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# FLORA MALESIANA

SERIES I - SPERMATOPHYTA  
*Flowering Plants*

Vol. 8, part 3  
*Revisions*

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TAXONOMICAL REVISIONS

BY  
LEWIS CLARK HOWLAND, PH.D.  
DIRECTOR OF THE BUREAU OF PLANTS

FLORA MALESIANA

1924

AS REVISED BY THE BUREAU OF PLANTS OF THE WAR DEPARTMENT,  
INCLUDING A KEY FOR IDENTIFICATION, AND A LIST OF THE  
REFERENCES TO THE LITERATURE OF THE SUBJECT, AND A SUMMARY OF  
THE HISTORY AND CURRENT STATUS OF THE FLORA.

PUBLISHED

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FOR THE NATIONAL BUREAU OF BOTANICAL RESEARCH

AND THE BUREAU OF PLANTS OF THE DEPARTMENT OF WAR,  
THE PRINCE OF WALES BOTANICAL GARDEN,  
THE SOUTHWEST PACIFIC ISLANDS.



LEWIS CLARK HOWLAND,  
DIRECTOR OF THE BUREAU OF PLANTS

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LEMBAGA ILMU PENGETAHUAN INDONESIA (L.I.P.I.)  
INDONESIAN INSTITUTE OF SCIENCES

# FLORA MALESIANA

BEING

*AN ILLUSTRATED SYSTEMATIC ACCOUNT OF THE MALESIAN 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*

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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 8

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DR C. G. G. J. VAN STEENIS  
DIRECTOR OF THE FOUNDATION 'FLORA MALESIANA'

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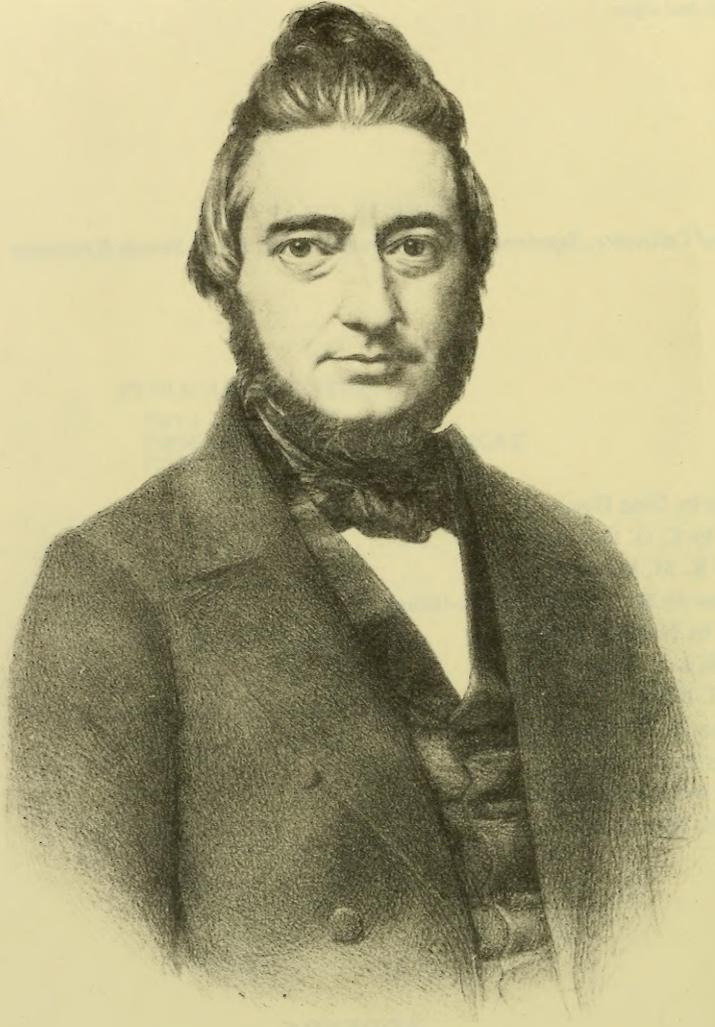
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*Dedicated to the memory of*  
**F. A. W. MIQUEL**

## DEDICATION

The eighth volume of *Flora Malesiana* is dedicated to the memory of the Dutch botanist F. A. W. MIQUEL, who, even though he never visited the tropics, contributed greatly to the development of the knowledge of the Malesian flora. He did so not just through his well-known *Flora Indiae Batavae*, but certainly also through his rôle in re-activating the Rijksherbarium during and following the somewhat difficult aftermath of BLUME's reign, and in rallying the support of Dutch and foreign botanists to study the many collections from the 'East Indies' which reached the Netherlands in the years between 1840 and 1870. MIQUEL also played an inconspicuous, but as it turned out, decisive part in the introduction of *Cinchona* in Java and last, but not least, left an important heritage in the person of his pupil SCHEFFER who became director of 's-Lands Plantentuin (*Hortus bogoriensis*) at Buitenzorg (Bogor), Java, in 1868 and who had a profound effect on the development of the gardens as well as on botanical and agricultural research in the former Netherlands East Indies. The MIQUEL period in Dutch systematic and tropical botany was characterized by an enthusiastic attempt to lay a foundation for a better knowledge of the Suriname and Indonesian floras; attempts which resulted in a preliminary, even though not always sufficiently critical, survey of what was known. A well organized home-basis for systematic studies was set up in the revitalized Rijksherbarium, and through MIQUEL's own herbarium, sold to the University, a similar basis was established at Utrecht for the study of the Suriname flora. MIQUEL had good contacts with collectors in the field as well as with the gardens and herbarium at Buitenzorg (Bogor). At a time when the British colonial floras and the *Flora Brasiliensis* were written, he attempted to create at least a modest basis for similar Dutch activities for the study of the hitherto insufficiently recognized and described dazzling tropical organic diversity.

A brief biography is in order for this dedication as a late salute to a great botanist who could not even dream of the scope of the future *Flora Malesiana*, but who would have been one of its most enthusiastic supporters. For references to other literature and to sources I must refer to my more extensive biography and bibliography of MIQUEL published in 1966 and to the important collection of documents from which MIQUEL's relations with his colleagues in Holland and abroad can best be seen, namely the collection of letters written to MIQUEL, now in the Utrecht University Library. Frequent correspondence was entertained with, for instance, HASSKARL, HORSFIELD, JUNGHUHN, TEYSMANN and KURZ, to mention only a few of MIQUEL's more than 200 correspondents. These letters vividly illustrate the difficult conditions under which collectors and botanists worked, and often account for otherwise puzzling characteristics of the literature on the Malesian flora of the MIQUEL era.

FRIEDRICH ANTON WILHELM MIQUEL was born 24 October 1811 at Neuenhaus (near Bentheim) in the Prussian province of Hannover. Neuenhaus is a village less than five kilometers away from the Dutch-German border near Almelo, a location which had its effect on MIQUEL's future career. The closeness of the Netherlands and the nature of the border dialect made the choice of the University of Groningen as the place for MIQUEL's higher education understandable. A certain reservation with respect to liberal tendencies in German universities, developments which had not yet reached the Netherlands, may also have influenced what must essentially have been MIQUEL's father's decision to send his son to Groningen. The father, a regional physician with a thorough classical background, had laid the foundation for MIQUEL's excellent knowledge of Latin, the language still used at the time in many of the courses given at Dutch universities. By going to Groningen in 1829, MIQUEL turned Dutch: in his later years he spoke Dutch without an accent, considered himself a Dutchman and was fully accepted as such by society and government.

MIQUEL chose medicine as his major study and took his degree in 1833 on a dissertation on the merits of the classical writers with respect to the liver. During his study, however, MIQUEL had followed the courses given by H. C. VAN HALL, professor of botany and rural economy. His relationship with VAN HALL soon became closer than would have been usual between a young medical student and a university professor. As early as 1832 MIQUEL published his first botanical paper in the form of a treatment of various groups of cryptogams for VAN HALL's *Flora Belgii*

The photograph on the opposite page is made from a lithograph by P. BLOMMERS, after a drawing by A. J. EHMLE, 1854. Courtesy Universiteitsmuseum, Utrecht.

*Septentrionalis*. In later years, when MIQUEL had evolved beyond his botanical master in scholarship and social status, relations with VAN HALL became sometimes more strained but even so remained mutually respectful. VAN HALL had one other pupil who, like MIQUEL, became involved in the study of the flora of the East Indies: P. W. KORTHALS (1807–1892), botanist and philosopher, member of the famous *Natuurkundige Commissie voor Nederlandsch Indië*. This Commission, founded 1820, was set up by the Government for the scientific exploration of the Netherlands Indies in the fields of botany, zoology, geology, etc. KORTHALS left Groningen before MIQUEL arrived, but the men met later on various occasions.

In later years MIQUEL was, to put it mildly, not exactly enthusiastic about his Groningen training. However, he would hardly have been more enthusiastic had he studied at any other Dutch University. Academic life in Holland in the early 1830s was on the whole rather sleepy and provincial, still full of the spirit of restauration rather than that of science as a rapidly developing human cultural endeavour per sé, such as MIQUEL learned to recognize and help develop in his later years. The essential urge towards inquisitiveness was usually not particularly evident in University circles. Many scientists of the period were still caught by an antiquated set of eighteenth century ideals, notions of utilitarianism, and an emphasis on idealistic speculation rather than on independent and inductive research with an international outlook.

MIQUEL left Groningen for Amsterdam in 1833, only to return to his Alma mater, to my knowledge, in September 1850 when Groningen University gave him an honorary degree in the natural sciences; a significant tribute mainly due to his old teacher, VAN HALL.

The first years of MIQUEL's professional career were spent in Amsterdam where he accepted a position as resident physician at the St. Pieters Buiten-Gasthuis, a hospital outside the city limits for infectious and mental diseases. The hospital was considered a very unhealthy place to live in, also for physicians (his friends called it a 'moordhol' (cut-throat den)) and MIQUEL left it, albeit reluctantly, after two years, when an opportunity presented itself to combine botany and medicine. It is not unlikely, although difficult to prove, that the assertion by MIQUEL's friend G. J. MULDER, in his Miquel obituary, that MIQUEL contracted the disease which would prematurely fell him in 1871 during his early Amsterdam years, is correct.

The position offered at Rotterdam was a combination of an ordinary private medical practice with the positions of director of the Rotterdam botanical garden and lecturer in botany at the medical school. Within a short time MIQUEL's activity switched towards physiological, morphological and taxonomic botany with work on living plants; studies which made him mature as a botanist. From 1835 onward we witness a rapid development towards that amazing productivity which would characterize MIQUEL until the very end. His attention went first of all to the cycads and cacti of the botanical garden. During these Rotterdam years MIQUEL established contacts with many foreign botanists: LEHMANN at Hamburg, SCHLECHTENDAL at Halle, DECAISNE and MONTAGNE at Paris, the HOOKERS at Kew, and, in the 1840s, also with East Indian botanists such as HASSKARL, TEYSMANN and ZOLLINGER. The contact with LEHMANN was set up in 1836 through the regular channels of seed-exchange; that with SCHLECHTENDAL, in the same year, aimed at finding his way towards the columns of *Linnaea* and the *Botanische Zeitung*. With this early correspondence MIQUEL presented himself as a botanist seeking international recognition and collaboration.

The correspondence with SCHLECHTENDAL, extending through 1866, just before the death of the botanist from Halle, is a highly interesting running commentary on the development of European botany in the mid-nineteenth century, bringing gossip as well as news on major developments, personalities, events, and on the emerging of new ideas. It provides us, for instance, with an insight into MIQUEL's development as a systematist working on tropical floras, into the motivation behind his activities as a national science politician and in general into his attitude as an individual scientist enthralled by organic diversity.

MIQUEL's first contacts with Suriname were established in 1837 when the first consignments of neotropical plants collected by HENRI CHARLES FOCKE came in. Not having a herbarium of any importance himself and not being connected with a center from which duplicates might be distributed, MIQUEL had only his publications to offer but even so managed to bring together a collection of plants mainly from Suriname, the Antilles, and Mexico, as well as collections obtained from the *Esslinger Reiseverein*.

## Dedication

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The Rotterdam years went by rapidly with many-sided activities in which MIQUEL's strengths and weaknesses became evident. His main strength derived from his enthusiastic and open approach to a great variety of botanical problems; his main weakness was that with his astonishing productivity he sometimes tended towards superficiality: there was so much to do and to enjoy in botany. His floristic beginnings had not really lasted long; towards the end of his Rotterdam years MIQUEL was an all-round taxonomist seeking to integrate findings in anatomy, morphology, physiology, lifecycles and descriptive taxonomy.

In 1840 MIQUEL married CATHARINA ELISABETH MADRY, a daughter of a leading Rotterdam banker. This marriage resulted in a socially and economically somewhat more relaxed life, but this reasonable affluence certainly did nothing to diminish MIQUEL's scientific activities. Between 1840 and 1846, for instance, he started on revisions of the large genera *Piper*, *Ficus* and *Casuarina*. His growing scientific standing was also reflected by career opportunities: after losing a competition for a botanical chair at Leiden University (W. H. DE VRIESE carried that prize away), MIQUEL was appointed professor of medical botany at the Amsterdam 'Athenaeum' in 1846. In that same year MIQUEL was elected member of the 'Instituut', the forerunner of the present Royal Netherlands Academy of Sciences.

"Jetzt werde ich all meine Zeit und all meine Kräfte der Botanik widmen können und da meine Gesundheit sich bedeutend gebessert hat, erwartet mich eine schöne Zukunft" (letter to SCHLECHTENDAL, 1 February 1846). This bright future would include the definitive shift towards work on the flora of the Far East. With no medical practice necessary any longer to earn his living, MIQUEL became a full-time plant taxonomist when he moved to Amsterdam. Here he found a richly stocked botanical garden although still no herbarium to speak of. His period of being a 'Privatgelehrter', a self-made scientist, who wrote his best work in the evening hours, was behind him. Professional recognition and a regular scientific position enabled MIQUEL from now on to play an important rôle in the development of botany in the Netherlands. This chance was eagerly taken. During these first years in Amsterdam various minor herbarium collections from the East Indies came to the hands of MIQUEL, in part directly through his association with HASSKARL, JUNGHUHN, and TEYSMANN, partly indirectly through HOHENACKER and his Esslingen society.

However, during his first years in Amsterdam MIQUEL was still heavily involved in other enterprises. ALPHONSE DE CANDOLLE unsuccessfully tried to obtain his collaboration to work up the *Lauraceae* for the *Prodromus*. MARTIUS (who paid a honorarium) had better luck: MIQUEL wrote up the *Piperaceae*, *Urticaceae* (in a wide sense) and several other families for the *Flora Brasiliensis*. MARTIUS became one of his dearest pen-friends: the number of letters exchanged between the two men comes near to that written between SCHLECHTENDAL and MIQUEL. The quality of the work for the *Flora Brasiliensis* is among MIQUEL's best, possibly because its format required a critical, actually almost monographic revision of the groups in question and also because all important collections were made available to him.

The main shift towards the botany of the East Indies came in 1848. In that year FRANZ WILHELM JUNGHUHN (1809–1864), the German surgeon who, during his employment by the government of the Dutch East Indies had become one of the most important scientific travellers in Java and Sumatra, returned to Holland on European leave. He brought a sizeable herbarium which he wanted to have studied by the Dutch taxonomists. It would have been natural to deposit his rich collections at the Rijksherbarium, but this was something JUNGHUHN definitely did not wish. The director, C. L. BLUME, had become more and more difficult in his relations with others and more and more reluctant to unpack the collections received from the East for the benefit of taxonomists not connected with the Rijksherbarium. In principle he was of the opinion that all collections made by government employees anywhere in the world, whether officially or even unofficially in their spare time (as was more or less the case with JUNGHUHN), should come to the Rijksherbarium. This principle was certainly sound as long as it was applied in such a way that qualified botanists, at home and abroad, would have free access to the collections. In his later years, however, BLUME tended to 'reserve' the newly arrived materials for himself. BLUME was probably by far the best taxonomist in the Netherlands of his time. He was publishing his sumptuous *Rumphia* and his *Flora Javae*, nicely executed folio works with good coloured illustrations. These works were among the best of their type at the time, certainly in scientific respect. BLUME had published

a great many new taxa between 1825 and 1827, while still at Buitenzorg, in the more sketchy *Bijdragen*. The diagnoses in the *Bijdragen*, unlike those in his later works, were often too concise for ready recognition. Other taxonomists seem to have had difficulties in obtaining BLUME's original material on loan for comparison or revision. BLUME's attitude did little to gain him friends and in the years 1848–1850 we find BLUME standing alone and fighting a losing battle against those he considered to be his enemies.

MIQUEL became involved when he was given the opportunity to study parts of JUNGHUHN's herbarium. On 30 June 1849 JUNGHUHN wrote to MIQUEL [translated]:

"In the meantime I have already from the beginning thought of you with respect to my Javanese and Sumatran herbarium and I have entertained the wish that you would take part in working it up." DE VRIESE and MOLKENBOER, in Leiden, had already sorted and arranged it provisionally, and MIQUEL was invited to come to Leiden and to discuss the work. "The conditions under which I have presented this herbarium, which was assembled by me in former years during my service as a medical officer, to the Government, were: that as long as Mr C. L. BLUME is director, the herbarium is not to be buried in the so-called Rijksherbarium, but that it may be available for research by Dutch botanists and myself. If these conditions are not accepted, the herbarium remains my property." The government accepted the conditions, thereby publicly repudiating its own servant BLUME in the official Rijksherbarium. The herbarium was placed under the care of W. H. DE VRIESE in his capacity of professor of botany and director of the botanic garden at Leiden. MIQUEL writes to SCHLECHTENDAL (28 October 1849): "Die Regierung hat darin zugestimmt und also ein aveu gegeben das dem Reichsherbar nicht zur Ehre dient. Und mit Recht."

The next step taken to obtain access to the collections from the East Indies was by MIQUEL and DE VRIESE separately. Both addressed themselves formally to the minister of the interior, THORBECKE, with complaints and a request for a new instruction for the director of the Rijksherbarium. It is not necessary to spell out the details. One phrase from the DE VRIESE's letter may suffice to show the unnecessarily acrimonious character of the quarrel [translated]: "[The Rijksherbarium] was never anything else but the focus of the morbid ambition of a single man . . ." MIQUEL's argument had mainly been that he had received complaints from foreign botanists. It is true that in the letters addressed to him, we find indeed several very critical remarks about BLUME. The Leipzig botanist GUSTAV KUNZE, for instance, wrote to MIQUEL on 18 January 1849 "Ich habe bei mehreren Gelegenheiten darauf hingedeutet . . . dass über seine früher beschriebenen Pflanzen kein Aufschluss zu erhalten ist." After first having tried to convince BLUME in private, by letter, to change his policy, THORBECKE came to the conclusion that the only solution would be to issue publicly a new instruction. The ukase came off on 11 November 1850 and was published in the *Staatscourant*. Reprints were sent to various botanical journals. MIQUEL comments to SCHLECHTENDAL: "Jetzt hat endlich die Regierung einen wichtigen Schritt gethan und eine sehr liberale Instruktion für ihn *i.e.* Blume ausgefertigt, die Sie wahrscheinlich schon kennen werden da der Minister Massregeln getroffen hat dass auch *apud exteros* diese eigentlich strafende Instruktion bekannt werde."

The instruction made a great difference and, strictly speaking, went even a little too far into the other direction. All material of any group, but not more than that of one family at the same time, had to be given on loan on request to botanists of acknowledged standing. The director was allowed to retain "a few families" for his own studies in his spare time [*sic!*]; he was no longer allowed to make use in his publications of manuscript annotations by others. Duplicates had to be distributed on a liberal scale.

Although the instruction was carried out by BLUME in a very incomplete way, as would become clear in 1861 when MIQUEL became director, the immediate result was that some of the undetermined collections became available for study by others.

Through his access to JUNGHUHN's herbarium MIQUEL's interest in the flora of the Dutch East Indies had become distinctly pronounced. He undertook to elaborate this large herbarium with its many novelties in collaboration with various specialists, which resulted in the *Plantae Jung-huhnianae* of which five instalments appeared.

During this work a plan matured to undertake an enumeration of everything known on the flora of the Dutch East Indies by which *Plantae Jung-huhnianae* would be superseded and hence

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discontinued. This new work would then be based on the published literature, new information from the collections of the Rijksherbarium, the HORSFIELD collections, those of ZOLLINGER, the remaining material of JUNGHUHN, REINWARDT's private herbarium, and specimens received from TEYSMANN, as well as all other collections MIQUEL could lay hands on.

In the course of 1854 MIQUEL sought the help of the government for his plan to write a *Flora Indiae Batavae*. JUNGHUHN enthusiastically supported the project with the government and towards the end of the year MIQUEL had received sufficient safeguards to make a beginning. Publication took place rapidly. The first part appeared on 2 August 1855. The presentation was modest and with a minimum of illustrations, the latter as always by his friend VER HUELL. The circa 3700 pages and 41 plates appeared in slightly over four years: the last part was published on 29 December 1859 when MIQUEL was already at Utrecht. In sheer size the *Flora* is matched among MIQUEL's publications only by his later *Annales*. The book constitutes the first comprehensive flora of the Malesian area and was evidently inspired by the *Flora Brasiliensis*, though published in the style of DE CANDOLLE's *Prodromus*. The descriptions are in Latin, the notes (mainly on use, pharmaceutical properties, and distribution) in Dutch; there are no keys. A virtue of the work is its sound delimitation in that not only descriptions of plants were incorporated from the Dutch East Indies proper, but also those from the Philippines and Malaya, and even common ones from British India which MIQUEL, being aware of its inadequate exploration, assumed might also occur in the Dutch East Indies.

In his introduction to the first volume MIQUEL stated some of his basic principles (pp. viii, ix). "I do not aim at the applause of those who seek the good of science in the multiplication of species and genera . . . Not he who adds most new names to the lists of plants, but he who tries to clear them from all those products of thoughtlessness and self-love, promotes true science. The principles of a correct evaluation of the differentiating characteristics of species must be found in the realm of organography, anatomy, and physiology, in order that the plant does not present itself to the mind of the taxonomist as an unchanging being such as the dried herbarium specimen. He must trace the laws of plant distribution in order to learn to distinguish the effect of all outside influences which modify the shape of the species in combination with the gradual changes in the development of the organs. Only in this way can he obtain a correct delimitation of the species." It cannot be denied that, though stated in the language of his time, the principles were advanced. They were rather similar, though more concise, to the principles laid down by J. D. HOOKER in his famous *Introductory Essay* in his *Flora Indica* (1855). Herbarium specimens alone are not to be trusted, characteristics derived from other branches of botany have to be taken into account. Undue splitting is harmful and to nobody's advantage. The variability of species is to be taken seriously.

It is still not quite clear to what extent MIQUEL really benefited from the new instructions to the Director of the Rijksherbarium when writing his *Flora Indiae Batavae*. If at all, the direct benefit of his efforts to make the riches of the state herbarium available to an outsider such as he was, must have been small. After his appointment as director of the Rijksherbarium (1871) MIQUEL discovered sizeable unconsulted collections of material from the East Indies awaiting to be worked upon by systematists. Actually MIQUEL worked mainly with the material made available to him by HORSFIELD, JUNGHUHN and ZOLLINGER as well as with the considerable collections received by him directly from TEYSMANN at Bogor which included also HASSKARL material.

MIQUEL described the situation to SCHLICHTENDAL in his letter of 16 February 1856. He stated that he had a good set of ZOLLINGER's material in his private herbarium and that the remaining numbers had been sent on loan to him by the Comte DE FRANQUEVILLE in Paris who bought ZOLLINGER's herbarium. HORSFIELD has sent him his "entire herbarium" (actually one set which had been made as complete as possible) to be used for the work on his *Flora*. The herbaria in Holland "sind alle für mich geöffnet und trotz H. Blume habe ich den freien Gebrauch des Reichs Herb. Mein Material ist also wohl sehr gross und ich arbeite mutig daran und hoffe es so weit zu bringen, dass ich wenigstens das zerstreute . . . Material zu einem ganzen zusammenbringe." Even so the availability of the Rijksherbarium material must not be overestimated. After all MIQUEL could not go there and select the material himself, neither BLUME type-material nor new not yet unpacked collections. The rules entitled him to receive family by family on loan; we cannot now know to what extent the material received was in any way complete.

The situation was in all probability not as rosy as MIQUEL depicted it and this was a considerable disadvantage. MIQUEL was eager, too eager perhaps, to lay his hands on any scrap of unidentified material and was often not critical enough to reject incomplete specimens. This is especially evident in his later supplement to the *Flora*, mentioned below, but this weakness was not absent either from his work on the *Flora* proper. Furthermore there was — clearly illustrated by his statement in letters to others — this tremendous urge to do a fast job. The result was a compilation of use to the contemporary botanist, but of lesser value to the botanist of the future (VAN STEENIS, in litt.). The Kew Floras followed a more enlightened path: critical revision and consultation of authentic material was pre-eminent in the work on the *Flora Indica*, later resumed as the *Flora of British India*, the *Flora Hongkongensis*, and later colonial floras.

Not a critical, really creative flora, therefore, but more modestly a summing up of what was known in the absence of any other up-to-date comprehensive review of the immense diversity of the Malesian flora. A diversity of which MIQUEL could have no adequate picture simply because of the too small number of collections available to him (however plentiful they may have seemed), but certainly also because he himself had never visited the tropics. He must have become aware of these circumstances when he received new material from TEYSMANN collected in Sumatra supplemented by material from other collectors such as DIEPENHORST, ZOLLINGER and SULPIZ KURZ (J. AMMAN) which led him to write one of his lesser successes in phytography, the *Prodromus Florae Sumatranæ* (1860–1861), published as a first supplement (not followed by any further instalments) to the *Flora Indiae Batavae*. In his introduction MIQUEL admits that contrary to (his own) expectations that the vegetation of Sumatra differed little from that of Java, it appeared that when the hitherto unknown inner parts of the island were explored the botanical diversity of Sumatra (and Borneo) proved to be unsuspectedly high. The book itself repeats the information given on collections from Sumatra in the *Flora* followed by a rather uncritical description of new taxa often based on insufficient material. MIQUEL would do much better later in his smaller revisions published in the *Annales*.

This astonishment is also evident from the letter to SCHLECHTENDAL of 7 March 1858 reporting on the progress of the *Flora*. It is perhaps good to quote MIQUEL himself in his assessment of the undertaking when the end was in sight. From this letter it becomes clear that the immense diversity started to baffle him as collection after collection was sent to him to be taken into account. He had obviously underestimated the colossal wealth of the tropical floras. However, he made a valiant attempt to master single-handedly a task which even at that time was already too heavy for him: "Mit meiner Flora schreite ich regelmässig vorwärts. Meine Hauptidee ist dabei, das Bekannte gehörig geordnet mit möglicher Kritik nach den Original-Exemplaren zusammenzustellen und dabei soviel möglich das existierende unbearbeitete Material zu verarbeiten. Ich begreife recht gut, dass das ganze nur ein sehr unvollständiges Bild dieser reichen Flora geben wird aber ich glaube doch dass zur weiteren Ausbildung dieser Flora, zumal in den Händen der ziemlich zahlreichen Botaniker die sich jetzt in unseren indischen Kolonien befinden, eine solche Grundlage Nutzen stiften wird. Von vielen Gruppen wussten wir bisjetzt nichts und ich habe wenigstens so viel Material dass ich ein allgemeines Bild davon entwerfen kann. Mein Material wächst aber täglich gewaltig heran, die eine Kiste folgt der anderen und ich erstaune täglich mehr über diesen unerschöpflichen Reichthum!"

We cannot further follow MIQUEL's very varied career as a scientist as well as a science-politician in any detail and must restrict ourselves mainly to his further activities in palaeotropical botany. We can also not touch on MIQUEL's rôle in the introduction of *Cinchona* into the Dutch East Indies nor on his work as a palaeobotanist and as a popular writer. All these facets of his versatile genius became apparent during the busy years in Amsterdam which lasted until 1859. In that year the chair of botany at the University of Utrecht became vacant and MIQUEL eagerly accepted appointment. His health was frail as ever and he enjoyed the possibility to move to a town almost free of malaria. Also, MIQUEL wanted to work in a 'real' University. The Amsterdam 'Athenaeum' was a college which did not lead to a doctor's degree; for this the students had to go to one of the universities. From his inaugural address delivered in the year of the *Origin of species*, it becomes clear that MIQUEL moved toward a biological species concept and towards rejection of the ancient dogma of the fixity of species in exchange for what he called the change of a species into a number of different series which reproduce independently. In later years

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MIQUEL did not return to this issue in print and we know but little of his ideas as presented in his teaching.

Utrecht provided MIQUEL with the opportunity to have graduate students. Actually, though he had quite a few pupils, most of them moved towards morphology, anatomy and physiology. Only two systematists took their degree with him. It was a source of constant regret to MIQUEL that he could not attract more pupils. The first of the systematists, P. DE BOER, wrote a thesis on the conifers of the Malayan Archipelago, but he did not continue in taxonomy. The second, R. H. C. C. SCHEFFER, took his degree in 1867 on a thesis on Malesian *Myrsinaceae*; he soon went to Java, where, upon MIQUEL's recommendation, he became the third director of 's-Lands Plantentuin, the Botanic Garden at Buitenzorg (Bogor) in 1868, a post left vacant since BLUME had left in 1826; in the long interval the garden having been under the care of the famous curators TEYSMANN and BINNENDIJK. SCHEFFER turned out to be an excellent director who laid the foundation for the expansion of botanical and agricultural research in the archipelago and as such can be said to have carried on the torch lit by MIQUEL.

The main event of the Utrecht years (1859–1871) was MIQUEL's appointment as director of the Rijksherbarium in Leiden, a function to be combined with his professorship in Utrecht.

Both BLUME and DE VRIESE died in the beginning of 1862, and thus both the directorate of the Rijksherbarium and the professorship of botany at Leiden became vacant. The formidable statesman THORBECKE, who had so effectively supported MIQUEL in 1850 in 'opening' the Rijksherbarium, was still in power. He first turned to MIQUEL to fill the vacancies because the latter now ranked indisputably first among his fellow-botanists in the Netherlands. It is interesting and revealing to let MIQUEL tell himself — again in a letter to SCHLECHTENDAL — the story of his dual appointment, and the reasons for his refusal to live at Leiden (18 May 1862):

“Die Regierung war mit der Sache sehr verlegen. Das Reichsherbarium hatte der Regierung wenig Freude gemacht, viel Geld gekostet; so lange Blume lebte konnte und wollte man nicht eingreifen. De Vriese's Tod erhöhte die Schwierigkeit, denn man fand Bedenken den jungen Dr. Suringar, der nur für de Vr[iese's] Abwesenheit als Prof. extraord. angestellt war, zu dessen Nachfolger in der bot. Professur zu proclamieren. Es wurden nun beide Stellen mir vereinigt angeboten und der Minister wollte mich durchaus nicht loslassen; er wies mich auf meine Verpflichtung gegenüber die Wissenschaft u.s.w. Da ich aber mich hier in Utrecht ganz wohl fühle und in dieser freundlichen und gesunden Stadt mit meiner Familie viele Elemente des Lebensglücks finde, hier mit meinen Collegen in dem angenehmsten Verhältniss stehe, hatte ich wenig Lust nach dem fieberreichen Leiden, dass ausserdem eine sehr stille Stadt ist, mich zu begeben. Das Endresultat ist nun, dass man an Suringar den Lehrstuhl der Botanik übertragen hat und dass ich zum Director des Reichs Herbarium ernannt bin, zugleich aber hier an der Universität bleibe. Die Eisenbahnverbindung macht diesen Zustand möglich, wobei gewiss meine Thätigkeit sehr in Anspruch genommen werden wird. Ich hoffe nun das Reichsherbarium so viel möglich dem In- und Auslande offen zu stellen damit die Massen von unbearbeitetem Material der Wissenschaft zum Nutzen werden können.”

The change-over did not take place without difficulties. MIQUEL had to dismiss the curator H. VAN HALL, the son of his old teacher H. C. VAN HALL, thus reducing the staff of the Rijksherbarium (in addition to himself) from three to two. Angry protests followed from certain Leiden quarters which found expression in the debates in the house of representatives ('Tweede Kamer') on 25 November 1862. The member for Leiden was not at all pleased and greatly objected to the new policy. The debate in the House revealed some interesting aspects of the state in which the Rijksherbarium had been found after BLUME's death. THORBECKE faithfully stood by his choice of MIQUEL. Not published was the fact revealed by the archives of the Leiden Rijksherbarium that THORBECKE had wanted MIQUEL to dismiss two of the three employees of the Rijksherbarium. The dismissal of only one was a typical MIQUEL compromise.

MIQUEL attacked the new challenge with energy and, again, in haste. Thanks to the better facilities, his published work was now mostly of a higher quality than for instance his rushed job on the Flora of Sumatra. It became clear that those rooms of the Rijksherbarium which had not been open to other botanists contained a wealth of unworked collections. MIQUEL obtained the collaboration of many colleagues in Europe and the United States to identify and describe the material from Eastern Asia. For the publication of the results of these studies on Malesian and

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Japanese plants MIQUEL started a sumptuous folio-journal, the *Annales Musei Botanici Lugduno-Batavi*. The format was chosen, just as was that of the later *Annals* of the R.B.G. Calcutta, to accommodate an ample choice of good illustrations. MIQUEL himself was the author of many of the papers, but we encounter many other names as well: METTENIUS, MEISNER, SCHOTT, HASSKARL, C. KOCH, R. CASPARY, S. KURZ, OUDEMANS and MIQUEL's pupils DE BOER and SCHEFFER.

MIQUEL, characteristically, was eager to work up the collections for again another area: Japan. A long series of papers in the *Annales* on the Japanese material was also separately published as the *Prolusio Florae Japonicae*.

The scientific papers followed each other in quick succession, the subjects dealt with varied greatly, and the style became more concise. There was so much to do and so little time left. How MIQUEL succeeded in combining the Leiden and Utrecht posts with this feverish scientific activity is a mystery. Even when one takes into account that the official duties were less heavy than they are to-day, it remains difficult to imagine how MIQUEL succeeded in constantly keeping up his scientific production. It is known that MIQUEL seldom prepared his courses, and that he worked until only a few minutes before the appointed hour, to resume his writing again immediately after. There was, however, also a busy correspondence with colleagues abroad and with the East Indies; there were the affairs of the Academy of Sciences, and, not least, the frequent visitors.

MIQUEL's official reports on the activities of the Rijksherbarium bring other proof with respect to his energy and organisational skill. On 20 January 1871 MIQUEL wrote his annual report for 1870. He died three days later, on 23 January, 59 years old. The last words of this report, probably the last text he wrote at all, contained a summing up of the tasks of the Rijksherbarium which (freely translated) "will be mainly dedicated to the study of the plant world of the Indonesian archipelago. If one takes into consideration the wealth of that flora and its very special character, our Herbarium will always be regarded as an important institution . . ."

After MIQUEL's death it would take some time until the importance of the institution was again fully realized. There was no real successor to MIQUEL nor was there a school of systematists. Forty years had to go by before tropical botany was revived again in the Netherlands, thanks to the foresight of F. A. F. C. WENT and through the activities of his pupil A. A. PULLE, both Utrecht scientists and successors to the heritage of MIQUEL.

F. A. STAFLEU

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Archives Rijksherbarium, Leiden.

Miquel correspondence, collection of letters received by Miquel from botanists at home and abroad. University Library, Utrecht (*c.* 1000 letters from *c.* 200 botanists).

Schlechtendal correspondence, letters written by Miquel to Schlechtendal. Institut für systematische Botanik und Pflanzengeographie der Martin-Luther Universität, Halle-Wittemberg, D.D.R.

### BIBLIOGRAPHY OF MIQUEL'S WORKS ON MALESIAN BOTANY

Extracted from STAFLEU's biography.

No mention is made of MIQUEL's reviews of papers dealing with Malesian botany.

Though naturally Malesian species were included in MIQUEL's monographic works on *Cycadaceae*, *Casuarina*, *Ficus*, and *Piperaceae*, these works are not cited.

## Dedication

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The *Annales Musei Botanici Lugduno-Batavi* (1863–1869) contain several dozens of important additions and new revisions of Malesian plants. These have not been cited separately, as has been done in STAFLEU's bibliography.

The same procedure has been followed with *Plantae Junghuhnianae* (1851–1857).

Several papers and books were published in instalments; the exact publication dates are cited in detail in STAFLEU's bibliography.

1839

Commentarii phytographici, quibus varia rei herbariae capita illustrantur. Fasciculus I (S. & J. Luchtmans, Leiden: pp. i–iv + 1–29, tt. i–iii).

Mélanges botaniques (Bull. Sci. Phys. Nat. Néerl.: 37–48).

1840

Commentarii phytographici, quibus varia rei herbariae capita illustrantur. Fasciculus II–III (S. & J. Luchtmans, Leiden: pp. i–iv + 31–146, tt. iv–xiv).

1845

*Pterisanthus cissoides* Bl. illustratio (Linnaea 18: 385–397).

1848

*Aeschynanthi speciem novam proponit* . . . (Bot. Zeitung 6: 509–510).

Piperaceae Reinwardtianae (Linnaea 21: 480–486).

1850[–1852]

Analecta botanica indica seu commentationes de variis stirpibus asiae australioris. Pars I (Verh. Erste Klasse Kon. Ned. Inst. Wet. ser. 3, 3, 1850, 1–30, tt. i–x); Pars altera (*ibid.* 4, 1851, 13–56, tt. i–vii); Pars III vel posthuma (*ibid.* 5, 1852, 1–30, tt. i–iii).

1851[–1857]

(Ed.) *Plantae Junghuhnianae*. Enumeratio plantarum, quas in insulis Java et Sumatra, detexit Fr. Junghuhn (A. W. Sythoff, Leiden: 5 fasc., 1851–1857, 572 pp.).

1853

*Cycadis Rumphii stirps femina* (Linnaea 25: 589–592, t. ii).

1854

Excerpta observationum de *Rafflesia Rochussenii femina* editarum, cum annotatione epieritica (Linnaea 26: 224–234).

De ramificatione monstrosa in arbore Sumatrana observata (Linnaea 26: 285–291, t. iii).

Monochlamydeen. In: H. Zollinger, Systematisches Verzeichnis der im indischen Archipel in den Jahren 1842–1848 gesammelten sowie der aus Japan empfangenen Pflanzen. Heft 2: 80–119.

1855[–1859]

Flora van Nederlandsch Indië (alternative title *Flora Indiae Batavae*) (G. C. van der Post, Amsterdam: 3 volumes, 1855–1859).

Voorlopig berigt over eene nieuwe *Wolffia* (Ned. Kruidk. Arch. 3: 425–429; Nat. Tijd. N. I. 10: 399–402. 1856).

1856

*Araliacearum indicarum genera et species aliquod novae* (Bonplandia 4: 137–139).

*Aroideae novae javanicae* (Bot. Zeitung 14: 561–565).

1857

*Rhodoleiae* (Champ.) generis hactenus dubii characterem, adjectâ specie sumatranâ (Versl. Med. Kon. Akad. Wet. afd. Natuurk. 6: 122–128).

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Nova genera Apocynearum indicarum (Versl. Med. Kon. Akad. Wet. afd. Natuurk. 6: 191–194).

Araliaceae (and various other families). In: W. H. de Vriese, *Plantae Indiae Batavae Orientalis fasc. 2* (E. J. Brill, Leiden: pp. 81–160).

1860[–1861]

Flora van Nederlandsch Indië. Eerste Bijvoegsel. Sumatra, zijne plantenwereld en hare voortbrengselen. Met platen (alternative title *Flora Indiae Batavae. Supplementum primum. Prodromus florum Sumatranæ. Accedunt Tabulae IV*) (C. G. van der Post, Utrecht: pp. xxiv + 656, tt. 4. 1860–1861).

1861

Revue des Palmiers de l'île de Sumatra (*J. Bot. Néerl.* 1: 1–29).

1862

Remarques sur quelques espèces de *Nepenthes* (*J. Bot. Néerl.* 1: 272–280, tt. i–ii).

Remarques sur le genre *Nania* (*J. Bot. Néerl.* 1: 292–297, t. iii).

Ueber Kaju Garu, ein wohlriechendes Holz in Indien, von Teysmann und Binnendijk, Vorstehern des botanischen Gartens in Buitenzorg in Java, mitgetheilt von Prof. Miquel (*Bot. Zeitung* 20: 265–266).

Sumatra, seine Pflanzenwelt und deren Erzeugnisse (German edition of *Flora Indiae Batavae, Suppl. I*) (C. G. van der Post, Amsterdam: pp. xxiv + 656, tt. iv).

1863[–1869]

(Ed.) *Annales Musei Botanici Lugduno-Batavi* (C. G. van der Post, Amsterdam: 4 volumes, 1863–1869).

1864

Choix de plantes rares ou nouvelles cultivées et dessinées dans le jardin botanique de Buitenzorg (C. W. Mieling, 's-Gravenhage: 26 col. lithogr. plates + 30 pp. text).

*Calpicarpum albiflorum* Teysm. et Binnend. (*Jaarb. Kon. Ned. Maatsch. Tuinbouw*: 29–32, t. i).

1868

*De Palmis archipelagi indici observationes novae* (*Verh. Kon. Akad. Wet.* 11: 1–33, t. 1).

1870[–1871]

*Illustrations de la flore de l'Archipel Indien* (C. G. van der Post, Amsterdam: pp. x + 114, tt. xxxvii. 1870–1871).

## ABBREVIATIONS AND SIGNS

acc. = according  
 Ak. Bis. = Aklan Bisaya (Philip. language)  
 Alf. Cel. = Alfuresse Celebes (language)  
 alt. = altitude  
 Anat. = Anatomy  
 Ap. = Apayao (Philip. language)  
 app. = appendix, appendices  
 appr. = approximate  
 Apr. = April  
 Arch. = Archipelago  
 atl. = atlas  
*auct. div.* = *auctores diversi*; various authors  
*auct(t). mal.* = *auctores malayenses*; authors dealing with Malesian flora  
*auct(t). plur.* = *auctores plures*; several authors  
 Aug. = August  
 Bag. = Bagobo (Philip. language)  
 basionym = original name of the type specimen; its epithet remains permanently attached to the taxon which is typified by it provided it is of the same rank  
 Bg. = Buginese (language)  
 Bik. = Bikol (Philip. language)  
 Bil. = Bilá-an (Philip. language)  
 Bill. = Billiton  
 Bis. = Bisaya (Philip. language)  
 Bon. = Bontók (Philip. language)  
 Born. = Borneo  
 Bt = Bukit; mountain  
 Bug. = Buginese (language)  
 Buk. = Bukidnon (Philip. language)  
*c.* = *circiter*; about  
 C. Bis. = Cebu Bisaya (Philip. language)  
*cf.* = *confer*; compare  
 Chab. = Chabecáno (Philip. language)  
 citations = see references  
 cm = centimetre  
*c.n.* = see *comb. nov.*  
*comb. nov.* = *combinatio nova*; new combination  
 CS = cross-section or transversal section of an organ  
*c.s.* = *cum suis*; with collaborators  
*cum fig.* = including the figure  
*cur.* = *curante*; edited by  
 D (after a vernacular name) = Dutch  
 Daj. = Dyak (language)  
 d.b.h. = diameter at breast height  
 D.E.I. = Dutch East Indies  
*descr.* added behind a reference = means that this contains a valid description  
 diam. = diameter  
 Distr. (as an item) = Distribution  
 Distr. (with a geographical name) = District  
*ditto* = the same, see *do*  
 Div. = Division, or Divide  
*div.* = *diversus* (masc.); various  
*do* = *ditto* (Ital.); the same  
 Dum. = Dumágat (Philip. language)  
 dupl. = duplicate  
 E = east (after degrees: eastern longitude)  
 E (after a vernacular name) = English  
 Ecol. = Ecology  
 ed. = edited; edition; editor  
 e.g. = *exempli gratia*; for examples  
*elab.* = *elaboravit*; revised  
*em(end).* = *emendavit*; emended  
 em(erg). ed. = emergency edition  
 Engl. = English  
*etc., &c.* = *et cetera*; and (the) other things

*ex auctt.* = *ex auctores*; according to authors  
*excl.* = *exclusus* (masc.); excluding, exclusive of  
*ex descr.* = known to the author only from the description  
*f.* (before a plant name) = *forma*; form  
*f.* (after a personal name) = *filius*; the son  
 f. (in citations) = figure  
 fam. = family  
 Feb(r). = February  
*fige* = according to  
 fig. = figure  
*fl.* = *flore, floret (floruit)*; (with) flower, flowering  
 For. Serv. = Forest Service  
*fr.* = *fructu, frutescit*; (with) fruit, fruiting  
 Fr. (after a vernacular name) = French  
 G. = Gunung (Malay); mountain  
 Gad. = Gaddang (Philip. language)  
*gen.* = *genus*; genus  
*genus delendum* = genus to be rejected  
 Germ. = German  
*geront.* = Old World  
*haud* = not, not at all  
 holotype = the specimen on which the original description was actually based or so designated by the original author  
 homonym = a name which duplicates the name of an earlier described taxon (of the same rank) but which is based on a different type species or type specimen; all later homonyms are nomenclaturally illegitimate, unless conserved  
 I. = Island  
*ib(id).* = *ibidem*; the same, in the same place  
 Ibn. = Ibanág (Philip. language)  
*ic.* = *icon, icones*; plate, plates  
*ic. inedit.* = *icon ineditum, icones inedita*; inedited plate(s)  
*id.* = *idem*; the same  
*i.e.* = *id est*; that is  
 If. = Ifugáo (Philip. language)  
 Ig. = Igorot (Philip. language)  
 Ilg. = Ilongót (Philip. language)  
 Ilk. = Ilóko (Philip. language)  
*in adnot.* = *in adnotatione*; in note, in annotation  
*incl.* = *inclusus* (masc.); including, inclusively  
 indet. = indetermined  
 Indr. = Indragiri (in Central Sumatra)  
*inedit.* = *ineditus* (masc.); inedited  
*in herb.* = *in herbario*; in the herbarium  
*in litt.* = *in litteris*; communicated by letter  
*in sched.* = *in schedula*; on a herbarium sheet  
*in sicc.* = *in sicco*; in a dried state  
*in syn.* = *in synonymis*; in synonymy  
 Is. = Islands  
 Is. (after a vernacular name) = Isinái (Philip. language)  
 Ism. = Isámal (Philip. language)  
 isotype = a duplicate of the holotype; in arboreous plants isotypes have often been collected from a single tree, shrub, or liana from which the holotype was also derived  
 Iv. = Ivatán (Philip. language)  
 J(av). = Javanese (language)  
 Jan. = January  
 Jr = Junior  
 Klg. = Kalinga (Philip. language)  
 Kul. = Kuláman (Philip. language)  
 Kuy. = Kuyónon (Philip. language)  
 Lamp. = Lampong Districts (in S. Sumatra)  
 Lan. = Lánao (Philip. language)

- lang. = language  
*l.c.* = *loco citato*; compare reference  
 lectotype = the specimen selected *a posteriori* from the authentic elements on which the taxon was based when no holotype was designated or when the holotype is lost  
 livr. = livraison, part  
*ll.cc.* = *l.c.* (plur.)  
 LS = longitudinal or lengthwise section of an organ  
 m = metre  
 M = Malay (language)  
 Mag. = Magindanao (Philip. language)  
 Mak. = Makassar, Macassar (in SW. Celebes)  
 Mal. = Malay(an)  
 Mal. Pen. = Malay Peninsula  
 Mand. = Mandaya (Philip. language)  
 Mang. = Mangyan (Philip. language)  
 Mar. = March  
 Mbo = Manobo (Philip. language)  
 Md. = Madurese (language)  
 Minangk. = Minangkabau (a Sumatran language)  
*min. part.* = *pro minore parte*; for the smaller part  
 mm = millimetre  
 Mng. = Mangguangan (Philip. language)  
 Morph. = Morphology  
 ms(c), MS(S) = manuscript(s)  
 Mt(s) = Mount(ains)  
*n.* = *numero*; number  
 N = north (after degrees: northern latitude); or New (e.g. in N. Guinea)  
 NE. = northeast  
*nec* = not  
*neerl.* = Netherlands, Netherlands edition  
 Neg. = Negrito (Philip. language)  
 N.E.I. = Netherlands East Indies  
 neotype = the specimen designated to serve as nomenclatural type when no authentic specimens have existed or when they have been lost; a neotype retains its status as the new type as long as no authentic elements are recovered and as long as it can be shown to be satisfactory in accordance with the original description or figure of the taxon  
 N.G. = New Guinea  
 N.I. = Netherlands Indies  
*no* = *numero*; number  
*nom.* = *nomen*; name (only) = *nomen nudum*  
*nom. al.* = *nomen aliorum*; name used by other authors  
*nom. alt(ern)*. = *nomen alternativum*; alternative name  
*nom. cons(erv)*. = *nomen conservandum*, *nomina conservanda*; generic name(s) conserved by the International Rules of Botanical Nomenclature  
*nom. fam. cons.* = *nomen familiarum conservandum*; conserved family name  
*nom. gen. cons.* = see *nomen conservandum*  
*nom. gen. cons. prop.* = *nomen genericum conservandum propositum*; generic name proposed for conservation  
*nom. illeg(it)*. = *nomen illegitimum*; illegitimate name  
*nom. leg(it)*. = *nomen legitimum*; legitimate name  
*nom. nov.* = *nomen novum*; new name  
*nom. nud.* = *nomen nudum*; name published without description and without reference to previous publications  
*nom. rej(ic)*. = *nomen rejiciendum*; name rejected by the International Rules of Botanical Nomenclature  
*nom. seminudum* = a name which is provided with some unessential notes or details which cannot be considered to represent a sufficient description which is, according to the International Rules of Botanical Nomenclature, compulsory for valid publication of the name of a taxon  
*nom. subnudum* = *nomen seminudum*  
*nom. superfl.* = a name superfluous when it was published; in most cases it is a name based on the same type as an other earlier specific name  
*non* followed by author's name and year, not placed in parentheses, and put at the end of a citation = means that this author has published the same name mentioned in the citation *independently*. These names (combinations) are therefore homonyms.  
 Compare p. 268b line 9-7 from bottom. The same can happen with generic names.  
 (*non* followed by abbreviation of author's name) before a reference (citation) headed by an other author's name = means that the second author has misinterpreted the taxon of the first author. Compare p. 7b line 3 from bottom: RETZIUS misapplied the name *Hypericum chinense* as earlier described by both OSBECK and LINNAEUS.  
*non. al.* = *non aliorum*; not of other authors  
*non vidi* = not seen by the author  
*nov.* = *nova* (femin.); new (species, variety, etc.)  
 Nov. = November  
 n.s. = new series  
*n. sp.* = *nova species*; new species  
*n. (sp.) prov.* = *nomen (specificum) provisorium*; provisional new (specific) name  
*n.v.* = *non vidi*; not seen  
 NW. = northwest  
 Oct. = October  
*op. cit.* = *opere citato*; in the work cited  
 p. = *pagina*; page  
 P. = Pulau, Pulu (in Malay); Island  
 Pal(emb). = Palembang  
 Pamp. = Pampangan (Philip. language)  
 Pang. = Pangasinan (Philip. language)  
 paratype = a specimen cited with the original description other than the holotype  
*part. alt.* = for the other part  
 P. Bis. = Panay Bisaya (Philip. language)  
 P.I. = Philippine Islands  
 pl. = plate  
*plurim.* = *plurimus*; most  
*p.p.* = *pro parte*; partly  
*pr. max. p.* = *pro maxima parte*; for the greater part  
*pro* = as far as is concerned  
*prob.* = *probabiliter*; probably  
*prop.* = *propositus*; proposed  
 Prov. = Province  
*pr.p.* = *pro parte*; partly  
 pt = part  
*quae est* = which is  
*quoad* basionym, syn., specimina, etc. = as far as the basionym, synonym(s), specimen(s), etc. are concerned  
 references = see for abbreviations the list in vol. 5, pp. cxlv-clxv  
 Res. = Residency or Reserve

## Abbreviations and signs

- resp. = respective(ly)  
S = south (after degrees: southern latitude)  
S (after a vernacular name) = Sundanese (language)  
Sbl. = Sambáli (Philip. language)  
SE. = southeast  
sec. = *secus*; according to  
sect. = *sectio*; section  
sens. ampl. (ampliss.) = *sensu amplo (amplissimo)*; in a wider sense, in the widest sense  
sens. lat. = *sensu lato*; in a wide sense  
sens. str. (strictiss.) = *sensu stricto (strictissimo)*; in the narrow sense, in the narrowest sense  
Sept. = September  
seq., seqq. = *sequens, sequentia*; the following  
ser. = series  
s.l. = *sensu lato*; in a wide sense  
S.-L. Bis. = Samar-Leyte Bisáya (Philip. language)  
Sml. = Sámal (Philip. language)  
s.n. = *sine numero*; (specimen) without the collector's number  
Sp. = Spanish (language)  
sp(ec). = *species*; species  
specim. = specimen(s)  
sphalm. = *sphalmate*; by error, erroneous  
spp. = *species*; species (plural)  
Sr = Senior  
s.s. = see *sens. str.*  
ssp. = *subspecies*; subspecies  
s.str. = see *sens. str.*  
stat. nov. = *status nova*; proposed in a new rank  
Sub. = Subánum (Philip. language)  
subg(en). = *subgenus*; subgenus  
subsect. = *subsectio*; subsection  
subsp. = *subspecies*; subspecies  
Sul. = Súlu (Philip. language)  
Sum. E.C. = Sumatra East Coast  
Sum. W.C. = Sumatra West Coast  
Suppl. = Supplement  
SW. = southwest  
syn. = *synonymum*; synonym  
synonyms = the names of taxa which have been referred to an earlier described taxon of the same rank and with which they have been united on taxonomical grounds or which are bound together nomenclaturally  
syntypes = the specimens used by the original author when no holotype was designed or more specimens were simultaneously designated as type  
t. = *tabula*; plate  
Tag. = Tagálog (Philip. language)  
Tagb. = Tagbanúa (Philip. language)  
Tagk. = Tagaká-ólo (Philip. language)  
Tapan. = Tapanuli (in NW. Sumatra)  
taxon = each entity throughout the hierarchic ranks of the plant kingdom which can be described and discriminated from other taxa of the same rank  
Taxon. = Taxonomy  
Tg = Tandjung (Malay); cape  
Ting. = Tinggián (Philip. language)  
Tir. = Tirurai (Philip. language)  
transl. = translated  
type = each taxon above the rank of a species is typified by a type belonging to a lower rank, for instance a family by a genus, a genus in its turn by a species; a species or infraspecific taxon is typified by a specimen. The name of a taxon is nomenclaturally permanently attached to its type; from this it cannot be inferred that the type always represents botanically the most typical or average structure found in the circumscription of the taxon  
type specimen = the specimen or other element to which the name of a species or infraspecific taxon is (nomenclaturally) permanently attached; botanically a type specimen is a random specimen on which the name was based by description. Therefore, it does not need to represent the average or most typical representative of a population. See holotype, isotype, lectotype, syntype, paratype, and neotype  
typ. excl. = *typo excluso*; type excluded  
typ. incl. = *typo incluso*; type included  
typus = see type and type specimen  
var. = *varietas*; variety  
var. nov. = *varietas nova*; new variety  
Vern. = Vernacular  
vide = see  
viz = *videlicet*; namely  
vol. = volume  
W = west (after degrees: western longitude)  
Yak. = Yakán (Philip. language)  
± = about  
& = and  
∅ = diameter  
♂ = male (flower, etc.)  
♀ = female (flower, etc.)  
♂, ♀ = bisexual (flower)  
(♂) (♀) = dioecious with unisexual flowers  
(♂♀) = monoecious with unisexual flowers  
(♂♀) = polygamous  
(♀♀) = polygamous  
∞ = many  
> = more than (in size, number, etc.)  
< = less than (size, number, etc.)  
× 2/5 = 2/5 of natural size  
× *montana* = means that the epithet *montana* is that of a hybrid



## LABIATAE (H. Keng, Singapore)<sup>1</sup>

Unarmed, erect, mostly aromatic (sometimes fetid-aromatic) herbs, sometimes woody at the base; stem mostly quadrangular, sometimes conspicuously noded. *Leaves* decussate, rarely whorled, mostly simple, rarely lobed or pinnate, exstipulate. Indumentum of simple, capitate-glandular or stellate hairs, or a combination. (*Extra-Mal.* sometimes woody, climbing, spiny and with spiral leaves.) *Flowers* bisexual, mostly zygomorphic, axillary, in pairs, or in short, fascicled cymes forming verticillasters, or in cincinni, in many cases compound into spurious spicate, racemose, capitate or paniculate, essentially cymose, inflorescences. *Calyx* persistent,  $\pm$  regular or unequally 4-5-toothed or -lobed, tubular or 2-lipped, sometimes with an appendage. *Corolla* tube long or short, sometimes with a hair-ring within, limb 5-, rarely 4-lobed, mostly 2-lipped and personate, lobes imbricate in bud. *Stamens* usually 4 and didynamous, inserted on the corolla tube, sometimes the upper (posterior) pair imperfect, rarely the lower pair barren (*Mosla*), filaments sometimes hairy, rarely connate at base; anthers linear to round, cells parallel or divaricate, sometimes confluent, rarely one cell barren (*Anisomeles*), or disjoined by a slender connective (*Salvia*), basifixed. *Disk* usually prominent, regular or irregular. *Ovary* superior, consisting of 2 carpels, each of which is 2-celled by intrusion of the ovary wall. Style simple, mostly gynobasic; stigma usually 2-fid, often with unequal arms. *Ovules* solitary, anatropous. *Fruit* consisting of 4 dry or rarely fleshy (*Gomphostemma*), 1-seeded schizocarpous nutlets which remain enclosed in the persistent calyx; the scar of attachment usually small and basal but sometimes sublateral and large; pericarp smooth or sculptured, endocarp sometimes hard; exocarp sometimes becoming gelatinous when moistened. *Seed* small, erect or  $\pm$  transverse (*Scutellaria*),  $\pm$  exalbuminous; seed-coat usually much deteriorated as to be almost negligible.

*Distribution.* Cosmopolitan, with *c.* 180 genera and over 3000 *spp.*, highly developed in the Mediterranean region; certain groups confined to distinct parts of the world, *e.g.* the (woody) *Prostantheroideae* in Australia and Tasmania, and *Catopharioideae* in Central America.

All native genera belong either to the group of 12 (African-) Indo-Australian genera: *Ajuga*, *Anisomeles*, *Basilicum*, *Ceratanthus*, *Leucas*, *Mentha*, *Ocimum*, *Plectranthus s.l.*, *Pogostemon s.l.*, *Salvia*, *Scutellaria*, *Teucrium*, or to the group of 16 Indo-Malesian genera which do not occur in Australia: *Achyrospermum*, *Acrocephalus*, *Cymaria*, *Elsholtzia*, *Eurysolen*, *Gomphostemma*, *Melissa*, *Mesona*, *Microtoena*, *Mosla*, *Nosema*, *Orthosiphon*, *Paraphlomis*, *Platostoma*, *Satureja*, *Stachys*. Several of the last group extend with their species to New Guinea however, *e.g.* *Acrocephalus*, *Cymaria*, *Microtoena*, *Orthosiphon*, *Satureja*.

The other genera of this group extend to West Malesia only, sometimes including Celebes. Their species may have a restricted occurrence in West Malesia, being confined *e.g.* to Malaya: *Gomphostemma crinitum*, to Sumatra: *Elsholtzia blanda*, *Mosla dianthera*, and *Teucrium quadrifarium*, to Java: *Stachys oblongifolia*, *Platostoma africanum*, to Sumba, or occupy only South Malesia (Sumatra, Java, sometimes also Lesser Sunda Is.): *Gomphostemma parviflorum*, *Melissa axillaris*, and *Nosema cochinchinense*, or North Malesia (the Philippines): *Salvia scapiformis*, *Mosla formosana*.

Reversely, none of the genera endemic to Australia have radiated into Malesia, though a few Australian species of wider generic area do extend to East Malesia, *viz* *Ceratanthus longicornis*, *Plectranthus congestus*, *P. parviflorum*, and *Teucrium corymbosum*.

(1) With co-operation of Dr. R. C. Bakhuizen van den Brink Jr and the General Editor.

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As *Labiatae* are largely developed in dry regions of the globe it is not astonishing that there is only one endemic genus in Malesia, viz *Acrymia*, a monotypic genus confined to ancient limestone hills in Malaya.

At species level there are, however, an unexpected large number of endemic Malesian species, namely 16. Half of them occur in more than one island or island group, viz *Achyrosperrum densiflorum*, *Elsholtzia pubescens*, *Gomphostemma curtisii*, *G. microcalyx*, *Paraphlomis oblongifolia*, *Plectranthus galeatus*, *P. javanicus*, and *Scutellaria javanica*.

Others have a narrower range and could be called local-endemics, being restricted to one island or island group; they are: *Gomphostemma dolichobotrys*, *Plectranthus apoensis*, *P. merrillii*, *P. petraeus*, *P. steenisii*, *Pogostemon philippinensis*, *P. reticulatus*, and *P. velatus*. The distribution of these endemic species over the islands of Malesia gives quite a different pattern from what is usual in other genera of forest plants, where endemics mostly center in New Guinea, the Philippines, Borneo, and Malaya.

Among the non-endemic species a few show considerable disjunctions (gaps) in their range, e.g. *Leucas marrubioides*: Asia — East Java, *Stachys oblongifolia*: SE. Asia — West Java, *Platostoma africanum*: Africa — India — Sumba, as well as the genus *Ceratanthus* which occurs in continental SE. Asia and then again in New Guinea.

One would expect quite some *Labiatae* in the category of disjunct drought plants, effected by the seasonal drought of the monsoons, as explained by VAN STEENIS (Reinwardtia 5, 1961, 419–429, 6 maps), because *Labiatae* have a tendency towards development in dry hot climates. There are indeed some lowland species which show this disjunct pattern which is defined by a strong or rather strong dry season (classes 4 and 5), viz: *Cymaria elongata* which occurs in India and then in Timor, *Cymaria dichotoma* known from SE. Asia and E. Java, S. Celebes, and N. Philippines, *Gomphostemma hemsleyanum* occurring in Upper Burma and then in the driest part of E. Java near Asem Bagus, *Platostoma africanum* found in India and Sumba, and *Orthosiphon thymiflorus* from SE. Asia and E. Java. There are some others, e.g. *Leucas marrubioides* which show a similar disjunction between SE. Asia and East Java, but this plant is little affected by the dry season, as it grows in East Java at 2000–2400 m altitude, and is thus less restricted in area by drought.

Malesian *Labiatae* show also a relation with those of the Pacific Islands, where this family is poorly represented, except in Hawaii, where there are 3 endemic genera of which some possess several species, viz *Haplostachys*, *Phyllostegia*, and *Stenogyne*. It is interesting that they are in part climbing and furthermore that they possess drupaceous fruits. According to BRIQUET (1895) they are allied to the Indo-Malesian genus *Gomphostemma* which shares this fruit character.

Ecology. *Labiatae* are found in almost all Malesian vegetation types, with exception of distinctly oligotrophic soil types. They are mostly dryland plants, although a few may extend into swampy places and lake beds, as e.g. *Pogostemon stellatus* and *Mesona palustris*.

They prefer open, sunny, hot places, rocky areas and grassland, but there are also true forest dwellers, as e.g. species in the genera *Gomphostemma*, *Pogostemon*, *Plectranthus*, *Achyrosperrum*, *Microtoena*, and *Stachys*.

Gregarious occurrence is very rare and always bound to interference by man in anthropogenous vegetation; e.g. on Mt Jang (E. Java) there are extensive, pure stands of *Elsholtzia pubescens* on the glades in the pyrogenous *Casuarina* forest (fig. 10). In dry areas fields and abandoned or fallow agricultural land may be invaded by the introduced *Hyptis suaveolens*.

As to altitude *Labiatae* are found in Malesia at all altitudes, except alpine; they find their upper level at c. 3400 m. But a number of genera occur in Malesia only in the mountains above 1000 m, e.g. *Melissa*, *Mosla*, *Stachys*, *Elsholtzia*, *Microtoena*, and *Eurysolen*. There are of course a number of species of other genera which ascend to fairly high altitude, or are even confined to montane or subalpine altitude, e.g. certain species of *Plectranthus*. Cf. VAN STEENIS, Origin of the Malaysian Mountain Flora in Bull. Jard. Bot. Btzg III, 13 (1934) 221–223, and his work Mountain Flora of Java (1972) pl. 24–25. It is noteworthy in this respect that the genus *Ajuga*, which would be expected to occur in the tropics in the mountains, occurs in Malesia at low altitudes.

*Dispersal*. No special mechanisms are known for the dispersal in nature of the dry nutlets in Malesia. In *Gomphostemma* the white pericarp is fleshy, but anyway the nutlets remain concealed

in a fairly large calyx. In some *Labiatae* the calyx teeth are bent inward more or less prohibiting the nutlets falling out and in such cases the calyx may act as a diaspore. In *Ocimum* and some other genera the pericarp swells and becomes gelatinous in contact with water.

*Pollination.* Malesian *Labiatae* are generally pollinated by bees and bumble-bees; there are no native representatives with long vividly coloured flowers to attract honey birds. It has, however, been described from the introduced *Leonotis nepetaefolia* by W. M. DOCTERS VAN LEEUWEN (Trop. Natuur 14, 1925, 68–72, 7 fig.), who observed flower visits by the honey bird *Cimuris pectoralis* HORSF.; for the rest he remarked that it is homogamous so that self-pollination is not excluded.

On flowers of *Anisomeles*, *Leucas* and *Salvia* he observed not bees or bumble-bees but only *Xylocopa*. This was also observed by HEIDE for *Plectranthus tuberosus* in Java (Med. Alg. Proefst. Landb. 14, 1923).

Further DOCTERS VAN LEEUWEN remarked that the small and narrow-flowered *Labiatae*, as e.g. *Mentha* and *Thymus* are visited by syrphids.

*Protandry* is a common phenomenon in *Labiatae*.

*Cleistogamous* flowers occur for instance in *Orthosiphon aristatus*: BACKER & BAKHUIZEN VAN DEN BRINK Jr (Fl. Java 2, 1965, 660) recorded that they are not rarely occurring, in which case the corolla is hidden in the calyx base; stamens are very short, the style is tortuous; ovary and nutlets, are, however, normal. Normally *Orthosiphon* is pollinated by butterflies (HEIDE, Dansk Bot. Ark. 5, 1927).

*Ocimum gratissimum* is visited by bees for its nectar; it has ultimately self-pollination.

*Plectranthus javanicus* is regularly visited in Java by *Bombus rufipes* (DOCTERS VAN LEEUWEN, Verh. Kon. Ak. Wet. A'dam 31, 1933, 261); *Elsholtzia pubescens* attracts by its honey-scented flowers swarms of bees in East Java.

In India *Ajuga bracteosa* is exclusively visited by day-time sphingids.

*General literature:* BRIQUET in E. & P. Nat. Pfl. Fam. 4, 3a (1895) 200; VAN DER PIJL, Blumea 20 (1972) 93, bibliogr.

*Palynology.* The colour of the fresh pollen ranges from white to yellow, orange, red or brownish red, the grains are small to large (extremes: 21  $\mu$ m in *Cymaria acuminata*, 124  $\mu$ m in *Catopheria chiapensis*). Shape varies between oblate and prolate. When acetolysed the grains appear radially symmetric, but according to RISCH (1956) they are often bilaterally compressed in fresh condition. Apertures are colpate, rarely operculate (*Teucrium*). Endexinous apertures are absent, although ERDTMAN (1952) mentions poroid structures in *Ajuga*. However, according to NABLI (1972) this is not the case in *Ajuga chamaepitys*. On the basis of the number of colpi *Labiatae* can be subdivided into two groups, one with 3 (rarely 4) colpi, the other with 6 (rarely 8 or 12) colpi.

The pollen grains of the first group are shed in the 2-nucleate stage and are considered primitive, those of the second group in the 3-nucleate stage and would be advanced (BORSOVA, 1960; WUNDERLICH, 1967). Only in *Monarda lindheimeri* both 3- and 6-colpate grains have been recorded (SCORA, 1967).

The exine consists of endexine, footlayer, layer of straight or branched columellae and an echinulate, perforate, reticulate or supra-reticulate tectum (NABLI, 1967).

The division of *Labiatae* in two main groups according to aperture number and nucleate condition, first recognized by ERDTMAN (1945) is correlated with differences in seed development, trichome distribution, anther morphology, chemotaxonomy and rust fungus resistance. It appears to indicate a fundamental demarcation line within the family, which is most clearly expressed in the taxonomic sequence of BENTHAM's system, where it can be placed between tribes IV and V. In BRIQUET's and MELCHIOR's treatment of the family this is less satisfactorily reflected (EL-GAZZAR & WATSON, 1968, 1970; WUNDERLICH, 1967). — *References:* ERDTMAN, Svensk Bot. Tidskr. 39 (1945) 279–285; Pollen-morph. plant-tax. I, Angiosp. (1952) 217–220; RISCH, Willdenowia 1 (1956) 617–641; BORSOVA, Dokl. Ak. Nauk. SSSR 133 (1960) 1465–1467; SCORA, Univ. Calif. Publ. Bot. 41 (1967) 1–71; WUNDERLICH, Öst. Bot. Z. 114 (1967) 383–483; EL-GAZZAR & WATSON, New Phytol. 67 (1968) 739–743; *ibid.* 69 (1970) 451–486; NABLI, C. R. Ac. Sc. Paris 294 (1972) 3210–3213; in The evolutionary significance of the exine, Linn. Soc. Symp. Ser. 1 (1976) 499–510. — J. MULLER.

Phytochemistry & Chemotaxonomy<sup>1</sup>. Chemical characters of *Labiatae* were treated in vol. 4 (1966) of my 'Chemotaxonomie der Pflanzen' (pp. 289–346, 474–476, 502). Supplementary chemotaxonomic comments were given in vol. 6 (1973; pp. 777–779 and 792–793) *sub Verbenaceae*. The manifold uses of members of the family as medicinal and culinary herbs, as spices and as sources of highly esteemed essential oils are based on the accumulation of different classes of secondary metabolites. A number of chemical features and trends are rather characteristic of *Labiatae*; including some of the most recent findings, these may be summarized as follows.

(1) Many taxa of the family are strongly aromatic. As a rule their essential oils accumulate in distinct glandular hairs. Sometimes (*e.g. spp.* of *Pogostemon*) internal glandular hairs and oil cells are present also. Depending on the species, the essential oils contain mainly monoterpenoids, sesquiterpenoids or phenylpropane derivatives. The occurrence of two to several chemotypes with regard to essential oils within many species is a highly interesting feature. Leaves of *P. cablin* BTH. yield the sesquiterpenoid-rich oil of patchouly which is highly esteemed in perfumery. It also contains two acidic compounds with bactericidal activity (E. KLEIN & W. ROJAHN, *Tetrahedron Letters*, 1969, 2279; S. NAKAHARA *c.s.* *Phytochemistry* 14, 1975, 2712) and the two sesquiterpenic alkaloids epiguaipyridine and patchoulipyridine (G. BÜCHI *c.s.* *J. Am. Chem. Soc.* 88, 1966, 3109).

(2) Iridoid glycosides (*i.e.* glucosylated cyclopentanoid non-volatile monoterpenoids: compare the reviews of O. STICHER & U. JUNOD-BUSCH, *Pharm. Acta Helv.* 50, 1975, 127–144 and of S. ROSENDAL JENSEN & B. JUHL NIELSEN, *Bot. Notis.* 128, 1975, 148–180) were isolated from many *Labiates* in recent time. They are especially common in the so-called verbenoid *Labiatae* and in many genera of *Stachydeae* and seem to replace volatile isoprenoids in a number of weakly aromatic taxa. More than 25 individual iridoid glycosides including lamiol, lamiide, phlomiol (C<sub>10</sub>-aglucones), melittoside, catalpol, antirrhinoside, galiridoside, harpagide, ajugol and reptoside (all with a decarboxylated C<sub>9</sub>-aglucone) are known at present from the genera *Ajuga*, *Anisomeles*, *Eremostachys*, *Galeopsis*, *Hemiandra*, *Lagochilus*, *Lamium*, *Leonurus*, *Leucas*, *Melittis*, *Microcorys*, *Molucella*, *Phlomis*, *Physostegia*, *Prasium*, *Prostanthera*, *Salazaria*, *Scutellaria*, *Sideritis*, *Stachys s.l.*, *Teucrium*, and *Trichostema*. Some species of *Nepeta* and *Teucrium marum* L. do not glucosylate the cyclopentanoid monoterpenoids, such as the nepetalactones and dolichodial, produced by them (*e.g.* F. E. REGNIER *c.s.* *Phytochemistry* 6, 1967, 1271, 1281; U. M. PAGNONI *c.s.* *Austr. J. Chem.* 29, 1976, 1375). These volatile constituents of their essential oils are toxic to insects (T. EISNER, *Science* 146, 1965, 1318) and excite cats (*Nepeta cataria*!) and related mammals.

(3) Diterpenes seem to be ubiquitous in *Labiates*. They occur as resinous compounds, as lactonoid bitter principles, as colourless phenolic compounds and as related quinonoid pigments. Accumulation takes place either in the glandular hairs or in the tissues of leaves, stems and roots. Many of these diterpenes are biologically active; depending on structural details and the localization in the plants they may act mainly as antifeedants, antibacterial, antifungal or antinematodal constituents (*e.g.* I. KUBO, *Agric. Biol. Chem.* 38, 1974, 1261). Diterpenes were investigated very intensively in recent years; like *e.g. Compositae*, *Labiatae* proved to be very versatile with regard to diterpenoid synthesis. Monocyclic lactonoid diterpenes (ovatolide and anisomelic acid) occur in *Anisomeles ovata* R. BR. and *A. malabarica* R. BR. (K. K. PURUSHOTHAMAN *c.s.* *Indian J. Chem.* 13, 1975, 1357). Bicyclic diterpenes of the labdane-manooloxide-type seem to be very common in the family. Many representatives of this structural type were isolated from members of the genera *Ballota*, *Lagochilus*, *Lasiocorys*, *Leonotis*, *Leonurus*, *Marrubium*, *Nepeta*, and *Sideritis*. Rearranged labdane-type diterpenes with the so-called clerodane skeleton were isolated from several species of *Teucrium*, a few species of *Salvia* and *Stachys* and from *Ajuga remota* (I. KUBO *c.s.* *J. C. S. Chem. Commun.* 1976, 949: the antifeedants ajugarin-I, -II and -III). Phenolic and quinonoid tricyclic diterpenoids with the abietane skeleton occur in many members of the family. Examples are carnosol, royleanone, horminone, the tanshinones, fuerstione and the many coleones (*e.g.* C. H. EUGSTER *c.s.* *Angew. Chemie* 82, 1970, 259; *Helv. Chim. Acta* 54, 1971, 1606; *ibid.* 56, 1973, 2534; *ibid.* 58, 1975, 343, 1899, 1921, 1934). The quinones represent the

(1) This chapter is much longer than usually in *Flora Malesiana*, but so much has been published since 1966 that it could only be meaningful in this way. — Ed.

yellow to red pigments of the glandular hairs on the leaves of certain species of *Coleus*, *Fuerstia*, *Horminum*, *Hyptis*, and *Plectranthus* and occur also in the roots of many *Labiatae*. The phenolic compounds of this class occur predominantly as lactonic bitter principles in leaves (many species of *Salvia*, *Rosmarinus officinalis* L., *Coleus barbatus* (BTH.) AGNEW, *Nepeta* spp.) and accompany the quinonoid pigments in roots (compare e.g. C. H. BRIESKORN & H. BUCHBERGER, *Planta Medica* 24, 1973, 190; A. PATUDIN *c.s. ibid.* 26, 1974, 201; W. H. WATSON *c.s.* *Tetrahedron Letters*, 1976, 2501). Tetracyclic kaurane-type bitter diterpenes are presently known from *Englerastrum scandens* ALSTON and several species of *Sideritis* and *Isodon*. The latter genus also produces the enmeine-type rearranged kauranes (review: E. FUJITA *c.s.* *J. Pharm. Soc. Japan* 94, 1974, 788). In the genus *Sideritis* pimarane-type tricyclic diterpenes, stachane-type and atisane-type tetracyclic diterpenes and trachylobane-type pentacyclic diterpenes were also detected (e.g. T. G. DE QUESADA *c.s.* *Phytochemistry* 14, 1975, 517). Most of the biologically active diterpenes are strongly oxygenated; epoxy, acetoxy, lactonoid and furanoid groupings occur frequently. It deserves mentioning that sometimes (e.g. the ajugarins) even a butenolide group is present; such diterpenes may be confused with cardenolides when plants are screened for cardioactive constituents. A structurally and biosynthetically different lactonoid bitter principle, ovatolide, was isolated long ago from leaves of *Hyptis pectinata*. A similar compound, bronolide, has been recently isolated from the Madagascan plant *Tetradenia fruticosa* (N. C. FRANCA & J. POLONSKY, *C. R. Ac. Sc. Paris* 273C, 1971, 439).

(4) *Labiatae* produce large amounts of triterpenes and phytosterols. Free triterpenic acids are main constituents of the cuticular waxes. In many instances ursolic and oleanolic acids predominate; they are often (e.g. *Anisomeles malabarica*, *Hyptis emoryi*, *Lepechinia chamaedryoides*) accompanied or replaced by betulinic acid. Recently a number of new triterpenic acids such as micromeric acid (J. BERMEJO *c.s.* *Tetrahedron Letters*, 1967, 4649: first isolation from *Micromeria benthamii* WEBB & BERTH.) and several oxygenated derivatives of ursolic and oleanolic acids (species of *Isodon*, *Nepeta*, *Salvia*, and *Rosmarinus*) was isolated from certain species; they are usually minor compounds of the cuticular waxes. Besides triterpenic acids, most *Labiates* produce appreciable amounts of triterpenic alcohols. As a rule the latter are present as acetates or related esters in resinous exudates (e.g. *Salvia glutinosa*) or in similar external or internal lipid fractions.  $\alpha$ -Amyrine,  $\beta$ -amyrine, lupeol, germanicol and uvaol are rather common. Recent investigations demonstrated the additional occurrence of betuline (*Plectranthus rugosus* WALL., *Nepeta aragonensis* LAMK) and many new compounds like anagadiol, 9,11-dehydro- $\alpha$ -amyrine, nivadiol, epialnusenol and 11 $\alpha$ -hydroxy- $\beta$ -amyrine in species of *Nepeta* and *Salvia* (e.g. A. G. GONZALEZ *c.s.* *J. C. S. Chem. Commun.* 1971, 567; *An. Quim. Madrid* 68, 1972, 709, 1433; D. A. H. TAYLOR, *J. Chem. Soc.* 1967C, 490). Weakly hemolytic saponins seem to be wide-spread in the family; their chemistry is still scarcely known, however; most probably the sapogenins are triterpenes. According to recent Russian investigations leaves of *Orthosiphon stamineus* BTH. ('*kumis kutjing*') contain the siphonosides A, B, C, D, and E with unidentified triterpenes as sapogenins and arabinose, glucose and galactose in the sugar chains. The ecdysone-type oxygenated sterols detected in several species of *Ajuga* (S. IMAI *c.s.* *Chem. Pharm. Bull.* 17, 1969, 335, 340; *J. C. S. Chem. Commun.* 1969, 82, 546), but not in members of 20 other genera of *Labiatae*, deserve mentioning here. The phytoecdysones cyasterone, ecdysterone, ajugasterone A, B, and C were isolated from *Ajuga chia*, *A. decumbens*, *A. incisa*, *A. iva*, *A. japonica*, *A. nipponensis*, and *A. turkestanica*. *A. decumbens* contains at the same time the insect-moulting inhibitor ajugalactone (K. NAKANISHI *c.s.* *J. Am. Chem. Soc.* 92, 1970, 7512). Just as iridoid glycosides phytoecdysones seem to be restricted to the verbenoid part of *Labiatae*.

