore in the Barringtonia association and in mixed rain-forest on limestone at 50 m. The fruit appears adapted for water-distribution.

Notes. The fruits are less flattened than those of T. microcarpa and are somewhat smaller than those of T. solomonensis. The Karmoindjawa specimen, Koorders 188 (BO), is sterile.

32. Terminalia celebica EXELL, Blumea 7 (1953) 325.—Fig. 14.

Tree, 20 m. Young branchlets glabrous and even the terminal bud has only a few hairs, growth sympodial. Leaves chartaceous, spirally arranged and ± crowded at the ends of the branchlets, glabrous, densely minutely verruculous above, obscurely pellucid-punctate or opaque, elliptic or narrowly elliptic, 7—15 by 3½—7 cm, acuminate at the apex, narrowly cuneate at the base; nerves 9—12 pairs; domatium scarcely conspicuous, glabrous; petiole glabrous, 1½—3 cm. Flowers yellowish, honey-scented, sessile, in axillary spikes 6—13 cm long; rhachis fulvous-tomentellous. Bracts at first conspicuous, glabrous, filiform, 3—9 mm, soon caducous, ø flowers very numerous and rather densely arranged at the upper end of the spike, with stalks 1½—3 mm long, ø flowers towards the base of the spike, less numerous. Lower receptacle (ovary) narrowed at the apex, sericeous, 2—2½ mm long, upper receptacle shallow-cupuliform, 1 by 2 mm, sparsely pubescent or nearly glabrous. Calyx-lobes almost glabrous, triangular, 2 by 1.2 mm. Filaments glabrous, 4—5 mm; anthers ½½ mm long. Disk barbate. Style glabrous, 4 mm. Fruit glabrous, oblong-ellipsoid, somewhat laterally compressed, when dry 4½—5½ by 1½—2 by 1.4—1.6 cm, apiculate at the apex, showing in cross-section a band of sclerenchymatous tissue 3—4 mm thick, including in it some isolated air-chambers, especially in a ring round the loculus, and radially extended into 9—10 spoke-like projections with further air-chambers between them.

Distr. Malaysia: Central Celebes (Malili). Fig. 23.

Ecol. Primary forest, 250 m.

Vern. Tollie poete.

Note. The structure of the fruit is very similar to that of T. solomonensis but it is longer and relatively narrower in shape and rather more compressed.

33. Terminalia beccarii EXELL, Blumea 7 (1953) 325.

Tree. Young branchlets sparsely appressed-pubescent at first, very soon becoming glabrous. Leaves chartaceous, spirally arranged along the branch, sparsely appressed-pubescent on the nerves otherwise glabrous, very obscurely verruculose, opaque, elliptic or obovate-elliptic, 7—14 by 4½—7½ cm, acuminate at the apex, obtuse at the base, with 2 or more rather conspicuous glands, black when dry, near the base of the midrib and each extending along, or in the direction of, a lateral nerve; nerves 8—9 pairs, somewhat impressed above and prominent beneath; petiole sparsely appressed-pubescent or almost glabrous, 2—4 cm. Flowers (ø not seen) in axillary spikes up to 18 cm long; rhachis glabrous or almost glabrous. Bracts not seen. Lower receptacle (ovary) glabrous 2 mm long; upper receptacle scarcely developed. Calyx-lobes ovate acute, 2 by
Flora Malesiana


Tree 15 m. Young branchlets rather stout, at first golden or fulvous-sericeous, later appressed-pubescent, finally glabrous. Leaves papyraceous or chartaceous, spirally arranged at the ends of the branchlets, sparsely appressed-pilose or almost glabrous, manifestly minutely verruculose above, rather obscurely pellucid-punctate, obovate or obovate-elliptic, 7–20 by 4–8\(^{1}/2\) cm, rounded and usually acuminate or obtuse at the apex, cuneate at the base, usually with 2 black (when dried) glands on each side of the midrib about 5–10 mm from the base; nerves 10–16 pairs, domatia usually present but not hairy; petiole sericeous, eventually sparsely sericeous or nearly glabrous, 1–2 cm. Flowers in axillary spikes 5–10 cm long; rhachis appressed-pubescent. Bracts hairy, filiform, 1–2 mm, soon caducous. Lower receptacle (ovary) glabrous or nearly so, sometimes with a few appressed hairs, 11/2–21/2 mm long; upper receptacle glabrous, shallow-cupuliform, 1 by 21/2–3 mm. Calyx-lobes deltoid or ovate, 1 by 1 mm, glabrous outside, hairy within. Filaments glabrous, 3–4 mm; anthers 0.6–0.7 mm long. Disk barbate. Style glabrous, 31/2–4 mm. Fruit glabrous, ellipsoid, at both ends, 3–31/2 by 1.3–11/2 cm when dried, showing in cross-section a circular band of sclerenchymatous tissue surrounding the loculus extended into 4–6 very irregular, radial projections partially enclosing honey-combed air-chambers between them.

Distr. Malaysia: Lesser Sunda Islands (Kangean Arch., Sumbawa, and Timor). Fig. 23.

Ecol. Mixed forest, 70–240 m.

Vern. Kētapang gunung, Kangean.

Notes. In his note sub T. trivialis v. SLOOTEN (L.c.) says ‘...it agrees with T. edulis (BLANCO) MERR., but it differs by its compressed, pilose, in sicco rugose fruit’, a statement which may cause confusion. He certainly intended ‘but the latter differs etc.’ instead of ‘but it differs’ for the cited description of the fruit applies to that of T. edulis not T. trivialis.


Young branchlets at first sericeous appressed-pubescent, soon glabrescent. Leaves chartaceous, spirally arranged along the branchlets, sometimes somewhat crowded towards their tips, sometimes pseudo-whorled, usually glabrous or nearly so, occasionally pubescent on the nerves below, shining above, not verruculose, sometimes rather obscurely verruculose below, obovate, obovate-elliptic or narrowly obovate, 7–12 by 31/2–61/2 cm, rounded and sometimes acuminate at the apex, cuneate at the base; nerves 6–9 pairs; domatia present but usually not hairy; petiole glabrous or sparsely pubescent, 1–11/2 cm, with 2 glands near the apex. Flowers sessile, in axillary spikes 7–10 cm long; rhachis golden-appressed-pubescent. Bracts glabrous or nearly so, filiform, 3–4 mm. Lower receptacle (ovary) usually glabrous rarely sparsely appressed-pubescent, 3–4 mm long; upper receptacle glabrous, shallow-cupuliform, 1 by 3–31/2 mm. Calyx-lobes glabrous outside, hairy inside, broadly ovate or deltoid, 2 by 2 mm. Filaments glabrous, 4 mm; anthers 0.8 mm long. Disk barbate. Style glabrous, 4–5 mm. Fruit glabrous ellipsoid, attenuated at each end, often beaked at the apex, 3–5 by 1.8–2 cm, showing in cross-section a ring of sclerenchymatous tissue round the loculus extended radially into 5–6 spoke-like projections with relatively large air-chambers filled with alveolar tissue between them; exocarp rather thick and hard when dried.

Distr. Malaysia: throughout the Philippines. Fig. 23.

Ecol. Primary forests at low and medium altitudes.


36. Terminalia lundquistii EXELL, Blumea 7 (1953) 326.—Fig. 22.

Tree 21 m. Young branchlets rather stout, at
first rufous-sericeous, soon sparsely appressed-pubescent, at length glabrescent. Leaves subcoriaceous, spirally arranged, glabrous above, appearing resinosous or glutinoso beneath, almost glabrous or sometimes pubescent on the nerves, elliptic or obovate elliptic, 8–13 by 4'/2–8'/2 cm, somewhat acuminate at the apex, cuneate at the base; nerves 8–11 pairs with glabrous domatia; petiole at first rufous-sericeous, later sparsely appressed-pubescent or glabrous, 1'/2–2 cm. Flowers (not seen) in axillary spikes 14 cm long; rhachis almost glabrous. Bracts not seen. Fruit glabrous, ellipsoid, somewhat beaked at the apex, irregularly verrucose and also rather densely minutely verruculose, 4–5 by 1'/2–2 cm, showing in cross-section some honey-combed tissue around the loculus surrounded by a thick band of sclerenchyma with short radial spoke-like projections.

Distr. Malaysia: South New Guinea (Mimika). Fig. 23.

Ecol. Primary forest on sandy soil, 50 m. Vern. Kari.

37. Terminalia plagata MERR. Philip. J. Sc. 30 (1926) 414.—Fig. 22.

Tree. Young branchlets densely fulvous-appressed-pubescent, later glabrescent. Leaves coriaceous or subcoriaceous, spirally arranged and somewhat crowded at the ends of the branchlets, shiny and glabrous above except for some appressed pubescence on the midrib, with close prominent reticulation, rather densely appressed-puberulous beneath, eventually nearly glabrous, spathulate or oblanceolate, 4–9 by 2–4 cm, rounded or blunt at the apex, cuneate at the base; nerves 7–10 pairs, with rather prominent domatia in their axils; petiole sericeous, 2–8 mm. Flowers unknown. Fruits at first sparsely appressed-pubescent, becoming glabrous, ellipsoid, 2–2.8 by 1.2–1'/2 cm, sometimes somewhat laterally compressed, beaked at the apex, showing in cross-section a stellate band of sclerenchymatous tissue about 2 mm thick around the loculus with some air-chambers included in it and with short radial projections and a relatively wide outer band of alveolar tissue.

Distr. Malaysia: Philippines: Sulu group (Tawi-Tawi Isl., close to NE. Borneo). Fig. 23.