(5) *Labiatae* synthesize and accumulate large amounts of phenolic constituents; flavonoids and caffeic acid derivatives form the bulk of their phenols. Flavonoids are ubiquitous in cormo-phytes, but some trends of flavonoid metabolism such as replacement of flavonols by flavones, lack of proanthocyanidins and catechins, 6-hydroxylation of flavones (e.g. 6-hydroxyapigenin (= scutellarein), 6-hydroxyluteolin) and methylation of one to several of the flavonoid hydroxyls are very characteristic of *Labiatae* and a number of more or less closely related taxa. Many new flavonoids were isolated from the family in recent time; most of them are heavily methylated derivatives of scutellarein and 6-hydroxyluteolin; they occur either as glycosides or as glucuronides, and — the more lipophilic ones — also as free compounds in exudates, cuticular waxes

and other lipid fractions. Some medicinal plants may serve to illustrate trends in flavonoid metabolism. Eupatirin, sinensetin and three additional tetramethyl ethers of 6-hydroxyapigenin and 6-hydroxyluteolin were isolated quite recently from leaves of *Orthosiphon stamineus* (E. BOMBARDELLI *c.s.* Fitoterapia 43, 1972, 35; S. MATSUURA *c.s.* J. Pharm. Soc. Japan 93, 1973, 1317). Salvigenin (= 3',6,7-trimethoxy-5-hydroxyflavone) occurs free and as 5-glycoside in leaves of *Salvia triloba* L. f. and *S. virgata* JACQ. (A. ULUBELEN *c.s.* J. Pharm. Sci. 57, 1968, 1037; Lloydia 38, 1975, 446). Roots of *Scutellaria baicalensis* GEORGI yielded two additional flavones, skullcap-flavone-I and -II; the latter was shown to be 2',6',6,7,8-pentamethoxy-5-hydroxyflavone; this compound has a rather unusual B-ring substitution; leaves of the same species yielded two free flavanones, carthamidin and isocarthamidin (M. TAKIDO *c.s.* J. Pharm. Soc. Japan 95, 1975, 108; *ibid.* 96, 1976, 381). Flavanones occur rarely in *Labiatae*; another example is didymin (= acinoside) from *Monarda didyma* L. and *Acinos thymoides* MOENCH (= *Satureja acinos* SCHEELE) which was shown to be the 7-rutinoside of isosakuranetin (= 5,7-dihydroxy-4'-methoxyflavanone) (H. WAGNER *c.s.* Chem. Ber. 102, 1969, 3605). Free chryso-splenetin (formerly isolated from *Chryso-splenium*!) occurs in relatively large amounts in *Plectranthus marrubioides* HOCHST. (leaves and inflorescences: M. HENSCH & C. H. EUGSTER, Helv. Chim. Acta 55, 1972, 1610). Flavone-C-glycosides seem to be restricted in *Labiatae* to those members which have the strongest affinities with *Verbenaceae*; they became known from members of the genera *Phlomis* and *Teucrium*. Caffeic acid is present in large amounts in practically all *Labiatae*. It is esterified with quinic acid (the several chlorogenic acids), glucose or with the alcoholic hydroxyl of  $\alpha$ -hydroxydihydrocaffeic acid (the so-called rosmarinic or labiatic acid). Mixtures of these polyphenolic constituents have some of the properties of true tannins and are described in botanical and phytomedical literature as 'tannins'. Generally they represent 1 to several percent of the dry weight of leaves and are more or less active as antibiotics, antipyretics and antioxidants. Rosmarinic acid and sugar esters of caffeic acid occur mainly in *Labiatae sensu strictissimo* (highly aromatic taxa with trinucleate, hexacolpate pollen grains) (compare *e.g.* V. I. LITVINENKO *c.s.* Planta Medica 27, 1975, 372). Rosmarinic acid has also been isolated from leaves of *Orthosiphon stamineus*. A number of phenolic compounds are likely to occur rather infrequently in *Labiatae*. Examples are hydroquinone (herb of *Majorana hortensis* MOENCH: S. S. SUBRAMANIAN *c.s.* Curr. Sci. 41, 1972, 202) and lignans such as (+)-sesamin (herb of *Sideritis canariensis* AIT.: A. G. GONZALEZ *c.s.* Phytochemistry 11, 1972, 2115), a diester of secoisolariciresinol (seed oil of *Salvia plebeia* R. BR.: R. G. POWELL & R. D. PLATTNER, Phytochemistry 15, 1976, 1963), and the cytotoxic constituents of leaves of *Hyptis verticillata* (podophyllotoxin and 4'-demethylpodophyllotoxin: V. F. GERMAN, J. Pharm. Sci. 60, 1971, 649). The strange coumarins from *Sideritis canariensis*, *S. montana* L. (siderin = 4,7-dimethoxy-5-methylcoumarin: P. VENTURELLA *c.s.* Tetrahedron Letters, 1974, 279) and *Leonotis nepetaefolia* R. BR. (6-methoxysiderin: K. K. PURUSHOTHAMAN *c.s.* J. C. S. Perkin I, 1976, 2594) and lithospermic acid which is present in leaves of some medicinally used East Asiatic species of *Lycopus* belong to the same category of phenolic constituents of *Labiatae*.

(6) True alkaloids are unknown from *Labiatae*. The betaines stachydrine and betonicine are produced in large amounts by many species of *Stachys* and related genera like *Eremostachys*, *Galeopsis*, *Lagochilus*, *Lamium*, *Leonurus*, *Marrubium*, *Panzeria*, *Phlomis* and *Sideritis*. Certain medicinally used East Asiatic species of *Leonurus* contain leonurine and several similar guanidine derivatives (G. REUTER & H. J. DIEHL, Pharmazie 26, 1971, 777). The alkaloids described in literature for *Rosmarinus officinalis* have been shown to be artefacts of isolation.

(7) Like *Scrophulariaceae*, *Plantaginaceae* and some related families, *Labiatae* do not store starch in their subterranean parts; perennial species store large amounts of oligogalactosides of sucrose (raffinose, stachyose, verbascose and ajugose).

(8) Seeds of *Labiatae* store proteins, fatty oils and sucrose and planteose (an isomer of raffinose); starch is absent. Generally fatty oils are present in largest amounts. With regard to seed oils *Labiatae* can be divided roughly in two main groups; those producing oils with linolenic acid as main fatty acid and those producing oils with oleic and linolic acids as main fatty acids. The former group includes taxa with hexacolpate trinucleate pollen grains and the latter mainly taxa with tricolpate binucleate pollen grains. Besides these trends with regard to 'common' fatty acids, certain species produce seed oils with appreciable amounts of 'unusual' fatty acids such as

laballic acid (*Leonotis nepetaefolium* R. BR.), lamellenic acid (*Lamium purpureum* L.), 5,9,12-octa-decatrienoic acids (*Teucrium depressum* SMALL) and  $\alpha$ -hydroxyoleic and  $\alpha$ -hydroxylinolic acids (*Salvia nilotica* MURR.) (some recent references: J. M. HAGEMAN *c.s.* Lipids 2, 1967, 371; C. R. SMITH *c.s.* *ibid.* 4, 1969, 462; M. B. BOHANNON & R. KLEIMAN, *ibid.* 10, 1976, 1976; J. S. COWIE *c.s.* J. C. S. Perkin I, 1972, 2197).

(9) The nutlets of many *Labiatae* are rich in mucilage. The taxonomic significance of this character has been discussed by I. C. HEDGE (Not. R. Bot. Gard. Edinb. 30, 1970, 79). Chemically the mucilages have only been studied in *Ocimum basilicum* L., *O. canum* SIMS, and *O. gratissimum* L.; they contain two uronic acids (galacturonic and mannuronic), three hexoses (glucose, galactose, mannose) and two pentoses (arabinose, xylose); additionally rhamnose may be present (R. T. TARANATHAN *c.s.* Austr. J. Chem. 24, 1971, 1501; *ibid.* 28, 1975, 1345; Indian J. Chem. 13, 1975, 307).

Summarizing it may be stated that *Labiatae* are characterized by an astonishingly broad spectrum of isoprenoid compounds (many types of monoterpenoids, sesquiterpenoids, diterpenoids and triterpenoids), caffeic acid derivatives and apigenin- and luteolin-derived flavonoids and by the replacement of starch-accumulation in perennial parts by oligosaccharides of the so-called stachyose series. At the same time they store mainly linolic or linoleic acid-rich oils in their starch-free seeds. True tannins and alkaloids are lacking. Their chemical characters place them convincingly in *Lamiales sensu* TAKHTAJAN and affirm close relationships of the latter with *Scrophulariales* of the same author. At family level the chemical characters agree very well with the classification proposed by R. WUNDERLICH (Öst. Bot. Z. 114, 1967, 383) and with the proposals of EL-GAZZAR & WATSON (New Phytologist 67, 1968, 739; *ibid.* 69, 1970, 451, 478) who plead for combination and reclassification of *Verbenaceae* and *Labiatae* (compare: Chemotaxonomie der Pflanzen 6, 1973, 777-779, 792-793). — R. HEGNAUER.

**Taxonomy.** Within the *Tubiflorae* the *Labiatae* are closest related with the *Verbenaceae* and the distinction between these two families rests on rather arbitrary grounds, as pointed out by BRIQUET in his admirable treatment in the Pflanzenfamilien (4, 3a, 1895, 205). He clearly explained that the traditional main distinction between these two families, *viz* a terminal style in *Verbenaceae* and a gynobasic one in *Labiatae* is not tenable. JUNELL (Symb. Bot. Uppsala 1, n. 4, 1934, 1-219, f. 1-257) has later studied this in more detail. In the system of BRIQUET (extracted by SHAW, Willis Dict. ed. 8, 1973, 625) *Ajugoideae* and *Prostantheroideae* have no gynobasic style, hence, the nutlets have in these two subfamilies a lateral-ventral attachment. Besides this, some genera of *Labiatae* have fruits without separation of nutlets, like a drupe, a situation which is frequent in *Verbenaceae*. However, there is rather unanimity of opinion that genera as *Ajuga*, *Teucrium*, *Rosmarinus*, and *Prostanthera* should be retained in *Labiatae*.

An other allied family is *Boraginaceae*, but that family is sharply separated from *Labiatae* by the position of the radicle. As BRIQUET (1895) remarked also in this family there are two types of ovary structure, gynobasic and with a terminal style, which thus supports the idea to keep *Labiatae* in the traditional sense. According to BRIQUET the gynobasic structure would represent a derived stage.

**Subdivision.** BRIQUET *l.c.* based his subdivision of the family almost entirely on the structure of the gynoecium and the fruit. He distinguished 8 subfamilies. I have arranged the native genera of Malesia into the 5 subfamilies which occur in Malesia as follows:

1. Style not gynobasic. Nutlets with lateral-ventral attachment, the contact surface often more than half the height of the ovary. Seed without endosperm. **Ajugoideae:** *Acrymia*, *Ajuga*, *Cymaria*, *Teucrium*.
1. Style gynobasic. Nutlets basally attached, with very small surface of contact.
2. Nutlets drupaceous with fleshy or strongly thickened exocarp and hard crustaceous endocarp. **Prasioideae:** *Gomphostemma*.
2. Nutlets with dry and often thin pericarp.
3. Seeds more or less transverse. Embryo with a bent radicle lying on one cotyledon. Disk tubular, elongate. **Scutellarioideae:** *Scutellaria*.
3. Seeds erect. Embryo with short, straight, superior radicle. Disk lobes when distinct alternate with the lobes of the ovary.
4. Stamens ascending or spreading and projecting straight forwards. **Stachyoideae:**

*Achyrosperrum, Anisomeles, Elsholtzia, Eurysolen, Leucas, Melissa, Mentha, Microtoena, Mosla, Paraphlomis, Pogostemon, Salvia, Satureja, Stachys.*

4. Stamens descending, lying upon or enclosed in the lower lip. **Ocimoideae:** *Acrocephalus, Basilicum, Ceratanthus, Mesona, Nosema, Ocimum, Orthosiphon, Platostoma, Plectranthus s.l.*

The key to the subfamilies can obviously not well be used as the main frame of a practical, general key to the genera.

For this we have chosen the key offered by BACKER & BAKHUIZEN VAN DEN BRINK *f.* in the Flora of Java, in which we have inserted the 7 genera which do not occur in Java. This key has the merit to cover also the genera which are solely represented by introduced, naturalized species, viz *Hyptis, Leonotis, and Leonurus*, and, furthermore, those genera of which the species occur only in cultivation, either for ornamental, medicinal, commercial, or other purposes. The latter are listed concisely at the end of this revision.

Uses. By their volatile, aromatic oils of different sorts *Labiatae* are in frequent use and even in cultivation, for medicinal purposes, condiments, and the perfume industry. An occasional one is yielding edible tubers, e.g. *Plectranthus rotundifolius*. See for further data under the species.

#### KEY TO THE GENERA

*Genera of which all species are cultivated are unnumbered;  
their species are listed at the end of this revision*

1. Corolla hidden in basal part of the calyx tube, minute (2–3 mm long). Flowers cleistogamous. Calyx bilabiate; upper lip much broader than the teeth of lower lip, its margins decurrent along the tube **30. Orthosiphon**
1. Corolla exerted from the calyx. Flowers chasmogamous.
  2. Flowers spirally arranged along the rachis of very dense, 2–15 cm long, simple spikes, 1.5–2 cm long, blue. Bracts during anthesis exceeding the calyx, very conspicuous at the tops of the spikes, brown, acutely acuminate, long-ciliate. Calyx below the apical margin of the short tube with 5 equal, c. 0.5 cm long, at first filiform, afterwards spinous teeth, alternating with 5 minute toothlets, finally closed at the top. Leaves linear-lanceolate, sharply serrate, ± sessile. Cultivated . . . . . **Pycnostachys**
  - 2'. Flowers pale yellow in axillary long-peduncled (6–8 cm), dichotomously branched, straight, many-flowered cincinni. Long-soft-hairy short plant with a soft-woody, prostrate stem less than 10 cm long, and crowded large leaves 15–20 by 10–12 cm; internodes c. 0.5 cm . . . . . **1. Acrymia**
  - 2". Otherwise. Flowers in verticillasters or in cymes, these with or without well-developed rachises, often combined into spurious heads, spurious spikes, racemes, or panicles.
  3. Perfect stamens 2; connective usually filiform; if not, then the plant finely stellate-hairy.
    4. Filaments short, not toothed; connective transverse to the filament and articulate with it, versatile, long-filiform; its anterior part erect under the upper lip, bearing a single well-developed, often linear perfect anther-cell; its posterior part stuck into the throat, never bearing a perfect anther-cell, but sometimes with effete malformed one. No stellate hairs. . . . . **20. Salvia**
    - 4'. Connective otherwise, the two anther-cells not separated in this way.
      5. Leaves rather approximate, subsessile, linear-lanceolate, with recurved, entire margins, rigid, finely stellate-hairy, 1.5–3.5 cm by 1.5–4.5 mm. Cultivated . . . . . **Rosmarinus**
      5. Leaves well-spaced, petioled, not stellate-hairy, rhomboid to ovate, 1–2 by 0.5–1 cm; margin flat, toothed . . . . . **17. Mosla**
      - 4". Otherwise again. Continue lead 6.
  - 3'. Stamens 4 but only the upper pair perfect; anther-cells divaricate. Calyx 2-lipped. Verticillasters 2-flowered, secund, spaced, in racemes. Corolla almost actinomorphic, hardly 2-lipped . . . **17. Mosla**
  - 3". Perfect stamens usually 4; if fewer, then the plant not stellate-hairy, nor the connective long-filiform.
    6. At least the medium and lower leaves deeply palmatifid or pinnatifid. Calyx teeth in normal flowers 5, subequal, rarely 6–7. Stamens covered by the upper lip. Style arms subequal. Disk equal-sided. Verticillasters combined into a terminal head or dense spurious spike. Corolla white; upper lip tinged with red, deeply bipartite. Calyx 13–15-nerved. Corolla tube exceeding the calyx; 2 posterior stamens longest. Nutlets ovoid, black. Plant lemon-scented when bruised. Cultivated. **Cedronella**
    7. Lower verticillasters wide apart, axillary. Corolla red; upper lip entire, densely pilose. Calyx 10-ribbed. Corolla tube slightly shorter than the calyx; 2 anterior stamens longest. Nutlets cuneate-triangular, truncate, brown. Plant not lemon-scented . . . . . **12. Leonurus**
  6. Leaves much less deeply or not divided.
    8. Upper lip of corolla distinctly spurred, shortly 3-lobed, lower lip subentire. Flowers blue, in spaced small verticillasters. ± Scapose herb, the stem with a few leaf pairs near the base **25. Ceratanthus**
    8. Upper lip of corolla not distinctly spurred.
      9. Calyx limb on the anterior side spathaceously split to near the base; tube very short. Flowers in dense spurious spikes; verticillasters 2-flowered. Bracts imbricate, large. Flowers small, white or pale red. Leaves entire, rather densely canescent on both surfaces, 0.5–2 by 0.7–1 cm. Cultivated **Majorana**

9. Calyx limb not deeply split on the anterior side, 2–10-fid, bilabiate or not.
10. Calyx segments (sometimes minute) in all flowers 4 or 2<sup>1</sup>.
11. Calyx with 2 entire lips which after anthesis appress themselves firmly against each other and close the mouth of the calyx; upper lip with a dorsal, patent, broadly oval, concave scale-like appendage finally falling off together with the posterior part of the tube; rest of the calyx persistent. Verticillasters spaced in raceme-like inflorescences . . . . . **6. Scutellaria**
11. Calyx without such a caducous hood-like appendage.
12. Flowers in spaced raceme-like inflorescence. Fruiting calyx urceolate-campanulate, the upper lobe strongly reflexed backwards. Filaments dilated below, but without a basal appendage . . . . . **31. Platostoma**
12. Flowers in dense, spike-like inflorescence. Fruiting calyx tubular-campanulate, the upper lobe not reflexed backwards. Posterior filaments with a basal appendage.
13. Calyx 8-nerved, in fruit deeply pitted between the nerves; the latter connected by many transverse vein-bars. Upper filaments glabrous . . . . . **27. Mesona**
13. Calyx 10-nerved, not deeply pitted between the nerves; transverse vein-bars inconspicuous. Upper filaments hairy . . . . . **28. Nosema**
- 10'. Calyx segments 8–10<sup>1</sup>; upper lip of calyx not decurrent along the tube; anther-cells in a line with each other.
14. Corolla orange, 2.2–5.2 cm long; tube inside either with 3 rings of hairs or without any ring; lower lip shrivelling up before the expansion of the flower . . . . . **11. Leonotis**
14. Corolla white, 1.2–1.5 cm long; tube inside with a single ring of hairs; lower lip large, not shrivelling up. . . . . **13. Leucas**
- 10". Calyx segments in all or most flowers 5, rarely more, but then the calyx distinctly bilabiate with a broad, entire, decurrent upper lip.
15. Calyx distinctly bilabiate, viz the segments arranged into 2 groups of 1–4, which considerably differ in dimension and shape; segments of each group contiguous, not alternating with those of the other group.
16. Lower lip of corolla 3-fid. Upper lip of calyx either 3-fid (3-dentate) or represented by an oval, entire, c. 1 mm long lobule, or the corolla is not distinctly bilabiate but subequally 4-lobed.
17. Leaf margin recurved, entire.
18. Plant finely white-stellate-hairy. Calyx 13-nerved; upper lip entire, ovate, c. 1 mm long, lower one 4-dentate. Spurious spikes on hard, more than 5 cm long stalks. Corolla blue or violet, c. 1 cm long. Stamens included. Style arms oblong, flattened. Stem acutely quadrangular. Leaves beset with white glands, longer than 2 cm. Cultivated . . . . . **Lavandula**
18. Plant with ordinary hairs. Calyx 10-nerved; upper lip 3-dentate; lower lip 2-fid. Verticillasters axillary, only the upper ones combined into a spurious spike. Corolla pale red or violet; c. 0.5 cm. Stamens usually exserted. Style bidentate. Stem obtusely quadrangular; internodes very short. Leaves beset with orange-brown glands, up to 10 by 3 mm. Cultivated . . . . . **Thymus**
17. Leaf margin either crenate-serrate or, if entire, not recurved.
19. Higher verticillasters placed in the axils of bracts, closely approximate, not combined into panicles; flowers distinctly bilabiate, not yellow; 1–2 stamens sometimes reduced to minute staminodes; ovary glabrous . . . . . **21. Satureja**
- 19'. All verticillasters placed in the axils of ordinary leaves, distant; flowers distinctly bilabiate, white or pale violet; all stamens perfect; ovary glabrous . . . . . **14. Melissa**
- 19". Otherwise again. Continue lead 24.
16. Lower lip of corolla and upper segment of calyx both entire, or corolla subequally 5-lobed, not distinctly bilabiate.
20. Corolla tube much exceeding the calyx.
21. Stamens free, distinctly exceeding the corolla. Stigma capitate-clavate. Corolla tube straight, narrow. Verticillasters at most 6-flowered . . . . . **30. Orthosiphon**
21. Stamens connate in their lower part, embraced by the lower lip. Style shortly bifid. Corolla tube sigmoid. Verticillasters 6–∞-flowered . . . . . **32. Plectranthus**
20. Corolla tube as long as or shorter than the calyx.
22. Verticillasters 6-flowered; inflorescence of older plants composed of spurious spikes or racemes. Calyx without a basal whorl of hairs. Topmost leaves not forming an involucre to the inflorescence.
23. Margins of upper lip of calyx decurrent along the tube. Stamens far exserted; 2 posterior ones just above the base with a pilose transverse process or with a tuft of hairs. Corolla 3.5–4 mm long . . . . . **29. Ocimum**
23. Margins of upper lip of calyx not decurrent along the tube. Stamens not far exserted, not with a subbasal process, nor with a tuft of hairs. Corolla at most 3 mm long . . . . . **24. Basilicum**
22. Verticillasters ∞-flowered, combined into terminal very dense heads or spikes 0.5–3 cm long. Calyx with a basal whorl of long hairs. Topmost leaves forming an involucre to the inflorescence . . . . . **23. Acrocephalus**

(1) An undivided lip is counted for 1 segment. Sometimes the segments are minute, tooth-like.

- 15. Calyx otherwise.
- 24. Corolla seemingly unilabiate as upper lip is very small and consists of 2 erect segments joined to the underlip which is seemingly 5-fid.
- 25. Flowers in rather dense terminal racemes or panicles. Leaves regularly crenate
- 4. Teucrium**
- 25. Flowers in axillary verticillasters. Leaves often decrescent upwards. Leaf margin irregularly wavy or remotely dentate
- 2. Ajuga**
- 24'. Corolla 4-lobed or obscurely bilabiate, viz the segments not considerably differing in size or shape. Stamens (if not reduced to minute staminodes) usually exserted (sometimes only by their anthers) and divergent; anther-cells parallel or divergent, more or less confluent. Flowers neither yellow nor red.
- 26. Filaments covered with patent long hairs . . . . . **19. Pogostemon**
- 26. Filaments glabrous or nearly so.
- 27. Anterior lobe of disk tongue-shaped, distinctly longer than the other lobes. Verticillasters combined into spurious spikes, these at last united into candelabre-shaped inflorescences. Corolla white; tube on the inside with an oblique ring of hairs . . . . . **9. Elsholtzia**
- 27. Disk equal-sided.
- 28. Verticillasters combined into dense, usually uninterrupted, spurious spikes, these solitary or sometimes at the base with 1-2 smaller spikes. Calyx often with a faucal row of erect long hairs; teeth long-ciliate. Corolla reddish violet, 5-6 mm long. Nutlets suborbicular. Stem subterete, usually swollen above the nodes, in the upper part rather densely covered with longish hairs . . . . . **19. Pogostemon**
- 28. Otherwise. . . . . **15. Mentha**
- 24". Corolla distinctly bilabiate. Stamens covered by the upper lip or embraced by the lower lip, less often exserted and then approximate and subparallel. Anther-cells parallel or in a line with each other.
- 29. Lower lip of corolla, or at least its medium segment, deflexed, saccate, at first embracing the likewise deflexed stamens and style; upper lip flat, lobed. Calyx segments 5, acute or subulate. Corolla 2.5-6 mm long. Flowers often capitate, but sometimes in fascicles, in unilateral cymes, or occasionally solitary.
- 30. Nutlets conchiform with a broad, inflexed, ribbed-crenate margin. Flowers in 6-15-flowered heads, violet; anther-cells in a line with each other. Leaves less than 5 cm long. Cultivated . . . . . **Marsypianthes**
- 30. Nutlets not conchiform, not with an inflexed margin. Flowers white or violet, capitate, or not; anther-cells confluent. Leaves often longer than 5 cm . . . . . **26. Hyptis**
- 29. No saccate lip or lip-segment present.
- 31. Lower lip of corolla entire, boat-shaped, stretched; upper lip 4-lobed, erect. Stamens embraced by the lower lip. Anterior disk-lobe tongue-shaped . . . . . **32. Plectranthus**
- 31. Lower lip of corolla more or less deeply 3-fid, not boat-shaped; midlobe sometimes divided again; upper lip 2-lobed or entire. Stamens covered by the upper lip. Disk equal-sided.
- 32. Upper lip of corolla distinctly 2-lobed. Mouth of calyx oblique. Anther-cells in line with each other (parallel).
- 33. Flowers densely spicate, reddish violet, pink or rarely white; verticillasters 6-flowered. Calyx 10-nerved. Corolla inside with a ring of hairs. Anthers of the 2 anterior stamens short-hairy, as are all filaments. Ovary truncate, apically finely pubescent. Nutlets with apical bristles . . . . . **7. Achyrospermum**
- 33. Flowers in ∞-flowered cymes often combined into panicles; at least the lower cymes stalked. Calyx 15-nerved. Corolla white, red-dotted tube glabrous inside. Filaments glabrous. Ovary not truncate, glabrous like the nutlets. Cultivated . . . . . **Nepeta**
- 32. Upper lip of corolla entire, or at most emarginate.
- 34. Flowers at least 1.5 cm long, often much longer.
- 35. No stellate hairs present. Corolla tube on the inside with a transverse ring of hairs.
- 36. Stamens not projecting from below the upper lip of the corolla. Anther-cells 2, ± in a line with each other. Cymes not terminating in cincinni. Corolla white or pale yellow, not variegated . . . . . **18. Paraphlomis**
- 36. Stamens far projecting from below the upper lip, 2 posterior ones with 1 anther-cell, 2 anterior ones with 2 parallel cells. Cymes terminating in rather long cincinni. Corolla white or with a violet lower lip . . . . . **8. Anisomeles**
- 35. Stellate hairs present at least on some part of the plant, especially on the lower surface of the leaves and the outside of the calyx, often intermixed with simple hairs. Corolla tube glabrous or hairy inside but without a ring of hairs, thin at the base, widened above the middle; upper lip distinctly convex. Corolla yellowish white or light yellow . . . . . **5. Gomphostemma**
- 34. Flowers less than 1.5 cm long.
- 37. Flowers in verticillasters, these often spicately arranged.
- 38. Leaves oblong-lanceolate, from a truncate or cordate base, obtuse or rounded. Flowers reddish violet . . . . . **22. Stachys**
- 38. Leaves ovate to rhomboid, with a cuneate base attenuate in the petiole, apex acute. Flowers white . . . . . **10. Eurysolen**

37. Flowers cymose or paniced, not in spikes or verticillasters, yellow, often brownish red spotted.
39. Flowers 4–7 mm long, in terminal and/or axillary, compound cymes. Calyx 2–3 mm long. Ovary slightly 4-lobed, style arms subequal. Nutlets reticulate-rugose with very large lateral contact scars.
40. Upper lip of corolla spreading, reflexed. Long-soft-hairy condensed plant with a prostrate soft-woody stem less than 10 cm long and crowded large leaves 15–20 by 10–12 cm; internodes c. 0.5 cm. Calyx 2.5–3 mm long (in fruit 3–4 mm). Corolla pale, 6–7 mm long, sulphur-yellow, endlobe white, tube dark red . . . **1. Acrymia**
40. Upper lip of corolla erect, arched (hooded). Habit quite different from the above. Calyx 2–2.2 mm long. Corolla 4–5 mm long, pale yellow, lower lip with a red blotch . . . **3. Cymaria**
39. Flowers 11–14 mm long, yellow, upper lip often brownish red, often paniced; inflorescence not distinctly forked and not ending in cincinni. Calyx 3.5–8 mm long. Ovary deeply 4-partite, glabrous. Style-arms very unequal. Nutlets obtusely trigonous, smooth . . . **16. Microtoena**

### 1. ACRYMIA

PRAIN, Kew Bull. (1908) 114; KENG, Gard. Bull. Sing. 24 (1969) 29. — **Fig. 1.**

Herb or undershrub. *Flowers* small, in terminal and axillary, many-flowered, peduncled, compound cymes. *Calyx* subcampanulate, 8-nerved, 5-toothed, the teeth subequal; throat naked within. *Corolla* shortly exerted, tube slightly enlarged upwards; limb 2-lipped, upper lip suberect or recurved, 2-fid, lower lip 3-lobed, spreading, midlobe larger than the lateral ones. *Stamens* 4, exerted, in



Fig. 1. *Acrymia ajugiflora* PRAIN, at foot of Kanching Ridge, Kanching For. Res., Selangor, Malaya. Leaves dark green, pale veined, flowers white with dark red throat (Photogr. J. A. REID, July 1953).

2 pairs, the upper pair slightly shorter; anthers reniform, 2-celled, at length confluent. Disk small, equal, entire. Style briefly 2-fid, branches very short. *Nutlets* obovoid, rugose and hirsute, scar very large, lateral.

Distr. Monotypic; in *Malesia*: Malay Peninsula.

**1. *Acrymia ajugiflora*** PRAIN, Kew Bull. (1908) 114; J. As. Soc. Beng. 74, ii (1908) 878; in Hook. f. Ic. Pl. 30 (1911) t. 2946; RIDL, Fl. Mal. Pen. 2 (1923) 654; HEND. J. Mal. Br. R. As. Soc. 17 (1939) 65; KENG, Gard. Bull. Sing. 24 (1969) 29, f. 3, pl. 1. — Fig. 1.

Low herb or undershrub. Stem soft woody, prostrate and rooting below, densely leafy above. Leaves thin chartaceous, elliptic to broadly elliptic, 15–20 by 10–12 cm, obtuse, base broadly acute or subtruncate, at margin irregularly serrate or doubly serrate, hirsute and strigose on both sides, especially along the nerves; petiole 3–4 cm, hirsute and strigose. *Compound cymes* dichotomously branched, with terminal flowers; flowers on the branches secund; peduncles slender, 6–8 cm. Bracteoles subulate, shorter than the pedicels. Pedicels slender, strigose, 2–3 mm long. *Calyx* campanulate, 2.5–3 mm long, in fruit 3–4 mm; teeth triangular, subequal in length, ciliate. *Corolla*

pale sulphur, endlobe white, tube dark red, 6–7 mm long, glabrous; upper lip suberect or recurved, 2-lobed, lobes oblong; lower lip spreading, 3-lobed, midlobe very large, obovate to orbicular. *Anthers* 2-celled, at length confluent; filaments exerted, hirsute only at base, glabrous elsewhere. *Nutlets* obovoid, subtriquetrous, 1.2–1.5 by 1 mm, rugose, sparsely hirsute.

Distr. *Malesia*: Malay Peninsula (Perak, Selangor).

Ecol. Undergrowth in dipterocarp forest on distinctly sandy soil at the foot of quartzite ridges (Klang Gates). As REID (Mal. Nat. J. 14, 1959, 27) pointed out former records from limestone rest on an error through confusion with the nearby limestone of Bt. Takun. A rare lowland plant. *Fl.* Jan.–Febr.

Note. A rather unique plant resembling *Gomphostemma* in habit, *Ajuga* in corolla structure, and *Cymaria* in inflorescence and fruit.

## 2. AJUGA

LINNÉ, Gen. Pl. ed. 5 (1754) 246; Sp. Pl. (1753) 561; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1895) 209; KENG, Gard. Bull. Sing. 24 (1969) 31. — Fig. 2.

Annual or perennial herbs. *Verticillasters* (in Mal. *sp.*) many-flowered, axillary or in terminal leafy spike-like inflorescence. *Calyx* usually 10-nerved; teeth 5, subequal. *Corolla* exerted; tube often annulate within; limb 2-lipped, upper lip usually very short, 2-fid, lower lip long and spreading or slightly concave, 3-lobed, midlobe the largest, often notched at apex. *Stamens* 4, in 2 pairs, ascending, exerted; anthers 2-celled, divaricate, often confluent at length. Disk equal-sided or produced behind. *Ovary* shortly 4-lobed; style 2-fid at the end, arms subequal. *Nutlets* elliptic or obovoid, reticulate-rugose; scar very large, lateral.

Distr. About 50 *spp.*, throughout the Old World, in *E. Malesia* 1 *sp.*, in E. Australia and Tasmania 2 *spp.*

Ecol. Mainly temperate, but in the Malesian tropics also in the lowland.

**1. *Ajuga bracteosa*** WALL. (Cat. 1829, n. 2032, *nomen* ex BTH. in Wall. Pl. As. Rar. 1 (1830) 59; Lab. Gen. Sp. (1835) 696; in DC. Prod. 12 (1848) 597; HOOK. f. Fl. Br. Ind. 4 (1885) 702; MERR. En. Philip. 3 (1923) 408; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 287; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 224; HOLTH. & LAM, Blumea 5 (1942) 237; HARA, En. Sperm. Jap. 1 (1948) 192; QUIS. Medic. Pl. Philip. (1951) 811; MASAM. Ic. Rep. Kanazawa Un. 4 (1955) 50; HATUS. Mem. Fac. Agr. Kagoshima Un. 5, 3 (1966) 48; KENG, Gard. Bull. Sing. 24 (1969) 31, f. 4. — *A. remota* BTH. in Wall. Pl. As. Rar. 1 (1830) 59. — *A. macrosperma* (non WALL.) MIQ. Fl. Ind. Bat. 2 (1859)

991. — *Bulga pyramidalis* (L.) O.K. var. *bracteosa* (WALL.) O.K. Rev. Gen. Pl. 2 (1891) 513. — Fig. 2.

Low, diffuse, much branched herb, usually less than 20 cm. Stem and branches from the rootstock, erect or ascending, generally hispid. Leaves oblanceolate, narrowly obovate or subspatulate, hirsute on both surfaces, 4–8 by 2–3 cm, obtuse or rounded, base cuneate or gradually attenuate, margin undulate; upper leaves sessile, lower ones shortly petioled. *Flowers* many in axillary verticillasters, sometimes crowded in a terminal, spike-like inflorescence, with ovate or cuneate-obovate, entire or toothed prominent bracts. *Calyx* campanulate, often ± oblique, 3–3.5 mm long, teeth

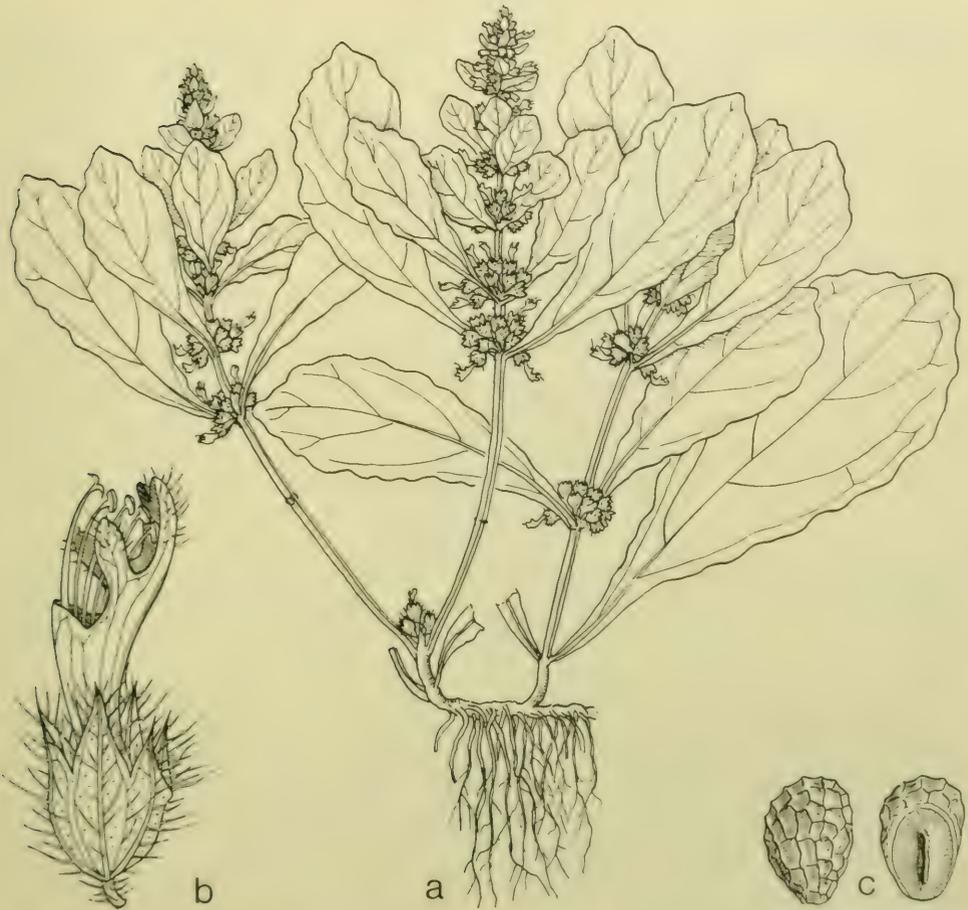


Fig. 2. *Ajuga bracteosa* WALL. ex BTH. a. Habit,  $\times 2/3$ , b. flower, c. nutlet, in two views, one showing the large hilum, both  $\times 4$  (a FORSTEN s.n., b-c PLEYTE 171).

triangular. Corolla white or pale blue (QUIS. l.c.), the tube straight, exerted, not inflated at base; lower lip 2 mm long, 3-lobed, hirsute without. Stamens exerted, the cells confluent, often hairy. Nutlets obovoid, 1.5–2 by 1 mm, shallowly rugose-reticulate, yellowish.

Distr. From Afghanistan through continental SE. Asia (India, Burma, Thailand, Indo-China, S. China to Formosa and the Ryu Kyu Is.); in Malesia: Philippines (Batan Is., Luzon, Mindanao), Talaud Is., N. & E. Celebes, Moluccas (Ternate, Halmahera), and W. New Guinea (Jappen I.: Serui).

Ecol. Stream banks and shaded ravines, also in open grassland, clearings, rice-fields, and coffee estates, mostly in damp places, in Indonesia below c. 200 m, but in the Philippines from 600–1700 m (MERR. l.c.). Fl. Jan.–Dec.

Vern. *Tilad*, Celebes, *sabasasi*, Jappen I.

Uses. Unknown in Malesia; in India leaves are said to be used medicinally (KIRTIKAR & BASU, Ind. Medic. Pl. 1918, 1048) and recorded to have a peculiar resinous odor and bitter taste.

Notes. Specific delimitation is in some alliances of this genus difficult. BENTHAM (Fl. Austr. 5, 1870, 136) already remarked that one of the Australian species could be hardly distinguished from the northern hemisphere *A. genevensis*. In contrast to HOOKER f. and MUKERJEE, I have taken the species in a more restricted sense, not including several synonyms, hence not occurring in Ethiopia and Japan. In comparison with the type (WALLICH 2032) Malesian specimens have more elongate and less hairy leaves and a shorter corolla. They match better the type of *A. remota* BTH. (WALLICH 2033), but there are intermediates and the latter is unanimously reduced to the former.



Fig. 3. *Cymaria dichotoma* BTH. a. Habit,  $\times \frac{2}{3}$ , b. fruiting calyx,  $\times 8$ . — *C. elongata* BTH. c. Fruiting calyx,  $\times 8$  (a-b Timor ZIPPELIUS 430 in L, c ex Flores CHB XV.K.B.XXVI.6 in L).

## 3. CYMARIA

BTH. Bot. Reg. *sub t.* 1292 (1830); BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1895) 209; KENG, Gard. Bull. Sing. 24 (1969) 63. — *Anthocoma* ZOLL. & MOR. Nat. Geneesk. Arch. N. I. 2 (1845) 569. — **Fig. 3.**

(Sub)shrubs. Stems and branches faintly 4-angled. *Flowers* small, in lax, many-flowered, peduncled, dichotomously branched cymes; cymes usually axillary, sometimes the upper ones forming a terminal thyrsoid inflorescence. *Calyx* campanulate (in fruit urceolate or subglobose), 10-nerved, intermediate nerves weaker than the other 5, equally 5-toothed. *Corolla* tube straight, exerted; limb 2-lipped, upper lip arched, erect, lower lip 3-lobed, spreading, midlobe larger than the lateral. *Stamens* 4, ascending under the upper lip, in 2 pairs, upper pair shorter; anthers 2-celled, divaricate, cells connivent, at length confluent. Disk equal, entire. Style 2-fid at apex, upper branch very short. *Nutlets* subglobose or obovoid, subtriquetrous, rugose, apex beset with white hairs; scar of contact surface very large, lateral.

Distr. About 2  *spp.* in continental Asia (Burma, Thailand, Indo-China, Hainan) and *Malesia*.  
Ecol. Bound to a seasonal lowland tropical climate.

## KEY TO THE SPECIES

1. Fruiting calyx urceolate, 2–2.5 mm long, with deltoid teeth. Corolla 2–2.5 mm long. Leaves membranaceous, glabrescent or puberulent . . . . . **1. C. dichotoma**  
1. Fruiting calyx campanulate, 5 mm long, with lanceolate teeth. Corolla 5.5–6 mm long. Leaves chartaceous to coriaceous, tomentose or densely woolly . . . . . **2. C. elongata**

**1. Cymaria dichotoma** BTH. (in Wall. Cat. 1829, n. 2080, *nomen*) Bot. Reg. *sub t.* 1292 (1830); in Wall. Pl. As. Rar. 1 (1830) 64; Lab. Gen. Sp. (1835) 705; in DC. Prod. 12 (1848) 603; MIQ. Fl. Ind. Bat. 2 (1859) 992; Hook. *f.* Fl. Br. Ind. 4 (1885) 705; PRAIN, J. As. Soc. Beng. 66, ii (1899) 522; *ibid.* 74, ii (1907) 826; RIDL. Fl. Mal. Pen. 2 (1923) 654; HEND. J. Mal. Br. R. As. Soc. 17 (1939) 66; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 227; KENG, Gard. Bull. Sing. 24 (1969) 65, f. 10 a–d. — *C. acuminata* DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 399 (Herb. Timor. Descr. 1835, 71); DELESS. Ic. Pl. 3 (1837) t. 86; BTH. in DC. Prod. 12 (1848) 602; MIQ. Fl. Ind. Bat. 2 (1859) 992; F.-VILL. Nov. App. (1880) 166; VIDAL, Phan. Cuming. Philip. (1885) 136; Rev. Pl. Vasc. Filip. (1886) 214; PRAIN, Ann. Bot. 6 (1892) 215; VAL. Bull. Dép. Agr. Ind. Néerl. 10 (1907) 53; MERR. En. Philip. 3 (1923) 408; BACK. & BAKH. *f.* Fl. Java 2 (1965) 617; KENG, Gard. Bull. Sing. 24 (1969) 63, f. 10 e–f (excl. *syn. C. timoriensis* BACK.). — *Anthocoma flavescens* ZOLL. Nat. Geneesk. Arch. N. I. 2 (1845) 569; HASSK. Flora 30 (1847) 596. — *Gomphostemma dichotomum* Z. & M. in Moritzi, Syst. Verz. (1846) 54; HASSK. Flora 30 (1847) 596 (not based on BTH.). — *C. mollis* MIQ. Fl. Ind. Bat. 2 (1859) 992; WARB. Bot. Jahrb. 18 (1893) 208; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 527; MANSFELD, Bot. Jahrb. 62 (1929) 377. — *Gomphostemma flavescens* (ZOLL.) MIQ. Fl. Ind. Bat. 2 (1859) 987; KOORD. Exk. Fl. Java 3 (1912) 143. — *Phlomis flavescens* (ZOLL.) BOERL. Handl. 2 (1899) 716, non MILL. 1768. — **Fig. 3a–b.**

Shrub, 0.5–2 m. Stem and branches finely pubescent. *Leaves* membranaceous, sometimes

very thin, narrowly elliptic, ovate to rhomboid, 5–11 by 3.5–6 cm, acute or subacute, rarely acuminate, serrate, crenate or remotely dentate, base cuneate or attenuate, entire; glabrous or finely hirsute above, appressed-pubescent beneath; petiole 0.5–2 cm, finely puberulent. *Flowers* small, 4–15 secundly arranged on the branches of axillary and terminal cymes; main peduncles 0.5–3 cm, finely pubescent. Bracts under the branches ovate, spatulate to lanceolate, 3–5 mm long. Pedicels short and slender, finely pubescent. *Calyx* campanulate, 1.5 mm long (in fruit urceolate, 2–2.5 mm long, often crowned with the erect, deltoid teeth), glandular and pubescent; teeth triangular. *Corolla* whitish, pale yellow or yellow, with a red basal spot in lower lip, 2–2.5 mm long, outside finely pubescent. Filaments ascending under the upper lip, included. *Nutlets* obovoid, 1.2–1.5 by 0.6 mm, reticulate, apex glandular and beset with short stiff hairs.

Distr. Continental SE. Asia (Burma, Thailand, Indo-China, Hainan) and *Malesia*; through *Malesia*, but very rare in the Malay Peninsula, absent in Sumatra, Borneo, western half of Java, Celebes except in the south, and Lesser Sunda Is., in the Moluccas only in Babar and Tenimbar Is.

Ecol. Distinctly bound to a seasonal, lowland climate, in Malay Peninsula and Puger (SE. Java) on limestone rocks, in open thickets and secondary growths, forest edges, deciduous forest, below 500 m *Fl.* (Jan.–)March–Aug.–(Oct.).

Vern. *Lukat lukut*, Luzon, *nigu nigu*, Sulu Is.

Notes. In my precursor I have kept *C. dichotoma* and *C. acuminata* as distinct, but a re-examination of the variability of the size and shape

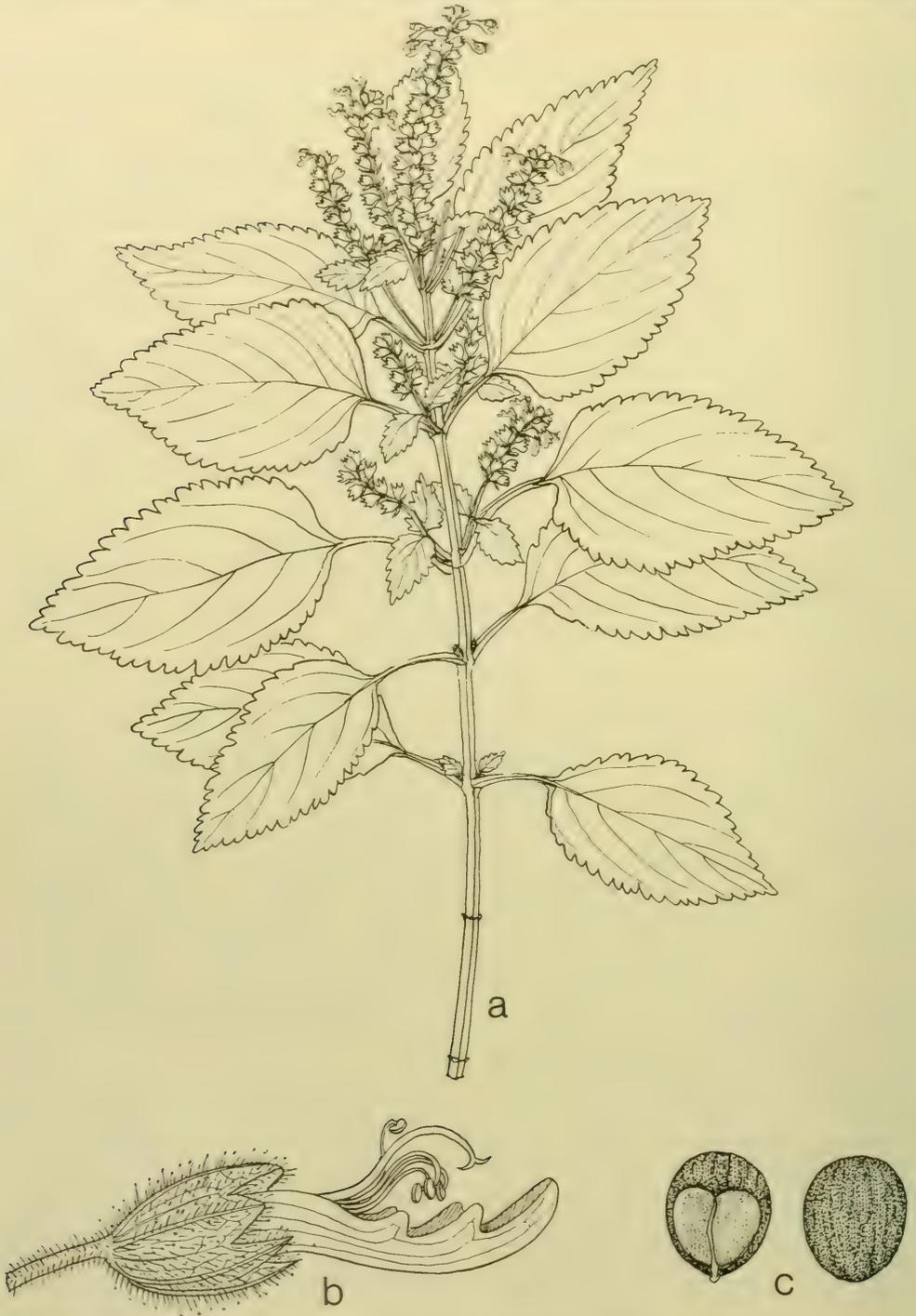


Fig. 4. *Teucrium viscidum* BL. *a.* Habit,  $\times \frac{2}{3}$ , *b.* flower,  $\times 8$ , *c.* seed from two sides, inner surface with large hilum,  $\times 14$  (J. J. SMITH 840).

of the leaves, the length of the main peduncles, etc. are too inconstant; the intermediates showed that this distinction is not tenable. The Timor specimens cited in the precursor (*l.c.* 64) have appeared to belong to a second species.

2. *Cymaria elongata* BTH. (in Wall. Cat. 1829, n. 2079, *nomen*; Bot. Reg. *sub t.* 1292, 1830, *nomen*) in Wall. Pl. As. Rar. 1 (1830) 64; Lab. Gen. Sp. (1835) 705; in DC. Prod. 12 (1848) 603; HOOK. f. Fl. Br. Ind. 4 (1885) 705; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 228. — *C. timoriensis* BACK. in sched.; KENG, Gard. Bull. Sing. 24 (1969) 64, in *nota, nomen*. — Fig. 3c.

Shrub. Stem and branches tomentose or densely villose. Leaves thin- to thick-coriaceous, oblong-ovate or ovate, 4.5–7 by 2.5–3.5 cm, acute or obtuse, serrate or crenate, puberulent or densely villose above, tomentose or densely woolly beneath, base rounded, shortly attenuate, entire; petiole 0.5–1 cm, tomentose. Flowers small, 6–15 secundly arranged on the branches of axillary and terminal cymes; main peduncles 0.2–0.5 cm long, densely villose. Bracts and bracteoles subulate, minute. Flowers almost sessile. Calyx tubular, 3.5–4 mm long (in fruit campanulate, slightly inflated below, 5 mm), glandular and woolly; teeth lanceolate.

Corolla 5.5–6 mm long, outside finely pubescent. Filaments ascending under the slightly arched upper lip, included. Style 2-branched at tip, shortly exposed. Nutlets obovoid-ellipsoid, subtriquetrous, 1.8 by 0.8 mm, coarsely reticulate, apex beset with soft hairs.

Distr. India (Burma), in *Malesia*: Lesser Sunda Is. (Timor; Atapupu).

Ecol. Obviously as the former species confined to regions with a distinctly seasonal climate.

Notes. At Leyden there are two collections (TEYSMANN 11672) from Timor and a duplicate from a plant grown in Hort. Bog. *sub* XV.K.B. XXVI.6 said to come from Flores. The late Dr. BACKER recognized this as a new species in MS which I referred with doubt to *C. acuminata* in my precursor. However, it appears distinct and supposed to be conspecific with *C. elongata*.

#### Excluded

*Cymaria triphylla* BACK., *inedit.* Under this name plants were distributed which have appeared to belong to *Vitex cymarioides* LAM & MEEUSE, Blumea 3 (1939) 248 = *Garrettia siamensis* FLETCHER, *cf.* BACK. & BAKH. f. Fl. Java 2 (1965) 612 (*Verbenaceae*).

## 4. TEUCRIUM

LINNÉ, Gen. Pl. ed. 5 (1754) 247; Sp. Pl. (1753) 562; BTH. in B. & H. Gen. Pl. 2 (1876) 1221; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1895) 210; KENG, Gard. Bull. Sing. 24 (1969) 175. — Fig. 4.

Annual or perennial hairy herbs (in Mal.); hair sometimes capitate-glandular. Leaves decussate. Flowers either 2 in a verticillaster, secund, forming terminal and axillary raceme-like inflorescences, or 6–18 in a verticillaster forming terminal and axillary cylindrical thyrses. Calyx campanulate, 10-nerved, 5-toothed with the upper 3 teeth slightly longer, less conspicuously 2-lipped. Corolla exerted; tube without a hair-ring inside; limb 2-lipped, the upper lip deeply 2-lobed, seemingly absent, the lower lip 3-lobed, associated with the two upper lobes forming a 5-lobed whole. Stamens 4, exerted, two lower ones longest; anthers reniform, 2-celled, at length confluent. Disk symmetrical. Style 2-fid, branches subequal. Nutlets flattened, subtriquetrous, rugose or reticulate; surface of contact large, oblique, lateral.

Distr. About 100 *spp.*, worldwide, many in the Mediterranean area; in *Malesia*: 3 *spp.* in the montane zone.

#### KEY TO THE SPECIES

1. Inflorescence raceme-like, with 2 flowers in each verticillaster.
  2. Plant distinctly to densely, patently often yellowish-long-pubescent on stems, rachis, and at least the underside of the leaf. Lower leaves rather shortly petioled; marginal teeth proportionally fine. Calyx teeth unequal, upper ovate-acute, lower narrow-acute, laterals shorter, ovate-deltoid bluntish. Corolla *c.* 12 mm (stretched). Floral bracts ovate-lanceolate, distinctly narrowed at both ends, narrower than the calyx and hardly as long . . . . . 1. *T. wightii*
  2. Plant sparsely hairy to glabrescent; stem and rachis puberulous to short hairy, the hairs curved and appressed. Lower leaves with long petioles; marginal teeth rather coarse. Calyx teeth equal. Corolla 6–9 mm (stretched). Floral bracts lanceolate, acute, narrower than and not concealing the calyx . . . . . 2. *T. viscidum*
1. Inflorescence a cylindrical thyrse, each verticillaster consisting of a pair of 3 9-flowered dichasia . . . . . 3. *T. corymbosum*

1. *Teucrium wightii* Hook. f. Fl. Br. Ind. 4 (1885) 701; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 220. — *T. tomentosum* WIGHT, Ic. (1849) t. 1458. — *T. quadrifarium* (non HAM. ex D. DON) KENG, Gard. Bull. Sing. 24 (1969) 175.

Erect annual, 0.5–1 m. Stem, branches, and leaves rather densely patent-pubescent, often yellowish. *Leaves* chartaceous, narrowly elliptic to ovate, 6–9 by 2–4 cm, serrulate, bluntly acute, base truncate or cordate, often oblique; margin slightly rugose above; petiole 1–1.5 cm, uppermost leaves subsessile. *Spurious racemes* axillary and terminal, generally forming panicles 7–10 cm long, in fruit to 15 cm or more. Pedicels 2–3 mm. Bracts ovate-lanceolate, acuminate, cuneate at base, smaller than the calyx. *Calyx* tubular-campanulate, pubescent, purple, 3–5 mm long, in fruit 6–7 mm, upper tooth ovate, broad, 2 lower teeth lanceolate, 1.5–2 mm long, the lateral teeth shorter than the others, broad-ovate deltoid, bluish. *Corolla* white with pale rosa markings on lip, expanded and recurved, 15–20 mm. *Nutlets* ovoid, 1.5 by 1 mm, rugose, dark-brown.

Distr. India, Thailand, to Kwantung; in *Malesia*: N. Sumatra (Gajo Lands: Takengon), one collection.

Ecol. Moist secondary forest, locally common, c. 1300–1400 m. *Fl.* Aug.

Notes. I have earlier referred the N. Sumatran plant to *T. quadrifarium* HAM. ex D. DON. Closer study showed that Asian material distributed under the latter name is often not homogeneous. Following HOOKER's interpretation of DON's species shows that this is clearly distinct from the Sumatran plant by the very much larger, broader bracts broadly rounded or almost truncate at base, which especially at the tips of racemes conceal the flowers and are neatly arranged in a 4-ranking strobiloid shape, DON saying: "*bractea cordatae, acuminatae, foliaceae, quadrifariam imbricatae*".

It seems that the N. Sumatran material is best arranged with *T. wightii*, which was originally described from the Nilghiries; but I saw at Leiden matching material from Thailand and Kwantung, and still other localities may turn up among erroneously named *T. quadrifarium*.

2. *Teucrium viscidum* BL. Bijdr. (1826) 827; HASSK. Cat. Hort. Bog. (1844) 133; MIQ. Fl. Ind. Bat. 2 (1859) 991, incl. var. *densiflora* MIQ.; MERR. En. Philip. 3 (1923) 409; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 295; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 218; BACK. & BAKH. f. Fl. Java 2 (1965) 618; CHOW, Acta Phytotax. Sin. 10 (1965) 330; KENG, Gard. Bull. Sing. 24 (1969) 176. — *T. stoloniferum* HAM. ex BTH. in Wall. Pl. As. Rar. 1 (1830) 58; ROXB. (Hort. Beng. 1814, 44, *nomen*) Fl. Ind. ed. Carey 3 (1832) 3; BTH. Lab. Gen. Sp. (1835) 674; in DC. Prod. 12 (1848) 583; MIQ. Fl. Ind. Bat. 2 (1859) 990; MAXIM. Bull. Ac. Imp. Sc. St. Pétersb. 9 (1877) 825, *pro var. typicum*; WARB. Bot. Jahrb. 13 (1891) 425; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 527; KOORD. Exk. Fl. Java 3 (1912) 142; BOLD. Zakkfl. (1916) 110. — *Melissa inodora* HASSK. Tijds. Nat. Gesch. Phys. 10 (1843) 127; Cat. Hort. Bog. (1844) 132; MIQ. Fl. Ind. Bat. 2 (1859) 969, *sec. KOORD.* Exk. Fl. Java 3 (1912) 142. — *T. philippinense* MERR. Philip. J. Sc. 7 (1912) Bot. 100 — Fig. 4.

Erect annual, 20–80 cm, often branched and

stoloniferous. Stem and branches hirsute, viscous-glandular. *Leaves* membranaceous, slightly fetid, narrowly ovate to ovate, 4–7 by 3–4 cm, distinctly crenate-serrate, acute or broadly acute, base cuneate or round, both surfaces scattered with weak, white hairs; petiole slender, 1.5–3 cm. Raceme-like *inflorescences* terminal and axillary, 2–3 cm long, in fruit up to 10 cm, densely or sparsely covered with both non-glandular and viscous, glandular hairs. Pedicels 2–3 mm. Bracts pilose, lanceolate, 2–3 mm. *Calyx* campanulate, 2–3 mm long, in fruit: urceolate or tubular, 3–6 mm, glandular-ciliate, 3 upper teeth ovate or triangular, 2 lower ones slightly narrower. *Corolla* pinkish to purple, slender, exerted, 5–8(–12) mm long, slightly concave. *Nutlets* shallowly ridged, ovoid or globose, 1.5 mm long.

Distr. India, Burma, Thailand, Indo-China, Hongkong to China, Korea, Formosa, and Japan; in *Malesia*: Central Sumatra, Java (mainly in W, Mt Gedeh-Mt Tjeremai, rare eastward: Mt Wilis, ?Tengger), Lesser Sunda Is. (Bali, Lombok, Timor), Philippines (Luzon), and New Guinea.

Ecol. Shaded localities, in forests and thickets, also sometimes on limestone rocks, occasionally in coffee estates, usually locally common, (550–) 800–1700 m. *Fl.* Jan.–Dec., mainly March–June.

Vern. Java: *sangkanet*, S, *rukuku*, J; New Guinea: *funeh*, MUSA lang., *Safia*, *kalal-anarg*, Amele lang., Amele, *iebiyhaai*, Hattam lang., Mt Arfak.

3. *Teucrium corymbosum* R. BR. Prod. (1810) 504; BTH. in DC. Prod. 12 (1848) 577; Hook. f. Fl. Tasm. 1 (1857) 285; BTH. Fl. Austr. 5 (1870) 133; CURTIS, Stud. Fl. Tasm. 3 (1967) 556. — *Scoparia australis* SIEB. in Schult. Mant. (1822) 66. — *Anisomeles australis* (SIEB.) SPRENG. Syst. Veg. Cur. Post. (1827) 226.

Erect or sprawling perennial, to 1 m high, weakly woody beneath. Stem, branches and leaves covered with short white hairs. *Leaves* chartaceous, narrowly elliptic to narrowly obovate, 2–5.5 by 0.8–2 cm, remotely serrate or deeply toothed, acute, base attenuate; petiole 0.5–1 cm long. Cylindric *thyrses* terminal and in the upper axils, 12–15(–25) cm long, consisting of 6–10 verticillasters, each verticillaster consisting of a pair of 3–9 flowered dichasia. Pedicels 3–5 mm long. Bracts linear, minute. *Calyx* campanulate, pilose, 2–2.5 mm long, 5-lobed; lobes lanceolate, spreading, 3 upper ones slightly longer than the 2 lower ones. *Corolla* white, 5–6 mm long, the lowermost lobe shallowly boat-shaped. *Nutlets* elliptical, flattened, 1–1.2 mm (immature) long, hispid.

Distr. Australia (Queensland, New South Wales, Victoria, S. Australia, and Tasmania); in *Malesia*: East New Guinea (Kainantu, Eastern Highlands), once collected.

Ecol. On riverside, at 1450 m. *Fl.* Febr.

#### Doubtful & Excluded

*Teucrium melissaefolium* NORONHA, Verh. Bat. Gen. 5 (1790) ed. 1, art. IV, 27, repr. 85, *nomen*.

Identity unchecked, possibly *T. viscidum* BL.

*Teucrium virginicum* (non L.) THUNB. Fl. Jav. (1825) 15, *nomen*.

Identity unchecked, possibly *T. viscidum* BL.

*Teucrium oliganthum* HASSK. Cat. Hart. Bog. (1844) 310.

This was described from Japanese specimens cultivated in the Botanic Gardens, Bogor.

## 5. GOMPHOSTEMMA

WALL. *ex* BTH. Bot. Reg. *sub* t. 1292 (Jan. 1830) *nom. valid.*; in Wall. Pl. As. Rar. 2 (1830-31) 12; PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 242; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1895) 223; KENG, Gard. Bull. Sing. 24 (1969) 79. — **Fig. 5.**

Perennial herbs or undershrubs, sometimes with tuberous roots. Stem coarse, tomentose or stellately pubescent. *Leaves* opposite, large, mostly long-petioled. *Flowers* medium or large, in few- to many-flowered verticillasters, often forming densely sessile or laxly branched cymose inflorescences, rarely seemingly racemose. Bracts ovate, lanceolate or linear. *Calyx* campanulate, 10-nerved, subequally 5-toothed. *Corolla* creamy to orange-yellow, tube slender, erect or incurved; throat narrow or inflated; limb 2-lipped, the upper lip galeate, entire or emarginate, the lower lip spreading, broadly 3-lobed. *Stamens* 4, pubescent, all ascending, the lower pair longer; anthers connivent in pairs, each anther 4-celled in bud, later 2-celled, cells transverse, parallel. Disk subequal or gibbous behind. Style very briefly 2-branched, lobes subulate, anterior one slightly longer. *Nutlets* drupaceous, glabrous or pubescent, pericarp usually fleshy and white, with a broad hilum; only 1 or 2, rarely all 4 developed.

Distr. About 30 *sp.*, continental SE. Asia (E. India and Burma to SW. China); in *Malesia*: 8 *sp.*, mostly in Sumatra and Malaya, not extending east of the Philippines, Celebes and Bali.

Ecol. Mostly in everwet rain-forest, but *G. javanicum* also in seasonal teak-forest in Java, mostly below 1000 m, rarely (*G. javanicum*) extending locally to 1500, 1800, and even 2400 m.

Note. PRAIN *l.c.* subdivided the genus into 3 sections, essentially based on corolla characters and this has also been the basis for the key here. In addition, the structure of the inflorescence and shape and size of the calyx have been found useful to differentiate the Malesian species.

## KEY TO THE SPECIES

1. Corolla with almost straight tube and narrow throat, glabrous inside. Nutlets usually 1 or 2. *Sect. Stenostoma.*
2. Calyx teeth triangular or lanceolate, much shorter than the tube.
  3. Flowers few in a verticillaster and forming an axillary spurious raceme. Calyx (in flower) 10-12 mm long . . . . . 1. *G. dolichobotrys*
  3. Flowers many in densely congested axillary verticillasters. Calyx 6-8 mm long . . . . . 2. *G. microcalyx*
2. Calyx teeth linear-subulate or narrow lanceolate, as long as or longer than the tube. Flowers in lax, axillary, peduncled, often branched cymes.
  4. Calyx teeth narrow lanceolate, nearly as long as the tube. Plant generally covered with golden yellow or dark brownish tomentum . . . . . 3. *G. parviflorum*
  4. Calyx teeth linear-subulate, considerably longer than the tube. Plant generally covered with ash-grey tomentum . . . . . 4. *G. crinitum*
1. Corolla with broad, distinctly incurved tube and inflated throat. Nutlets usually 1-4.
5. Corolla tube hirsute inside, and included in the calyx; lips small. Nutlets usually 1-3. *Sect. Podosiphon*
  5. *G. hemsleyanum*
5. Corolla tube glabrous inside, and exceeding the calyx; lips large and prominent. Nutlets usually 4. *Sect. Gomphostemma.*
  6. Calyx tube not ribbed. Ovary glabrous or punctate. Flowers in lax, peduncled, branched cymes. Stem ascending. . . . . 6. *G. curtisii*
  6. Calyx tube often conspicuously ribbed. Ovary villous or hispid. Flowers more or less congested in axillary verticillasters. Stem erect.
    7. Calyx teeth generally shorter than the tube. Flowers c. 10-15 in a verticillaster. Bracts linear-lanceolate. Calyx (in flower) 10-15(-20) mm long . . . . . 7. *G. javanicum*
    7. Calyx teeth often considerably longer than the tube. Flowers c. 20 in a verticillaster. Bracts subulate. Calyx (in flower) 18-25 mm long . . . . . 8. *G. scortechinii*

1. *Gomphostemma dolichobotrys* MERR. Contr. Arn. Arb. 8 (1934) 148. — *G. racemosum* H. KENG, Gard. Bull. Sing. 24 (1969) 80, f. 14. — **Fig. 5a-b.**

Erect herb, to 2 m. Stem, branches, and inflorescence axis densely covered with yellowish brown long, simple and short, stellate hairs. *Leaves* chartaceous, elliptic or ovate-elliptic, 8-20(-25) by

6-13(-14) cm, acute or shortly acuminate, base broadly acute or subrounded; margin denticulate; long, appressed hairs above, ciliate, velutinous beneath, dense stellate hairs on the midrib and nerves; petiole 1-5(-7) cm, densely covered with brown hairs. *Verticillasters* 6-8-flowered, forming an axillary spurious racemose inflorescence 6-7

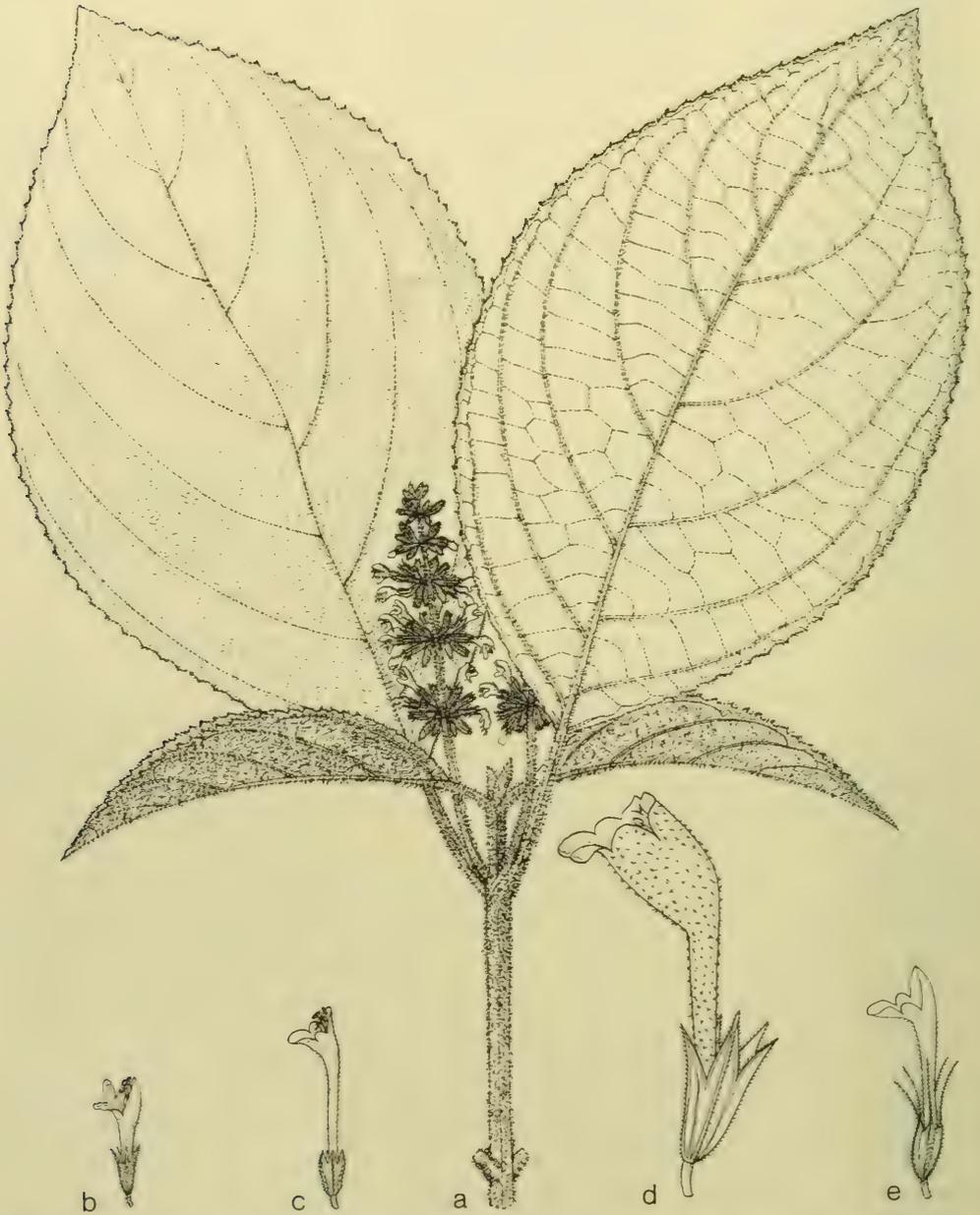


Fig. 5. *Gomphostemma dolichobotrys* MERR. a. Habit,  $\times \frac{1}{2}$ , b. flower. — *G. microcalyx* PRAIN. c. Flower. — *G. scortechinii* PRAIN. d. Flower. — *G. crinitum* WALL. ex BTH. e. Flower. All flowers nat. size (a-b VAN STEENIS 8684, c KUNSTLER 2155, d Scortechini s.n., e GRIFFITH s.n.; c-e after PRAIN).

(-10) cm long excluding the peduncle. Bracts narrowly lanceolate, 6-8 mm, caducous. Pedicels 1.5-2 mm. *Calyx* tubular, 10-12 mm long, densely stellate-pubescent, teeth lanceolate, acuminate, 3-4 mm long. *Corolla* tubular, slender, white, 18-20 mm long, puberulent outside. *Stamens* epicrolline, free portion 4 mm long, ciliate. Ovary glabrous. *Nutlet*, usually only one developed, globose.

Distr. *Malesia*: North Sumatra (Gajo Lands: Takengon; Lau Alas).

Ecol. Rain-forest, along streams, 1000-1150 m. *Fl. Jan.-Aug.*

Note. Readily recognized by the axillary, spurious racemose inflorescence (unique in the genus) and the linear caducous bracts subtending the flowers.

**2. *Gomphostemma microcalyx* PRAIN, J. As. Soc. Beng. 59, ii (1890) 316; Ann. R. Bot. Gard. Calc. 3 (1891) 251, pl. 84; J. As. Soc. Beng. 74, ii (1907) 723; RIDL, Fl. Mal. Pen. 2 (1923) 652; KENG, Gard. Bull. Sing. 24 (1969) 82. — Fig. 5c.**

A coarse perennial herb, 60-150 cm, woody below. Stem stout, erect, hoary pubescent and scabrid. *Leaves* herbaceous, oblong-ovate, 12-15 by 7-9 cm, acute, base abruptly cuneate, entire; margin elsewhere entire or crenate or remotely toothed, finely stellate-pubescent on both surfaces; petiole of upper leaves 1-2 cm, of lower leaves 4-5 cm, scabrid. *Flowers* in dense, few-flowered verticillasters in the axils of the lower leaves and on the bare stem below the leaves. Bracts ovate-lanceolate, entire, 6-7 mm long. *Calyx* 6-7 mm long; teeth short, triangular, less than half as long as the tube. *Corolla* tubular, orange-yellow, cream pale yellow, or whitish, 2.5-3.5 cm long, puberulent outside; throat very narrow. Style and ovary glabrous. *Nutlets* smooth, glabrous.

Distr. *Malesia*: Sumatra, Malay Peninsula, and Borneo.

Ecol. Lowland rain-forest, also in bamboo forest, in Malaya also found on limestone hills, mostly at low altitudes, but in Sumatra ascending to c. 1800 m. *Fl. Jan.-Dec.*

Note. Closely allied to *G. parviflorum* WALL. ex BTH., but with a much smaller calyx with diminutive teeth and a much narrower corolla. The structure of the inflorescence in these two species is also different: verticillasters densely congested in *G. microcalyx*, peduncled, lax and often branched in *G. parviflorum*.

**3. *Gomphostemma parviflorum* WALL. ex BTH. in Wall. Pl. As. Rar. 2 (1830-31) 12, in parte; MIQ. Fl. Ind. Bat. 2 (1859) 987; Hook. f. Fl. Br. Ind. 4 (1885) 697, in parte; PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 252, pl. 86; DUNN, Not. R. Bot. Gard. Edinb. 6 (1915) 189; KOORD. Exk. Fl. Java 3 (1923) 143; BACK. & BAKH. f. Fl. Java 2 (1965) 619; KENG, Gard. Bull. Sing. 24 (1969) 83. — *G. dichotomum* ZOLL. & MOR. Syst. Verz. (1846) 54; MIQ. Fl. Ind. Bat. 2 (1859) 986. — *G. bartlettii* MERR. Pap. Mich. Ac. Sc. 19 (1934) 191.**

Coarse, erect shrub, 2.5-3 m. Stem stout, sulcate, densely brownish stellate-tomentose. *Leaves* chartaceous, elliptic-ovate, 15-20 by 6-10 cm, acute, base attenuate, entire; margin elsewhere finely serrate, hirsute above, densely tomentose beneath;

petiole 2-4 cm, tomentose. *Flowers* in lax or condensed, many-flowered, axillary, peduncled, often branched cymes. Bracts lanceolate to ovate, 1-1.5 cm long. *Calyx* 1-1.4 cm long, densely tomentose outside; teeth narrow lanceolate, nearly as long as the tube. *Corolla* orange to orange-yellow, pale yellow or greenish white, 2-2.5 cm long, outside puberulent, throat narrow. Style and ovary glabrous. *Nutlets* smooth, glabrous, 8 by 3 mm.

Distr. Continental SE. Asia (India, Assam, Khasya, Sikkim, Burma, Thailand to SW. China: Yunnan) and *Malesia*: Sumatra (northern half), West Borneo (once), and West Java (Priangan: Pasir Kiamis near Garut, once).

Ecol. Rain-forest from almost sea-level to c. 1500 m. *Fl. Jan.-Dec.*

Vern. Sumatra: *kotok ring-ring*, Karo-Alas, *sarang banua*, *suri-suri*, Toba-Batak, Asahan.

Note. The single specimen from West Borneo (HANS WINKLER 1113) was in my precursor mentioned under *G. curtisii*.

**4. *Gomphostemma crinitum* WALL. ex BTH. in Wall. Pl. As. Rar. 2 (1830-31) 12; Lab. Gen. Sp. (1835) 648; in DC. Prod. 12 (1848) 552; MIQ. Fl. Ind. Bat. 2 (1859) 987; Hook. f. Fl. Br. Ind. 4 (1885) 695; PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 254, pl. 88; J. As. Soc. Beng. 74, ii (1907) 723, incl. var. *griffithii*; RIDL, Fl. Mal. Pen. 2 (1923) 652; HEND. Mal. Nat. J. 6 (1950) 389, f. 359; KENG, Gard. Bull. Sing. 24 (1969) 84. — *G. parviflorum* (non WALL. ex BTH. 1830) BTH. Lab. Gen. Sp. (1835) 648; in DC. Prod. 12 (1848) 551. — Fig. 5e.**

Coarse perennial herb, 50-150 cm. Stem stout, erect, sulcate, hoary-pubescent or scabrid. *Leaves* herbaceous, elliptic-ovate or oblanceolate, 25-30 by 8-15 cm, acute, base cuneate, entire; margin elsewhere entire or remotely serrate, pubescent above, softly pubescent or tomentose beneath; petiole 2-5 cm, scabrid. *Flowers* in lax or condensed, many-flowered axillary, often branched cymes. Bracts linear, lanceolate or ovate-lanceolate, 1-2 cm long. *Calyx* 1.5-2 cm long, hispid-tomentose; teeth linear subulate, 9-13 mm long. *Corolla* greenish white or yellow, 2.5-3.5 cm long, outside puberulent; throat narrow. Style and ovary glabrous. *Nutlets* smooth, glabrous, 6 by 3 mm.

Distr. Continental SE. Asia (Burma: Tenasserim; Thailand, Indo-China) and *Malesia*: Malay Peninsula (common).

Ecol. Usually on limestone cliffs and at the base of limestone hills, below c. 500 m. *Fl. Jan.-Dec.*

Vern. *Chempaka hutan*, *dërta dapur*, *jênjulong bukit*, *mênjulong bukit*, *mungulon bukit*, M.

Uses. BURKILL (Dict. 1935, 1097) reported that a decoction of the roots is administered after confinement. Pounded leaves, with camphor, are applied to swellings of the groin.

**5. *Gomphostemma hemsleyanum* PRAIN ex COLLETT & HEMSL. J. Linn. Soc. Bot. 28 (1890) 116; PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 250, pl. 82; BACK. & BAKH. f. Fl. Java 2 (1965) 619; KENG, Gard. Bull. Sing. 24 (1969) 85.**

Perennial herb, c. 60 cm. Stem erect, woody, 4-angled, sulcate, densely tomentose. *Leaves* oblong to elliptic ovate, 6-12(-18) by 3.5-4.5(-7) cm, acute; base attenuate; margin crenulate-

serrulate, hispid above, densely greyish tomentose beneath; petiole 1-1.5(-3) cm. *Flowers* ∞, in axillary subglobular verticillasters, the upper ones almost forming an interrupted spurious spike. Bracts linear lanceolate, 6-12 by 2-3 mm. *Calyx* tubular-campanulate, 12-14 mm long, in fruit 16-22 mm; teeth broadly lanceolate, 7-9 mm long. *Corolla* white or creamy yellow, 8-10 mm long, incurved, inside hirsute below the throat. *Nutlets* 1-3, smooth, glabrous, ellipsoid, 4.5(-6) by 2.5 (-5) mm.

Distr. Upper Burma and *W. Malesia*: extreme East Java (near Asem Bagus, once).

Ecol. Seasonally very dry, arid sunny place, at 150 m. *Fl.* May.

The species shows the characteristic disjunct area of species between the drought areas of Burma and Java, cf. STEEN. Reinwardtia 5 (1961) 426, map 6. Asem Bagus is situated in the driest part of Java with only 0-5 rainy days during the four driest consecutive months of the year.

Note. Though the single Javanese record has smaller dimensions in leaves and flowers as compared with the typical form, and the leaf margin is crenulate-serrate instead of 'argute'-serrate, there is no doubt about the identity.

**6. Gomphostemma curtisii** PRAIN, J. As. Soc. Beng. 59, ii (1890) 315; Ann. R. Bot. Gard. Calc. 3 (1891) 266, pl. 92; J. As. Soc. Beng. 74, ii (1907) 725; RIDL. Fl. Mal. Pen. 2 (1923) 654; BURTT, Bull. Bot. Surv. India 7 (1965) 87; KENG, Gard. Bull. Sing. 24 (1969) 85. — *Cyrtandromoea repens* RIDL. J. Str. Br. R. As. Soc. n. 57 (1910) 74; Fl. Mal. Pen. 2 (1923) 543. — *G. parvum* MERR. Pap. Mich. Ac. Sc. 19 (1934) 192.

Coarse perennial herb, 60-150 cm. Stem flexuose, ascending, scabrid. *Leaves* herbaceous, ovate to oblong-ovate, or cordate, 8-12 by 3-7 cm, acute, base very shortly cuneate; margin serrate or denticulate, sparsely hirsute above, appressed tomentose beneath; petiole 3-12 cm, tomentose. *Flowers* many in lax, axillary, branched cymes at the lower part of the stem. Bracts oblong, 10-15 mm long, long-acuminate, entire or crisped. *Calyx* 12-14 mm long, smooth, red glabrous within; teeth subulate-lanceolate, slightly larger than the tube. *Corolla* white, 25-35 mm long, distinctly recurved, outside puberulous. Style and ovary glabrous. *Nutlets* glabrous or punctate, oblong-ovoid, 6 by 3 mm; apex rounded.

Distr. *Malesia*: Sumatra, Malay Peninsula.

Ecol. Hill and montane rain-forest, 250-1300 m. *Fl.* March-Sept.

Vern. *Dukut tawar panas*, Karo-Batak, Asahan.

Notes. The records from Borneo in my precursor are referred now to *G. parviflorum*.

Specimens from the Gajo Lands (N. Sumatra) collected by DE WILDE (12358, 12844, 13483, 13615) deviate in having orange flowers and narrow, fusiform-swollen tuberous roots. Also in other species the colour of the corolla is variable.

**7. Gomphostemma javanicum** (BL.) BTH. Lab. Gen. Sp. (1835) 650; HASSK. Cat. Hort. Bog. (1844) 133; BTH. in DC. Prod. 12 (1848) 553; MIQ. Fl. Ind. Bat. 2 (1859) 986; F.-VILL. Nov. App. (1880) 166; PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 261; KOORD. Exk. Fl. Java 3 (1912) 143; Fl. Tjibodas 3

(1918) fam. 254, p. 83; BACK. & BAKH. f. Fl. Java 2 (1965) 618; KENG, Gard. Bull. Sing. 24 (1969) 86. — *Prasium javanicum* BL. Bijdr. (1826) 840. — *Prasium phlomoides* REINW. ex BL. (Cat. 1823, 84, nomen) Bijdr. (1826) 840. — *G. oblongum* WALL. ex BTH. in Wall. Pl. As. Rar. 2 (1830-31) 12; in DC. Prod. 12 (1848) 551; MIQ. Fl. Ind. Bat. 2 (1859) 986; PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 261, pl. 95; J. As. Soc. Beng. 74, ii (1907) 725; KOORD. Exk. Fl. Java 3 (1912) 143; RIDL. Fl. Mal. Pen. 2 (1923) 653, f. 131, incl. var. *setosa* RIDL.; MERR. Contr. Arn. Arb. 8 (1943) 148; DOAN, Fl. Gén. I.-C. 4 (1936) 1032; HEND. J. Mal. Br. R. As. Soc. 17 (1939) 66. — *G. phlomoides* (REINW. ex BL.) BTH. Lab. Gen. Sp. (1835) 649; ZOLL. Nat. Geneesk. Arch. N. I. 2 (1845) 59; BTH. in DC. Prod. 12 (1848) 551; MIQ. Fl. Ind. Bat. 2 (1859) 985; KURZ, Nat. Tijd. N. I. 27 (1864) 213; KOORD. Exk. Fl. Java 3 (1912) 143; BEUMÉE, Flor.-anal. Onderz. Djatiboschen (1927) 138. — *G. philippinarum* BTH. in DC. Prod. 12 (1848) 551; F.-VILL. Nov. App. (1880) 166; VIDAL, Phan. Cuming. Philip. (1885) 136; Rev. Pl. Fasc. Filip. (1886) 214; PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 259, pl. 101; MERR. En. Philip. 3 (1923) 409. — ?*G. furfuraceum* HALL. f. Bull. Herb. Boiss. 6 (1898) 351, t. 9, f. 1 a-c, 622. — *G. cinereum* ELMER, Leaf. Philip. Bot. 8 (1919) 3086. — *G. lacteum* RIDL. J. Bot. 62 (1924) 300; Fl. Mal. Pen. 5 (1925) 326.

Coarse perennial herb, 0.5-2 m. Stem erect, woody, 4-angled, densely tomentose. *Leaves* herbaceous, elliptic-oblong, ovate or obovate, 15-30 by 5-10 cm, acute, base abruptly cuneate or subtruncate; margin crenate or crenate-serrate; hispid above, densely pubescent beneath; petiole 1-3 cm, densely tomentose. *Flowers* 10-15 in dense, axillary verticillasters. Bracts ovate-lanceolate, 6-10 mm long. Pedicels 4.7 mm. *Calyx* 1-1.5 (-2) cm long, often very prominently ribbed, hirsute within; teeth lanceolate, acute or acuminate, generally shorter than the tube. *Corolla* creamy yellowish white or white, 4-4.5(-5) cm long, distinctly incurved, tomentose externally. Style sparingly hirsute when young, later glabrous; ovary villous. *Nutlets* 1-4, smooth, hispid at the apex, 6 by 4 mm, glassy-whitish.

Distr. Continental SE. Asia (Burma, Andamans, Indo-China); in *Malesia*: Malay Peninsula, Sumatra (incl. Mentawai Is., Banka), Java (incl. Madura I.), Lesser Sunda Is. (Bali), Borneo (incl. Anambas & Natuna Is.), throughout the Philippines, SW. Celebes (Bonthain).

Ecol. In shaded localities, mainly (rain-)forests, also in teak forests under a seasonal climate, from the lowland to c. 2400 m. *Fl.* Jan.-Dec.

Galls on sprouts and inflorescences are caused by gall-gnats.

Vern. Java: *galipung bulu, kali(n)dung, sapunëga, S, djintënan lëgëtan, pëpër, p. tahi, pëperan, sëmbung limpung, têngku, J, kopëtan, Md*; Philippines: *ata-ata, Tag., kagong, Bag., kasumisuni, magtîngon, Buk., aňganab, Ilocos Norte.*

Uses. The aňganab is administered to wounds, and an extraction is used internally against stomach-ache. HARTLEY (Lloydia 32, 1969, 265) listed it as a medicine against cancer.

Notes. This is the most widely spread, hence a polymorphous species in indument and characters

of the leaf and flowers, which is the reason that it was described under various names. BACKER & BAKHUIZEN VAN DEN BRINK *f. l.c.* recognized in Java two main forms: *f. javanicum*: corolla 3–5.2 cm; narrow part of corolla tube 1.5–2 cm, exceeding the strongly ribbed calyx; calyx lobes often abruptly acuminate; style glabrous or almost so; and *f. phlomoides* (BTH.): corolla 2.5–3 cm; narrow part of corolla tube whether or not exceeding the not very strongly ribbed calyx, 0.8–1.2 cm; calyx lobes acute to subacuminate; style with many long hairs at apex. But they also pointed out that these two extremes are connected by a large series of intermediates.

I have included *G. furfuraceum* HALL. *f.* (from Sumatra); the only difference in the description and illustration is the colour of the fruit, which was said to be red (*l.c.* 622), that of *G. javanicum* being creamy white, at length turning into brownish or black.

8. *Gomphostemma scortechinii* PRAIN, J. As. Soc. Beng. 59, ii (1890) 315; Ann. R. Bot. Gard. Calc. 3 (1891) 260, pl. 93; J. As. Soc. Beng. 74, ii (1907) 724; RIDL. Fl. Mal. Pen. 2 (1923) 653; KENG,

Gard. Bull. Sing. 24 (1969) 89, *excl. specim. sumatr.*— Fig. 5d.

Coarse, perennial herb, 60–150 cm, erect, woody below. Stem sulcate, scabrid. Leaves thin- to thick-herbaceous, elliptic-oblong or obovate, 20–30 by 10–15 cm, acute, the base long-cuneate; margin entire or remotely serrate, sparingly hirsute above, densely tomentose on the nerves beneath; petiole usually short, 0.5–1 cm long, sometimes obsolete. Flowers c. 20 in dense axillary verticillasters. Bracts subulate, 6–8 mm long. Pedicels 8–10 mm long. Calyx 18–25 mm long, prominently ribbed, hirsute within; teeth lanceolate, longer than the tube. Corolla orange-yellow or yellow, 30–60 mm long, distinctly incurved, outside tomentose. Style hirsute towards the apex, with spreading hairs; ovary densely villous. Nutlets smooth, hispid towards the apex, 8 by 5.5 mm.

Distr. Continental SE. Asia (Burma: Tenasserim; Thailand) and Malesia: Malay Peninsula.

Ecol. Rain-forest, 300–1500 m. Fl. Jan.–March.

Note. Close to *G. javanicum*. The Sumatran specimens cited in my precursor I have now referred to *G. parviflorum*.

## 6. SCUTELLARIA

LINNÉ, Gen. Pl. ed. 5 (1754) 260; Sp. Pl. (1753) 598; BTH. in DC. Prod. 12 (1848) 412; in B. & H. Gen. Pl. 2 (1876) 1201; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 225; KENG, Gard. Bull. Sing. 24 (1969) 164. — Fig. 6.

Herbs, sometimes woody below. Leaves opposite, rarely sessile. Flowers in terminal or upper axillary racemose inflorescence. Bracts minute or conspicuous and foliaceous. Calyx short, campanulate, 2-lipped, accrescent; calyx tube with a large caducous shield- or pouch-like appendage ('scutellum') above the upper lip; in fruit, at first the lips closed together, then the upper lip falling away together with the appendage. Corolla trumpet-shaped, usually sharply recurved from the base and erect upwards, not annulate within, 2-lipped; upper lip often boat-shaped, entire or notched; lower lip broad, 3-lobed. Stamens 4; lower pair longer, anthers often dimidiate or 1-celled; upper pair shorter, anthers 2-celled. Disk tubular, elongate. Ovary oblique, on a short gynophore; style 2-fid. Nutlets very minute, smooth, granular or hispid; seeds more or less transverse, with curved embryo.

Distr. About 200 spp. almost throughout the world, absent in S. Africa, the Pacific islands (except the Bonins near Japan), and New Zealand, in Malesia 3 spp.

Ecol. In the Malesian tropics both at low and high altitude.

### KEY TO THE SPECIES

1. Flowers mostly 3 (rarely 2 or 4) in a verticillaster, radially spreading . . . . . 1. *S. discolor*
1. Flowers generally 2 in a verticillaster, secund.
  2. Flowering calyx 1–1.5 mm long; pedicels = perpendicular to the rachis. Leaves broadly ovate, rounded or reniform, the base often cordate . . . . . 2. *S. indica*
  2. Flowering calyx 3–4 mm long; pedicels always obliquely erect (at angles of 60° to 75°) to the rachis. Leaves lanceolate or narrowly ovate, the base acute to rounded . . . . . 3. *S. javanica*

1. *Scutellaria discolor* WALL. ex BTH. in Wall. Pl. As. Rar. 1 (1830) 66; BTH. Lab. Gen. Sp. (1834) 428; in DC. Prod. 12 (1848) 417; MIQ. Fl. Ind. Bat. 2 (1859) 972; PRAIN, J. As. Soc. Beng. 74, ii (1907) 714; KOORD. Exk. Fl. Java 3 (1912) 144; RIDL. Fl. Mal. Pen. 2 (1923) 649; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 253; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 337; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 146; HEND. Mal. Nat. J. 6 (1950) 394, f. 364; BACK. & BAKH. f. Fl. Java 2 (1965) 620; KENG, Gard. Bull. Sing. 24 (1969) 165; STEEN. Mt. Fl. Java (1972) pl. 24-7. — *S. indica* (non L.) BL. Bijdr. (1826) 839. — *S. colebrookiana* (non WALL.) Z. & M. ex MOR. Syst. Verz. (1846) 54. — *S. heteropoda* MIQ. Fl. Ind. Bat. 2 (1859) 972, incl. var. *grandis* MIQ. — *S. zollingeriana* BRIQ. Ann. Cons. Jard. Bot. Genève 2 (1898) 104.

See further synonym under the variety.

**var. discolor.**

Small herbs, usually 20–50(–100) cm. Stem hirsute, rarely branched. Leaves membranaceous, broadly elliptic to rounded, rarely ovate, 4–6(–11) by 2.5–5(–10) cm, sometimes smaller, obtuse or rounded, base often rounded to cordate, margin coarsely crenate, glabrescent or sparsely pubescent on both surfaces; petiole 1–2 (or more) cm, hirsute. Flowers in simple terminal raceme-like inflorescences 10–15 cm long; 3 (sometimes 2 or 4) flowers subverticillately arranged in verticillasters not confined to one plane. Bracts linear, 1–3 mm. Pedicels 2–4 mm, pubescent. Calyx cup-shaped, 2–2.5 mm long, in fruit 4–5 mm, hirsute. Corolla trumpet-shaped, blue, pale-blue, or purple-violet, 10–12 mm long. Nutlets ellipsoid, 1.2 by 0.7 mm, black, echinate.

Distr. Continental SE. Asia (from the Deccan to Assam, Nepal, Burma, Thailand, Indo-China, and SW. China: Yunnan), widely spread in *Malesia*: Malay Peninsula, Java, Bawean I., Lesser Sunda Is. (Kangean, Lombok, Flores, Sumba, Sumbawa, Alor, Wetar, Timor), Moluccas (Ceram, Ambon), and New Guinea.

It is peculiar that this species is not found in several large islands (Celebes, Philippines). The single record of Sumatra by KORTHALS specimens named by MIQUEL *S. heteropoda* var. *grandis* (KENG, l.c. 166) is almost certainly mislocalized and came from Java where other similar specimens of KORTHALS had their provenance.

Ecol. Grassland along streams, shady and moist places in rain-forest, trails in forest, moist rocks in ravines, in Sumbawa in lowland Dipterocarp forest, in the Vogelkop in oak forest, in Timor on limestone in *Podocarpus* forest; from the lowland up to c. 2400 m, at low altitude on several small islands but also on the larger islands. Fl. Jan.–Dec.

Vern. Nilam bukit, toma, M; Java: beug-beureuman tangkal, daun kukuran, djawër kotok (leuweung), kipahit, tjawir kotok hualan, S, ampèru lèmah, djarongan, lampèsan, J; Moluccas: daun kukur, Ambon, huta alosu, Ceram, majana kusu, Ternate.

Uses. According to HEYNE (Nutt. Pl. 1927, 1326) used against pains in the loins.

Notes. A wide-ranging, rather variable species. Early collected and described Indian specimens were rather tiny herbs usually less than 30 cm, with rounded or reniform leaves c. 1.5–2 cm and



Fig. 6. *Scutellaria discolor* WALL. ex BTH. var. *cyrtopoda* (MIQ.) ADELB. a. Habit,  $\times \frac{2}{3}$ , b. flower,  $\times 2$ , c. left: calyx in fruit, intact; right: final fruiting stage,  $\times 4$  (COERT 252).

few-flowered terminal inflorescence. Malesian specimens are generally taller with elliptic to rounded, larger leaves c. 4.5–6 by 3.5–5 cm and many-flowered terminal and upper-axillary inflorescences.

According to MIQUEL (*l.c.* 973) the bracts, calyx, and corolla are glandular-pilose.

*S. zollingeriana* I have here referred to the type variety.

*var. cyrtopoda* (MIQ.) ADELB. in Back. Bekn. Fl. Java (em. ed.) 14 (1954) fam. 201, p. 14; BACK. & BAKH. *f.* Fl. Java 2 (1965) 620; KENG, Gard. Bull. Sing. 24 (1969) 167; STEEN. Mt. Fl. Java (1972) pl. 25–8. — *S. cyrtopoda* MIQ. Fl. Ind. Bat. 2 (1859) 973; KOORD. Exk. Fl. Java 3 (1912) 144. — Fig. 6.

Stem densely glandular-hairy. Leaves chartaceous, ovate to broadly ovate, 3.5–5 by 2–4 cm, acute or broadly acute, base rounded, margin crenate-serrate, appressed hirsute above, pilose on the nerves beneath; petiole 0.5–1.5 cm, pilose. Bracts very prominent, lower ones lanceolate, 3–5 mm long, decrescent upwards.

Distr. *Malesia*: W.–E. Java (Mt Malabar eastwards to Mt Jang).

Ecol. Shady places, sometimes moist, both in light mixed and in *Casuarina* forest, 1600–3200 m. Fl. Jan.–Dec.

Notes. The variety is mainly characterized by the more copiously glandular-hairy stem, rather small ± thicker leaves, and more prominent bracts.

DUNN (Not. R. Bot. Gard. Edinb. 6, 1915, 176) referred HENRY 10240 from Yunnan to this taxon, but this is probably not correct.

**2. *Scutellaria indica* LINNÉ, Sp. Pl. (1753) 600; BURM. *f.* Fl. Ind. (1768) 130; HASSK. Cat. Hort. Bog. (1844) 132; BTH. in DC. Prod. 12 (1848) 417; Fl. Hongk. (1861) 278; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 527; MERR. En. Philip. 3 (1923) 409; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1923) 255; MANSFELD, Bot. Jahrb. 62 (1929) 377; BACK. & BAKH. *f.* Fl. Java 3 (1968) 657; KENG, Gard. Bull. Sing. 24 (1969) 167. — *S. copelandii* MERR. Philip. J. Sc. 7 (1912) Bot. 349.**

Small herb, usually prostrate, 20–30 cm, often not branched. Stem and branches acutely 4-angular, glabrescent or strigose. Leaves chartaceous, mostly radical, broadly ovate to rounded or reniform, 1.5–2(–3) by 1.5–2 cm, base usually cordate, appressed hirsute on both surfaces, margin crenate; petiole 0.5–1.5 cm, hirsute and scabrid. Flowers in a terminal, raceme-like inflorescence, solitary or occasionally several; flowers 2 in a verticillaster, opposite. Pedicels nearly perpendicular to the rachis. Bracts rounded to ovate, 2–3 mm long, villous. Calyx 1.5 mm long, in fruit 3–4 mm, glandular-hairy. Corolla pale to deep purple, 12–14 cm long, puberulent. Nutlets protuberant, 1 by 0.6 mm.

Distr. Continental East Asia (Indo-China, China, Japan, Formosa, Hongkong) to *Malesia*: N. Sumatra (Gajo & Batak Lands), W. Java (Mt Ipi in Priangan), Lesser Sunda Is. (Sumbawa, Alor, Flores, Timor), Central Celebes (Masamba), Philippines (Mindanao, Mindoro), Moluccas (Ternate, Halmahera, Banda), and New Guinea.

Ecol. On cliffs and boulders along streams, grassy open plain, along tracks in secondary forest,

rather rare in *Malesia*, from low altitude to 2300 m. Fl. Jan.–Dec.

Vern. Sumatra: *bangun bangun batu*, Batak; Java: *daun kukuran*; Philippines: *banod*, Bag.; New Guinea: *samsi*, Wapi lang., Wigote.

Note. The Papuan specimens tend to have larger and thinner leaves and often the stems are branched, each branch ending in a racemose inflorescence, perhaps representing a distinct form or variety.

**3. *Scutellaria javanica* JUNGH. Java 1 (1853) 661; MIQ. Fl. Ind. Bat. 2 (1859) 974; KOORD. Exk. Fl. Java 3 (1912) 144; BACK. & BAKH. *f.* Fl. Java 2 (1965) 620; KENG, Gard. Bull. Sing. 24 (1969) 168. — *S. horsfieldiana* MIQ. Fl. Ind. Bat. 2 (1859) 974; KOORD. Exk. Fl. Java 3 (1912) 145; STEEN. Arch. Hydrobiol. Suppl. 10 (1932) 324. — *S. violacea* HEYNE var. *horsfieldiana* (MIQ.) O. K. Rev. Gen. Pl. 2 (1891) 531.**

See for further synonyms under the varieties.

#### KEY TO THE VARIETIES

1. Leaves thin-membranaceous, usually over 3 cm long; margin crenate or entire.
  2. Rachis of inflorescence not or thinly glandular-hairy. Leaves 3–4 by 1.5–2 cm
    - a. *var. javanica*
  2. Rachis of inflorescence often densely glandular-hairy. Leaves 7.5–10 by 3–3.5 cm
    - b. *var. sumatrana*
1. Leaves chartaceous to thin-coriaceous, much shorter; if long then the margin often with 2–3 coarse teeth on each side.
  3. Leaves 0.5–1.5 cm long; margin often remotely crenate or subtire . . . . . c. *var. luzonica*
  3. Leaves 2–3.5(–6.5) cm long; margin often with 2–3 coarse teeth on each side
    - d. *var. russeliaefolia*

#### a. *var. javanica*.

Slender undershrub, 60–100 cm, often branched. Stem and branches acutely 4-angled, pubescent. Leaves thin-membranaceous, lanceolate, narrowly ovate to ovate, 3–4(–5) by 1.5–2(–3) cm, acute or caudate, base rounded or acute, more or less entire, margin elsewhere crenate or remotely serrate, often only few-toothed; puberulent on both surfaces; petiole 1–3 cm, hirsute. Flowers in terminal, sometimes also in upper axillary, lax, pseudo-racemes 8–10 cm long; rachis glandular-hairy, often 2 flowers in a whorl, secund. Pedicels obliquely attached (in angles of 60° to 75°) to the rachis. Calyx campanulate, 3–4 mm long, in fruit 5–6 mm, hirsute. Corolla trumpet-shaped, blue or white, 14–16 mm long, puberulent, upper lip notched. Nutlets broadly oblong, flattened, 1.5–1 mm long, black, finely tuberculate and puberulent.

Distr. *Malesia*: Sumatra (rare), Central to East Java (Mts Dieng E. to Mt Ardjuno), Central & North Celebes, Philippines (Luzon, Mindoro), Moluccas (Ceram) and New Guinea.

Ecol. Open primary, often light forest, forest-edges, trails, in Tondano in coffee-estates, near Moresby in Eucalypt savannah and in Daru I. on damp soil in savannah forest; from low altitude to c. 2300 m, in Java not below 600 m. Fl. Jan.–Dec.

Vern. Java: *perlutan*, *sonkèttan*, J, Diëng, *kapintèn*, *upar upar*, J, *Ungaran*; New Guinea: *riemos*, *Tehid lahag*, Vogelkop Pen.

**b. var. *sumatrana*** (Miq.) BACK. Trop. Natuur 10 (1921) 37, f. 7; STEEN. Arch. Hydrobiol. Suppl. 10 (1932) 323; ADELB. in Back. Bekn. Fl. Java (em. ed.) 14 (1954) fam. 201, p. 14; BACK. & BAKH. f. Fl. Java 2 (1965) 620; KENG, Gard. Bull. Sing. 24 (1969) 171. — *S. sumatrana* MIQ. Fl. Ind. Bat. 2 (1859) 974; MERR. Contr. Arn. Arb. 8 (1934) 149.

Differs from the type variety mainly in the thinner and larger leaves (7.5–10 by 3–3.5 cm) and in the sparsely hirsute inflorescence rachis which may reach a length of 20 cm and is not glandular-hairy. Flowers blue, lip-base white.

Distr. *Malesia*: Sumatra, Lesser Sunda Is. (Sumba, Flores), and Philippines (Mindoro, Mindanao).

Ecol. In thickets along trails, on ridges and in forest, 500–2850 m, usually above 1000 m. Fl. Jan.–Dec.

Vern. N. Sumatra: *bangun bangun na gerger*, *b. b. na rata*, *b. b. na rosa*, Karo-Batak.

**c. var. *luzonica*** (ROLFE) H. KENG, Gard. Bull. Sing. 24 (1969) 171. — *S. luzonica* ROLFE, J. Linn. Soc. Bot. 21 (1884) 315; MERR. En. Philip. 3 (1923) 410; MANSFELD, Bot. Jahrb. 62 (1929) 377; LAM, Blumea 5 (1945) 582; QUIS. Medic. Pl. Philip. (1951) 833. — *S. marivelensis* ELMER, Leaf. Philip. Bot. 2 (1908) 516.

Ascending, procumbent herb. Leaves chartaceous, lanceolate to broadly ovate, 0.5–1.5 by 0.3–1 cm, acute to acuminate, base subrounded, margin remotely crenate or subentire; petiole 2–3 mm or leaf subsessile. Racemes 2–4 cm long.

Distr. *Malesia*: Philippines (Luzon) and New Guinea.

Ecol. Ravines, ridges in mossy forest, grassland, stream banks, forest floor, peaty forest on sand, (300–)1000–2400 m, at 3300 m on Mt Suckling (New Guinea), along mountain streams occasionally found at lower altitude. Fl. Jan.–Dec.

Vern. Philippines: *lupiñgan*, *sidit*, Ig.; New Guinea: *buisik*, Telefomin.

**d. var. *russeliaefolia*** (VATKE) H. KENG, Gard. Bull. Sing. 24 (1969) 172. — *S. russeliaefolia* VATKE, Bot. Zeit. 30 (1872) 716; MERR. En. Philip. 3 (1923) 410.

Small herb, suberect. Leaves chartaceous to thin-coriaceous, ovate, 2–2.5(–6.5) by 1–2(–3) cm, acute or acuminate, base rounded or often subcordate, the margin with 2–3 coarse teeth on each side; lateral veins usually very prominent; petiole less than 5 mm long or subsessile, hirsute. Flowers blue and white.

Distr. *Malesia*: Philippines (Luzon, Mindoro, Catanduanes, Basilan, Leyte, Panay), NE. Celebes (Minahassa).

Ecol. Primary forest, often in mossy forest, 500–2350 m. Fl. Jan.–June.

#### Cultivated

***Scutellaria splendens*** LINK, KLOTSCH & OTTO, Ic. Pl. Rar. Hort. Berol. 1 (1841) 31, t. 13; BACK. & BAKH. f. Fl. Java 2 (1965) 620.

A plant with bright red corolla, native to Mexico. Cultivated in mountain regions in Java as a garden ornamental.

***Scutellaria* sp.** — At the Mission Station Toromambuno, Papua, 2500 m, another species is cultivated (BORGSMANN 342).

#### Excluded

***Scutellaria ? japonica*** BURM. f. Fl. Ind. (1768) 130; MERR. Philip. J. Sc. 19 (1921) 378.

BURMAN recorded this species for Japan and Java. BENTHAM concluded that BURMAN's description is based on a mixture (in DC. Prod. 12, 1848, 58, 241, 431) which he referred in part to *Plectranthus coetsa* D. DON and in part to *Melissa parviflora* BTH.; he stated to have examined the original specimens in the Burman herbarium. However, neither of these two species occurs in either Japan or Java. In MERRILL's opinion (*l.c.*) BURMAN's description was mainly drawn up from the *Melissa* part. Also, BURMAN could not have had material from the Javanese *Plectranthus teysmannii* and *Melissa axillaris* BAKH. f. (with which they might have been confounded) as at BURMAN's time these mountain plants from the interior of Java were not yet collected.

KOIZUMI and later OHWI (Fl. Jap. 1965, 786) have accepted BURMAN's description as the basis of *Plectranthus japonicus* (THUNB.) KOIZ.

## 7. ACHYROSPERMUM

BLUME, Bijdr. (1826) 840; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 268; J. K. MORTON, J. Linn. Soc. Lond. Bot. 58 (1962) 261; KENG, Gard. Bull. Sing. 24 (1969) 23. — **Fig. 7.**

Undershrubs or herbs. Stems terete to obscurely 4-angled, pubescent. *Verticillasters* few-flowered, usually forming a terminal, spike-like inflorescence. *Calyx* 10-nerved, tubular-campanulate, 5-toothed, = 2-lipped, the upper lip slightly longer. *Corolla* slender. 2-lipped, the upper (or posterior) lip short, erect, notched; the lower (or anterior) lip 3-lobed, the midlobe often concave. *Stamens* 4, under the upper lip in 2 pairs, the lower (or anterior) pair longer; anthers 2-celled, cells

parallel. Disk equal-sided. Styles briefly 2-fid. *Nutlets* scaly and chaffy on the ventral surface and on the top, rough and pubescent on the dorsal surfaces.

Distr. Over 10 *sp.* described from tropical E. Africa, Madagascar, and the Seychelles through Indo-Himalaya to *W. Malesia* (1 *sp.*).



Fig. 7. *Achyrospermum densiflorum* Br. a. Habit,  $\times \frac{2}{3}$ , b. flower, c. fruiting calyx, both  $\times 4$ , d. nutlet, left from outside, right from inside,  $\times 12$  (a-b POPTA 4316, c-d BACKER 4818).

1. *Achyropermum densiflorum* Bl. Bijdr. (1826) 840; BTH. in DC. Prod. 12 (1848) 458; MIQ. Fl. Ind. Bat. 2 (1859) 989; HOOK. f. Fl. Br. Ind. 4 (1885) 673, *in nota*; MERR. En. Philip. 3 (1923) 412; BACK. & BAKH. f. Fl. Java 2 (1965) 624; KENG, Gard. Bull. Sing. 24 (1969) 23, f. 1; STEEN. Mt. Fl. Java (1972) pl. 24-2; MURATA, Acta Phytotax. Geobot. 25 (1973) 106. — *A. phlomoides* Bl. Bijdr. (1826) 841; MIQ. Fl. Ind. Bat. 2 (1859) 990; KOORD. Exk. Fl. Java 3 (1912) 148. — *A. philippinense* BTH. in DC. Prod. 12 (1848) 458; MIQ. Fl. Ind. Bat. 2 (1859) 990; F.-VILL. Nov. App. (1880) 165; VIDAL, Phan. Cuming, Philip. (1885) 136; Rev. Pl. Vasc. Filip. (1886) 214. — Fig. 7.

Suberect herb, 10–60 cm. Stem and branches pubescent. *Leaves* thin, narrowly elliptic or ovate, 6–8 by 2.5–4 cm, acute or broadly acute, base cuneate or attenuate, hirsute or pilose on both surfaces, margin serrate or crenate-dentate; petiole 0.5–6 cm, hirsute. *Verticillasters* always in a terminal, spike-like inflorescence 4–6 (or more) cm long. Bracts pale greenish yellow to pink, broadly ovate or spatulate, 6–8 mm, pilose and ciliate. *Calyx* campanulate, 6–8 mm long, in fruit 8–10 mm,

more or less 2-lipped, the upper lip 2-toothed, slightly longer than the lower lip, the teeth straight (in fruit often slightly recurved), obtuse or rounded at apex. *Corolla* white to light violet or pink, 3–4 mm exceeding the calyx, upper lip erect, emarginate, lower lip much longer than the upper one, straight or decurved. *Stamens* in 2 pairs, the lower pair longer, exserted. *Nutlets* obtusely trigonous, 1.2–2 by 0.5 mm, scaly and chaffy on the ventral surfaces and on the top, rough and pubescent on the dorsal surface.

Distr. *Malesia*: Central & S. Sumatra, W. Java (E. as far as Mt Tjeremai and Banjumas), Lesser Sunda Is. (Lombok, W. Sumbawa), and Philippines (Luzon, Mindoro, Leyte, Mindanao).

Ecol. In forests often along streams and in damp, shaded places at low and medium altitudes from c. 500 to 2000 m, rarely reported down to 150 m confined to everwet climatic conditions. Fl. Febr.–Sept.

Vern. *Tjutjung leuweung*, S.

Note. HOOKER f. (*l.c.*) suggested possible conspecificity with the Indian *A. wallichianum* (BTH.) BTH., but I rather want to keep them apart.

## 8. ANISOMELES

R.BR. Prod. (1810) 503; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 268; KENG, Gard. Bull. Sing. 24 (1969) 33. — Fig. 8.

Herbs, or sometimes shrubby. Stems and branches softly pubescent or woolly. *Flowers* in axillary whorls or forming a loose terminal spicate or paniculate inflorescence. *Calyx* ovoid or tubular-campanulate, straight, 10-nerved, almost equally 5-toothed. *Corolla* tube short, annulate within; upper lip short, entire and erect; lower lip 3-lobed, broad and patent, midlobe retuse or notched. *Stamens* exserted, in 2 pairs, those of the lower pair often  $\pm$  longer; anthers of the upper pair sterile, of the lower pair only one cell fertile. Disk equal-sided. Style subequally 2-fid. *Nutlets* smooth, flattened, bluntly angular, and with rather prominent scar on the ventral surface.

Distr. About 5–6 *spp.*, through the Old World, from E. Africa through SE. Asia, and Malesia to NE. Australia; in *Malesia*: 2 *spp.*

Ecol. Open, often waste places, and secondary growths, not a constituent of the primary forest, in the lowland and hills.

Notes. Already BENTHAM (Fl. Austr. 5, 1870, 89) remarked on the difficulty of specific delimitation. Alluding to R. BROWN, who described three species from Australia, he said he could not follow him, having a very much larger range of specimens before him, and decided that they form a continuum of one variable species, *A. salvifolia*. However, he remarked in addition that certain specimens were very similar to others found in India, but did not further elaborate this point.

CLARKE (in HOOK. f. Fl. Br. Ind. 4, 1885, 672) had four species, but made a remark under two of them, *viz* *A. candicans* BTH. and *A. heyneana* BTH. to the effect that they were very doubtful or perhaps a form of another species, thus leaving only two distinct species.

Both the continental Asian and Malesian material, of which I have now a far larger range of specimens than BENTHAM, shows a large variability; in habit and degree of hairiness. Leaf-shape varies considerably, apical and basal leaves differ in one specimen; and there are degrees and transitions of the leaf-base, from narrow-cuneate to rounded.

There appears to be, only one major constant taxonomic character, *viz* the length (not the exact shape) of the calyx lobes in proportion to the calyx tube.

It may be possible that there occur, besides the phenotypic and the fluctuating variability, genetically defined replacing races or subspecies, but their discrimination falls outside the realm of herbarium taxonomy.

Nomencl. BABU & NAYAR (Taxon 18, 1969, 595) have proposed to conserve the name *Anisomeles* against *Epimeredi* ADANS. 1763, because ROTHMALER (in Fedde, Rep. 53, 1944, 12) had claimed that *Anisomeles* type (in P) was *Anisomeles*. According to BAKHUIZEN VAN DEN BRINK f. (Fl. Java 2, 1965, 624) this is a mixture, making conservation unnecessary.

## KEY TO THE SPECIES

1. Fruiting calyx teeth nearly as long as the tube. Leaves generally ovate to broadly ovate, varying from glabrescent, hirsute to densely villose. Flowers usually numerous (over 20) in dense, axillary verticillasters forming together a terminal, dense, spurious-spicate inflorescence . . . . . 1. *A. indica*
1. Fruiting calyx teeth much shorter (less than  $\frac{1}{3}$ ) than the tube. Leaves generally narrowly oblong, always densely woolly. Flowers fewer (usually less than 15) in axillary verticillasters which are often distantly disposed . . . . . 2. *A. malabarica*

**1. *Anisomeles indica* (L.) O.K. Rev. Gen. Pl. 2 (1891) 512, incl. f. *albiflora* (HASSK.) O.K., f. *rubicunda* O.K.; MERR. Fl. Manila (1912) 411; Sp. Blanc. (1918) 336; En. Philip. 3 (1923) 412; BACK. Onkr. Suiker. (1931) 560, incl. var. *mollissima* (BTH.) BACK., Atlas (1973) t. 531; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 152; STEEN. Bull. Jard. Bot. Btzig III, 17 (1948) 389, incl. var. *biflora* STEEN.; QUIS. Medic. Pl. Philip. (1951) 812; BACK. & BAKH. f. Fl. Java 2 (1965) 624, incl. var. *albiflora* (HASSK.) BACK., var. *serratifolia* (MIQ.) ADELB.; KENG, Gard. Bull. Sing. 24 (1969) 34, f. 5. — *Nepeta indica* L. Sp. Pl. (1753) 571; THUNB. Fl. Java (1825) 15. — *Ballota disticha* L. Mant. 1 (1767) 83; BURM. f. Fl. Ind. (1768) 126. — *Marrubium indicum* BURM. f. Fl. Ind. (1768) 127. — *Nepeta amboinica* L. f. Suppl. (1781) 273, excl. syn. RHEEDE *quae est Anisochilus carnosus* (L.) WALL. — *A. ovata* R.BR. in W.T.Ait. Hort. Kew. ed. 2, 3 (1811) 364; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 396; BTH. Lab. Gen. Sp. (1835) 702, incl.  $\beta$  *mollissima* BTH.; in DC. Prod. 12 (1848) 455; MIQ. Fl. Ind. Bat. 2 (1859) 975, incl. var.  $\gamma$  *serratifolia* MIQ.; F.-VILL. Nov. App. (1880) 665; VIDAL, Phan. Cuming. Philip. (1885) 136; Rev. Pl. Vasc. Filip. (1886) 214; HOOK. f. Fl. Br. Ind. 4 (1885) 672; PRAIN, J. As. Soc. Beng. 74, ii (1907) 715; RIDL. Fl. Mal. Pen. 2 (1923) 649. — *A. disticha* HEYNE ex ROTH, Nov. Pl. Sp. (1821) 254. — *Nepeta disticha* (non L.) BL. Bijdr. (1826) 823. — *Nepeta malabarica* (non L.) BL. Bijdr. (1826) 823. — *A. mollissima* WALL. Cat. (1829) n. 2039, nomen. — *A. glabrata* BTH. in Wall. Cat. (1829) n. 2041, nomen. — *A. candicans* BTH. in Wall. Pl. As. Rar. 1 (1830) 59 (WALL. Cat. 1829, n. 2038), *e. deser.* — *A. heyneana* BTH. in Wall. Pl. As. Rar. 1 (1830) 59 (WALL. Cat. 1829, n. 2028). — *Phlomis indica* (L.) BLANCO, Fl. Filip. (1837) 474; ed. 2 (1845) 330; ed. 3, 2 (1878) 247. — *Phlomis alba* (non FORSK. 1775) BLANCO, Fl. Filip. (1837) 474; ed. 2 (1845) 330; ed. 3, 2 (1878) 247; cf. MERR. Sp. Blanc. (1918) 336. — *A. malabarica* [non (L.) R.BR.] HASSK. Cat. Hort. Bog. (1844) 133; Pl. Jav. Rar. (1848) 485, incl. var. *albiflora* HASSK.; MIQ. Fl. Ind. Bat. 2 (1859) 976. — *A. albiflora* (HASSK.) MIQ. Fl. Ind. Bat. 2 (1859) 976; KOORD. Exk. Fl. Java 3 (1912) 148. — *A. secunda* O.K. Rev. Gen. Pl. 2 (1891) 512, nom. *superfl.*, based on WALL. Cat. (1829) n. 2028 (= *A. heyneana*). — *A. tonkinense* GANDOGER, Bull. Soc. Bot. Fr. 65 (1918) 65, *e. deser.* — *Epimeredi indicus* (L.) ROTHMALER in Fedde, Rep. 53 (1944) 12, p.-p.; PARHAM, Pl. Fiji (1964) 254. — Fig. 8.**

Herbaceous or shrubby, 0.5–2 m. Stem and branches acutely 4-angled, sparingly hairy to densely pubescent. Leaves thin- to thick-membranaceous, ovate to broadly ovate, 4.5–6 by 3–3.5 cm, acute, crenate-serrate, base rounded or truncate, hirsute or woolly on both surfaces, subcordate, less often shortly cuneate, entire, sometimes almost pinnatifid; petiole 1.5–4 cm, tomentose. Flowers usually numerous (over 20), in a dense verticillaster, the whorls distant below, approximate above in a dense spicate inflorescence, rarely very few-flowered with solitary flowers in the leaf-axils. Bracts linear, 3–4 mm, pilose. Calyx campanulate, 5–7 mm long, in fruit 9–10 mm, shortly pedicelled, hirsute and pilose; teeth lanceolate, acute, almost as long as the tube, ciliate. Corolla greenish to whitish, with dark reddish lines inside, sometimes purple or blue, tubular, 15–18 mm long. Filaments hirsute. Nutlets broadly ovoid, 1.8–2 by 1.4–1.5 mm, subcompressed, black.

Distr. India, China, Japan, Ryu Kyu Is., Taiwan, throughout *Malesia*, Bismarck Arch., and Fiji Is.

Ecol. Open and waste, sunny places, grasslands, in settled areas, also in teak-forests, common, under everwet and seasonal climatic conditions, 1–600(–c. 1700) m. Fl. Jan.–Dec.

Vern. *Malabar catmint*, E; Sumatra: *sibo*, *tibo*, *Karo*, *batu-babra*, M; Java: *babadotan beureum*, *b. bodas*, *bandotan putih*, *patuk bangkong*, S, *kihileud*, J, *daun salangkeng*, Md, *rumpat ati-ati*, r. *upuh*, M; Philippines: *kabling-lalake*, *kadling-parang*, *talingharap*, Tag., *lilitan*, *litalit*, *subasuba*, Ilk., *sauang sauang*, Mbo.; Celebes: *balotji*, *mankuru-im-parab*.

Uses. According to RIDLEY (*l.c.*) this is an excellent plant for hive bees. HEYNE (1927) mentions that in Java a decoction of the leaves is internally used for gravel, and in the Philippines it is said to be antirheumatic and stomachic, and good for gastric catarrh and intermittent fever (QUISUMBING, *l.c.*). The leaves would contain a volatile oil and a bitter alkaloid. In Malaya the plant is commonly used in cakes of sago (BURK. Dict. 1935, 160). From Sumba reported to be a fetid herb with aromatic-scented flowers.

Note. The flower colour varies considerably.

**2. *Anisomeles malabarica* (L.) R.BR. ex SIMS, Bot. Mag. 46 (1819) t. 2071; BTH. in Wall. Pl. As. Rar. 1 (1830) 59; in DC. Prod. 12 (1848) 456; HOOK. f. Fl. Br. Ind. 4 (1885) 673; PRAIN, J. As. Soc. Beng. 74, ii (1907) 716; RIDL. Fl. Mal. Pen. 2 (1923) 649;**



MUKERJEE, Rec. Bot. Surv. India 14 (1940) 153; KENG, Gard. Bull. Sing. 24 (1969) 37. — *Nepeta malabarica* L. Mant. 2 (1771) 566. — *A. salviifolia* R. BR. Prod. (1810) 503; BTH. Lab. Gen. Sp. (1835) 702; in DC. Prod. 12 (1848) 455; MIQ. Fl. Ind. Bat. 2 (1859) 976; BTH. Fl. Austr. 5 (1870) 89; K. SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 118; WARB. Bot. Jahrb. 13 (1891) 425; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 528; MANSFELD, Bot. Jahrb. 62 (1929) 376; DOMIN, Bibl. Bot. 22 (Heft 89) (1929) 1121, incl. var. *moschata* (R. BR.) DOMIN, var. *inodora* (R. BR.) DOMIN; KENG, Gard. Bull. Sing. 24 (1969) 37; HENTY & PRITCHARD, Bot. Bull. Lae 7 (1975) 103, fig. — *A. moschata* R. BR. Prod. (1810) 503. — *A. inodora* R. BR. l.c. — *A. candicans* (non BTH. 1830) DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 396; MIQ. Fl. Ind. Bat. 2 (1859) 976. — *A. intermedia* WIGHT ex BTH. Lab. Gen. Sp. (1835) 703; BTH. in DC. Prod. 12 (1848) 456. — *Epimeredi salviifolius* (R. BR.) ROTHMALER in Fedde, Rep. 53 (1944) 12. — *Epimeredi malabaricus* (L.) ROTHMALER, l.c.

Subshrubby, 0.5–1.5 m. Stem and branches densely villose or woolly. Leaves membranaceous to thick-chartaceous, oblong to narrowly ovate, 3–8 by 1.5–3 cm, acute, crenate-serrate, base broadly acute or shortly cuneate, entire, densely woolly beneath, sparsely hirsute above; petiole 0.5–2.5 cm, softly woolly. Flowers many (10–15 or less) in dense axillary whorls, the whorls distantly disposed below, more or less approximate above, forming an interrupted spicate inflorescence. Bracts linear-lanceolate to lanceolate, 1–3 mm long. Calyx tubular-campanulate, 6–8 mm long, in fruit 8–10 mm, hirsute or densely villose externally, teeth lanceolate, much shorter (less than  $\frac{1}{3}$ ) than the tube, ciliate. Corolla lilac or pale blue, 6–10 (–14) mm long, puberulent. Filaments puberulent or pubescent. Nutlets ellipsoid, 2 by 1 mm, smooth and shining.

Distr. Mauritius, continental SE. Asia (Ceylon, India, Burma, Thailand, Indo-China) to tropical Australia; in *Malesia*: Penang (2 old coll.), Lesser Sunda Is. (Timor), the South Moluccas (Babar, Tanimbar), New Guinea (W.–E.), and Bismarck Arch.

Ecol. Open, often waste places, mostly under seasonal climatic conditions, at low altitude. Fl. Febr.–Sept.

Notes. FERN-VILLAR (Nov. App. 1880, 165) mentioned this species to occur in the Philippines, but MERRILL excluded it (En. Philip. 3, 1923, 413), and no material is available to sustain this record.

The species is taken here in the broad sense. BENTHAM already referred to the variability of the Australian material and remarked that Australian forms approached very near to a few of narrow-leaved Indian specimens. Both leaf-shape and indumentum vary a great deal.

Fig. 8. *Anisomeles indica* (L.) O. K. a. Habit,  $\times \frac{2}{3}$ , b. flower, c. fruiting calyx, both  $\times 4$  (BOERLAGE s.n.).

## 9. ELSHOLTZIA

WILLD. in Roem. & Usteri, Mag. 4, 11 (1790) 3; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1897) 327; KENG, Gard. Bull. Sing. 24 (1969) 73. — *Aphanochilus* BTH. Bot. Reg. sub t. 1282 (1829). — Fig. 9-10.

Herbs or undershrubs. *Verticillasters* in spike-like or paniculate inflorescences, slender or stout, terete or secund. Bracts linear to lanceolate, (in Mal. spp.) usually small. *Calyx* ovoid or campanulate, 5-toothed, teeth unequal. *Corolla* tubular, shortly exerted, straight or incurved; limb 4- or 5-lobed, obliquely 2-lipped, upper lip erect, notched, lower lip spreading, 3-lobed. *Stamens* 4, divergent or distant, often slightly unequal; anthers 2-celled, cells divaricate or at length confluent; filaments glabrous. Disk produced behind the ovary, oblique. Style subequally 2-fid with subulate lobes. *Nutlets* minute, ovoid, glandular and (in Mal. spp.) pubescent.

Distr. About 60 spp., in the northern temperate to tropical part of the Old World, 1 sp. in Ethiopia, 1 sp. in Europe, centering in Asia; in *Malesia*: 2 spp. in Sumatra, Java, the Lesser Sunda Is., and SW. Celebes.

Ecol. In *Malesia* characteristic of the montane to subalpine zone, sometimes gregarious.

## KEY TO THE SPECIES

1. *Verticillasters* consisting of 2-12 flowers, apart, secund, forming a spike-like inflorescence. Calyx 2 mm (in fruit 2.5-3 mm) long, tube gibbous, sparsely short-haired . . . . . 1. *E. blanda*
1. *Verticillasters* consisting of many (usually over 15) flowers, closely approximate, terete, in dense spike-like or paniculate inflorescences. Calyx tubular, not gibbous, 2-4.5 mm long, in fruit 3-6.5 mm, sparsely or densely covered with whitish hairs . . . . . 2. *E. pubescens*

1. *Elsholtzia blanda* KENG, *nom. nov.*, based on the type of *Aphanochilus blandus* BTH.: WALLICH, Cat. (1829) n. 1550. — *Perilla elata* D. DON, Prod. Nep. (1825) 115, non *E. elata* Z. & M. 1845. — *Aphanochilus blandus* BTH. Bot. Reg. sub t. 1282 (1829), *nomen*; in Wall. Pl. As. Rar. 1 (1830) 29, *descr.*; *ibid.* 2 (1830-31) 19; Bot. Mag. 58 (1831) t. 3091. — *E. blanda* BTH. Lab. Gen. Sp. (1833) 162; in DC. Prod. 12 (1848) 160; HOOK. f. Fl. Br. Ind. 4 (1885) 643; STEEN. Arch. Hydrobiol. Suppl. 10 (1932) 323; Bull. Jard. Bot. Btzg III, 13 (1934) 222; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 89; KENG, Gard. Bull. Sing. 24 (1969) 73, f. 12.

Herb, woody below, c. 1 m. Stem often branched, puberulous or hoary. *Leaves* elliptic lanceolate, 3-5 by 0.5-1 cm, acuminate, base attenuate, narrowed into the petiole, coarsely serrate, glabrous above, puberulous and dark glandular beneath; petiole 0.5 cm. *Verticillasters* 2-12-flowered, closely apart, secund, in spike- or panicle-like inflorescences, 5-12 cm long. Bracts lanceolate, 1-2.5 mm. *Calyx* urceolate, 1.5-2 mm long, in fruit 2-3 mm, glandular pubescent without; mouth of fruiting calyx slightly contracted; teeth erect, lanceolate. *Corolla* campanulate, yellowish green or whitish, 2.5-3 mm long, 2-lipped, sparingly pubescent. *Stamens* in 2 pairs, subequal; filaments pubescent. *Nutlets* broadly ellipsoid, flattened, c. 0.7 mm long.

Distr. Continental SE. Asia (India, Burma, Thailand, to S. China); in *Malesia*: N. Sumatra (Toba region; Mts Singalang, Merapi & Talang).

Ecol. Forest edges, light forest, glades, open heathland, c. 1000-1800 m. *Fl.* April-Sept. Shoots and inflorescences are sometimes galled by aphids.

Vern. *Ser ser*, *silassie*, Sumatra.

Nomencl. After having described *Aphanochilus blandus* in 1829 BENTHAM soon afterwards (in Wall. Pl. As. Rar. 2: 19) found that it had earlier been described by D. DON as *Perilla elata*. In proposing the new combination under *Elsholtzia* he maintained his own epithet, emphatically citing *Perilla elata* as a synonym, whereby his new combination is illegitimate under the present Code. The epithet *elata* is already occupied in *Elsholtzia* and no other synonyms are available.

As the epithet *blanda* is established in botanical literature for nearly 1½ century, it is for stability of nomenclature advisable to keep it in use. Therefore a new name is coined, based on the same type as that of BENTHAM, for which reason it is not a homonym (Art. 64) and in accordance with Art. 72 dates from this revision.

2. *Elsholtzia pubescens* BTH. Lab. Gen. Sp. (1833) 162; in DC. Prod. 12 (1848) 161; MIO. Fl. Ind. Bat. 2 (1859) 965; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 222; BACK. & BAKH. f. Fl. Java 2 (1965) 632; *ibid.* 3 (1968) 657; KENG, Gard. Bull. Sing. 24 (1969) 76; STEEN. Mt. Fl. Java (1972) pl. 24-6. — *E. mollissima* BTH. Lab. Gen. Sp. (1833) 163; in DC. Prod. 12 (1848) 161; KOORD. Exk. Fl. Java 3 (1912) 150. — *E. elata* ZOLL. & MOR. Nat. Geneesk. Arch. N. 1. 2 (1845) 5; BTH. in DC. Prod. 12 (1848)

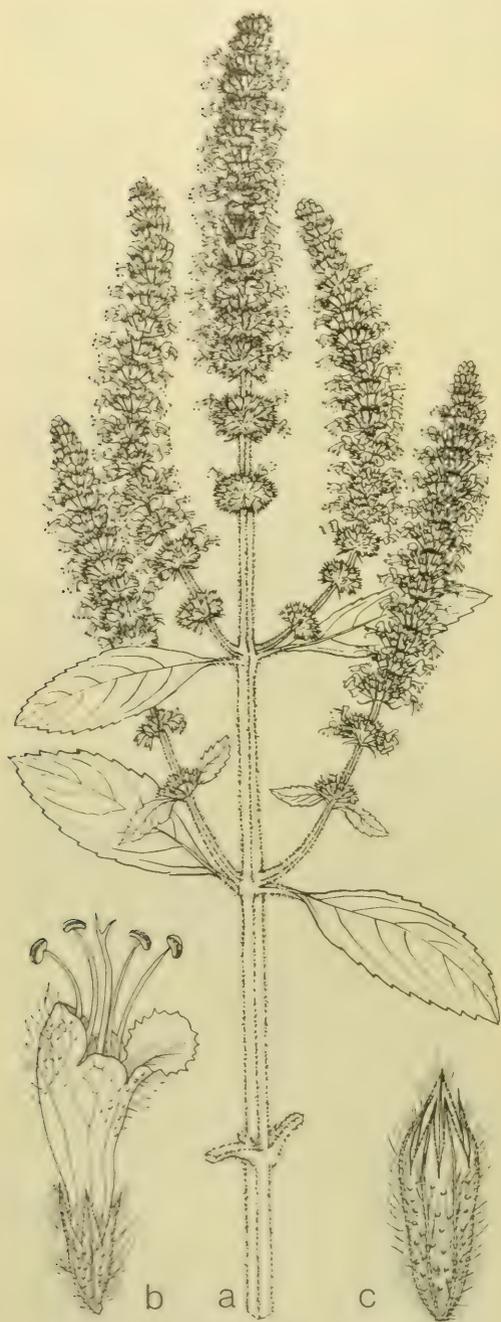


Fig. 9. *Elsholtzia pubescens* BTH. a. Habit,  $\times \frac{1}{2}$ , b. flower, c. fruiting calyx, both  $\times 6$  (a-b B. J. KARSTEN 32, c KOORDERS 29143).

161; JUNGH. Java 1 (1853) 633; MIQ. Fl. Ind. Bat. 2 (1859) 966; KENG, Gard. Bull. Sing. 24 (1969) 75. — *E. eriantha* BTH. in DC. Prod. 12 (1848) 161; MIQ. Fl. Ind. Bat. 2 (1859) 966; KOORD. Exk. Fl. Java 3 (1912) 150. — *Anisochilus euneurus* MIQ. Fl. Ind. Bat. 2 (1858) 957; KOORD. Exk. Fl. Java 3 (1912) 153. — Fig. 9-10.

Erect herb, 1-2 m or more. Stem and branches densely tomentose. Leaves membranaceous, narrowly lanceolate, ovate or elliptic, 5-8 by 2.5-3.5 cm, acute or acuminate, serrulate or serrate, base acute or attenuate, entire, sparingly hirsute above, velutinous or tomentose beneath; petiole 0.5-1.5 cm. Verticillasters 20-30-flowered, closely approximate (or widely apart below), forming terminal, spike-like or paniculate inflorescences, 7-10 cm. Bracts linear, linear-lanceolate to ovate, 2.5-4 mm, densely pubescent. Calyx tubular, narrowed at both ends, 2-4.5 mm long, in fruit 4-7.5 mm, with soft curled, appressed whitish hairs, teeth subequal, sharply pointed. Corolla white, 4-7 mm long. Stamens exserted, filaments puberulent. Style shortly 2-fid. Nutlets narrowly ellipsoid, 1-1.2 by 0.5 mm, puberulent and gland-dotted.

Distr. *Malesia*: Java (from Mts Tangkuban Prahū & Papandajan eastwards), Lesser Sunda Is. (Bali, Lombok, Sumba, Flores, Timor), the tip of the SW. Peninsula of Celebes (Mt Bonthain), ? New Guinea (NGF 3617).

Ecol. Open places, in grassfields, in *Casuarina junghuhniana* forest often in masses, also in Eucalypt forest in Timor, 1000-2950 m. Fl. June-Nov. An excellent honey producer for wild bees. Fig. 10.

Vern. *Djugul*, S, *djungul*, Bali, *kudèang*, J, *kadangu*, Sumba.

Uses. Leaves sometimes used as a vegetable.

Notes. *E. elata* Z. & M., in the precursor still recognized as distinct, is only a robust form with somewhat stouter, robust spikes and larger calyx (4-4.5 mm).

Related to *E. incisa* BTH. from India.



Fig. 10. Thickets of *Elsholtzia pubescens* Bth. (in front, 2 m high) are found in the pyrogenous mountain tjemara forest (*Casuarina junghuhniana*) on the Jang Plateau, East Java, c. 2000 m altitude, where *Pteridium* hardly ever fails (right lower edge). The sweet scent of *E. pubescens* attracts small bees and their honeycombs are a welcome delicacy (Photogr. VAN STEENIS).

#### 10. EURYSOLEN

PRAIN, Sc. Mem. Med. Offic. Ind. 11 (1898) 43; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 275; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 226; KENG, Gard. Bull. Sing. 24 (1969) 77. — Fig. 11.

Herb or undershrub. *Flowers* small, in many-flowered verticillasters condensed in terminal and axillary spikes. *Calyx* tubular, 10-nerved, 5-toothed, teeth nearly equal, throat naked within. *Corolla* shortly exserted; tube annulate within, gibbous in front above the annulus; limb 2-lipped, upper lip erect, slightly concave, retuse at the tip, lower lip 3-lobed, spreading, midlobe broader than lateral ones. *Stamens* 4, in 2 pairs, the lower pair slightly longer; anthers ellipsoid, 2-celled in bud, later confluent and 1-celled; filaments puberulous. Disk uniform. Style shortly 2-fid, upper branch very short. *Nutlets* ovoid, subtriquetrous, papillose-glandular; scar of contact surface very large, lateral.

DISTR. Monotypic, continental SE. Asia (Burma, Thailand to Yunnan); in *Malasia*: Central Sumatra, E. Java, and Lesser Sunda Is.



Fig. 11. *Eurysolen gracilis* PRAIN. a. Habit,  $\times \frac{2}{3}$ , b. corolla, c. calyx, both  $\times 4$ , d. LS of fruiting stage (a VAN STEENIS 11118, b-c BÜNNEMEIJER 9057, d after PRAIN).

1. *Eurysolen gracilis* PRAIN, Sc. Mem. Med. Offic. Ind. 11 (1898) 43; Ann. R. Bot. Gard. Calc. 9 (1906) 61, pl. 75; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 276; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 227; WU, Acta Phytotax. Sin. 8 (1959) 2; KENG, Gard. Bull. Sing. 24 (1969) 77, f. 13. — Fig. 11.

Herb or undershrub, 0.30–1 m. Stem and branches puberulous. Leaves membranaceous, ovate to rhomboid, 6–8 by 2.5–4 cm, acute or acuminate, serrate, glabrescent on both surfaces, base acute; petiole slender, 1.5–3 cm. Flowers 6–10(–30) in a verticillaster, in terminal or upper-axillary spikes, 8–15 cm long. Calyx tubular, 3–3.5 mm long, in fruit 4–4.5 mm, sparsely puberulous and papillose-glandular externally, but hardly 2-lipped. Corolla white, tubular, 5–6.5 mm long; limb 2-lipped; upper lip short. Stamens exserted. Ovary very shortly stalked. Nutlets c. 1 mm (immature).

Distr. Tropical SE. Asia; in *Malesia*: Central Sumatra (Mt Kerintji), E. Java (Mt Jang), and Lesser Sunda Is. (W. Sumbawa: Batu Lanteh, common in Flores).

Ecol. Open places in moist mountain valleys, 700–1800 m. Fl. Apr.–Jan. Though in Java and Sumbawa occurring in a seasonal climate region, the two rare localities in the mountains are both almost certainly local 'everwet islands'.

Note. The Malesian material slightly deviates in the more spaced verticillasters (internodes to 1.5 cm at the base of the spike) and the large number of flowers per verticillaster (30 or more).

## 11. LEONOTIS

R.BR. in W. T. Aiton, Hort. Kew. ed. 2, 3 (1811) 409; BTH. in DC. Prod. 12 (1848) 534; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 246.

Herbs or shrubs. *Flowers* rather large, densely crowded in axillary verticillasters. Bracts slender. *Calyx* funnel-shaped, 8–10-nerved, 8–10-toothed; mouth slightly oblique, uppermost tooth longest. *Corolla* as long as or longer than the calyx, 2-lipped; upper lip long, concave, villous, lower lip 3-lobed. *Stamens* 4, ascending under upper lip of corolla; lower pair longer; anther-cells divaricate, confluent. Disk equal. Style subulate, with the upper stigmatic segment reduced to a tiny tooth. *Nuts* oblong or obovoid, glabrous.

Distr. About 15 spp., in tropical and southern Africa, one species occurring in warm parts of Asia and America as a weed, probably after having escaped from cultivation.

**1. *Leonotis nepetaefolia* (L.) R.BR.** in W.T.Ait. Hort. Kew. ed. 2, 3 (1811) 409; BTH. in Wall. Pl. As. Rar. 1 (1830) 59; Lab. Gen. Sp. (1834) 618; in DC. Prod. 12 (1848) 535; MIQ. Fl. Ind. Bat. 2 (1859) 984; HOOK. f. Fl. Br. Ind. 3 (1885) 8 (*repetifolia*); PRAIN, J. As. Soc. Beng. 74, ii (1907) 717; BOLD. Zakfl. (1916) 108; RIDL. Fl. Mal. Pen. 2 (1923) 655; DOCT.V.LEEUWEN, Trop. Natuur 14 (1925) 68, f. 1–4; BACK. Onkr. Suiker. (1931) 553, Atlas (1973) t. 525; SAYEEDUD-DIN, J. Bomb. Nat. Hist. Soc. 41 (1940) 795; STEEN. Fl. Scholen Indon. (1951) 338; BACK. & BAKH. f. Fl. Java 2 (1965) 622. — *Phlomis nepetaefolia* LINNÉ, Sp. Pl. (1753) 586.

Annual herb, 1–2.5 m. Stem and branches deeply furrowed, finely pubescent. *Leaves* membranaceous, oblong-ovate to ovate, 4.5–6(–12) by 3–5(–9.5) cm, acute or abruptly acuminate, base rounded to truncate, abruptly narrowed into the petiole (2–7.5 cm), coarsely crenate serrate, finely pubescent on both surfaces. *Flowers* in 2–8 distant, globose, dense verticillasters, 2.5–7 cm  $\varnothing$ , composed of several, vertically deflexed, 2-seriate, many-flowered cincinni. Bracts linear-subulate, 0.5–1.4 cm, pubescent, strongly deflexed, hidden by the flowers. *Calyx* 1.2–1.5 cm long, in fruit 1.5–2 cm, incurved, ribbed, short soft hairy below, and

with long white hairs above; teeth 8–9, unequal, sharply pointed. *Corolla* orange, 2–2.5 cm long, the tube with 3 rings of hairs inside; upper lip arched, 1–1.2 cm long, outside densely set with orange-coloured hairs. *Nutlets* oblong-obovoid, 2.5–3 mm long, truncate above, dull black.

Distr. Native of tropical Africa, naturalized in many parts of the tropics, in *Malesia*: Sumatra, Banka, Malaya, Singapore, and Java (common in West, more rare in Central and East Java).

Ecol. A weed, found along roadsides, in waste places, fallow fields near ponds and lakes, etc., 5–1350 m. Pollinated by birds (cf. DOCTERS VAN LEEUWEN). Fl. Jan.–Dec.

Vern. *Lopend vuurtje*, Dutch; *nampong*, S.

Uses. BURKILL (Dict. 1935, 1329) stated that in Malaya the leaves are medicinal for wounds. Cultivated in Malaya.

## Cultivated

***Leonotis leonurus* (L.) R.BR.** in W.T.Ait. Hort. Kew. ed. 2, 3 (1811) 410; BACK. & BAKH. f. Fl. Java 2 (1965) 622.

A native of tropical Africa, formerly cultivated in Central Java as a hedge plant near Sela, on the saddle Merbabu-Merapi at c. 1200 m.

## 12. LEONURUS

LINNÉ, Gen. Pl. ed. 5 (1754) 254; Sp. Pl. (1753) 584; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 256; KENG, Gard. Bull. Sing. 24 (1969) 97.

Erect herbs. *Leaves* often lobed or palmate-pinnately dissected. *Verticillasters* of numerous flowers axillary. Bracts subulate. *Calyx* turbinate, 5-nerved and 5-toothed, teeth more or less equal, spinescent, spreading. *Corolla* naked or annulate within, 2-lipped; upper lip entire, erect, convex; lower lip 3-lobed, midlobe very large, deeply notched. *Stamens* 4, in 2 pairs, ascending under the upper lip; lower pair slightly longer; anthers 2-celled, cells parallel, connivent. Disk uniform. Style equally 2-fid, branches obtuse or subulate. *Nutlets* dry, smooth, triquetrous, truncate at apex.

Distr. About 8 spp., mainly in temperate Asia and Europe, one introduced and sometimes cultivated in the tropics and *Malesia*.

**1. *Leonurus sibiricus* LINNÉ**, Sp. Pl. (1753) 584; BURM. f. Fl. Ind. (1768) 127; BL. Bijdr. (1826) 828; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 397; Herb. Timor. descr. (1835) 69; ZOLL. Nat. Geneesk. Arch. N. I. 2 (1845) 591; BTH. in DC. Prod. 12 (1848) 501; MIQ. Fl. Ind. Bat. 2 (1859) 978; Sumatra (1860) 572; KURZ, Nat. Tijds. N. I. 27 (1864) 213; F.-VILL. Nov. App. (1880) 165; HOOK. f. Fl. Br. Ind. 4 (1885) 678; VIDAL, Phan. Cuming. Philip. (1885) 136; Rev. Pl. Vasc. Filip. (1886) 214; PRAIN, J. As. Soc. Beng. 74, ii (1907) 720; KOORD. Exk. Fl. Java 3 (1912) 147; MERR. Fl. Manila (1912) 412; Sp. Blanc. (1918) 336; En. Philip. 3 (1923) 412; RIDL. Fl. Mal. Pen. 2 (1923) 651; BACK. Onkr. Suiker. (1931) 558, Atlas (1973) t. 530; BURK. Dict. (1935) 1329; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 193; HEND. Mal. Nat. J. 6 (1950) 389, f. 358i; QUIS. Medic. Pl. Philip. (1951) 819; BACK. & BAKH. f. Fl. Java 2 (1965) 623; KENG, Gard. Bull. Sing. 24 (1969) 98, f. 16. — *L. tataricus* (non L. 1753) BURM. f. Fl. Ind. (1768) 127. — *L. marrubiatrum* (non L.) BURM. f. l.c. — *L. japonicus* HOUTT. Nat. Hist. Pl. 9 (1778) 366, t. 57, f. 1; HARA, J. Jap. Bot. 51 (1976) 226, incl. f. *niveus*. — *Stachys artemisiae* LOUR. Fl. Coch. (1790) 365; BLANCO, Fl. Filip. (1837) 476; ed. 2 (1845) 331 ('*Starchis*'); ed. 3, 2 (1878) 249, t. 259. — *L. heterophyllus* SWEET, Hort. Brit. (1827) 321; KUPRIANOVA, Fl. URSS 21 (1954) 156; H. W. LI, Acta Phyt. Sin. 12 (1974) 214. — *L. artemisia* (LOUR.) S.Y. HU, J. Chin. Univ. Hongkong 2 (1974) 381, f. 1, incl. var. *albiflorus*.

Annual or perennial, 0.5–1.5 m. Stem 4-angled, furrowed, softly pubescent or glabrescent. *Leaves* chartaceous, upper ones linear, 4–5 cm, lower and basal ones ovate or deltoid in outline, 5–7 by 3–4.5 cm, palmati-pinnately partite or dissected, with linear incised segments, glabrous or glabrescent above, often glaucous and pubescent on the nerved beneath; petiole 2–4 cm. Bracts subulate or spinescent, 4–10 mm. *Calyx* 4–5 mm long, in fruit 6–7 mm, glabrous or sparingly pubescent, glandular, teeth subulate. *Corolla* white, pink, or reddish, 10–11(–15) mm long; tube often obliquely annulate within; upper lip obovate, pubescent outside; midlobe of lower lip obovate, pubescent. *Filaments* included; anthers glandular. *Nutlets* ellipsoid, brown, 2 mm.

Distr. Native in temperate Asia, now distributed in many warm and tropical countries; in *Malesia*: NE. Sumatra (Asahan), Malay Peninsula (also Singapore), Banka, Borneo (Sarawak), Philippines (Batan Is., Luzon, Mindanao), Celebes, Java (throughout), Lesser Sunda Is. (Bali, Timor), Moluccas.

Ecol. Waste places, river-banks, railway embankments, always in settled land, still local and as a whole fairly rare, sometimes cultivated as an ornamental or for medicinal purpose and escaped, under both everwet and seasonal climatic conditions, 1–2000 m. Fl. Jan.–Dec. (in Java).

Taxon. The specific name *Leonurus sibiricus* L. has been applied to a very widely distributed species

from Siberia, China, Korea, Japan to India and Malesia. KUPRIANOVA (1954) first pointed out that two entities are involved. The northern entity occurs from Siberia, Mongolia, to N. China (Inner Mongolia, Hupeh, Shansi, and Shensi) (*vide* LI, 1974), and the southern entity is found in Amur, Ussuri, Korea, Japan, China (incl. Tibet), India, and Malesia (*vide* HARA, 1976). Thus these two entities are slightly sympatric around N. China. The northern entity differs from the southern one, as summarized by LI (1974) in the following features: (1) the more finely dissected linear leaf-segments (usually 1–3 mm wide), (2) the larger corolla (to 1.8 and sometimes even to 2.3 cm long) with soft hairs externally, (3) the lower corolla-lip about  $\frac{1}{3}$  shorter than the upper one, and (4) the calyx, especially in its middle portion, being covered with soft hairs.

Since the type species of *L. sibiricus* was collected from Siberia, thus a new name for the southern entity seems to be needed. Thus far three names have been suggested. One name, *L. heterophyllus* SWEET (1827), was favoured by KUPRIANOVA (1954) and LI (1974); another, *L. japonicus* HOUTT. (1778) was favoured by HARA (1976); and a new combined name, *L. artemisia* (LOUR.) S. Y. HU (1974) was made based on *Stachys artemisia* LOUR. (1790).

It appears that the differences between the northern and southern entities as understood, are no more than ecotypical, thus they seem to warrant subspecific, rather than specific distinction. The specific name *L. sibiricus* L. is therefore maintained in this treatment. If in the future some new traits are discovered to support the segregation of these two entities into two species, then *L. japonicus* HOUTT. would seem to be an appropriate name for the southern entity.

Vern. *Lion's tail*, *Siberian motherwork*, E; *dëndèrèman*, *padang dèrman*, S. *gindjèan*, J; Sumatra: *si saratang*, M; Mal. Pen.: *sèranting*, *tèbungaga*, M; Philippines: *kamariang-sungsong*, Tag.; Moluccas: *gofu hairan roriha*, Ternate, *laranga kohari*, Tidore.

Uses. In Java considered a substitute for opium, but its chemical properties are harmless (HEYNE, Nutt. Pl. ed. 3, 1950, 1327). An infusion in spirits is sometimes given after childbirth. In Malaya employed as a poultice against head-aches. A decoction of the leaves is used in the Philippines as a diuretic. HOOPER (Gard. Bull. S. S. 6, 1929, 82) stated it to be a general remedy in puerperal and menstrual diseases. HARTLEY (Lloydia 32, 1969, 266) listed it as anti-cancerogenous.

#### Doubtful

*Leonurus cardiaca* (non L.) THUNB. Fl. Jav. (1825) 15, *nomen*. Java. Identity unknown.

*Leonurus cordifolia* NORONHA, *L. indica* NORONHA, *L. marrubifolia* NORONHA, Verh. Bat. Gen. 5 (1790) ed. 1, art. IV, 19, repr. 79, *nomina*. Java. Identity unknown.

## 13. LEUCAS

R. BR. Prod. (1810) 504; BTH. in B. & H. Gen. Pl. 2 (1876) 1213; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 250; J. K. MORTON, J. Linn. Soc. Lond. Bot. 58 (1962) 263; KENG, Gard. Bull. Sing. 24 (1969) 100. — Fig. 12–14.

Herbs or undershrubs. Stems and leaves often villous. *Flowers* medium or small, in dense axillary, distant verticillasters; sometimes forming terminal, capitate clusters. *Calyx* 8–10-nerved, often striate; mouth equal or oblique; teeth 8–10, usually unequal, posterior one largest. *Corolla* (in Mal.) white, tube slender, often not exerted, with a hairy ring inside or not; upper lip erect, concave, the margins often fringed with dense velutinous hairs; lower lip 3-fid, spreading, midlobe very large. *Stamens* 4, didynamous; upper pair shorter; all ascending under upper lip, cells divaricate, ultimately confluent. Disk entire or lobed, uniform or enlarged anteriorly. Style subulate; upper branch minute or obsolete. *Nutlets* ovoid, triquetrous, obtuse.

Distr. About 60 *sp.*, chiefly in warm and tropical parts of Africa and Asia; in *Malesia* 6 *sp.*

## KEY TO THE SPECIES

1. Verticillasters few, usually congested into a terminal cluster or clusters. Mouth of calyx tube oblique, the upper part projected forwards.
  2. Calyx tube tubular, 8–9 mm long (in flower); calyx teeth 10. Bracts lanceolate, as long as the calyx . . . . . **1. *L. aspera***
  2. Calyx tube turbinate, 5–7 mm long (in flower). Bracts linear, shorter than the calyx.
    3. Plant usually hispidous. Leaves elliptic or narrowly lanceolate. Calyx mouth open; teeth 8, subequal, the posterior one only slightly larger than the others. . . . . **2. *L. zeylanica***
    3. Plant usually finely puberulous. Leaves generally linear-lanceolate. Calyx mouth often constricted, especially in fruit; teeth 7–10, very unequal, the posterior one much longer than the others . . . . . **3. *L. lavandulifolia***
1. Verticillasters few to many, on distant nodes, not congested into a terminal cluster or few clusters.
  4. Calyx tube curved, the mouth oblique with the upper part projected forwards. Plants sparsely hirsute. Flowers numerous (usually over 30) in a verticillaster . . . . . **4. *L. martinicensis***
  4. Calyx tube straight, the mouth not oblique. Plants densely woolly or tomentose. Flowers relatively fewer (generally below 20) in a verticillaster.
    5. Bracts subtending the flowers nearly as long as the calyx. Stem and branches densely brownish woolly . . . . . **5. *L. marruboides***
    5. Bracts subtending the flowers minute. Stem and branches tomentose . . . . . **6. *L. flaccida***

**1. *Leucas aspera*** (WILLD.) LINK, En. Hort. Berol. 2 (1822) 113; SPRENG. Syst. 2 (1825) 743; BTH. Lab. Gen. Sp. (1834) 615; in DC. Prod. 12 (1848) 532; MQ. Fl. Ind. Bat. 2 (1859) 982; HOOK. f. Fl. Br. Ind. 4 (1885) 690; KOORD. Exk. Fl. Java 3 (1912) 146; MERR. En. Philip. 3 (1923) 410; BACK. Onkr. Suiker. (1931) 558, Atlas (1973) t. 527; QUIS. Medic. Pl. Philip. (1951) 828; BACK. & BAKH. f. Fl. Java 2 (1965) 623; KENG, Gard. Bull. Sing. 24 (1969) 101; HENTY & PRITCHARD, Bot. Bull. Lae 7 (1975) 107, fig. — *Phlomis aspera* WILLD. En. Hort. Berol. 2 (1809) 621. — *L. minahassae* KOORD. ex BOERL. Handl. 2, 2 (1899) 716, *nomen*; KOORD.-SCHUM. Syst. 3 (1914) 112, *nomen*.

Annual herb, 30–60 cm, often branched. Stem and branches hispid, with spreading hairs. *Leaves* membranaceous, linear-lanceolate, or narrowly lanceolate, 4–6 by 0.8–1 cm, acuminate, base attenuate, margin remotely crenate, tomentose on both surfaces, pilose on nerves; petiole 0.5–1 cm long, densely hispid. *Flowers* subsessile, in terminal

verticillasters, forming a globular head 1.5–2.5 cm Ø. Bracts narrowly lanceolate, 8–10 mm long, ciliate along the margins. *Calyx* 7–10 mm (only slightly accrescent in fruit), cylindrical, tube pilose, 10-nerved and 10-toothed, mouth strongly oblique, teeth erect, the posterior one longest. *Corolla* 15–16 mm long, strongly curved, with a hairy ring inside near the middle; upper lip 2 mm long, densely velutinous, lower lip 6 mm sparsely pubescent. Anthers red. *Nutlets* narrowly ovoid, 2.5 by 0.8 mm, ventral surface triquetrous, dorsal one rounded, finely granulate or nearly smooth, black.

Distr. Continental SE. Asia (India, Burma, Thailand, Indo-China) to Mauritius; in *Malesia*: Malay Peninsula (incl. Penang), Java (vicinity of Djakarta; Central–East Java; Madura I.; Kangean Is.), Philippines (Luzon, Mindoro, Mindanao), N. Celebes (Minahassa), and E. New Guinea (Morobe Distr., one coll.).

Ecol. Various habitats, mostly grassy plains, maize fields, open dry sandy soils, waste places,

teak-forest, railway embankments, dunes, locally often common, from sea-level to c. 500 m. *Fl.* Jan.–Dec.

It is curious to note that whereas in Java it is preferring the distinctly seasonal areas, growing in profusion in the very driest areas, it is also found in Penang and NE. Celebes with an everwet climate.

Vern. Java: *patji-patji*, M, *lènglèngan*, *ngangègan*, J; Philippines: *karukansòli sulasulasihan*, Tag., *pansi-pansi*, Ting., Tag., Bis., *paysi-páysi*, Bis., *sipsipan*, Pamp.

Uses. In the Philippines it is said that the crushed plant is applied hot to wounds (QUISUMBING, *l.c.* 820). TAVERA (*Pl. medic. Filip.* 1892, 199) stated that bruised leaves are used against bites of snakes and poisonous insects.

Note. According to BACKER (1931, *l.c.*) and ADELBERT *L. aspera* is possibly only a form of *L. zeylanica*, and can sometimes hardly be distinguished from it.

2. *Leucas zeylanica* (L.) R. BR. in Aiton, Hort. Kew. ed. 2, 3 (1811) 409; SPRENG. Syst. 2 (1825) 742 ('*ceylonica*'); BTH. Lab. Gen. Sp. (1834) 614; in DC. Prod. 12 (1848) 531; MIQ. Fl. Ind. Bat. 2 (1859) 982; HOOK. f. Fl. Br. Ind. 4 (1885) 689; HALL. f. Bull. Herb. Boiss. 6 (1898) 617, *incl. var. β latifolia* HALL. f.; K.SCH. & LAUT. Nachtr. Fl. Schutzgeb. (1905) 373; PRAIN, J. As. Soc. Beng. 74, ii (1907) 718; KOORD. Exk. Fl. Java 3 (1912) 146; MERR. Int. Rumph. (1917) 457; En. Philip. 3 (1923)



Fig. 12. *Leucas zeylanica* (L.) R. BR. Along a roadside at Pontianak (Photogr. A. ELSENER, Febr. 1961).

411; RIDL. Fl. Mal. Pen. 2 (1923) 650; BARTLETT, Pap. Mich. Ac. Sc. 6 (1926) 35; MERR. Pl. Elm. Born. (1929) 268; MANSFELD, Bot. Jahrb. 62 (1929) 378; BACK. Onkr. Suiker. (1931) 555, Atlas (1973) t. 526; BURK. Dict. (1935) 1338; HEND. Mal. Nat. J. 6 (1950) 392, t. 362; QUIS. Medic. Pl. Philip. (1951) 821; BACK. & BAKH. f. Fl. Java 2 (1965) 623; KENG, Gard. Bull. Sing. 24 (1969) 101. — *Phlomis zeylanica* LINNÉ, Sp. Pl. (1753) 586. — *Leonurus marrubiastrum* (non L.) BURM. f. Fl. Ind. (1768) 127. — ? *Phlomis obliqua* THUNB. Fl. Jav. (1825) 15, *nomen*. — *Phlomis cephalotes* (non ROTH) BL. Bijdr. (1826) 830. — *Spermacoce ? denticulata* WALP. Nov. Act. Ac. Caes. Leop.-Car. 19 (1843) Suppl. 1, p. 352; Repert. 6 (1846) 29; F.-VILL. Nov. App. (1880) 113. — *L. malayana* HANCE ex WALP. Ann. Bot. Syst. 3 (1852) 269; MIQ. Fl. Ind. Bat. 2 (1859) 984. — *L. bancana* MIQ. Fl. Ind. Bat. Suppl. 1 (1861) 572; KOORD.-SCHUM. Syst. Verz. 1 (1910) fam. 254, p. 3. — Fig. 12.