Tree. Young branchlets considerably thickened at the tips, at first rufous-sericeous, soon glabrescent, growth symiodal. Leaves papyraceous to chartaceous or sometimes subcoriaceous, spirally arranged and crowded at the tips of the branchlets, sericeous when very young eventually glabrous or almost glabrous except for appressed pubescence on the midrib, conspicuously minutely verruculose above and bellulcid-punctate at certain stages of development but these characters are not seen when the leaf is young and it becomes opaque as it grows old, obovate, narrowly obovate or obovate-spathulate, 5–12 by 2'/2–6'/2 cm, rounded at the apex, cuneate at the base; nerves 8–10 pairs, domatia present in their axils, sometimes hairy; petiole sericeous, eventually sparsely appressed-pubescent, or glabrous, 1'/2–2 cm, usually with 2 glands at or above the middle. Flowers in axillary spikes 5–8 cm long; 6 numerous, glabrous, 1'/2–2 mm stalked; 6 sessile, fewer, towards the base of the spike, rhachis nearly glabrous. Bracts glabrous, filiform, 1 mm. Lower receptacle (ovary) glabrous, 1'/2–2 mm long; upper receptacle glabrous, shallow-cupuliform 1 by 2 mm. Calyx-lolobs broadly deltoid, glabrous, 0.8 mm long. Filaments glabrous, 1'/2–2 mm (probably immature); anthers 1'/2 mm long. Disk barbate. Style glabrous, 1'/2 mm. Fruit glabrous, ellipsoid, 2–4'/2 by 1.2–2 cm, often beaked and stipitate, showing in cross-section a complete ring of sclerenchymatous tissue 5–6 mm broad in which 5–6 irregular masses of alveolar tissue are embedded or the latter may be more developed at the expense of the sclerenchyma which is sometimes little more than a framework.

Distr. Malaysia: Philippine Islands (Luzon, Mindanao, Sulu Arch., and Palawan). Fig. 23.

Ecol. Forests at low altitudes.


Note. The specimens described as T. wakahagensis have rather larger fruits but there seems to be no difference in structure.

39. Terminalia papuana EXELL, Brittonia 2 (1936) 246.—T. brassii EXELL, tom. cit. (1936), non T. brassii EXELL (1935)—Fig. 22.

Large, deciduous tree, 20–30 m. Bark grey, grey-brown or black. Young branchlets stout, at first fulvous- or rufous-sericeous, later glabrescent. Leaves papyraceous, spirally arranged and crowded at the ends of the branchlets, very shiny above, sparsely pilosulous or glabrous, rather obscurely verruculose, appressed-pubescent below eventually glabrescent, manifestly but not very conspicuously pellucid-punctate, obovate to obovate elliptic, 10–20 by 5–13 cm, rounded and usually shortly acuminate at the apex, subcuneate or slightly cordate at the base; nerves 8–12 pairs, domatia usually present but without indumentum other than that covering the undersurface of the lamina; petiole appressed-pubescent, becoming nearly glabrous, 2–3 cm. Flowers white, sessile, in axillary spikes 5–10 cm long; rhachis appressed-pubescent. Bracts not seen. Lower receptacle (ovary) densely sericeous 2–3 mm long, upper receptacle scarcely developed. Calyx-lolobs triangular, 1'/2 by 2 mm, subsericeous outside, nearly glabrous within. Filaments glabrous, 3 mm; anthers 0.8 mm long. Disk barbate. Style glabrous, 3 mm. Fruit glabrous when mature, ellipsoid, not laterally compressed, 5–6 by 2'/2–3 cm, beaked or apiculate at
the apex, shortly stipitate at the base, showing in cross-section an irregular mass of sclerenchymatous tissue enclosing pockets of alveolar tissue, which breaks down to form air-chambers.

Distr. Malaysia: New Guinea (Idenburg River, Bernhard Camp, and Mafulu). Fig. 23.

Ecol. Rain-forest, from the flood-plains up to 850–1200 m.

Note. The description of the fruit is taken from Brass & Versteegh (A) from Idenburg River, Bernhard Camp. It has been a puzzle which fruiting specimens to correlate with the flowering material described as T. papuana. It is to be hoped that the right choice has been made. Other as yet unidentified specimens from lower altitudes with much smaller fruits are also very similar in leaf.


Tree, 30 m. Young branchlets fulvous-tomen-

Fig. 24. Terminalia zollingeri Exell. a. Flowering branch, × 1/2, b. ♀ flower, × 31/2, c. ♂ flower, × 31/2, d. ♀ flower in longitudinal section, × 31/2, e. fruit, × 1/2, f. stone, × 1/2 (after van Slooten).
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by

1953

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above and at times beneath, usually opaque or very obscurely pellucid-punctate, sometimes somewhat glaucous beneath, obovate, narrowly obovate or obovate-elliptic, 6-19 by 2½-10 cm, rounded, shortly acuminate or obtuse at the apex, narrowly cuneate at the base; nerves 6-8 pairs, rather widely spaced, domatia usually present, mostly glabrous; petiole usually glabrous sometimes sparsely appressed-pubescent, 1-2½ cm, usually with 2 glands at or near the middle. 

Flowers sessile, in axillary spikes 10-16 cm long, rhachis appressed-pubescent or glabrous. Bracts filiform, hairy, 2 mm. Lower receptacle (ovary) rufous-tomentose or sericeous 2-2½ mm long; upper receptacle scarcely developed. Calyx-lobes triangular pubescent or nearly glabrous, 2 by 1½ mm. Filaments glabrous, 3-4 mm; anthers ½ mm long. Dish barbate. Style glabrous 3-4 mm. Fruit hairy at first, glabrous when mature, sub-glabose or ovoid, slightly laterally compressed (sometimes appearing more flattened due to drying), 3½-5 by 3-4 cm, showing in cross-section thin irregular bands of sclerenchyma enclosing masses of alveolar tissue, the whole surrounded by a layer 3-5 mm thick of a spongy or fibrous nature.

Distr. Lower Burma (Mergui), Lower Siam (Puket), in Malaysia: Sumatra, Malay Peninsula, Borneo, Philippines. Fig. 26.

Ecol. Primary forests at low altitudes.


Uses. The timber is said to be not very durable. Bark is used in Palembang as a yellow or brown dye.

42. Terminalia mollii EXELL, Blumea 7 (1953) 324.—Fig. 22.

Tree 30 m. Young branchlets slender, at first rufous or fulvous-tomentellous, later becoming glabrous. Leaves spirally arranged along the branchlets or somewhat crowded towards their tips, subcoriaceous, shiny and almost glabrous above, very obscurely verruculose, sparsely puberulous on the nerves below, opaque, obovate-elliptic, 2½-7 by 1½-3.2 cm, rounded at the apex, rounded to subacute at the base; nerves 5-6 pairs, rather widely spaced, with glabrous domatia in their axils; petiole puberulous, 8-15 mm, with 2 glands near the apex. Flowers not known. Fruit subglobose, 3½ by 3 cm when dried, shiny, glabrous, corky, showing in cross-section only a narrow band of sclerenchymatous tissue round the loculus surrounded by a broad corky layer.

Distr. Malaysia: Central Sumatra (Upper Indragiri, Tapanulu and Priaman). Fig. 26.

Note. The name Terminalia mollii T. & B. first occurs in a catalogue of the Buitenzorg Botanic Garden printed in 1855 but the issue was deliberately suppressed and only 2 copies were kept for internal use in the curator's office at Bogor, and are now incorporated in the Bibliotheca Bogoriensis so that names in it cannot be considered as validly published in spite of Van Sleuten's opinion (I.e.) to the contrary. For a fuller discussion see Van Steenis (Bull. Jard. Bot. Btzg III, 13, 1933, 117). This standpoint as regards Cat. Hort. Bog. (1855) allows the retention of *T. mollii* Olliv. for the African species.


Tree up to 30 m by 75 cm. Young branchlets rather stout, rufous- or silvery-tomentose or sericeous soon glabrescent. Leaves chartaceous to subcoriaceous, spirally arranged along the branchlets or often crowded towards their tips, appressed-pubescent when young, usually glabrous or nearly glabrous when mature, sometimes rufous-pubescent on the nerves beneath, sometimes rather sparsely or more densely minutely verruculose
Fig. 25. *Terminalia foetidissima* Griff. a. Flowering branch, × 2/3, b. bud, × 6, c. flower, × 5, d. stone, × 2/3, e. fruit, × 2/3 (after van Slooten).
Ecol. Primary forest from sea-level to 10 m. 
Vern. Katuko, Pariaman, simar kulihip, Tapanuli.

43. Terminalia phellocarpa King, J. As. Soc. Beng. 66, 2 (1897) 330; Ridl. Fl. Mal. Pen. 1 (1922) 705; Burk. Dict. (1935) 2141; Corner, Wayside Trees (1940) 194.—Fig. 22.

Tree 12–20 m. Young branchlets rufous-appressed-pilosce, slender. Leaves subcoriaceous, spirally arranged, somewhat crowded at the ends of the branchlets, at first appressed-pubescent especially on the nerves, later almost glabrous, rather shiny above, not verruculose, opaque, elliptic to obovate, 3/2–8 by 1/2–4 1/2 cm, rounded at the apex, cuneate to rounded at the base; nerves 5–6 pairs with glabrous domatia; petiole at first appressed-pubescent later glabrescent, 8–18 mm, usually with 2 glands a little above the middle. Flowers sessile, in axillary spikes 3–4 cm long, rhachis appressed-pubescent. Bracts filiform, hairy, 2 mm. Lower receptacle (ovary) rufous-tomentellous, 1/2 mm long; upper receptacle scarcely developed. Calyx-lobes hairy, ovate-triangular, 2 by 1 mm, reflexed at the tips. Filaments glabrous, 3 mm; anthers 0.8 mm long. Disk barbate. Style not seen (β flowers all immature). Fruit glabrous or nearly glabrous when mature, ellipsoid or suborbicular ± laterally compressed, 6–7 by 4–5 by 3–3 1/2 cm, usually shortly beaked at the apex showing in cross-section a very narrow band of sclerenchyma round the loculus and a thick corky layer with radiating fibres.

Distr. Malaysia: Sumatra (Palembang) and Malay Peninsula (Kedah, Perak, Malacca, Selangor, Johore, Singapore). Fig. 26.

Ecol. Swamp forests at low altitudes.

Vern. Jelawai, mempelam babi (pig’s mango), pauh kijang (barking deer’s mango, by confusion with Irvingia), pelawai; telisiai, Johore, renjang, Mal. Pen.

Notes. According to Corner (l.c.) the fruits are distributed mainly by floodwater floating them through the forest. This seems to be the Terminalia species most completely adapted for water-distribution. The specimens from Sumatra have relatively broader, flatter fruits but material is insufficient to decide whether this difference is constant.