Annual herb, 20–60 cm, often branched. Stem and branches hispid. Leaves membranaceous, lanceolate, 4–5.5 by 1–1.3 cm, acuminate, base attenuate, entire; margin elsewhere remotely serrate, hirsute on both surfaces; petiole 0.2–0.8 cm, hispid. Flowers subsessile, in terminal verticillasters, usually 6–8 forming a globose head, 1.5–2 cm Ø, occasionally also axillary verticillasters occur below. Bracts linear, 4–5 mm, spinescent. Calyx turbinate 5–6 mm long, in fruit 7–8 mm, slightly curved, hispid, 10-nerved and 8-toothed; mouth slightly oblique, pubescent within; uppermost tooth slightly longer than the rest. Corolla 8 mm long, tube with a hair-ring near the middle; upper lip obovate, white-woolly; lower lip patent, 3–4 mm long, 3-lobed. Anthers red. Nutlets obovoid, 3 by 1 mm, apex truncate; ventral surface angular, dorsal rounded; smooth.

Distr. Throughout S. and SE. Asia, throughout *Malesia*, but rather few collections from Borneo and East *Malesia*, not yet collected in Celebes.

Ecol. Sunny dry localities, often on sandy soil, paddy dams, waste places, roadsides, from the lowland to c. 1000 m. *Fl.* Jan.–Dec. Leaf-galls occur, caused by aphids.

Vern. Malaya: *katumbit*, *ketumbak luka-luka*; Java: *patji patji*, S, *lènglèngan*, J; Philippines: *guma-guma*, Sul., *masibulan*, Gad.

Uses. In spite of the disagreeable smell of the plant and the very bitter taste, it is sometimes used in Bali as a vegetable (in *sajor*), cf. HEYNE, Nutt. Pl. (1927) 1327. Furthermore the sap of the leaves is used for sores of eyes and nostrils. A poultice for scabies, itches, head-aches, vertigo, and colic. Also used as a vermifuge with children.

3. *Leucas lavandulifolia* J.E. SM. in Rees, Cycl. 20 (1812) n. 2; PRAIN, J. As. Soc. Beng. 74, ii (1907) 719; MERR. Fl. Manila (1912) 412; Int. Rumph. (1917) 457; Sp. Blanc. (1918) 336; COSTERUS & J.J. SM. Ann. Jard. Bot. Btzg 32 (1922) 29; MERR. En. Philip. 3 (1923) 411; RIDL. Fl. Mal. Pen. 2 (1923) 650; BACK. Onkr. Suiker. (1931) 557, Atlas (1973) t. 529; STEEN. Arch. Hydrobiol. Suppl. 10 (1932) 323; BURK. Dict. (1935) 1338; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 167; QUIS. Medic. Pl. Philip. (1951) 820; BACK. & BAKH. f. Fl. Java 2 (1965) 623; KENG, Gard. Bull. Sing. 24 (1969) 103. — *Phlomis linifolia* ROTH, Nov. Sp. (1821) 260; BL.

Bijdr. (1826) 829. — *Phlomis zeylanica* (non L.) BL. Cat. (1823) 15; BLANCO, Fl. Filip. (1837) 475 ('*ceilanica*'); ed. 2 (1845) 331; ed. 3, 2 (1878) 248. — *L. linifolia* (ROTH) SPRENG. Syst. 2 (1825) 743; BTH. Lab. Gen. Sp. (1834) 617, (1835) 744; HASSK. Cat. Hort. Bog. (1844) 133; ZOLL. Nat. Genesk. Arch. N. 1. 2 (1845) 591; BTH. in DC. Prod. 12 (1848) 533; MIQ. Fl. Ind. Bat. 2 (1859) 983; F.-VILL. Nov. App. (1880) 165; VIDAL, Phan. Cuming. Philip. (1885) 136; HOOK. f. Fl. Br. Ind. 4 (1885) 690; VIDAL, Rev. Pl. Vasc. Filip. (1886) 214; KOORD. Exk. Fl. Java 3 (1912) 146. — Fig. 13-14.



Fig. 14. *Leucas lavandulifolia* J. E. SM. Palembang (Photogr. DE VOOGD).



Fig. 13. *Leucas lavandulifolia* J. E. SM. a. Habit,  $\times \frac{2}{3}$ ; b. flower,  $\times 2$ ; c. fruiting calyx,  $\times 4$  (a, c KOORDERS 23278, b BOERLAGE 58).

Erect, fetid, annual herb, 30-80 cm, often much-branched. Stem and branches pubescent, subglaucous. Leaves herbaceous, linear-lanceolate, rarely lanceolate, 4-6 by c. 0.5 cm, subsessile, acuminate, base attenuate, entire, margin elsewhere subentire or remotely and sparingly serrate. Flowers shortly pedicelled, in terminal and axillary, always leafy verticillasters, often congested towards apex and forming a cluster or clusters 1.5-2 cm  $\varnothing$ . Bracts linear, 3-4 mm, puberulous. Calyx obliquely turbinate, 6-7 mm long, in fruit 8-9 mm, glabrescent or puberulent; mouth oblique, pubescent within with white hairs, slightly constricted; teeth varying from 7-10, the uppermost one large and broad, others minute and spinescent. Corolla 10 mm long; tube annulate within near the middle; upper lip oblong, woolly; lower lip patent, the midlobe large, obovate. Anthers red-brown. Nutlets oblong, 2.5 by 1 mm, rounded at apex, inner surface angular, outer rounded, dark brown, pale at base.

Distr. Continental Asia (India to China) and throughout Malesia, though not yet collected in the Lesser Sunda Is.; once collected in Bawean I., and very rare in Borneo mainland and New Guinea (in Misool I. and once in Morobe Distr.). According to MERRILL also in the Mascarenes.

Ecol. Open waste places, coconut estates, roadsides, grassland, fallow agricultural land, paddy dams, locally often numerous, from sea-level to c. 1500 m. Fl. Jan.-Dec. Galls on young stems are caused by aphids.

Vern. Patji-patji, M; Sumatra: lènggas, M, (daun) patjè patjè or patji-patji, M; Java: lènglèngan, lingko-lingkoan, nlènglèngan, S, lèngan, J, sarap nornor, sèbasé, Md; Bali: patji patji; Philippines: karukansólt, salita, solasolasthan, Tag., pansipansi, Tag., Bis., kaskasimba, Ilk., laŋga-laŋga, Bik., paysi-paysi, Bis., samparan, Bul.; NE.

Celebes: *kékombaïn*, Manado; Moluccas: *daun héran*, *d. sétan*, *gofi hairan*, Ternate, *hairani*, Halmahera, *laranga*, Tidore, *langa-langa*, Bugin, lang.

Uses. Said to be in use for healing chronic leg sores, dermatosis, as an anthelmintic for round worms, and for appeasing affection of the nerves. In the Philippines (and also elsewhere) a poultice of fresh leaves is applied on wounds, especially on those with inflammation; in Java commonly applied on stinking wounds on animals in order to cleanse them from fly larvae, also for eye-sores and as a gargle. HEYNE, Nutt. Pl. (1927) 1326, mentioned further the use of the plant as a vegetable at Djakarta and fodder for cattle. There seems to be some application of the plant in veterinary surgery. A decoction of the roots is sometimes used for inflamed callosity.

4. *Leucas martinicensis* R. Br. Prod. (1810) 504; BTH. in Wall. Pl. As. Rar. 1 (1830) 60; Lab. Gen. Sp. (1834) 617; in DC. Prod. 12 (1848) 533; MIQ. Fl. Ind. Bat. 2 (1859) 983; HOOK. f. Fl. Br. Ind. 4 (1885) 688; PRIN, J. As. Soc. Beng. 74, ii (1907) 718; RIDL. Fl. Mal. Pen. 2 (1923) 650.

Annual herb, 40–60 cm, often branched. Stem and branches obtusely 4-angled, hirsute. *Leaves* membranaceous, oblong or lanceolate-ovate, 5–8.5 by 2–4.5 cm, obtuse, base cuneate or rounded, entire; margin elsewhere serrate-crenate; appressed-hirsute on both surfaces; petiole 1–1.5 cm, hirsute. *Flowers* numerous (over 30), subsessile, in axillary, globose verticillasters (2–3.5 cm Ø) distributed on distant nodes. Bracts linear-lanceolate, 0.5–1 cm. *Calyx* tubular, 1–1.2 cm long, in fruit 1.4–1.6 cm, hirsute and woolly outside, 10-toothed; teeth lanceolate, ciliate, with spinescent tips, the uppermost largest, 5 mm long. *Corolla* 7–8 mm long, included in the calyx tube or barely exerted; not annulate within; the two lips subequal. *Nutlets* oblong-obovoid, c. 2 mm long, shining, dark-brown.

Distr. Tropical America, Africa, and continental Asia (India and Indo-China); in *Malesia*: Malay Peninsula: Perak, one collection.

Ecol. Waste places.

5. *Leucas marrubioides* DESF. Mém. Mus. Hist. Nat. Paris 11 (1824) 6, t. 3, f. 1; BTH. in Wall. Pl. As. Rar. 1 (1830) 61; Lab. Gen. Sp. (1834) 611; in DC. Prod. 12 (1848) 528; HOOK. f. Fl. Br. Ind. 4 (1885) 683; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 181; STEEN. Mt. Fl. Java (1972) pl. 25–9. — *L. javanica* BTH. var. *montana* ZOLL. Nat. Geneesk. Arch. N. I. 2 (1845) 569; MIQ. Fl. Ind. Bat. 2 (1859) 980 (ZOLLINGER 2187, n.v.). — *L. javanica* BTH. f. *montana* BACK. & BAKH. f. Fl. Java 2 (1965) 622.

Perennial herb, 0.5–1 m. Stem and branches densely brownish woolly. *Leaves* thin- to thick-membranaceous, ovate, broadly ovate or subrounded, 2.5–5 by 1.5–3.5 cm, acute or bluntly acute, base rounded or cordate, entire; margin elsewhere coarsely serrate or crenate, sericeous above, densely woolly beneath; petiole 0.2–1 cm, the upper leaves sessile. *Flowers* 10–20 in axillary verticillasters, distributed at distant nodes. Bracts linear-lanceolate, 7–10 mm, ciliate. *Calyx* tubular campanulate, straight, densely silky sericeous outside, 10–12 mm long, in fruit 11–13 mm, including the teeth; teeth 9–10, filiform, unequal, 2–3 mm,

ciliate. *Corolla* tube equalling the calyx, annulate within, lower lip 4–5 mm long, woolly. *Nutlets* ellipsoid, 1.5–2 by 1 mm, obtuse at the apex, smooth.

Distr. Continental SE. Asia (Ceylon, Deccan Peninsula); in *Malesia*: eastern half of Java (Mts Lawu, Ardjuno, Tenger-Smeru, Jang).

Ecol. Mountain grasslands and tjemara forest (*Casuarina junghuhniana*), 200–2800 m. Fl. Jan.–Dec.

6. *Leucas flaccida* R. Br. Prod. (1810) 505; BTH. Lab. Gen. Sp. (1834) 609; in DC. Prod. 12 (1848) 526; MIQ. Fl. Ind. Bat. 2 (1859) 979; HOOK. f. Fl. Br. Ind. 4 (1885) 684; WARB. Bot. Jahrb. 13 (1891) 425; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 528; MANSFELD, Bot. Jahrb. 62 (1929) 378; KENG, Gard. Bull. Sing. 24 (1969) 107. — *Phlomis chinensis* (non RETZ.) BL. Bijdr. (1826) 829. — *L. parviflora* BTH. in Wall. Pl. As. Rar. 1 (1830) 62. — *L. mollissima* WALL. ex BTH. in Wall. Pl. As. Rar. 1 (1830) 62; Lab. Gen. Sp. (1834) 607; in DC. Prod. 12 (1848) 525; HOOK. f. Fl. Br. Ind. 4 (1885) 682; MERR. & ROLFE, Philip. J. Sc. 5 (1910) Bot. 381; MERR. En. Philip. 3 (1923) 411; Trans. Am. Phil. Soc. 24, 2 (1935) 339; HEND. J. Mal. Br. As. Soc. 17 (1939) 66; HATUS. Mem. Fac. Agr. Kagoshima Un. 5 (1966) 48; KENG, Gard. Bull. Sing. 24 (1969) 106. — *Phlomis moluccana* ROXB. (Hort. Beng. 1814, 95, nomen) Fl. Ind. ed. Carey 3 (1832) 11. — *L. decemdentata* (non R. Br.) BTH. Lab. Gen. Sp. (1834) 609; in DC. Prod. 12 (1848) 526, p.p.; FORBES, Wand. (1885) 354, 514. — *L. javanica* BTH. Lab. Gen. Sp. (1834) 611; HASSK. Cat. Hort. Bog. (1844) 133; ZOLL. Nat. Geneesk. Arch. N. I. 2 (1845) 591, incl. var. *littoralis* ZOLL., excl. var. *montana* ZOLL.; BTH. in DC. Prod. 12 (1848) 528; MIQ. Fl. Ind. Bat. 2 (1859) 980, incl. var. *horsfieldiana* MIQ., excl. var. *montana* ZOLL.; KURZ, Nat. Tijds. N. I. 27 (1864) 213; F.-VILL. Nov. App. (1880) 165; VIDAL, Phan. Cuming. Philip. (1885) 136; Rev. Pl. Vasc. Filip. (1886) 214; MERR. Fl. Manila (1912) 412; KOORD. Exk. Fl. Java 3 (1912) 146; MERR. En. Philip. 3 (1923) 410; BACK. Onkr. Suiker. (1931) 557, Atlas (1973) t. 528; BACK. & BAKH. f. Fl. Java 2 (1965) 622, incl. f. *javanica* BACK. et f. *littoralis* BACK., excl. f. *montana* BACK.; HATUS. Mem. Fac. Agr. Kagoshima Un. 5 (1966) 48; KENG, Gard. Bull. Sing. 24 (1969) 105. — *L. procumbens* (non DESF.) DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 398; Herb. Timor. descr. (1835) 70; MIQ. Fl. Ind. Bat. 2 (1859) 979. — *Isodeca flaccida* (R. Br.) RAFIN. Fl. Tell. 3 (1836) 88. — *L. chinensis* R. Br. β *obliganthos* HASSK. Flora 25, ii (1842) Beibl. 26. — *L. biflora* (non R. Br.) BTH. in DC. Prod. 12 (1848) 527; MIQ. Fl. Ind. Bat. 2 (1859) 980; KOORD.-SCHUM. Syst. Verz. 1 (1910) fam. 254, p. 3; KOORD. Exk. Fl. Java 3 (1912) 146. — *L. leucocephala* MIQ. Fl. Ind. Bat. 2 (1859) 981; KOORD. Exk. Fl. Java 3 (1912) 146. — *L. oxyodon* MIQ. Fl. Ind. Bat. 2 (1859) 981; KOORD. Exk. Fl. Java 3 (1912) 146. — *L. angularis* (non BTH.) HOOK. f. Fl. Br. Ind. 4 (1885) 684; O. K. Rev. Gen. Pl. 2 (1891) 523; KOORD. Nat. Tijds. N. I. 62 (1902) 218. — *L. marrubioides* DESF. var. *leucocephala* (MIQ.) O. K. Rev. Gen. Pl. 2 (1891) 523. — *L. marrubioides* (non DESF.) CERON, Cat. Pl. Herb. Manila (1892) 135. — *L. sericea* ELMER, Leaf. Philip. Bot. 1 (1908) 340.

Annual herb, 0.25–1.5 m. Stem and branches slender, covered with soft appressed or long villous hairs. *Leaves* thin- or thick-membranaceous, lanceolate to narrowly or broadly ovate, 2–3(–4) by 1–1.5(–3) cm, obtuse or acute, base rounded or cuneate, entire; margin elsewhere crenate-serrate or coarsely serrate, densely tomentose on both surfaces; petiole 0.2–1 cm. *Flowers* 2–8(–10) in spaced axillary verticillasters. Bracts linear, 2–3 mm, setose. *Calyx* tubular, 5–9 mm long, in fruit 7–10 mm, sparsely or densely tomentose outside, 10-toothed, teeth lanceolate or triangular at the base and abruptly narrowed apically. *Corolla* 13–16 mm long, tube short- or long-exserted, annulate within; lower lip slightly longer than the upper one. Filaments white; anthers red. *Nutlets* obovoid, 1.5 by 0.5 mm, subtruncate above, smooth.

Distr. Continental S. and SE. Asia (Burma, Thailand, Indo-China, S. China), Formosa, Ryukyu Is.; throughout *Malesia* (except Sumatra and Borneo) to NE. Australia.

Ecol. In open waste places, thickets and grassland, forest edges, or on limestone hills and littoral rocks, at low and high altitudes *e.g.* in tjemara forest in E. Java, from sea-level ascending to 3000 m. *Fl.* Jan.–Dec.

Vern. Java: *saja hetela*, S, *lènglèngan*, *paseg puti*, J, *patji-patji*, M, S; Lesser Sunda Is.: *bimig arial*, *daaratuk*, *kafi*; Philippines: *paling-harap*, Tag., *bagbagsangi*, *pangpangau*, Bon., *banbansit*,

Ilk.; New Guinea: *maunz*, Habi'inz dial. Tairora, Kainantu.

Notes. In the precursor I have remarked under *L. javanica* (*l.c.* 106) that the species is very polymorphous. Still, I distinguished two other allied species, *L. mollissima* WALL. *ex* BTH. and *L. flaccida* R. BR., which differed mainly in the indument of the calyx, the relative length of the corolla tube, *etc.*

However, closer examination of descriptions and material has made it clear to me that these differences cannot be upheld, and that only one polymorphous, very widely distributed species is involved, the oldest name of which is *L. flaccida* R. BR.

Experimental and field work may show that here and there racial distinctions might be possible.

#### Excluded

*Leucas chinensis* R. BR.; BTH. *Linnaea* 6 (1831) 81; DECNE, *Nouv. Ann. Mus. Hist. Nat. Paris* 3 (1834) 398; *Herb. Timor. descr.* (1835) 70.

This record is based on CHAMISSO's collection from Manila, which is perhaps a form of *L. flaccida* R. BR.

*Leucas pubescens* BTH.; USTERI, *Beitr. Kenntn. Philip. Veg.* (1905) 124.

MERRILL noted that he had seen no specimens of this species, which is definitely known only from India, and that the identification of USTERI's specimen is probably wrong.

## 14. MELISSA

TOURN. *ex* LINNÉ, *Gen. Pl.* ed. 5 (1754) 257; *Sp. Pl.* (1753) 592; BRIQ. in E. & P. *Nat. Pfl. Fam.* 4, 3a (1896) 295; KENG, *Gard. Bull. Sing.* 24 (1969) 108. — **Fig. 15.**

Branched, perennial herbs. *Leaves* crenate. *Flowers* medium-sized, usually in few-flowered, axillary verticillasters. *Calyx* tubular, always 13-nerved, sometimes not very clearly so due to the reticulation of transverse veins; 2-lipped; upper lip 3-toothed, teeth broad and highly connate, often slightly recurved; lower lip 2-toothed, teeth long and subulate. *Corolla* straight or  $\pm$  recurved, long and slender; upper lip emarginate or notched, erect; lower lip 3-lobed, flat and spreading. *Stamens* 4, didymous, ascending, posterior pair smaller and shorter than anterior pair; anthers 2-celled, cells divaricate. Disk equal-sided. Style lobes subequal. *Nutlets* obovoid, smooth and dark, often with a very prominent scar.

Distr. Species 3, in S. Europe and S. to SE. Asia, extending to S. China, Formosa, and *Malesia* (Sumatra, Java).

1. *Melissa axillaris* BAKH. *f.* in Back. & Bakh. *f.* *Fl. Java* 2 (1965) 629; KENG, *Gard. Bull. Sing.* 24 (1969) 108, f. 18; MURATA, *Acta Phytotax. Geobot.* 24 (1969) 84; in Hara, *Fl. E. Himal.* 2nd Report (1971) 115; STEEN, *Mt. Fl. Java* (1972) pl. 25–5. — *M. hirsuta* BL. *Bijdr.* (1826) 830, *non* HORNEB. 1815; BTH. *Lab. Gen. Sp.* (1834) 394; in DC. *Prod.* 12 (1848) 241. — *M. parviflora* BTH. in Wall. *Pl. As. Rar.* 1 (1830) 65, *non* SALISB. 1796; *Lab. Gen. Sp.* (1834) 394; in DC. *Prod.* 12 (1848) 241; HOOK. *f.* *Fl. Br. Ind.* 4 (1885) 651; MIQ. *Fl. Ind. Bat.* 2 (1859) 969; KOORD. *Exk. Fl. Java* 3

(1912) 149; DUNN, *Not. R. Bot. Gard. Edinb.* 6 (1915) 160; BÜNNEMEIJER, *Trop. Natuur* 7 (1918) 102, f. 14; KUDO, *Mem. Fac. Sc. & Agr. Taihoku Un.* 2, 2 (1929) 96; STEEN, *Bull. Jard. Bot. Bitzg III*, 13 (1934) 227; MUKERJEE, *Rec. Bot. Surv. India* 14 (1940) 100. — *Geniosporum axillare* BTH. in Wall. *Pl. As. Rar.* 2 (1830–31) 18. — *Calamintha gracilis* var. *pilosior* MIQ. *Fl. Ind. Bat.* 2 (1859) 968. — **Fig. 15.**

Erect herb, up to 1 m,  $\pm$  woody at the base. Branches pubescent when young. *Leaves* thin or thick membranaceous, very variable in size and

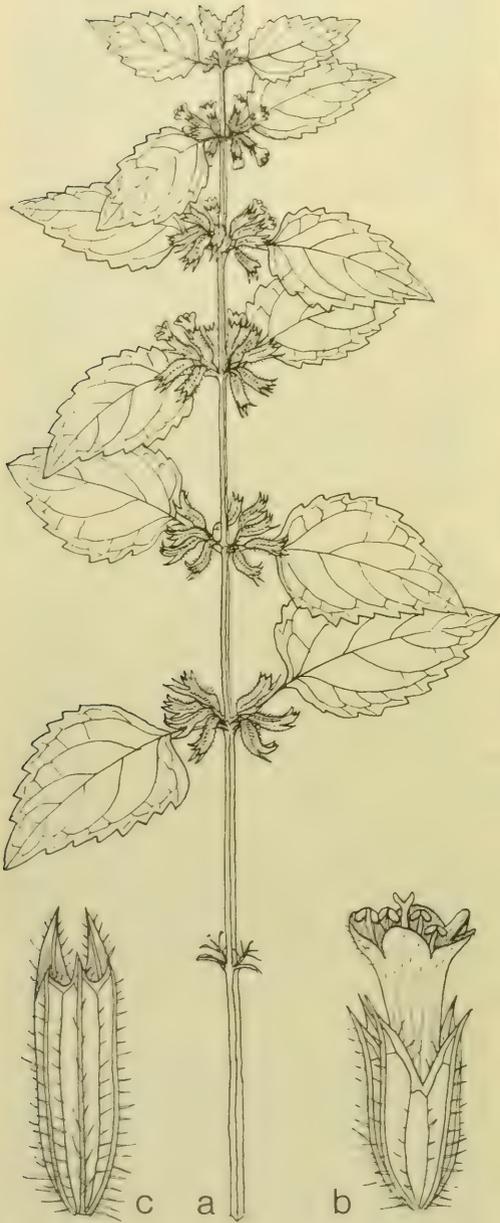


Fig. 15. *Melissa axillaris* BAKH. f. a. Habit,  $\times \frac{2}{3}$ , b. flower,  $\times 4$ , c. fruiting calyx, both  $\times 4$  (a COERT 352, b-c BACKER 21063).

shape; small ones ovate or elliptic, 1.2–3 by 0.8–1.5 cm, acute, base rounded or cuneate; larger ones lanceolate-ovate, often unequalateral, 5–7 by 2–3 cm, acuminate, at base acute; petiole 0.5–3 cm. Flowers usually 4–8 in axillary verticillasters. Pedicels 1–2 mm, sericeous. Calyx 5–6 mm long, in fruit 6–8 mm, pilose on the ribs outside; tube not inflated below. Corolla white, 9–10 mm long. Stamens: anterior pair barely exerted. Nutlets 8 by 2 mm, finely puberulent, with a very conspicuous scar on the ventral base.

Distr. From India to SW. China and Formosa; in *Malesia*: N.–Central Sumatra (Gajo Lands; Mt Kerintji) and W.–Central Java (Mt Patuha eastwards to Mt Merbabu).

MIQUEL (*l.c.*) and MERRILL (En. Born. 1921, 519) recorded it from Borneo, but this must rest on an error, possibly confusion with *Leucas flaccida*.

Ecol. Forest edges and along trails, open places along streams, but not on swampy soil, 1500–2600 m. Fl. Febr.–May.

Vern. *Djawër kotok*, S, *sangkëtan*, J.

Uses. On Mt Diëng (Central Java) leaves are externally used against head-ache.

#### Cultivated

*Melissa officinalis* L. 1753; F.-VILL. Nov. App. (1880) 165; BACK. & BAKH. f. Fl. Java 2 (1965) 629.

MERRILL (En. Philip. 3, 1923, 422) excluded this European species from the Philippine flora on arguments unknown to me; it is certainly cultivated occasionally in the mountains of Java.

#### Doubtful

*Melissa hortensis* NORONHA, *M. longifolia* NORONHA, *M. montana* NORONHA, Verh. Bat. Gen. 5 (1790) ed. 1, art. IV, 20, repr. 79, *nomina*. Java. Their identity is unknown.

## 15. MENTHA

LINNÉ, Gen. Pl. ed. 5 (1754) 257; Sp. Pl. (1753) 592; BTH. in B. & H. Gen. Pl. 2 (1876) 1182; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 317; DE WOLF, *Baileya* 2 (1954) 3, cult. spp., key; KENG, Gard. Bull. Sing. 24 (1969) 111. — Fig. 16.

Perennial herbs with creeping rootstocks, often strongly scented. *Leaves* often gland-dotted. *Flowers* small, in axillary verticillasters (in Mal.) or forming terminal spicate to paniculate inflorescences. Bracts often small. *Calyx* tubular or campanulate, 10-nerved, 5-toothed, teeth subequal. *Corolla* funnel-shaped, short, 4-lobed, uppermost lobe broader than the other 3, emarginate, thus faintly 2-lipped. *Stamens* 4, slightly didynamous; anthers 2-celled, cells parallel; filaments almost free, erect. Disk entire, uniform. Style shortly subequally 2-branched. *Nutlets* ovoid, smooth or reticulate.

Distr. Thirty or more spp., and many hybrids, mainly in the northern temperate regions of the Old World; in *Malesia*: 1 sp. possibly native, some others cultivated.

## TENTATIVE KEY TO THE SPECIES

(from *Flora of Java*)

1. Flowers in terminal leafless racemes or panicles . . . . . **M. piperita**
1. Flowers or verticillasters axillary, or plant never flowering.
  2. Leaves all or for the greater part with a rounded to truncate or shallow-cordate, rarely broadly cuneate base. Stem quadrangular, not grooved, very thinly short-hairy or glabrous . . . **M. cordifolia**
  2. Leaves with an acute to obtuse, cuneate, usually not very broad base. Stem more hairy than in the preceding species.
    3. Verticillasters globose, dense. Calyx rather densely long-hairy, 10-nerved, c. 3 mm long, throat after anthesis closed by a ring of hairs . . . . . **M. pulegium**
    3. Verticillasters not globose, rather dense. Calyx densely short-hairy, with 5 thick nerves and some thinner ones, c. 2 mm long, glabrous inside . . . . . **1. M. arvensis var. javanica**

**1. *Mentha arvensis* L. var. *javanica* (BL.) HOOK. f.** Fl. Br. Ind. 4 (1885) 648; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 319, ssp. *haplocalyx* BRIQ. var. *zollingeri* BRIQ., nomen; OCHSE & BAKH. Ind. Groent. (1931) 353, f. 223, as *M. arvensis*; BACK. Onkr. Suiker. (1931) 563, Atlas (1973) t. 534; BURK. Dict. (1935) 1454; BACK. & BAKH. f. Fl. Java 2 (1965) 631; KENG, Gard. Bull. Sing. 24 (1969) 111, f. 19. — *M. javanica* BL. Bijdr. (1826) 826; BTH. Lab. Gen. Sp. (1833) 183; SPANOGHE, Linnaea 15 (1841) 332; HASSK. Cat. Hort. Bog. (1844) 131; BTH. in DC. Prod. 12 (1848) 173; VIDAL, Phan. Cuming. Philip. (1885) 136; Rev. Pl. Vasc. Filip. (1886) 213; PRIN, J. As. Soc. Beng. 74, ii (1907) 710; KOORD. Exk. Fl. Java 3 (1912) 150; MERR. Int. Rumph. (1917) 458; KOORD. Fl. Tjibodas 3 (1918) 98; MERR. En. Philip. 3 (1923) 413; RIDL. Fl. Mal. Pen. 2 (1923) 655; OCHSE & BAKH. Ind. Groent. (1931) 352, f. 223. — Fig. 16a-d.

Aromatic, prostrate, stoloniferous herb, often rooting below. Stem 30–60 cm, pubescent with appressed hairs. *Leaves* thin-membranaceous, lanceolate to broadly lanceolate, 2.5–4.5(–7) by 1–2.5(–3) cm, acute, base long-cuneate, entire; margin elsewhere serrate; sparingly hairy above, glabrous beneath; petiole 0.5–1 cm. *Flowers* in axillary verticillasters. Bracts linear or subulate, 2–4 mm. Pedicels 2–2.5 mm. *Calyx* tubular-

campanulate, 2–2.5 mm long, in fruit 3 mm, with appressed short and long hairs, 5-toothed; teeth subequal, lanceolate or subulate, ciliate, often shorter than the tube. *Corolla* violet or lilac, 4.5–5 mm long, puberulent outside. *Stamens* either short and included or long and exerted. *Nutlets* ellipsoid, 1 mm long, finely granular, often pointed above, and with a large lateral scar below.

Distr. Ceylon and ?continental Asia; in *Malesia*: Malay Peninsula, Sumatra (also Batu Is.), Java, Lesser Sunda Is. (E. Timor), NE. Celebes, Philippines (Mindoro, Luzon, Samar), and Moluccas (Banda).

Ecol. Mostly humid, open localities, borders of paddies, etc., 150–1200 m. Fl. Jan.–Dec.

Vern. Malay Peninsula: *pohok*, derived from the Chinese *po-ho* or *po-he*; Sumatra: *iu-iu*, West Coast Res.; Java: *bidjanggut*, *budjanggus*, *budjangkut*, *S*, *kidjangut*, *S*, *J*, *djanggot*, *J*, *daun poko*, *M*; Lesser Sunda Is.: *ortalam*, Port. Timor; Philippines: *polihos*, S.L.Bis., *polio*, Tag., both corruptions from the Spanish *poleo*.

Uses. Often cultivated. HEYNE (Nutt. Pl. 1927, 1328) reported that in Java pounded leaves mixed with some chalk are used against head-ache. He gave also results of chemical analyses: oil is bitter with low menthol % and high pulegon %, and agreeable aromatic odour. OCHSE & BAKH. *l.c.* said it is used as a vegetable (*talab*) and added to sambal

## Cultivated

*Mentha arvensis* LINNÉ, Sp. Pl. (1753) 577; F.-VILL. Nov. App. (1880) 164; MERR. Fl. Manila (1912) 411; Sp. Blanc. (1918) 337; En. Philip. 3 (1923) 413; QUIS. Medic. Pl. Philip. (1951) 822; KENG, Gard. Bull. Sing. 24 (1969) 113. — *M. crispa* (non L.) BLANCO, Fl. Filip. (1837) 474; ed. 2 (1845) 530; ed. 3, 2 (1878) 246. — Fig. 16e.

Vern. *Yerba buena*, Sp.; Philippines: *ablebána*, If.

Note. A native of Europe. According to MERRILL it is introduced by the Spaniards and widely scattered in cultivation in the Philippines, not flowering; and as a pot plant in the Malay Peninsula and Singapore.

*Mentha* × *cordifolia* OPIZ ex FRESEN, Syll. Ratisb. 2 (1828) 232; BACK. & BAKH. f. Fl. Java 2 (1965) 631; CANTORIA, Philip. J. Sc. 97 (1968) 281. — *M. merdinah* BACK. ex OCHSE & BAKH. Ind. Groent. (1931) 354, f. 224.

Vern. *Kresmen*, S, *merdinah*, J.

Notes. A native of the northern temperate countries, cultivated in Java. It never flowers and is propagated vegetatively.

CANTORIA *l.c.* examined the Philippine material of so-called *M. arvensis* and *M. javanica* phytochemically and came to the conclusion that all this was the same species which he referred to *M.* × *cordifolia*.

He stated, however, also that in the Philippine *Menthas* no flowers were ever found. This is not true as CONKLIN & BUWAYA PNH 79601 from the Mountain Prov. in Luzon, 1200 m alt. near an irrigation canal (vern.: *amtin di olhan ietang*), which I identified as *M. arvensis* var. *javanica*, is in flower; obviously it does not belong to *M.* × *cordifolia*.

*Mentha* × *piperita* L.; FILET, Pl. Bot. Tuin Weltevreden (1855) 71; MIQ. Fl. Ind. Bat. 2 (1859) 967; PURSEGLOVE, Trop. Crops, Dicot. 2 (1968) 636.

Native of Europe; at one time obviously cultivated in Java. VAN STEENIS found this (Jan. 1954) in (Portuguese) Timor above Maubisse near Flecha, at c. 2000 m, often gregarious in damp places and near watercourses (*n.* 18363); it flowered seldom, and is commonly used by the Portuguese in chickenbroth.

*Mentha pulegium* LINNÉ, Sp. Pl. (1753) 577; BACK. & BAKH. f. Fl. Java 2 (1965) 631.

A native of the northern temperate countries, in Java locally cultivated in gardens as a condiment.

## Excluded

*Mentha sativa* (non L. 1763) THUNB. Fl. Java (1825) 15.

Probably refers to one of the cultivated species listed above. *M. sativa* L. seems never to have been introduced.



Fig. 16. *Mentha arvensis* L. var. *javanica* (BL.) Hook. f. a. Habit, × 1/2, b. flower, c. calyx, d. nutlet, all × 6. — *M. arvensis* L. e. calyx, × 6 (a–b VAN DER GAAG 117, c–d BACKER 26437, all from Java, e HARTZ *s.n.*, from Denmark).

for fragraney. KLOPPENBURGH-VERSTEEG (Ind. Pl. 1909) said that extractions are used against cough and indisposition of the stomach and that it possesses sudorific quality. HARTLEY (Lloydia 32, 1969, 269) listed it as a possible medicine against cancer.

Notes. The Malesian form differs from the European form mainly in the calyx teeth, which are separated by wide bays and from their triangular base soon narrow into almost filiform or mucronate teeth, a feature easily observed in fruiting calyxes.

It is not quite certain that this mint is native in Malesia, though it is admittedly already recorded by BLUME. It is nowhere recorded as truly belonging to native swamp vegetation. See also under *M.* × *cordifolia* below.



Fig. 17. *Microtoena insuavis* (HANCE) PRAIN ex BRIQ. *a.* Habit, nat. size, *b.* mature bud, *c.* open flower, both  $\times 2$ , *d.* anterior lip, *e.* two stamens, *f.* young anther, *g.* older stage with confluent cells, enlarged (largely after PRAIN, 1889).

## 16. MICROTOENA

PRAIN in Hook. Ic. Pl. 19 (1889) t. 1872; J. As. Soc. Beng. 59, ii (1890) 310; Bull. Soc. Bot. Fr. 42 (1895) 417; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 269; HSUAN, Act. Phytotax. Sin. 10 (1965) 41; KENG, Gard. Bull. Sing. 24 (1969) 117. Sometimes also wrongly spelled '*Microtaena*'. — **Fig. 17.**

Erect, branching, perennial herbs. *Flowers* in large terminal panicles and smaller axillary cymes. *Calyx* campanulate, accrescent in fruit, obscurely 10-nerved, unequally 5-toothed, the posterior tooth largest; throat glabrous within. *Corolla* tube long-exserted, 2-lipped; upper lip galeate, concave, entire; lower lip spreading, 3-fid, midlobe much narrower and longer than the lateral ones. *Stamens* 4, in 2 pairs, ascending under the upper lip, two upper ones slightly longer; anther-cells divaricate when young, at length confluent; filaments often hirsute. Disk equal-sided. Style bifid, upper branch very short. *Nutlets* minute, ovoid, ventral surface subtriquetrous, smooth or granular.

Distr. About 6  *spp.* in Indo-Himalaya, Indo-China, and S. China; in *Malesia*: 1  *sp.* in Java and Bali.

1. *Microtoena insuavis* (HANCE) PRAIN ex BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 269; KOORD. Exk. Fl. Java 3 (1912) 148; DUNN, Not. R. Bot. Gard. Edinb. 6 (1915) 188; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 183; WU, Acta Phytotax. Sin. 8 (1959) 44; HSUAN, Acta Phytotax. Sin. 10 (1965) 46; BACK. & BAKH. f. Fl. Java 2 (1965) 625; KENG, Gard. Bull. Sing. 24 (1969) 117, f. 21, *excl. specim. Pap.* — *Gomphostemma insuave* HANCE, J. Bot. 22 (1884) 231. — *Plectranthus patchouli* CLARKE in Hook. f. Fl. Br. Ind. 4 (1885) 624. — *M. cymosa* PRAIN in Hook. Ic. Pl. 19 (1889) t. 1871; J. As. Soc. Beng. 59, ii (1890) 310; *ibid.* 72, ii (1907) 709; Kew Bull. Misc. Inf. (1902) 11; RIDL. J. Mal. Br. R. As. Soc. 1 (1923) 85. — **Fig. 17.**

Herb 0.5–1 m. Stem and branches densely villose. *Leaves* chartaceous, ovate to broadly ovate, 7–10 by 4.5–7.5 cm (sometimes much smaller), serrate or crenate-serrate; adpressedly pubescent on both surfaces; acute, base rounded or subcordate, often abruptly cuneate; petiole slender, 1–7 cm. Paniculate thyrses, 10–35 cm. Bracts narrowly lanceolate, 2–5 mm. *Calyx* turbinate, 3–4 mm long, in

fruit 6–7 mm, hirsute and glandular; teeth triangular, subequal. *Corolla* yellow or reddish, 12–16 mm, pubescent; upper lip reddish brown, hooded; lower lip shallowly 3-fid, the central lobe narrowly elliptic, laterally spreading. *Nutlets* ovoid, flattened, 1.5 by 1 mm, finely granular.

Distr. From India through Burma to S. China; in *Malesia*: N. Sumatra (Batak Lands), Java (rare in West Java: Preanger Mts; more common in East Java: Mts Ungaran, Lawu, N. Ardjuno, Jang, Idjen), Lesser Sunda Is. (Bali). Not in New Guinea (KENG, *l.c.*).

Ecol. Damp forests, along river-banks, waterfalls (Trawas), c. 1000–1700 m, but at Trawas waterfall below 1000 m. *Fl.* May–Oct.

Note. Because of the strongly scented leaves, this plant is called the Chinese Patchouli by PRAIN (1907). Other patchouliis include the Indian or original Patchouli which is *Pogostemon heyneanus* BTH. and the Malayan Patchouli which is *Pogostemon cablin* (BLANCO) BTH. PRAIN suggested that *Microtoena* was originally introduced to Java, but it is certainly truly native.

## 17. MOSLA

BUCH.-HAM. ex (BTH. in Wall. Pl. As. Rar. 1 (1830) 66, *in syn.*) MAXIM. Bull. Ac. Sc. St. Pétersb. 20 (1875) 457; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1897) 326; KENG, Gard. Bull. Sing. 24 (1969) 119. — *Orthodon* BTH. ex OLIV. J. Linn. Soc. Bot. 9 (1865) 167, *non* R. BR. 1820 (*Musci*). — *Hedeoma* PERS. *sect. Mosla* BTH. Lab. Gen. Sp. (1834) 366. — **Fig. 18.**

Aromatic, annual herbs. *Leaves* usually glandular beneath. *Verticillasters* 2-flowered, secund, in terminal or axillary raceme-like inflorescence. Bracts minute or the lower ones large and leafy. *Calyx* campanulate, 10-nerved, often gibbous at base, subequally 5-toothed and 2-lipped; upper lip (in Mal.  *spp.*) 3-toothed,

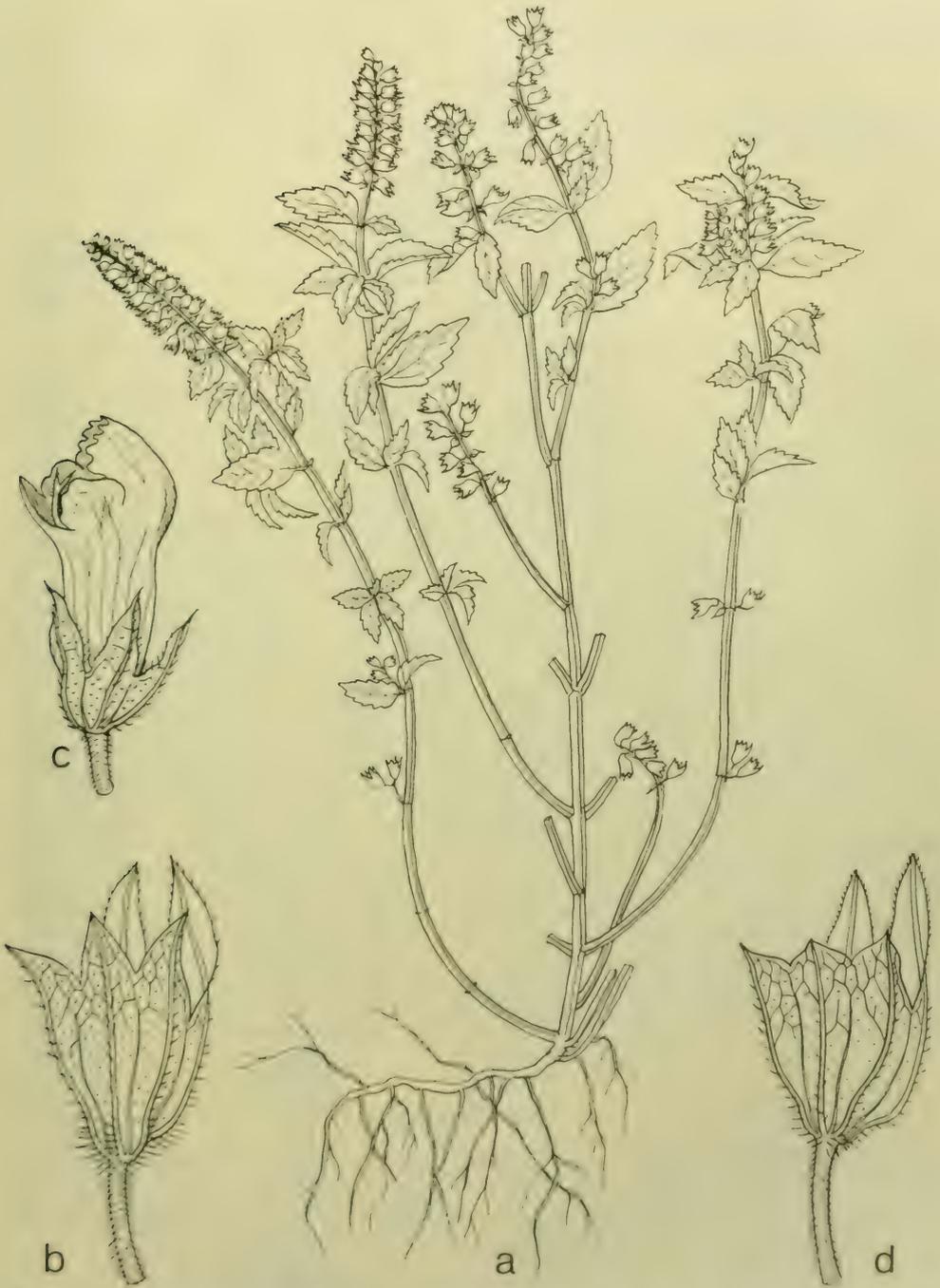


Fig. 18. *Mosla formosana* MAXIM. a. Habit,  $\times 2/3$ , b. fruiting calyx,  $\times 8$ . — *M. dianthera* (ROXB.) MAXIM. c. Flower, d. fruiting calyx, both  $\times 8$  (a BS 37803, b PNH 42669, c Fl. Taiwan 17865, d LÖRZING 9979).

lower lip 2-toothed, generally slightly longer; throat pubescent. *Corolla* exerted; lips short, upper lip notched, lower one 3-fid. *Stamens* 4, only upper pair perfect or 2; anthers 2-celled, cells divaricate; lower pair abortive, present or absent. Disk glandular, produced in the front. Style deeply bifid. *Nutlets* (in Mal. *spp.*) reticulate.

Distr. About 10 *spp.*, in continental Asia from India to Japan and Taiwan, 2 of which in border areas of *Malesia*, viz N. Sumatra and N. Luzon.

Note. Proposed for conservation against *Orthodon* BTH. ex OLIV. (Taxon 18, 1969, 595), but unnecessarily so.

## KEY TO THE SPECIES

1. Leaves rhomboid to ovate, 1–2 by 0.5–1 cm. Upper lip of calyx shallowly 3-toothed, teeth deltoid.  
 1. Leaves ovate to oblong-ovate, 2–2.5 by 0.8–1 cm. Upper lip of calyx deeply 3-toothed, teeth lanceolate

1. *M. dianthera*2. *M. formosana*

1. *Mosla dianthera* (ROXB.) MAXIM. Bull. Ac. Sc. St. Pétersb. 20 (1875) 457; HOOK. f. Fl. Br. Ind. 4 (1885) 647; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1897) 326, f. 98 E; DUNN, Not. R. Bot. Gard. Edinb. 6 (1915) 155; KENG, Gard. Bull. Sing. 24 (1969) 120, f. 22 a–f; H.-W. LI, Acta Phytotax. Sin. 12 (2) (1974) 231. — *Lycopus dianthera* (ROXB.) Hort. Beng. 1814, 4, *nomen* BUCH.-HAM. ex ROXB. Fl. Ind. 1 (1820) 145. — *Cunila nepalensis* D.DON, Prod. Nep. (1825) 107. — *M. ocymoides* BUCH.-HAM. ex (BTH. in Wall. Pl. As. Rar. 1 (1830) 66, in *syn.*) DUTHIE, Fl. Upper Ganget. Pl. 2 (1911) 257; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 101. — *Hedeoma nepalensis* (D.DON) BTH. Lab. Gen. Sp. (1834) 366; in DC. Prod. 12 (1848) 244. — *Orthodon punctatum* KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 80. — Fig. 18c.

Erect herb, 30–100 cm, branched, sparsely pubescent, often woody at base. *Leaves* membranaceous, rhomboid or ovate, 1–2 by 0.5–1 cm, acute at both ends, few-toothed; glabrous above, often glandular beneath; petiole 2–5 mm, pubescent. Paniculate *inflorescence* terminal, often profusely branched, 10–30 cm long, branches 4–15 cm long, lax-flowered. Bracts lanceolate, often minute, 1–2 mm. *Calyx* 2–2.5 mm long, in fruit 4–5 mm; throat with a ring of hairs; teeth deltoid. *Corolla* pale pinkish or pink, 3–3.5 mm, 2 fertile stamens slightly shorter than the upper corolla-lobe; staminodes generally absent. *Nutlets* ellipsoid, 1 by 0.7 mm broad, brown, reticulate.

Distr. Continental Asia: India, Burma, Thailand, Indo-China, China, Manchuria, Korea, Japan, Formosa, and *Malesia*: N. Sumatra (Toba-Batak Lands).

Ecol. Open places along trails, 1000–1250 m. Fl. May–July.

Note. The Malesian material differs slightly from the Indian in which the leaves are larger (1.5–3.5 by 1–2 cm) and the anterior staminodes usually present.

2. *Mosla formosana* MAXIM. Bull. Ac. Sc. St. Pétersb. 20 (1875) 459; MERR. En. Philip. 3 (1923) 414; KENG, Gard. Bull. Sing. 24 (1969) 122, f. 22 g–i; H.-W. LI, Acta Phytotax. Sin. 12 (2) (1974) 232. — *M. lysimachiiflora* HAYATA, Ic. Pl. Form. 8 (1919) 104. — *Orthodon formosanum* (MAXIM.) KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 79. — *Orthodon lysimachiiflorus* (HAYATA) MASAM. Trans. Nat. Hist. Soc. Form. 22 (1932) 232. — Fig. 18a–b.

Erect herb, 20–100 cm. Stem and branches greyish, pubescent. *Leaves* thin-membranaceous, ovate to oblong-ovate, 2–2.5 by 0.8–1 cm, acute at both ends; crenate-serrate or sharply serrate, glabrescent on both surfaces; petiole 0.5–1 cm. *Flowers* in terminal raceme-like inflorescences, 3–4 cm long. Bracts lanceolate,  $\pm$  longer than the buds, often gland-dotted. *Calyx* 1.5 mm long, in fruit 4–5 mm long, glandular, hirsute on the nerves; teeth lanceolate, ciliate. *Corolla* purple, 3–4 mm long. *Nutlets* ovoid to nearly rounded, 0.8 mm  $\varnothing$ , brown, slightly flattened, reticulate.

Distr. Formosa and *Malesia*: Philippines (N. Luzon: Bontoc, Mts Polis & Pukis).

Ecol. Open places, along trails, on forest edges, 1000–1600 m. Fl. March–July.

Vern. *Holog*, *holò di onghab*, Ifuago.

## 18. PARAPHLOMIS

PRAIN (Ann. R. Bot. Gard. Calc. 9, 1901, 60, *nom. prov.*) J. As. Soc. Beng. 74, ii (1907) 791; RIDL. Fl. Mal. Pen. 2 (1923) 651; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 209; H.-W. LI Acta Phytotax. Sin. 10 (1965) 58; KENG, Gard. Bull. Sing. 24 (1969) 135. — Fig. 19.

Fig. 19. *Paraphlomis oblongifolia* (BL.) PRAIN ex KOORD. a. Habit,  $\times \frac{1}{2}$ , b. single flower,  $\times 2$ . — *P. javanica* (BL.) PRAIN ex BACK. & BAKH. f. c. Calyx,  $\times 2$  (a–b after PRAIN, c BLUME 1462).



Herbs or shrubs. *Leaves* membranaceous, long-petioled. *Flowers* medium-sized, in dense, many-flowered verticillasters, often forming axillary, globose clusters. Bracteoles numerous, filiform. *Calyx* campanulate, 10-nerved, more or less equally 5-toothed, teeth deciduous or persistent; tube erect or slightly incurved. *Corolla* tube outside pubescent, glabrous and annulate within; limb 2-lipped; upper lip erect; lower lip spreading, 3-lobed. *Stamens* 4, ascending under the upper lip, the lower pair longer; anthers connivent, the 2 cells divaricate; filaments glabrous without basal appendages. Disk uniform, entire. Style 2-fid, lobes subequal or the upper one shorter. *Nutlets* obovoid, triquetrous below, rounded above and on the dorsal surface, glabrous; pericarp thick, more or less coriaceous.

Distr. Continental SE. Asia (E. Himalayas to S. China), Formosa, c. 6 spp.; in *W. Malesia* 2 spp., not yet known from the Lesser Sunda Is., Moluccas, and New Guinea.

## KEY TO THE SPECIES

1. Verticillasters only sparingly hirsute. Corolla white (to pale yellow?), 2–2.5 cm long; limb densely short-hairy outside. Fruiting calyx almost glabrous, the teeth often broken off . . . . **1. *P. javanica***
1. Verticillasters densely covered with long woolly hairs, golden yellow. Corolla pale yellow, 1.5–2 cm long; limb densely pilose outside. Fruiting calyx hirsute or woolly pubescent, the teeth persistent . . . . **2. *P. oblongifolia***

**1. *Paraphlomis javanica* (BL.) PRAIN** (Ann. R. Bot. Gard. Calc. 9, 1901, 59, *nom. prov.*) ex BACK. & BAKH. f. Fl. Java 2 (1965) 619; KENG, Gard. Bull. Sing. 24 (1969) 136, f. 26 a–g. — *Leonurus javanicus* BL. Cat. (1823) 83; Bijdr. (1826) 828; BTH. Lab. Gen. Sp. (1834) 522; HASSK. Cat. Hort. Bog. (1844) 132. — *Phlomis rugosa* BTH. in Wall. Pl. As. Rar. 1 (1830) 63; Lab. Gen. Sp. (1834) 634; in DC. Prod. 12 (1848) 545; HOOK. f. Fl. Br. Ind. 4 (1885) 693; PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 231; STAFF, Trans. Linn. Soc. Lond. 4 (1894) 216. — *Gomphostemma petiolare* MIQ. Fl. Ind. Bat. 2 (1859) 987; PRAIN, Ann. R. Bot. Gard. Calc. 9 (1901) 59; KOORD. Exk. Fl. Java 3 (1912) 143. — *Gomphostemma membranifolium* MIQ. Fl. Ind. Bat. 2 (1859) 988; RIDL. J. Fed. Mal. St. Mus. 8 (1917) 77 ('*membranifolia*'). — *Phlomis javanica* (BL.) PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 231; *ibid.* 9 (1901) 59. — *Gomphostemma rugosum* (BTH.) PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 262; KOORD. Exk. Fl. Java 3 (1923) 143. — *P. rugosa* (BTH.) PRAIN (Ann. R. Bot. Gard. Calc. 9, 1901, 60, pl. 74, *nom. prov.*) J. As. Soc. Beng. 74, ii (1907) 721; MERR. En. Philip. 3 (1923) 412; RIDL. Fl. Mal. Pen. 2 (1923) 651; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 209. — *Gomphostemma luzonense* ELMER, Leaf. Philip. Bot. 1 (1908) 339. — *Leonurus membranifolius* (MIQ.) BOLD. Zakkf. (1916) 108; MERR. Brittonia 5 (1943) 29. — *Lamium gesnerioides* HAYATA, Ic. Pl. Formos. 8 (1918) 92. — *Lamium longepetiolata* HAYATA, l.c. — *Gomphostemma sumatrense* RIDL. J. Mal. Br. R. As. Soc. 1 (1923) 85. — *P. brevidens* MERR. Pap. Mich. Ac. Sc. 19 (1934) 193. — **Fig. 19c.**

Undershrub, 0.5–1.8 m. Stem obtusely 4-angled, deeply furrowed, minutely hirsute. *Leaves* thin-membranaceous, elliptic, oblong-ovate or oblong-lanceolate, 15–30 by 6–12 cm, acuminate or caudate, base cuneate or truncate or rounded, entire; margin elsewhere irregularly crenate-serrate, glabrous or with minute scattered hairs on the nerves

on both surfaces; petiole 4–10 cm, puberulent. *Flowers* in small distant verticillasters, axillary. Bracteoles filiform, short-hairy. *Calyx* turbinate, 0.8–1.2 cm long (in fruit about the same length, with the teeth often broken off), white or suffused with red at apex, tube slightly curved, hispid below; teeth 5, lanceolate, 2–4 mm long, triangular at base, membranaceous. *Corolla* light yellow or white, with pink or dark purple centre, 2–2.5 cm long, tube annulate within; both lips pubescent outside, upper lip narrow, rounded at apex; lower lip 3-lobed, midlobe oblong, lateral lobes lanceolate. Style branches subequal. *Nutlets* whitish, brown to black, obovoid, 6 by 3–3.5 mm, acute and triquetrous below, rounded above.

Distr. Continental SE. Asia (E. Himalayas, Thailand, Indo-China, S. China), Formosa; in *Malesia*: N. Sumatra, Malay Peninsula, Java, N. Borneo (Kinabalu), and Philippines (Luzon, Leyte).

Ecol. Open and humid places in rain-forest, from the lowland to c. 1800 m, mostly above 600 m. Fl. Jan.–Dec.

Vern. Java: *galibung bulu*, S, *tjitjabian utan*; Philippines: *botiagon*, Mbo.

**2. *Paraphlomis oblongifolia* (BL.) PRAIN** (Ann. R. Bot. Gard. Calc. 9, 1901, 59, *nom. prov.*) ex KOORD. Fl. Tjibodas 3 (1918) 84; BACK. & BAKH. f. Fl. Java 2 (1965) 619; KENG, Gard. Bull. Sing. 24 (1969) 139, f. 26 h–i; STEEN. Mt. Fl. Java (1972) pl. 25–7. — *Leonurus oblongifolia* BL. Bijdr. (1826) 828; BTH. Lab. Gen. Sp. (1834) 522; HASSK. Cat. Hort. Bog. (1844) 310; in DC. Prod. 12 (1848) 502. — *Gomphostemma macrophyllum* MIQ. Fl. Ind. Bat. 2 (1859) 988; KOORD. Exk. Fl. Java 3 (1912) 143; KOORD.-SCHUM. Syst. Verz. 1 (1912) fam. 254, p. 2. — *Phlomis oblongifolia* (BL.) O. K. Rev. Gen. Pl. 2 (1891) 529; PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 231; *ibid.* 9 (1901) 59, pl. 73. — **Fig. 19a–b.**

Undershrub, 1–2 m. Stem and branches soft-woolly. *Leaves* thin-membranaceous, oblong-ovate, 15–20 by 6–8 cm, acuminate or cordate, base cuneate, entire; margin elsewhere remotely toothed, springly hispid on the nerves on both surfaces; petiole very slender, 5–8 cm. *Flowers* in distant axillary verticillasters, densely covered with long golden hairs. Bracts filiform, densely woolly. *Calyx* obconic-campanulate, 1–1.2 cm long, in fruit 1.2–1.4 cm, whitish with violet teeth; tube slightly curved, hirsute; teeth subulate. *Corolla* pale yellow, 1.5–2 cm long, outside densely pubescent; upper lip obovate, boat-shaped, apex trun-

cate; lower lip with 3 subequal rounded lobes, the middle one broader, constricted below. Posterior style branches much shorter than the anterior. *Nutlets* dark blue to black, oblong, 7–8 by 3.5 mm, subtriquetrous, glabrous.

Distr. *Malesia*: Sumatra (North: Brastagi to Merapi; South: Mt Tanggamus and near Ulu Belu, Lampongs), West Java, N. Celebes.

Ecol. Primary forest, 700–1800 m. *Fl.* Jan.–Dec.

Vern. *Bubukuan bulu*, S; *bubukuan* is a common name for Strobilanthes and other Acanthaceae, alluding to swollen nodes, *bulu* referring to hairs.

### 19. POGOSTEMON, *nom. cons. prop.*

DESF. Mém. Mus. Hist. Nat. Paris 2 (1815) 154, t. 6; HASSK. Flora 25 (1842) II, Beibl. 25 ('*Pogonostemon*'); Cat. Hort. Bog. (1844) 130; BTH. in DC. Prod. 12 (1848) 151; in B. & H. Gen. Pl. 2 (1876) 1179; MIQ. Fl. Ind. Bat. 2 (1859) 961; O. K. Rev. Gen. Pl. 2 (1891) 529; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1897) 328; KENG, Gard. Bull. Sing. 24 (1969) 151. — *Alopecuro-veronica* LINNÉ (Fl. Zeyl. 1747, 193, *descr.*) Amoen. Ac. 4 (1759) 143, *nomen valid., rejic. prop.* — *Dysophylla* BL. Bijdr. (1826) 826; BTH. Fl. Austr. 5 (1870) 81; in B. & H. Gen. Pl. 2 (1876) 1180; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1897) 330; KENG, Gard. Bull. Sing. 24 (1969) 67. — *Eusteralis* RAFIN. Fl. Tell. 2 (1836) 95. — *Dysophylla sens.* EL-GAZZAR & L. WATSON *ex* AIRY SHAW, Taxon 16 (1967) 190, *non* BL., *homon. illeg., cf.* BAKH. f. & STEEN. Taxon 17 (1968) 235–236. — **Fig. 20.**

Herbs or undershrubs, usually pubescent, sometimes strongly scented. *Leaves* opposite or whorled, sessile or petiolate. *Flowers* small or minute, in simple or branched spicate-racemose inflorescences formed of many densely flowered, subcapitate, approximate or distant, verticillasters. Bracts small or minute, densely hairy. *Calyx* tubular, 5-toothed; throat naked within. *Corolla* tubular, exserted; limb subequally 4-fid or faintly 2-lipped (in the latter case upper lip 3-lobed, lower lip entire, patent). *Stamens* 4, exserted, usually straight; filaments bearded; anthers 2-celled, confluent. Disk equal, subentire. Style shortly 2-fid at the top, subequal. *Nutlets* ovoid or ellipsoid, smooth or granulate.

Distr. About 50  *spp.* throughout SE. Asia to China and Japan, southwards through the whole of *Malesia* (9  *spp.*), one extending to Australia.

Taxon. The genus is taken here in a wider sense than usual, including the whorled-leaved species of '*Dysophylla*'. The type species of *Dysophylla*, *D. auricularia*, is a true *Pogostemon*. SHAW (1967) felt induced to maintain the name in a new sense to cover the whorled-leaved species, but this is nomenclaturally untenable as *D. auricularia* is the type, and the phyllotaxis is insufficient taxonomically for a generic level. The merging of the two genera was already proposed by HASSKARL (1842), followed by MIGUEL (1859), and O. KUNTZE (1891). BENTHAM (1870) in accepting *Dysophylla* gave as the alternative that "it would at any rate form a very marked section", and this suggestion is here followed.

Nomencl. It has been overlooked that *Alopecuro-veronica* L. is an older, perfectly valid generic name, against which *Pogostemon* is proposed to be conserved.

#### KEY TO THE SPECIES

1. Leaves in whorls of 4–10 . . . . . 1. *P. stellatus*
1. Leaves opposite.
2. Spicate racemes usually branched and forming a panicle.
3. Habit proportionally slender, verticillasters clearly to even widely spaced, with internodes always visible, less than 1 cm  $\varnothing$ , short appressed-hairy. Calyx 3–3.5 mm (in fr. 3.5–4 mm) long . . . . . 2. *P. heyneanus*

3. Habit more robust, axes not slender, verticillasters in an almost continuous thick spike 1–2 cm wide, densely patent-canescens or hirsute. Calyx 4–6 mm (in fr. 5.5–6 mm) long.
4. Leaves short appressed-hairy to glabrous. Verticillasters grey-pubescent, with dense cincinni of seriate-imbriating, lanceolate, acute bracts, not seldom more or less secund. Calyx tubular, pubescent, without bristles. Spikes several . . . . . 3. *P. cablin*
4. Leaves with long bristles of c. 1 mm long. Verticillasters very dense, condensed and in few spikes, not secund, not in regularly seriate-imbriating cincinni, the bracts obovate-acute. Calyx somewhat inflated, the teeth not narrow, and shorter in proportion to the tube, the latter with bristle-hairs, but the teeth densely short hairy, at least their margin . . . . . 4. *P. villosus*
2. Spicate racemes usually simple, terminal, solitary, rarely accompanied by 1 or 2 short spicate racemes at the base.
5. Verticillasters distinctly apart.
6. Calyx cylindric, 5–7 mm (in fr. 7–8 mm) long; teeth not spreading.
7. Calyx seemingly angled, glabrous except for very scant bristle-hairs on the calyx tube and at the apex of the teeth, and on the bracts. Leaves ovate to broadly ovate, base rounded or cordate . . . . . 5. *P. reticulatus*
7. Calyx terete, evenly short pubescent, as are the bracts. Bristle-hairs absent. Leaves oblong-ovate to ovate, base cuneate to rounded . . . . . 6. *P. philippinensis*
6. Calyx campanulate, 4–4.5 mm (in fr. 5–5.5 mm) long; teeth often spreading . . . . . 7. *P. menthoides*
5. Verticillasters nearly continuous, occasionally interrupted only at the base; rachis densely tomentose or hairy.
8. Flowers relatively large; calyx 4.5–5 mm long; corolla 7–8 mm long. Verticillasters 12–20-flowered . . . . . 8. *P. velatus*
8. Flowers very small; calyx 1.2–1.5 mm long; corolla 2–2.5 mm long. Verticillasters ∞-flowered . . . . . 9. *P. auricularius*

**Section Eusteralis (RAFIN.) KENG, *comb. nov.***

*Eusteralis* RAFIN. Fl. Tell. 2 (1836) 95. — *Dysophylla auct., excl. sp. typ. D. auricularia*.

Leaves in whorls of 4 or more.

1. *Pogostemon stellatus* (LOUR.) O. K. Rev. Gen. Pl. 2 (1891) 529 ('*stellatum*'). — *Mentha stellata* LOUR. Fl. Coch. 2 (1790) 361. — *Mentha verticillata* ROXB. (Hort. Beng. 1814, 44, *nomen*) Fl. Ind. ed. Carey 3 (1832) 5, *non* L. 1759. — *Dysophylla verticillata* (ROXB., *non* L.) BTH. in Wall. Pl. As. Rar. 1 (1830) 30, *nom. illeg.*; in DC. Prod. 12 (1848) 157; F.-VILL. Nov. App. (1880) 164; VIDAL, Phan. Cuming. Philip. (1885) 136; HOOK. f. Fl. Br. Ind. 4 (1885) 639; VIDAL, Rev. Pl. Vasc. Filip. (1886) 213; BOERL. Handl. 2 (1899) 714, *incl. var. macrostachya* (MIQ.) BOERL.; PRAIN, J. As. Soc. Beng. 74, ii (1907) 876; RIDL. Fl. Mal. Pen. 2 (1923) 648; MERR. En. Philip. 3 (1923) 416; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 81; HEND. Mal. Nat. J. 6 (1950) 394. — *Dysophylla stellata* (LOUR.) BTH. in Wall. Pl. As. Rar. 1 (1830) 30, *pro nomen*; Lab. Gen. Sp. (1833) 159; in DC. Prod. 12 (1848) 158; KENG, Gard. Bull. Sing. 24 (1969) 70. — *P. verticillatus* (ROXB., *non* L.) MIQ. Fl. Ind. Bat. 2 (1859) 965, *incl. var. macrostachya* MIQ., *nom. illeg.* — *Dysophylla benthamiana* HANCE, Ann. Sc. Nat. V, 5 (1866) 234; MERR. Trans. Am. Phil. Soc. 24, 2 (1935) 342.

*See for further synonyms under the variety.*

**var. stellatus.**

Annual (or sometimes perennial) herb, erect or ascending. Stem laxly or profusely branched, 10–100 cm, glabrous or very sparsely hairy. Leaves in whorls of 4–10, sessile or subsessile, glabrous, linear, 3–7 (or more) cm by 2–5 mm, acuminate, base attenuate; margin entire or obscurely serrate.

Flowers in villous, cylindric, terminal spicate inflorescences, 3–6 cm long; verticillasters close-set throughout. Calyx campanulate, with soft, white hairs, 1–1.2 mm long; teeth subequal, triangular, spreading. Corolla pink, or pinkish purple, tubular, c. 2 mm long, lobes pubescent. Filaments exerted, hairy. Nutlets ellipsoid, pale brown, minute.

Distr. From India through SE. Asia and China to Japan, and through Malesia to tropical Australia; in Malesia: in several islands rare, not recorded from Java and the Lesser Sunda Is.

Ecol. Grasslands and garden lands, swamps, bogs, lake beds, open wet places, e.g. rice-fields, at low altitude, but in Celebes and New Guinea ascending to c. 2500 m. Fl. May–Jan.

Vern. New Guinea: *tsambi kumu*, Kaugel dial., Medpa, *wamena*, Dani lang., Baliem, *weypa*, Melpa lang., Mt Hagen.

Note. The typification of *P. stellatus* has shown that BENTHAM has applied the name *Dysophylla stellata* in India for a different species, as I have demonstrated in the precursor (Gard. Bull. Sing. 24, 1969, 71).

**var. roxburgianus (KENG) KENG, *comb. nov.*** — *Dysophylla quadrifolia* (ROXB., *non* D.DON) BTH. in Wall. Pl. As. Rar. 1 (1830) 30; in DC. Prod. 12 (1848) 157; F.-VILL. Nov. App. (1880) 164; VIDAL, Phan. Cuming. Philip. (1885) 136; HOOK. f. Fl. Br. Ind. 4 (1885) 639; VIDAL, Rev. Pl. Vasc. Filip. (1886) 213; MERR. En. Philip. 3 (1923) 415; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 79. —

*Mentha quadrifolia* ROXB. (Hort. Beng. 1814, 44, *nomen*) Fl. Ind. ed. Carey 3 (1832) 4, *nom. illeg.*, *non* D.DON, 1825. — *Dysophylla stellata* (LOUR.) BTH. *var. roxburgiana* KENG, Gard. Bull. Sing. 24 (1969) 72.

Leaves in whorls of 4, 3–6 cm long, 3–7 mm wide.

Stem tomentose or pubescent.

Distr. Continental SE. Asia to *Malesia*: Philippines (Luzon, Panay, Mindanao), SW. Celebes, and New Guinea.

Ecol. Open wet places as the type variety, up to c. 950 m. Fl. Jan.–Dec.

### Section Pogostemon

Leaves opposite.

**2. Pogostemon heyneanus** BTH. in Wall. Pl. As. Rar. 2 (1830–31) 16; Lab. Gen. Sp. (1833) 154; in DC. Prod. 12 (1848) 153; MIQ. Fl. Ind. Bat. 2 (1859) 961; F.-VILL. Nov. App. (1880) 164; PRAIN, J. As. Soc. Beng. 74, ii (1907) 707; Kew Bull. (1908) 78, with ample discussion of synonymy; MERR. Philip. J. Sc. 7 (1912) Bot. 346; En. Philip. 3 (1923) 414; RIDL. Fl. Mal. Pen. 2 (1923) 647; HEYNE, Nutt. Pl. (1927) 1332; BURK. Dict. (1935) 1783; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 71; QUIS. Medic. Pl. Philip. (1951) 830; BACK. & BAKH. f. Fl. Java 2 (1965) 633; KENG, Gard. Bull. Sing. 24 (1969) 152. — *P. patchouli* (*non* PELLET.) HOOK. f. Fl. Br. Ind. 4 (1885) 633, *excl. var. suavis* (TENORE) HOOK. f.

Erect branching herb, 0.5–1.5 m high. Stem and branches slender, sparingly pubescent. Leaves thin-membranaceous, ovate to broadly ovate, 5–8 by 3.5–5.5 cm, acute, base broadly cuneate, often slightly oblique, entire, margin elsewhere crenate or double-crenate; sparingly puberulous or sometimes almost glabrous on both surfaces; petiole 1–3 cm, puberulous. *Paniculate inflorescence* 6–10 cm long, terminal; verticillasters globular, 0.5–1.5 cm apart at the base, more approximate upwards. Bracts narrowly lanceolate, 3–3.5 mm long, acute, puberulous. *Calyx* 3–3.5 mm long, in fruit 3.5–4 mm, outside tomentose; teeth equal, triangular. *Corolla* white, or the upper lip pale violet, 4.5–5 mm long, glabrous. Filaments exerted, almost straight, all bearded. Style shortly 2-branched. *Nutlets* obliquely ovoid, 0.5–0.6 mm long, black, smooth.

Distr. Ceylon and continental SE. Asia; in *Malesia*: Sumatra, Malaya, West Java, Borneo (Sarawak; SE. Borneo), Philippines (Palawan, Panay, Mindanao). Possibly not native in *Malesia*. Also cultivated.

Ecol. Thickets, old clearings, coconut groves, stream banks in forest, from the lowland up to c. 1800 m. Fl. Jan.–Dec.

Vern. Sumatra: *patchouli*, M, *dukut nilam*, Karo, *babuda*, Lampongs; Malaya: *boon kalif*, *Indian patchouli*, *nilam bukit*, *pakoehitam*, *poko nyao*, *ruku*, *rumpit kuku*, M; Java: *dilēm*, M, Md, *dilēm kembang*, J, *dilēp*, S; Philippines: *kadlum*, P.Bis., *lagumtum*, *malbaka*, Sub.

Uses. According to BURKILL & HANIFF (Gard. Bull. S. S. 6, 1930, 238) a decoction of the leaves is used in Malaya against coughs and asthma. A decoction of the roots is sometimes administered for dropsy. HEYNE (*l.c.* 1332) says that flowering plants contain a volatile oil smelling like patchouli, but apparently it has never been grown for the oil. In Mindanao leaves are applied to wounds. HARTLEY (Lloydia 32, 1969, 275) listed this species as a possible anti-cancer medicine.

**3. Pogostemon cablin** (BLANCO) BTH. in DC. Prod. 12 (1848) 146; MIQ. Fl. Ind. Bat. 2 (1859) 964; F.-VILL. Nov. App. (1880) 164; VIDAL, Rev. Pl. Vasc. Filip. (1886) 213; PRAIN, J. As. Soc. Beng. 74, ii (1907) 708; Kew Bull. (1908) 78; MERR. Philip. J. Sc. 7 (1912) Bot. 345; Fl. Manila (1912) 411; Int. Rumph. (1917) 458; Sp. Blanc. (1918) 337; En. Philip. 3 (1923) 414; RIDL. Fl. Mal. Pen. 2 (1923) 647; MERR. Trans. Am. Phil. Soc. 24 (1935) 341; BURK. Dict. (1935) 1782; QUIS. Med. Pl. Philip. (1951) 829; PARHAM, Pl. Fiji (1964) 255; BACK. & BAKH. f. Fl. Java 2 (1965) 633; PURSEGLOVE, Trop. Crops, Dicot. 2 (1968) 636; KENG, Gard. Bull. Sing. 24 (1969) 154. — *Mentha cablin* BLANCO, Fl. Filip. (1837) 473. — *P. mollis* HASSK. Tijd. Nat. Gesch. Phys. 10 (1843) 123 (*'Pogostemon'*); Cat. Hort. Bog. (1844) 310, *non* BTH. 1833. — *P. tomentosus* HASSK. Cat. Hort. Bog. (1844) 131 (*'Pogostemon'*); BTH. in DC. Prod. 12 (1848) 153; MIQ. Fl. Ind. Bat. 2 (1859) 962; KENG, Gard. Bull. Sing. 24 (1969) 153. — *Mentha auricularia* (*non* L.) BLANCO, Fl. Filip. ed. 2 (1845) 329; ed. 3, 2 (1878) 245. — *P. patchouly* PELLET. Mém. Soc. Sc. Orléans 5 (1845) 277, t. 7; HOOK. Kew J. Bot. 1 (1849) 328, t. 11 (*'patchouli'*); MIQ. Fl. Ind. Bat. 2 (1859) 962; F.-VILL. Nov. App. (1880) 164; HOOK. f. Fl. Br. Ind. 4 (1885) 634, *incl. var. suavis* HOOK. f.; THISELTON-DYER, Kew Bull. (1888) 71; RIDL. Trans. Linn. Soc. Lond. II, 3 (1893) 336; TROMP DE HAAS, Teysmannia 15 (1904) 475; KOORD. Exk. Fl. Java 3 (1912) 151. — *P. comosus* MIQ. Fl. Ind. Bat. 2 (1859) 963; KOORD. Exk. Fl. Java 3 (1912) 152. — *P. heyneanus* BTH. *var. patchouly* (PELLET.) O. K. Rev. Gen. Pl. 2 (1891) 529. — *P. nepetoides* STAPF, Kew Bull. (1908) 116; MERR. Philip. J. Sc. 7 (1912) Bot. 347, *incl. var. glandulosus*; En. Philip. 3 (1923) 414. — *P. battakianus* RIDL. J. Mal. Br. R. As. Soc. 1 (1923) 85. — *P. javanicus* BACK. *ex* ADELB. Reinwardtia 3 (1954) 150, f. 1; BACK. & BAKH. f. Fl. Java 2 (1965) 632, 657.

Erect, aromatic, branched herb, 0.5–1 m. Stem and branches tomentose. Leaves thin- or thick-membranaceous, narrowly ovate or ovate, 5–10 (–14) by 3.5–6.5 (–10) cm, with short appressed hairs; apex acute, base cuneate-rounded to truncate, sometimes oblique, always entire; margin elsewhere incisely dentate or crenate or partly double-serrate; petiole 1–3.5 (–6.5) cm, tomentose. *Spicate racemes* 3 or many forming a terminal panicle, 15–30 (–40) cm long; verticillasters slightly apart below, closely approximate above, grey pubescent, with dense cincinni of seriatly imbricating, lanceolate, acute bracts, sometimes ± secund. *Calyx* tubular, 4–5 mm long, in fruit 5–6 mm, narrowed at both ends, pubescent, without bristles, equally 5-toothed. *Corolla* white, lavender blue, or violet, 6–7 mm long. Filaments

soft hairy. Style 2-branched at the apex. *Nutlets* ellipsoid, 0.6–1 mm long, 0.5–0.6 mm broad, sub-triquetrous, smooth, black.

Distr. Ceylon and continental SE. Asia; in *Malesia*: N. Sumatra, Malaya, Java, Lesser Sunda Is. (Bali, Sumba, Sumbawa, Alor, Flores, Timor), Celebes, Philippines (Luzon, Leyte), and New Guinea (Morobe Distr.: NGF 27934). Also cultivated and occasionally escaped from cultivation, which makes it difficult to decide in which areas it is really native in Malesia. Only in Luzon it is found in forest and may be native. In Java it is never found in the flowering state.

Ecol. Garden lands and clearings and in settled areas, up to *c.* 1900 m (Sumatra). *Fl.* May–Febr.

Vern. Malaya: *nilam*, *patchouly*, M; Lesser Sunda Is.: *remi kawini*, *roo nggolé*, Sumba, *pisak*, Alor, *ugapa*, Timor; Philippines: *kabling*, *karlin*, Tag., *kablin*, Tag., Pamp., Ilk., *kabiling*, Pamp., *kadling*, Tag., Bis., *kadlim*, Bik., Sul., S.L.Bis., *kadlien*, Bis., *sarok*, Ig.

Uses. The leaves are widely extracted for the well-known patchouli oil of commerce, not to be confused with that extracted from *Microtoena insuavis* (Khasya patchouli), from *Pogostemon heyneanus* (Indian patchouli), and that of *Pogostemon hortensis*. Patchouli oil is used in perfumes and cosmetics. According to QUISUMBING (*l.c.* 830) the crushed leaves are often used for hair-washing in the Philippines. Furthermore, the leaves and innovations are employed as an insecticide against cockroaches, moths, *etc.*, and as a repellent for leeches, and they are also added to baths for their presumed antirheumatic quality. An infusion of fresh leaves is taken internally to allay painful menstruation.

4. *Pogostemon villosus* (ROXB.) BTH. Lab. Gen. Sp. (1833) 153; in DC. Prod. 12 (1848) 152; Hook. f. Fl. Br. Ind. 4 (1885) 632; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 70. — *Elsholtzia villosa* ROXB. Fl. Ind. ed. Carey 3 (1832) 4.

Undershrub, 0.5–0.8 m. Stem and branches sparsely puberulent. *Leaves* thin-membranaceous, ovate to deltoid, (4–)7–11 by (3–)6–8.5 cm, with long bristles (*c.* 1 mm), scattered all over both surfaces; apex acute or broadly caudate, base cuneate or truncate and shortly decurrent, entire; margin elsewhere shallowly and irregularly incised, serrate-crenate on the incisions; petiole (1–)4–6.5 cm, puberulent. *Verticillasters* densely congested in terminal, few-branched spikes, 3–6 cm long, 1.5 cm Ø; peduncle 0.5–3 cm long, woolly. Bracts obovate, acute, equalling or slightly longer than the calyx, villous. *Calyx* tubular-campanulate, 4.5–5 mm long, outside with scattered bristles; teeth broadly lanceolate, margin ciliate. *Corolla* 5–6 mm long, lilac, tube very slender. Filaments shortly exserted, villous.

Distr. SE. Asia (Assam, Silhet); in *Malesia*: Central West Sumatra (Mt Kerintji), 2 collections (BÜNNEMEIJER 8811, 9612).

Ecol. Mountain forest, 1500–1900 m. *Fl.* March–April.

Notes. Its closest ally is obviously not *P. cablin* but *P. hispidus* PRAIN (Kew Bull. 1908, 254; MUKERJEE, *l.c.*), which differs (*ex descr.*) by appressed-pubescent peduncles, lax-paniculate



Fig. 20. *Pogostemon philippinensis* S. MOORE. a. Habit,  $\times \frac{2}{3}$ , b. flower,  $\times 4$  (VANOVERBERGH 208).

spikes, ovate to ovate-lanceolate bracts, and a smallish calyx of 4 mm long.

Especially with regard to the heterogeneity of the WALLICH material noted by HOOKER *f.* a closer comparison with the Indian material is necessary.

**5. *Pogostemon reticulatus* MERR.** Philip. J. Sc. 8 (1912) Bot. 348; En. Philip. 3 (1923) 415; KENG, Gard. Bull. Sing. 24 (1969) 155.

Erect, branched herb, 50–75 cm. Stem and branches puberulent, scattered, with long white hairs. *Leaves* ovate to broadly ovate, thin-membranaceous, 5–10 by 3.5–7 cm, obtuse or shortly acuminate, base rounded or cordate; margin coarsely and irregularly crenate, ciliate on both surfaces; petiole 3–6 cm. *Pseudo-raceme* terminal, solitary, 6–15 cm long including the peduncle; verticillasters 3–8-flowered, internodes 1–2 cm, more or less evenly apart. Bracts filiform, 2 mm, puberulent, ciliate. *Calyx* tubular, 4.5–6 mm long, puberulent and very sparingly pilose, narrowed at both ends; teeth oblong-lanceolate, ciliate. *Corolla* lilac.

Distr. *Malesia*: Philippines (Luzon).

Ecol. Thickets and forests at low and medium altitude.

Vern. *Kadling*, Tag.

Note. Closely related to the next species. LOHER 4207 deviates from the typical form by conspicuously peduncled verticillasters; they are normally subsessile.

**6. *Pogostemon philippinensis* S. MOORE,** J. Bot. 43 (1905) 146; MERR. Philip. J. Sc. 5 (1910) Bot. 381; En. Philip. 3 (1923) 415; KENG, Gard. Bull. Sing. 24 (1969) 156. — *P. membranaceus* MERR. Philip. J. Sc. 7 (1912) Bot. 347; En. Philip. 3 (1923) 414. — Fig. 20.

Erect herb, 50–75 cm, branched. Stem and branches puberulent. *Leaves* thick- or thin-membranaceous, oblong-ovate to ovate, 3–9 by 2.5–5 cm, acuminate, base cuneate to rounded, entire; margin elsewhere serrate or double-serrate; glabrescent above, glandular-punctate beneath; petiole 1–3 cm, puberulent. *Spicate raceme* terminal, solitary, 4–12 cm long; verticillasters 10–∞-flowered, more or evenly apart. Bracts linear-lanceolate, pubescent, caducous. *Calyx* tubular, 5–6 mm long, in fruit 6–7 mm, sparingly pubescent and glandular-punctate. *Corolla* lavender, slender, glabrous, 9–10 mm long. Filaments exerted, bearded below the middle. *Nutlets* ovoid, 0.6–0.7 mm long, obscurely triquetrous, smooth.

Distr. *Malesia*: Philippines (Luzon, Mindoro, Panay).

Ecol. Damp ravines, alluvial forest, thickets, also in mossy forest, ascending to *c.* 2400 m. *Fl.* Aug.–March.

Vern. *Legleg*, *ngingiyau*, Bon., *paŋga-ti-niang*, Ilk., *kadlum puru*, Mang.

**7. *Pogostemon menthoides* BL.** Bijdr. (1826) 825; BTH. Lab. Gen. Sp. (1833) 156; in DC. Prod. 12 (1848) 155; HASSK. Cat. Hort. Bog. (1844) 130; MIQ. Fl. Ind. Bat. 2 (1859) 963; KURZ, Nat. Tijds. N. I. 27 (1864) 213; KOORD. Exk. Fl. Java 3 (1912) 151; Fl. Tjibodas 3 (1918) fam. 254, p. 91; BACK. &

BAKH. *f.* Fl. Java 2 (1965) 632; KENG, Gard. Bull. Sing. 24 (1969) 156; MURATA, Acta Phytotax. Geobot. 24 (1969) 87; STEEN. Mt. Fl. Java (1972) pl. 25–10. — *P. fratermus* MIQ. Fl. Ind. Bat. 2 (1859) 963; KOORD. Exk. Fl. Java 3 (1912) 151. — *P. plectranthoides* (non DESF.) KOORD. Exk. Fl. Java 3 (1912) 153.

Erect branched herb, 0.5–1 m. Branches pubescent. *Leaves* thick-membranaceous, lanceolate to ovate, 1–5(–8) by 0.7–3(–5) cm, acute, base acute or rounded, often slightly oblique; margin often doubly serrate or incised-serrate in larger ones; sericeous on both surfaces; petiole 0.5–1 cm, pubescent. *Spicate raceme* terminal, solitary, 3–15 cm long; verticillasters 3–12-flowered, evenly apart. Bracts linear, minute. *Calyx* campanulate, strigose, 4–4.5 mm long, in fruit 5–5.5 mm, 5(occasionally 7)-toothed; teeth lanceolate, sharply pointed, often spreading. *Corolla* white and violet, or reddish, 6–7 mm long, 2-lipped, sparingly puberulent. Filaments exerted, bearded below the middle. *Nutlets* subglobose, 0.6 by 0.5 mm, obscurely 3-angular, black, finely reticulate.

Distr. SE. Asia (Assam, Burma, Thailand, Indo-China); in *Malesia*: Java (from Mt Gedeh eastwards), Lesser Sunda Is. (Bali), Borneo (Mt Kinabalu), and Philippines (Luzon).

Ecol. In deep shade of rain-forest, often along trails, also in elfin forest and in *Casuarina* forest, 1000–2200 m. *Fl.* Jan.–Dec.

Vern. *Dilēm*, *tjuwing areuj*, S.

Uses. The fragrant leaves are in Java sometimes laid between clothes as a repellent to insects.

Note. The record of *P. plectranthoides* DESF., a species of India, is evidently based on a misinterpretation or on an early collection of cultivated specimens in the Bogor Botanic Gardens. The record from Banka by KURZ seems doubtful.

**8. *Pogostemon velatus* BTH.** in DC. Prod. 12 (1848) 155; MIQ. Fl. Ind. Bat. 2 (1859) 964; F.-VILL. Nov. App. (1880) 164; VIDAL, Phan. Cuming. Philip. (1885) 136; Rev. Pl. Vasc. Filip. (1886) 213; MERR. En. Philip. 3 (1923) 415; KENG, Gard. Bull. Sing. 24 (1969) 159. — *P. williamsii* ELMER, Leaf. Philip. Bot. 9 (1934) 3197.

Perennial branching, aromatic herb or under-shrub, 1 m. Stem and branches stout, densely tomentose. *Leaves* thick-membranaceous, lanceolate to broadly ovate, 3–8(–11) by 1.5–4(–5) cm, acute or acuminate, base rounded or cordate, margin remotely double-serrate, densely velutinous on both surfaces; petiole 1–3 cm. *Spicate raceme* terminal and solitary, 5–12(–15) cm long, (1–1.5–) 2–2.2 cm Ø; verticillasters 12–20-flowered, closely approximate. *Calyx* tubular, 4.5–5 mm long, in fruit 6–6.5 mm and mouth enlarged, sparingly pilose; teeth 5, broadly lanceolate, ciliate. *Corolla* dark or deep blue, slender, 7–8 mm long, pilose externally. Filaments exerted, hairy below. *Nutlets* subspherical, 0.6 by 0.5 mm, black, smooth.

Distr. *Malesia*: Philippines (Luzon).

Ecol. Primary forest, ravines and thickets, 1200–2400 m. *Fl.* Jan.–Dec.

Vern. *Dila*, Ilk., *opop*, Ig., *sipan-ti-bayungan*, Bon.

Note. The type of *P. williamsii* ELMER has the narrower spikes and leaves.

9. *Pogostemon auricularius* (L.) HASSK. Tj. Nat. Gesch. Phys. 10 (1843) 127 ('*Pogonostemon*'); Cat. Hort. Bog. (1844) 131; MIQ. Fl. Ind. Bat. 2 (1859) 964; EL-GAZZAR & WATSON, Taxon 16 (1967) 188; BACK. & BAKH. f. Fl. Java 3 (1968) 657; KENG, Gard. Bull. Sing. 24 (1969) 180. — *Majana foetida* RUMPH. Herb. Amb. 6 (1750) 41, t. 16 f. 2. — *Mentha auricularia* LINNÉ, Mant. 1 (1767) 81. — *Mentha foetida* BURM. f. Fl. Ind. (1768) 126. — *Dysophylla auricularia* (L.) BL. Bijdr. (1826) 826; BTH. Lab. Gen. Sp. (1833) 158; in DC. Prod. 12 (1848) 156; F.-VILL. Nov. App. (1880) 164; VIDAL, Phan. Cuming. Philip. (1885) 136; Hook. f. Fl. Br. Ind. 4 (1885) 638; VIDAL, Rev. Pl. Vasc. Filip. (1886) 213; PRAIN, J. As. Soc. Beng. 74, ii (1907) 710; KOORD. Exk. Fl. Java 3 (1912) 152; MERR. Int. Rumph. (1917) 458; En. Philip. 3 (1923) 415; RIDL. Fl. Mal. Pen. 2 (1923) 648; J. Mal. Br. R. As. Soc. 1 (1923) 84, incl. var. *montana* RIDL.; MANSFELD, Bot. Jahrb. 62 (1929) 378; BACK. Onkr. Suiker. (1931) 564, Atlas (1973) t. 535; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 79; HEND. Mal. Nat. J. 6 (1950) 393, f. 363; QUIS. Medic. Pl. Philip. (1951) 817; BACK. & BAKH. f. Fl. Java 2 (1965) 633; KENG, Gard. Bull. Sing. 24 (1969) 67, f. 11, a-d.

Erect annual herb. Stem simple or laxly branched, 30–80 cm, pubescent with spreading hairs. Leaves opposite, membranaceous, narrowly ovate to ovate, 4–6 by 2–3 cm, acute or rarely obtuse, base cuneate or rounded, entire; margin elsewhere irregularly serrate; pubescent and glandular on both surfaces; petiole 2–8 mm, hairy. Flowers in dense, villous, terminal, cylindrical spicate inflorescences 4–7 cm long; verticillasters formed of numerous flowered cymules, close-set. Bracts narrowly elliptic, long ciliate. Calyx subcampanulate, gland-dotted, 1.2–1.5 mm long, 5-toothed, teeth subequal, triangular; calyx in fruit urn-shaped, teeth often incurved over the nutlets. Corolla lavender, pale pink, or white, 2–2.5 mm long; tube slender, exserted; lobes obtuse, pubescent. Filaments 3.5–4 mm, slender, villous. Stamens lilac. Nutlets ellipsoid, 0.6 by 0.4 mm, finely reticulate, brown.

Distr. Throughout SE. Asia to S. China, and throughout Malesia, but not yet recorded from the Lesser Sunda Is. and not from Australia.

Ecol. Sunny, constantly or periodically humid localities, borders of ditches, dams of paddies, grassy wastes, thickets, locally often common, from the lowland ascending to c. 2000 m. Fl. Jan.–Dec.

Vern. Sumatra: *kékutjing*, *kutjing kutjing*, M., *ajiri kutjing*, Djambi, *daun silipan*, Langkat,

*angur angur*, Karo, *si-marihur-ihur-ni-asu*, Batak; Malaya: *ékor kuching*, *poko awi tana*, M; Java: *buntut sérot*, *busu*, *djangnan rambit*, *délangking*, *majana utan*, M, *buntut séro*, *b. utjing*, S, *kétumpang*, *s(è)langking*, J; Borneo: *kambang kambing*; Philippines: *buntut pusa*, Tag.; Moluccas: *maja busuk*, *m. hutan*.

Uses. Pounded leaves, whether or not powdered with lime, are applied as a poultice on the abdomen (RIDLEY). Poulticing is also recorded for other troubles, e.g. diarrhoea, colic, worms and a sore throat. BURKILL & HANIFF said that the plant is in Malaya in common use for simple disturbances of the stomach in children (Gard. Bull. S. S. 6, 1930, 238). HARTLEY listed it as potential anti-carcinogenic (Lloydia 32, 1969, 265).

#### Imperfectly known species

*Pogostemon cristatus* HASSK. Tj. Nat. Gesch. Phys. 10 (1843) 121 ('*Pogonostemon*'); Cat. Hort. Bog. (1844) 130; MIQ. Fl. Ind. Bat. 2 (1859) 962; BACK. & BAKH. f. Fl. Java 2 (1965) 633.

According to BACKER & BAKHUIZEN VAN DEN BRINK Jr, this species is closely allied to *Pogostemon heyneanus* BTH. "from which it may be distinguished by the larger dimensions of the flower". No materials seen.

#### Cultivated

*Pogostemon hortensis* BACK. (in Heyne, Nutt. Pl. ed. 1, 4, 1917; ed. 2, 1927, 1332, *in obs.*) ex ADELB. Reinwardtia 3 (1954) 152; BACK. & BAKH. f. Fl. Java 2 (1965) 633.

Cultivated at Bogor and at Nongkodjadar, Mt Tengger, East Java. Only known in sterile state. Vern. *Dilèm djawa*.

#### Excluded

*Pogostemon gracilis* HASSK. Tj. Nat. Gesch. Phys. 10 (1843) 126 ('*Pogonostemon*'); Cat. Hort. Bog. (1844) 130; MIQ. Fl. Ind. Bat. 2 (1859) 962.

This is probably a plant cultivated in the Bogor Botanic Gardens. I have seen no material and it is not well possible to evaluate it from the brief description.

In HASSKARL's herbarium at L there is a sheet from India labelled *Dysophylla gracilis* DALZ. in his handwriting. His name might therefore represent a new combination, but this is not likely as it does not explain why he gave a new diagnosis without reference to DALZELL.

## 20. SALVIA

LINNÉ, Gen. Pl. ed. 5 (1754) 15; Sp. Pl. (1753) 23; BTH. in B. & H. Gen. Pl. 2 (1876) 1194; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 270; KENG, Gard. Bull. Sing. 24 (1969) 160; FUJITA, Acta Phytotax. Geobot. 24 (1970) 113; T. C. HUANG & J. T. WU, Taiwania 20 (1975) 213. — **Fig. 21.**

Herbs, undershrubs, or shrubs. Leaves opposite, cauline or almost all radical, simple, 3-foliolate, pinnate or 1–2-pinnatifid. Flowers small to large and showy; verticillasters in terminal and axillary racemes. Bracts small or large, sometimes

brilliantly coloured in cultivated forms. *Calyx* campanulate or tubular, 9–11-nerved, 2-lipped; upper lip entire or 3-fid; lower lip notched or 2-toothed. *Corolla* 2-lipped; tube naked or annulate within; upper lip erect; lower lip 3-lobed, central lobe usually wider than the lateral ones, entire or emarginate. Fertile *stamens* 2, representing the lower pair; filaments short, articulating with a slender connective, and sometimes produced beyond the joint; connective linear, transverse, with an upper ascending arm which bears a linear fertile anther-cell, and a lower straight or deflexed branch bearing a reduced anther-cell or empty. Disk usually enlarged anteriorly. Style shortly 2-fid; the lobes usually subulate, equal or the lower larger, sometimes flattened. *Nutlets* ovoid, often triquetrous, smooth.

Distr. About 500 *sp.*, widely distributed in temperate and subtropical regions in the world, rather few in the tropics. Probably only one species is native to *Malesia*; several other species are more or less naturalized; still others are cultivated in the gardens as ornamental. Only the native and truly naturalized species are included in the following key. The key in BACK. & BAKH. *f. Fl. Java* 2 (1965) 625–628 covers also many cultivated species enumerated here at the end.

## KEY TO THE SPECIES

1. Leaves mostly radical and pinnate or 1–2-pinnatifid (3 or 5 leaflets). Rhizomatous herb, usually less than 20 cm high. Style-branches nearly equal . . . . . **1. *S. scapiformis***
1. Leaves cauline, entire or serrate, but not pinnatifid. Erect or procumbent herbs, usually more than 30 cm high. Style-branches very unequal.
2. *Calyx* fully covered with viscid, glandular hairs, less than 7 mm long in the fruiting stage. Flowers blue.
3. Stem alternately with 2 rows of hairs on the nodes in the middle of the sides. *Calyx* in fruit c. 3–4 mm. Upper lip broad, acute . . . . . **2. *S. misella***
3. All four sides of the stem hairy.
4. Spurious racemes rather dense (nodes c. 0.5 cm), in fairly short panicles. Plant c. 40–70 cm. *Calyx* in fruit c. 3–4 mm, the lips and teeth acute . . . . . **3. *S. plebeia***
4. Spurious racemes rather lax (nodes c. 1 cm), slender. Plant c. 0.5–1.5 m. *Calyx* in fruit 5.5–7 mm, upper lip short-mucronate, the two teeth of the underlip clearly mucronate . . . . . **4. *S. riparia***
2. *Calyx* covered with hispid, strigose or curly hairs, not viscid-glandular, more than 8 mm long in the fruiting stage.
5. Verticillasters distant, internodes 1–2 cm. Corolla 12–17 mm longer than the calyx. Flowers red . . . . . **5. *S. coccinea***
5. Verticillasters approximate, internodes 2–5 mm. Corolla 2–3 mm longer than the calyx. Flowers purplish blue . . . . . **6. *S. hispanica***

**1. *Salvia scapiformis*** HANCE, *J. Bot.* 23 (1885) 368; *Bot. Mag.* (1888) t. 6980; MERR. *Philip. J. Sc.* 5 (1910) *Bot.* 228; En. *Philip.* 3 (1923) 413 ('*scapiformis*'); KUDO, *Mem. Fac. Sc. & Agr. Taihoku Un.* 2, 2 (1929) 175; KENG, *Gard. Bull. Sing.* 24 (1969) 161, f. 29 g–i; FUJITA, *Acta Phytotax. Geobot.* 24 (1970) 113; J. T. WU & T. C. HUANG, *Taiwania* 20 (1975) 77. — **Fig. 21.**

Dwarf rhizomatous herb, 10–50 cm high. *Leaves* sparsely hairy, very variable, nearly all radical, (in Mal.) odd-pinnatifid, sometimes bipinnatifid, ovate or broadly ovate in outline, 5–10(–18) cm long; leaflets often 5, sometimes 3 or 7, rarely 3-foliolate; terminal ones largest, ovate, 1–4 by 0.8–3 cm, acute, base rounded or cordate, entire; margin crenate-serrate, or few-toothed in the lateral ones, glabrescent on both surfaces; petiole very slender, 4–10 cm. *Flowers* 4–7 in a verticillaster, the whorls 1–1.5 cm apart, in a raceme-like inflorescence borne on a terminal scape; rachis of inflorescence capitate-glandular-hairy. *Calyx* tubular-campanulate, inside strigose-hairy (hairs 0.8–1.5 mm long), 5–5.5 mm long, in fruit 7–9 mm,

sparsely pilose, 2-lipped; upper lip broad deltoid, entire; lower lip sharply 2-toothed. *Corolla* purple, 8–9 mm long, exerted; tube annulate within; upper lip erect, emarginate; lower lip shorter, 3-lobed. *Stamens* exposed, lower connective-branches reduced. Style shortly 2-branched, branches nearly equal. *Nutlets* ellipsoid, 2–2.5 by 1 mm, flattened-subtriquetrous.

Distr. China, Formosa, Ryu Kyu Is.; in *Malesia*: Philippines (N. Luzon).

Ecol. On cliffs, mossy banks, boulders and in ravines along small streams, 400–1500 m. *Fl.* March–Sept.

Notes. The affinity of this species is with *S. yunnanensis* WRIGHT from Yunnan and with *S. saxicola* BTH. in WALL. from Nepal.

The Philippine specimens have, as far as we have seen, only pinnatifid leaves, whereas the 'normal' form from S. China and Formosa has cordate-ovate leaves which are coarsely crenate. In Formosa (GRESSIT 442) and the Ryu Kyu Is. (HATUSIMA 19267), however, there are also plants with 1–2-pinnate leaves of which the terminal lobe then

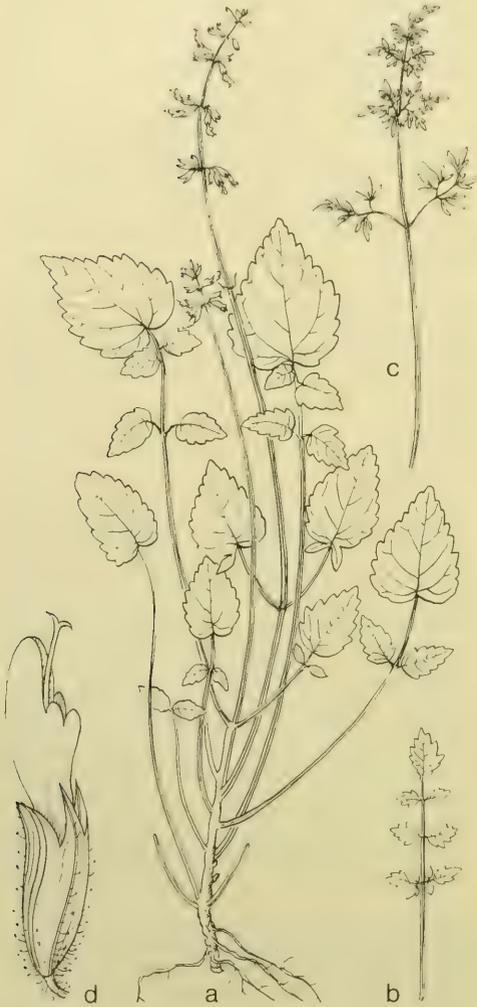


Fig. 21. *Salvia scapiformis* HANCE. a. Habit, b. partly 2-pinnate leaf, c. partly 3-pinnate leaf, all  $\times \frac{1}{2}$ , d. flower,  $\times 4$  (a, d RAMOS Fl 33145, b BS 40256, c BS 40233).

$\pm$  resembles in shape the 'normal' leaf. In Luzon hitherto only the pinnate-leaved specimens are found (ELMER 8637, BS 33145, 40233, PNH 17973, 19792), one of them having even distinctly bipinnate leaves (BS 40233, distributed as a *n.sp.* in sched. by MERRILL).

Pinnate leaves are peculiar to several *Salvia* species. The occurrence of pinnation in the leaves of *S. scapiformis* in Formosa and Luzon we ascribe to juvenile flowering, due to habitat (cliffs or damp dark mossy forest with poor soil). Similar pinnation is also found in Hawaiian scandent *Stenogyne*;

a comparable case is found in the Composite *Ainsliaea pteropoda*; here Malesian specimens with incised leaves have been described as a distinct species, *A. reflexa*.

In a recent study of the Formosan *Salvias* T. C. HUANG & J. T. WU (Taiwania 20, 1975, 213–228) distinguished besides the simple-leaved *S. scapiformis* HANCE three allied species and did not mention the Philippine form. In trying to identify the latter with their key it appears that the differences of the Formosan taxa are minute, that the key contains discrepancies with the illustrations and descriptions, and furthermore that in the Philippine form the length of the hairs inside the calyx varies from 0.8–1.2 mm. In an other, biosystematical study (Taiwania 20, 1975, 77–98) J. T. WU & T. C. HUANG studied their cytology, palynology, hybridization, and chromosomes which supported the minuteness of the differences, one entity appearing to be a tetraploid. In my view no more than one species is concerned, possibly segregated into not even sharply distinct local races.

2. *Salvia misella* KUNTH in H.B.K. Nov. Gen. Sp. 2 (1818) 290; EPLING in Fedde, Rep. Beih. 110 (1938) 16; BACK. & BAKH. f. Fl. Java 2 (1965) 627. — *S. obscura* BTH. Lab. Gen. Sp. (1833) 245; in DC. Prod. 12 (1848) 297; STEEN. Bergcultures 12 (1938) 1936–1940.

Slender herb, creeping, decumbent, sometimes erect, to 75 cm. Stem sparsely hirsute. Leaves membranaceous, lanceolate-ovate or ovate, 1.5–4 (–6) by 0.8–2.5 (–4) cm, acute; base cuneate, narrowed into the petiole, entire; margin elsewhere serrate, hirsute and puberulent on both surfaces; petiole 2–10 mm. Flowers 2–3 in a verticillaster, in terminal spikes, 6–15 cm long, very slender. Bracts lanceolate-ovate, 1.5 mm long. Calyx campanulate, 1.5–2 mm long, in fruit 3–4 mm, covered with both long strigose and short capitate glandular hairs, deeply 2-lipped; upper lip rounded shortly caudate, lower lip 2-toothed. Corolla pale violet to dark blue, 5–6 mm long; lower lip nearly twice as long as the upper one. Nutlets ellipsoid, 1.2–1.5 mm long.

Distr. Native of tropical America, locally naturalized in Malesia: W.–E. Java and Lesser Sunda Is. (Kangean Is., Sumbawa, Flores, Timor), also in Queensland, the Solomon Is. (Guadalcanal) and New Caledonia.

Ecol. A weed of open waste places, up to c. 1000 m. Fl. Febr.–Oct.

3. *Salvia plebeia* R. BR. Prod. (1810) 501; BTH. in DC. Prod. 12 (1848) 355; MIQ. Fl. Ind. Bat. 2 (1859) 970 ('plebeja'); F.-VILL. Nov. App. (1880) 165; VIDAL, Phan. Cuming, Philip. (1885) 136; Rev. Pl. Vasc. Filip. (1886) 214; PRAIN, J. As. Soc. Beng. 74, ii (1907) 713; MERR. Int. Rumph. (1917) 457; Sp. Blanc. (1918) 337; En. Philip. 3 (1923) 413; RIDL. Fl. Mal. Pen. 2 (1923) 655; QUIS. Medic. Pl. Philip. (1951) 833; KENG, Gard. Bull. Sing. 24 (1969) 162, f. 29 d–f. — *S. violacea* (non RUTZ & PAV. 1798) BLANCO, Fl. Filip. ed. 2 (1845) 14; ed. 3, 1 (1877) 27.

Erect herb, 40–60 cm or more. Stem 4-angled, grooved, tomentose or glabrescent. Leaves membranaceous, sparsely hirsute or nearly glabrous, very narrowly elliptic or narrowly ovate, 2–4 by

0.8–1.5 cm, subacute or obtuse, base usually cuneate, entire; margin elsewhere crenate; petiole 2–4 cm, hirsute. *Pseudo-racemes* terminal and in upper leaf-axils, often forming large panicles. *Flowers* 4–10 in a verticillaster. Bracts small, linear-spathulate; pedicels 1–2 mm, hairy. *Calyx* campanulate, 2 mm long, in fruit 2.5 mm, densely tomentose and glandular, 2-lipped; upper lip obtuse, often shortly 3-fid at the tip; lower 2-toothed, teeth acute. *Corolla* violet, purplish, or blue, small, 3–3.5 mm long, shortly exserted; upper lip oblong, obtuse; lower lip 3-lobed, mid-lobe exceeding the lateral ones. *Nutlets* ovoid, 1 by 0.7 mm, brown, rugose.

Distr. Continental SE. Asia (from the Deccan to Korea and Japan) to Australia; in *Malesia*: N. Sumatra (Karo-Batak Lands: Toba plateau) and Philippines (Cagayan Prov.), very rare. The New Guinea record mentioned in the precursor should be omitted; it was cultivated in a botanic garden at Lae.

Ecol. A weed of fallow land, in Sumatra at 1000–1350 m, in Luzon at low altitude in and about towns. *Fl.* Aug., Oct.

Vern. Sumatra: *riku ruku bēgal*, Karo.

Note. LÖRZING noted crushed leaves to be aromatic.

4. *Salvia riparia* KUNTH in H.B.K. Nov. Gen. Sp. 2 (1818) 300; EPLING in Fedde, Rep. Beih. 110 (1938) 16, pl. 1, f. 2; BACK. & BAKH. *f. Fl. Java* 2 (1965) 627. — *S. occidentalis* (non SWARTZ 1788) WELSEM, *Trop. Natuur* 1 (1912) 161, f. 1; *ibid.* 2 (1913) 13; BACK. *Bull. Jard. Bot. Btzg II*, 12 (1913) 29; BOLD. *Zakfl.* (1916) 110; DEN BERGER, *Trop. Natuur* 6 (1917) 101; HEYNE, *Nutt. Pl.* (1927) 1327; BACK. *Onkr. Suiker.* (1931) 562, Atlas (1973) t. 533; HEUBEL, *Trop. Natuur* 24 (1935) 119. — *S. privoides* BTH. *Bot. Voy. Sulph.* (1844) 150; MEER MOHR, *Trop. Natuur* 27 (1938) 226, f. 2 & 3; STEEN. *Bergcultures* 12 (1938) 1636–1640. — *S. plebeja* (non R. Br.) HENRY & PRITCHARD, *Bot. Bull. Lae* 7 (1975) 108, fig.

Erect, fetid herb, 0.5–1.5 m or more high. Stem and branches covered with both long strigose and short viscid-glandular hairs. *Leaves* membranaceous, lanceolate-ovate to ovate, 1.5–6.5(–12) by 0.6–4(–5) cm, acute or obtuse, base cuneate or attenuate, narrowed into the petiole, entire; margin elsewhere serrate; hirsute on both surfaces; petiole 0.2–1.5 cm. *Flowers* 2–3 or more in a verticillaster, in terminal spikes, 8–20 cm long. Bracts spatulate, pointed, 2–3 mm. *Calyx* campanulate, 3–3.5 mm long, in fruit 5.5–7 mm, densely covered with viscid-glandular hairs; upper lip rounded, 1-mucronate; lower lip 2-toothed. *Corolla* pale blue-violet, with white streaks on the lower lip, 5.5–6 mm long. *Nutlets* brown, ellipsoid, 1.5–2 mm long, swelling when soaked in water.

Distr. Native of America (from Mexico to Peru and the West Indies), locally naturalized in *Malesia*: Sumatra, W.–E. Java, the Lesser Sunda Is. (Bali, Sumba, Flores, Timor), and E. New Guinea.

Ecol. Sunny to moderately shaded dry localities, roadsides, forest edges, thickets, fallow agriculture fields, also in teak forests in Java; 15–1000 m. *Fl.* Jan.–Dec.

Vern. Java: *langon*, *legetan*, *l. warak*, *randa*

*nunut*, *J. baluan*, Md, *tjod balu*, Balinese; *aidois*, Tetun lang., *cai fau*, Uai Uwa lang., E. Timor.

Uses. HEYNE (*l.c.*) records that this species is sometimes used as a ground-cover for heavy clay soils; the only drawback is that it cannot well stand the effect of slowly decaying leaves from surrounding shade trees.

Note. Differs from *S. misella* KUNTH merely by the larger dimension of flower parts.

5. *Salvia coccinea* JUSS. ex MURR. in Comm. Goett. 1 (1778) 86, t. 1; HASSK. *Pl. Jav. Rar.* (1848) 481; PRAIN, *J. As. Soc. Beng.* 74, ii (1907) 712; KOORD. *Exk. Fl. Java* 3 (1912) 148; BUYS-MAN, *Flora* 107 (1914) 215; DEN BERGER, *Trop. Natuur* 6 (1917) 101, f. 1; RIDL. *Fl. Mal. Pen.* 2 (1923) 655; EPLING in Fedde, *Rep. Beih.* 110 (1938) 133; BRUGGEMAN, *Ind. Tuinb.* (1939) 148. — *an?* *S. coccinea* BUCHOZ, *Hist. Règne Vég.* II Dec. 3, t. 2 (1773) (*n.v.*). — *S. pseudococcinea* JUSS. ex MURR. in Comm. Goett. 1 (1778) 86; JACQ. *Coll.* 2 (1786) 302; MANSFELD, *Bot. Jahrb.* 62 (1929) 378. — *S. coccinea* JUSS. ex MURR. *var. pseudococcinea* (JACQ.) GRAY, *Syn. Fl. N. Am.* 21 (1878) 368; O. K. *Rev. Gen. Pl.* 2 (1891) 530; BACK. *Onkr. Suiker.* (1934) 561, Atlas (1973) t. 532; BACK. & BAKH. *f. Fl. Java* 2 (1965) 628; KENG, *Gard. Bull. Sing.* 24 (1969) 162, f. 29 a–c. — *S. coccinea* JUSS. ex MURR. *var. lactea* ADELB. in Back. *Bekn. Fl. Java* (em ed.) 14 (1954) fam. 201, p. 29; BACK. & BAKH. *f. Fl. Java* 2 (1965) 628.

Slender herb, 0.5–1 m. Stems several, ascending, often branched, finely pubescent (in some cultivated forms with extremely long silky hairs). *Leaves* membranaceous, ovate or deltoid-ovate, 2.5–3.5 by 1.5–2.5 cm, acute, base truncate or cordate, margin crenate or serrate; glabrous above, finely pubescent beneath; petiole slender, 0.5–1 cm, finely puberulous. *Pseudo-racemes* terminal. *Flowers* 6–10 in a verticillaster. Bracts ovate-acuminate, caducous; pedicels 2–4 mm, slender, puberulous. *Calyx* tubular-campanulate, 7–8 mm long, in fruit 9–10 mm, hirsute, striate; upper lip entire, obtuse; lower lip 2-toothed, teeth triangular, acute. *Corolla* crimson, red, violet, blue (with white throat), or rarely white, 20–25 mm long; tube straight, much exserted, widened upwards; upper lip short, erect; lower lip spreading or recurved, 3-fid. *Nutlets* narrowly ovoid, 3 by 1.2 mm, smooth, brown, swelling when soaked in water.

Distr. Native of tropical America, cultivated in the tropics and occasionally escaping from cultivation; in *Malesia* found naturalized in Malaya (also Penang), Sumatra (Sibolangit), Java, N. Celebes, Philippines (Luzon), and E. New Guinea; also in New Caledonia and other Pacific islands.

Ecol. Weed on fallow lands, along roadsides, abandoned garden land, 600–1700 m. *Fl.* Jan.–Dec. The calyx is tinged red in the red-flowered form, but green in the white-flowered form. Flowers open in the morning, close about noon.

Vern. Java: *totongoan*, S.

6. *Salvia hispanica* LINNÉ, *Sp. Pl.* (1753) 25; KOORD. *Exk. Fl. Java* 3 (1912) 148; KOORD.-SCHUM. *Syst. Verz.* (1913) fam. 254, p. 5; BACK. *Bull. Jard. Bot. Btzg II*, 12 (1913) 29; BOLD. *Zakfl.* (1916) 110; KOORD. *Fl. Tjibodas* 3 (1918) fam. 254, p. 89; HEYNE, *Nutt. Pl.* (1927) 1327; BACK. &

BAKH. *f. Fl. Java* 2 (1965) 627. — *Kiosmina hispanica* (L.) RAFIN. *Fl. Tell.* 3 (1836) 92. — *S. stachyoides* KUNTH var.  $\beta$  *allodapa* HASSK. *Nat. Tijds. N. I.* 10 (1856) 51.

Erect or ascending herb, 0.5–1 m or more. Stem and branches villous and hispid. *Leaves* membranaceous, oblong-lanceolate to ovate, 3–7.5 by 1–4.5 cm, acute or acuminate, base obtuse and abruptly attenuate, entire; margin elsewhere serrate or serrulate; pubescent on both surfaces; petiole slender, 1–3 cm. *Flowers* 6–10 in a verticillaster, these congested into a dense, terminal false spike, 3–10(–18) cm long; internodes 2–5 mm long. Bracts ovate, pointed, 6–8 mm long. *Calyx* tubular, slightly inflated below, 6–7 mm long, in fruit 8–9 mm; densely pilose; upper lip strongly keeled, sharply pointed; lower lip 2-toothed. *Corolla* (purplish) blue, 8–9 mm long, the lips shortly exposed; upper lip rounded, sericeous outside; lower lip 3-lobed. *Stamens* barely exposed; lower connective branch swollen. Style 2-branched, upper branch long and slender (2.5 mm long), pointed, lower one short, club-shaped; the main style articulate above the base. *Nutlets* ellipsoid, 1.5 mm long.

Distr. Native in tropical America, cultivated and naturalized in *Malesia*: West Java.

Ecol. Open localities, roadsides, fallow or weed-grown agricultural fields; sometimes cultivated for the seeds; 900–1700 m. *Fl. Jan.–Dec.*

Vern. Java: *salasi huma*, *tjoing*, *tjuing*, *S.*

Uses. HEYNE (*l.c.*) reported that seeds are sometimes used as a surrogate for those of *selasi* (*Ocimum*).

#### Cultivated

A number of *Salvia* species is recorded to be or have been cultivated. Our experience in Malaya is that the cultivated species do not set viable nutlets in the lowland except for *S. coccinea*.

*Salvia azurea* LAMK *ssp. pitcheri* (TORR. ex BTH.) EPLING in Fedde, *Rep. Beih.* 110 (1938) 194; BACK. & BAKH. *f. Fl. Java* 2 (1965) 626.

Native in the southern part of North America. Corolla sky blue, rarely white. Cultivated in Java as an ornamental.

*Salvia confertiflora* POHL, *Pl. Bras. Ic.* 2 (1833) 134, t. 190; BACK. & BAKH. *f. Fl. Java* 2 (1965) 628.

Native of Brazil. Corolla bluish. Cultivated in Java, occasionally naturalized.

*Salvia farinacea* BTH. *Lab. Gen. Sp.* (1833) 274; BACK. & BAKH. *f. Fl. Java* 2 (1965) 626.

Native in the southern part of North America.

Corolla bluish violet or white. Cultivated in Java as an ornamental.

*Salvia fulgens* CAV. *Icon.* 1 (1791) 15, t. 23; MIO. *Fl. Ind. Bat.* 2 (1859) 970; BURK. *Dict.* (1935) 1979.

Native to Mexico. Corolla bluish. Cultivated in Java and Malaya.

*Salvia ianthina* OTTO & DIETR. *Allg. Gartenz.* 15 (1847) 362; BACK. & BAKH. *f. Fl. Java* 2 (1965) 628.

Native of Mexico or Peru. Corolla blue. In Java locally running wild, but not truly naturalized.

*Salvia officinalis* LINNÉ, *Sp. Pl.* (1753) 23; BURM. *f. Fl. Ind.* (1768) 13; THUNB. *Fl. Jav.* (1825) 15; F.-VILL. *Nov. App.* (1880) 165; MERR. *En. Philip.* 3 (1923) 413 (as *excl. sp.*); BACK. & BAKH. *f. Fl. Java* 2 (1965) 626.

Native of southern Europe. Corolla violet, rarely white. Cultivated in mountain regions in Java.

*Salvia purpurea* CAV. *Icon.* 2 (1793) 52, t. 166; BURK. *Dict.* (1935) 1979.

Native to Mexico and Central America. Corolla purple. Cultivated in Malaya.

*Salvia splendens* SELWOLD *ex* NEES in Weid-Neuwied, *Reise Bras.* 2 (1821) 335 (*n.v.*); SCHULT. & SCHULT. *Mant.* 1 (1822) 185, *descr.*; KER-GAWL. *Bot. Reg.* (1823) t. 687; DEN BERGER, *Trop. Natuur* 6 (1917) 101, f. 2; BRUGGEMAN, *Ind. Tuinb.* (1939) 147, f. 148; BACK. & BAKH. *f. Fl. Java* 2 (1965) 628.

Native of Brazil. Corolla bright crimson. Cultivated in many parts of *Malesia* as an ornamental, in Java also locally naturalized.

There seems to be an older name *S. splendens* BUCHOZ, *Hist. Règne Vég.* II Déc. 3, t. 2 (1773) (*n.v.*). It is not certain that this is a valid name and that it is the same species.

*Salvia tiliifolia* VAHL, *Symb. Bot.* 3 (1790) 7; BACK. *Trop. Natuur Jub. no.* (1936) 58; BACK. & BAKH. *f. Fl. Java* 2 (1965) 627.

Indigenous to E. Mexico and the West Indies. Corolla blue. In E. Java locally naturalized as a weed below Nongkodjadjar, 1000–1100 m.

*Salvia uliginosa* BTH. *Lab. Gen. Sp.* (1833) 251; BACK. & BAKH. *f. Fl. Java* 2 (1965) 626.

Indigenous in southeastern part of North America. Corolla sky-blue, rarely white. Cultivated in Java as an ornamental.

*Salvia viridis* L. var. *horminum* (L.) BATT. & TRABUT, *Fl. Algér.* (1890) 685; BACK. & BAKH. *f. Fl. Java* 2 (1965) 628.

Native of the Mediterranean region and SW. Asia. Corolla pink, violet or white. Cultivated in Java.

## 21. SATUREJA

LINNÉ, *Gen. Pl. ed.* 5 (1754) 247; *Sp. Pl.* (1753) 567; BTH. in B. & H. *Gen. Pl.* 2 (1876) 1187, in part; BRIQ. in E. & P. *Nat. Pfl. Fam.* 4, 3a (1896) 296. Sometimes wrongly spelled '*Satureia*'. — *Calamintha* MILL. *Gard. Dict. ed.* 4, 1 (1754); MOENCH. *Meth. Pl.* (1794) 408; BTH. in DC. *Prod.* 12 (1848) 226; in B. & H. *Gen. Pl.* 2 (1876) 1190; KENG, *Gard. Bull. Sing.* 24 (1969) 41. — *Melissa sect. Calamintha* (MOENCH.) BTH. *Lab. Gen. Sp.* (1834) 384. — **Fig. 22.**

(In Mal.) Often slender and prostrate herbs. *Leaves* crenate-serrate or entire. *Flowers* small or medium-sized, in dense axillary verticillasters which are often forming loose spicate or racemose inflorescences. *Calyx* campanulate or tubular, straight (slightly gibbous at the base in the fruiting stage, in Mal.); 10–13-nerved, 2-lipped; upper lip 3-toothed; lower lip 2-toothed, teeth subulate; throat naked or villous. *Corolla* tube nearly straight, with a longitudinal hairy stripe inside or not; limb 2-lipped; upper lip broad, erect, entire or emarginate; lower lip spreading, 3-lobed. *Stamens* 4, in 2 pairs, ascending under the upper lip; upper pair always smaller and often imperfect (in Mal.); anthers 2-celled, cells parallel or divaricate. Disk uniform, entire. Style lobes equal or the upper lobe smaller. *Nutlets* minute, subglobose, smooth.

Distr. About 200  *spp.* in temperate and warm regions of the northern hemisphere, 2  *spp.* extending to the mountains of  *Malesia* as far as New Guinea.

Note. In my precursor I have treated the two Malesian species under the generic concept  *Calamintha*. Controversial opinions have been expressed about its delimitation: KOCH (Linnaea 21, 1848, 673) merged it with  *Clinopodium*, BENTHAM treated it as a section of his concept of  *Melissa*. I have followed BRIQUET whose broad concept of  *Satureja* includes  *Calamintha* as a section.

#### KEY TO THE SPECIES

1. Bracteoles minute, not exceeding the pedicels, at most short-puberulous. Calyx 3 5–4.5 mm long, the lower half of the tube lax short-hairy, the teeth bristly-ciliate. Corolla 3.5–4.5 mm . . . 1.  *S. gracilis*
1. Bracteoles involucrate, mostly far exceeding the pedicels, densely patently long-hairy. Calyx 4–10 mm long, long-hairy. Corolla 6–14 mm . . . . . 2.  *S. umbrosa*

1.  *Satureja gracilis* (BTH.) LOES. Bot. Jahrb. 34 (1904) Beibl. 75, p. 13; NAKAI, J. Coll. Sc. Univ. Tokyo 31 (1911) 149; BOLD. Zakfl. (1916) 110; MERR. Brittonia 5 (1943) 29; BACK. & BAKH. f. Fl. Java 2 (1965) 630. —  *Calamintha gracilis* BTH. in DC. Prod. 12 (1848) 232; MIQ. Fl. Ind. Bat. 2 (1859) 968, incl. var.  $\gamma$   *rubella*, excl.  $\beta$   *pilosior*; PRAIN, J. As. Soc. Beng. 74, ii (1907) 711; RIDL. Fl. Mal. Pen. 2 (1923) 648; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 99; KENG, Gard. Bull. Sing. 24 (1969) 42. —  *Clinopodium gracile* (BTH.) O. K. Rev. Gen. Pl. 2 (1891) 42; H. W. LI, Acta Phytotax. Sin. 12 (2) (1974) 222. —  *Calamintha moluccana* MIQ. Fl. Ind. Bat. 2 (1859) 968. — Fig. 22.

Slender, prostrate herb. Stem puberulous, rooting on the lower nodes. *Leaves* membranaceous, broadly ovate or subrounded, 1–2 by 0.8–1.5 cm, acute, base rounded or broadly cuneate, entire, margin elsewhere crenate-serrate, glabrous on both sides except on the nerves; petiole 0.5–1 cm, puberulous. *Flowers* in lax, many-flowered verticillasters in the axils of upper leaves, sometimes aggregated in a racemose or subcapitate terminal inflorescence. Bracts subulate, puberulous. Pedicels slender, 1–3 mm. *Calyx* tubular-campanulate, 2–3 mm long, in fruit 4–4.5 mm, sparsely hirsute; tube slightly inflated below; upper teeth recurved, highly connate, slightly shorter than the lower ones; lower teeth subulate, ciliate, slightly incurved. *Corolla* straight, violet or pink, 3–4 mm long, barely exerted. Anther-cells parallel, connivent. *Nutlets* rounded, compressed, 0.5–0.6 mm  $\varnothing$ , pale brown, finely reticulate.

Distr. Continental SE. Asia (Assam, Burma, Thailand, and southern China) to E. Asia (S.

Japan, Formosa); in  *Malesia*: Malay Peninsula, ? Central W. Sumatra, W. Java (Preanger Mts), Central & SW. Celebes (Masamba, Bonthain), ? Moluccas (Ambon). A rare plant.

In L there is a KORTHALS specimen labelled 'Melintang', a place in SE. Borneo; Mt Belintang is in Central W. Sumatra. MIQUEL recorded a KORTHALS specimen from Sumatra, but it has never been collected again in that island. Further there are abundant specimens on 3 sheets from ZIPPEL, but it remains uncertain where these were collected, notes adding either Moluccas (which must then be Ambon) or Timor; from the name in sched. ' *Cumila moluccana* Zp.' it would appear that they came likely from Ambon if these labels belong to the material in question, Mt Salhutu attaining an altitude of c. 1000 m.

Ecol. Damp open places, in grassland, moist roadsides, streamside in forest, 600–1400 m. Fl. April–Oct. In Central Celebes the altitude is given as 2000–2400 m, but this was not ticketed by EYMA himself and is likely wrong.

2.  *Satureja umbrosa* (BIEB.) SCHEEL, Flora 26 (1843) 577; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 302, incl. var.  *javanica* BRIQ. et var.  *repens* (D. DON) BRIQ.; KOORD. Exk. Fl. Java 3 (1912) 149; BACK. & BAKH. f. Fl. Java 2 (1965) 630; STEEN. Mt. Fl. Java (1972) pl. 25–1. —  *Melissa umbrosa* BIEB. Fl. Taur.-Cauc. 2 (1808) 63. —  *Thymus repens* D. DON, Prod. Fl. Nepal. (1825) 113. —  *Ziziphora javanica* BL. Bijdr. (1826) 822; MIQ. Fl. Ind. Bat. 2 (1859) 971; cf. BACK. Bull. Jard. Bot. Botz II, 12 (1913) 34. —  *Calamintha umbrosa* (BIEB.) RCHB. Fl. Germ. Exc. 1 (1830) 329,

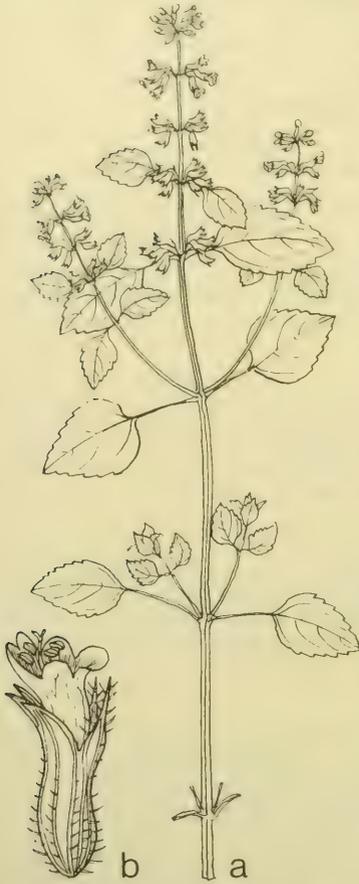


Fig. 22. *Satureja gracilis* (BTH.) LOES. a. Habit,  $\times 2/3$ , b. flower,  $\times 8$  (HOLSTVOOGD 523).

*excl. descr.*; FISCH. & MEY. Ind. Sem. Hort. Petrop. 6 (1840) 6; BTH. in DC. Prod. 12 (1848) 233; MIQ. Fl. Ind. Bat. 2 (1859) 968; HOOK. f. Fl. Br. Ind. 4 (1885) 450; BOERL. Handl. 2, 2 (1899) 715, *incl. var. javanica* (BTH.) BOERL.; MERR. & ROLFE, Philip. J. Sc. 3 (1908) Bot. 123; MERR. En. Philip. 3 (1923) 410; KENG, Gard. Bull. Sing. 24 (1969) 43, f. 7. — *Clinopodium repens* (D. DON) WALL. *ex* BTH. in Wall. Pl. As. Rar. 1 (1830) 66; H. W. Li, Acta Phytotax. Sin. 12 (2) (1974) 217. — *Clinopodium umbrosum* (BIEB.) C. KOCH, Linnaea 21 (1848) 673; O. K. Rev. Gen. Pl. 2 (1891) 514, *incl. var. repens*; MURATA, Acta Phytotax. Geobot. 24 (1969) 77; in Hara, Fl. E. Himal. 2nd Report (1971) 114. — *Calamintha repens* BTH. in DC. Prod.

12 (1848) 233, *incl. var. javanica* BTH.; MIQ. Fl. Ind. Bat. 2 (1859) 968, *incl. var.  $\beta$  javanica* BTH. *et var.  $\gamma$  colorans* MIQ. — *Stachys rubiseipala* ELMER, Leaf. Philip. Bot. 1 (1908) 338. — *Leucas urticifolia* (non R. BR.) KOORD. Exk. Fl. Java 3 (1912) 147.

Slender herb, profusely branched, often prostrate. Stem 0.25–1 m, pubescent, often rooting on the lower nodes. Leaves membranaceous, puberulous, ovate to broadly ovate, 1–1.5(–4.5) by 0.8–1.2(–3) cm, acute, base rounded or cuneate, entire; margin elsewhere serrate; petiole 0.3–1 cm, pubescent. Flowers usually in dense whorls, subcapitate, terminal and in axils of upper leaves. Bracts subulate, hirsute, 3–4 mm, often 2–4 in groups, forming an involucre at the base of the verticillasters. Pedicels 3–6 mm, pubescent. Calyx 4–4.5 mm long, in fruit 4.5–6 mm, pubescent with spreading long hairs; tube slightly inflated below; upper teeth spreading, only slightly recurved; lower teeth subulate, pilose on the margins. Corolla reddish violet or pinkish to purple, with white spots inside the lip, 5–6 mm long, 2-lipped, straight. Stamens 4, only 2 larger ones functional. Nutlets subrounded, c. 0.8 mm  $\varnothing$ , compressed, smooth.

Distr. Continental S. Asia (Caucasus to Afghanistan and India to S. China), E. Asia (Formosa), and Malesia: Sumatra (Mt Kerintji), Java (from Mt Patuha in W to Mt Idjen in E), Lesser Sunda Is. (Bali, Lombok), Philippines (N. Luzon), and W. New Guinea (Lake Habbema near Mt Wilhelmina; Kokoda Distr., Lake Myola).

Ecol. Shaded ravines, glades, open slopes, moist grasslands, rocky plains, in E. Java in *tjemara* (*Casuarina*) forest and in Luzon often in pine forest and savannah; 1200–3200 m. Fl. March–Nov.

Vern. Java: *lègattan*, J, Diëng; Philippines: *pupuguk*, Ig.

Notes. The type specimen of *Melissa umbrosa* BIEB. was from Ibrice (as 'Iberiae'), Turkey. Specimens of this plant from Western Asia to the Far East and to Malesia are essentially homogeneous. In the mountains of Java at altitudes from 2000 to 3200 m, an alpine form with larger flowers (calyx 8–10 mm long at anthesis; 10–12 mm in fruit; corolla long-exserted) and larger nutlets (1–1.2 mm  $\varnothing$ ) occurs which was recognized by BENTHAM, BOERLAGE and others as representing a distinct variety (*var. javanica* or *var. repens*).

The two specimens collected in W. New Guinea are noted by BRASS to have white flowers, the one by CROFT (LAE 61933) had purplish flowers.

#### Cultivated

*Satureja hortensis* LINNÉ, Sp. Pl. (1753) 568; BACK. & BAKH. f. Fl. Java 2 (1965) 629.

A native of the Mediterranean region, sometimes cultivated in the mountains of Java as a condiment.

Vern. *Bonenkruid*, Dutch.

## 22. STACHYS

LINNÉ, Gen. Pl. ed. 5 (1754) 243; Sp. Pl. (1753) 580; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1896) 260; KENG, Gard. Bull. Sing. 24 (1969) 172. — Fig. 23.

Herbs or undershrubs. *Leaves* opposite, crenate or serrate. *Verticillasters* axillary and in terminal spike-like inflorescence. *Calyx* campanulate, 10-nerved; teeth 5, unequal, less distinctly 2-lipped. *Corolla* usually with a ring of hairs within; upper lip ascending, concave, entire; lower lip spreading, 3-lobed, the midlobe the largest. *Stamens* 4, subequal ascending; anthers 2-celled, the cells divaricate (in *Mal. spp.*); filaments glabrous. Style 2-fid, the branches subequal. *Nutlets* ovoid, obtuse above, subtriquetrous below, glabrous.

Distr. One of the largest genera of the family, with c. 200 *spp.*, and worldwide distribution, especially developed in the Orient, the Mediterranean, the Cape, and Chile (BRIQUET, *l.c.*), absent from Australasia and the Pacific, in *Malesia* only found in two close spots in the mountains of West Java.

1. *Stachys oblongifolia* BTH. in Wall. Pl. As. Rar. 1 (1830) 64; Lab. Gen. Sp. (1834) 545; in DC. Prod. 12 (1848) 474; Hook. f. Fl. Br. Ind. 4 (1885) 676; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 188; BACK. Bekn. Fl. Java (em. ed.) 14 (1944) fam. 201, p. 57; STEEN. Mt. Fl. Java (1972) pl. 25-6. — *S. sericea* (non WALL. ex BTH.) STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 223. — *S. melissaefolia* (non BTH.) BACK. & BAKH. f. Fl. Java 2 (1965) 624; KENG, Gard. Bull. Sing. 24 (1969) 173. — Fig. 23.

Annual herb, erect. Stem 30-60 cm, rarely branched, often densely villous. *Leaves* thick-membranaceous, narrowly elliptic or lanceolate, 4-6 by 1.5-2.5 cm, broadly acute, base truncate or subauriculate, margin crenate-serrate, densely villose on the surfaces; petiole about 0.5 cm. *Verticillasters* 4-10-flowered, in distant upper axils, forming spike-like inflorescence, to 15 cm long or more; rachis tomentose. Bracts narrowly elliptic, 6 mm long. *Calyx* campanulate, 5-6 mm long, in fruit 6-7 mm, pilose; the 3 upper teeth slightly longer; the 2 lower teeth joined (BACKER 26072) or nearly free (VAN STEENIS 11657). *Corolla* reddish violet, 10-12 mm long, strigose without, upper lip 3-4 mm long, lower lip 5-6 mm long. *Nutlets* broadly obovoid, flattened, 1.8 by 1.6 mm, subtriquetrous.

Distr. SE. Asia (Bengal, Assam, Silhet, Himalaya), ? S. China; in *Malesia*: West Java: Preanger Mts (Talun and Rantja Gedeh near Kertosari).

Ecol. Damp glades in mountain forest and along forest borders, very local but common, 1600-1750 m.

Taxon. Already HOOKER *f.* (1885) remarked on the difficulty of specific delimitation in this genus in India — 6 epithets being involved — which is also felt elsewhere in the world, even in Europe. BACKER and I (*ll. cc.*) were uncertain about the proper correlation of the Javanese specimens with those from Asia. After having now studied the types of *S. sericea*, *S. melissaefolia*, and *S. oblongifolia*, it is clear that they are very closely allied. Neither in the leaves (shape, hairiness) nor in the number of flowers or their bracteoles I can find consistent differences.

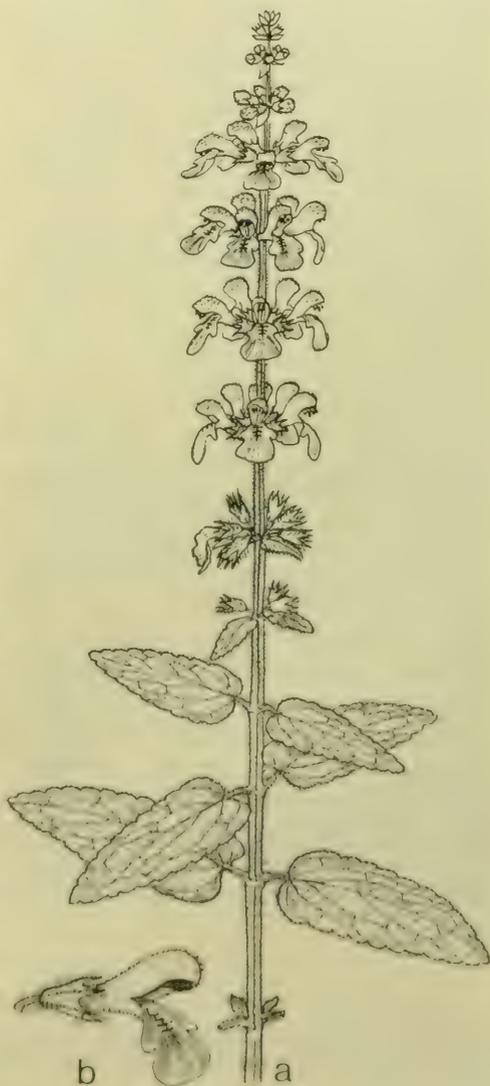


Fig. 23. *Stachys oblongifolia* BTH. a. Habit,  $\times \frac{2}{3}$ , b. flower,  $\times 2$  (VAN STEENIS 11657).

The conclusion is that for distinction (rather smallish) characters can only be found in the flowers, three taxa being provisionally defined as follows:

*S. floccosa* BTH. (*S. sericea* WALL., *homon. illeg.*, non CAV.; *S. vestita* BTH., *p.p.*; *S. splendens* BTH., *p.p.*): Corolla tube rather slender, clearly exceeding the calyx tube, as high as the calyx teeth, limb mostly long densely silky hairy beneath. Calyx tube *c.* 1.5–2 times as long as the teeth, the bays between the teeth rather narrow-acute, teeth rather narrow-deltoid, with a long mucro, about as long as the limb. Calyx *c.* 7–9 mm in all.

*S. melissaefolia* BTH. (*S. splendens* BTH., *p.p.*): Corolla tube distinctly exceeding the calyx tube, limb hairy beneath but not prominently long-silky. Calyx tube 2–4 times as long as the unequal calyx teeth, the latter separated at the base by rounded bays, deltoid, not mucronate, the tip acutish ending in a sort of gland. Calyx *c.* 8 mm in all.

*S. oblongifolia* BTH.: Corolla tube slightly exceeding the calyx tube, shorter than the calyx teeth, the limb hairy beneath but not densely long-sericeous. Calyx tube *c.* 1.5–2 times as long as the teeth, the bays between the teeth rather acutish, teeth deltoid, sharply acute to shortish mucronate. Calyx *c.* 5.5–7 mm long in all.

Those who would adhere to a broader species concept would accept possibly only one species which then should bear the name *S. oblongifolia* BTH. in WALL. As specimens are scarce in the

herbarium, population field studies should bring evidence for a final conclusion. Anyway the Javanese specimens are conspecific with *S. oblongifolia* s. str. although it seems that there is a small difference in having the two lower calyx teeth somewhat fused at the base.

Finally I remark that the assemblage of continental Asian specimens is heterogeneous and some forms may not be distinguishable from the European *S. alpina* L. — Ed.

#### Cultivated

*Stachys arvensis* L. This was sporadically found in ditches in the Mission Garden, Keglsugl airstrip, New Guinea, by Dr. N. M. WACE, 14 Sept. 1971 (ANU 13035). This may become naturalized. It is not known whether it was brought intentionally or came along with other seed as a weed. Identified by J. MENNEMA, Leiden.

*Stachys sieboldii* MIQ. Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 112; KOORD. Exk. Fl. Java 3 (1912) 147.

A Japanese species, with edible tubers. Whether this was ever cultivated in Java seems doubtful; it does not even occur in the Catalogues of the Botanic Gardens, Buitenzorg (Bogor), and there is no material to back this record which may be just based on fancy as many other records in KOORDERS'S FLORA.

### 23. ACROCEPHALUS

BTH. Bot. Reg. *sub* t. 1282, 1300 (1829–30); HASSK. Cat. Hort. Bog. (1844) 128 ('*Acrocephalum*'); BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1897) 365; J. K. MORTON, J. Linn. Soc. Lond. Bot. 58 (1962) 239; in Hutch. & Dalz. Fl. W. Trop. Afr. ed. 2, 2 (1963) 445; ROBIJNS *f.* Bot. Notis. 119 (1966) 185; KENG, Gard. Bull. Sing. 24 (1969) 25. — Fig. 24.

Annual herbs. Stems quadrangular. *Leaves* opposite or seemingly whorled by the presence of the leaves of underdeveloped lateral branchlets. *Verticillasters* agglomerated into terminal or axillary globose or ovoid spurious heads or cylindrical terminal and upper axillary spurious spikes. Bracts imbricate. *Flowers* very small, sessile. *Calyx* ovoid (in fruit tubular), 7-nerved, base slightly gibbous; upper lip flat, entire; lower lip (in *Mal. sp.*) generally 4-toothed; throat naked. *Corolla* tube very short, subequally 5-lobed. *Stamens* 4, declinate, the lower pair slightly longer, glabrous; filaments free, toothless, included; anthers reniform, cells confluent. Disk small, equal-sided or gibbous. Style 2-fid. *Nutlets* minute, ellipsoid, smooth or glandular.

Distr. Uncertain in Africa, ? *c.* 130 *spp.* (see note), anyway *c.* 5–6 *spp.* in continental SE. Asia, of which 1 *sp.* in *Malesia*.

Note. In the old circumscription the genus comprised some 130 *spp.* MORTON (*l.c.*) recently split it up, separating the African species, but ROBIJNS *f.* maintains that the segregated genera cannot satisfactorily be demarcated.



Fig. 24. *Acrocephalus indicus* (BURM. f.) O. K. a. Habit,  $\times \frac{2}{3}$ , b. flower, c. fruiting calyx, both  $\times 8$ , d. nutlet,  $\times 20$  (J. DORGELO 7362).

1. *Acrocephalus indicus* (BURM. f.) O. K. Rev. Gen. Pl. 2 (1891) 511; MERR. Philip. J. Sc. 7 (1912) Bot. 101; En. Philip. 3 (1923) 421; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 109; BACK. Onkr. Suiker. (1931) 570, Atlas (1973) t. 541; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 29; BACK. & BAKH. f. Fl. Java 2 (1965) 638; KENG, Gard. Bull. Sing. 24 (1969) 26, f. 2, incl. f. *spicatus* (C.B.ROB.) KENG. — *Prunella indica* BURM. f. Fl. Ind. (1768) 130. — *Ocimum capitellatum* LINNÉ f. Suppl. (1781) 276. — *Ocimum capitatum* ROTH, Nov. Pl. Sp. (1821) 276. — *Lumnitzera capitata* (ROTH) SPRENG. Syst. 2 (1825) 687. — *Ocymum acrocephalum* BL. Bijdr. (1826) 834. — *Origanum benghalense* (non BURM. f.) BL. Bijdr. (1826) 831. — *A. capitatus* (ROTH) BTH. Bot. Reg. sub t. 1282, 1300 (1829–30); in Wall. Pl. As. Rat. 2 (1830–31) 18; Lab. Gen. Sp. (1832) 23; in DC. Prod. 12 (1848) 47; MOR. Syst. Verz. (1846) 55; MIO. Fl. Ind. Bat. 2 (1858) 941; F.-VILL. Nov. App. (1880) 163; HOOK. f. Fl. Br. Ind. 4 (1885) 611; RIDL. Fl. Mal. Pen. 2 (1923) 644. — *A. blumei* BTH. Bot. Reg. sub t. 1300 (1830); Lab. Gen. Sp. (1832) 23; HASSK. Cat. Hort. Bog. (1844) 128; ZOLL. Nat. Geneesk. Arch. N. I. 2 (1845) 591. — *Pogonostemon plectranthoides* (non DESF.) HASSK. Cat. Hort. Bog. (1844) 131; MIO. Fl. Ind. Bat. 2 (1859) 961. — *Lumnitzera acrocephala* BL. ex MIO. Fl. Ind. Bat. 2 (1858) 941, in syn. — *A. spicatus* C.B.ROB. Philip. J. Sc. 6 (1911) Bot. 356; MERR. En. Philip. 3 (1923) 421. — Fig. 24.

Slender annual herb, up to 1 m. Stem quadrangular, glabrous, often branched from the base; branches often ascending. Leaves elliptic to narrowly lanceolate, 2–5.5 by 0.5–1 cm, acute, base attenuate, margin remotely serrate, glabrous or glabrescent on both surfaces, glandular beneath; petiole 0.2–1 cm. Flowers in terminal and upper axillary spurious heads or short dense spikes, 5–15 mm across, up to 3 or 4 cm long, subtended at the base with 2 or several leafy bracts; flowering bracts suborbicular, 2–3 mm  $\varnothing$ , shortly acuminate, each bract subtending 3–6 flowers. Calyx tubular, 2–2.5 mm long, in fruit 4.5–5 mm, pubescent externally, 2-lipped; upper lip entire, rounded; lower lip with 4 lanceolate teeth, shorter than the upper lip. Corolla white or pale purple, tubular, 3 mm long, suberect, inconspicuously 2-lipped; upper lip shortly 4-lobed, lower lip entire, longer than the upper lip. Stamens 4, in 2 pairs, epicorolline. Nutlets minute, oblong-ellipsoid, 0.7 by 0.4 mm, compressed, smooth.

Distr. Continental SE. Asia (India, Assam, Thailand, Indo-China to S. China) and throughout Malesia.

Ecol. In open vegetation and in grassland, also in fallow fields and paddies, largely below 800 m, ascending in N. Sumatra (Toba) to 1250 m, rather rare, but locally common; sometimes in both everwet and strongly seasonal climates. Fl. Jan.–Dec.

Vern. *Aántingan*, M, *bèbèriéh*, Atjeh, *sangkétan rambat*, J.

## 24. BASILICUM

MOENCH, Suppl. Meth. Pl. (1802) 143; O.K. Rev. Gen. Pl. 2 (1891) 512; J. K. MORTON, J. Linn. Soc. Lond. Bot. 58 (1962) 238; in Hutch. & Dalz. Fl. W. Trop. Afr. ed. 2, 2 (1963) 454; KENG, Gard. Bull. Sing. 24 (1969) 38. — *Moschosma* REICHB. Consp. (1828) 171, in *adnot.*; BTH. Lab. Gen. Sp. (1832) 24; in DC. Prod. 12 (1848) 48; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1897) 368. — Fig. 25.

Erect, annual or perennial herbs, branched. *Verticillasters* 6-flowered, secund, in axillary and terminal raceme-like inflorescences. *Flowers* very small. Bract minute. *Calyx* campanulate, 10-nerved, 5-toothed, the uppermost tooth often very broad and forming the upper lip, the 2 lateral teeth often associated with the 2 lower teeth and forming the lower lip; throat of calyx naked. *Corolla* tubular-campanulate, tube short, limb 2-lipped; upper lip (in *Mal. sp.*) clearly 3-lobed, midlobe entire or shallowly notched; lower lip entire, auriculate at base. *Stamens* 4, declinate; filaments not appendiculate; anthers 2-celled. Disk equal-sided. *Nutlets* ovoid, compressed, smooth.

Distr. about 6–7 *spp.* in the tropics of the Old World, in Africa, Asia, Malesia, and N. Australia; in *Malesia* 1 *sp.*, in N. Australia an endemic species closely allied to it.

Nomencl. MAHESHWARI has proposed to conserve *Moschosma* (Taxon 19, 1970, 481), but this has not been accepted.

1. *Basilicum polystachyon* (L.) MOENCH, Suppl. Meth. Pl. (1802) 143; O.K. Rev. Gen. Pl. 2 (1891) 512; MORTON in Hutch. & Dalz. Fl. W. Trop. Afr. ed. 2, 2 (1963) 454; KENG, Gard. Bull. Sing. 24 (1969) 39, f. 6. — *Ocimum tenuiflorum* (non L. 1753) BURM. f. Fl. Ind. (1768) 129. — *Ocimum polystachyon* LINNÉ, Mant. 2 (1771) 567. — *Lumnitzera polystachyum* (L.) JACQ. f. ex SPRENG. Syst. 2 (1825) 687. — *Ocimum polystachyum* L. var. BL. Bijdr. (1826) 834. — *Moschosma polystachyum* (L.) BTH. in Wall. Pl. As. Rar. 2 (1830–31) 13; in DC. Prod. 12 (1848) 48; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 397; HASSK. Cat. Hort. Bog. (1844) 129; MIO. Fl. Ind. Bat. 2 (1858) 942; F.-VILL. Nov. App. (1880) 163; HOOK. f. Fl. Br. Ind. 4 (1885) 612; VIDAL, Phan. Cuming. Philip. (1885) 135; Rev. Pl. Vasc. Filip. (1886) 212; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 529; MERR. Sp. Blanc. (1918) 339; En. Philip. 3 (1923) 421; RIDL. Fl. Mal. Pen. 2 (1923) 644; MANSFELD, Bot. Jahrb. 62 (1929) 380; BACK. Onkr. Suiker. (1931) 570, Atlas (1973) t. 542; BURK. Dict. (1935) 1498; QUIS. Medic. Pl. Philip. (1951) 824; BACK. & BAKH. f. Fl. Java 2 (1965) 638 ('*polystachyon*'). — *Moschosma tenuiflorum* [non (L.) HEYNH. 1840] MERR. Fl. Manila (1912) 408. — Fig. 25.

Erect herb, 0.4–1 m. Stem much branched, ± glabrous, prominently 4-angled. *Leaves* thin-membranaceous, ovate to oblong-ovate, 2–5 by 1–3.5 cm, acuminate or caudate, base acute or attenuate, irregularly serrate, glabrous on both surfaces; petiole slender, 1–4 cm. Raceme-like

*inflorescence* 3–6 cm long (in fruit over 10 cm). Bracts minute, lanceolate, aristate, 1–2 mm. Pedicels 1–2 mm, persistent. *Calyx* campanulate, pubescent, 1.5–2 mm long (in fruit 3–3.5 mm, slightly inflated at base); upper lip broad, entire, reflexed; lower lip 4-toothed, 2 lateral teeth ovate, and 2 lower teeth cuspidate. *Corolla* pale lilac to purple or flesh-coloured, sometimes white, 2–2.5 mm long. *Stamens* 4, in 2 pairs, included. *Nutlets* minute, broadly ellipsoid, compressed, smooth.

Distr. Tropics of Africa, SE. Asia (incl. Ceylon), throughout *Malesia* to New Britain and Queensland.

Ecol. Fallow rice-fields, watersides, swampy grasslands, open waste places, largely in settled areas, with a preference for seasonal climatic conditions, therefore in Java largely in areas subject to a dry climate, and scarce in most of Sumatra, Malay Peninsula, and Borneo. *Fl.* Jan.–Dec.

Flowers are often galled, and inflorescences bear sometimes large red galls, caused by a gall-midge.

Vern. *Musk basil*, E; Sumatra: *main-main*, *sulasèh dulang*, *tapua djattèn*, M; Java: *surawung gunung*, *s. leuweung*, *wangung langit*, S, *bajèm bali*, M, *sangkèt(an)*, *wangon*, *wangun*, J; Philippines: *loktokong*, *pansi-pansi*, Tag., *bauing*, Mag., *lodo-kong*, Pang.

Uses. According to HEYNE (Nutt. Pl. ed. 3, 1950, 1335) the crushed leaves are used in Java for sprains. Decoctions are used externally and internally for epilepsy, palpitations of the heart, neuralgia and convulsions.



Fig. 25. *Basilicum polystachyon* (L.) Moench. a. Habit,  $\times 2/3$ , b. flower, c. fruiting calyx, both  $\times 12$  (a RAHMAT SI BOEHA 463, b-c BACKER 35568).

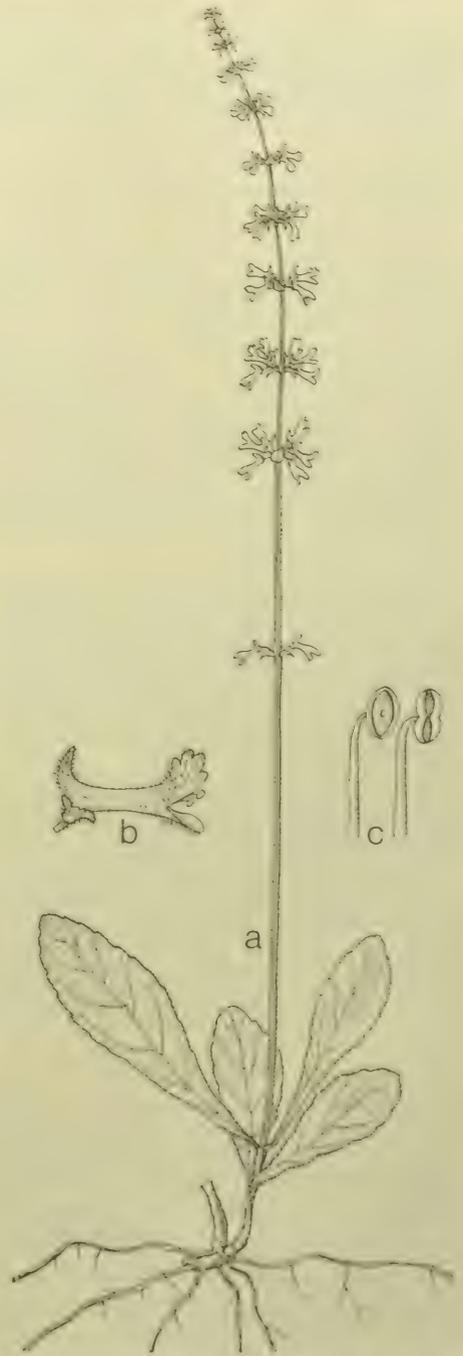


Fig. 26. *Ceratanthus longicornis* (F.v.M.) G. TAYLOR. a. Habit,  $\times 2/3$ , b. flower,  $\times 3$ , c. stamens, thecae finally confluent,  $\times 14$  (BRASS 8403).

## 25. CERATANTHUS

F.v.M. (Fragm. Phyt. Austr. 5 (1865) 52, *in obs.*, *nom. prov.*) ex G. TAYLOR, J. Bot. 74 (1936) 35; KENG, Gard. Bull. Sing. 24 (1969) 46. — *Plectranthus sect. Cornigera* F.v.M. Fragn. Phyt. Austr. 5 (1865) 51. — *Hemsleia* KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 142, *non Hemsleya* COGN. 1889. — **Fig. 26.**

Herbs. *Leaves* opposite (or basal ones subverticillate). *Flowers* usually small, in few-flowered verticillasters, forming a terminal raceme-like inflorescence. *Calyx* turbinate (more or less saccate in fruit), 5-toothed, 2-lipped; upper lip 3-lobed, lower lip obtuse, strongly incurved and gibbous in fruit. *Corolla* tube exerted, spurred at the base; limb 2-lipped, upper lip 3–4-lobed, recurved, lower lip entire, concave. *Stamens* 4, in 2 pairs; filaments free, inserted at two levels. Style shortly 2-fid. *Nutlets* orbicular, often finely pitted.

Distr. About 10  *spp.*, largely in continental SE. Asia (Thailand, Indo-China, and SW. China), 1  *sp.* in *Malesia* (S. New Guinea) and Queensland.

Note. LAM (Proc. 7th Pac. Sc. Congr. 5, 1953, 9) has suggested that the genus would be an artificial assemblage of *Plectranthus* species with spurred corolla, which would then explain the Malesian disjunction. As the genus is differing from that genus by more characters, however, I find this unlikely; there are more genera showing this disjunction, especially those bound to a seasonal climate, such as *Anisomeles malabaricus*, *Germainia*, etc.

**1. *Ceratanthus longicornis*** (F.v.M.) G. TAYLOR, J. Bot. 74 (1936) 39, f. 2; KENG, Gard. Bull. Sing. 24 (1969) 46, f. 8. — *Plectranthus longicornis* F.v.M. Fragn. Phyt. Austr. 5 (1865) 51; BTH. Fl. Austr. 5 (1870) 76; F. M. BAILEY, Queensl. Fl. 4 (1901) 1189; DOMIN, Bibl. Bot. 22 (Heft 89) (1929) 1117, *incl. var. scapiger* DOMIN; STEEN. Bull. Jard. Bot. Bitz III, 13 (1934) 222. — **Fig. 26.**

Perennial herb, 25–45 cm. Stem unbranched, rarely branched from the base, tomentose or pubescent, thickened (sometimes nodiferous) and scaly in underground portion. *Leaves* usually 2–3 pairs, linear oblanceolate, obovate or oblong, 2.5–3.5(–5) by 1–1.5 cm, obtuse or rounded, base attenuate, margin sinuate or coarsely toothed or subentire, hirsute on both surfaces; petiole 0.2–0.5 cm. *Verticillasters* (4–5)–6–8-flowered, forming a terminal, slender raceme 10–15 cm. Bracts cordate, acuminate. Pedicels 2–3 mm. *Calyx* turbinate, widely opened, 1.5–2.5 mm long, upper lip

formed of a broad, truncate and emarginate upper tooth with 2 smaller lateral teeth at its base, lower lip obtuse and emarginate. *Corolla* blue, violet or deep purple, obliquely campanulate, produced at the base a narrow conical, recurved spur; upper lip erect, broad, shortly 3-lobed; lower lip oblong, concave. *Stamens* included, 2 upper ones inserted near the mouth, 2 lower ones near the base of the corolla tube; anthers 2-locular, later confluent and 1-celled, reniform, dorsifixed. *Fruiting calyx* accrescent, inflated, 2.5–3 mm long and broad; upper tooth recurved at the top and decurrent at the base; lower lip strongly concave and saccate. *Nutlets* globular, flattened, 1 mm  $\varnothing$ , glandular.

Distr. NE. Queensland, in *Malesia*: SE. New Guinea (Oriomo, Middle Fly and Wassi Kussa R. areas).

Ecol. Locally common in seasonally dry lowland grasslands and savannahs.

## 26. HYP TIS

JACQ. Collect. 1 (1786) 101, 103, *nom. cons.*; BTH. in B. & H. Gen. Pl. 2 (1876) 1178; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1897) 333; EPLING, Kew Bull. (1936) 378; Rev. Mus. La Plata n.s. 7, Bot. (1949) 153; KENG, Gard. Bull. Sing. 24 (1969) 90. — *Mesosphaerum* P. BROWNE, Hist. Jamaica (1756) 257; O. K. Rev. Gen. Pl. 2 (1891) 525. — *Schaueria* HASSK. Flora 25 (1842) II, Beibl. 25, *nomen*. — **Fig. 27.**

Herbaceous or shrubby, often aromatic. *Leaves* serrate, gland-dotted. *Flowers* small or medium, variously arranged in densely spicate or densely capitate inflorescences or in few-flowered clusters, often secund. Bracts subulate or setaceous. *Calyx* tubular or campanulate, straight or oblique, 10-nerved; teeth 5, subequal, acute or awned, erect. *Corolla* 5-lobed, 2-lipped; upper lip 2-lobed, lobes erect or

spreading or reflexed; lower lip 3-lobed, the midlobe abruptly deflexed, with thickened margins, sometimes saccate at the base. *Stamens* 4, declinate; filaments free, without basal appendages; anther-cells confluent. Disk entire, equal-sided. Style subentire or shortly 2-fid. *Nutlets* oblong or ovoid, smooth or rugose sometimes only one or two developed.

Distr. Species over 300, all American. The following 5 spp. naturalized as weeds in the Old World tropics.