Large tree up to 40 m. Bark grey or brown; sapwood whitish. Young branchlets much thickened, rufous-sericeous, becoming glabrous. Leaves spirally arranged, crowded at the thickened ends of the branchlets, rufous-tomentose when young, later sparsely appressed-pubescent or nearly glabrous, shining above, rather sparsely appressed-pubescent and sometimes minutely verruculose beneath, usually opaque, obovate-cuneate, 15–40 by 4 1/2–18 cm, rounded at the apex, narrowly cuneate below the middle and usually subordinate at the base; nerves 24–30 pairs, almost perpendicularly to the midrib and rather closely spaced, domatia present but rather inconspicuous and not hairy; petiole thick, at first rufous-sericeous, becoming nearly glabrous, 5–10 mm. Flowers white, in axillary spikes 25–50 cm long; rhachis fulvous-tomentellous. Bracts filiform, 2 mm, soon caducous. β Flowers numerous with appressed-pubescent stalks 3–5 mm long; γ flowers few, sessile towards the base of the spike. Lower receptacle (ovary) fulvous-sericeous, 3–6 mm long, narrowed at the apex into a slender stalk above the ovary; upper receptacle nearly glabrous, shallow-cupuliform, 1 by 3 mm. Calyx-lobes glabrous or nearly so, ovate-acuminate, 2 by 1/2 mm. Filaments glabrous, 3/2–4 1/2 mm; anthers 1/2–0.6 mm long. Disk barbate. Style glabrous, 4 mm. Fruit sparsely appressed-pilosae or nearly glabrous when mature, ovoid or ellipsoid, sometimes slightly laterally compressed, sometimes rather obscurely 5-lobed, often shortly beaked at the apex, 3/2–6 by 2.2–3 cm, showing in cross-section very irregular and sinate sclerenchymatous tissue partly enclosing and partly surrounded by alveolar tissue and a band of corky tissue 2–3 mm thick round the outside.

Distr. Malaysia: Sumatra (Simalur Isl., East and South coasts, Enggano, Krakatau), Borneo, Philippines, Lesser Sunda Islands (Flores), Celebes (Menado, Palopo, Buton Isl.), Moluccas (Talaud, Ternate, Sula, Ceram) and New Guinea. Fig. 28.

Ecol. Primary forests up to 500 m.


Uses. The timber is said to be similar to that of T. catappa L. The fruits are edible.

Vern. Kétupang, M, kétupang darat, kédawang, Benocoen, mértapang, luhajang paja, Simalur, katapang, Karo; Philippines: lanipáu, S.L. Bis., C. Bis., Mbo, nipon, Bag, talaisi, Tagb., yanipó, Mbo; dalipo, Palopo, tusawara, Sula.

Fig. 26. Distribution of Terminalia series H: 41. foetidissima, 42. molii, 43. phellocarpa.
Fig. 27. *Terminalia copelandii* Elmer. River bank of Kuala Bahewa, Karakelong Island (Talaud) (H. J. Lam).
Notes. This is one of the largest leaved species of *Terminalia*. Sterile specimens may at times be confused with those of *T. catappa* owing to the fact that both species have obovate leaves with subcordate bases. The leaves of *T. copelandii* are relatively longer and narrower and have more numerous, more closely spaced lateral nerves. The inflorescences are usually longer and the fruits less compressed.

A sterile specimen collected at Ende in Flores Island (FRI 8923) may belong to this species.


Buttressed tree, 35–45 m, with a large, spreading crown. Outer bark grey or grey-brown; inner purple or mauve, then brown against the cambium. Sapwood poorly defined, light with concentric wavy rings, sometimes almost porous. Young branchlets fulvous-tomentose, stout or very stout. Leaves coriaceous, spirally arranged along the branchlets, sometimes rather crowded in whorls towards the tips, finely reticulate above, somewhat shiny, remaining tomentose on the midrib and principal nerves, obscurely minutely verruculose, fulvous or rufous-tomentose below especially on the nerves, finally becoming nearly glabrous, rather obscurely pellucid-punctate at some stages of development, obovate-elliptic, narrowly obovate-elliptic or obovate-oblong, 12–35 by 5–12 cm, rounded and sometimes shortly acuminate or mucronate at the apex, cuneate or occasionally rounded at the base sometimes with 2 conspicuous black glands; nerves 10–18 pairs, domatia absent or inconspicuous; petiole fulvous- or rufous-tomentose or tomentellous, 1–2 cm, occasionally with 2 glands at or near the middle. Flowers sessile, rather large for the genus, in axillary spikes 10–12 cm long; rhachis fulvous- or rufous-tomentose. Bracts hairy, caducous, 1 mm long. Lower receptacle (ovary) fulvous-tomentellous, 5 mm long; upper receptacle shallow-cupuliform, fulvous-tomentellous, 2–2½ by 6–7 mm. Calyxlobes fulvous-tomentellous, broadly ovate-deltoid, 2½ by 2½–3 mm. Filaments glabrous, 6–12 mm; anthers 0.8 mm long. Disk densely pilose. Style glabrous, 5–8 mm. Fruit red, fleshy, at first tomentose, nearly glabrous when ripe, ellipsoid, more or less laterally compressed, 6–17½ by 4–8 by 3½–6 cm, slightly beaked at the apex, the endocarp showing in cross-section a broad band of very hard selerenchymatous tissue including in it some irregularly shaped and irregularly spaced air-chambers and a rather large loculus (up to 2½ by 2 cm in larger fruits) containing the edible kernel.

Distr. Solomon Islands (New Georgia), in Malaysia: New Guinea, S. Moluccas (Aru Islands). Fig. 28.

Ecot. Common in rain-forests and riverine forests up to 1000 m.

Uses. The wood is medium hard inclined to be brittle. The fruit, which is by far the largest known in the Combretaceae, is edible, the kernel being one of the best-flavoured tropical nuts and a favourite article of diet among the natives.


Tree. Leaves papyraceous, glabrous when old except for some reddish hairs on the midrib and on the principal veins below, narrowly obovate-cuneate or narrowly oblong-elliptic, 25–35 by 9–12 cm, obscurely pellucid-punctate, sometimes rather prominently sparsely verruculose above (? pathological); nerves 14–17 pairs, without domatia; petiole with remains of a fulvous tomentum, 1½–3½ cm, with or more glands. Flowers and fruits unknown.

Distr. Malaysia: Sumatra (Palembang: Batu-radja). Fig. 28.

Vern. Kaju kédjoh, M.

Note. Only known from the inadequate original collection, Teysmann 3692 (BO, L, U) consisting of detached leaves and portions of branchlets. The material is in poor condition and both the rather sparse wart-like projections on the upper surface of leaf and the numerous 'glands' on the petiole may be pathological. In spite of the paucity of material there is enough to make it probable that the species is indeed a *Terminalia* and one not identifiable with any other known Sumatran species.

Pella 12 from Celebes which van Slooten (l.c. 1924) mentioned in a note sub *T. adenopoda*, though he rightly did not consider it to be the same, is probably *T. copelandii* Elm.

47. *Terminalia canaliculata* Exell, Blumea 7 (1953) 327.

Semi-deciduous buttressed tree, 30 m. Bark brown or pale brown, flaky. Sapwood pale, heartwood red-brown. Young branchlets at first appressed-pubescent soon becoming sparsely pubescent or glabrous, growth sympodial. Leaves chartaceous, spirally arranged and somewhat crowded towards the ends of the branchlets, appressed-pubescent when young, soon glabrescent, obovate,
Fig. 29. Fruits of *Terminalia* numbered to correspond with the species in the text; of each species a fruit and its section; all from herbarium material; loculus and hollows black, sclerenchyma white, alveolar tissue dotted; nat. size.—44. *T. copelandii* (IDRIS 19), 45. *T. kaernbachii* (BRASS 6973) & 45'. *T. kaernbachii* (CARR 12239) (seed drawn in the section!) showing variation in size.
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**Fig. 30. Distribution of Terminalia series J, K, and L:** 47. *canaliculata*, 48. *archboldiana*, 49. *capitulata*.

Obovate-elliptic or elliptic, 8–15 by 4–7 cm, rounded and shortly acuminate at the apex, cuneate at the base, with numerous transverse canal-like mucilage cavities conspicuously visible with a lens on the upper surface and appearing translucent with transmitted light; nerves 9–13 pairs; domatia frequent, usually showing perforations of the lamina; petiole sparsely appressed-pubescent or glabrous, 11/2–3 cm. *Flowers* white, in axillary spikes 10–13 cm long; rachis appressed-pubescent. Bracts caducous. ♀ Flowers stalked; stalk appressed-pubescent, 1–1 1/2 mm; ‡ fewer, at the base of the spike, sessile. *Lower receptacle* (ovary) sericeous, 2–2 1/2 mm long; upper receptacle scarcely developed. *Calyx*-lobes sparsely pubescent outside, pilosulose inside, triangular 2 1/2 by 1 1/2 mm. Filaments glabrous, 3 mm; anthers 1 1/2 mm long. Disk barbate. Style unknown. *Fruit* unknown.

**Distr. Malaysia:** New Guinea (Papua; Palmer River, Oriomo River, and Milne Bay). Fig. 30.

Ecot. Canopy tree in forests on the lower ridges and swampy flats at low altitude.

**Vern. Kama, Upper Waria, gara,** Oriomo River.

Note. This species is remarkable for the linear markings on the upper surface of the leaf. These are translucent when the leaf is held up to the light. Dr C. A. Reinders-Gouwentak describes them as canal-like cavities containing mucilage found above the xylem of the smaller veins and within the xylem of the larger and medium-sized veins.