## KEY TO THE SPECIES

1. Flowers in many-flowered verticillasters, congested into globose or ellipsoid spurious heads (or dense spikes).
2. Spurious heads axillary, globose or subglobose.
3. Spurious heads 0.8–1.2 cm (in fr.) Ø. Peduncles 0.5–1 cm long . . . . . 1. *H. brevipes*
3. Spurious heads 1.5–2 cm (in fr.) Ø. Peduncles 3–5(–8) cm long . . . . . 2. *H. capitata*
2. Spurious heads (or dense spikes) terminal, oblong or ellipsoid, (in fr.) 3–5 cm long . . . . . 3. *H. spicigera*
1. Flowers in few-flowered short cymes, axillary or in terminal spurious racemes or panicles.
2. Cymes 6–15-flowered, comb-shaped, in terminal spurious racemes or panicles. Calyx tubular, 3–4 mm long in fruit. . . . . 4. *H. pectinata*
2. Cymes 2–5-flowered, clustered in leaf-axils or racemously disposed. Calyx obliquely campanulate, 8–10 mm long in fruit . . . . . 5. *H. suaveolens*

1. *Hyptis brevipes* POIT. Ann. Mus. Hist. Nat. Paris 7 (1806) 465; BTH. Lab. Gen. Sp. (1833) 105; in DC. Prod. 12 (1848) 107; MOR. Syst. Verz. (1846) 54; MIQ. Fl. Ind. Bat. 2 (1858) 959; F.-VILL. Nov. App. (1880) 164; VIDAL, Phan. Cuming. Philip. (1885) 135; HOOK. f. Fl. Br. Ind. 4 (1885) 630; VIDAL, Rev. Pl. Vasc. Filip. (1886) 213; BRIO. Ann. Cons. Jard. Bot. Genève 2 (1898) 227, incl. var. *serrata* BRIO.; MERR. Philip. J. Sc. 1 (1906) Suppl. 122; PRIN, J. As. Soc. Beng. 74, ii (1907) 704; KOORD. Exk. Fl. Java 3 (1912) 153; MERR. Fl. Manila (1912) 409; Sp. Blanc. (1918) 338; COSTERUS & SMITH, Ann. Jard. Bot. Btzg 32 (1922) 28; MERR. En. Philip. 3 (1923) 416; RIDL. Fl. Mal. Pen. 2 (1923) 645; MERR. Pl. Elm. Born. (1929) 268; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 147; BACK. Onkr. Suiker. (1931) 565, Atlas (1973) t. 536; STEEN. Trop. Natuur 25 (1936) 4, f. 6; Gard. Bull. S. S. 9 (1938) 67, pl.; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 62; EPLING, Rev. Mus. La Plata n.s. 7, Bot. (1949) 443; HEND. Mal. Nat. J. 6 (1950) 390, f. 360; BACK. & BAKH. f. Fl. Java 2 (1965) 634; KENG, Gard. Bull. Sing. 24 (1969) 90. — *H. acuta* BTH. Linnaea 6 (1831) 82. — *Thymus biserratus* BLANCO, Fl. Filip. (1837) 478. — *Mentha javanica* (non BL. 1826) SPANOGHE, Linnaea 15 (1841) 332. — *Leucas globulifera* HASSK. Cat. Hort. Bog. (1844) 133; MIQ. Fl. Ind. Bat. 2 (1859) 984; PRIN, J. As. Soc. Beng. 74, ii (1907) 705. — *Pycnanthemum subulatum* BLANCO, Fl. Filip. ed. 2 (1845) 333; ed. 3, 2 (1878) 251, t. 204. — *Mesosphaerum brevipes* (POIT.) O. K. Rev. Gen. Pl. 2 (1891) 525. — Fig. 27a–c.

Erect herb, 0.5–1.5 m, not aromatic. Stem shortly branched, glabrous or pilose. Leaves membranaceous, narrowly lanceolate or ovate-oblong, 4–8 by 1–2.5 cm, acute or acuminate, base long cuneate, entire, margin elsewhere serrate, sparsely hispid on nerves on both surfaces; petiole 0.5–1 cm, hispid. Flowers in dense spurious heads, 0.6–0.8 cm Ø, in fruit 0.8–1.2 cm Ø, on axillary, hispid slender peduncles, 1–1.2 cm long. Subtend-

ing bracts lanceolate or subulate, 4–6 mm long, setaceous. Calyx subtubular, 2.5–3 mm long, in fruit 3–4 mm; teeth erect, subulate, 1–1.4 mm long, sparsely ciliate. Corolla white, 3–4 mm long; lips glandular, the lower lip yellowish. Anthers purple. Nutlets ovoid, 0.7 mm long, dark brown, minutely rugose, not swelling when soaked in water.

Distr. Native of Mexico, since long naturalized in and now found throughout *Malesia* and other tropics.

Ecol. Waste places, often abundant in fallow rice-paddies, mainly under everwet climatic conditions, rather rare in seasonally drought areas, ascending to c. 1200 m. Fl. Jan.–Dec.

Once this species has been found at c. 3100 m on the summit of Mt Agung, Bali, in small, condensed but flowering specimens, near fumaroles which act as 'open glasshouses' (VAN STEENIS, 1936, *l.c.*), together with some other medium altitude plants. This is explained by exozooic dispersal of seed by either game or monkeys, or by Balinese who annually pilgrimage this sacred summit.

Vern. Malaya: *ati-ati putèh, gantanggau, kanching baju, sawi ènggang, s. hutan*, M; Java: *boborondongan, boborongan, djukut pèndjul, gèng-gèjan, kanèju, ki heuleud, mata munding*, S, *godong pusèr*, J; Sumatra: *ane-ane*, M; Borneo: *kumpai huluman*; Philippines: *lombar-kombèran, liñgaliñgalingàhan, pansì-pansì, pompul-pompulan*, Tag., *albaka*, Sul., *lubulan*, Sub., *niog-niogan*, Bik., P.Bis., *pulipul*, If.; Celebes: *pupulut alus, tutumbalen*, Minahassa.

Uses. In Malaya the leaves are sometimes eaten. A decoction of the leaves is considered a protective medicine after childbirth; also used to drive out worms in children by application to the abdomen (BURK. Dict. 1935, 1220).

2. *Hyptis capitata* JACO. (l.c. Rar. 1, 1781–87, t. 114, *sine descr. et anal., inval.*) Collect. 1 (1786) 102; BTH. in DC. Prod. 12 (1848) 106; MIQ. Fl. Ind. Bat. 2 (1858) 958; F.-VILL. Nov. App. (1880) 164;

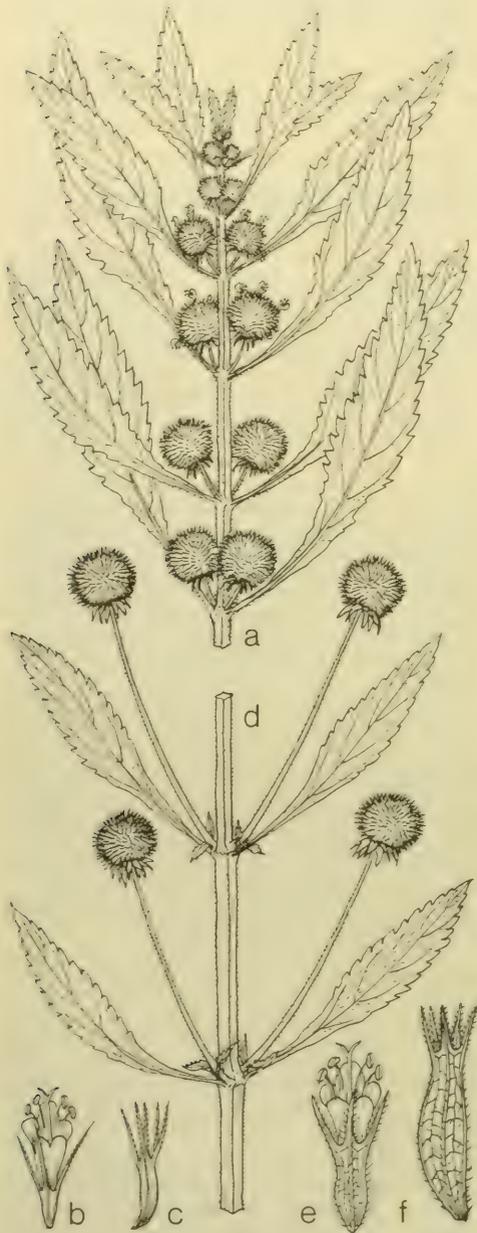


Fig. 27. *Hyptis brevipes* POIT. a. Habit,  $\times \frac{2}{3}$ , b. flower, c. fruiting calyx, both  $\times 4$ . — *H. capitata* JACQ. d. Habit,  $\times \frac{2}{3}$ , e. flower, f. fruiting calyx, both  $\times 4$  (a-c SCHIFFNER 2471, d SCHIFFNER 2868, e-f SCHIFFNER 2484).

VIDAL, Phan. Cuming. Philip. (1885) 136; Rev. Pl. Vasc. Filip. (1886) 213; BRIQ. Ann. Cons. Jard. Bot. Genève 2 (1898) 225, *pro var. mariannarum* BRIQ.; MERR. Philip. J. Sc. 1 (1906) Suppl. 122; *ibid.* 5 (1910) Bot. 381; Fl. Manila (1912) 409; KOORD. Exk. Fl. Java 3 (1912) 153; MERR. Philip. J. Sc. 11 (1916) Bot. 311; Sp. Blanc. (1918) 338; En. Philip. 3 (1923) 416; DAMMERMAN, Nat. Tijds. N. I. 86 (1926) 75, 93; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 147; BACK. Onkr. Suiker. (1931) 566, Atlas (1973) t. 537; HOLTH. & LAM, Blumea 5 (1942) 237; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 63; EPLING, Rev. Mus. La Plata n.s. 7, Bot. (1949) 470; QUIS. Medic. Pl. Philip. (1951) 817; BACK. & BAKH. f. Fl. Java 2 (1965) 634. — *Thymus virginicus* (non L. 1771) BLANCO, Fl. Filip. (1837) 478. — *Pycnanthemum decurrens* BLANCO, Fl. Filip. ed. 2 (1845) 333; ed. 3, 2 (1878) 251, t. 294. — *H. celebica* ZOLL. ex KOORD. Med. Lands Pl. Tuin 19 (1898) 561; BOERL. Handl. 2 (1899) 714. — *H. lanceolata* (non POIR. 1813) BRIQ. Ann. Cons. Jard. Bot. Genève 2 (1898) 225 (*quoad* CUMING 591); MERR. En. Philip. 3 (1923) 416. — *Mesosphaerum capitatum* JENNINGS, Ann. Carneg. Mus. 11 (1917) 246. — *H. decurrens* (BLANCO) EPLING in Fedde, Rep. 34 (1933) 120. — *H. rhomboidea* (non MART. & GAL. 1844) EPLING, Kew Bull. (1936) 278; Rev. Mus. La Plata n.s. 7, Bot. (1949) 468; KENG, Gard. Bull. Sing. 24 (1969) 92, f. 15; HENTY & PRITCHARD, Bot. Bull. Lae 7 (1975) 105, fig. — *H. mariannarum* (BRIQ.) EPLING, Rev. Mus. La Plata n.s. 7, Bot. (1949) 471. — Fig. 27d-f.

Stout, erect annual herb, 0.5–2.5 m, not aromatic. Stem and branches (often very short) densely or sparsely pubescent on the angles. *Leaves* lanceolate or rhomboid-elliptic, 6–10(–14) by 1.5–4(–6) cm, acute or acuminate, base cuneate and decurrent; margin crenate-serrate or serrate, sparsely pubescent on the nerves of lower surfaces; petiole 2–3 cm. *Flowers*  $\infty$  in crowded verticillasters forming axillary, solitary globular heads, 0.8–1 cm  $\varnothing$  (1.5–2 cm  $\varnothing$  in fruit); peduncle 3–5(–8) cm, basal involucre bracts linear-lanceolate, hairy, 3–6 mm long. *Calyx* 3–4 mm long, in fruit 6–8 mm; teeth subulate, erect, as long as or shorter than the tube. *Corolla* white, violet-dotted, 5–6 mm long. Anthers purple. *Nutlets* ovoid, compressed 1.2–2 mm long, round-truncate above, subtriquetrous below, sparingly puberulent, brown, pericarp not swelling when soaked in water.

Distr. Native of tropical America, since long naturalized in all tropics, and throughout *Malesia*, also in Hainan, Micronesia and the Solomons.

Specimens in Guam have already been collected by GAUDICHAUD and Philippine records date from BLANCO, so that the import in the Old World may well have occurred along the old Spanish trans-pacific galleon route.

Ecol. Open, sunny to slightly shaded waste places, along water courses, on fallow paddies, also in teak-forest, in East Java under seasonal conditions and sometimes gregarious, from sea-level to c. 1300 m. *Fl.* Jan.–Dec.

Vern. Sumatra: *morroguni*, *wurakapiki*, *sec.* DAMMERMAN; Borneo: *lubok bulu*, Sarawak, *dan buku napsu*, *oaga bini*, Brunei, *tembuku-tembuku*, *timan-timan*; Lesser Sunda Is.: *abgoanam*, *ilite bublong*, *merara welana*, *tatabak*; NE. Celebes: *aring kaming*, *kan-i-lamperan-sela*, *kide*, *penten-*

*gipus*, *rumpit kembang gros*, *r. (ne) membe*, *tutum-balen*, *t. sela*, Minahassa; Philippines: *botonesan*, *kambali*, *kambar-kombaran*, *linga-lingahan*, *turukan*, Tag., *bababanga*, *leng-lenga*, *tetetei*, Bon., *palapasagi*, P. Bis., *pansi-pansi*, *tarotabako*, Bik., *palopalot*, *tultulisan*, Ilk., *tabaku-tabaku*, Sul.; New Guinea: *pupu*.

Uses. In the Philippines a decoction of the leaves is used for cleansing wounds and against amenorrhoea (QUIS. *l.c.* 817).

Notes. EPLING (1933, *l.c.*) first referred the Malasian specimens to *H. decurrens* (BLANCO) EPLING, but in his monograph of 1949 he reduced this to *H. rhomboidea* MART. & GAL. which name I used also in my precursor. However, after a close study of many specimens from various parts of the world, I agree with BENTHAM, MIQUEL, and MERRILL to accept the name *H. capitata*, although EPLING (1949, *l.c.*) maintains that this is central American (Mexico to Peru) and that the Old World weed belongs to the Mexican *H. rhomboidea* JACQ.; but in his key (1949, *l.c.* 459) the reverse is said. The only true differences which I can distract from his key and descriptions are that in *H. rhomboidea* the stem is distinctly hairy on the angles (indistinctly so or glabrous in *H. capitata*) and that in flowering heads the calyx tube is 2 mm with teeth of 2 mm (in *H. capitata* 1.5 mm and 1.5 mm respectively). Apart from the minuteness of these characters for specific distinction, I have found them to be inconstant by intermediates as to the degree of hairiness of the ribs and to the size of the calyx teeth. Besides, these two characters occur in several specimens in all combinations in Javanese material.

I have also reduced *H. mariannarum* (BRIO.) EPLING and believe that *H. macrocephala* MART. & GAL. is also conspecific, which EPLING himself suggests. There may be many more reductions necessary in *subsect. Genuinae* before a tolerable specific concept is reached, as at least EPLING's key is very shaky and characters used do not appear to have great taxonomic value.

3. *Hyptis spicigera* LAMK, *Encycl.* 3 (1789) 185; BTH. in DC. *Prod.* 12 (1848) 87; MIQ. *Fl. Ind. Bat.* 2 (1858) 958; F.-VILL. *Nov. App.* (1880) 164; MERR. *Philip. J. Sc.* 1 (1906) *Suppl.* 122; *Fl. Manila* (1912) 409; Sp. *Blanc.* (1918) 338; En. *Philip.* 3 (1923) 417; EPLING, *Rev. Mus. La Plata n.s.* 7, *Bot.* (1949) 253; KENG, *Gard. Bull. Sing.* 24 (1969) 95. — *Pycnanthemum elongatum* BLANCO, *Fl. Filip.* ed. 2 (1845) 333; ed. 3, 2 (1878) 252. — *Mesosphaerium spicigerum* (LAMK) O. K. *Rev. Gen. Pl.* 2 (1891) 527.

Erect annual herb, 1–1.5 m high. Stem scabrous; branches glabrous or only slightly pubescent. Leaves herbaceous, lanceolate to elliptic-lanceolate, 2.5–6 by 1.2–3 cm, acute or acuminate, base acuminate, decurrent; margin serrulate, glabrous or glabrescent on both surfaces; petiole 0.5–2.5 cm. *Verticillasters* many-flowered, forming a dense spike-like or head-like inflorescence, 1–1.5 cm long, in fruit 3–4.5 cm, terminal and in upper leaf-axils. Bracts subulate, 3–4 mm long, setaceous. Flowers purplish, pale blue or violet. *Calyx* tubular, 4–5 mm long, in fruit 6–7 mm, ribbed, reticulate; teeth subulate, 2 mm long, setaceous. *Nutlets* ellipsoid, compressed, 1.2 mm long, finely granulate.

Distr. Native of tropical America, naturalized in various tropical countries, in *Malesia*: Lesser Sunda Is. (Sumba, Alor, Timor), SE. Borneo, Philippines (Luzon, Mindoro, Palawan, Mindanao), Celebes (incl. Buton & Muna Is.), Moluccas (Buru). Also in the Marianas.

Ecol. Waste places, wet rice-paddies, coastal coral limestone, open dry grasslands, locally sometimes abundant, from the lowland to 900 m. *Fl.* Jan.–Dec.

Obviously well standing a dry season; EYMA noted that in Kolonedale (Celebes) leaves are shed in the dry season.

Vern. Lesser Sunda Is.: *mossolan*, Alor; Philippines: *ikugkuting*, Sul., *kalu-ui*, C. Bis.; Celebes: *babalu bugis*.

4. *Hyptis pectinata* (L.) POIT. *Ann. Mus. Hist. Nat. Paris* 7 (1806) 474, t. 30; BTH. *Lab. Gen. Sp.* (1833) 127; MIQ. *Fl. Ind. Bat.* 2 (1858) 960; ? F.-VILL. *Nov. App.* (1880) 164; BACK. *Ann. Jard. Bot. Btzg Suppl.* III (1909) 404; KOORD. *Exk. Fl. Java* 3 (1912) 153; BACK. *Onkr. Suiker.* (1931) 567, *Atlas* (1973) t. 538; MUKERJEE, *Rec. Bot. Surv. India* 14 (1940) 46; EPLING, *Rev. Mus. La Plata n.s.* 7, *Bot.* (1949) 268; PARHAM, *Pl. Fiji* (1964) 254; BACK. & BAKH. *J. Fl. Java* 2 (1965) 634; KENG, *Gard. Bull. Sing.* 24 (1969) 96; HENTY & PRITCHARD, *Bot. Bull. Lac* 7 (1975) 104, fig. — *Nepeta pectinata* LINNÉ, *Syst. Nat.* ed. 10 (1759) 1097. — *Mesosphaerium pectinatum* (L.) O. K. *Rev. Gen. Pl.* 2 (1891) 525.

Erect, perennial, aromatic herb, often shrubby, 0.5–2.5 m. Stem and branches glabrous or pubescent. Leaves herbaceous, ovate or elliptic, 2–3 by 1–1.5 cm, acute or acuminate, base rounded or truncate, entire; margin elsewhere serrate or more often crenate, glabrous or glabrescent above, sparsely or densely tomentose and glaucous beneath; petiole 0.5–1 cm. *Spurious racemes* 4–8(–15) cm long, consisting of 10 to many secund cymes, densely congested toward apex, generally forming large, terminal panicles; cymes 6–15-flowered, subcapitate, secund, pectinate, incurved. Bracts crinite and setaceous. *Calyx* tubular, 2–2.5 mm long, in fruit 3–4 mm, tomentose; teeth subulate, setaceous, slightly longer than the calyx-tube. *Corolla* violet or pale mauve fading to cream, 3–3.5 mm long. *Nutlets* small, oblong, 1.5–2 mm long, smooth, black; pericarp slightly swelling when soaked in water.

Distr. Native of the American tropics, introduced and naturalized in many other parts of the world, in *Malesia*: West Java (area between Bandung and Djakarta), New Guinea (Morobe Distr.). Also in Burma, New Caledonia, and the Marianas.

F.-VILLAR recorded this species from the Philippines, but MERRILL doubted this disposition and indeed hitherto no collections are known from there.

In 1888 already BOERLAGE collected it at Bogor in the Botanic Gardens and this was probably the source for the West Javanese establishment.

Ecol. Waste places, sunny localities, borders of watercourses, scattered but locally gregarious, from sea-level to c. 700 m. *Fl.* April–Dec.

5. *Hyptis suaveolens* (L.) POIT. *Ann. Mus. Hist. Nat. Paris* 7 (1806) 472, t. 29, f. 2; BTH. *Lab. Gen.*

Sp. (1833) 124; HASSK. Cat. Hort. Bog. (1844) 130; BTH. in DC. Prod. 12 (1848) 126; TEYSM. Nat. Tijds. N. I. 11 (1856) 193; MIQ. Fl. Ind. Bat. 2 (1858) 959; F.-VILL. Nov. App. (1880) 164; VIDAL, Phan. Cuming. Philip. (1885) 136; Hook. f. Fl. Br. Ind. 4 (1885) 630; VIDAL, Rev. Pl. Vasc. Filip. (1886) 213; K.SCH. & LAUT. Nachtr. Fl. Schutzgeb. (1905) 372; PRAIN, J. As. Soc. Beng. 74, ii (1907) 705; KOORD. Exk. Fl. Java 3 (1912) 153; MERR. Fl. Manila (1912) 409; Sp. Blanc. (1918) 338; En. Philip. 3 (1923) 417; RIDL. Fl. Mal. Pen. 2 (1923) 645; DAMMERMAN, Nat. Tijds. N. I. 86 (1926) 44, 75; BARTLETT, Pap. Mich. Ac. Sc. 6 (1926) 59; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 147; BACK. Onkr. Suiker. (1931) 567, Atlas (1973) t. 539; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 63; EPLING, Rev. Mus. La Plata n.s. 7, Bot. (1949) 261; HEND. Mal. Nat. J. 6 (1950) 391, f. 361; QUIS. Medic. Pl. Philip. (1951) 817; BACK. & BAKH. f. Fl. Java 2 (1965) 634; HATUS. Mem. Fac. Agr. Kagoshima Un. 5 (1966) 48; KENG, Gard. Bull. Sing. 24 (1969) 96; HENTY & PRITCHARD, Bot. Bull. Lae 7 (1975) 106, fig. — *Ballota suaveolens* LINNÉ, Syst. Nat. ed. 10 (1759) 1100. — *H. ebracteata* R.BR. in W. T. Aiton, Hort. Kew. ed. 2, 3 (1811) 391; BTH. Linnaea 6 (1831) 82. — *Marrubium indicum* (non BURM. f.) THUNB. Fl. Jav. (1825) 15, 21; BLANCO, Fl. Filip. (1837) 477; ed. 2 (1845) 352; ed. 3, 2 (1878) 250. — *Bysteropogon graveolens* (non L'HÉRIT.) BL. Bijdr. (1826) 824. — *Schaueria graveolens* HASSK. Flora 25 (1842) II, Beibl. 25. — *Mesosphaerum suaveolens* (L.) O. K. Rev. Gen. Pl. 2 (1891) 525.

A strongly aromatic, almost fetid, much-branched herb, 0.5–2 m high. Stem hirsute, 4-angled. Leaves firmly herbaceous, ovate to broadly obovate, 3–5 by 2–4 cm, subacute, base rounded, truncate, often slightly oblique; margin irregularly serrulate; sparsely pilose above, densely pubescent beneath; petiole slender, 0.5–3 cm, sparsely pubescent. Flowers in lax, 2–5-flowered second cymes, arranged racemously towards the ends of branches in the axils of smaller leaves. Peduncles pubescent, 0.5–1 cm long. Bracts minute, setaceous. Calyx campanulate, 5–5.5 mm long, in fruit 8–10 mm, strongly ribbed; mouth villous; teeth erect, setaceous. Corolla blue or bluish violet; tube slender. Anthers purple. Nutlets narrowly oblong, 1.2–1.5 mm long, often emarginate at the top, faintly rugose, dark brown; pericarp swelling to a gelatinous mass when soaked in water.

Distr. Native of tropical America, naturalized in all tropical countries and throughout Malesia, though rare in forest-clad islands (e.g. Borneo). Also in New Ireland, Marianas, Carolines, etc.

Ecol. Usually in dry open localities, along streams, roadsides, in dunes, fallow agriculture fields, lalang wastes, in all waste places, along the sea-shore, coconut plantations, tobacco and rubber estates, clearings, garden regrowths, raised coral limestone, teak- and Eucalypt savannahs, even on kērangas in Brunei, often gregarious and forming dense stands, under both everwet and seasonal conditions, from sea-level to c. 1300 m. Fl. Jan.–Dec.

In the dry season shedding its leaves, as does *Lantana*.

Vern. Bush tea-bush, E.; Malaya: lērkuing,

malbar hutan, pohok kēmangi, p. p. hutan, ruku-ruku, sēlasēh hutan, sēpulut, M; Sumatra: dērēng-dērēng, sēlasie, M; Java: babadotan, djukut bau, karang bau, sumengit, S. bandotan, basinan, bērokan, lampēsān, sangkētān, sēlangking, susurawungan, tobil, J. komandhin, mang kamang, srēngēngē, Md, ruku ruku hutan, sēlasi hutan, M; Timor: jagalētte, kunfa matē, kumu busuk, k. sui; Alor: kawada; Flores: kasi kamba; Sumba: khalawau; Philippines: kabling kabāyo, pansipansian, suag-kabāyo, suob k., Tang., saneeg, Cebu, bailing, Sul., amotan, kolongkōgong, Bik., loko-loko, Bis., pilodo, P.Bis., bangbangsit, litalit, Ilk.; Ambon: solasi bankit; New Guinea: samsir, Wapi lang, Pultalul.

The names derived from *sēlasi* refer to the likelihood of the nuts with those of *Ocimum* which swell to a gelatinous mass when soaked in water.

Uses. In Java it is considered a medicinal plant (HEYNE, Nutt. Pl. 1927, 1333). It is sometimes used as forage for cattle. It is also said to promote lactation in women.

In Peninsular Thailand the very tips of the shoots are sometimes added to food as a flavouring. Medicinally, it is a stimulant, sudorific and useful against catarrh in Malaya. Malays use it for poulticing skin complaints (BURK. Dict. 1935, 1220).

In the Philippines the fetid-aromatic leaves are put under beds, chairs, etc. to drive out bedbugs (QUIS. Medic. Pl. Philip. 1951, 818). The crushed leaves are used as an antiseptic for wounds and skin-diseases (SANTOS & VALENZUELA, J. Philip. Pharm. Ass. 1, 1928, 86). The leaves are further used for the preparation of antirheumatic and antispasmodic baths. Also the roots find application, e.g. as an appetizer, for affection of the uterus, etc. (cf. SANTOS, VALENZUELA & GUERRERO, Philip. Bur. For. Bull. 22, 1921, 233).

HARTLEY (Lloydia 32, 1969, 265) listed this species as a potential medicine against cancer.

#### Excluded

*Hyptis atrorubens* POIT.: WALP. Nov. Act. Acad. Nat. Cur. 19 (1943) Suppl. 1, p. 373; MERR. En. Philip. 3 (1923) 417.

The record of the presence of this American species in Manila is based on a specimen collected by MEYEN. MERRILL (*l.c.*) thinks this may be an erroneous identification.

*Hyptis mutabilis* (A. RICH.) BRIQ.; MERR. & PERRY, J. Arn. Arb. 27 (1946) 325.

Recorded from a collection of Guam; MERRILL & PERRY noted: "Like the four other species of *Hyptis* naturalized in the Old World, this is a native of tropical America. Its introduction into Guam undoubtedly was through the medium of the Acapulco–Manila galleons previous to 1815." So far, however, it has not been recorded from the Philippines or elsewhere in Malesia.

*Hyptis radiata* WILLD.

Recorded as from Java by O. KUNTZE (Rev. Gen. Pl. 2, 1891, 525) under the name *Mesosphaerum radiatum* O. K. Possibly due to an erroneous identification.

*Hyptis spicata* POIT.; BTH. Linnaea 6 (1831) 82; in DC. Prod. 12 (1848) 121; F.-VILL. Nov. App. (1880) 164; MERR. En. Philip. 3 (1923) 417.

According to MERRILL, there was no evidence that the species exists in the Philippines.

## 27. MESONA

BLUME, Bijdr. (1826) 838; BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1897) 365; KENG, Gard. Bull. Sing. 24 (1969) 113. — Fig. 28.

Annual herbs. Stems erect or procumbent, pubescent. *Verticillasters* many-flowered, forming axillary and terminal, racemose inflorescences. Bracts often caducous. *Flowers* small. *Calyx* campanulate (in fruit tubular, declinate, lower part of the fruiting calyx tube deeply pitted between the nerves and the connecting transverse bars), 8-nerved, 2-lipped, upper lip 3-fid, lower entire. *Corolla* short; throat inflated, abruptly constricted towards the base; limb 2-lipped, upper lip truncate or 3-lobed with the median lobe very broad, lower lip oblong, concave. *Stamens* 4, in 2 pairs; anther-cells confluent; filaments long-exserted, those of the posterior pair appendaged at the base. Style briefly 2-fid. Disk gibbous, produced in front. *Nutlets* ellipsoid or ovoid, minute, smooth.

Distr. About 2-3 *spp.* in continental SE. Asia (India, Himalayas, Burma, Thailand, Indo-China, S. China), Formosa, and *Malesia*: 1 *sp.*

1. *Mesona palustris* Bl. Bijdr. (1826) 839; BTH. in DC. Prod. 12 (1848) 46; MIQ. Fl. Ind. Bat. 2 (1858) 940, incl. *var. petiolata* MIQ.; KOORD. Exk. Fl. Java 3 (1912) 157; BACK. & BAKH. f. Fl. Java 2 (1965) 638; KENG, Gard. Bull. Sing. 24 (1969) 114, f. 20 a-f; STEEN. Mt. Fl. Java (1972) pl. 25-3. — *Geniosporum parviflorum* WALL. (Cat. 1831, n. 2750, *nomen*) ex BTH. in Wall. Pl. As. Rar. 2 (1830-31) 18; Lab. Gen. Sp. (1832) 20. — *M. wallichiana* BTH. in DC. Prod. 12 (1848) 46; HOOK. f. Fl. Br. Ind. 4 (1885) 610; BOERL. Handl. Fl. N. I. 2 (1899) 713. — *M. parviflorum* (WALL. ex BTH.) BRIQ. in E. & P. Nat. Pfl. Fam. 4, 3a (1897) 365; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 28. — *M. philippinensis* MERR. Philip. J. Sc. 7 (1912) Bot. 101; En. Philip. 3 (1923) 420; KENG, Gard. Bull. Sing. 24 (1969) 116, f. 20 g. — Fig. 28.

Erect, aromatic herb, 30-50 cm. Stem slender, not or only sparsely branched at apex, pubescent or densely villous, glabrescent. *Leaves* membranaceous or chartaceous, oblong-elliptic or narrowly obovate-elliptic, 2-8 by 1.2-3.5 cm, acute or obtuse, crenate or serrulate, base narrowly acute or rounded; petiole 0.5-2 cm, hispid or villous. *Verticillasters* close or distant, many- (usually 12-20 or more)-flowered; inflorescence 5-20 cm; rachis villous or hirsute. Bracts lanceolate to ovate, 7-10 mm, acuminate, caducous. Pedicels 5-6 mm. *Calyx* 2-2.5(-3) mm long, covered with white

hairs; upper lip 3-lobed, ciliate, lower lip oblong, rounded, often thin and transparent; in fruit tubular-urceolate, 4-5 mm long. *Corolla* pink or lilac white, 4-5 mm long. *Nutlets* ellipsoid, flattened, c. 1 by 0.4-0.7 mm, finely granular.

Distr. India & Burma to Indo-China, in *Malesia*: Central Sumatra (Mt Singalang), throughout Java, Lesser Sunda Is. (Bali, Lombok, Sumbawa), Celebes, Philippines (northern half of Luzon), and East New Guinea (Wau, once).

Ecol. Roadsides, along ditches, open grassy slopes, forest borders, dry rice-fields, in New Guinea on a grassy ridge with *Banksia*, *Grevillea* and *Vaccinium*, not a marsh plant, standing both everwet and seasonal conditions, locally sometimes rather common, 75-2300 m. Fl. March-Nov.

Vern. *Djangelan*, S.

Uses. In Central Java used for the preparation of a somewhat harsh, slimy cool drink. In West Java to blacken a favourite kind of titbit, called *tjintjau hitam*.

Notes. A variable species. The Philippine material has congested flowers, a less inflated fruiting calyx tube with less conspicuous cross-bars and pits. It matches some specimens from Java and there are intermediate forms in Celebes and the Lesser Sunda Is.

The Taiwan *M. procumbens* HEMSL. is possibly conspecific.



Fig. 28. *Mesona palustris* BL. a. Habit,  $\times \frac{2}{3}$ , b. flower, c. fruiting calyx, both  $\times 8$ , d. nutlet,  $\times 12$  (a-b B. J. KARSTEN 47, c-d COERT 1027).



Fig. 29. *Nosema cochinchinense* (LOUR.) MERR. a. Habit,  $\times \frac{2}{3}$ , b. flower, c. calyx, both  $\times 6$ . — *N. clausum* (MERR.) KENG. d. Flower,  $\times 6$  (a-c HORNER 8, d BS 41313).

## 28. NOSEMA

PRAIN, J. As. Soc. Beng. 73, ii (1904) 20; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 108; KENG, Gard. Bull. Sing. 24 (1969) 122. — Fig. 29.

Erect herbs, branched or not. Stem and branches slender, pubescent. *Leaves* opposite, petioled. *Verticillasters*  $\infty$ -flowered, forming terminal, cylindrical, racemose inflorescences, continuous or interrupted below. *Flowers* small. Bracts leafy below, gradually diminishing in size upwards. *Calyx* obliquely ovoid, 10-nerved, 2-lipped, the upper lip oblong, entire or very shallowly 3-lobed, the lower lip round, entire, much shorter than the upper lip; fruiting calyx tube flattened cylindrical, transverse veins connecting the longitudinal nerves, inconspicuous, not deeply pitted. *Corolla* short; throat inflated, abruptly constricted towards the base; limb 2-lipped, the upper lip slightly shorter, unequally 3-lobed, the median lobe often very broad; lower lip oblong, entire, concave. *Stamens* 4, in two pairs, declinate; anther-cells confluent; filaments pubescent, those of the upper pair spurred with an appendage at the base. *Nutlets* ovoid, minute, smooth.

Distr. Six or more *spp.* in continental Asia (India, Burma, Thailand, Indo-China, S. China: Kwantung, Fokien, Hainan); in *Malesia*: 2 *spp.*, one in N. Sumatra and one in the Philippines.

## KEY TO THE SPECIES

1. Inflorescence 12–15 cm long, verticillasters generally 0.5–1.5 cm apart. Upper corolla lip very unequally 3-lobed, the midlobe much broader than the lateral ones. Fruiting calyx thick-coriaceous, pitcher-shaped, inflated in the middle, 6.5–7 mm long . . . . . 1. *N. clausum*
1. Inflorescence 6–8 cm long, verticillasters  $\pm$  continuous. Upper corolla lip equally 3-lobed. Fruiting calyx herbaceous, tubular, not or only slightly inflated in the middle, 8–8.5 mm long . . . . . 2. *N. cochinchinense*

1. *Nosema clausum* (MERR.) H. KENG, Gard. Bull. Sing. 24 (1969) 123, f. 23 a–e. — *Mesona clausa* MERR. Philip. J. Sc. 7 (1912) Bot. 345; En. Philip. 3 (1923) 420. — Fig. 29d.

Erect, unbranched herb, 20–30 cm. Stem densely villous. *Leaves* chartaceous, oblong or narrowly oblong, 4.5–6 by 1–2 cm, acute or obtuse, base acute, velvety on both surfaces, lateral nerves 7–8 pairs; petiole 0.5–1.5 cm, velvety. *Spurious spike* terminal, 12–15 cm long, interrupted; verticillasters 12–20-flowered, c. 1.5 cm  $\varnothing$ , 2–2.5 cm apart. Bracts 2 subtending each whorl, ovate, acuminate, 0.5–1.5 cm long, densely villous, the lowermost ones almost foliaceous. *Calyx* obliquely campanulate, 2.5–3 mm long, densely hairy, the upper lip lanceolate-oblong, obscurely 3-lobed; lower lip truncate-rounded; fruiting calyx thick-coriaceous, pitcher-shaped, 7–8 mm long, slightly inflated in the middle, the mouth nearly closed by the lid-like lower lip. *Corolla* violet, trumpet-shaped, 3.5–4 mm long, inflated from middle upwards and abruptly narrowed into a small lower tube; upper lip shortly 3-lobed, central lobe much larger than the two lateral ones; lower lip entire, concave. *Stamens* in 2 pairs, the upper pair pubescent and appendaged at the base. *Nutlets* ellipsoid, 1 mm long, smooth.

Distr. *Malesia*: Philippines (Culion), 2 collections.

Ecol. Open, damp places at low altitude. *Fl.* Oct., Dec.

2. *Nosema cochinchinense* (LOUR.) MERR. Trans. Am. Phil. Soc. n.s. 24 (1935) 343; WU, Acta Phytotax. Sin. 8 (1959) 62; KENG, Gard. Bull. Sing. 24 (1969) 125, f. 23 f–h. — *Dracocephalum cochinchinense* LOUR. Fl. Coch. (1790) 371; ed. Willd. (1793) 450. — *Mesona prunelloides* HEMSL. J. Linn. Soc. Bot. 26 (1890) 267. — *N. prunelloides* (HEMSL.) C. B. CLARKE ex PRAIN, J. As. Soc. Beng. 73, ii (1904) 21; DUNN, Not. R. Bot. Gard. Edinb. 6 (1915) 134. — *N. capitatum* PRAIN var. *javanica* C. B. CLARKE ex PRAIN, J. As. Soc. Beng. 73, ii (1904) 21, in *adnot.* — *Mesona capitata* (PRAIN) DOAN, Fl. Gén. I.-C. 6 (1936) 932. — Fig. 29a–c.

Erect herb, 30–50 cm, sparingly branched. Stem obscurely angled, densely villous. *Leaves* chartaceous, oblong or narrowly oblong, 4–6 by 1–1.5 cm, both ends acute or obtuse, margin crenulate, sparsely villous on both surfaces; petiole 0.5–1(–2) cm. *Inflorescence* terminal, 6–8 cm long; verticillasters almost continuous. Bracts subtending the lowermost whorls similar to the normal leaves but smaller, densely villous. *Calyx* obliquely campanulate, 2.5–3 mm long, densely hairy; upper lip shallowly 3-lobed; lower lip much shorter than the upper one, emarginate or notched in the middle, densely covered with long hairs outside; fruiting calyx herbaceous, tubular, 8–8.5 mm long. *Corolla* purple, mauve, blue or white, campanulate, 3–4 mm long; upper lip shortly 3-lobed, the lobes more or less equal in size; lower lip oblong, entire,

concave. *Stamens* in 2 pairs, the upper pair puberulent and appendaged at the base. *Nutlets* minute, c. 1 mm long, smooth.

Distr. Continental SE. Asia (Thailand, Indo-China to S. China: Kwantung, Hainan), in *Malesia*: N. Sumatra (Batak-Toba Lands and Padang Lawas).

Ecol. Open places, rocky habitats, grassy savannahs, open mossy ground, 100–1000 m. *Fl.* Jan.–Dec.

Note. The JUNGHUHN specimens cited in the precursor from Java, were actually collected in the Batak Lands, N. Sumatra; they were described by PRAIN as *N. capitatum* var. *javanica*.

## 29. OCIMUM

LINNÉ, *Gen. Pl.* ed. 5 (1754) 259; *Sp. Pl.* (1753) 833; BTH. *Lab. Gen. Sp.* (1832) 1 ('*Ocymum*'); in B. & H. *Gen. Pl.* 2 (1876) 1171; BRIQ. in E. & P. *Nat. Pfl. Fam.* 4, 3a (1897) 369; FURTADO, *Gard. Bull. S. S.* 4 (1929) 416; KENG, *Gard. Bull. Sing.* 24 (1969) 125. — **Fig. 30.**

Strongly scented aromatic herbs or undershrubs. Stems often much-branched. *Leaves* opposite, petioled. *Flowers* small; verticillasters 6–10-flowered, forming racemose, simple or branched inflorescences. Pedicels recurved under the calyx. Bracts minute, caducous. *Calyx* ovoid or campanulate (in fruit deflexed), 10-nerved, 2-lipped; upper lip large, broad, flat (in fruit strongly reflexed), often decurrent on the tube; lower lip usually with 4 narrow, pointed teeth. *Corolla* campanulate, not annulate within, 2-lipped; upper lip truncate, subequally 4-fid; lower lip longer, declinate, flat, entire. *Stamens* 4, declinate, in 2 pairs, exerted; filaments free (in Mal.) or the lower pair connate below, naked or the upper pair toothed or hairy below; anther-cells confluent. Disk entire or 2–4-lobed, equal-sided. Style 2-fid; branches subulate or flattened. *Nutlets* smooth or subrugose, in some species the pericarp swelling and becoming mucilaginous when moistened.

Distr. About 100–150 spp., throughout the tropics, and *Malesia*, mostly developed in Africa.

### KEY TO THE SPECIES

1. Two lower calyx teeth much shorter than the upper tooth; mouth of the fruiting calyx closed by the upcurved lower lip . . . . . **3. *O. gratissimum***
1. Two lower calyx teeth equalling or slightly longer than the upper tooth, the lower lip not upcurved, the mouth of the fruiting calyx remaining open.
  2. Pedicels as long as the calyx, finally curved patent, almost transverse to the rachis . . . . . **4. *O. tenuiflorum***
  2. Pedicel shorter (or seemingly shorter) than the calyx, finally bent upright, appressed against the rachis.
    3. Corolla 7–9 mm long, white or violet. Fruiting calyx 5–9 mm long . . . . . **2. *O. basilicum***
    3. Corolla 5–6 mm long, white. Fruiting calyx 4–6 mm long . . . . . **1. *O. americanum***

**1. *Ocimum americanum*** LINNÉ, *Cent. Pl.* 1 (1755) 15; AMOEN. *Ac.* 4 (1759) 276 ('*Ocymum*'); BACK. & BAKH. *f. Fl. Java* 2 (1965) 640; KENG, *Gard. Bull. Sing.* 24 (1969) 126. — *O. africanum* LOUR. *Fl. Coch.* (1790) 370; MERR. *Trans. Am. Phil. Soc.* 24, 2 (1935) 343. — *O. canum* SIMS, *Bot. Mag.* 51 (1823) t. 2452; BTH. *Lab. Gen. Sp.* (1832) 3, (1835) 707; MOR. *Syst. Verz.* (1846) 55; BTH. in DC. *Prod.* 12 (1848) 32; MIQ. *Fl. Ind. Bat.* 2 (1858) 936; HOOK. *f. Fl. Br. Ind.* 4 (1885) 607; K.SCH. & HOLLR. *Fl. Kais. Wilh. Land* (1889) 118; K.SCH. & LAUT. *Fl. Schutzgeb.* (1900) 530; KOORD. *Exk. Fl. Java* 3 (1912) 158; RIDL. *Fl. Mal. Pen.* 2 (1923) 644; KUDO, *Mem. Fac. Sc. & Agr. Taihoku Un.* 2, 2 (1929) 113; MANSFELD, *Bot. Jahrb.* 62 (1929) 380; BACK. *Onkr. Suiker.* (1931) 573, *Atlas* (1973) t. 544; OCHSE & BAKH. *Ind. Groent.* (1931) 355,

*f.* 225; BURK. *Dict.* (1935) 1574; MUKERJEE, *Rec. Bot. Surv. India* 14 (1940) 17. — *O. brachiatum* BL. *Bijdr.* (1826) 833; HASSK. *Cat. Hort. Bog.* (1844) 128; *Pl. Jav. Rar.* (1848) 477.

Branched, erect herb, 0.30–1 m, strongly smelling of camphor. Stem and branches striate, pubescent or glabrescent. *Leaves* lanceolate to elliptic, 2.5–5 by 0.9–2.5 cm, acute, base cuneate, margin entire or remotely crenulate, glabrous and glandular-dotted on both surfaces; petiole 1–2.5 cm. *Verticillasters* in terminal, simple or branched, raceme-like inflorescences, 7–15 cm long. Bracts elliptic-lanceolate, 2–3(–5) mm long, acuminate, hairy. *Flowers* subsessile. *Calyx* 2–2.5 mm long, in fruit 3–4.5 mm, villous within, pubescent with long, white hairs outside; uppermost tooth broad and rounded, ciliate; lower teeth lanceolate-subu-

late. *Corolla* white, 4–6 mm long, glabrescent or puberulous. *Filaments* exerted, slender, upper ones toothed above the base. *Nutlets* narrowly ellipsoid, 1.2 mm long, punctate, black, swelling in water.

Distr. Tropical Africa and continental SE. Asia; in *Malesia*: Sumatra, Malaya, West Java, Lesser Sunda Is. (Lombok), E. New Guinea.

Ecol. In Java cultivated in kitchen gardens, widely naturalized, along roadsides, in fields and humas, also in teak forest, open waste places in settled areas, up to c. 500 m. *Fl.* Jan.–Dec. Galls on young stems are caused by aphids.

Vern. Malaya: *kēmangi*, *pohok*, *roko roko*, M; Java: *kēmangi*, M, J, *surawung*, S, *kēmangèh*, *kēmangi*, Md; *hairy basil*, E.

Uses. Eaten raw as a side-dish, also an important ingredient for curries and sayur. Nutlets taken with cool sweet drinks under the names of *tjao*, M, *tjingtjao*, S, *dawet*, J. Leaves are also used in flavouring dishes with a fishy or disagreeable smell.

HARTLEY (Lloydia 32, 1969, 272) listed this species as a potential medicine against cancer. BURKILL (Dict. 1935, 1574) stated that pounded leaves are in Malaya placed on the forehead against catarrh and that a decoction is used for coughs.

Notes. According to BACKER possibly a small-flowered form of *O. basilicum*.

In Ali I. (W. Sepik) specimens have been collected of a 3 ft tall plant with very small and narrow leaves (c. 15 by 2.3 mm), in regrowth of an old German plantation (NGF 40930).

2. *Ocimum basilicum* LINNÉ, Sp. Pl. (1753) 833; BURM. f. *Fl. Ind.* (1768) 129; BL. Cat. (1823) 83; Bijdr. (1826) 832 ('*Ocymum*', also incl. var.  $\beta$ ); BTH. Lab. Gen. Sp. (1832) 4; in DC. Prod. 12 (1848) 32, incl. var. *glabratum* et var. *pilosum*; MIQ. *Fl. Ind. Bat.* 2 (1858) 937, incl. varieties; HOOK. f. *Fl. Br. Ind.* 4 (1885) 608; PRAIN, J. As. Soc. Beng. 74, ii (1907) 702; MERR. Philip. J. Sc. 3 (1908) Bot. 433; KOORD. Exk. Fl. Java 3 (1912) 158; MERR. Fl. Manila (1912) 407; Int. Rumph. (1917) 460; Sp. Blanc. (1918) 340; En. Philip. 3 (1923) 421; RIDL. Fl. Mal. Pen. 2 (1923) 634; BARTLETT, Pap. Mich. Ac. Sc. 6 (1926) 35; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 113; BACK. Onkr. Suiker. (1931) 573; BURK. Dict. (1935) 1571; HEND. Mal. Nat. J. 6 (1950) 395, f. 365; QUIS. Medic. Pl. Philip. (1951) 824; WEHRHAHN in Pareys, Blumengärten (ed. Bonstedt) 2 (1952) 312; CHALFIN, Gard. J. (1962) 87; BACK. & BAKH. f. *Fl. Java* 2 (1965) 639; PURSEGLOVE, Trop. Crops, Dicot. 2 (1968) 636; KENG, Gard. Bull. Sing. 24 (1969) 127. — *O. americanum* (non L.) BLANCO, Fl. Filip. (1837) 480; ed. 2 (1845) 335; ed. 3, 2 (1878) 254, t. 407. — *O. citriodorum* BLANCO, *ibid.* ed. 2 (1845) 591; ed. 3, 2 (1878) 256.

Very aromatic, lemon-scented, erect, branched herb, 0.5–1 m. Stem and branches glabrous or hispidly hairy when young. *Leaves* membranaceous, ovate or elliptic-ovate, 3–5 by 1.2–2 cm, acute, base cuneate, entire, margin elsewhere entire or few-toothed, glabrescent or hairy; petiole 1–2 cm. *Verticillasters*  $\infty$ -flowered, in simple or branched racemes 10–15 (or more) cm long. Bracts lanceolate-ovate, 2–3 mm long. Pedicels very short. *Calyx* 2–3 mm long, in fruit 5–9 mm; upper lip suborbicular; lower lip with central pair of teeth

longer than the upper lip, sharply pointed. *Corolla* white, pinkish, or violet, 7–9 mm long, glabrous or hispid. *Filaments* exerted; upper ones with a tooth above the base. *Nutlets* dark brown, ellipsoid, 1.5 mm long, pitted, swelling in water.

Distr. Throughout the Old World tropics and throughout *Malesia*.

Ecol. Settled areas and open waste places, roadsides, teak forests, dry paddies, up to c. 450 m, in New Guinea once found at 1150 m. *Fl.* Jan.–Dec. Galls on young stems caused by aphids or coccids.

Vern. *Basil*, *sweet basil*, E.; Malaya: *kēmangi*, *puar*, *ruku*, *sēlasi antan*, s. *hitam*, s. *puteh*, M; Sumatra: *hulasi*, *kulasa koling*, *leam*, *rudang nalopak*, *rudañgna*, r. *birong*, r. *lopak*, *sēlang bano*, *sulasih*, *theulaleh*, M; Java: *kēmangi*, *salasih*, *solasi*, s. *bodas*, s. *hideung*, *surawung*, *tēlasi bodas*, S, *kēmangi*, *lampas*, *sēlasih*, s. *ireng*, *tēlasih*, t. *ireng*, *tulasih*, J, *sēlasē*, *sēlasi*, s. *dulang*, s. *hitam*, s. *putih*, M, *salasē*, Md; Lesser Sunda Is.: *slasih*, s. *tjēmēng*, *sulakèt*, *sulasih*, Bali, *afi*, Timor, 'ndakēbuu, Roti, *woonènè*, Let'; Celebes: *amping*, *bañla*, *kukuru*, *kulasi*, *lasi*, *solasi*, *sulasi*, *tolasi*, t. *djating*; Ambon: *sulasi kubus*; Philippines: *balanoi*, Tag., *albahaca*, Tag., Ibn., *solási*, Tag., Pamp., *bauing*, *ruku ruku*, Sul., *bidai*, Ilk., *bouak*, Bis., *kalu-ui*, C. Bis., *kamañgi*, P. Bis., *samarig*, *samilig*, Bik., *valanoi*, Iv.

Uses. Widely used as a condiment. As of *O. americanum* the nutlets, which swell and become gelatinous in water, are added to cool sweet drinks. They are said to have stimulant, diuretic and demulcent properties. They are also used as an aphrodisiac, for gonorrhoea, diarrhoea, dysentery and constipation. They are especially prescribed in eye sores. Flowers are said to be a remedy for coughs of children.

Leaves are used in a decoction as a carminative and stimulant and as a remedy for coughs, in washing ulcers, and for hiccups. Roots are used for bowel complaints of children and as a febrifuge.

Flowers of the purple-flowered variety are sometimes deposited on tomb-stones and in offerings. A sacred plant in Hindu religion (*tulsi*), no doubt derived from its manyfold use.

Oils of *selasih* are used in perfumes; in Java the variety with citrus-scent is estimated (HEYNE, Nutt. Pl. 1927, 1336). There is also a form with a fennel scent.

Notes. Recently MORTON (J. Linn. Soc. Bot. 58, 1962, 232) pointed out that *O. basilicum* differs but little from *O. americanum* (= *O. canum*) except in size, though the latter is more hairy. These differences are obviously also expressed in chromosome numbers, W. African material of *O. americanum* having  $2n = 24$  and *O. basilicum*  $2n = 48$ .

H. MARZELL wrote an extensive history of basil (Regn. Veget. ed. 71, 1970, 135–143.)

3. *Ocimum gratissimum* LINNÉ, Sp. Pl. (1753) 832; BL. Bijdr. (1826) 832 ('*Ocymum*'); BTH. in DC. Prod. 12 (1848) 34; MIQ. Fl. Ind. Bat. 2 (1858) 938; HOOK. f. Fl. Br. Ind. 4 (1885) 608; PRAIN, J. As. Soc. Beng. 74, ii (1907) 702; RIDL. Fl. Mal. Pen. 2 (1923) 644; KOORD. Exk. Fl. Java 3 (1923) 158; BACK. Onkr. Suiker. (1931) 575, Atlas (1973) t. 546; BURK. Dict. (1935) 1574; CHEVALIER, Rev. Bot. Appl. Agr. Col. 18 (1938) 478; BACK. & BAKH. f.

Fl. Java 2 (1965) 639; KENG, Gard. Bull. Sing. 24 (1969) 128.

Perennial herb, 1–3 m high, woody at the base. Stem and branches glabrous, pubescent when young. *Leaves* membranaceous, elliptic-lanceolate, 5–10 by 2.5–4.5 cm, acute, base cuneate, entire; margin elsewhere coarsely crenate-serrate, puberulent or pubescent; petiole 2–4.5 cm, slender, pubescent. *Verticillasters* in simple or branched racemes 10–15 cm long, rachis softly pubescent. Bracts sessile, ovate, acuminate. Pedicels very short. *Calyx* 1.5–2 mm long, in fruit 3–4 mm; upper lip rounded and recurved; lower lip with central pair of teeth minute and much shorter than the upper lip. *Corolla* greenish white, 3.5–4 mm long, pubescent outside. *Filaments* distinctly exserted; upper pair with a bearded tooth at the base. *Nutlets* subglobose, 1.5 mm long, rugose; outer pericarp not slimy-swollen in water.

Distr. Pantropical; in *Malesia*: Sumatra (also Banka), Malaya, West Java, and New Britain.

Ecol. Open waste places along roadsides, etc. in settled areas at low altitude up to *c.* 300 m. *Fl.* Jan.–Dec. Rather rare.

Vern. *Kēmangi hutan, ruku ruku rimba, sēlasi bēsar, s. djambi, s. mēka(h), M*; Sumatra: *sēlasi djambi, s. tjina* (Banka).

Uses. Also cultivated as a hedge-plant, and found in native cemeteries. Leaves when bruised strongly smelling of cloves (*f. caryophyllatum*) or of thyme (*f. graveolens*). According to HEYNE (Nutt. Pl. 1927, 1337) hardly of economic importance; an infusion of the leaves is used as a kind of tea in S. Sumatra. Also applied to ritual washing of corpses.

4. *Ocimum tenuiflorum* LINNÉ, Sp. Pl. (1753) 597; in Stickm. Herb. Amb. (1754) 130; Amoën. Ac. 4 (1759) 130; Syst. Nat. ed. 10 (1759) 1105; BTH. Lab. Gen. Sp. (1832) 11; in DC. Prod. 12 (1848) 39; MERR. Int. Rumph. (1917) 461; DOMIN, Bibl. Bot. 22 (Heft 89) (1929) 1116, *incl. var. anisodorum* (F.v.M.) DOMIN. — *O. sanctum* LINNÉ, Mant. 1 (1767) 85; BL. Cat. (1823) 83; THUNB. Fl. Jav. (1825) 15; BTH. Lab. Gen. Sp. (1832) 11; in DC. Prod. 12 (1848) 38; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 397 (= Herb. Timor. descr. 1835, 69); BLANCO, Fl. Filip. (1837) 480; ed. 2 (1845) 334; ed. 3, 2 (1878) 254, t. 257; HASSK. Cat. Hort. Bog. (1844) 128; MIQ. Fl. Ind. Bat. 2 (1858) 939; Sumatra (1860) 571; F.-VILL. Nov. App. (1880) 162; VIDAL, Phan. Cuming. Philip. (1885) 135; HOOK. f. Fl. Br. Ind. 4 (1885) 609; VIDAL, Rev. Pl. Vasc. Filip. (1886) 212; K.SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 118; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 532; PRAIN, J. As. Soc. Beng. 74, ii (1907) 701, *incl. var. ciliata* PRAIN *et var. thyrsoides* PRAIN; MERR. Fl. Manila (1912) 408; Int. Rumph. (1917) 460; Sp. Blanc. (1918) 340; En. Philip. 3 (1923) 422; RIDL. Fl. Mal. Pen. 2 (1923) 643; BARTLETT, Pap. Mich. Ac. Sc. 6 (1926) 35; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 114; BACK. Onkr. Suiker. (1931) 574, Atlas (1973) t. 545; MERR. Contr. Arn. Arb. 8 (1934) 149; BURK. Dict. (1935) 1575; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 19; QUIS. Medic. Pl. Philip. (1951) 827; BACK. & BAKH. f. Fl. Java 2 (1965) 639; KENG, Gard. Bull. Sing. 24 (1969) 130. — *O. monachorum* LINNÉ, Mant. 1 (1767) 85; BL.



Fig. 30. *Ocimum tenuiflorum* L. a. Habit,  $\times 2/3$ , b. flower, c. fruiting calyx, both  $\times 4$  (BAKHUIZEN VAN DEN BRINK 8153).

Cat. (1823) 83; Bijdr. (1826) 831. — *O. album* (non L.) BLANCO, Fl. Filip. (1837) 479. — *O. flexuosum* BLANCO, Fl. Filip. (1837) 481; ed. 2 (1845) 335; ed. 3, 2 (1878) 255; MIQ. Fl. Ind. Bat. 2 (1858) 939. — *Moschosma tenuiflorum* (L.) HEYNE. Nomencl. 1 (1840) 532. — *O. nelsonii* ZIPP. ex SPANOGHE, Linnaea 15 (1841) 333, nomen; MIQ. Fl. Ind. Bat. 2 (1858) 939. — *O. virgatum* (non THUNB.) BLANCO, Fl. Filip. ed. 2 (1845) 334; ed. 3, 2 (1878) 253. — *O. brachiatum* (non Bl.) HASSK. Pl. Jav. Rar. (1848) 471. — Fig. 30.

Erect, much branched herb, 30–60 cm, often woody at the base. Stem and branches soft hairy. Leaves membranaceous, elliptic-oblong or elliptic, 3–6 by 1–2.5 cm, obtuse or acute, base cuneate or attenuate, entire; margin elsewhere entire or remotely serrate; pubescent on both surfaces, especially on the nerves underneath; petiole 1–2.5 cm. *Verticillasters* in slender racemes or panicles 8–10 cm long. Bracts ovate, acuminate, 2–3 mm long, ciliate. Pedicels 3–4.5 mm, pubescent. *Calyx* 2.5 mm long, in fruit 3–3.5 mm; upper lip suborbicular, reflexed, shortly apiculate; lower lip longer than the upper, teeth 4, lanceolate. *Corolla* lavender or white, 3.5–4 mm long. *Filaments* exserted, slender, the upper ones with a small bearded basal appendage. *Nutlets* minute, broadly ellipsoid, 1.2 mm long, smooth, swelling in water.

Distr. Pantropical, possibly a native of tropical Asia, throughout *Malesia*.

Ecol. A weed of waste places in settled areas, often in great quantity, in grassfields, along roadsides and sunny dry places, thickets and planted in garden land and on cemeteries; up to c. 600 m. *Fl.* Jan.–Dec. Galls on young stems are caused by aphids.

Vern. *Sacred basil, holy basil*, E.; Malaya: *oku, ruku ruku, ruru, salassay, sulasi*, M; Sumatra: *kémangi, rudjang tampua, r. taba, ruku-ruku, sélası putih; sini sini*, Nias; Java: *kélampès, kémangi, ruku-ruku, r. mèrah, r. putih, sélasih*, M, *klampès, lampès, l. beureung, l. bodas, salasi wungu, surawung*, S, *kémangèn, kémangi, k. abang, k. putih, kumangi, lampès, l. abang, l. irèng, l. putih, télasi putih, J, kémanghi, komangi, koroko, k. èrèng*, Md, *kémangé, Kangean*; Bali: *kéntjarum, sélası mèhik, s. miik, uku-uku*; Lombok: *kémangi, kumangi, rëruku*; Sumba: *këndung*; Borneo: *beng, sulasi*; Moluccas: *lufé-lufé*, Ternate, *busu-busu, luluban*, Ambon, *kayu ikan manasin*, Banda; Celebes: *balakama, busu-busu, gangan bau balanda, kémangèn, kokuru, k. amping, k. kulo, k. kuro, k. mahamu, k. mea, k. putih, k. raindang, kukuru, kurasi, kuri*

*mbida, k. mahèndèng, lèngid, l. budo, l. mèha, pikit, p. mopuha, p. mowuro, pongpong, p. kulo, p. putih, p. rangdang, p. rundung, tjamangi, t. balanda, tjamani balanda, ukadju tjamangi*; Philippines: *albahaca*, Span., *balanoi*, Tag., *loko-loko*, Tag., Pamp., *bidai*, Ilk., *kamangkau*, Bik., *kamagni, kolokoko, kolon-kogon*, Bis., *katigau, lalui*, C.Bis., *luku-luku*, Sul., *magau*, Mag., *malinau*, Sub.; New Guinea: *wabkaran* (K.Sch.).

Uses. According to HEYNE (Nutt. Pl. 1927, 1328) not used as a vegetable, sometimes as a condiment, and with some minor medicinal applications: cold with children, healing wounds, promoting lactation in women, a decoction of seeds said to be a demulcent. Seeds used for cleansing eyes. In Sumatra used with ceremonial offerings to spirits. In the Philippines said that a decoction of leaves is used for aromatic baths and as a remedy against gonorrhoea. In Malaya used against rheumatism.

Notes. BENTHAM (1848) and MERRILL (1917) were well aware of the fact that *O. sanctum* and *O. tenuiflorum* are not distinct; DOMIN (1929) finally drew the nomenclatural consequence.

The commonest form has a purple calyx and corolla, other forms have a green calyx and purple corolla, still others have a green calyx and white corolla.

#### Cultivated

*Ocimum viride* WILLD.; v. BREA DE HAAN, *Teysmannia* 15 (1904) 249; BURK. Dict. (1935) 1576.

Native of tropical Africa, at one time introduced and cultivated in Java, with the intention of using it against mosquito attack, but without success. Also cultivated in the Malay Peninsula, where burned leaves are used as a repellent against mosquitos (BURK. l.c.). The statement that mosquitos will also be repelled by the living plants is incorrect.

#### Excluded

*Ocimum canum* (non SIMS) F.-VILL. Nov. App. (1880) 162.

Since *O. americanum* L. (= *O. canum* SIMS) does not occur in the Philippines, this probably refers to another species of the genus.

*Ocimum menthoides* (non L.) BURM. f. Fl. Ind. (1768) 129.

Mentioned as occurring in "Zeylong and Java". Its exact identity is unknown.

### 30. ORTHOSIPHON

BTH. Bot. Reg. sub t. 1300 (1830); in B. & H. Gen. Pl. 2 (1876) 1174; BRIQ. in E. & P. Nat. Pfl. Fam. 4. 3a (1897) 372; SLIESEN, Reinwardtia 5 (1959) 37; KENG. Gard. Bull. Sing. 24 (1969) 132. — *Clerodendranthus* KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 117. — Fig. 31.

Herbs or undershrubs. Leaves serrate or crenulate or subentire. *Verticillasters* of 4–6 flowers arranged in terminal, racemose inflorescences. *Calyx* tubular campanulate (in fruit deflexed), 10-nerved, 2-lipped; upper lip broad, membranaceous,

often recurved, strongly decurrent; lower lip 4-toothed, lateral teeth oblong, aristate, central teeth subulate. *Corolla* tube slender, limb 2-lipped; upper lip 3-4-lobed; lower lip entire, concave. *Stamens* 4, declinate, included or long-exserted; filaments free, not appendaged at base; anther-cells confluent. Disk 4-lobed, produced anteriorly. Style filiform, entire; stigma capitate or clavate. *Nutlets* ovoid or globose, smooth.

Distr. About 40 spp. in the tropics of the Old World; in *Malesia* 2 spp.

## KEY TO THE SPECIES

1. Flowers all cleistogamous. Corolla concealed in the calyx, not opening, 2-3 mm long . . . 1. *O. aristatus*
1. Flowers chasmogamous, corolla opening and exceeding the calyx.
2. Stamens exerted more than 2 cm from the corolla tube, reaching far beyond the top of the lower lip; tube very slender, 10-18 mm, lips 4.5 and 10 mm respectively. Style 4.5-5 cm . . . 1. *O. aristatus*
2. Stamens hardly longer than the corolla tube; tube not particularly slender, 8-10 mm, both lips c. 3-4 mm. Style c. 1 cm . . . 2. *O. thymiflorus*

1. *Orthosiphon aristatus* (BL.) MIQ. Fl. Ind. Bat. 2 (1858) 943; MERR. En. Philip. 3 (1923) 422; BACK. Onkr. Suiker. (1931) 577, Atlas (1973) t. 548; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 26; QUIS. Medic. Pl. Philip. (1951) 828; SLEESEN, Reinwardtia 5 (1959) 38; KOCHUMMEN, Mal. Nat. J. 18 (1964) 73, pl. 9; BACK. & BAKH. f. Fl. Java 2 (1965) 640; KENG, Gard. Bull. Sing. 24 (1969) 132, f. 25. — *Clerodendron spicatum* THUNB. Fl. Jav. (1825) 22, non *O. spicatum* BTH. 1848. — *Ocymum aristatum* BL. Bijdr. (1826) 833; HASSK. Cat. Hort. Bog. (1844) 128. — *Ocymum grandiflorum* (non L'HÉRIT.) BL. Bijdr. (1826) 835. — *O. stamineus* BTH. in Wall. Pl. As. Rar. 2 (1830-31) 15; Lab. Gen. Sp. (1832) 29; HASSK. Cat. Hort. Bog. (1844) 129; MOR. Syst. Verz. (1846) 55; BTH. in DC. Prod. 12 (1848) 52, incl. var. *angustifolia* BTH.; MIQ. Fl. Ind. Bat. 2 (1858) 943; F-VILL. Nov. App. (1880) 163; VIDAL, Phan. Cuming. Philip. (1885) 135; HOOK. f. Fl. Br. Ind. 4 (1885) 615; v.d. BURG, Geneesh. Ned. Ind. 3 (1885) 539; VIDAL, Rev. Pl. Vasc. Filip. (1886) 212; PRAIN, J. As. Soc. Beng. 74, ii (1907) 703; KOORD. Exk. Fl. Java 3 (1912) 159; BUYSMAN, Flora 117 (1915) 362; RIDL. Fl. Mal. Pen. 2 (1923) 645; MANSFELD, Bot. Jahrb. 62 (1929) 381. — *O. tomentosus* (non BTH.) T. & B. Cat. Hort. Bog. (1866) 132. — *O. grandiflorum* BOLD. Zakfl. (1916) 110, non TERRAC. 1892; HEYNE, Nutt. Pl. (1927) 1338; BACK. Onkr. Suiker. (1931) 577; BURK. Dict. (1935) 1592; BRUGGEMAN, Ind. Tuinb. (1939) 137; MERR. Brittonia 5 (1943) 29. — *Clerodendranthus stamineus* (BTH.) KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 117. — *O. spicatum* (THUNB.) BACK., BAKH. f. & STEEN. Blumea 6 (1950) 359, non BTH. 1848. — *Clerodendranthus spicatus* C.-Y. WU ex H.-W. LI, Acta Phytotax. Sin. 12(2) (1974) 233. — Fig. 31.

Slender, ascending herb, 0.25-2 m. Stem 4-angled, sparingly pubescent in young shoots. *Leaves* chartaceous or membranaceous, lanceolate, ovate or rhombic, 3-9 by 2-4.5 cm, acuminate, base cuneate, decurrent, entire; margin elsewhere coarsely serrate, puberulous or pubescent on the nerves and glandular on both surfaces; petiole 1-2(-4.5) cm, puberulent. *Verticillasters* distantly apart below, arranged in lax terminal racemes

10-15(-20) cm long. Bracts sessile, ovate, 1-2 mm long. *Calyx* curved campanulate, 2.5-4.5 mm long, in fruit 6.5-12 mm, puberulous on the nerves, outside gland-dotted or warted. *Corolla* white, pale lilac or lilac, 10-16(-20) mm long; tube slender, 10-12 mm, straight; upper lip shallowly 4-lobed, recurved; lower lip straight, concave. *Filaments* glabrous, filiform, coiled in bud, projecting c. 2 cm beyond the corolla-throat. Style 5-6 cm, the tip enlarged, club-shaped, very shortly 2-fid; branches clasped. *Nutlets* broadly oblong, compressed, 1.5 mm long, rugose.

Distr. Throughout continental SE. Asia to tropical Australia, throughout *Malesia*, but at L not represented from the Moluccas, in Celebes and Borneo very rare.

Ecol. In thickets and along forest borders in shaded not too dry localities, along roadsides and ditches, and in teak- and bamboo-forests, in rubber estates, among sago palms, on levees, in grassland, in regrowths and old garden land, from sea-level to c. 1000 m. Fl. Jan.-Dec.

Flowers are occasionally cleistogamous; the corolla remains then concealed inside the calyx base, stamens are very short and the style is tortuous; yet the ovary and nutlets are normal.

Root galls are caused by nematodes.

Vern. *Kattesor*, D.; Sumatra: *giri giri marèh*, Djambi, *sèsungui*, Simalur, M; Java: *kumis kutjing*, M (the common name), *kumis utjing*, *singkir*, S, *rè mudjung*, *rèmu(k)h djung*, J, *sè salasèjan*, *songot kotjèng*, Md; Philippines: *kabling-gubát*, *kabling parang*, Tag; Moluccas: *lupu mangu-umi*, Halmaheira; New Guinea: *tjikupi-tjikupi*, Kaisah village, *mangkat kwabon*, Kaliki village, S. Irian.

Confusingly the name *kumis kutjing* (cat's whiskers) is also sometimes by error used for the Capparidaceae *Gynandropsis*.

Uses. Often cultivated in gardens for ornamental and medicinal purposes.

AS VAN DER SLEESEN remarked (*l.c.* 39-41) it is very strange indeed that this plant, which is showy as an ornamental, was not collected or mentioned by botanists and explorers before 1777 from *Malesia* when THUNBERG collected it in Java. And

plaints and illness, renal calculi, phosphatury catarrh of the bladder, gout, etc. and also, together with *Phyllanthus urinaria* and *Desmodium gangeticum* against gall stones and podagra.

Although the plant has repeatedly been under thorough phytochemical and pharmacological investigation (see references in VAN DER SLEESSEN, l.c. 41) a specific constituent responsible for its medicinal value has not been found.

Notes. BACKER (1931, l.c. 576) distinguished in Java two forms (by him accepted as species *O. aristatus* and *O. grandiflorus*) distinct by minor differences in hairiness and upper calyx lobe which are, however, not sharply separated.

MERRILL has proposed to use as correct name *O. spiralis* (LOUR.) MERR. Lingn. Agric. Rev. 2 (1923) 137; Trans. Am. Phil. Soc. 24, 2 (1935) 344, based on *Trichostema spiralis* LOUR. Fl. Coch. (1790) 371, of which LOUREIRO mentions the stamens to be "longissima". However, as VAN DER SLEESSEN pointed out, his phrase "*folia integerrima tomentosa*" rather defeats this reduction, because though the dentation of the leaf margin varies, the leaves are never tomentose, but glabrous and at most sometimes sparsely short-hairy. The impression is that LOUREIRO's plant was a mixture. There is no LOUREIRO specimen in the BM.

2. *Orthosiphon thymiflorus* (ROTH) SLEESSEN, Reinwardtia 5 (1959) 42, incl. var. *viscosus* (BTH.) SLEESSEN; BACK. & BAKH. f. Fl. Java 2 (1965) 640; KENG, Gard. Bull. Sing. 24 (1969) 135. — *Ocimum thymiflorum* ROTH, Nov. Pl. Sp. (1821) 269. — ? an *Ocimum viscosum* ROTH, l.c. 274. — *Ocimum tomentosum* (non LAMK) BTH. in Wall. Pl. As. Rar. 2 (1830-31) 14; Lab. Gen. Sp. (1832) 27; in DC. Prod. 12 (1848) 51, incl. var. *parviflorus* BTH.; HASSK. Nat. Tijd. N. I. 10 (1856) 49; BACK. Onkr. Suiker. (1931) 578, as var. *glabratus* (BTH.) BACK. — *Ocimum glabratus* BTH. in Wall. Pl. As. Rar. 2 (1830-31) 14; Lab. Gen. Sp. (1832) 28; in DC. Prod. 12 (1848) 50; MIQ. Fl. Ind. Bat. 2 (1858) 942; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 23. — *O. viscosus* BTH. in Wall. Pl. As. Rar. 2 (1830-31) 14; Lab. Gen. Sp. (1832) 27; MOR. Syst. Veg. (1846) 55; BTH. in DC. Prod. 12 (1848) 50; MUKERJEE, Rec. Bot. Surv. India 14 (1930) 23. — *O. petiolaris* MIQ. Fl. Ind. Bat. 2 (1858) 943. — *O. tomentosum* BTH. var. *viscosus* (BTH.) HOOK. f. Fl. Br. Ind. 4 (1885) 614.

Erect or ascending herb, 30-50 cm. Stem often glandular-pubescent. Leaves ovate or broadly ovate, 3-4.5(-7) by 2.5-3(-4.5) cm, obtuse or subacute, base rounded or truncate, (usually not decurrent), entire; margin elsewhere crenate or wavy, glabrescent above, viscous and glandular-punctate below; petiole 1-2.5(-5) cm, pubescent. *Verticillasters* 5-6-flowered; racemose inflorescence terminal, 5-8(-12) cm. Bracts ovate, acuminate, 2-5 mm long. Pedicels 2-3 mm, shortly pubescent. Calyx tubular, 4-5 mm long, in fruit 7-8 mm, puberulous outside; upper lip broadly triangular; lower lip with 4 filiform teeth. Corolla pale pink, 11-14 mm long, tube slightly incurved, puberulous. Stamens included. Style 9-10 mm long. Nutlets subglobose, compressed, minutely glandular.

Distr. Ceylon to Indo-China; in *Malesia*: Central and East Java, very rare.

Ecol. Only from 3 localities, viz Kediri, Nusa

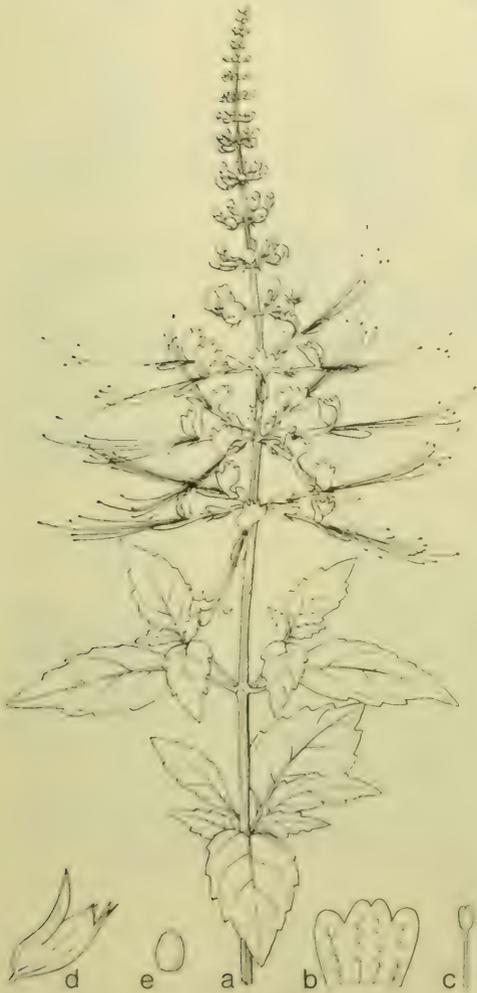


Fig. 31. *Orthosiphon aristatus* (BL.) MIQ. a. Habit,  $\times 1/2$ , b. upper lip of corolla,  $\times 1/2$ , c. style and stigma, d. fruiting calyx,  $\times 2$ , e. nutlet,  $\times 3$ .

its medicinal use was not mentioned before 1885 from Java, and in SE. Asia still later. As it is also not known to occur in genuinely native forest vegetation, it would even seem to be an introduced plant of which the Eurasians and Europeans detected the medicinal value in the latter half of the 19th century. Propagation is easy from cuttings.

Its medicinal use is now universal throughout *Malesia*, leaves being used as a strong diuretic in infusa (tea) against various kinds of kidney com-

Barung, and G. Sadeng near Puger, all, it seems, in dry calcareous localities under seasonal climatic conditions. *Fl. Dec.*

Note. In Asia several varieties are distinguished.

From Java a viscous-haired *var. viscosus* (BTH.) SLEESEN was reported by MORITZI, *l.c.* as *O. viscosus* BTH. (ZOLLINGER 1873) which I have not seen.

### 31. PLATOSTOMA

BEAUV. *Fl. Owar.* 2 (1805) 61, t. 95; BTH. in DC. *Prod.* 12 (1848) 46; in B. & H. *Gen. Pl.* 2 (1876) 1172 ('*Platystoma*'); BRIQ. in E. & P. *Nat. Pfl. Fam.* 4, 3a (1897) 365.

Annual herbs. *Leaves* serrate, petiolate. *Flowers* small, in verticillasters in a terminal racemose inflorescence. Bracts narrowly elliptic. *Calyx* urceolate-campanulate, deeply 2-lipped; upper lip rounded, strongly deflexed in fruit, with a broad deltoid lobe on each side at the base; lower lip ovate, slightly concave. *Corolla* tubular-campanulate, upper lip 3-lobed, the median lobe deeply 2-fid, thus seemingly 4-lobed; lower lip shorter, entire, boat-shaped. *Stamens* 4, declinate, shortly exposed, inserted at two different levels of the corolla tube; filaments dilated below, but not appendaged; anther-cells confluent. Disk swollen, glandular. Style briefly 2-fid. *Nutlets* ovoid, minutely reticulate.

Distr. About 5  *spp.*, in tropical Africa and India, in Malesia 1  *sp.* (Sumba).

1. *Platostoma africanum* BEAUV. *Fl. Owar.* 2 (1805) 61, t. 95; BTH. in DC. *Prod.* 12 (1848) 47; BAKER, *Fl. Trop. Afr.* 5 (1900) 349; MUKERJEE, *Rec. Bot. Surv. India* 14 (1940) 34 ('*Platystoma*'). — *Ocimum flaccidum* A. RICH. *Tent. Fl. Abyss.* 2 (1847) 179. — *P. flaccidum* BTH. *ex* Hook. *f. Fl. Br. Ind.* 4 (1885) 611 ('*Platystoma*').

Branched, slender herb, 30 cm or more high. Stem and branches sparingly puberulent. *Leaves* thin membranaceous, rhomboid to ovate, sparingly puberulent on both surfaces, 1.2–3.5 by 0.5–1.5 cm, acute, base cuneate or attenuate, entire, margin elsewhere serrate; petiole 0.5–1 cm. *Verticillasters*

several to many-flowered, in terminal, often simple racemose inflorescence, 2 or more cm long. Bracts narrowly elliptic, 4–5 mm, glandular and hirsute. *Flowers* on 2–3 mm long pedicels. *Calyx* 2–2.5 mm long, in fruit 3–4 mm, sparingly puberulent; upper lip rounded, strongly deflexed backwards in fruit; lower lip ovate, flat or slightly concave. *Corolla* 3–4 mm long, pale lilac (*vide* BAKER). *Nutlets* ovoid, minute, brown to black, finely reticulate.

Distr. Tropical Africa and S. Asia (India: Deccan Peninsula); in Malesia: Lesser Sunda Islands (Sumba), once collected.