**48. Terminalia archboldiana** EXELL, Brittonia 2 (1936) 137.

Tree up to 30 m, with flatly spreading branches. Bark pale brown, fissured, scaly; wood hard, yellow-brown. Young branchlets slender, minutely appressed-puberulous, buds sericeous. *Leaves* coriaceous or subcoriaceous, spirally arranged, sometimes whorled or crowded towards the ends of the branchlets, shiny and sparingly appressed-pubescent or glabrous above, appressed-pubescent eventually glabrescent beneath, not or rather obscurely verruculose, opaque, obovate or obovate-elliptic, 3–7 by 1 1/2–3 1/2 cm, rounded or blunt at the apex, cuneate at the base, 2 glands sometimes present on the midrib 5–10 mm from the base; nerves 5–6 pairs; domatia often present but usually not hairy; petiole appressed-pubescent, 2–4 mm. *Flowers* sessile, white, greenish or yellowish, buds pointed, in short, axillary, sometimes subcapitate spikes 2 1/2–3 cm long; rachis sericeous. Bracts sericeous, 1–2 mm, early caducous. *Lower receptacle* (ovary) 1 1/2–2 1/2 mm long, sericeous; upper receptacle scarcely developed. *Calyx*-lobes sericeous or almost glabrous, recurved, triangular, 2 by 1 1/2 mm. Filaments glabrous, 2 mm; anthers 0.4 mm long. Disk barbate. Style glabrous, 3 mm. *Fruit* sericeous when young, later more sparsely appressed-pubescent, subglobose to ellipsoidal, when dried 8 by 7 mm (perhaps immature).

**Distr. Malaysia:** E. New Guinea (Papua: Rona and Kanosia) Fig. 30.

Ecot. A common tree in hillside rain-forest at 450 m, found in open savannah at the same altitude; also recorded in forest at Kanosia at 15 m.

Note. L. J. Brass describes this species as a common tree up to 30 m high growing in hillside forest at Rona, Laloki River and it was originally described from Brass 3642 from this locality. C. E. Carr found it again in open savannah in the same district and at the same altitude but described it as a tree of 5 m. He also collected it in forest at Kanosia nearly at sea-level and again described it as a tree only 5 m high. I feel convinced that the material all belongs to the same species and it is of course possible that Carr's specimens came from young trees. The ecological data clearly need verification.

**49. Terminalia capitulata** EXELL, Blumea 7 (1953) 322.

Tree 17 m by 120 cm; crown wide-spreading. Bark thick, black, scaly, rough. Young branchlets rufous-sericeous. *Leaves* subcoriaceous, spirally arranged and more or less crowded towards the ends of the branchlets, at first densely rufous-sericeous becoming sparsely sericeous-pilose on both surfaces, conspicuously and rather densely minutely verruculose above, rather inconspicuously so beneath, pellucid-punctate, obovate, 1 1/2–4 1/2 by 0.7–2.6 cm, usually rounded at the apex and cuneate at the base; nerves 5–7 pairs, with domatia in their axils; petiole rufous-sericeous, 3–7 mm. *Flowers* white, sessile, in 3–6-flowered pseudo-capitulae with peduncle up to 4 cm long provided with 2–3 bracts, 2–3 mm long, at the apex. *Lower receptacle* (ovary) rufous-sericeous, 1 1/2–2 mm long; upper receptacle scarcely developed. *Calyx*-lobes rufous-sericeous outside, glabrous inside, triangular or ovate-triangular, acute, 2 mm long. Filaments glabrous, 2 mm; anthers 0.3 mm long. Style glabrous, 2 mm. *Fruit* unknown.

**Distr. Malaysia:** W. New Guinea (Balim River). Fig. 30.

Ecot. Primary forest on river bank, 1600 m.

Note. The structure of the inflorescence is very unusual in Terminalia.

Tree. Leaves membraneous (young) crowded at the ends of the branches, glabrous, not verruculose, narrowly elliptic, narrowly obovate-elliptic or oblong-ovate, 8–20 by 3–6½ cm, acuminate at the apex, cuneate at the base; petiole 4 cm long, without glands. Flowers and fruits unknown.

Distr. Malaysia: Sumatra (W. Coast).

Note. Only known from the type gathering, TEYSSMANN 850 (BO, L, U); leaves only.

Cultivated species

The following species are cultivated in various Malaysian gardens: T. arjuna (ROXB.) W. & A., T. chebula RETZ. and T. farraceae (POIR.) DC. The latter species, owing to mis-identification, is variously referred to in the literature as Bucida baceras, Bucida nitida and T. nitida.


Excluded species


There is no type in existence. MERRILL (L.C. 1923) considers that it may be Elaeocarpus monocera CAV. (Elaeocarpaceae).

Terminalia quadrialata MERR. Philip. J. Sc. C. Bot. 4 (1909) 301 = Combretedendron quadrialatum (MERR.) MERR. (Lecythidaceae).


Insufficiently known species

Terminalia amboinensis HORT. ex STEUD. Nomencl. ed. 2, 2 (1841) 668, nomen nudum.

Terminalia curranii MERR. ex E. SCHNEIDER, Bull. Bur. For. Philip. no 14 (1916) 197, nomen nudum. This is said ‘to be known from one specimen from Laguna; no wood specimen present’. No type has been seen; it may represent possibly either T. nitens PRESL. or T. foetidissima GRIF.

4. CALYCOPTERIS

LAMK, Ill. Gen. (1791–6) t. 357; Tabl. Enc. 2 (1819) 485.—GETONIA ROXB. PL. COROM. 1 (1798) 61, t. 87.

Scandent shrubs. Leaves opposite or subopposite. Flowers ♂, 5-merous, shortly pedicelled or subsessile in terminal leafy panicles. Receptacle (calyx-tube) divided into a lower part (lower receptacle) surrounding and adnate to the ovary and an upper campanulate part (upper receptacle) containing the disk and bearing the stamens. Calyx-lobes 5, accrescent. Petals 0. Stamens 10, biseriate, inserted within the upper receptacle above the margin of the disk; anthers versatile. Disk cupular without free margin. Style subulate. Ovary with 3 pendulous ovules of which one often aborts at an early stage and another aborts later. Fruit 5-gonous and 5-furrowed, crowned by the 5 spreading, accrescent calyx-lobes. Seed solitary.

Distr. Monotypic, India, Assam, Burma, Indo-China, Siam, and the Malay Peninsula.

Note. The question of priority between Calycopteris LAMK and Getonia ROXB. has long been a cause of instability in the nomenclature of this genus. LAMARCK’s tab. 357 in his ‘Illustrations des Genres’ is still of uncertain date but was published not later than 1796 and probably about 1793–4. This plate seems to validate the genus although the corresponding text was not published until 1819. As long as ROXBURGH’s Getonia appeared to have the firm date of 1795 it still seemed better to accept this name in view of the certainty about the date of Calycopteris; but W. T. STEARN now assures me that he has conclusive evidence (cf. p. ccc) that ROXBURGH’s ‘Plants of the Coast of Coromandel’ was published in parts and that Getonia did not appear until 1798, later than any possible date for Calycopteris.


Large scandent shrub. Young branchlets densely fulvous-tomentellous. Leaves chartaceous densely fulvous-pubescent above when young, somewhat glabrescent when older, densely fulvous-tomentell-
lous below, finely reticulate, ovate to narrowly elliptic 6–17 by 2–7 cm, usually acuminate or acute at the apex, cuneate, rounded or subcordate at the base; petiole 1/2–1 cm, fulvous-tomentellous. Panicle with reduced leaves at the points of branching and narrowly elliptical tomentellous leaf-like bracts, 10–11 by 4–4 1/2 mm, subtending the flowers. Flowers yellowish-green. Lower receptacle fulvous-villous, 4 1/2 by 2 mm. Upper receptacle fulvous-villous both within and without, 3 by 4 1/2 mm. Calyx-lobes narrowly elliptic or oblanceolate fulvous-sericeous-tomentellous 4 by 2 mm, in fruit reaching a length of 1–1 1/2 cm. Filaments 2 1/2 mm; anthers 0.6 mm long. Style 5 mm, pilose except at the apex. Fruit ellipsoid, densely villous, 7–8 by 2–3 mm.

Distr. SE. Asia, in Malaysia: Malay Peninsula (Penang & Langkawi Islands, Pahang); also in Lower Siam.

Ecol. A climber in mixed forests and along river-banks.

Uses. The flowers are used in Penang as a poultice for head-aches.

Vern. Pelawas, M.

5. LUMNITZERA


Small, evergreen, trees or shrubs. Leaves spirally arranged, sessile or almost sessile, fleshy-coriaceous, entire, glabrous when mature. Flowers ♀, 5-merous, actinomorphic, red, white, pink or yellow, in short terminal or axillary spikes or racemes. Receptacle (calyx-tube) not externally differentiated into an upper and a lower part but produced to form a tube beyond the ovary, bearing two adnate persistent bracteoles and terminating in a 5-lobed persistent calyx. Petals caducous. Stamens 5–10 borne on the inner wall of the receptacle tube; anthers versatile. Disk absent or inconspicuous. Ovules 2–5; style filiform, persistent, not adnate to the wall of the receptacle; stigma simple. Fruit (pseudocarp) compressed-ellipsoid, obtusely angled, more or less woody, crowned by the persistent calyx.

Distr. Species 2: one in E. Africa, Madagascar, tropical Asia, Malaysia, N. Australia, and Polynesia, the other in tropical Asia, Malaysia, N. Australia and Polynesia.

Ecol. Small trees or shrubs of mangrove swamps, tidal rivers, and estuaries, mostly on the land side of the mangrove, often above flood level.

VAN BODEGOM asserts (in litt.) that Lumnitzera forms a definite têrântum mangrove type (girdle) occupying the back-mangrove on solid, drier soils which are sandy or have a sandy subsoil. He observed
Lumnitzera to be frequent in the Riouw Islands but less so on the muddy shores of Bengkalis except on the more sandy northern shores of the islands, where they may form pure stands as e.g. on the N. bank of Sg. Kembung. Similar observations were made by van der Zwaan (Het Bosch 2, 1934, 160) for Indragiri; exceptional trees may reach 40 m by 60–70 cm there. de haan (Tect. 24, 1931, 51) found Lumnitzera in Tijlatap (S. Java) forming part of his type 8 in girdle A4, characterized by solid shallow soils with local marlbanks below, inundated yearly only during very few days. Along Djakarta Bay Lumnitzera racemosa is locally gregarious in the back-mangrove. Van Dijk (Boschbedrijf etc., 1939, 55) found Lumnitzera gregarious in the Island of Meos Noem (Geelvink Bay).

According to van Slooten (Trop. Natuur 11, 1922, 54, 65, map; Bull. Jard. Bot. Btgg III, 6, 1924, 43–49, map; Blumea Suppl. 1, 1937, 162–175, map) the two species, though occurring throughout Malaya where their areas overlap, practically exclude each other in habitat, and have never been collected in exactly the same stand. L. littorea appears to be entirely absent from the shores of the (muddy) Java Sea where in contrast L. racemosa has numerous stations. The exact cause of this different ecological behaviour is not yet known.

Wood anat. See under the species.

Uses. The timber is valuable; see under the species.

**KEY TO THE SPECIES**

1. Flowers red, shortly pedicellate. Stamens twice as long as the petals. Inflorescences terminal. Knee-shaped pneumatophores usually present

**1. L. littorea**

1. Flowers white (occasionally pink?) or yellow (in var. lutea), sessile. Stamens equalling or only slightly exceeding the petals. Inflorescences axillary. Knee-shaped pneumatophores absent. **2. L. racemosa**


Tree up to c. 25 m by 50 cm, usually smaller, not buttressed, with slender knee-shaped pneumatophores. Bark dark brown, fissured, inner bark reddish-brown, sapwood yellowish-brown, heartwood dark brown. Young branchlets reddish or grey, glabrous. Leaves usually crowded at the ends of the branchlets, narrowly obovate-elliptic, 2–8 by 1–2½ cm, rounded at the apex and cuneate at the base, with rather obscure marginal glands. Racemes short, terminal, c. 1½–3 cm long. Flowers red, shortly (1–1½ mm) pedicelled. Receptacle glabrous, tubular or narrowly infundibuliform, laterally compressed, slightly constricted just below the apex and then expanded into the calyx, 8–10 mm long, with two small, ovate, ciliolate bracteoles 1½–4½ mm long, adnate to it usually just below its middle. Calyx-lobes very broadly ovate, c. 1 mm long, slightly imbricate, margin ciliolate. Petals red, glabrous, oblong-elliptic, 4½ by 1½–2 mm. Stamens 5–10, c. 10 mm long, double the length of the petals. Style 10 mm, glabrous. Fruit glabrous, c. 10 by 4 mm longitudinally ribbed, somewhat corky in texture with a very thin inner layer of sclerenchyma and some strands of sclerenchymatous tissue dispersed throughout the pericarp.

Distr. Tropical Asia, northern Australia, and Polynesia, throughout Malaysia but apparently absent or very rare on the coasts of the Java Sea, where it is replaced by L. racemosa.

Ecol. Generally a small tree, the back-mangrove, sometimes gregarious, also above the tide level.


Uses. Wood dark grey; timber hard, durable, fine-grained, keeps its shape remarkably well; when first cut it has the scent of roses. Suitable for bridges, wharf-building, axles of carts, flooring, tool-handles, furniture, sleepers, ship-building, etc. but difficult to obtain in large pieces. Repeatedly recorded as sound for pier-posts standing seawater conditions, especially if the bark is not removed.


(1) See also the notes sub. L. littorea.
Fig. 32. Lumnitzera littorea (Jack) Voigt. a. Flowering twig, nat. size, b. flower, $\times 2$, c. rhachis with fruits, $\times 2$.

Notes. It is not always easy to distinguish L. littorea from L. racemosa from deficient or disintegrated herbarium material. From leaves alone I doubt whether a confident determination can be given (at least without anatomical investigation). Attention to the following points will, however, enable most specimens to be named:

(a) When well preserved flowers are available there is no difficulty. Those of L. littorea are red with stamens twice as long as the petals; those of L. racemosa are white (rarely pink or yellow) with stamens approximately equalling the petals.

(b) With old flowers or young fruits two features should be noted: (i) the flowers are shortly pedicellate in L. littorea and sessile in L. racemosa (but it is not always easy to decide); (ii) in L. littorea the adnate bracteoles are merely very small appendages which do not interfere much with the general outline of the receptacle (calyx-tube). They are subopposite and usually attached somewhat below the middle of the receptacle. In L. racemosa the bracteoles are distinctly larger
and interfere more fundamentally with the general outline of the receptacle (see fig. 1, b). They are often attached at different levels, sometimes one above and one below the middle of the receptacle.

(c) Older fruits, where characters mentioned in (b) become less evident, are said to be distinguishable in cross-section. In _L. racemosa_ there is a well-developed inner layer of sclerenchyma with regular, radial, spoke-like projections. In _L. littorea_ the pericarp looks more uniform and somewhat corky in structure with irregularly dispersed strands of sclerenchyma and only a very narrow band of sclerenchyma surrounding the seed-cavity. But this distinction is not always as clear as it sounds.

(d) In the complete absence of flowers and fruits, if the rachis of the inflorescence remains and appears rather stout and clearly terminal the specimen is _L. littorea._

(e) If the buds and very young branchlets are appressed-pubescent the specimen is _L. racemosa,_ but a glabrous specimen is not necessarily _L. littorea._

(f) Any trace of pubescence on the leaves also indicates _L. racemosa_ but care must be taken not to be misled by mould.

2. _Lumnitzera racemosa_ Willd. Neue Schr. Ges. Naturf. Fr. Berl. 4 (1803) 187.—Fig. 1, b.

Small tree, up to c. 8 m by 30 cm, or shrub; knee-shaped pneumatophores absent. Bark rough, reddish-brown. Young branchlets reddish or grey, sometimes appressed-pubescent at first, soon glabrous. Leaves pubescent or glabrous, narrowly obovate, narrowly obovate-elliptic or narrowly elliptic, 2–9 by 1–2½ cm, blade cuneate to the subsessile base or sometimes narrowed 5–8 mm above the base thus appearing sub-petiolate. Spikes short, axillary, c. 2 cm long. Flowers white (rarely pink?) or yellow (in var. _Intea_), sessile. Receptacle tubular or narrowly urceolate, laterally compressed, glabrous or pubescent, 6–8 mm long, usually contracted just above the middle at the insertion of the two broadly ovate, 1½ mm long, sometimes ciliolate, opposite or subopposite adnate bracteoles. _Calyx_—lobes broadly ovate-acute often gland-tipped, sometimes with 3 glands, sometimes glandless, 4½–1 mm long. _Petals_ white (?) sometimes pink) or yellow, glabrous, narrowly elliptic or oblanceolate, 4 by 1 mm. Stamens 10, equalling or slightly exceeding the petals. _Style_ 6–7 mm long, glabrous. _Fruit_ appressed-pubescent or glabrous, 10–12 by 3–5 mm; pericarp with a well-developed inner layer of sclerenchyma extended radially giving a spoke-like appearance in cross-section.

_Distr._ Eastern tropical Africa, Madagascar, tropical Asia, northern Australia and Polynesia, throughout _Malaysia_ but almost absent from the shores facing the Indian Ocean.

_Ecol._ Small tree or shrub of mangrove swamps. According to _Hasskarl_ (Nat. Tijd. N.I. 10, 1856, 170) and _Teysmann_ (op. cit. 14, 1857, 368) it has been grown in occasionally (freshwater)-flooded
sandy soil in the Buitenzorg Botanical Garden, where it has flowered and fruited.

Wood anat. (L. racemosa & L. racemosa var. pubescens) MOLL & JANSSONIUS, Mikr. Holzes 3 (1914) 382 & 383.

Uses. The timber is similar in quality to that of the preceding species, but dimensions are generally even smaller. The bark is sometimes used for tanning purposes.


KEY TO THE VARIETIES

1. Flowers white (rarely pink?) var. racemosa . . . . var. lutea


Distr. etc. As for the species.

Note. The typical variety with white flowers [perhaps occasionally pink—see L. rosea (GAUD.) PR.]. There is little doubt that L. rosea was described from the common combretaceous mangrove in Manila Bay, which is L. racemosa. I have seen no other reference to a pink-flowered form.


Ecol. Small tree of the mangrove formation in tidal forest.

Note. A yellow-flowered variety with gland-tipped calyx-lobes. While it was thought that the yellow flower-colour and gland-tipped calyx-lobes in association were characters distinguishing L. lutea from L. racemosa there was justification for maintaining them as separate species; but gland-tipped calyx-lobes are to be found in the white-flowered variety, especially in New Guinea and the Philippines. L. racemosa var. racemosa has been recorded from Timor (although I cannot verify the flower-colour and the specimens are now without flowers) so that var. lutea is apparently not geographically isolated from the type variety.
It seemed useful to correct some errors which have crept into the text of volume 4 as well as to add some additional data which came to our knowledge and are worth recording. Valuable help in general was rendered by Dr R. C. BAKHIUZEN VAN DEN BRINK Jr, for additions to the Burmanniaceae by Dr F. P. JONKER, for Chenopodiaceae by Dr C. A. BACKER, for Viburnum by Mr J. H. KERN, for A. by Dr P. VAN ROYEN, and for a grass by Dr P. JANSEN. Printing errors have only been corrected if they may give rise to confusion.

Page numbers a and b denote respectively the left and right column.


End of paragraph 2: the correct name for the Malaysian 'Erigeron linifolius WILLD.' is: E. sumatrensis RETZ.

The grass figured in fig. 11 is rightly Isachne kinabaluensis MERR., a species very closely allied to (or possibly only a race of) I. panerangensis Z. & M.

Last line of paragraph 2: omit 'L)' in the authority of Dodonaea viscosa JACQ. The combination is not based on Ptelea viscosa L.

Line 11 from bottom: omit 'BL)' from the authority of Weirmannia blumei PLANCH.

Line 5 from top: replace Dianella nemososa LAMK by the earlier name D. ensifolia L., which SCHLITTLER erroneously placed in the synonymy.

An other example of phytomorphosis is that in Leersia hexandra Sw. No fruit is set in Malaysia but the ovary is sometimes attacked by a fungus (Testicularia leersiae CORNU) which causes the ovary to expand by which it resembles a grain.

Cf. VAN OEVEREN (Teymannia 33, 1922, 395) and BACKER (Handb. Fl. Jav. pt 2, 1928, 195, footnote).

Change in legend to fig. 26 Epichloë treubi into: Epichloë bambusae PAT.

Alinae 2 from bottom: the correct name for Ptelea trinervia WIGHT seems to be P. melastomoides (POIR.) BL.