### 32. PLECTRANTHUS *sens. lat.*

L'HÉRIT. *Stirp. Nov.* (Mar. 1788) 84, t. 41, 42, *nom. cons.*; R. BR. *Prod.* (1810) 505; BL. *Bijdr.* (1826) 835; BTH. in B. & H. *Gen. Pl.* 2 (1876) 1175; BRIQ. in E. & P. *Nat. Pfl. Fam.* 4, 3a (1897) 352; BULL. & KILLICK, *Taxon* 6 (1957) 239; J. K. MORTON, *J. Linn. Soc. Lond. Bot.* 58 (1962) 231; LAUNERT, *Mitt. Bot. München* 7 (1968) 295, pl. 1–3; KENG, *Gard. Bull. Sing.* 24 (1969) 141; S. T. BLAKE, *Contr. Queensl. Herb.* 9 (1971) 1; CODD, *Mitt. Bot. München* 10 (1971) 245; Bothalia 11 (1975) 372. — *Germanea* LAMK, *Encycl.* 2 (Apr. 1788) 690. — *Coleus* LOUR. *Fl. Coch.* (1790) 372; BTH. in B. & H. *Gen. Pl.* 2 (1876) 1176; BRIQ. in E. & P. *Nat. Pfl. Fam.* 4, 3a (1897) 359; KENG, *Gard. Bull. Sing.* 24 (1969) 48. — *Solenostemon* SCHUMACHER in Schumacher & Thonn. *Beskr. Guin. Pl.* (1827) 271; BTH. in B. & H. *Gen. Pl.* 2 (1876) 1175; BRIQ. in E. & P. *Nat. Pfl. Fam.* 4, 3a (1897) 359; J. K. MORTON, *J. Linn. Soc. Lond. Bot.* 58 (1962) 251; CODD, *Mitt. Bot. München* 10

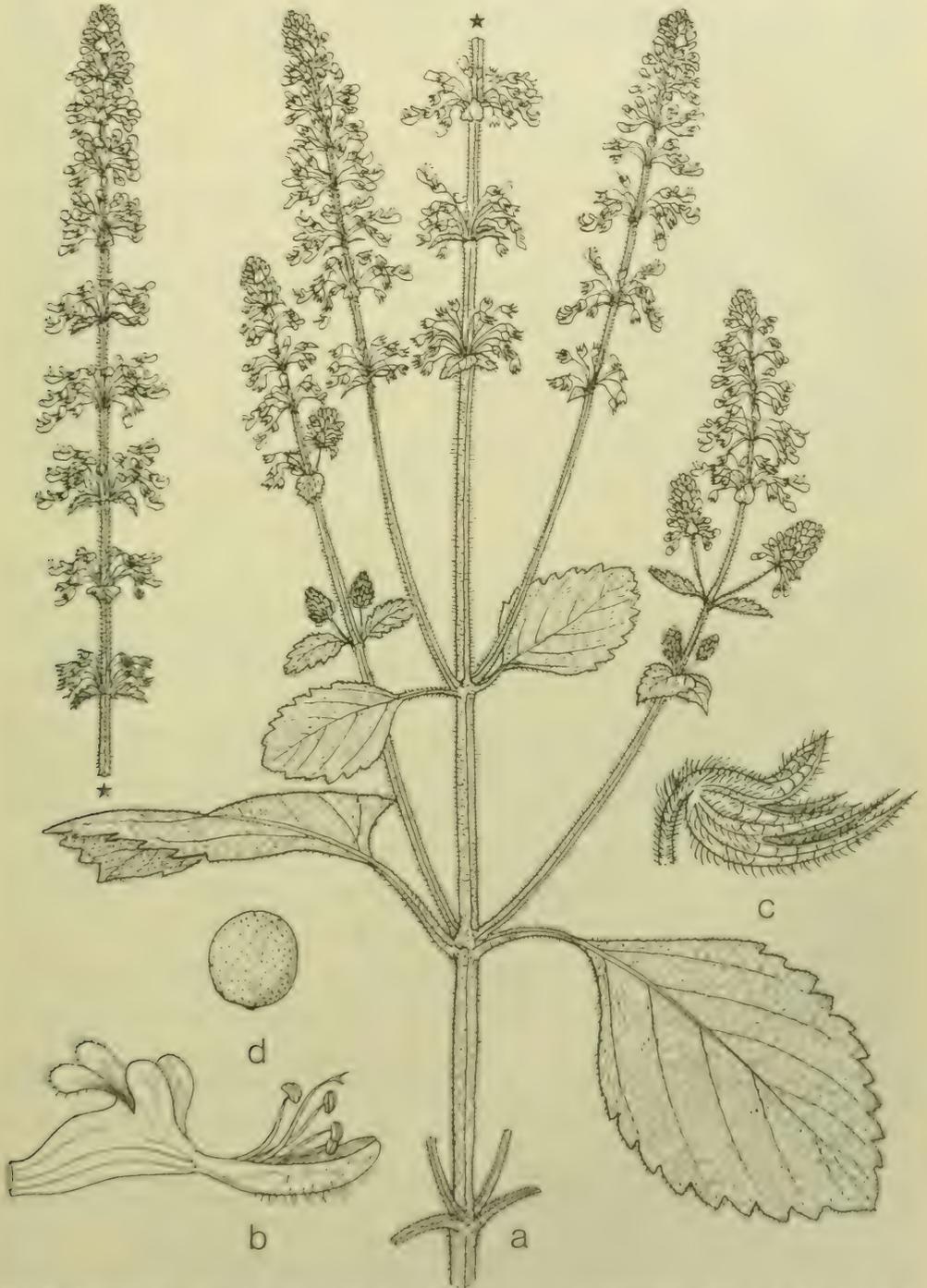


Fig. 32. *Plectranthus steenisii* Ktze. a. Habit,  $\times 2$ , b. corolla, c. fruiting calyx, both  $\times 6$ , d. nutlet,  $\times 9$  (VAN STEENIS 7111).

(1971) 249; S. T. BLAKE, *Contr. Queensl. Herb.* 9 (1971) 6. — *Rabdosia* HASSK. *Flora* 25 (1842) II, Beibl. 25; HARA, *Jap. Bot.* 47 (1972) 193; CODD, *Bothalia* 11 (1975) 436. — *Majana* (RUMPH.) O. K. *Rev. Gen. Pl.* 2 (1891) 523. — *Isodon* (BTH.) Lab. *Gen. Sp.*, 1832, 40, as *Plectranthus sect. Isodon* KUDO, *Mem. Fac. Sc. & Agr. Taihoku Un.* 2, 2 (1929) 118; CODD, *Taxon* 17 (1968) 239; S. T. BLAKE, *Contr. Queensl. Herb.* 9 (1971) 4. — **Fig. 32.**

Herbs or undershrubs. *Leaves* opposite. *Flowers* usually small, in lax or dense, 6-many-flowered cymes or verticillasters which are arranged in terminal and axillary spurious spikes, racemes or panicles. *Calyx* tubular or campanulate, straight or declinate, often accrescent; limb 5-toothed, subequal or 2-lipped. *Corolla* tube exerted, long or short, decurved or straight, sometimes having a spur or angle on the upper side; limb 2-lipped, the upper lip short, 3–4-fid, recurved, the lower lip entire or notched, long boat-shaped. *Stamens* 4, declinate; filaments free or connate below into a sheath around the style or adnate to the corolla tube but free from each other; anther-cells usually confluent. Disk usually produced anteriorly, there nearly to fully as long as the ovary. Style briefly 2-fid. *Nutlets* orbicular or occasionally oblong or ovoid, smooth, granulate or punctate.

*Distr.* About 200  *spp.* in the tropical and subtropical regions of the Old World, many in Africa; throughout *Malesia*.

*Taxon.* There is no unanimity of opinion about generic delimitation in the *Coleus-Plectranthus* complex, there being, for *Malesia*, at least four names concerned. MORTON and LAUNERT are being inclined to recognize only few genera or only one in this complex, but CODD and BLAKE suggest there are more.

About *Ceratanthus* there is not much trouble; its distinctly spurred corolla and the insertion of the stamens (the posterior pair near the base of the corolla tube, the anterior pair near the mouth) are two good characters for its distinction.

As to *Coleus* it has been held that this was distinct by the fused bases of the stamens. As MORTON pointed out — and both LAUNERT and CODD agree — this is an unreliable character in some species, and in degree even variable in the type species of *Coleus*, *C. amboinicus*. I must maintain, however, that in that species there is always a fusion. However, in closely related species such as *Plectranthus apoensis*, *P. congestus*, etc. which share the calyx characters, the stamens are free. And thus *Coleus* — as to the type species — cannot be divorced from *Plectranthus*.

There remains then the question whether there are sharply defined taxa within *Plectranthus* (incl. *Coleus*), for which only two characters could be used, viz the structure of the calyx and of the inflorescence, and also whether the bracts are differentiated from the leaves or not, and whether the peduncles are developed or not. Apart from our view that the latter characters are not particularly important, calyx and inflorescence characters cannot be correlated.

As to the calyx there are three main types which are quite distinct in extreme form, viz:

*Solenostemon* SCHUMACHER & THONN. *em.* MORTON (*Coleus sect. Solenostemon* (SCHUMACHER) BTH., *Coleus sect. Solenostemoides* BRIQ.): Calyx distinctly 2-lipped, upper lip large reflexed, lower lip 2-fid to various degree, with narrow segments, lateral teeth very short and rounded.

*Coleus amboinicus* group: Upper lip as in *Solenostemon*, but all four other lobes equally large, narrow pointed.

*Plectranthus sens. str.* (*Isodon* (BTH.) KUDO; *Plectranthus sect. Isodon* BTH.; *Plectranthus subg. Isodon* (BTH.) BRIQ.; *Elsholtzia sect. Rabdosia* BL.; *Rabdosia* (BL.) HASSK.): all 5 calyx segments about equal, fairly short in proportion to the tube.

In checking these characters with the species, it appears, however, that these extremes are connected by intermediate structures. In *Coleus scutellarioides sens. str.* the lateral lobes are stunted and rounded, but in *C. galeatus* and *C. sparsiflorus* they are triangular, pointed and somewhat larger, though still smaller than the other teeth. *Plectranthus congestus* belongs to the *amboinicus* type, but the lateral lobes are very wide and almost rounded. In the Papuan specimens of *Coleus scutellarioides* the lateral teeth are half as long as those of the lower lip and obliquely truncate. In *C. galeatus* the acute-triangular teeth are almost as long as the upper lip, the lower lip being longest. In *Plectranthus teysmannii* and *P. javanicus* the teeth are almost equal, but in *P. apoensis*, *congestus*, and *parviflorus* the upper lip is wider than the others.

The only conclusion can be that in this complex the calyx structure is variable and one is unable to sharply define taxa within it, and the inflorescence structures (namely whether of stalked cymes or in verticillasters) are not always correlated with the calyx characters, which of course defeats distinction of more than one genus.

Chromosomes. DE WET (S. Afr. J. Sc. 54, 1958, 153) published an account of chromosome numbers of South African species, but there are obviously at least three base numbers and from these no evidence can be produced for sustaining generic distinction.

## KEY TO THE SPECIES

1. Calyx subequally 5-toothed, not 2-lipped.
  2. Basic inflorescence a stalked cyme. Flowers small (calyx less than 2 mm, corolla 5-6 mm long); calyx teeth deltoid.
    3. Stamens long-exserted. Fruiting calyx 3.5-4 mm long. Corolla white, the tube gibbous above. Upper leaves sessile or even amplexicaulous . . . . . 1. *P. teysmannii*
    3. Stamens included in lower lip of corolla. Fruiting calyx 4.5-5 mm long. Corolla violet-blue, the tube not gibbous above. Upper leaves petioled . . . . . 2. *P. javanicus*
  2. Basic inflorescence a verticillaster. Flowers proportionally large (calyx 4-4.5 mm, corolla 10-12 mm long); calyx teeth lanceolate. Corolla blue, prominently gibbous above. Aromatic . . . . . 3. *P. steenisii*
1. Calyx unequally 5-toothed, distinctly 2-lipped (the upper tooth generally larger and much broader than the others and forming the upper lip, and the others forming the lower lip).
  4. Median teeth and lower teeth similar in shape and length, free, and all with narrow, acute or aciculary acuminate apices. Inflorescence a verticillaster.
    5. Flowering calyx (and entire inflorescence) densely covered with long greyish arachnoid pubescence, strongly declinate, the teeth all claw-like curved. Corolla tube shorter than the calyx. Inflorescence paniculate . . . . . 4. *P. petraeus*
    5. Flowering calyx glabrescent or sparsely hairy, nearly straight, the teeth erect or reflexed, quite apart. Corolla tube longer than the calyx. Spurious spike solitary, or with 1 or 2 branches at the base, rarely paniculate (in *P. apoensis* and *P. congestus*).
      6. Corolla tube curved and declinate or constricted near the median portion. Leaves orbicular or reniform in outline, more rarely ovate.
        7. Corolla tube not constricted in the middle,  $\pm$  trumpet-like widened; filaments fused at the base into a tube around the style-base, exposed. Flowers 10-20 or more in a verticillaster . . . . . 5. *P. amboinicus*
        7. Corolla tube constricted near the median portion; filaments adnate to the throat of the corolla tube, enclosed. Flowers 6-8 in a verticillaster . . . . . 6. *P. apoensis*
      6. Corolla tube straight or bent near the base, neither strongly declinate nor constricted near the median portion. Leaves ovate or broadly ovate in outline.
        8. Median and lower calyx teeth lanceolate, the median ones becoming broader and blunt in fruiting stage. Flowers numerous (usually over 20) in a verticillaster; inflorescence paniculate . . . . . 7. *P. congestus*
        8. Lower and median calyx teeth subulate, sharply pointed. Flowers less than 12 in a verticillaster; inflorescence a spurious spike, solitary or with 1 or 2 branches below . . . . . 8. *P. parviflorus*
  4. Median and lower teeth dissimilar in shape and length; median teeth shorter than the lower ones, with acute, rounded or truncate tip; lower teeth connate to various degree.
    9. Median teeth usually much shorter ( $1/2$  or less) than the lower ones, with rounded or truncate apices (rarely mucronate in 2 varieties of *P. scutellarioides*).
      10. Fused 2 lower calyx teeth with an almost truncate apex with the dents wide apart. Roots with sessile tubers . . . . . 9. *P. rotundifolius*
      10. Lower teeth deeply bifid at apex, but the teeth close, almost parallel. No tubers on roots.
        11. Corolla c. 1 cm long (in some New Guinea specimens up to 18 mm), the tube with a curve, slender below the curve, rather suddenly widening above it. Flowers usually in verticillasters . . . . . 10. *P. scutellarioides*
        11. Corolla c. 2 cm long, straight, the tube rather gradually widening, narrow funnel-shaped. Flowers in stalked cymes . . . . . 11. *P. merrillii*
    9. Median teeth slightly shorter ( $2/3$  to  $3/4$ ) than the lower ones, with acute or acuminate apices.
      12. Median teeth about  $2/3$  as long as the lower ones, in fruiting stage about half as long as the latter. In damp mossy forests above 1000 m.
        13. Spurious spikes 2-4 cm long. Flowers 1-3 . . . . . 12. *P. sparsiflorus*
        13. Spurious spikes 5-25(-30?) cm long. Flowers 5-8(-15) . . . . . 13. *P. galeatus*
      12. Median teeth about  $3/4$  as long as the lower ones, in fruiting stage almost as long as the latter. On limestone hills in lowland below 200 m . . . . . 14. *P. kunstleri*

1. *Plectranthus teysmannii* MIO. Fl. Ind. Bat. 2 (1858) 944; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 223; H. J. LAM, Blumea 5 (1945) 581; BACK. & BAKH. J. Fl. Java 2 (1965) 636; KENG, Gard. Bull. Sing. 24 (1969) 144; STEEN. Mi. Fl. Java (1972) pl. 25-4. — *P. punctatus* (non L'HÉRIT.) BL. Cat. (1823) 84; FILET, Plantk. Woordenb. ed. 2 (1888) 126. — *P. zollingeri* BRIG. Ann. Cons. Jard. Bot. Genève 2 (1898) 234.

Erect herb or undershrub, 0.5-1.5 m. Stem and branches tetragonous, slender, pubescent. Leaves chartaceous, ovate or elliptic-ovate, 2.5-5 by 1.5-3.5 cm, acute or acuminate, base truncate or rounded, rarely acute, entire; margin elsewhere serrate-dentate, puberulent above, densely glandular-pubescent beneath; petiole 0.2-1 cm; upper leaves sessile or even amplexicaulous. Flowers in lax stalked cymes disposed in lateral thyrses, and

forming a large terminal panicle 12–15(–20) cm long, 4–5 cm wide. *Calyx* subcampanulate, 1.5–2 mm long, in fruit 3.5–4 mm, densely glandular-villous, subequally 5-toothed, teeth deltoid, blunt or rounded. *Corolla* white with small lilac dots on upper lip, 5–6 mm long, the tube straight, gibbous above. Filaments long exserted. *Nutlets* ovoid, 0.8–1 mm long.

Distr. N. Thailand; in *Malesia*: Java (from Priangan Mts Tilu & Papandajan eastwards), Lesser Sunda Is. (Bali, Lombok, Sumbawa, Flores), and Central & S. Celebes.

Ecol. Grasslands, thickets, forest edges, also in *Casuarina* forest, never in marshy places, 1400–2700 m, in the Lesser Sunda Is. and Celebes as low as c. 1000 m. *Fl. Jan.–Dec.*

Vern. Java: *slanghet*, J, *djôngè*, S.

Note. Possibly wider spread in continental SE. Asia.

**2. *Plectranthus javanicus* (BL.) BTH.** Lab. Gen. Sp. (1832) 45; HASSK. Cat. Hort. Bog. (1844) 129; BTH. in DC. Prod. 12 (1848) 69; MIQ. Fl. Ind. Bat. 2 (1858) 946; KOORD. Exk. Fl. Java 3 (1912) 155; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 222; BACK. & BAKH. f. Fl. Java 2 (1965) 636; KENG, Gard. Bull. Sing. 24 (1969) 142; STEEN. Mt. Fl. Java (1972) pl. 25–2. — *P. virgatus* REINW. ex BL. Cat. (1823) 84, *nomen*. — *Ocymum tenuiflorum* (non L.) BL. Cat. (1823) 83, *nomen*. — *Elsholtzia javanica* BL. Bijdr. (1826) 825. — *Rabdosia javanica* (BL.) HASSK. Flora 25 (1842) II, Beibl. 25. — *P. menthoïdes* (non BTH.) MOR. Syst. Verz. (1846) 55. — *P. intermedius* ZOLL. & MOR. in Mor. Syst. Verz. (1846) 55; KOORD.-SCHUM. Syst. Verz. 1 (1910) fam. 254, p. 8; KOORD. Exk. Fl. Java 3 (1912) 154. — *P. rufescens* BTH. in DC. Prod. 12 (1848) 59; MIQ. Fl. Ind. Bat. 2 (1858) 945; KOORD. Nat. Tijd. N. I. 62 (1902) 218; KOORD.-SCHUM. Syst. Verz. 1 (1910) fam. 254, p. 8; KOORD. Exk. Fl. Java 3 (1912) 154. — *P. benthamianus* MIQ. Fl. Ind. Bat. 2 (1858) 946; KOORD. Exk. Fl. Java 3 (1912) 155. — *P. diffusus* MERR. Philip. J. Sc. 1 (1906) Suppl. 235; *ibid.* 5 (1910) Bot. 382; En. Philip. 3 (1923) 418; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 222. — *Moschosma philippinense* ELMER, Leaflet. Philip. Bot. 10 (1939) 3809, *nomen*.

Herb or undershrub, 0.8–2 m, often much-branched, fetid when bruised but not aromatic. Stem and branches angled, slender, pubescent. *Leaves* membranaceous, ovate to oblong-ovate or rhomboid, 2–5(–8) by 1–2.5(–5) cm, acuminate, base acute or rounded, entire; margin elsewhere prominently serrate; crisped hairy on both surfaces; petiole 0.5–1 cm long. *Flowers* in lax, lateral stalked cymes and forming large compound terminal panicles, 20–30 (or more) cm long. Bracts foliaceous, gradually reduced upwards. *Calyx* 1.5–2 mm long, in fruit 4.5–5 mm, sparingly hirsute, subequally 5-toothed, teeth deltoid, acute. *Corolla* violet-blue to pale blue, 5–6 mm long, straight, the limb not conspicuously gibbous, 2-lipped. *Stamens* free, filaments pubescent below, included in the lower lip of corolla. *Nutlets* ovoid or ellipsoid, c. 1 mm long, glabrous, smooth, brown to black.

Distr. *Malesia*: N. Sumatra (Karo, Mt Kerintji), Java (from Mt Gedeh eastwards), Lesser Sunda Is.

(Bali, Lombok, Sumbawa, Flores, Timor), and the Philippines (N. Luzon).

Ecol. Forest edges and secondary growths, clearings, grassland, also in *Casuarina* forest, along streams, and in glades, (850–)1000–2400 m. *Fl. Jan.–Dec.*

Vern. *Rheumatiek plant*, D.; Sumatra: *latêng ajam*, M; Java: *surawung langit*, *tjuru*, S, *sangkèan*, *jangèlan*, J; Bali: *sangket sangket*; Philippines: *bungbungtiit*, Ig.

**3. *Plectranthus steenisii* H. KENG** (in Back. & Bakh. f. Fl. Java 3, 1968, 658, *nomen*) Gard. Bull. Sing. 24 (1969) 145, f. 27. — Fig. 32.

Erect, aromatic herb. Stem and branches densely villous. *Leaves* membranaceous, ovate or spatulate-obovate, 5–9 by 4–6.5 cm, acute or rounded, base acute or acuminate, entire; margin elsewhere crenate-dentate; hirsute on both surfaces, especially densely on the nerves; petiole 1–3 cm. *Flowers* 20–30 in a verticillaster, arranged in spurious spikes and disposed in a large terminal panicle 25–30 cm long. Pedicels 2–4 mm. *Calyx* campanulate, 4–4.5 mm long, in fruit 5.5–6 mm, the teeth subequal, lanceolate. *Corolla* blue, 10–12 mm long, tube erect, prominently gibbous in the medium portion above; upper lip 4-lobed, lower lip concave. Filaments inserted at the base of corolla tube, free above the point of insertion. Style briefly 2-fid. *Nutlets* subrotundate, flattened, 1.2 mm long and wide.

Distr. *Malesia*: East Java (Mts Ardjuno, Tengger, Idjen), 3 collections.

Ecol. Stony slopes in *Casuarina* forest, 2000–2650 m; on Mt Idjen above Bajeman said to have been collected by BACKER between 50–600 m which I think is an error. *Fl.* April, June, Oct. Locally on Mt Ardjuno gregarious in one place.

Note. Manifestly different from other Malesian species by the very long corolla (10–12 mm) and the gibbous corolla tube.

**4. *Plectranthus petraeus* BACK. ex ADELB.** (Bekn. Fl. Java (em. ed.) 14, 1954, fam. 201, p. 47, *descr. neerl.*) Reinwardtia 3 (1954) 152, f. 3; BACK. & BAKH. f. Fl. Java 2 (1965) 636; KENG, Gard. Bull. Sing. 24 (1969) 145; BLAKE, Contr. Queensl. Herb. 9 (1971) 54, f. 2 N, 4 H, pl. 27, map 36.

Undershrub, 1–1.5 m, very fragrant. Stem and branches slender, nearly terete. *Leaves* membranaceous, elliptic or ovate, 4–10 by 3–6 cm, acute or obtuse, base cuneate or shallowly cordate, entire; margin elsewhere crenate-serrate; petiole 1–3 cm. *Flowers* in verticillasters arranged in spurious spikes disposed in large terminal panicles 15–20 cm long. Bracts rhomboid, sessile, 2.5 mm long and wide. Pedicels 2–3 mm. *Calyx* campanulate, curved, 3–3.5 mm long, in fruit 4–5 mm, 5-toothed, teeth all subulate, claw-like curved, densely covered with long greyish arachnoid pubescence. *Corolla* white with violet-tinged upper lip, 7–8 mm long, tube shorter than the calyx, limb 2-lipped, the lips pubescent and with yellow glands outside. *Stamens* included in the lower lip of corolla. *Nutlets* rounded, flattened, c. 1 mm  $\varnothing$ .

Distr. *Malesia*: East Java (Mt Idjen).

Ecol. Between grass, herbs and seedling trees (amongst which *Casuarina*, *Harmsiopanax*, *Trema*, *Wightia*) on old lavastreams (*rèdjèngans*), in

exposed places, locally common, 1100–1450 m. Fl. April–July, Nov.

**5. *Plectranthus amboinicus* (LOUR.) SPRENG.** Syst. 2 (1825) 690; LAUNERT, Mitt. Bot. München 7 (1968) 298, pl. 2; ADAMS, Fl. Jamaica (1972) 645. — *Coleus amboinicus* LOUR. Fl. Coch. (1790) 372; MIQ. Fl. Ind. Bat. 2 (1858) 948; F.-VILL. Nov. App. (1880) 163; GÜRKE, Bot. Jahrb. 19 (1894) 210, incl. var. *violaceus* GÜRKE; KOORD. Exk. Fl. Java 3 (1912) 155; MERR. Philip. J. Sc. 7 (1912) Bot. 344; Fl. Manila (1912) 410; Int. Rumph. (1917) 459; Sp. Blanc. (1918) 338; WEEHUIZEN, Nat. Tijds. N. I. 78 (1919) 124; MERR. En. Philip. 3 (1923) 418; OCHSE & BAKH. Ind. Groent. (1931) 350, f. 221; BURK. Dict. (1935) 634; MERR. Addisonia 20 (1937) 11; VOOGD, Trop. Natuur 27 (1938) 61, f. 4; QUIS. Medic. Pl. Philip. (1951) 813; BACK. & BAKH. f. Fl. Java 2 (1965) 637; PURSEGLOVE, Trop. Crops, Dicot. 2 (1968) 634; KENG, Gard. Bull. Sing. 24 (1969) 50. — *Coleus aromaticus* BTH. in Wall. Pl. As. Rar. 2 (1830–31) 16; Bot. Reg. sub t. 1520 (1832); Lab. Gen. Sp. (1832) 51; in DC. Prod. 12 (1848) 72. — *P. aromaticus* (BTH.) ROXB. Fl. Ind. ed. Carey 3 (1832) 22, non ROXB. 1814, nomen. — *Coleus suganda* BLANCO, Fl. Filip. (1837) 438; ed. 2 (1845) 337; ed. 3, 2 (1878) 259; BTH. in DC. Prod. 12 (1848) 71; MIQ. Fl. Ind. Bat. 2 (1858) 948. — *Coleus carnosus* HASSK. Flora 25 (1842) II, Beibl. 25; Cat. Hort. Bog. (1844) 130; BTH. in DC. Prod. 12 (1848) 79 (as *sp. dubia*); MIQ. Fl. Ind. Bat. 2 (1858) 953; RIDL. Fl. Mal. Pen. 2 (1923) 646. — *Coleus suborbicularis* ZOLL. & MOR. in Mor. Syst. Verz. (1846) 54. — *Majana amboinica* (LOUR.) O. K. Rev. Gen. Pl. 2 (1891) 524.

A more or less succulent herb, non-tuberous, 0.3–1 m. Stem and branches subterete, densely pubescent when young, glabrescent when old. Leaves thick, fleshy, broadly ovate, suborbicular or reniform, 5–7 by 4–6 cm, obtuse or rounded, base rounded or truncate, often long-attenuate, sparsely pubescent above and hirsute on the nerves beneath; margin coarsely crenate to dentate-crenate except in the basal part; petiole 2–4.5 cm, pubescent. Flowers in dense, 10–20 (or more)-flowered cymes forming subglobose verticillasters disposed in terminal spike-like inflorescences, rachis 10–20 cm, fleshy and pubescent. Bracts broadly ovate, 3–4 cm long, acute. Calyx campanulate, 2–4 mm long, hirsute and glandular, subequally 5-toothed, upper tooth broadly ovate-oblong, obtuse, abruptly acute, lateral and lower teeth acute. Corolla blue, curved and declinate, 8–12 mm long, tube 3–4 mm long,  $\pm$  trumpet-like widened; limb 2-lipped, upper lip short, erect, puberulent, lower lip long, concave. Filaments fused below into a tube around the style. Nutlets smooth, pale-brown, roundish flattened, c. 0.7 by 0.5 mm.

Distr. Possibly native in India, cultivated and introduced in many warmer parts of the world, almost pantropic, throughout *Malesia*.

LAUNERT *l.c.* remarked on this widely spread popular spice which is commonly used in tropical Africa that it may well be native in tropical Africa and spread from there in early times.

Ecol. Along roadsides, old garden lands, riverbanks, cliffs along roads in settled areas, up to c. 1500 m. Fl. Jan.–Dec. In Java flowering rarely,

not known to flower in the Philippines. Propagated by cuttings which readily take root.

Vern. Sumatra: *tramun*, Gajo, *daun djintèn, tèrbangun*, Karo; Java: *adjèran, atjèran, daun djintèn, S, daun kutjing, iwak ira, surawung, J, bangun bangun, daun djintèn, d. hati hati, sukan, tèrbangun, M, daun kambing, madja nèrèng, Md*; Bali: *iwak*; W. Flores: *golong dj. potjo*; Timor: *kuwu ètu*; Philippines: *clavo, limon, orégano, torongil de limon*, Span., *bildu*, Sul., *latai, suganda*, Sub., *suganda*, Tag.

Uses. Cultivated for its fragrant, aromatic leaves and assumed medicinal properties. In Malaya used as a flavouring for drinks; also used for coughs of children and pains near stomach or heart. According to BURKILL (Dict. 1935, 635) leaves are mixed with rice flour for offerings when a house is built. HEYNE wrote (Nutt. Pl. 1927, 1334) that leaves are rubbed on hair and clothes during bathing. OCHSE & BAKHUIZEN (*l.c.* 350) reported that in Java fresh leaves are added to certain dishes of fish or goat's meat to remove the strong smell. In the Philippines macerated leaves are used with burns and also for bites of centipedes and scorpions; furthermore for dyspepsia, asthma, and as a medicine after childbirth.

**6. *Plectranthus apoensis* (ELMER) H. KENG,** Gard. Bull. Sing. 24 (1969) 147. — *Coleus apoensis* ELMER, Leaf. Philip. Bot. 7 (1915) 2694; MERR. En. Philip. 3 (1923) 418.

Herb, 1–2 m. Stem and branches erect and slender, obscurely angular, puberulent. Leaves more or less succulent, suborbicular or reniform, 4–7.5 by 5–6.5 cm, rounded, base truncate, entire; margin elsewhere irregularly crenate or double-dentate; petiole 1.5–3 cm, slender, hairy. Flowers 6–8 in verticillasters, forming lax spicate inflorescences disposed in a large terminal panicle 20–25 cm long, 10–12 cm wide. Pedicels divaricate, 2 mm. Calyx campanulate, 2.5 mm long, upper tooth broad and 3-veined, lower 4 teeth sharply pointed. Corolla light blue, 6–7 mm long; tube slender, constricted at about the middle, slightly gibbous near the base; limb 2-lipped, upper lip recurved, lower lip concave, notched. Stamens 4, attached on the throat of corolla, enclosed. Style shortly 2-fid.

Distr. *Malesia*: Philippines (Mindanao: Mt Apo), one collection.

Ecol. Associated with grasses in thickets on fertile soil, along an open ridge, 1000 m. Fl. Sept.

Vern. *Calalapo-bulan*, Bagobo.

Note. The four stamens are attached on the throat of the corolla nearly at the same level, but do not form a filamentous tube as in *Coleus s. str.* Incidentally, ELMER described this plant under *Coleus* with uncertainty.

**7. *Plectranthus congestus* R. BR.** Prod. (1810) 506; BTH. Lab. Gen. Sp. (1832) 36; in DC. Prod. 12 (1848) 66; Fl. Austr. 5 (1870) 79; KENG, Gard. Bull. Sing. 24 (1969) 147; BLAKE, Contr. Queensl. Herb. 9 (1971) 52, f. 2 S, 4 g, 26, 36 (map).

Tall herb, 1–1.5 m. Stem and branches hoary-tomentose. Leaves membranaceous, ovate or elliptic, 2–6 by 1.5–4 cm, obtuse, base cuneate, entire; margin elsewhere undulate-crenate, tomentose on both surfaces; petiole 0.5–1 cm. Flowers

numerous (c. 20–30) in dense clusters, forming false spikes and disposed in terminal panicles 15 cm or more long, and 5–8 cm Ø. Pedicels subsessile, 1–2 mm long. *Calyx* villous and glandular-dotted, 2 mm long, in fruit 2.5–3 mm (the median teeth, in some fruiting specimens, e.g. WOMERSLEY NGF 11010, become broadened with a broadly acute to rounded tip), declinate, 5-toothed, the upper tooth broadly ovate, obtuse, not decurrent, the median and lower teeth subulate, acute, incurved. *Corolla* pale blue or lilac, with orange glands on outside surface of the lips, 6 mm long, declinate and slightly gibbous on the base of the upper side below the middle. *Stamens* epicorolline. *Nutlets* rounded, flattened, subtriquetrous, 0.8 mm Ø, glandular-dotted.

Distr. Queensland and NW. Australia; in *Malesia*: Lesser Sunda Is. (Timor) and E. New Guinea (incl. Louisiades).

Ecol. Open places and thickets, savannahs, coastal coral limestone and sea-cliffs, from sea-level to c. 1500 m. *Fl.* March–Aug.

**8. *Plectranthus parviflorus* WILLD.** En. Hort. Berol. 1 (1806) t. 65, non R. BR. 1810, *sens lat.*; BTH. Lab. Gen. Sp. (1832) 37; in DC. Prod. 12 (1848) 67; Fl. Austr. 5 (1870) 78; HILLEBRAND, Fl. Hawaii (1888) 344; MANSFELD, Bot. Jahrb. 62 (1929) 379; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 222; KENG, Gard. Bull. Sing. 24 (1969) 150; BLAKE, Contr. Queensl. Herb. 9 (1971) 35, f. 2 L, 4 A, 18, 35 (map). — *P. australis* R. Br. Prod. (1810) 506; BTH. in DC. Prod. 12 (1848) 67; DOMIN, Bibl. Bot. 22 (Heft 89) (1929) 1118. — *P. klossii* S. MOORE, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 137, incl. *var. major*; MANSFELD, Bot. Jahrb. 62 (1929) 379; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 222; KENG, Gard. Bull. Sing. 24 (1969) 150; BLAKE, Contr. Queensl. Herb. 9 (1971) 32, f. 2 B–C, 3 I, 16, 17 A–C, 36 (map).

Erect herb or semi-shrub, 0.1–1 m. Stem and branches rather fleshy, glabrescent to densely villous. *Leaves* thick- or thin-chartaceous, ovate to suborbicular, 1–2.5(–9) by 0.5–1(–5) cm, broadly acute or rounded, base rounded or subcordate, often slightly oblique, entire; margin elsewhere crenate or remotely crenulate, soft rugose or villous on both surfaces; petiole 0.5–1(–3.5) cm long, woolly. *Flowers* 6–12 in dense verticillasters, laxly disposed in terminal and upper axillary racemes 5–30(–35) cm long, simple or branched at the base. Bracts cordate, caducous. *Calyx* 1.2–2.5 mm long, in fruit 2.5–5 mm, densely villous and woolly, the upper tooth very broad, decurrent in fruit, the 4 lower teeth subulate, sharply pointed. *Corolla* white or light blue with dark markings on the throat, 3.5–5.5 mm long; lower lip boat-shaped, longer than the upper lip. *Stamens* exerted. *Nutlets* very minute, ovoid, c. 0.8 mm long.

Distr. Australia, Polynesia, and ?Melanesia; in *East Malesia*: Lesser Sunda Is. (Sumbawa, Wetar, Flores, Timor) and New Guinea.

The Sumatran specimens mentioned in the precursor *l.c.* 150 have here been discarded; their identity is uncertain and the material too young to place with certainty.

Ecol. Rocky, steep slopes, dry forest, savannah grassland, limestone cliffs, old garden lands,

(60–)400–2200 m. *Fl.* Oct.–May. According to VAN STEENIS very aromatic.

Vern. *Kunum*, W. Timor, Dawan lang., *ahi liga inen*, Bobonero; New Guinea: *mum*, Dani lang.

Notes. BLAKE (*l.c.* 35–45) devoted a critical, lengthy synonymy and discussion to this species which he amply described from Australian specimens. He said that *P. parviflorus* is distinguished in the field by its tuberous base, the (small) tuber formed at ground level being already developed in seedlings before the second pair of leaves is developed; after flowering plants die down almost to the tuber, new shoots being later produced from it and the basal part of the stem.

I have included in this concept also *P. klossii* from New Guinea which BLAKE keeps apart as a separate species. In carefully comparing his key and descriptions it turns up that the main difference given by BLAKE is the presence of a tuberous stem-base in *P. parviflorus*. In this species also the axis of the inflorescence would have, besides normal shorter and longer hairs, also sessile glands (in his key: 'many and coloured') while in *P. klossii* there would be no or few of such sessile coloured glands. In addition, he himself says (bottom of *l.c.* 39) that the indumentum of leaves and stems is more variable than those in the other Australian species, which observation almost reduces the assumed differences between *P. klossii* and *P. parviflorus* to the tuberous stem-base. However, there are no complete collections of *P. klossii* including the stem-base, so that we are ignorant in this respect. It is remarkable that BLAKE completely ignored to mention the very close affinity.

CLAMAGIRAND 59bis, from Timor, has exceptionally long pedicels, 5–6 mm, under the fruiting calyx.

**9. *Plectranthus rotundifolius* (POIR.) SPRENG.** Syst. 2 (1825) 690; BTH. in DC. Prod. 12 (1848) 65. — *Germanea rotundifolia* POIR. Encycl. Suppl. 2 (1812) 763. — *P. tuberosus* BL. Bijdr. (1826) 838; ALSTON in Trimen, Handb. Fl. Ceyl. 6 (1931) Suppl. 236. — *Ocymum tuberosum* FÉE, Rec. Trav. Soc. Amateurs Sc. Agr. Arts Lille (1826/27) 193–212; repr. p. 8, non ROXB. 1832. — *Coleus tuberosus* (BL.) BTH. Lab. Gen. Sp. (1832) 59, non A.RICH. 1851; HASSK. Cat. Hort. Bog. (1844) 129; BTH. in DC. Prod. 12 (1848) 79; MIQ. Fl. Ind. Bat. 2 (1858) 953; F.-VILL. Nov. App. (1880) 163; HOOK. f. Fl. Br. Ind. 4 (1885) 625; MERR. Int. Rumph. (1917) 459; RIDL. Fl. Mal. Pen. 2 (1923) 646; HEYNE, Nutt. Pl. (1927) 1335; OCHSE & BAKH. Ind. Groent. (1931) 351, f. 222; BURK. Dict. (1935) 636. — *Coleus parviflorus* BTH. in DC. Prod. 12 (1848) 72; KOORD. Exk. Fl. Java 3 (1912) 157; BACK. & BAKH. f. Fl. Java 2 (1965) 637; PURSEGLOVE, Trop. Crops, Dicot. 2 (1968) 634. — *Coleus rotundifolius* (POIR.) CHEV. & PERROT in Chev. Vég. Ut. Afr. Trop. Franç. 1 (1905) 101; CHEV. Rev. Bot. Appl. Agr. Col. 18 (1938) 482.

Decumbent or ascending herb, 0.4–1 m; lower half of stem creeping, rooting from the nodes, and some of the roots swollen into sessile, oblong, 2–4 cm long, brownish black, aromatic tubers similar to small potatoes. Stem densely pubescent on the angles. *Leaves* thick-membranaceous, juicy, faintly aromatic when bruised, ovate to broadly ovate or suborbicular, 2–5(–6) by 1.5–3.5(–4) cm, rounded, base cuneate; margin elsewhere coarsely

crenate; petiole 1-3(-5) cm. Terminal false spikes 5-15 cm long. Flowers 4-6 in a verticillaster. Pedicels 1-2 mm, puberulent. Bracts minute. *Calyx* campanulate; upper and lower teeth reflexed at anthesis; upper tooth oblong, acute, finely ciliate; median ones very short, with rounded apex; lower teeth highly connate forming an almost truncate apex, abruptly acute as 2 tips, widely apart. *Corolla* light or dark violet, 7-10(-12) mm long, tube strongly curved; upper lip very short. Filaments connate below into a tube enveloping the style.

Distr. ?India, frequently cultivated in Madagascar, Ceylon, throughout continental Asia and in *Malesia*: Sumatra, Malaya, Java, Philippines, Moluccas.

The native country is not definitely known; it may have originated in cultivation in ancient times. It was already well-known to RUMPHIUS.

Ecol. Cultivated only, in the lowland, rarely up to c. 1000 m. *Fl.* Febr.-Aug.

Vern. Sumatra: *tramun*, Gajo, *hombili*, *këmbili*, *këmbili*, M; Java: *huwi këntang*, *këntang*, *k. bogor*, *k. djawa*, *k. saba*, *kumili djawa*, *S*, *daun sabrang*, *gombili*, *këntang djawa*, *ubi këmbili*, M, *gëmbili*, *këntang djawa*, *k. djëmbut*, *k. eeler*, *k. eereng*, *k. këntul*, *k. klitji*, *kumbili djawa*, *J*, *kambili*, *k. gangan*, *k. larbhat*, *larbha(k)*, *obijsola*, Md; Borneo: *gambili*, *gombili*, M; Bali: *sabrang*; Lombok: *sëbrang*; Moluccas: *kombili*, M, *isahu*, *isياهو*, *katilën*, Ceram, *safut*, Buru, *tua*, Key Is.

Uses. The white, starchy, slightly aromatic tubers become dark with age. They are eaten cooked or steamed, sometimes even raw; they are also mixed with *sayor*. Adult tubers are also used as a substitute for potatoes, for the preparation of minced meatballs. BURKILL (Dict. 1935, 636) says they should be consumed in small quantities, as they are somewhat indigestible. HEYNE (*l.c.* 1335) says cultivation in Java is mostly in loose soil on fallow rice-fields, in West Java (Banten, Djakarta) and East Java (Bagelen, Kedum Jogja); harvested after 3-4 months. HARTLEY (*Lloydia* 32, 1969, 265) listed it as a potential anti-cancerogene.

Note. No fruiting specimens are ever found in Java.

10. *Plectranthus scutellarioides* (L.) R. BR. Prod. (1810) 506; BL. Bijdr. (1826) 837; HUNTER, J. Str. Br. R. As. Soc. n. 53 (1909) 100. — *Ocymum scutellarioides* LINNÉ, Sp. Pl. ed. 2, 2 (1763) 834; BURM. f. Fl. Ind. (1768) 130. — *Polypodium ovatum* BURM. f. Fl. Ind. (1768) 223; cf. STEEN. Bull. Jard. Bot. Btzg. III, 13 (1934) 288. — *P. aromaticus* ROXB. Hort. Beng. (1814) 45, *nom. valid.*, based on RUMPH. Herb. Amb. 5, t. 101, *non* (BTH.) ROXB. 1832. — *P. ingratus* BL. Bijdr. (1826) 836. — *P. laciniatus* BL. Bijdr. (1826) 838. — *Coleus scutellarioides* (L.) BTH. in Wall. Pl. As. Rar. 2 (1830-31) 16; Lab. Gen. Sp. (1832) 53; in DC. Prod. 12 (1848) 73; MIQ. Fl. Ind. Bat. 2 (1858) 949, *incl. var. ingratus* (BL.) MIQ., *var. gracilis* MIQ., *var. laciniatus* (BL.) MIQ., *var. blumei* (BTH.) MIQ. *et var. celebica* MIQ.; Sum. (1860) 571, *incl. var. gracilis* MIQ.; F.-VILL. Nov. App. (1880) 163; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 528; KOORD. Exk. Fl. Java 3 (1912) 156; MERR. Int. Rumph. (1917) 460; KOORD. Fl. Tjibodas 3 (1918) fam. 254, p. 93; MERR. En. Philip. 3 (1923) 420 (as

excl. sp.); BACK. Onkr. Suiker. (1931) 569; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 288; BACK. & BAKH. f. Fl. Java 2 (1965) 637; KENG, Gard. Bull. Sing. 24 (1969) 51, f. 9, *incl. var. crispipilus* (MERR.) KENG, *var. grandifolius* (BTH.) KENG, *var. integrifolius* (ELMER) KENG *et var. gibbsiae* (S. MOORE) KENG. — *Coleus atropurpureus* BTH. in Wall. Pl. As. Rar. 2 (1830-31) 16, *incl. var. ramosior* BTH.; Lab. Gen. Sp. (1832) 54; in DC. Prod. 12 (1848) 74, *incl. var. densiflorus* BTH. *et var. javanicus* BTH.; MIQ. Fl. Ind. Bat. 2 (1858) 951; F.-VILL. Nov. App. (1880) 163; PRAIN, J. As. Soc. Beng. 74, ii (1907) 706; KOORD. Exk. Fl. Java 3 (1912) 156; RIDL. Fl. Mal. Pen. 2 (1923) 646; MERR. En. Philip. 3 (1923) 418; BARTLETT, Pap. Mich. Ac. Sc. 6 (1926) 59; BURK. Dict. (1935) 635; DOAN, Fl. Gén. I.-C. 4 (1936) 950; HEND. J. Mal. Br. R. As. Soc. 17 (1939) 65; Mal. Nat. J. 6 (1950) 396, f. 366; QUIS. Medic. Pl. Philip. (1951) 815. — *Coleus acuminatus* BTH. Linnaea 6 (1831) 81 (type in Leningrad); in DC. Prod. 12 (1848) 73; MIQ. Fl. Ind. Bat. 2 (1858) 950; F.-VILL. Nov. App. (1880) 163; VIDAL, Phan. Cuming. Philip. (1885) 135; Rev. Pl. Vasc. Filip. (1886) 213; MERR. En. Philip. 3 (1923) 418. — *Coleus ingratus* (BL.) BTH. Lab. Gen. Sp. (1832) 53; HASSK. Cat. Hort. Bog. (1844) 129; MOR. Syst. Verz. (1846) 54; BTH. in DC. Prod. 12 (1848) 73; KOORD. Exk. Fl. Java 3 (1912) 156. — *Coleus grandifolius* BTH. Lab. Gen. Sp. (1832) 54; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 398; Herb. Timor. Descr. (1835) 70; SPANOGHE, Linnaea 15 (1841) 333; BTH. in DC. Prod. 12 (1848) 73; MIQ. Fl. Ind. Bat. 2 (1858) 952. — *Coleus secundiflorus* BTH. Lab. Gen. Sp. (1832) 55; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 398; Herb. Timor. Descr. (1835) 70; BTH. in DC. Prod. 12 (1848) 75; MIQ. Fl. Ind. Bat. 2 (1858) 952. — *Coleus blumei* BTH. Lab. Gen. Sp. (1832) 56; HASSK. Cat. Hort. Bog. (1844) 129; BTH. in DC. Prod. 12 (1848) 75; F.-VILL. Nov. App. (1880) 163; KOORD. Exk. Fl. Java 3 (1912) 157; MERR. Fl. Manila (1912) 410; Int. Rumph. (1917) 460; Sp. Blanc. (1918) 339; En. Philip. 3 (1923) 419; RIDL. Fl. Mal. Pen. 2 (1923) 646; BURK. Dict. (1935) 635; QUIS. Medic. Pl. Philip. (1951) 815. — *Coleus laciniatus* (BL.) BTH. Lab. Gen. Sp. (1832) 56; HASSK. Cat. Hort. Bog. (1844) 129; BTH. in DC. Prod. 12 (1848) 76; KOORD. Exk. Fl. Java 3 (1912) 156; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 56. — *Coleus multiflorus* BTH. Lab. Gen. Sp. (1832) 55; WALP. Nov. Act. Ac. Caes. Leop.-Car. 19 (1843) Suppl. 1, 373; Reperit. 3 (1845) 517; BTH. in DC. Prod. 12 (1848) 75; MIQ. Fl. Ind. Bat. 2 (1858) 951; F.-VILL. Nov. App. (1880) 163; MERR. En. Philip. 3 (1923) 419; *non P. multiflorus* HOCHST. *ex BTH.* in DC. Prod. 12 (1848) 49. — *Coleus pumilus* BLANCO, Fl. Filip. (1837) 482; ed. 2 (1845) 336; ed. 3, 2 (1878) 257; BTH. in DC. Prod. 12 (1848) 78; MIQ. Fl. Ind. Bat. 2 (1858) 950; MERR. Fl. Manila (1912) 410; Sp. Blanc. (1918) 339; En. Philip. 3 (1923) 420; STAPP in Curtis, Bot. Mag. 150 (1924) t. 9034. — *Coleus grandifolius* BLANCO, Fl. Filip. (1837) 482; ed. 2 (1845) 336; ed. 3, 2 (1878) 258, t. 208; F.-VILL. Nov. App. (1880) 163; *non BTH.* Lab. Gen. Sp. (1832) 54. — *Coleus verschaffeltii* LIM. Illustr. Hort. 8 (1861) t. 293. — *P. monadelphus* LLANOS *ex F.-VILL.* & NAVES in Blanco, Fl. Filip. ed. 3, 4 (1880) 105; *non* ROXB. 1832. — *Majana scutellarioides* (L.) O. K. Rev. Gen. Pl. 2 (1891) 524,

*incl. var. atropurpureus* (BTH.) O. K. *et var. blumei* (BTH.) O. K. — *Coleus hybridus* Hort. ex VILM. Blumengärtnered. 3, Voss & Sieb. 1 (1896) 844; BRUGGEMAN, Ind. Tuinboek (1939) 111. — *Coleus igolotorum* BRIQ. Ann. Cons. Jard. Bot. Genève 2 (1898) 236; MERR. En. Philip. 3 (1923) 419. — *Coleus gaudichaudii* BRIQ. Ann. Cons. Jard. Bot. Genève 2 (1898) 237. — *Coleus formosanus* HAYATA in Matsum. & Hayata, En. Pl. Formos. (1906) 320; KUDO, Mem. Fac. Sc. & Agr. Taihoku Un. 2, 2 (1929) 145; HATUS. Mem. Fac. Agr. Kagoshima Un. 5 (1966) 48. — *Coleus macranthus* MERR. *var. crispipilus* MERR. Philip. J. Sc. 1 (1906) Suppl. 234. — *Coleus pubescens* MERR. Philip. J. Sc. 3 (1908) Bot. 432; En. Philip. 3 (1923) 420. — *Coleus crispipilus* MERR. Philip. J. Sc. 5 (1910) Bot. 382; En. Philip. 3 (1923) 419. — *Coleus zschokkei* MERR. Philip. J. Sc. 5 (1910) Bot. 382; En. Philip. 3 (1923) 420. — *Solenostemon blumei* (BTH.) MAZA in Maza & Roig. Fl. Cuba (Bot. Ser. Agr. Commer. Trab. Cuba n. 22) (1914) 127, in obs. — *Coleus rehnelianus* A. BERGER, Bot. Jahrb. 54 (1915) Beibl. 120, p. 71; ALSTON in Trimen, Handb. Fl. Ceyl. 6 (1931) Suppl. 236; BACK. & BAKH. f. Fl. Java 2 (1965) 637. — *Coleus integrifolius* ELMER, Leaf. Philip. Bot. 7 (1915) 2696; MERR. En. Philip. 3 (1923) 419. — *Coleus sp.* MERR. Philip. J. Sc. 11 (1916) Bot. 311. — *Coleus gibbsiae* S. MOORE in Gibbs, Arfak (1917) 178. — *P. blumei* (BTH.) LAUNERT, Mitt. Bot. München 7 (1968) 301; ADAMS, Fl. Jamaica (1972) 645. — *Solenostemon scutellarioides* CODD, Bothalia 11 (1975) 439.

Erect or ascending branched herb, 0.5–1.5 m, aromatic, without tubers. Stem and branches finely pubescent or glabrous. *Leaves* membranaceous, very variable in size, shape and colour, generally ovate in outline, blade 1–15 (usually 4–7) by 1–10 (usually 3–5) cm, acute or acuminate, base rounded or cuneate, entire, margin elsewhere crenate, serrate, remotely crenate or sometimes lacinate, pubescent on the main and secondary veins; petiole 1–5(–8) cm. *Flowers* in verticillasters or in irregularly branched cymes disposed in simple or branched thyrses 5–10(–25) cm long, 3–5(–8) cm Ø; peduncles of the lateral cymes short or elongated. Bracts ovate-acute, pubescent, 2–3 mm long, caducous. *Calyx* obliquely campanulate, 10-nerved, 2–2.5 mm long, in fruit 4–6 mm, hirsute and sparingly gland-dotted, unequally 5-toothed; upper tooth broadly ovate, subacute; two lateral teeth very short, oblong-obtuse, truncate or rounded, occasionally mucronate with a tiny apiculate apice; two lower teeth subulate, connate. Pedicels 3–4 mm, pubescent. *Corolla* boat-shaped, blue or violet, with whitish tube, upper lip often paler than the lower one, 8–13 mm long (rarely 15–18 mm in some Papuan specimens), puberulent, tube abruptly decurved, upper lip short, erect, lower lip long, concave, enclosing the stamens and most of the style. *Stamens* in 2 pairs; filaments connate beyond the point of attachment to the corolla tube. *Nutlets* broadly ovate or orbicular, brown, shining, 1–1.2 mm long.

Distr. Continental SE. Asia (India, Burma, Thailand, Indo-China, S. China), Formosa, throughout *Malesia* to Australia, Melanesia (Solomons) and Polynesia. In *Malesia* also frequently cultivated for ornamental purpose and here and there spontaneous.

Ecol. On all sorts of habitats from the lowland to the mountains, in rain-forest, along shaded stream-banks and other watercourses, on rice-field dykes, in thickets, in Malaya also on limestone hills, in secondary forest, mossy forest, etc. up to c. 2900 m. Fl. Jan.–Dec.

Taxon. Recently LAUNERT (Mitt. Bot. München 7, 1968, 301) dropped the Linnean basionym and coined a new combination for the *Malesian* plant, without giving evidence in what respect *P. blumei* differs from *P. scutellarioides*.

Vern. Sumatra: *aram gara*, (*daun*) *ati ati*, *hatisolo*, *poko ati ati*, *singgelam*, *tinggëlan*, M, *saribotong uding*, Simalur, *bangun bangun na geger*, *b. b. na rata*, (*bunga*) *piladan(g)*, *si grësing*, Batak; Java: *djawër beureum*, *d. kotok*, *si grësing*, S, *daun bunga*, *d. pinang*, *d. pupur*, *d. wangi*, *dilam*, *majana*, *m. mas*, *m. mèrah*, *miara mas*, *mijana*, *nilam*, *n. bunga*, *n. pinang*, M, *iler*, *këntangan*, J, *arak*, *daun dhilëm*, *d. dhilëp*, *dhin kamadhanan*, Md; Lesser Sunda Is.: *arak*, *dëlëm*, *dilëm*, *miana*, *m. irëng*, *m. muk*, *m. nila*, *m. tjëmëng*, Bali, *kunu wangi*, Timor, *kunu roto*, Sawu; Borneo: *sa-mayuk*, Sg. Segaliud, Sabah, *ati ati*, Kedayan lang.; Philippines: *malamayana*, Tag., *badiara*, *maliana*, *mayana*, Tag., Bis., Pamp., *dapomaya*, *lampunaga*, *lapunaya*, *tapomaya*, Bis., *maryana*, *maryapa*, Pamp., *sahemaya*, *saymayu*, Sul., *salumaya*, Sub., *aga dinokud*, *kodalita*, If., *myana*, Cebu; Moluccas: *até até*, *a. a. mahamu*, *a. a. mopura*, *atei*, *ati ati*, *atoi mapuha*, *daun dilam*, *mayana*, *m. hitam*, *pantji-pantji*, *pupuru*, *rangon tati*, *salbu kero*, *salëbung*, *s. kero*, *saru-saru*, *sërëwung*, *s. mea*, *s. raindang*, *s. rangdang*, *s. rundang*; *ton kau*, Ceram; New Guinea: *amaneh*, Kompiai, *budinar* (*pap*), Merauke, *bungu*, Onjob lang., Cape Vogel, *edomani*, Enga lang., *Wabag*, *doraim*, Chimbu, *Masul*, *kondu*, Hagen, *ib'kombi*, *kabwe*, *karap*, *kombil*, Mendi lang., *kumberumi*, Kaugel dial., *Medpa*, *maifërai*, Duntantina, *moipaherra*, Asaro, *Kefamo*, *ngondum*, *Waghi*, *Minj*, *nump*, *Yoowid* dial., Chimbu, Hagen lang., *nongu nongu*, Tifal lang., *Telefomin*, *oiabua*, *Minufia* lang., *Kabubu*, *porbagu*, Kutubu lang., *Wasemi* I., *ekinarò*, *kiena-ëro*, *uwoije*, Kapauko lang., *waokum*, Dani lang., *Baliem*, *mun*, Dani lang., *nogoipa*, Kukubari, Tari Subdistr., *ljamun*, *tagau*, *kapugund*, Kepilam, Enga lang., *apiuna*, Kainantu.

Uses. Except cultivation for ornamental purpose this species is also assumed to have medicinal use. BURKILL (Dict. 1935, 635) says it is employed for dyspepsia and ophthalmia. In Java and Sumatra it is used as an abortifacient and also as a repellent for intestinal worms. In the Philippines sometimes used for head-aches and bruises. In Java many minor uses, see HEYNE, Nutt. Pl. (1927) 1334.

Notes. From the complicated synonymy it is already clear that this is a common variable species. In the precursor I distinguished four varieties, mostly based on formerly described species. But as more specimens were available it became clear that they are connected by too many intermediate specimens. Leaf-colour, -size and -shape vary enormously, especially in cultivation. Thus I agree with BACKER, who also took (1965) a broad view of its delimitation. Some forms — often in cultivation — with lacinate leaves, the main characters for distinguishing *P. laciniatus* BL. = *Coleus laciniatus* (BL.) BTH., are genetically

apparently based on minor differences. KUSWATA (unpubl.) could raise from seed of a form with shallowly dentate leaf margin and regular venation another form with laciniate leaves and irregular venation. RIFE (Proc. Summerschool Bot. 1960, 334-340) has shown that the laciniate form differs in only a single gene from that with the normal leaf shape. Also the flower colour is variable.

In New Guinea this common species is very variable: BW 14029, from Anggi Gita Lake, Arfak (vern. *armessèssa*, Manikiong lang.) and LAE 54026, from Mt Suckling, have very small and narrow leaves, 10-20 by 4-7 mm; in KOSTERMANS 567 from Baliem Valley, leaves and stems are densely tomentose; in NGF 21345 from Finisterre Mts (vern. *mowdarapo*, Sewe), calyx and corolla are unusually large; in ROBBINS 1022 and ANU 5822, from Kainantu, leaves are thick and densely hairy; NGF 38843 has hairy leaves; BRASS 22157 from Milne Bay Distr., has unusually narrow, lanceolate, hairy leaves.

**11. *Plectranthus merrillii* H. KENG, nom. nov.** — *Coleus macranthus* MERR. Philip. J. Sc. 1 (1906) Suppl. 234; *ibid.* 5 (1910) Bot. 382; En. Philip. 3 (1923) 419; KENG, Gard. Bull. Sing. 24 (1969) 59, non *P. macranthus* HOOK. f. 1885.

Erect, branched herb, 1-2 m, rather fetid-aromatic. Stem and branches rusty pubescent when young. *Leaves* membranaceous, ovate, oblong-ovate or narrowly rhomboid, 4-12(-15) by 1.5-5(-7) cm, acute or broadly acute, base rounded, subtruncate or acute, always entire and decurrent; margin elsewhere serrate or remotely dentate; puberulent on both surfaces but with more punctate glands beneath; petiole 2-6(-7) cm, slender. *Flowers* 5-9 (rarely more) in stalked cymes arranged in terminal or subterminal thyrses, 15-25 cm long, 4-5 cm  $\varnothing$ , in fruit to 30 cm long; rachis glandular-puberulent. Bracts lanceolate, 2-3 mm, caducous. *Calyx* campanulate, glandular-puberulent without, 4-7 mm long, in fruit 8-12 mm, upper tooth broadly ovate, acute, lateral teeth short and ovate with rounded apex, the lower teeth linear-lanceolate, connate, longer than the rest. *Corolla* lavender or white, 1.5-2 cm long, slightly puberulent, the tube rather gradually widening, narrowly funnel-shaped; upper lip short and 3-lobed, lower lip concave. *Nutlets* ovoid, 1.2-1.6 mm long, glabrous.

Distr. *Malesia*: Philippines (N. Luzon, Mountain Prov.).

Ecol. Primary forest, mossy forest, 1200-2460 m. Fl. Febr.-April, Sept.-Oct.

Vern. *Bungbungtit*, Ig.

**12. *Plectranthus sparsiflorus* (ELMER) H. KENG, comb. nov.** — *Coleus sparsiflorus* ELMER, Leaf. Philip. Bot. 7 (1915) 2699; MERR. En. Philip. 3 (1923) 420; KENG, Gard. Bull. Sing. 24 (1969) 60. — *Coleus scutellarioides* ELMER, Leaf. Philip. Bot. 7 (1915) 2697, non (L.) BTH. 1830.

Suberect herb, 30-40 cm, often branched below. Stem and branches glabrous, rooting in the lower part. *Leaves* membranaceous, oblong-lanceolate or elliptic, 3-10 by 1.5-4 cm, acute or caudate, base cuneate, entire; margin elsewhere crenate-serrate or obtusinate; glabrous on both surfaces, nerves hirsute or puberulent; petiole 1-2.5 cm, slender. *Flowers* 1-3 in cymules disposed in short thyrses;

thyrses terminal or in the upper leaf axils, 2-4 cm long and  $\varnothing$ ; rachis puberulent, 3-5-branched. Bracts ovate, 8-10 mm long, acute, caducous. *Calyx* turbinate, 3.5-4 mm long, in fruit 5-6 mm, glandular and hirsute; upper tooth rounded, 5-nerved (3 main nerves and 2 additional lateral ones); lateral teeth deltoid, pointed; lower teeth lanceolate, pointed, connate below, longer than the rest. *Corolla* pale violet or violet, 10-18 mm long, tube decurved, limb 2-lipped. *Stamens* in 2 pairs. *Nutlets* (? immature, ELMER 13614) oblong-cylindric, 1.4 mm long.

Distr. *Malesia*: Philippines (Mindanao).

Ecol. In damp, mossy forest, 1000-1900 m. Fl. March-Sept.

Vern. *Manangid-ta-usá*, Bag., *nabioda*, Mbo., *handamy*, Cebu, *sliyav*, *sulumayas*, Sindangan dial.

**13. *Plectranthus galeatus* VAHL, Symb. Bot. 1 (1790) 43; BL. Bijdr. (1826) 836.** — *Germanea galeatus* (VAHL) POIR. in Lamk, Encycl. Suppl. 2 (1812) 763. — *P. macrophyllus* BL. Bijdr. (1826) 835. — *P. bicolor* BL. l.c. 837, incl. variety. — *Coleus galeatus* (VAHL) BTH. Lab. Gen. Sp. (1832) 56; HASSK. Cat. Hort. Bog. (1844) 129, incl. var. *rubrinervis* HASSK.; BTH. in DC. Prod. 12 (1848) 76; MIQ. Fl. Ind. Bat. 2 (1858) 955; KOORD. Exk. Fl. Java 3 (1912) 156; Fl. Tijbodas 3 (1918) fam. 254, p. 93; BACK. & BAKH. f. Fl. Java 2 (1965) 637; KENG, Gard. Bull. Sing. 24 (1969) 60, incl. var. *borneensis* KENG; STEEN. Mt. Fl. Java (1972) pl. 24-5. — *Coleus bicolor* (BL.) BTH. Lab. Gen. Sp. (1832) 55; HASSK. Cat. Hort. Bog. (1844) 129; BTH. in DC. Prod. 12 (1848) 75; MIQ. Fl. Ind. Bat. 2 (1858) 954; KOORD. Exk. Fl. Java 3 (1912) 156. — *Coleus macrophyllus* (BL.) BTH. Lab. Gen. Sp. (1832) 55; HASSK. Cat. Hort. Bog. (1844) 129, incl. var. *concolor* HASSK.; BTH. in DC. Prod. 12 (1848) 75; MIQ. Fl. Ind. Bat. 2 (1858) 951. — *Coleus spectabilis* MIQ. l.c. 951. — *Coleus remotiflorus* MIQ. l.c. 954; RENDLE, J. Bot. 63 (1925) Suppl. 82. — *Coleus puberulus* MIQ. Fl. Ind. Bat. 2 (1858) 955; BOERL. Handl. 2 (1899) 714. — *Coleus macropus* MIQ. Fl. Ind. Bat. 2 (1858) 956.

Erect or ascending, sparsely branched, slender herb, up to 1.5 m. Stem and branches rusty pubescent when young, often with purple dots. *Leaves* varying from oblong to broadly ovate, mostly ovate, 6-12(-18) by 3-8(-13) cm, acute or acuminate, base rounded or shortly cuneate, subentire, margin elsewhere irregularly crenate, glabrous above, pubescent on the nerves below; petiole 3-10 cm, very slender, puberulous. *Flowers* 5-8 (rarely up to 15) in short, stalked cymes disposed in terminal and axillary thyrses; these 5-15 by 4-5.5 cm, often branched at the base; rachis rusty-sericeous. Bracts subulate, 2-3 mm, caducous. *Calyx* subcampanulate, sericeous and gland-dotted, 3-5 mm long, in fruit 7-8 mm, unequally 5-toothed; upper tooth ovate, subacute, often strongly reflexed in fruiting stage, many-nerved, lateral teeth deltoid, acute at apex, lower teeth lanceolate-subulate, connate, longer than the rest, accrescent in fruit. *Corolla* purplish blue or white with purple lower lip, 1.5-2 cm long, puberulous, tube very slender below, slightly gibbous at the base, abruptly decurved above; limb 2-lipped; upper lip short and erect, lower lip concave; filaments partly exerted. *Nutlets* broadly ovoid, 1 mm long.

Distr. *Malesia*: Sumatra (rare), Java (becoming rare in East Java), Lesser Sunda Is. (Bali), Borneo (Kinabalu area and E. Kutei).

Ecol. Fago-Lauraceous rain-forests, in Borneo also in Dipterocarp forest; also in mossy elfin forest, (450-)1000-2400 m. Fl. Jan.-Dec. Leaf-galls caused by mites. In E. Java sometimes found at 600 and 800 m, and in E. Kutei (Borneo) found along streamsides at 450-700 m; also in Bali at 450 m, but these low localities are exceptional. The species prefers wet forest and damp soils; it does not occur in *Casuarina* forest and in E. Java only in the ever-wet enclaves.

Vern. Java: *miara*, *sĕlasih hutan*, M, *djawĕr gĕdĕh*, *d. gunung*, *d. konĕng*, *d. kotok*, S, *dhin-kamandhinan*, Md.

**14. *Plectranthus kunstleri*** PRAIN, J. As. Soc. Beng. 66, ii (1897) 521; *ibid.* 74, ii (1907) 706; Ann. R. Bot. Gard. Calc. 9 (1906) 55, pl. 70; RIDL, Fl. Mal. Pen. 2 (1923) 646; STEEN, Bull. Jard. Bot. Btzg III, 13 (1934) 222; KENG, Gard. Bull. Sing. 24 (1969) 151.

Erect herb, 0.5-1 m high. Stem and branches finely puberulous. Leaves thin-membranaceous, ovate to broadly ovate, 6-12 by 4-6 cm, acute, base truncate or cuneate, entire, margin elsewhere remotely crenate, very sparsely pubescent on the main and secondary veins on both surfaces; petiole 1-4.5 cm. Flowers in terminal panicles, 10-15 cm long, the lower branches 5-6 cm. Bracts ovate, acute, 2-3 mm long, caducous. Calyx obliquely campanulate, 2-2.5 mm long, in fruit 6-7 mm, shortly hirsute and sparingly gland-dotted, unequally 5-toothed; upper tooth broadly ovate, subrounded; two lateral teeth shorter (about  $\frac{3}{4}$ ) than the lower teeth (later almost equal in fruit); two lower teeth subulate, connate beneath. Pedicels 3-4 mm long, glandular-puberulent. Corolla boat-shaped, pinkish purple, 7-8(-10) mm long, puberulent, tube decurved, only slightly gibbous near the base, upper lip short, erect, lower lip concave, enclosing the stamens and style. Stamens in 2 pairs; filaments free from each other from the point of attachment to the corolla tube. Nutlets oblong ovoid, black, 1 mm long.

Distr. *Malesia*: Malay Peninsula (Perak: Kula Dipang, 2 coll.) and recently Pulau Langkawi (Kedah).

Ecol. On limestone rocks, in shade, at 50-200 m.

#### Cultivated

***Plectranthus caninus*** ROTH, Nov. Pl. Sp. (1821) 279. — *Ocimum monadelphum* ROTH, l.c. 267. — *Coleus spicatus* BTH. in Wall. Pl. As. Rar. 2 (1830-31) 15; HOOK. f. Fl. Br. Ind. 4 (1885) 624; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 52, non *Plectranthus spicatus* auct. al. — *Coleus heyneii* BTH. Lab. Gen. Sp. (1832) 50. — *P. monadelphus* ROXB. Fl. Ind. ed. Carey 3 (1832) 22.

Procumbent herb. Leaves thick, fleshy, obovate-spathulate, 3-5 by 2-4 cm, crenate or remotely dentate, apex rounded, base narrowly attenuate. Thyse terminal cylindrical, to 12 cm long, peduncled. Corolla bright blue-mauve, 2.5 cm long, gibbose. Filaments high-fused.

Native of India, cultivated and probably run wild in the highlands of New Guinea (Toromambuna

Mission Station, BORGMANN 342; Kainantu Sub-distr., Aiyura H.A.E.S., in nursery plots, NGF 42901).

If the synonymy provided by Hooker f. is correct this name must be accepted as the valid name for what was currently called *Coleus spicatus* in India, of which I have not seen material. If the species would also occur in E. Africa, as HOOKER f. suggested with a question mark and with reference to *Ocimum zatarhendii* FORSSK., the name *Plectranthus zatarhendii* (FORSSK.) BRUCE, Kew Bull. (1935) 590, should be accepted.

#### Doubtful & Excluded

*Coleus* ? *blancoi* BTH. in DC. Prod. 12 (1848) 79; MIQ. Fl. Ind. Bat. 2 (1858) 957.

This was re-named for *Coleus grandifolius* BLANCO, Fl. Filip. (1837) 482, a later homonym of *C. grandifolius* BTH. 1832. BLANCO stated that it is common in the Philippines. According to MERRILL (1923) and QUISUMBING (1951), it is a synonym of *Coleus blumei* or *Plectranthus scutellarioides* (L.) R. BR.

*Coleus grandifolius* (non BTH. 1832) KOORD. Minahassa (1898) 561.

Recorded as wild and cultivated at Manado, Celebes. Probably refers to either *Plectranthus scutellarioides* (L.) R. BR. or its form, earlier recognized as *Coleus scutellarioides* var. *grandifolius* (BTH.) H. KENG.

*Coleus macrostachys* BTH. Lab. Gen. Sp. (1832) 57; in DC. Prod. 12 (1848) 76; MIQ. Fl. Ind. Bat. 2 (1858) 952; KOORD. Exk. Fl. Java 3 (1912) 156.

Based on COMMERSON'S collection, also listed two Zollinger numbers (928 and 1970), all from Java. '*Verticillastri 10-15-flori . . . calyx . . . dentes laterales acuti et infimi . . .*'. Exact identity unknown.

*Coleus persoonii* BTH. 1832; G. DON, Gen. Hist. 4 (1838) 683.

A native of Madagascar. Erroneously recorded as occurring also in Luzon, the Philippines.

*Coleus savannicola* K. SCH. in K. Sch. & Laut. Fl. Schutzgeb. (1900) 529; MANSFELD, Bot. Jahrb. 62 (1929) 380.

Type specimen was from New Guinea (Kaiser Wilhelms Land, Bismarck Mts, 500-1000 m, LAUTERBACH 2777). According to MANSFELD probably merely a form of *Coleus scutellarioides* = *Plectranthus scutellarioides* (L.) R. BR.

*Coleus verschaaffeltii* LEM. Illustr. Hort. 8 (1861) t. 293.

Originally described as '*Plectranthus blumei* var.' by J. VERSCHAFFELT in Bull. Comptes-rendu expos. de la Soc. royale d'Agric. et de Bot. de Gand, 23-24 juin 1861. It is most likely a synonym of *Plectranthus scutellarioides* (L.) R. BR.

*Plectranthus australis* (non R. BR. 1810) DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 397; Herb. Timor. Descr. (1835) 69.

Based on GAUDICHAUD'S collection from Timor. Probably refers to *P. parviflorus* WILLD.

*Plectranthus coetsa* BUCH.-HAM. ex D. DON 1825; G. DON, Gen. Hist. 4 (1838) 680.

Mentioned the occurrence of this species in Java. As it resembles *P. teysmannii* MIQ. in inflorescence and flower, it is possibly due to an erroneous identification of the latter species.

*Plectranthus crassifolius* HASSK. Flora 40 (1857) 652, non BTH. 1832.

HASSKARL received this plant labelled as '*P. patchouli*'. Exact identity unknown, possibly refers to either *Pogostemon cablin* (BLANCO) BTH. or, more likely, to *Plectranthus amboinicus* (LOUR.) SPRENG.

*Plectranthus leschenaultii* BTH. Lab. Gen. Sp. (1832) 34; in DC. Prod. 12 (1848) 64; MIO, Fl. Ind. Bat. 2 (1858) 947; KOORD. EXK. Fl. Java 3 (1912) 155.

Based on LESCHENAUULT's collection from Java. Exact identity unknown.

#### Cultivated

*Cedronella canariensis* (L.) WEBB & BERTH.: BACK. & BAKH. f. Fl. Java 2 (1965) 621.

Native of the Canaries; locally cultivated in Java as a garden ornamental. Flowers white, the upper lip tinged with red.

*Lavandula officinalis* CHAIX: BACK. & BAKH. f. Fl. Java 2 (1965) 621.

Native of the Mediterranean region; cultivated in the mountains of Java as an ornamental. Flowers blue or violet.

*Majorana hortensis* MOENCH: BACK. & BAKH. f. Fl. Java 2 (1965) 630. — *Origanum majorana* L.: CHEV. Rev. Bot. App. & Agr. Col. 18 (1938) 485.

Native of SW. Asia and N. Africa; cultivated in the mountains of Java. Flowers white or pale pink.

*Marsypianthes chamaedrys* (L.) O. K.: BACK. & BAKH. f. Fl. Java 2 (1965) 635; *ibid.* 3 (1968) 658. — *M. hyptoides* MART. ex BTH.: BUYSMAN, Flora 107 (1914) 218.

Native of Brazil; cultivated in E. Java, locally run wild there (Mt Tengger; Tretes).

*Nepeta cataria* L.: BACK. & BAKH. f. Fl. Java 2 (1965) 621.

Native of Europe; cultivated in Java as an ornamental. Corolla white, red-dotted.

*Perilla frutescens* (L.) BRITT. Mem. Torr. Bot. Cl. 5 (1894) 277; HAND.-MAZZ. Act. Hort. Gothob. 13 (1939) 350; MURATA in Hara, Fl. E. Himal. (1966) 280. — *Ocimum frutescens* LINNÉ, Sp. Pl. (1753) 597. — *P. ocimoides* LINNÉ, Gen. Pl. ed. 6 (1764) 578; HOOK. f. Fl. Br. Ind. 4 (1885) 646; BURK. Dict. (1935) 1694; DOAN, Fl. Gén. 1.-C. 4 (1936) 983; MUKERJEE, Rec. Bot. Surv. India 14 (1940) 85. — *?Perilla sp.* CHEVALIER, Rev. Bot. Appl. & Agr. Col. 18 (1938) 481.

Native of SE. Asia; stated to occur in Java (DOAN) and in the Philippines (CHEVALIER). Tallish plant with violet flowers. The leaves serve as a flavouring for food and the oil extracted from the seeds is used for cooking, for burning, and a little in the arts (BURKILL, *l.c.*).

It was not cultivated in the Bogor Botanic Gardens and is to our knowledge not found elsewhere, unless a sterile specimen collected in a clearing in Enggano I. (SW. Sumatra: LÜTJEHARMS 4919) would belong to it. *Perilla* is not taken up in the Key to the Genera.

*Perilla sp.* is mentioned from W. Java by MORITZI, Syst. Verz. (1846) 55; the identity of this collection (ZOLLINGER 822) is uncertain. Also the provenance is uncertain as ZOLLINGER included plants received from Japan in his collection.

*Pycnostachys speciosa* GÜRKE: BACK. & BAKH. f. Fl. Java 2 (1965) 635.

Native of tropical Africa; cultivated in Java as a garden ornamental. Flowers blue.

I have not seen material from Java to which BACKER refers. In his description he said that the leaves are linear-lanceolate, tapering towards the ends, 5–15 by 0.5–2.8 cm, the petiole being 0–5 mm. This does not agree with BACKER's description in Fl. Trop. Afr. in which he defines the leaves as large, lanceolate and amplexicaul. So the identity of BACKER's record remains uncertain; his description seems to fit in more with that of *P. aff. stuhlmannii* (see below).

*Pycnostachys aff. stuhlmannii* GÜRKE in Engl. Pfl. Ost-Afr. C (1895) 349; BAKER, Fl. Trop. Afr. 5 (1900) 380.

Leaves linear-lanceolate, subsessile, *c.* 7–8 by 1 cm, puberulous. Flowers pale blue.

A native of tropical Africa, introduced in Malaya and obviously locally run wild, collected 2 miles E of Brinchang village, forming a dispersed patch on a roadside waste (H. M. BURKILL 2889, Oct. 1961, at 1500 m).

*Pycnostachys urticifolia* HOOK. Bot. Mag. 89 (1863) t. 5365; BAKER, Fl. Trop. Afr. 5 (1900) 386.

Leaves ovate, broad at base, long-petioled, 5–7 by 3–4 cm. Flowers bright blue.

A native of East and South Africa, cultivated and run wild in Malaya in the Cameron Highlands, first collected in 1951, now well established (H. M. BURKILL 761); also cultivated in the Botanic Gardens at Lae (NGF 10541) and those at Tjibodas (VAN OOSTSTROOM 14178).

*Rosmarinus officinalis* LINNÉ: THUNB. Fl. Jav. (1825) 15; BLANCO, Fl. Filip. (1837) 20; ed. 2 (1845) 15; ed. 3, 1 (1877) 28, t. 94; F.-VILL. Nov. App. (1880) 165; MERR. Fl. Manila (1912) 407; Int. Rumph. (1917) 456; Sp. Blanc. (1918) 336; En. Philip. 3 (1923) 409; Trans. Am. Phil. Soc. 24, 2 (1935) 339; QUIS. Medic. Pl. Philip. (1951) 831; BACK. & BAKH. f. Fl. Java 2 (1965) 618.

Native of the Mediterranean region; in Java in the mountain districts locally cultivated as an ornamental. Aromatic shrubby herb with bluish flowers.

Also cultivated in gardens for medicinal purposes and commonly sold in the markets in the Philippines, where it is used to bathe women in the puerperal state and against rheumatism and catarrhs; macerated in alcohol it is in use as a hair lotion, said to prevent baldness.

Vern. Philippines: *roméro*, Span., Tag., *duméro*, Tag., *rosmiro*, Bontoc; *rosemary*, E.

*Thymus vulgaris* LINNÉ: F.-VILL. Nov. App. (1880) 165; BACK. & BAKH. f. Fl. Java 2 (1965) 631.

Native of S. Europe; stated to be cultivated in the Philippines and in Java. Corolla small, pale red or lilac.

Recently collected by J. M. B. SMITH (ANU 15359) at Keglsugl (Mt Wilhelm), New Guinea, at 2600 m on disturbed ground next to burnt remains of old shelter. Identified by J. MENNEMA, Leiden.

#### Doubtful & Excluded

Several of the names mentioned below were included in a list of *nomina nuda* of NORONHA, which were published under his name in the Verh. Bat. Genootschap 5 (1790) ed. 1, art. IV, a volume later reprinted with a different pagination. Unfortunately the names were all taken up in Index Kewensis and have thus come into 'circulation', the reason we account for them. HASSKARL has endeavoured by means of the vernacular names, added to the Latin plant names in NORONHA's list, to evaluate the latter. This interpretation was used by Index Kewensis. This is especially in *Labiatae* a hazardous proceeding. It could be possible, in studying NORONHA's mss in Paris, to come to a more definite conclusion, but this is, it seems, a waste of time as the names have no botanical value.

The same can be said of names listed by THUNBERG in his Florula Javanica (1825). Also these names could be evaluated in studying his collections at Uppsala.