In 2nd line of legend of fig. 27 replace 'galled swollen fruit' by: bark-gall.


Paragraph 8: not BOERLAGE, but BAKHIUZEN VAN DEN BRINK Jr (in MS) supposed the relationship between Otopetalum and Microchites.

Paragraph 2: the correct name for the common 'Ziziphus jujuba' L. is Z. mauritiana LAMK.

Second line of 14th paragraph from top first letter should be: G.
3 Unfortunately it has appeared that the name Acer niveum Bl., an almost consistently used new combination for Acer javanicum Jungh. non Burm., is not the correct name for this species, apart from the question whether it is conspecific with the earlier A. oblongum Wall., which is here not considered. A careful scrutiny of the nomenclatural value and exact dates of the references showed that the correct name is A. laurinum Hask. The essential synonymy, which should replace the one given on page 1, is as follows:


4 Add to distribution of A. laurinum Hask.: Timor.

5 Add to distribution of Helmholtzia novoguineensis: Japp. Island (Sarurai pr. Serui, Aet & Idjan 22).

6 The correct authority for Ancistrocladus is: Ancistrocladus WALL. [Cat. (1832) 1052] ex WIGHT & ARNOTT, Prod. 1 (1834) 107, non cons.

7 Line 12 from bottom read instead of ‘Hugoniaceae’: Hugoniaceae.

8 Ancistrocladus tectorius has recently been collected in East Borneo (Sg. Wain, pr. Balikpapan, Kostermans 4315, flowers red or dull white, stalks of inflorescence reddish).

9 In 1950 Dr F. H. ENDERT rightly drew my attention to the fact that de Wit has entirely failed to give an adequate evaluation of the astounding botanical work accomplished by forest services generally and the Bogor Forestry Institute in particular. Invaluable papers on forest composition contained in the journal ‘Tectona’ by ENDERT and others have only partially been given attention, while on the other hand trivial and sketchy papers of amateurs were duly recorded. This makes the whole treatment of chapters 80 onwards distinctly unbalanced. I had in mind asking Dr ENDERT to write an entirely new essay devoted solely to the work accomplished by the Forestry Research Institute at Bogor, as a re-writing of the chapters is out of question. Unfortunately Dr ENDERT died early in 1953 and I can find nobody to perform this task.

10 Add in the key:

11a. Outer perianth lobes obovate, fleshy in the upper part. Inner lobes linear to ob lanceolate, almost 1 mm long. Connective with 2 apical divergent, acute crests. Flower-wings broad, half rhomboid to half-cuneate.

12a. B. candida

13a. Outer perianth lobes triangular obtusely apiculate, with thick, fleshy margin, not fleshy in the upper part. Inner lobes orbicular or lanceolate, often minute. Proceed to 14.


15 Insert before 14. Burmannia lutescens:

Slender saprophyte, 6–16 cm high. Stem usually simple, only branched at the top into the inflorescence, 1–5-flowered, beset with small, reduced, scalelike, lanceolate, acute leaves, 2–5 mm long. Larger leaves often acuminate or subulate, sometimes imbricate in the lower stem part. Radial, rostrate, leaves lacking. Bracts similar to the stem scales, about 3 mm long. Flowers white or white with yellow or blue, 6–10 mm long, prominently 3-winged. Outer perianth-lobes about 2 mm long, obovate, obtuse, thick and fleshy in the upper part. Inner lobes erect, linear to oblanceolate, obtuse, almost 1 mm long. Perianth-tube cylindrical, slightly swollen in the upper part, about 4 mm long. Anthers sessile in the perianth-throat below the inner lobes. Connective oblong with two apical, acute, divergent crests, basal hanging spur lacking. Style filiform, bearing at its apex 3 subsessile, obconical to funnel-shaped stigmas. Style with stigmas about 4 mm long. Ovary obconical to ovoid, about 2.5 mm long. Flower wings 5–8 mm long and up to 4.5 mm broad, half-rhomboid to half-cuneate, running from the base of the limb to below the base of the ovary.

Disr. Tenasserim (Amherst, Mergus), W. Siam (Koh Chang), Langkawi Islands (Terutau Isl.), and Malaysia: Central Sumatra (Indragiri, between S. Temberan to Sanglap, Oct. 15, 1939, 400 m alt., Bwulda 7043).

Add to distribution of Burmanhia lutescens: Central West Celebes (E. of Lindu Lake, W. slope of Mt Njilalaki, c. 1000 m alt., July 1939, Bloembergen 4017; Central Celebes, Masamba, base of West spur of Mt Kambuno, 1400–1700 m, July 1937, Eyma 1283).

Add to first paragraph: and Sumatra.

It was said that Gymnosiphon aphyllus Bl. occurred ‘throughout Malaysia’. However, it was at that time (and with it the whole genus) not yet recorded from Sumatra, but it appears to have been found in Central Sumatra (Indragiri, Muara Padjanki, about sea-level, April 1939, Bwulda 6455). The identification is not wholly certain as the specimen is in fruit.

Line 8 from top add: Tembeling, twice collected (Carr s.n., July 1929; Corner 23829, Nov. 1930, type).

In the synonymy of Geomitra clavigera Becc. the reference to Thismina clavigera F.V.M. should read: Pap. & Proc. R. Soc. Tasm. for 1890 (1891) 235.


First line: Date of DC Prod. 8 is 1839, not ‘1939’. In the legend under the figure ‘A rich-flowered individual’ should be replaced by: From an unpublished painting (c. 1820) probably from Royle of Carey, in the Kew Herbarium.

Line 5, add after 322: Lam & van Royen, Blumea 7 (1952) 152.

The distribution of S. paniculatum is extended to include Central Celebes, Moluccas (Ceram), and the whole of New Guinea.

The page of description of Stackhousia intermedia is not ‘174’ but: 281.

Third line, year of Lindl. Nat. Syst. ed. 2 is: 1835.


First line change ‘(1748)’ into: 1784.

Line 12 from top, change the letter S. into Saururopsis.

Line 2 change ‘1837’ into: 1838.

Line 9 from bottom replace ‘287’ by: 278.

In the 1st line of the 7th paragraph it should be: f. inutile.

Last line omit komma at the end.

Line 4 from bottom omit: (gilleveaigui) and add to line 5 ditto behind 106: (gilleveaigui).

Line 4 at end of line, change ‘552’ into: 512.

Line below figure replace ‘l.c.; Miq. l.c. 682’ into: Bijdr. (1825) 243; Miq. Fl. Ind. Bat. 1, 2 (1859) 682;

A second collection of Torreconcila queenslandica has turned up from SE New Guinea: Brown River, Carr 12956, 100 m alt., 27.8.1935; this possesses also sterile shoots which I described and figured (of a 2nd Queensland collection) in Proc. R. Soc. Queensl. 62 (1952) 67, pl. 3. These sterile shoots have 3-fid leaves of which the side-lobes are minute but the central, filiform lobe up to 1½ cm long.

For Alteranthera ficoidea under ‘Uses’, read: A. ficoidea.

Line 19 from top of column replace ‘1828’ by: 1824.

Fifth line of species 2. ‘polysperma’ should be replaced by: polysperma. Further: ‘12’ in last line from bottom should be: 20.


The exact citation of Allmania nodiflora is: 1. Allmania nodiflora (L.) R.Br. in Wall. Cat. (1832) 6890, nomen nudum) ex Wight in Hook. Lond. J. Bot. 1 (1834) 226, t. 128; etc. Insert in synonymy of ‘Allmania nodiflora’: Achyranthes nodiflora Roxb. Fl. Ind. 2 (1824) 495;

Line 4 from top, add at the end: nomen nudum.
Line 7 from top, add before Moq.: Mart. Beitr. Amar. 1825 (Nova Acta Leop. 13, 1826, 287); etc.

Line 9 from top after 'Mar?': replace 'ex' by: Beitr. Amar. 1825 (Nova Acta Leop. 13, 1826, 287); etc.

Add to distribution of Allmania nodiflora: Billiton (Beccari).

Amaranthus gracilis: There is no unanimity of opinion on the correct name of this species; according to Merrill (Amer. J. Bot. 23, 1936, 609–611) it should be called Amaranthus viridis L. Among Linnaeus's citations two refer to it and two not and there is no absolute certainty that the Linnéan specimen was really the basis of his description though it agrees with his description. Personally I would be inclined to follow Merrill's carefully considered opinion which is anyhow much better substantiated than that of Thellungi.

In the reference to Cystalus place: 'non Lour.' between brackets before: Blume.

Line 1, insert behind 'cata': DC. Hort. Monsp. (1813) 103.

Add to distr. of the genus Papilia: and the Northern Territory of Australia.

Last line, omit after 'DC.': 'ex'.

Line 1, lower part of column add after '(1813)': 102.


Add to distribution of Pupalia lappacea: Central East Borneo: W. Kutai, Kombeng, limestone rock in low forest, Nov. 1925, Endert 5402; and Arnemlsland (Specht a. 1950).

Add at the end of the references to Aerva sanguinolenta: Zipp. ex Span. Linnaea 15 (1841) 345, nomen nudum.

Line 11 under A. sanguinolenta replace '509' by: 503.

Line 4–5 from top of synonymy of 1. Nothosaerva brachiatia, substitute for 'Illecebrum brachiatum Linné, Mant. (1767) 23': Achyranthes brachiatia Linné, Mant. 1 (1767) 50.—Illecebrum brachiatum Linné, Mant. 2 (1771) 213.

The correct authority for 1. Centrostachys aquatica is: (R.BR.) Wall. in Roxb. Fl. Ind. 2 (1824) 579, 497.

Line 18 from references, add after Achyranthes argentea: Lamk. Enc. 1 (1785) 545.

Add before 1st line from top: Malay Peninsula (rare on Cameron's Highlands, Henderson in litt. 1950).
encircling only \(\frac{1}{2}-\frac{2}{3}\) of the seed. Strongly smelling when bruised.

1a. Perianth-segments not or indistinctly keeled on the back. Top of ovary and fruit studded with yellow glands. Stigmas 2–5, usually 3 or more. Fruiting perianth concealing the fruit. Fruit usually horizontal, rarely vertical.

1. Ch. ambrosioides

1a. Perianth-segments in their upper half with a very conspicuous broad dorsal keel. Top of ovary and fruit glandless. Style 1, deeply bifid. Fruiting perianth pressed against the fruit but (because of their narrowness) not concealing it. Fruit always vertical. Leaves at most \(2\frac{1}{2}\) cm long, deeply dentate or pinnatisect. 1. Ch. carinatum

1. Young vegetative parts and outside of perianth with an indumentum of white or pink villi. Undersurface of leaves without any yellow glands. Stigmas 2. Embryo encircling almost the entire seed. Not or faintly smelling when bruised. Proceed sub 2 of the key on p. 100.

101b Add before species 2, the following:


Annual, 10–35 cm long. Main-stem creeping at the base, higher up ascending, much branched, with ascending-erect branches, strongly smelling when bruised (same smell as Ch. ambrosioides). All vegetative parts rather densely clothed with short glandular hairs, not powdery; leaves also with many longer ordinary hairs. Leaves rather shortly but distinctly petaled or the highest subsessile, ovate-oblong, obtuse, coarsely obtusely dentate or subpinnatisect, usually thickish and \(\frac{3}{4}\)-\(\frac{2}{3}\) cm long; highest floral leaves often very small. Flowers sessile, in the axils of nearly all leaves, in small, dense, subglobose clusters; clusters forming together a narrow interrupted leafy spike. Tepals 5, erect-incurred, narrowly oblong from a much narrowed base, acute, very concave, \(\pm\) 1\(\frac{1}{2}\) mm long, on the back, from about the middle to near the top, with a longitudinal broad, \(\pm\) triangular keel; keels with truncate tips, forming stellately spreading wings to the perianth, long-hairy. Stamens (not seen) 1. Ovary glandless; style 1. Longish, deeply bifid. Fruiting perianth pressed against the fruit but not concealing it. Fruit erect, broadly oval, compressed, sharply keeled all around. Seed shining dark-brown, \(\pm\) 2\(\frac{1}{2}\) mm diam.; pericarp inseparable; embryo encircling \(\pm\) one half of the seed. 


Ecol. Open places, near villages, tobacco-fields, c. 550 m.

103b Line 2 of column under Spinacia, replace 'expansa Mürr.' by: tetragonoides (PALLAS) O.K.

104a Bottom line, insert between '5' and '111': '1979.'

105 Reference to Suaeda, substitute at the end '18' by: t. 18, nom. cons.


105a Line 3 from bottom of references of Suaeda maritima, insert after 'Moq.:' Ann. Sc. Nat. 23 (1831) 316.

106a Line 4 from bottom of references to Salsola kali, insert after 'Moq.:' Chen. Mon. En. (1840) 147.

106b Distr. add: Sumbawa & Aru Islands.

107 Read here and further for 'Aegialitès': Aegialitis.

112 First paragraph, add behind references of Limonium: nom. cons.

113 Recently quite some material of Umbelliferae has become available which was not examined by the late Dr Buwalda. This will possibly be dealt with in a later supplement in vol. 5.


116b Add to distr. of Hydrocotyle vulgaris in New Guinea: Wissel Lake Region, Wea delta, EyMA 4922.


122 The authority for 10. Trachymene arfakensis is: (GIBBS) BuW.

125b Ditto for 16. Trachymene caerulea: (HOOK.) GRAH.

126 Change in key 2nd line into:

1. Radical leaves triest. 2. E. moluccanum


Its only species mentioned here should be called:

1. Anthriscus cerefolium (L.) Hoffm. with the printed references as synonyms.

127a Replace the wrong provisional description by:

2. Eryngium moluccanum STEEN. n. sp.—Fig. 5a.

Rhizoma conspicua. Caules agglomerati. Folia basalia trisecta, chartacea, longe petiolata, superiort sensim brevius petiolata usque senilia, summa simplicia. Capitula panicata (2-4) flora, pedunculata, pedunculis 3-4 ex eadem axilli oris. Flores 4, nonnulli
Fig. 5a. *Eryngium moluccanum* Steen. a. Habit, × 2/3, b. partial inflorescence, × 5, c. ♀ flower, × 10, d. sterile flower, × 10, e. petal, lateral and ventral, × 13, f. stamen, × 13, g. fruit, × 10, h. fruit in section (vittae hatched, × 20 (after type)).

Plant glabrous, up to 30 cm. Rootstock firm, covered by the brown withered sheath-bases. Stems tufted, erect, little branched, ribbed; lowest internode 10 cm, upper ones gradually shorter. Leaves green, 3-parted, the basal ones incised to $\frac{1}{3}$, cauleine ones to $\frac{1}{3}$, but similar in shape and gradually somewhat smaller, the highest simple, oblong. Petiole terete, not winged, thin, that of the basal leaves up to 10 cm, higher up gradually diminishing in length to about nil; blade hardly subcoriaceous, when flattened suborbicular or even broader than long in outline, base broad-cuneate, sharply set off against the petiole, $\frac{1}{2}$–$\frac{3}{2}$ by $\frac{1}{2}$–$\frac{3}{2}$ cm; segments ovate, acute, edge with thick-margined, coarse, spiny teeth; nerves and main veins prominent, reticulations not so. Heads 3–4, umbellately clustered together at the nodes and apices of the stems, $\frac{1}{2}$–1 cm peduncled. Involucral bracts lanceolate, entire or with a coarse spiny tooth on either side and a spiny tip, $\frac{1}{2}$ by 3 mm, some more coriaceous and larger than the others. Floral bracts in the head mostly absent, in shape and texture resembling the smaller involucral bracts. Flowers white, 1–3 fertile and 6, 1–2 sterile, stipitate by the linear aborted ovary. Fertile flowers: ovary obconical, studded with papillae which increase in size apically, ± 1 mm long. Sepals lanceolate, $\frac{1}{3}$ mm long, persistent, pointed. Petals strongly infolded, sulcate, $\frac{3}{2}$ mm high, the infolded half with a pointed tip and often connected with the erect half by a hymen. Stamens rose; filaments $\frac{1}{4}$ mm; anthers obovate, $\frac{3}{2}$ mm. Styles spreading, recurved in fruit, persistent, 2 mm. Sterile flowers: ovary stalk-like, $\frac{1}{2}$ mm; sepals as in the fertile flowers; petals and sexual organs absent a reduced gynoecium excepted. Mericarps separated by a narrow groove, semi-globular, the upper papillae hardened, subspunose, in section obtusely 5-angled $\frac{1}{3}$ by $\frac{1}{4}$ mm; thickest vittae near the commissure, further one under each rib alternating with faint additional ones.


Note. A species which cannot be placed satisfactorily with Wolff's monograph, possibly belonging to sect. Campestria Wolff. (I am not very much impressed with the natural delimitation of the sections distinguished by him.) The most aberrant feature of the new species is the depauperation of the heads, a phenomenon which, however, is observed in several other microtherm genera represented in the Austral-Antarctic region and in New Guinea (cf. Trachymene, Oreomyrrhis). I found this also in a specimen of Eryngium expansa F. V. M. (C. E. Hubbard 3730) where there are only 6–7 flowers per head.

The depauperation gave some difficulties with the generic identification of the Ceram plant, one of the remarkable finds by my late colleague Dr Eyma, as in its heads the floral bracts—the characteristic of the genus by which it is recognized from others in the subfamily Saniculoideae—are absent or scarcely distinct from the involucral bracts. However, I found that the small involucral bracts correspond with the number of flowers (and therefore probably represent marginal floral bracts). In young heads there was also sometimes a bract between the flowers inside the row of involuclar bracts, which settles that floral bracts are, essentially, present.

The affinity of this species is apparently remote. It is not at all related to the Australian ones, and nothing similar is recorded from the Subantarctic where, for plant geographical reasons, its alliance should be found. This remote status points to high antiquity and historic-plant-geographically it should be classed with Papuzilla and a few other chance survivors of an ancient mountain flora. It may well turn up in the highlands of New Guinea.

127a The authority for Torilis japonica is: (Houtt.) DC.

131b Ditto for Aiptum tenuifolium: (Moench.) Thell.

132 Ditto for Trachyspermum ammi: (L.) Sprague and for T. roxburghianum: (DC.) Craib.

133 Ditto for Cryptotaenia canadensis: (L.) DC.

136 The oldest authority for the genus Foeniculum seems to be: Bohm. in Luidw. Def. Gen. Pl. (1760) 344, no 852.

136a Line 20 from top change Wulf into Wolff.

141 On Tetracera a more elaborate treatment has been published by R. D. Hoogland, The genus Tetracera in the Eastern World (Reinwardtia 2, 1953, 185-225), which formed the basis for the treatment in F. M. W. in the key to the species of Tetracera 'back of the carpels' means the adaxial side, which is, properly, their ventral side.

143a Add to the synonyms of Tetracera scandens: Delima tripetala Nees & Bl. in Syll. Pl. (Rutig.) 1 (1824) 95; Blume ex Spr. Syst. Veg. 2 (1825) 597; G. Don, Gen. Hist. 1 (1831) 71.

(1) It is quite probable that this is an early import of E. foetidum L., which through isolation has acquired racial character and represents a depauperate form of it; this was already hinted at by Bentham. Cf. this volume p. lxi, § 7.
145a Add to the synonyms of *T. norditiana*: *T. floribunda* Diels, Bot. Jahrb. 57 (1922) 440. It possibly belongs to var. *moluccana* but this cannot definitely be settled since the type is lost.

154 A full revision of the genus *Dillenia* was published by R. D. Hoogland in his thesis, a pre-issued reprint from Blumea 7 (1952) 1–145. This formed the basis on which the treatment in F.M. was made and in which the Latin diagnoses of new species are embodied.

164b 19. *D. alatu* has also been found by Specht in Arnhemland, Northern Territory of Australia.

176 Line 3 of references to *Lonicera* replace at the end '10' by: 210, nom. illeg.

177a Line 11 of synonymy of 1. *Lonicera japonica*, omit: 'Zipp., ex'.

180a At end of line 1 of references of *Lonicera javanica* replace '333' by: 334.


186b In line 3 from top the authority of *V. integrifolium* is: WALL. [Cat. 457, nom. nud.] ex DC. Prod. 4 (1830) 324.

189b Add to the references under *V. clemensae*: KERN, Reinw. 2 (1952) 157, fig. 10.

189b Add to the description of *V. clemensae* KERN: *Inflorescence* nearly sessile, up to 8 cm long and 10 cm wide, paniculate; lowest branches 2–5-nate, middle ones opposite, upper ones alternate. *Flowers* small, c. 3 mm wide. *Calyx*-limb distinctly lobed; lobes triangular, c. 1/2 mm long and wide. *Corolla* globular in bud, rotate when open, glabrous; tube very short, 1/4 mm; lobes ovate, slightly cucullate, 1/4 mm. Stamens exerted, much shorter than corolla-lobes; filaments inserted near base of corolla, with inflexed top in the bud-stage; anthers broadly ovate, 1/2 mm long.

191a Last line read: *Ebulus*, not: 'Ebulum'.

191b First line from top read after Tokyo: 42 (1921) 14.

192a Add to distr. of *Sambucus javanica*: New Guinea (Wissel Lakes between Ginnambarai to Djembodini, Febr. 1939, EYMA 4618).

192 First word of 5th line of references under *Carlemannia* read: Jahresber.

200b Omit among the references to *Kalanchöe laciniata*: *Kalanchöe acutiflora* and the citations referred to it.

202a Add to line 15 of the references of *Kalanchöe integra*: (Andr.). Change in line 16 the year '1812' into: 1819. Add in line 17 after '728': ; Span. Linnaea 15 (1841) 207.

202b Add to distr. of *K. integra*: Sumbawa, Timor.

205a The authority of *Bergia ammanniioides* is, correctly: HEYNE ex ROTH, Nov. Sp. Pl. (1821) 219, 402.

207b Line 1 from top should read: *Steris javana* LINNÉ, Mant. 1 (1767) 54.—

214 Add to reference of *Luzula*: nom. cons.


231a The authority of *Phytolacca icosandra* is: LINNÉ, Syst. ed. 10 (1759) 1040.

232b Line 2 from bottom, change 'R.Br.' into: DC.

235a First line of *Piriqueta racemosa* insert after 'SWEET': Hort. Britt. ed. 1 (1827) 154;

236 Reference to *Turnera*, change 'ed. 2' into: ed. 5.

240b Add letter 'i' in fig. 2.

245 Under distr. of *Joinvillea* add in the 2nd line between 'the' and 'New Hebrides': Solomons,

256a First line of *Monochoria vaginalis* after 'PRESL': ex KUNTH, En. 4 (1843) 134; *PRESL* did not formally make the new combination, though he certainly intended to do so and has accordingly always been accredited by common sense with the botanical act and *eo ipso* the nomenclatural transfer.

267 Reference to *Mollugo*, change '463' into: 89.

269a Line 13 from bottom insert after *Gl. dictamnoides*: BURM. f. Fl. Ind. (1768) 113;

283a Line 25 from bottom, omit: 'Blatti aciade', and put the pertaining reference under *S. acida*.

286b Omit under 5. *Sommeratia griffithii* the reference to *Watson*.

295 Change in note under the generic description *Hematanthera* into *Nematanthera*.

299 Change third word of generic references into: *Pl.*

301 Last name of legend to fig. 5, read: *D. puber* Bl.

319a In line 21 from the top replace var. *reticulata* etc. by: *D. hispida* var. *hispida*.

332b Omit in legend of fig. 13 the last letter of the 2nd line.

346a Last line read: *campestre*.

367 First line read: Gen. Pl. ed. 5 (1754) no 59.

368 Change in the key:


9a. Leaves 50–90 by 1–2 cm. Heads with numerous flowers. Anthers with 4 acute tips. Upper part of bracts with a small triangular field of small papillae . . . . . . . . 12. *X. grandis*

9a. Leaves 1/2–8 cm long, up to 3 mm wide. Heads with one or two flowers. Anthers with 2 obtuse tips. Upper part of bracts with a narrow elliptic field of small papillae . . . . . . . . 17. *X. oligantha*

374a Add to ecol. of *Xyris indica*: According to Dr BEUMÉE (in litt. May 11, 1953) the local gregarious occurrence of *X. indica* in West Java is, according to the pre-war experience of the Agricultural Consultation Service,
especially connected with soils which are deficient in phosphate; this might point to development of *Xyris* in those rice-fields where rice is not under optimal conditions.

Add:


Leaves ensiform, 1/2–8 cm long, up to 3 mm wide, stiff, subfalcate, obtuse, glabrous except for the papillate margin; sheath 5–20 mm, membranous along the margin, provided with an up to 2 mm long obtuse ligule. Peduncle 1–12 cm by c. 1 mm, quadrangular, with 4 papillate ribs. *Head* subglobose to ellipsoid, 1–5 by 0.8–3 mm. Basal bracts ovate, 1/2–2 mm by 1–11/2 mm, acute to subacute, margin membranous with 5 complete nerves papillate in a narrow elliptic region in the upper 3/5. Median bracts ovate, 2–4 by 11/2–31/2 mm, acute, sometimes mucronate, with one complete and 4 once forked descending nerves, papillate in a narrow elliptic region in the upper fourth. Lateral *sepal* 21/2–4 by c. 11/2 mm, acute, crest narrow, entire. Median sepal cap-shaped, 11/2–2 by c. 1 mm, 1-nerved, papillate at the top. *Petals* 2–3 mm, limb spatulate, 11/2–21/2 by 1–2 mm, outer margin irregularly serrate, claw c. 11/2 mm. *Stamen* 0.4–1.2 mm, filaments 0.2–0.4 mm, anthers 0.2–0.8 mm, emarginate at the top, broadly emarginate at the base; cells with one obtuse tip, base obtuse. *Staminodes* absent. Ovary obovoid, obtuse, 3-sided, l-celled, 11/2–31/2 by 1–11/2 mm. Styles 11/2–21/2 mm, 3-fid, arms 11/2–1 mm, their tip filiform.


**Notes.** Its 1–2-flowered heads, absence of staminodes, 4-angled peduncle and small size characterize this species. It has been identified sometimes with *X. pacificiflora* Willd. but differs in the entire crest of the lateral sepals, the absence of staminodes, and the two-tipped anthers.

First line of generic description correct: Gen. Pl. ed. 5 (1754) no 351.

Add to distr. map of *Drosera burmanni*: S. Moluccas (Aru Islands: P. Trangan, Bwulada 5490, 5342).


Add to localities of *Drosera petalata* in New Guinea: Lake Habbema, 3225 m, Aug. 1938, Bras 9195; East New Guinea, plateau N of Mt Giluwe, Central Highlands, May 1951, 2200 m, Shaw Mayer.

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383a Read: 1. Octomeles sumatrana Miqel.

384a Add to distr. of *Octomeles sumatrana* Melanesia (e.g. Bougainville, *Waterhouse* 875).

384a Add to Ecol.:

I have omitted to make mention of Melchior's recent article on the scales which occur on the undersurface of the leaves (Ber. Deutsch. Bot. Ges. 62, 1950, 72–77). Melchior says that these scales have either a secretory function or one of water suction. He is in favour of the latter, and compares them with the similar absorptive scales of the Bromeliaceae (sic). Though this function can be admitted for the latter, the ecology of *Octomeles*, one of the fastest growing trees restricted to everwet, riverine forest, preferably on wet alluvial silt, shows that Melchior's opinion is not in accordance with the ecological facts.

Add to references of Tetrameles: *Anictocolea Nimmo in Graham* Cat. Pl. Bombay (1839) 252.

385b Lower part, first line, add after '407': —*Anictocolea grammamiana Nimmo in Graham* Cat. Pl. Bombay (1839) 252.

In addition to the revision of *Ereyibe* in the *Flora Dr Hoogland* has composed a complete enumeration (review) of the genus in *Blumea* 7 (1953) 342–361.

Line 13 from top, replace '1833–1846' by: (1838).

Line 9–10 from bottom, omit after 'Dennst.': the brackets and 'nom. nud. ex'.

Add the following note to *Merremia mammosa*:

**Note.** The nomenclatural basis of *M. mammosa* is not quite satisfactory as no specimen of *Loureiro* has been located and the identity of *Batata mammosa* Rumph. (Herb. Amb. 5: 370, t. 131) to which *Loureiro* referred is under dispute, cf. van Ooststroom, *Blumea* 3 (1939) 346–347.

459 Paragraph 2, replace *I. plebeja* by *I. plebeia*.

481a Line 18 from top add after 'Mantu.': 1.

485b For species 37. *Ipomoea crassicaulis* the correct name is *I. fistulosa* Mart. ex Choisy in DC.

According to C. A. O'Donnell (Bol. Soc. Argent. Bot. 4, 1952, 175–176) Bentham mentions on p. 153 of the *Voy. Sulph.* that he knew the contents of the *Prodromus of* De Candolle; hence his work was almost certainly published posterior to it. This is in agreement with Miss Tucker who stated that p. 134, containing *Batatas crassicaulis* Bth. *Voy. Sulph.* was published in 1845 and not in 1844 (cf. J. Arn. Arb. 11, 1930, 243–244).

497b Line 18 from top replace 'Clarke' by: Benth.

C. G. G. J. van Steenis
INDEX TO SCIENTIFIC PLANT NAMES
compiled by
M. J. van Steenis-Kruseman

Suprageneric epithets have been entered under the family name to which they belong preceded by the indication of their rank (tribes, e.g.).
Supraspecific epithets have been entered under the generic name to which they belong preceded by the indication of their rank (sections, series).
Infrageneric epithets have been entered under the generic name to which they belong preceded by the indication of their rank.
New names and new combinations have been printed in bold type, synonyms in italics.
'Map' printed behind a page number denotes that a map of the concerned taxon is present on that page.
An asterisk behind a page number denotes the presence of a figure of the concerned taxon.
Page numbers in bold type denote main treatment.
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UNDER THE AUSPICES OF
KEBUN RAYA INDONESIA (BOTANIC GARDENS OF
INDONESIA), BOGOR, INDONESIA,
AND THE RIJKSHERBARIUM, LEYDEN, HOLLAND,
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