*Anisochilus siamensis* RIDL. Erroneously mentioned from the Malay Peninsula in Index Kewensis; it was described from Lower Thailand.

*Ballota verticillata* NORONHA, l.c. 8, repr. 69, *nomen*.

*Craniotome versicolor* RCHB.: STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 221; cf. KENG, Gard. Bull. Sing. 24 (1969) 150.

The record of this SE. Asian species is based in 2 collections (BÜNNEMEIJER 8459 & 8720) made on Mt Kerintji. I have these tentatively reduced to *Plectranthus parviflorus* in my precursor, but cannot fully endorse this now. Unfortunately the specimens at L are too young and do not carry flowers for re-examination.

*Galeopsis magnifolia* NORONHA, l.c. 16, repr. 76, *nomen*.

*Lavandula bipinnata* (non ROTH) O. K.: KOORD. Exk. Fl. Java 3 (1912) 145.  
Erroneously recorded from Java.

*Lavandula burmanni* (non BTH.) BOERL. Handl. 2, 2 (1899) 714. Erroneously recorded for Malesia.

*Molucella spinosa* (non L.) BURM. f. Fl. Ind. (1768) 128; O. K. Rev. Gen. Pl. 2 (1891) 527.  
Erroneously recorded for the Moluccas.

*Phlomis zeylanica* (non L.) THUNB. Fl. Jav. (1825) 15, *nomen* ('ceylanica').  
Probably referring to *Leucas zeylanica* (L.) R. BR.

*Prunella bicolor* NORONHA, P. violacea NORONHA, l.c. 8, repr. 70, *nomina* ('Brunella').

*Rosmarinus communis* NORONHA, l.c. 25, repr. 83. An culta?

*Sideritis rigida* NORONHA, l.c. 27, repr. 85, *nomen*.

## ANACARDIACEAE (Ding Hou, Leyden)<sup>1</sup>

Trees, erect or scandent shrubs, or climbers, very rarely epiphytic shrubs; usually with acrid, often turpentine smelling sap becoming black when exposed to the air. Buttresses sometimes present. Stipules absent. *Leaves* often crowded at the (thickened) end of twigs, spiral or alternate (only opposite or decussate in *Bouea*), sometimes subverticillate; simple, uni- or tri-foliolate, imparipinnate, rarely paripinnate (*Euroschinus*) (bipinnate in *extra-Mal. Spondias* sp.); margin entire (rarely crenate-dentate in *Rhus* spp.); petioled (petiole often thickened at the basal part), rarely subsessile or sessile. *Inflorescences* terminal and/or axillary, rarely cauliflorous, paniculiform (panicles or thyrses), sometimes racemose or spiciform, rarely flowers solitary; bracts and bracteoles usually caducous, sometimes persistent; pedicels distinct, obscure, or 0, often articulated. *Flowers* regular, bisexual, or unisexual by abortion (plants monoecious, dioecious, or polygamous). *Hypanthium* sometimes present (*Melanochyla*). Floral axis (between calyx and stamens) often obscure, sometimes distinct and elongated (*Gluta* & *Swintonia*). *Calyx* 5- or 4- (rarely 3-)lobed (or perianth bract-like, in *Pistacia*), sometimes calyptiform (*Gluta*), caducous or persistent, rarely accrescent (*Parishia*). *Petals* 5 or 4, or 0 (in *Pistacia*), free, sometimes the basal part longitudinally adnate to the floral axis, imbricate or valvate, rarely contorted, caducous or persistent, sometimes accrescent (*Swintonia* & *Gluta* spp.). *Stamens* equal or twice the number of calyx lobes or petals, rarely more or  $\infty$  (*Gluta* spp.), inserted on the margin of disk, or just outside or inside of this margin, or on an enlarged torus (*Gluta*); all (sometimes 1 or more) fertile in  $\sigma$  or bisexual flowers, imperfect or sterile, rarely rudimentary, or wanting (*Pistacia*) in  $\rho$  flowers; filaments subulate or filiform, free or infrequently basally connate, glabrous, sometimes hairy or papillate; anthers dorsi- or basifixed, or dorsobasifixed, longitudinally dehiscent, seemingly 2-celled (with 4 pollen sacs) at anthesis, usually introrse; connective rarely prolonged, dilated and apically 2-lobed (*Androtium*). Torus prominent (*Gluta*). *Disk* usually present and distinct (rarely obscure or none), persistent (caducous in *Androtium* & *Buchanania*), often fleshy, sometimes thin; round, flat or concave above, pulvinate, rim-like, short-cupular, or consisting of 5 gland-like lobes (*Swintonia*), rarely stipiform (*Mangifera* spp.), often slightly crenulate or notched, rarely lobed. *Ovary* free, or the basal part connate with disk or receptacle, superior, sometimes partly or wholly immersed in disk or receptacle and seemingly semi-inferior or inferior (*Pegia*, *Melanochyla* & *Semecarpus* spp.), rarely really inferior (*Drimycarpus* & *extra-Mal. Holigarna*), usually sessile, sometimes stiped (*Gluta*); 1-carpellate and 1-celled, or syncarpous and 2-5(-12)-celled (if 1-celled there are 3 styles), apocarpous (4-6-carpellate in *Buchanania* & *Androtium*), or carpels incompletely connate (5-carpellate in *Dracontomelon* & *Koordersiodendron*), usually 1 carpel fertile; styles 1-5(-12), distinct or obscure, terminal or excentric; stigmas 1-5(-12), distinct or obscure; rudimentary pistil small, obscure, or absent in  $\sigma$ . *Ovule* 1 in each carpel or cell, pendulous, apotropous. *Fruits* drupaceous, sometimes subtended by enlarged calyx lobes (*Parishia*) or petals (*Swintonia* & *Gluta* spp.), or an enlarged fleshy hypocarp (pedicel, receptacle; in *Anacardium* & *Semecarpus*), 1-5(-12)-celled, 1-5(-12)-

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(1) A grant from the Netherlands Foundation for the Advancement of Tropical Research (WOTRO), enabling me to acquire field knowledge on this family in West Malesia in 1966, is gratefully acknowledged.

seeded; exocarp thin; mesocarp usually fleshy and resinous, sometimes waxy or oily; endocarp or stone fibrous, crustaceous, woody, or almost bony. *Seed* exalbuminous or with scanty endosperm, rarely labyrinthine (*Mangifera spp.*); testa membranous or chartaceous, sometimes adherent to the endocarp; raphe or chalazal vascular bundles sparsely or profusely branched, often distinctly shown on the testa; embryo straight or curved; cotyledons free, rarely partly or incompletely united (*Gluta spp.*), plano-convex, rarely unequal (fig. 71), radicle short.

**Distribution.** About 70 genera with c. 600 *spp.*, distributed chiefly throughout the tropics and subtropics. Malesia is the richest major tropical area for this family, with more genera represented than in any other area; even though *Rhus* is not richly represented in species.

Within Malesia occurrence is mainly in West Malesia. The richest endemic development is in Malaya and Borneo; as usual Sumatra has a fair number of species but few endemics. Fig. 1 & 2.

Only few genera occur in the temperate zone, e.g. *Rhus*, which is largely warm-temperate; *Pistacia* is mainly extra-tropical, but occurs with a few species in the tropics.

Species of several genera are widely cultivated for their fruit, viz *Anacardium*, *Bouea*, *Mangifera*, and *Spondias*. They may run wild and become naturalized, e.g. *Anacardium*, the cashew nut, which is according to CORNER common in villages in Malaya, especially on the East Coast, where it is so thoroughly established to appear indigenous. The same holds for cultivars or semi-domesticated forms of *Mangifera*, *Spondias*, etc. in Borneo and other islands. For this reason it is in some cases even impossible to establish with certainty the really indigenous occurrence of some species, especially if they are found both in continental SE. Asia and in Malesia.

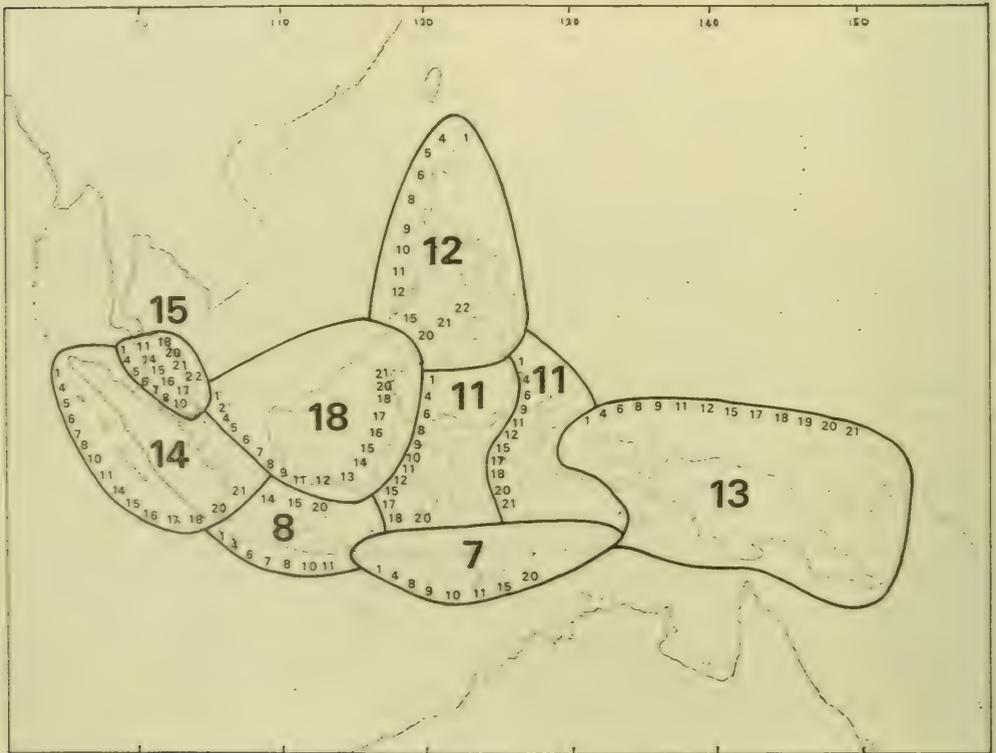


Fig. 1. Map showing the occurrence of indigenous genera in the main divisions of Malesia; genera indicated by their number, totals in large numerals (omitting 3. *Anacardium* and 10. *Lanea*, which are introduced).

Of the genera treated here *Anacardium* and assumedly *Lannea* are definitely introduced and naturalized.

*Androtium*, *Koordersiodendron*, and *Melanochyla* are confined, so far known, to Malesia. *Bouea*, *Drimycarpus*, *Parishia*, *Pegia*, and *Swintonia* are found in Malesia and continental SE. Asia.

Most of the following genera occur in the southeastern part of continental Asia and Malesia with only one or a few species distributed in other areas: *Buchanania* (also found in Australia and as far east as in Polynesia), *Dracontomelon* (also occurring in Solomon Is., eastwards to the Fiji Is.), *Gluta* (with also 1 sp. found in Madagascar), *Mangifera* and *Pentaspadon* (distributed as far east as the Solomon Is.), and *Semecarpus* (also occurring in Australia, Micronesia, Melanesia, and as far east as the Fiji Is.).

*Lannea* is chiefly an African genus with only 1 sp. recorded to occur in tropical Asia, and obviously introduced in Malesia. The big genus *Rhus* (*sens. lat.*: c. 150 spp.) occurs mainly in the warm-temperate zones of both hemispheres and extends also into the tropics; there are 8 spp. of it in Malesia.

*Spondias* appears to have two centres of distribution: tropical America and Indo-Malesia.

Each of the following two small genera has only one species in Malesia: *Pleiogynium* consists of c. 3 spp. distributed in the Pacific Is., Fiji, Solomons, Australia, and Malesia, and *Euroschinus* has 6 spp.: 4 in New Caledonia, one in Australia, and one in New Britain and Malesia.

The following two genera, each consisting of c. 10 spp., have a rather wide and interesting distribution. *Camptosperma* is known from Madagascar, the Seychelles, Ceylon, Thailand through Malesia (with 5 spp.), Micronesia & Melanesia, and Latin America. *Pistacia* is disjunctly distributed in the Canary Is., the Mediterranean, Asia Minor, SE.-E. Asia, Malesia (with 2 spp.), and North and Central America (Texas; Mexico).

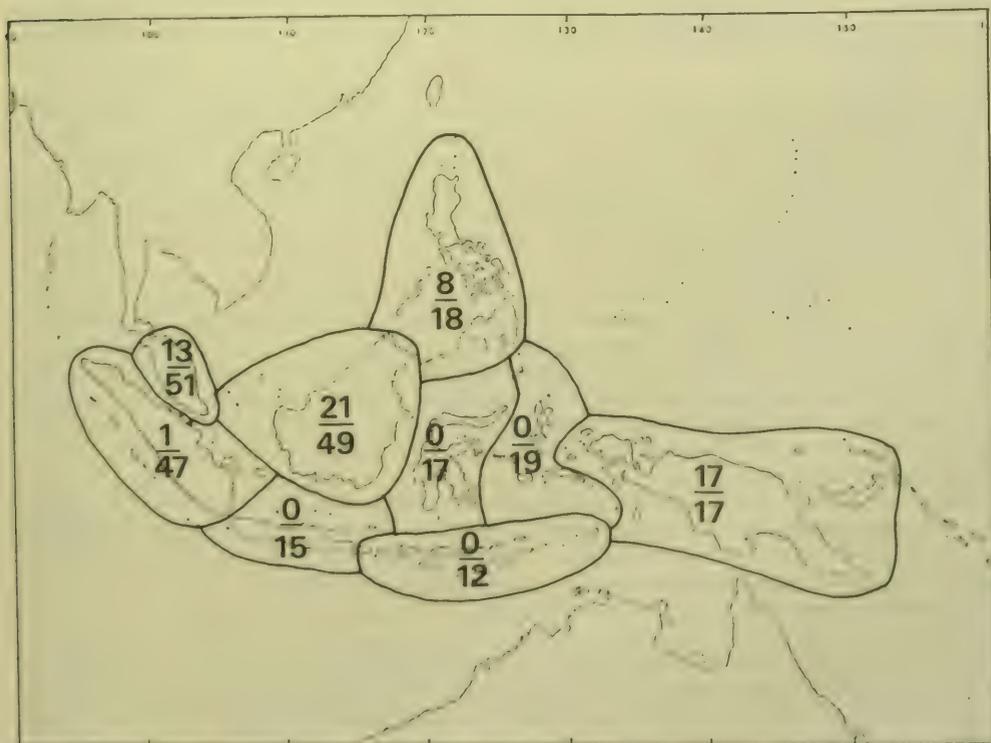


Fig. 2. Species density of *Anacardiaceae* in Malesia: above the hyphen the number of endemic, below it the number of non-endemic species in each island (group).

*Anacardium* is an American genus and one of its species, *A. occidentale*, is widely cultivated in the tropics and naturalized in places.

Ecology. In Malesia, species of the *Anacardiaceae* occur mainly in primary rain-forest, rarely in secondary and seasonal forest, or cleared areas.

In the forest *Anacardiaceae* usually occur scattered in the undergrowth and lower strata, with the exception of the large trees mentioned below under 'habit', which make part of the canopy. But also the latter are hardly ever common and never gregarious.

Gregarious or very common occurrence is almost only found in swamp- and peat-forest, and in riparian forest by species of *Gluta*, *Pentaspadon*, *Mangifera*, *Dracontomelon*, *Melanochyla*, *Androtium*, *Swintonia*, and especially *Campnosperma* (fig. 60).

Gregarious occurrence is also on record of two trees on limestone in the Langkawi Is. (NW. Malaya), viz on *P. Langgung* of *Pentaspadon curtisii* and on *G. Raya*, Langkawi, of *Swintonia floribunda*, both forming almost pure stands.

Furthermore, *Swintonia robinsonii* was found dominating a stretch of forest on a steep ridge at c. 1450 m altitude on *G. Rabong*, S. Kelantan.

As to altitude the great majority of species is found at low and medium altitude, below 1000 m; about two dozen *spp.* ascend between 1000 and c. 1500 m, some 6 *spp.* even ascending to 1500–2000 m (*Semecarpus bracteatus*, *S. heterophyllus*, *Rhus taitensis*, *R. lamprocarpa*, *Mangifera indica*, *M. foetida*), but sometimes only with one collection. True montane species are extremely rare: *Rhus succedanea* (900–2400 m), *R. borneensis* (1200–2000 m), *R. caudata* (900–2400 m), *R. linguata* (1100–1770 m), and *Swintonia robinsonii* (1050–1650 m). It is remarkable that *Rhus chinensis* ascends in extratropical Yunnan to much higher altitude than in Malesia, viz to 3200 m, in Malesia to 1350 m.

*Climatic conditions.* Most Malesian *Anacardiaceae* are constituents of the primary rain-forest, but quite a number tolerate or even prefer a seasonal climate; for example *Semecarpus heterophyllus* is very common in the teak forests in Java. *Lannea coromandelica* is also characteristic for a seasonal climate. Also for the cultivation of the better species of *Mangifera* a seasonal climate is more suitable.

During the dry season these species are frequently leaf-shedding, flowers and young foliage appear on the bare branches with the onset of the rainy season.

A deciduous habit occurs in proportionally many *Anacardiaceae* genera, e.g. in some *spp.* of *Gluta* (*G. pubescens*, *G. malayana*), in *Parishia*, some *spp.* of *Spondias*, and in most *spp.* of *Rhus* and *Pentaspadon*. In most cases the deciduous habit is not especially bound to a distinct seasonal climate; a small decrease in rainy days or a prolonged dry spell seems also under everwet rain-forest conditions a sufficient impetus.

*Substratum.* Several species are characteristic constituents of swamp- and peat-forests, tidal river-banks or temporary overflowed areas or swamps, e.g. *Androtium astylum*, *Campnosperma spp.*, *Gluta renghas*, *G. velutina*, *Mangifera gedebe*, *Melanochyla auriculata*, *Pentaspadon motleyi* (fig. 58), *Swintonia glauca*, etc. Trees of such permanently or temporarily inundated habitats may produce prominent buttresses. But large buttresses may also occur in dryland species, e.g. in *Spondias pinnata*, *Koordersiodendron pinnatum*, *Gluta malayana* (fig. 19), and *Dracontomelon dao* (fig. 32). Other genera may lack buttresses in all species, e.g. *Mangifera*, although *M. gedebe* is a true swamp-forest species.

A few swamp-forest species may have stilt-roots, e.g. *Melanochyla bracteata* (fig. 46), *M. auriculata*, and *Gluta velutina* (fig. 25). *Campnosperma coriaceum* develops in deep swamps apart from prop-roots slender-kneed pneumatophores or loop-roots over 1 m high (fig. 62). Also in deep swamps *Gluta renghas* develops a conically thickened stem-base (fig. 27).

One species, *Pentaspadon curtisii*, is confined to limestone; other species may sporadically occur on this bedrock.

Of *Semecarpus* one species, *S. stenophyllus*, is from the Philippines recorded to be confined to streambeds. As usual with such rheophytic plants, growing on gravel and rocks along mostly swift-running streams at low altitude and subject to sudden overflow, it has the stenophyllous habit.

*Habit.* As to habit, most Malesian species are trees of small to medium size, but *spp.* of *Gluta*, *Buchanania*, *Bouea*, *Dracontomelon*, *Mangifera*, *Koordersiodendron*, *Parishia*, *Spondias* and

*Swintonia* can attain large sizes, sometimes with massive crowns, and reach a height of 30–55 m and a stem diameter of  $\frac{3}{4}$ – $1(-1\frac{1}{2})$  m.

The only true genus of lianas is *Pegia*.

Climbing habit has also been mentioned in some *Rhus* and *Semecarpus* spp. which are recorded either as a shrub or as an epiphyte. This observation of variable habit is also recorded from *Spondias philippinensis*, which is even cited to be a shrub, a small tree, a liana, an epiphyte, and a big tree. This variability is doubtless due to the fact that these species may be erect and terrestrial, but may also begin their life as a 'hemi-epiphyte', which means that they start as an epiphyte and by sending roots down along a host tree may reach the soil and become terrestrial and may eventually outlive their host tree. This change of habit has been described for species of several other rain-forest genera, *Vaccinium*, *Fagraea*, *Ficus*, and others, and has been described and explained in full for *Wightia* (*Scroph.*) by VAN STEENIS (Bull. Jard. Bot. Btzg III, 18, 1949, 213–227).

Some species of *Semecarpus* exhibit a characteristic *cycadoid* or 'Schopfbaum' habit, that is: they remain unbranched for a long time and carry an apical tuft of large, often sessile pseudo-whorled leaves, as a sort of nest; sometimes they produce several such nests in succession. This is characteristic for *Semecarpus magnificus* and *S. nidificans* in Papua, the latter's epithet being even derived from this peculiar habit. Also young plants of *S. bunburyanus* and *S. curtisii* (fig. 53) show this growth mode.

*Pollination.* The plants of most species in this family are dioecious or polygamous and bear many-flowered inflorescences. The flowers possess nectary organs or disks and are sometimes fragrant. They are cross-pollinated and are evidently entomophilous.

*Myrmecophily.* Twigs of several species may be hollowed out by ants removing the pith and making slitwise openings, the twigs thus becoming spindle-shaped swollen and inhabited by ants. This is found especially in New Guinea, in several species of *Semecarpus*, viz *S. australiensis*, *S. brachystachys*, *S. cassuvium*, and *S. schlechteri*; a synonym of the latter species derived even its epithet from its ant-inhabited twigs (*S. myrmecophila*). This phenomenon is also found in *Euroschinus papuanus*. In some of these species the occurrence seems to be rare, in others more common, but the general impression is that it is in none of the cases peculiar to the species, as is the case with true myrmecophilous plants in which almost every specimen is inhabited by ants which are entirely adapted to this kind of shelter.

An interesting case in this respect occurs in *Semecarpus aruensis*, of which some specimens have young fruits with a shallow cavity at the basal part on the surface just above the hypocarp. In one such cavity I found sixteen insect eggs (possibly of ants). Fig. 48a–c. The fruits were gradually deformed by the presence of these insects: the basal part of these fruits seems flattened and its margins laterally curved to form a pocket or pit leaving an opening to the outside. Field observations are needed to clarify whether it is a matter of galls or a symbiosis with ants.

*Galls.* Leaf-galls observed in species of *Buchanania*, *Dracontomelon*, *Gluta*, *Mangifera*, *Semecarpus*, *Melanochyla* and *Spondias* are usually hemispherical or conical, 1–3(–10) mm high and broad. They are caused chiefly by gall-midges, sometimes by acarids, and rarely by *Psyllidae* (cf. DOCTERS VAN LEEUWEN, Zoocecidia, 1926, 321–326, f. 570–582; Ned. Kruidk. Arch. 51, 1941, 171–174, f. 46). The galls on the leaves and branchlets of *Rhus chinensis* (syn. *R. semialata*) are very irregularly shaped and are caused by *Aphis chinensis* (cf. SCHENK, Flora 33, 1850, 289–292; ENGLER in E. & P. Nat. Pfl. Fam. 3, 5, 1892, 169, f. 107 B & C; SHIRAI, Bot. Mag. Tokyo 9, 1895, 1–6, t. 1 & 2).

Galled fruits have been observed in some specimens of *Campnosperma montanum* and *Semecarpus albicans* (see notes under the species).

*Dispersal.* The fruits of *Anacardiaceae* are drupaceous and vary considerably in size: from less than  $1\frac{1}{2}$  cm long (e.g. in *Buchanania*, *Campnosperma*, *Euroschinus*, *Rhus*, etc.) to 25 cm (e.g. in *Mangifera*); embryos of some species of the latter genus belong to the largest in the world. The drupes or sometimes their stones (endocarps) have been reported to be dispersed in various ways.

Some fruits are eaten and dispersed by birds and/or other animals (bats, squirrels, monkeys, elephants, etc.). In Djambi (Central Sumatra) the fruiting season is Jan.–Febr., attracting game, pigs, elephants, etc. By end March RITTEN (Trop. Natuur 28, 1939, 19, fig.) observed numerous seedlings of *Durio* and *Mangifera odorata* (*ambatjan*) in the excrements of elephants. ASHTON told me that he saw squirrels in Sarawak eating the fruits of *Dracontomelon*. Sometimes one

would find plenty of the fruits under the tree with only part of the pulp eaten; pigs consumed such dropped fruits, but the hard stones, which remained internally intact, were carried away and thus disseminated.

Also fruits may be washed away to some distance by rain into places suitable for germination and growth. Some species of *Dracontomelon*, *Campnosperma*, *Gluta*, etc. growing in peat-swamp forests, on tidal river-banks or occasionally in inundated areas, are dispersed by water. Fruits of the cultivated *Anacardium* and *Spondias* were found drifting along the sea-coast or floating in the sea.

Many species of *Parishia* (fig. 68h), *Gluta* (incl. *Melanorrhoea*), and *Swintonia* (fig. 13i) bear fruits possessing rather long accrescent calyx lobes or (wing-like) petals sometimes reaching more than 10 by 1 $\frac{1}{4}$  cm. Such winged fruits turn upside-down when they fall from the tree and rotate away in their descent (cf. RIDL. Disp. 1930).

Except for the small-fruited drupaceous genera which may be carried by birds over some distance, there are no devices leading to accept long-distance dispersal in *Anacardiaceae*, except that fruit of swamp inhabiting species may be carried by the water of rivers.

Germination & Seedlings. In *Anacardiaceae* several seedling types occur. These have been arranged in the following survey, partly derived from literature, partly from my own experience, in which also seedlings from non-Malesian species are arranged. The terminology is in agreement with that used in my forthcoming book.

(i) *Macaranga* type: Cotyledons thin, elevated above the soil on a stretching hypocotyl, ultimately shedding the envelopes and exposed, and then with photosynthetic function. Leaves are almost always spirally arranged. — This is found e.g. in *Rhus ovata* S. WATS. and *R. nodosa*. Seedlings of *Lannea coromandelica* and *Rhus typhina* L. may belong to this type, or could belong to the *Sloanea* type, but their descriptions are insufficient to make a decision.

(ii) *Sloanea* type: Cotyledons thick, food-storing, elevated above the soil on a stretching hypocotyl, ultimately shedding the envelopes and exposed. The first two leaves are mostly opposite while the subsequent ones are spirally arranged. — This is for instance found in *Anacardium excelsum* SKEELS, *A. occidentale*, *Buchanania arborescens*, *B. latifolia* ROXB., *Dracontomelon dao*, *Parishia insignis*, *Rhus aromatica* AIT., *Spondias mombin*, *S. pinnata*, and *S. purpurea*. *Lannea coromandelica* and *Rhus typhina* L. may also belong to this type, but descriptions are insufficient for making a decision.

(iii) *Heliciopsis* type/subtype: Cotyledons either thick and of the food-storing type, or thin haustoria covered by the persistent pericarp and testa, secund at soil level. The shoot withdraws from the envelopes and stretches. Leaves are almost always all spirally arranged, the lower ones being often scale-like (cataphylls) and gradually pass into developed leaves. — To this type belong for example *Gluta macrocarpa*, *G. renghas* and *G. usitata* (WALL.) DING HOU (syn. *Melanorrhoea usitata* WALL.), *Mangifera gedebe*, *M. indica*, *Melanochyla fulvinervis*, *Rhus glauca* THUNB. (syn. *R. thunbergiana* SCHULT.). *Semecarpus curtisii* seems also to belong to this type, but there the first internode elongates and the first two leaves are opposite.

(iv) *Heliciopsis* type/*Koordersiodendron* subtype: Cotyledons either thick, of the food-storing type, or thin haustoria covered by the persistent fruit-wall and testa, secund above the soil on an elongated hypocotyl. The shoot withdraws from the envelopes and stretches. Either all leaves spirally arranged, or the first two opposite and subsequent ones spirally arranged. — To this type belong for instance *Koordersiodendron pinnatum* and *Swintonia* sp.

According to the shape and phyllotaxis of leaves in advanced seedlings they may be classified as follows:

#### A. Leaves all spirally arranged

(a) Lowest leaves scale-like (cataphylls), all higher leaves simple. This is e.g. found in *Gluta macrocarpa*, *G. renghas*, *G. usitata* (WALL.) DING HOU (syn. *Melanorrhoea usitata* WALL.), and *Melanochyla fulvinervis*. This situation can occur also in *Mangifera indica*, but in this species it is variable; see below.

(b) Lowest leaves scale-like (cataphylls), higher leaves simple, ultimate leaves compound. This is e.g. found in *Rhus glauca* THUNB. (syn. *R. thunbergiana* SCHULT.).

(c) All leaves simple. This occurs in *Mangifera gedebe* and *Rhus ovata* S. WATS. (in which it varies, see sub d). It can also occur in *Mangifera indica*.

(d) First leaves simple, higher ones compound. This occurs *e.g.* in *Rhus nodosa* and can also occur in *R. ovata* S. WATS.

(e) All leaves compound. This can be found in *Rhus typhina* L., but varies in that species.

*B. First two leaves opposite, next leaves spirally arranged*

(f) All leaves simple. This is *e.g.* found in *Anacardium excelsum* SKEELS, *A. occidentale* (both with 4 lowest leaves in 2 decussate pairs), *Buchanania arborescens*, *B. latifolia* ROXB., sometimes in *Mangifera indica*, and furthermore in *Semecarpus curtisii* and *Swintonia sp.*

(g) First two leaves simple, higher ones compound. This occurs *e.g.* sometimes in *Rhus typhina* L.

(h) All leaves compound. This is found for example in *Dracontomelon dao*, *D. lenticulatum*, *Koordersiodendron pinnatum*, *Parishia insignis*, *Rhus aromatica* AIT., *R. typhina* L., *Spondias mombin*, *S. pinnata*, and *S. purpurea*.

*Literature:* PIERRE, Flore forestière de Cochinchine 5 (1892) pl. 361; LUBBOCK, A contribution to our knowledge of seedlings (1892) 369–380, f. 255–260; TROUP, Silviculture of Indian trees 1 (1921) 235–249, f. 99–102; DUKE, Ann. Mo. Bot. Gard. 52 (1965) 314, 318–320, f. 90, 93 & 94; DE LA MENSBRUGE, La germination et les plantules des essences arborées de la forêt dense humide de la Côte d'Ivoire (1966) 233–238, pl.; WILKINSON, J. Nat. Hist. 1967(4), p. 508, f. 3; CSAPODY, Keimlingsbestimmungsbuch der Dikotyledonen (1968) 47, t. 49; MEIJER, Bot. Bull. Sandakan 11 (1968) 112, pl.; DUKE, Ann. Mo. Bot. Gard. 56 (1969) 152, f. 38; GILLIS, Rhodora 73 (1971) 172; BURGER, Seedlings of some tropical trees and shrubs mainly of South East Asia (1972) 32–37, f. 1–3; SCHOPMEYER, Seeds of woody plants in the United States (1974) 718, f. 4–5; DE VOGEL, Germination and seedlings in Malesian woody plants (in press), pl. 2–8. — E. F. DE VOGEL.

*Taxonomy.* In the latest monographic treatment of the *Anacardiaceae* LINDLEY (Intr. Nat. Syst. 1830, 127) by ENGLER (in DC. Mon. Phan. 4, 1883, 171–500, t. 4–15), this family was divided into four tribes, *i.e.* *Mangifereae*, *Spondieae*, *Rhoideae*, and *Semecarpeae*. In 1892, ENGLER (in E. & P. Nat. Pl. Fam. ed. 1, 3, 5: 138–178, f. 88–178) added one more tribe, *Dobineae*. His subdivision into tribes has, except for the additional tribe *Dobineae*, generally been followed (*cf.* BARKLEY, Am. Midl. Nat. 28, 1942, 465–474; Lloydia 20, 1957, 255–265).

In the position of the tribe *Dobineae* ENGL., which consists of two *extra-Malesian* genera (both perennial herbs or subshrubs): *Dobinea* BUCH.-HAM. *ex* DON and *Campylopetalum* FORMAN, opinions differ. According to ERDTMAN (Pollen Morph. & Pl. Taxon., Angiosperms, 1952, 48), pollen morphology is in favour of excluding *Dobinea* from the *Anacardiaceae*. FORMAN (Kew Bull. 1954, 555–564, f. 1–2) considered, however, with good reasons, that these two genera for the present would be best placed in *Anacardiaceae* (tribe *Dobineae*). This tribe has also been proposed as a separate family, *Podoaceae* BAILL. *ex* FRANCH. (corr. HUTCH.) by AIRY SHAW in Willis, Dict. Fl. Pl. & Ferns, 7th ed. (1966).

The Australian genus *Blepharocarya* F.v.M. has also been segregated from the *Anacardiaceae* as the type of a new family, *Blepharocaryaceae*, by AIRY SHAW (Kew Bull. 18, 1965, 254; in Willis, *l.c.*). The only character for this distinction is the conrescent, cupule-like axes of the  $\gamma$  inflorescence which seems insufficient for raising this genus to family rank. The coralloid inflorescence of the S. African genus *Laurophyllus* is morphologically halfway such contraction to a cupule-like structure.

Furthermore, the genus *Pistacia* has been proposed to represent a monotypic family, *Pistaciaceae* (MARCH.) CARUEL (*cf.* WILLIS, *l.c.*). It differs from other *Anacardiaceae* by a single perianth of which the segments are bract-like and are indeed by COPLAND Jr (Phytomorph. 5, 1955, 440–449) suggested to be bracteal in nature, which would make the flowers apetalous. In addition KUPRIANOVA (Bot. Zhurn. SSSR 46, 1961, 803–814, 2 tab.) stated that *Pistacia* would have a different pollen morphology although ERDTMAN *l.c.* had earlier advanced that pollen morphology supports that *Julianiaceae* should be referred to *Anacardiaceae* near *Pistacia*. From his detailed study of the reproductive structure of *Pistacia chinensis* COPLAND Jr concluded that many of its distinctive details are characteristic of *Anacardiaceae* and he added that also *Julianiaceae* agree in many details with this family. Also the gross morphology and the occurrence of resinous ducts make it reasonable to include *Pistacia* in *Anacardiaceae*, as was done by HUTCHINSON (Evol. Phyl. Fl. Pl. 1969, 409; Fam. Fl. Pl. ed. 3, 1, 1973, 451).

In agreement with the subdivision by ENGLER, the main characters of each tribe occurring in

Malesia with the Malesian genera belonging to it are given below. For the etymological spelling of the tribal names, I have followed that of AIRY SHAW in Willis' Dictionary, 8th ed. (1973).

Tribe **Anacardiaceae** — *Mangifereae* MARCH. Rév. Anacard. (1869) 185, *excl. Solenocarpus* W. & A.; ENGL. in DC. Mon. Phan. 4 (1883) 179; in E. & P. Nat. Pfl. Fam. 3, 5 (1892) 144. — Type genus: *Anacardium* L.

Leaves simple, spiral or alternate (opposite in *Bouea*). Stamens 5-∞, in 1 or more whorls, sometimes 1-4 by abortion. Carpels solitary, or 5, free, with only one fertile (*Buchanania* & *Androtium*); style often lateral, gynobasic; ovule pendulous from a basal funicle. — (*Buchanania*, *Androtium*, *Anacardium*, *Mangifera*, *Swintonia*, *Gluta*, *Bouea*).

Tribe **Spondiadeae** DC. Prod. 2 (1825) 74 ('*Spondiaceae*'); ENGL. *l.c.* (1883) 175 & 242; *l.c.* (1892) 149. — Type genus: *Spondias* L.

Leaves mostly compound, usually imparipinnate, trifoliolate, rarely simple (*extra-Mal. sp.*). Stamens twice the number of petals. Carpels united, mostly 5 or 4, sometimes more (*Pleiogynium*), or only 3, very rarely only 1; styles terminal; ovule pendulous from the apex of the locule. Fruits 3- to 5-celled, rarely more, or only 1-celled. — (*Dracontomelon*, *Pleiogynium*, *Lannea*, *Spondias*, *Koordersiodendron*, *Pegia*).

Tribe **Semecarpeae** MARCH. Rév. Anacard. (1869) 168; ENGL. *l.c.* (1883) 178; *l.c.* (1892) 174. — Type genus: *Semecarpus* L.

Leaves simple. Stamens in one whorl, same number as the petals. Ovary consisting of (assumedly 3) united carpels, unilocular, usually partly immersed in and adnate to the fleshy, discoid, cupular or tubular disk; styles 3; ovule suspended from a funicle from the wall of the ovary above its middle or just below the apex. Fruit 1-seeded, usually with an enlarged, fleshy hypocarp. — (*Melanochyla*, *Semecarpus*, *Drimycarpus*).

Tribe **Rhoeae** MARCH. Rév. Anacard. (1869) 179 ('*Rhoideae*'); ENGL. *l.c.* (1883) 176; *l.c.* (1892) 154. — Type genus: *Rhus* L.

Leaves usually imparipinnate, trifoliolate, or simple. Stamens in 1 or 2 whorls. Ovary consisting of 1 carpel or (assumedly 3) united carpels, 1-celled; styles 3 (2 or 1), terminal or lateral, free or united below; ovule attached on a short funicle from the base or suspended from the wall near the apex. Fruit 1-celled, in *Camposperma* incompletely 2-celled by a pseudoseptum (2-celled in *extra-Mal. genus*). — (*Pentaspadon*, *Camposperma*, *Euroschinus*, *Rhus*, *Parishia*, *Pistacia*).

*Affinities of the family.* *Anacardiaceae sens. lat.* is a coherent and natural family which is most closely allied to *Burseraceae*, especially expressed in the macromorphological characters as agreed by LEENHOUTS (Fl. Males. I, 5<sup>2</sup>, 1956, 210), who already pointed out the similarities and differences between them. Besides, *Anacardiaceae* are assumed to be related in a greater or lesser degree to *Sapindaceae*, *Meliaceae*, *Sabiaceae*, *Rutaceae*, *Simaroubaceae*, *Zygophyllaceae*, *Julianiaceae*, etc. — *Literature:* HOOK. *f.* in B. & H. Gen. Pl. 1 (1862) 416; MARCHAND, Rév. Anacard. (1869) 134-136; ENGL. in DC. Mon. Phan. 4 (1883) 173-174; HUTCH. Evol. Phyl. Fl. Pl. (1969) 402-412; Fam. Fl. Pl. ed. 3, 1 (1973) 436-459; THORNE, *Aliso* 6 (1968) 62; CRONQUIST, Evol. Class. Fl. Pl. (1969) 262-269.

*Anacardiaceae* can be distinguished from the related families by a combination of the following characters: (1) leaves exstipulate; (2) presence of resin-ducts with resinous sap usually quickly turning black when exposed to the air; (3) usual presence of a distinct disk; (4) ovary usually 1-celled and with only 1 ovule; (5) ovule apotropous; (6) drupaceous fruits; (7) seeds usually exalbuminous.

*Morphology.* *Domatia.* As exposed by JACOBS (Proc. R. Ac. Sc. A'dam ser. C, 69, 1966, 275-316, fig.) domatia are usually found in or near the axils of nerves on the undersurface of leaves or leaflets in some species of the following genera: *Dracontomelon*, *Pegia*, *Pentaspadon*, *Pleiogynium*, and *Rhus*. They appear as pits or cavities and are usually roofed over by hairs. Fig. 34b, 57b, 65c. Their presence or absence in some taxa of the *Anacardiaceae* can sometimes be used as a supporting character for distinguishing related genera or species, which is especially useful in naming sterile material.

Domatia are marsupiform (*i.e.* pocket-shaped) in *Pleiogynium timorense* and *Anacardium*

*occidentale*, and some African  *spp.* of *Lannea*; marsupiform-lebetiform (between basin- and pocket-shaped) in *Pentaspadon motleyi*; lebetiform (with a basin-shaped cavity) in *Pleiogynium timorense*; cavernose in *Swintonia schwenkii*; or consist of axillary hair tufts in *Dracontomelon*.

*Indumentum*. Besides normal hairs, scales occur in *Campnosperma* and stellate hairs are found in *Lannea* and some *Semecarpus spp.* In *Melanochyla* and *Semecarpus* papillae are a feature of the underside of the leaves (fig. 45).

*Venation*. Besides the normal reticulate veins there occur in several species reticulate-scalariform venation or clear crossbar veins. A marginal nerve or intramarginal vein is found in the leaves of *e.g.* *Drimycarpus* and some species of *Spondias*, respectively, while in *Buchanania* between each pair of nerves an intermediary vein (shorter than the nerves but parallel to them) is found, here called 'internerv vein'. In most genera the areolae have one dendroid vein; in *Rhus* there are no areolae as the veins end blind.

*Unifoliolate leaves*. In *Rhus* leaves are almost always compound, but *R. borneensis* has simple leaves, without any trace of articulation. In *R. linguata* leaves are also simple but clearly unifoliolate with a distinct articulation at the apex of the petiole.

*Teratology*. COSTERUS & SMITH (Ann. Jard. Bot. Btzg 24, 1911, 110, t. 20, f. 14; *ibid.* 28, 1914, 137) recorded a seed of *Mangifera indica* having germinated within the fruit and one double-fruit of *Mangifera sp.* MASTERS (J. Proc. Linn. Soc. Bot. 6, 1862, 24-26, f. 1-3) found the following terata in the seeds of *Mangifera indica*: (a) the complete absence of one of the cotyledons, (b) the plumule in the one case giving off no shoot at all, in the other giving rise to three shoots from its side, and (c) the production of adventitious roots from the 'scooped-out' portion of the cotyledon.

In *Mangifera decandra* I observed one stamen with the filament broadened gradually at about the upper half and the anther attached on one side (*cf.* Reinwardtia 8, 1972, 324, f. 1h). In *Euroschinus papuanus* two stamens were found with their filaments united.

*Palynology*. The pollen grains in *Anacardiaceae* are of small to medium size and suboblate to prolate in shape. The majority of the genera are characterized by the *Rhus* pollen type, which is tricolporate with a perforate or finely reticulate-striate sculpture. The distribution of sculpture is generally isopolar, but in *Gluta* a few species occur with heteropolar sculpture. Pollen closely similar to the *Rhus*-type occurs in *Burseraceae* (ERDTMAN, Pollen morph. plant taxon. I, 1952, 47-48; BAKSI, Linn. Soc. Symp. Ser. 1, 1976, 379-405).

In a few genera the pollen is quite different, however. *Parishia* has a pollen type characterized by fairly large size, spherical shape, three large, but indistinctly outlined, pores and a coarsely reticulate sculpture with high and thin, sinuously winding muri and intraluminal verrucae. *Dobinea* also has a deviating pollen type which is small, suboblate, and tricolporate with a coarsely reticulate sculpture; this has formed one of the arguments for segregation as a separate family, *Podoaceae*. The most distinct pollen type is that of the genus *Pistacia*, separated by AIRY SHAW as *Pistaciaceae*. It is spherical, periporate with 3-8 irregularly outlined and slightly elliptical pores which are closed by a granulate membrane. Sculpture is finely reticulate. The type resembles the pollen of *Juliania* (*Julianiaceae*), which SHAW assumes closely related to *Anacardiaceae*.

The tribe *Rhoeae* contains the *Rhus* pollen type together with the aberrant *Parishia* and *Pistacia* pollen types, while in *Anacardiaceae*, *Spondiadeae* and *Semecarpeae* only the *Rhus* pollen type is found. The tribe *Dobineae* is characterized by the *Dobinea* pollen type. — J. MULLER.

*Anatomy*. Most relevant anatomical data on the Malesian *Anacardiaceae* are given for the wood by DADSWILL & INGLE (1948) and for the leaf by WILKINSON (1971) (the results of her thesis together with additional observations will be published later in separate instalments). The wood anatomy of *Androtium* and *Pegia* is unknown, as well as the leaf anatomy of *Pegia*. Of the other genera usually only a small portion of the species has been investigated anatomically.

Characteristic wood anatomical features of the family are large, half-bordered to almost simple, rounded to irregularly shaped, vessel-ray pits (in all Malesian genera), simple to minutely bordered pits to the fibres, and the presence of horizontal gum- or resin-canals in the rays of most genera (but not in *Anacardium*, *Bouea*, *Dracontomelon*, *Drimycarpus*, *Mangifera p.p.*, *Rhus*, and *Semecarpus*). Vessel perforations are exclusively simple except in *Campnosperma* in which they are partly scalariform, and in *Euroschinus* in which they are occasionally reticulate.

The fibres are predominantly septate in *Dracontomelon*, *Koordersiodendron*, *Lannea*, *Pentasp*

don, and *Spondias*; only sparsely septate in *Anacardium*, *Buchanania* p.p., *Camposperma*, *Euroschinus*, *Pleiogynium*, and *Rhus* p.p.; and non-septate in the remaining Malesian genera studied thoroughly so far. The rays are usually narrow (however, in some genera up to 5–7 cells wide) and clearly heterogeneous, except in *Gluta* (including *Melanorrhoea*) and *Swintonia* in which they are weakly heterogeneous to homogeneous. Siliceous inclusions have been noted in the rays of *Gluta* s.l., *Parishia*, and *Swintonia*. Solitary crystals are of common occurrence in the rays of most genera, whilst they occur only rarely in the axial parenchyma of a few genera. The parenchyma is typically paratracheal, but additional apotracheal bands occur in *Bouea*, *Gluta* s.l., *Mangifera*, and *Swintonia*. The paratracheal parenchyma is aliform to confluent in *Anacardium*, *Buchanania*, *Dracontomelon*, *Drimycarpus*, *Koordersiodendron*, *Melanochyla*, *Pleiogynium*, *Semecarpus*, and *Spondias*. It is more scanty, vasicentric in *Camposperma* ( $\pm$  absent), *Euroschinus*, *Lansea*, *Parishia*, *Pentaspadon*, *Pistacia*, and *Rhus*. DADSWELL & INGLE (1948) emphasized the high degree of correlation between the occurrence of these three (not always easily separable) types of parenchyma distribution and current tribal subdivision of the family. The groupings do, however, not exactly coincide. Similar findings were discussed by HEIMSCH (1942) who studied also *extra*-Malesian genera and noted that there are only some trends for each tribe of the *Anacardiaceae* to show a particular wood anatomical feature more frequently than others. MOLL & JANSSONIUS' (1911) wood anatomical grouping of Javanese genera is probably artificial because it is based on too few genera, and because their interpretation of the fibre-type (with bordered pits) in *Melanochyla*, *Semecarpus*, and *Spondias* is questionable.

WILKINSON'S study (1971) has demonstrated the great diversity of leaf anatomical characters of considerable diagnostic and systematic significance. Only the main leaf anatomical characters can be mentioned here briefly. The trichomes in *Anacardiaceae* include simple unicellular or multicellular, uniseriate hairs (single or in groups); stalked, branched trichomes (the 'stellate hairs' of macromorphologists, in *Lansea*); peltate scales (in *Camposperma* only) and a diversity of glandular hairs. These glands may be emergent or sunken, their stalks may be unicellular (as in the tribes *Anacardieae*, *Semecarpeae* and *Rhoeae*, except in *Pentaspadon motleyi* and *Parishia maingayi*) or multicellular (as in the *Spondiadeae*). The bodies of these hairs may be globose, ovoid, cylindrical or intermediate in shape. The adaxial epidermis contains glandular cells (probably mucilage cells) in the genera *Buchanania* and *Camposperma*. Abaxial epidermal papillae of diverse but often highly characteristic morphology occur in many species of *Drimycarpus*, *Melanochyla*, *Semecarpus*, and *Swintonia* and in *Rhus chinensis*. DING HOU (Blumea 24, 1978, 3–4) made a key to the papillose genera and species based on appearance and distribution of the papillae at low magnification. The stomatal complex is predominantly cyclocytic in *Anacardiaceae*, but anomocytic stomata or anomocytic to cyclocytic stomata predominate in most genera of the *Rhoeae* and in *Androtium* and *Swintonia* p.p. Paracytic stomata characterize the genera *Anacardium* and *Dracontomelon*. The latter genus moreover shows columnar hydathode stomata. The stomatal complex in *Buchanania* and *Spondias* is rather variable and includes cyclocytic, anomocytic, paracytic and intermediate types. Columnar sclereids occur throughout the mesophyll in *Bouea* and in some species of *Mangifera*. The occurrence of secretory canals in the phloem of all *Anacardiaceae* is an outstanding feature. Such canals occur moreover in cortex and pith of a great number of genera and may also occur in the corresponding parts of petiole and midrib. The vascularization of midrib and petiole is fairly constant with a large, solid or dissected, arc-shaped abaxial system and a flat adaxial plate. In some species of *Lansea* the adaxial plate is absent.

As with the wood anatomical diversity, there are trends for each tribe of *Anacardiaceae* to show a particular leaf anatomical character complex more frequently than others, but it is impossible to characterize each tribe unambiguously using leaf anatomical characters only. The reduction of *Melanorrhoea* to *Gluta* can be supported by anatomical evidence, although the absence of simple trichomes in *Gluta renghas* and *G. velutina*, and their presence in 4 species formerly referred to *Melanorrhoea* as reported by WILKINSON (1971) invites further studies to see whether the indumentum supports the recognition of at least two infrageneric taxa within *Gluta* s.l.

The entire evidence from wood and leaf anatomy unambiguously supports suggestions of affinities of *Anacardiaceae* with *Burseraceae* and *Julianiaceae*.

*Literature:* For general surveys also covering the older literature see SOLEREDER, Syst. Anat.

Dicot. Stuttgart (1899) 278–283, Ergänz. Bd (1908) 109–110; METCALFE & CHALK, Anat. Dicot. Oxford (1950) 452–462. Selected and additional references: GORIS, Ann. Sc. Nat. Bot. IX, 11 (1910) 1–29 (leaf anatomy in tribe *Anacardiaceae* and inter-relationships); MOLL & JANSSENIUS, Mikr. 2, Leiden (1911) 438–512 (wood anatomy, Java); DEN BERGER, Med. Proefst. Boschwezen 13 (1926) 87–93 (wood, Java and E. Sumatra); HEIMSCH, Lilloa 8 (1942) 83–198 (wood anatomy and affinities); DADSWELL & INGLE, Austr. J. Sc. Res. ser. B–1 (1948) 391–415 (wood anatomy, relationships, SW. Pacific, including Malaysia); CHATTAWAY, Trop. Woods 102 (1955) 55–74; *ibid.* (1956) 100–124 (crystals in wood); DESCH, Mal. For. Rec. 15 (1957) 6–29 (wood, Malaya); KONING-VROLIJK *c.s.* Nova Guinea n.s. 10 (1959) 137–175 (*Koordersiodendron*, wood properties); ZAHUR, Mem. Agr. Exp. Sta. Cornell Univ. 358 (1959) 70–71 (bark anatomy); UPHOF *c.s.* Plant Hairs, in Handb. Pfl.-Anat. 4, V, Berlin (1962); GHOSH & PURKAYASTHA in Indian Woods 2, Dehra Dun (1963) 264–323; BURGESS, Timbers of Sabah, Sandakan (1966) 3–34; KRIBS, Commercial Foreign Woods on the American Market, New York (1968) 5–10; WILKINSON, Leaf anatomy of various *Anacardiaceae* with special reference to the epidermis. Thesis, Univ. London (1971) 626 pp. (unpublished); PRAKASH, Notes Jodrell Lab. 7 (1972) 1–19 (root wood anatomy of *Mangifera* and *Spondias*); HAYASHI *c.s.* Micrographic Atlas of Southeast Asian Timber, Kyoto (1973) 1–6; VAN DER GRAAFF & BAAS, Blumea 22 (1974) 101–121 (wood anatomy *Rhus*); PARAMESWARAN & LIESE, Wood Sc. Techn. 6 (1974) 81–90 (cell length wood & bark, *Mangifera*); Bull. Govt For. Exp. Sta. Meguro 269 (1974) 1–95 (wood properties, *Spondias*); SCURFIELD *c.s.* Austr. J. Bot. 22 (1974) 211–231 (silica, *Anacardium* and *Melanorrhoea*); OKANO *c.s.* Bull. Tokyo Univ. For. 67 (1975) 20–50 (*Campnosperma* wood); PURKAYASTHA *c.s.* Ind. For. Rec. n.s. 2, i (1976) 48 pp. (wood anatomy, Andaman Is.); DING HOU, Blumea 24 (1978) in the press (leaf epidermal papillae). — P. BAAS.

Phytochemistry. The chemical characters of *Anacardiaceae* were discussed more than 10 years ago in my 'Chemotaxonomie der Pflanzen' (vol. 3, 1964, 90–115, 631–632, 667).

The family yields many valuable products. Examples are: (a) important tanning materials such as sumac (= sumach = dried and ground leaves of several species of *Rhus*), quebracho (= heartwood extracts of species of *Schinopsis*) and Chinese galls (= very tannin-rich galls of *Rhus chinensis* MILL., syn. *R. semialata* MURR.); (b) mastic (an oleoresin obtained from *Pistacia lentiscus* L.; (c) the varnish producing latices of a number of so-called lacquer trees (*e.g.* *Rhus verniciflua* STOKES, syn. *R. vernicifera* DC.; and *Gluta usitata* (WALL.) DING HOU, syn. *Melanorrhoea usitata* WALL.); (d) cashew nut shell liquid from *Anacardium occidentale* L. which is used for the manufacture of plastic resins; (e) tropical fruits such as mango (*Mangifera indica* L.), hogplum (*Spondias spp.*) and cashew apple (*Anacardium occidentale* L.); (f) edible seed kernels like cashew nuts (*Anacardium occidentale* L.) and pistachio nuts (*Pistacia vera* L.); (g) woods used for furniture and other purposes (*e.g.* species of *Campnosperma*, *Dracontomelon*, *Gluta*, *Koordersiodendron*, *Swintonia*). Phytochemical research was much stimulated by the manifold uses of members of the family and by the severe allergenic skin disease caused by species like poison ivy (*Rhus radicans* L.), poison sumac (*Rhus vernix* L.), poison oak (*Rhus diversiloba* TORR. & GRAY) and poison wood (*Metopium toxiferum* (L.) KRUG & URBAN), and various trees of several genera in Malaysia known by the vernacular name *rengas*.

Formerly (1964) *Anacardiaceae* were chemically characterized as follows: (1) There is a strong tendency to deposit silicic acid in leaves, especially in *Mangiferaeae* and *Spondiadeae*. (2) The contents of the secretory canals occurring in the phloem of all species represent an outstanding feature; depending upon the taxa, these canals store mainly oleoresins (= essential oils + triterpenic resins; *e.g.* mastic) or latices containing mucilages, phenol oxidases (= laccases) and alkylated phenols. The technical and toxic properties of these latices are mainly governed by structural details of the predominating phenolic constituents; the strongly allergenic urushiols of the Japanese lacquer trees and of poison ivy are alkylated *o*-dihydroxyphenols. (3) There is a strong tendency to accumulate gallitannins in leaves, galls and barks and condensed tannins in heartwoods. (4) There is a tendency to produce 5-desoxyflavonoids (*e.g.* leucofisetinidine, fustin, fisetin, sulphuretin, robinetin, dihydrorobinetin) in heartwoods. (5) The flavonols kaempferol, puerictin and myricetin and the proanthocyanidins (formerly called leucoanthocyanidins) brocyanidin and prodelphinidin are common phenolics of leaves; the compounds with a trihydroxylated B-ring (myricetin, prodelphinidin), however, are possibly restricted to *Rhoeae*.

(6) Leaf juices of *Anacardiaceae* are very acid; quinic acid (mainly in young leaves) and shikimic acid contribute in a high degree to the acidity of the cell saps.

Recent phytochemical research added much to our knowledge of the chemistry of several tannins, of the triterpenic resins (*Mangifera indica* L., several species of *Pistacia*, *Schinus terebinthifolius* RADDI) and of mucilages (*Anacardium occidentale* L., species of *Lannea* and *Loxopterygium*, *Mangifera indica* L., latex of Japanese lacquer trees). M. GROSS *c.s.* (Phytochemistry 14, 1975, 2263) analyzed very carefully the urushiol fractions of several toxic American *Anacardiaceae*; they are mixtures of *o*-diphenolic compounds with straight C<sub>15</sub> or C<sub>17</sub> lateral chains; the compounds with di- to tetraenoic alkyl residues are much more toxic than those with saturated or mono-unsaturated lateral chains.

Totally new chemical constituents of *Anacardiaceae* are alkaloids and biflavonoids. S. R. JOHNS *c.s.* (Aust. J. Chem. 19, 1966, 1951) isolated an indolic alkaloid from the leaves of *Dracontomelon dao* (BLANCO) MERR. & ROLFE (syn. *D. mangiferum* BL.) and suggested that it is biogenetically related to canthinone and related rutaceous alkaloids. Biflavanones (*e.g.* rhusflavanone, succedaneafflavanone) and biflavones (*e.g.* agathisflavone, amentoflavone, hinokiflavone and robustaflavone) have been isolated from fruits and seeds of *Rhus succedanea* L. (L.-C. CHEN *c.s.* Phytochemistry 13, 1974, 276, 657, 1571, 1617; *ibid.* 14, 1975, 1644; J. C. S. PERKIN I, 1976, 98) and *Semecarpus anacardium* L. f. (N. S. PRAKASA RAO & L. R. ROW, Phytochemistry 12, 1973, 671). Biflavonoids were formerly considered to be characteristic of Gymnosperms but were detected later in some *Anacardiaceae*, *Euphorbiaceae*, *Guttiferae* and in the genus *Viburnum*; hence they seem to be much more wide-spread than it was originally presumed.

Concluding it may be stated that much has been contributed since 1964 to our knowledge of the chemical characters of anacardiaceous plants. The detection of an indolic alkaloid and of biflavonoids implies that really new biochemical trends of *Anacardiaceae* became known in recent time. This does not add much to our understanding of the true affinities of the family, however, because all the presently known striking biochemical features of *Anacardiaceae* (hydrolyzable and condensed tannins, triterpenoid resins, alkenylated phenols, 5-desoxyflavonoids, biflavonoids and canthinone-like indolic alkaloids) doubtlessly evolved more than once within Angiosperms. For tracing phylogenetic relationships between taxa of family rank and higher ranks such characters are of little value unless all facts needed for an unambiguous interpretation of their systematic meaning are available; this is not yet the case with the chemical characters of *Anacardiaceae*. — R. HEGNAUER.

Chromosomes. Chromosome numbers of about 50 species belonging to about 17 genera were reported with somatic numbers:  $2n = 24, 28, 30, 32, 40, 48, 60$ , which clearly points to the occurrence of polyploidy. Of the following genera, which have their representatives (including cultivated ones) in Malesia, chromosome numbers have been recorded: *Anacardium* ( $2n = 40$ ), *Lannea* ( $2n = 28, 30, 40$ ), *Mangifera* ( $2n = 40$ ), *Pistacia* ( $2n = 24, 28, 30$ ), *Rhus* (incl. *Toxicodendron*) ( $2n = 30$ , once reported as  $2n = 32$ ), *Semecarpus* ( $2n = 60$ ), and *Spondias* ( $2n = 32$ ). In view of the economic importance of mango (*Mangifera indica*) it would be highly desirable to obtain information on chromosomes of the (indigenous) species from Malesia. Taking the family as a whole, more information on chromosomes is needed, especially for those taxa found in Indo-Malesia. — *Literature*: C. D. DARLINGTON & A. P. WYLIE, Chromosome Atlas of Flowering Plants, ed. 2 (1955) 198–199; A. A. FEDOROV (ed.), Chromosome Numbers of Flowering Plants (1969) 30; R. J. MOORE (ed.), Index to Plant Chromosome Numbers (1967–71), Regn. Veget. 90 (1973) 264–265.

Uses. *Anacardiaceae* produce some of the best known, economically important, tropical fruits, nuts and other products. For more detailed information, readers should consult the following publications: HEYNE, Nutt. Pl. (1927) 965–981; BURKILL, Dict. (1935); H. R. SWEET & F. A. BARKLEY, Bull. Mo. Bot. Gard. 24 (1936) 216–229; W. H. BROWN, Useful Pl. Philip. 2 (1950) 331–353; QUISUMBING, Medic. Pl. Philip. (1951) 535–546.

Fruits and nuts. The renowned *Mangifera indica* (mango), *Spondias cytherea* (hog-plum) and *Anacardium occidentale* (cashew-nut) are widely cultivated in the tropics. *Pistacia vera* L. (pistachio nut or green almond) is grown in the Mediterranean region, especially in Sicily. There are also others cultivated locally in Malesia for their edible fruits: *Mangifera caesia*, *M. foetida*, and *M. odorata*; *Spondias pinnata* and *S. purpurea*; *Bouea macrophylla*, and *Dracontomelon spp.*

*Timber.* In Malesia some species of *Dracontomelon*, *Swintonia*, *Gluta*, *Buchanania*, *Campnosperma*, and *Koordersiodendron* can grow into big trees. The heartwood of some of these species is hard, durable, excellent for furniture, building, etc. Planks or boards of these timbers have irregular, beautiful, black markings. It is desirable and urgently needed to do research to find some means to remove the irritant sap, so one can safely handle and use these valuable timbers. Cf. FOXWORTHY, Mal. For. Rec. 3 (1927) 140–144, photogr.; DESCH, *ibid.* 15 (1957) 6–29, photogr.; LOMIBAO & MENIADO, Forpride Digest 3 (1974) 69–70.

*Lacquers.* The Oriental lacquer is economically important in China and Japan; it is a natural product obtained from the resinous sap of *Rhus verniciflua* STOKES and *R. succedanea*. The Burmese lacquer is the product of *Gluta usitata* (WALL.) DING HOU (syn. *Melanorrhoea usitata* WALL.).

*Tannins.* The South Americans species of *Schinopsis*, especially *S. quebracho-colorado* (SCHLECHT.) BARKLEY & MEYER is one of the world's most important sources of tannin (cf. BARKLEY, Proc. Iraq. Sc. Soc. 5, 1962, 44–69). Tannins are also obtained from some members of *Rhus*: *R. coriaria* L. (Sicilian sumac); *R. glabra* L., *R. typhina* L. and *R. copallina* L. (American sumac); and *R. chinensis* (using the nut-galls).

*Other minor uses.* There are some further miscellaneous uses of bark, leaves, flowers, kernels, etc. which are in local use as medicine, vegetable, food, etc. There are also some other economic products (oils, dyes, varnishes, gums, etc.) which are used only on a limited scale and for local consumption. See for these under the species.

*Dermatitis.* *Anacardiaceae* have usually secretory ducts in both vegetative and reproductive parts. The resinous liquid substance is colourless or pale yellow and clear, more rarely thick and greyish brown, hardening and turning black when exposed to the air. Fig. 22, 57h. In some species this resinous sap is mild and causes only a slight itching of the skin on contact, but in others the irritant sap is of a powerfully caustic nature and blisters the skin. The poisonous quality varies with the species. The susceptibility to such resinous sap varies according to the sensitivity of the person involved. Even eating mango fruit may cause mild skin-itching in very susceptible persons.

In the temperate zone the poisonous qualities are best known from species of *Rhus* in North America, the so-called *poison ivies* and *poison oaks*. Also in Malesia *Rhus spp.* may contain poisonous qualities, e.g. *R. succedanea*.

Similarly or even more dangerous trees are found in the Malesian tropics where they are known under the collective name *rengas*; they belong to the following genera: *Gluta* (incl. *Melanorrhoea*), *Melanochyla*, *Semecarpus*, and *Swintonia*. See discussion by BURKILL, Dict. (1935) 1435–1437.

The poisonous constituent of the resinous sap is volatile and will gradually disappear. For this reason timber of *rengas* trees must be dried and exposed for several years as it is otherwise dangerous to handle. Lacquered articles or furniture made from dried timber just mentioned may be still toxic to persons who are especially susceptible (cf. O. AMES, J. Arn. Arb. 12, 1931, 1–3, t. 27).

In the lowland forests in Malesia *rengas* trees are common and it is important that one should be able to recognize such trees. It is undesirable to shelter under a *rengas* tree during a tropical shower, because raindrops may carry the poison from the leaves (cf. CORNER, Ways. Trees, 1940, 116). CORNER commented on recognition of *rengas* trees in the field "that the inner bark of all *rengas* trees is bright pinkish or reddish brown, in contrast with the white sapwood; and on the surface of the trunk and the limbs there are nearly always a few black stains where the sap has oozed out and darkened. These stains are the surest guide to the recognition of the trees. Black lines may also be seen in the freshly cut sapwood or just beneath the bark and, if the bark has been extensively injured some hours or days previously, the wound will be covered with a pitch-black smear. In a few species the sap darkens quickly but in most it takes about half an hour." CORNER added that "it is doubtful whether animals suffer from the poison; monkeys and squirrels appear to be immune, for they will eat the *rengas* fruits; and certain kinds of insects feed on sap, their bodies becoming lacquered."

RIDLEY (Disp. 1930, 270–271) quoted from a report that once two whole companies of a military expedition were affected by serious injuries to the feet caused by wading across rivers which had fallen *rengas* fruits in the water.

The volatile poisonous substance, a hitherto unidentified aromatic compound, may be conveyed to some distance by the smoke and flakes of burning material, or by saw dust, of the *Anacardiaceae*. The fumes arising from the roasting cashew-nuts are very irritating (*cf.* R. N. CHOPRA *c.s.* Poisonous Plants of India ed. 2, 1, 1965, 270–282). It has occurred that inhaling smoke around camp-fires of careless wood-cutters in Borneo had fatal results; this is fortunately rare as native peoples are usually aware of the danger involved with *rengas* trees.

I witnessed victims of *rengas* poisoning during my field trip on *Anacardiaceae* to Malesia and Singapore in 1966. One collector, who chopped down a tree (*c.* 15 m tall) of *Semecarpus bumburyanus* on Mt Kinabalu for obtaining fruiting material, and another, who in Malaya climbed a low-branched tree of *Swintonia spicifera* to collect specimens, had painful effects of itching, or a swollen face, ears and eyes. I was with them there preparing the collections; fortunately, I was not affected.

A surveyor of a timber company in Sarawak had inflamed arms and legs and suffered painful itching when he came back from his work in the forest. It was found that he wore short-sleeved shirt and shorts, and incidentally had touched the wet leaves of young *Melanochyla* plants.

In Malaya, I met persons who said that they would not be affected by the *rengas* sap. One labourer was felling a (big) tree of *Gluta wallichii*; he posed for a photograph to show that he was immune (fig. 21).

The remedy for the sap-poison is to apply weak solutions of mild alkali or active reducing agents, such as formalin, sulphites, 'hypo', or 'potash' (CORNER, *Ways. Trees*, 1940, 117), or using antihistamine tablets or injections followed by medical advice (VAN ROYEN, *Man. For. Trees Papua New Guinea* 4, 1964, 3). If one has severe reaction on contact with the poisonous plants, it is advisable to see a doctor.

Mr. ANTA, one of the excellent Indonesian professional collectors of Herbarium Bogoriense severely suffered from *rengas* poisoning on hands and arms when returning from an expedition to New Guinea. At the advice of the dermatologist Professor VERBUNT, at Djakarta, he was efficiently cured by bathing his blistered hands in a weak solution of tannin (crystals of which can be had cheaply from any druggist) for some 5–10 minutes each day and later less frequently. Mr. ANTA experienced also that new outbreaks could be expected after many months (even a year), but could be immediately suppressed in this way; on later expeditions he always carried tannin crystals in his outfit (comm. VAN STEENIS).

### Identification of *Anacardiaceae*

In the field and especially in the herbarium *Anacardiaceae* can be spotted by black spots where twigs are cut, scars of flowers, fruits, twigs, or leaves, and other bruised places, which result from coagulated and blackened resin which is characteristic for the family.

As collections are mostly either in flower or in fruit, two keys have been offered for identification of the genera. Fertile material can in this way fairly easily be named to the genus.

With incomplete material identification is more difficult, *e.g.* with very young fruit, or flowers with one sex only, and especially with sterile material. For this reason some additional information is provided in three lists of spotting characters which may be helpful to facilitate identification of inadequate material.

#### *I. Vegetative characters*

- (1) Deciduous habit occurs in *spp.* of 6. *Gluta*, 10. *Lannea*, 21. *Parishia*, 17. *Pentaspadon*, 20. *Rhus*, 11. *Spondias*.
- (2) A true climbing habit is only peculiar to 13. *Pegia*.
- (3) Hemi-epiphytes occur in *spp.* of the genera 20. *Rhus*, 15. *Semecarpus*, 11. *Spondias philippinensis*.
- (4) Twigs inhabited by ants in 19. *Euroschinus* and 15. *Semecarpus*.
- (5) Leaves simple, decussate: 7. *Bouea*.
- (6) Leaves always simple, spirally arranged: 3. *Anacardium*, 2. *Androtium*, 1. *Buchanania*, 18. *Camposperma*, 16. *Drimycarpus*, 6. *Gluta*, 4. *Mangifera*, 14. *Melanochyla*, 20. *Rhus borneensis*, 15. *Semecarpus*, 5. *Swintonia*.

- (7) Leaves always compound (incl. unifoliolate): 8. *Dracontomelon*, 19. *Euroschinus*, 12. *Koordersiodendron*, 10. *Lannea*, 21. *Parishia*, 13. *Pegia*, 17. *Pentaspadon*, 22. *Pistacia*, 9. *Pleiogynium*, 20. *Rhus* (except *R. borneensis*, several *spp.* also unifoliolate), 11. *Spondias*.
- (8) Inter-nerval veins are found e.g. in *spp.* of 1. *Buchanania* and 16. *Drimycarpus*.
- (9) A marginal nerve is found in 5. *Swintonia*, 16. *Drimycarpus*, and intramarginal veins occur in 11. *Spondias* (except *S. philippinensis*).
- (10) Stellate hairs occur in 10. *Lannea* (this deciduous tree produces also often large masses of white, hardening exudate of gum) and some *spp.* of 15. *Semecarpus*.
- (11) Leaves unifoliolate or trifoliolate: 20. *Rhus*, *p.p.*
- (12) Leaflets crenate-dentate, tomentose on the lower surface: 20. *Rhus chinensis*.
- (13) Leaflets (3-)5-6(-8) pairs, the terminal one usually very small, reduced or not developed, or obscure (the leaf paripinnate): 19. *Euroschinus*.
- (14) Leaves with hair-like fibers shown upon breaking: 4. *Mangifera spp.*
- (15) Lower surface of leaves (all simple) with distinct papillae: most *spp.* of 14. *Melanochyla*, 15. *Semecarpus*, 16. *Drimycarpus*, and some *spp.* of 5. *Swintonia*.
- (16) Lower surface of leaves with dense or sparse, peltate, or lobed, red-centered scales: 18. *Camposperma*, *p.p.*
- (17) Lower surface of leaves or leaflets with hairy or glabrous domatia: some *spp.* of 8. *Dracontomelon*, 13. *Pegia*, 17. *Pentaspadon*, 9. *Pleiogynium*, 20. *Rhus*.
- (18) Veins not reticulate; no areolae: 20. *Rhus*.

## II. Flowering characters

- (1) Calyx calyptriform: 6. *Gluta*.
- (2) Petals valvate: 15. *Semecarpus spp.*, 11. *Spondias*.
- (3) Petals villous or woolly on the inner surface; filaments villous: 14. *Melanochyla*.
- (4) Petals with thickened glandular ridge(s) on the inner surfaces: most *spp.* of 4. *Mangifera*.
- (5) Petals 0: 22. *Pistacia*.
- (6) Stamens 20-∞: most *spp.* of 6. *Gluta*.
- (7) Stamens unequal, usually 1 or 2 much stouter and longer than the others: 3. *Anacardium* and most *spp.* of 4. *Mangifera*.
- (8) Ovary apocarpous, carpels 4-6, free; leaves simple: 2. *Androtium*, 1. *Buchanania*.
- (9) Carpels 5, connate at the apex and base; leaves imparipinnate: 8. *Dracontomelon*.
- (10) Disk usually hairy. (Leaf simple, lower surface usually distinctly papillose): 15. *Semecarpus*.

## III. Characters of fruits and seeds

- (1) Fruit seated on a fleshy hypocarp formed by the enlarged disk, calyx, and floral axis: 3. *Anacardium*, 15. *Semecarpus*.
- (2) Fruit with dense, rusty-hairy processes (insect-gall-like): 14. *Melanochyla*, *M. fulvinervis*.
- (3) Fruit crowned with persistent floral parts and developed from an inferior ovary: 16. *Drimycarpus*.
- (4) Fruit with (much) enlarged (wing-like) calyx lobes: 21. *Parishia*.
- (5) Fruit with (much) enlarged (wing-like) petals: 6. *Gluta*, *p.p.*, 5. *Swintonia*.
- (6) Fruit more than 5 cm Ø, with a rather thick layer of pulp and a one-celled stone: 4. *Mangifera*, *p.p.*
- (7) Fruit with 5-12 scars or bases of styles at the middle or at the upper half on its surface; 5-12-celled: 8. *Dracontomelon*, 9. *Pleiogynium*.
- (8) Fruit 1-5-celled; endocarp (stone) hard, each cell covered with an operculum: 8. *Dracontomelon*, 10. *Lannea*.
- (9) Fruit ± oblong, c. 1 by 1/2 cm, the scar of the style or its base on one side at the upper 1/3: 11. *Spondias*, *S. philippinensis*.
- (10) Fruit 5- or 4-celled; endocarp 5- or 4-lobed, each lobe usually with irregular processes: 11. *Spondias*, *p.p.*
- (11) Fruit 5- or 4-celled, with interocular cavities shown on a medium, transection: 11. *Spondias*, *p.p.*

- (12) Fruit incompletely 2-celled, with a seed curved around the incomplete septum: 18. *Camposperma*.  
 (13) Cotyledons in a greater or lesser degree united: 6. *Gluta*, *p.p.*  
 (14) Seed labyrinthine (testa present in the crevices of lobes or folds of cotyledons): 4. *Mangifera*, *p.p.*

## KEY TO THE GENERA

## Based on flowering material

1. Inflorescences appearing before leaves or accompanied by some young ones (specimens collected from deciduous trees sometimes only consisting of bare inflorescences).
  2. Calyx calyptriform. Stamens  $\infty$  . . . . . 6. *Gluta*
  2. Calyx distinctly 4-lobed.
    3. Stamens or staminodes 8 . . . . . 10. *Lanea*
    3. Stamens or staminodes 4 . . . . . 21. *Parishia*
1. Inflorescences appearing at the same time as the leaves or accompanied by leaves.
  4. Leaves simple.
    5. Leaves decussate. . . . . 7. *Bouea*
    5. Leaves spiral, alternate, or sometimes subverticillate.
      6. Calyx calyptriform, at anthesis breaking away transversally at the base, often also bursting and opening irregularly, or splitting on one side . . . . . 6. *Gluta*
      6. Calyx distinctly 5- or 4-lobed.
        7. Petals villous or woolly on the inner surface. Stamens with villous filaments . . . . . 14. *Melanochyla*
        7. Petals not villous or woolly on the inner surface, often glabrous, sometimes with thickened glandular ridges (*Mangifera*), or puberulous on the inner surface. Stamens with glabrous or very rarely papillose filaments.
          8. Carpels 4-6, free. Stamens usually 10, all fertile.
            9. Anther cells not separate, dehiscent latrorse; connective not prolonged . . . . . 1. *Buchanania*
            9. Anther cells separate, dehiscent introrse; connective prolonged, dilated and apically 2-lobed . . . . . 2. *Androtium*
          8. Carpels 1-3, united into a 1- or imperfectly 2-celled ovary. Stamens usually 5, sometimes 6-10 (-12, *extra-Mal.*).
            10. Stamens 6-10(-12), one to all of them fertile.
              11. Flowers bisexual. Stamens 6-10, almost all equal in length and fertile. Ovary imperfectly 2-celled. Leaves often with dense or sparse, minute, peltate or lobed scales on both surfaces . . . . . 18. *Camposperma*
              11. Flowers  $\delta$  and bisexual. Stamens (7-)10, unequal, 1-5 (rarely more) fertile. Ovary 1-celled. Leaves without the scales like above.
                12. Petals narrow-lanceolate to linear, 7-15 mm long. Leaves without hair-like fibers shown upon breaking . . . . . 3. *Anacardium*
                12. Petals elliptic or elliptic-oblong, oblong or oblanceolate, 4 $\frac{1}{2}$ -6 mm long. Leaves with hair-like fibers shown upon breaking. . . . . 4. *Mangifera*
      10. Stamens 5, one to all of them fertile.
        13. Disk short-cupular, pulvinate, or stipe-like, distinct or obsolete, or consisting of 5 gland-like lobes and confluent with the base of filaments. Ovary with 1 style and/or 1 stigma.
          14. Petals often with thickened glandular ridges on the inner surface. Stamens unequal, usually only 1 (rarely more) fertile (but all fertile in *M. superba*) . . . . . 4. *Mangifera*
          14. Petals without such glandular ridges on the inner surface. Stamens equal and all fertile . . . . . 5. *Swintonia*
        13. Disk usually round, flat or slightly concave above, rarely short-cupular. Ovary with 3 styles and/or 3 stigmas (except 1 style and 1 stigma in *Drimycarpus*).
          15. Disk usually hairy; rudimentary pistil very small or 0 in  $\delta$ . Ovary usually hairy. Leaf beneath often papillose . . . . . 15. *Semecarpus*
          15. Disk glabrous; rudimentary pistil distinct in  $\delta$ . Ovary glabrous. Leaf beneath not papillose, or rarely with rather compact papillae in *Drimycarpus*.
            16. Petiole 0- $\frac{1}{2}$  cm. ♀ Flower with a superior ovary . . . . . 20. *Rhus*
            16. Petiole 1 $\frac{1}{2}$ -2 $\frac{1}{2}$  cm. ♀ Flower with an inferior ovary . . . . . 16. *Drimycarpus*
    4. Leaves compound: uni- or trifoliolate, or imparipinnate, very rarely pseudoparipinnate or paripinnate.
      17. Flowers with one perianth whorl . . . . . 22. *Pistacia*
      17. Flowers with distinct calyx and petals.
        18. Stamens or staminodes the same number as the petals (4 or 5).
          19. Flowers 4-merous. Disk hairy. Calyx accrescent . . . . . 21. *Parishia*
          19. Flowers 5-merous. Disk glabrous. Calyx not accrescent . . . . . 20. *Rhus*
        18. Stamens or staminodes twice the number as the petals (8 or 10).
          20. Petals valvate. Leaflets with a distinct, continuous, intra-marginal vein (except *S. philippinensis*) . . . . . 11. *Spodias*

20. Petals imbricate, at least at the apex. Leaflets without such intra-marginal vein.  
 21. Ovary 1-celled.  
 22. Terminal leaflet similar to the lateral ones. Stamens 10: 5 fertile and 5 staminodes. Ovary hairy  
**17. Pentaspadon**  
 22. Terminal leaflet usually very small, reduced or not developed. Stamens in ♂ or bisexual flowers  
 10, all fertile. Ovary glabrous. . . . . **19. Euroschinus**  
 21. Ovary 5-12-celled.  
 23. Leaflets 10-16 pairs, without domatia. (Ovary with incompletely connate carpels)  
**12. Koordersiodendron**  
 23. Leaflets (1-3-9 pairs, often with hairy domatia (except *Dracontomelon costatum*).  
 24. Ovary with incompletely connate carpels. Petals 4-10 mm long . . . . . **8. Dracontomelon**  
 24. Ovary with completely connate carpels. Petals smaller, 1 $\frac{1}{4}$ -3 mm long.  
 25. Climbers. Disk c. 1 mm  $\varnothing$ . Stamens  $\frac{3}{4}$ -1 mm . . . . . **13. Pegia**  
 25. Trees. Disk 1 $\frac{1}{2}$ -1 $\frac{3}{4}$  mm  $\varnothing$ . Stamens 2-3 mm . . . . . **9. Pleiogynium**

## KEY TO THE GENERA

## Based on fruiting material

1. Leaves simple.  
 2. Leaves decussate . . . . . **7. Bouea**  
 2. Leaves spiral or alternate.  
 3. Calyx caducous, calyptiform. Petals caducous, or persistent and enlarged (wing-like) in fruit  
**6. Gluta**  
 3. Calyx persistent (except in some specimens of *Buchanania*), distinctly 4- or 5-lobed.  
 4. Fruit developed from an inferior ovary and crowned with persistent floral parts . . . **16. Drimycarpus**  
 4. Ovary and fruit superior and subtained by the persistent floral parts.  
 5. Petals persistent, usually (much) enlarged, wing-like, and reflexed in fruit . . . . . **5. Swintonia**  
 5. Petals usually caducous and not enlarged in fruit.  
 6. Fruit with a distinct or conspicuous hypocarp.  
 7. Leaf lower surface not papillose. Fruits reniform . . . . . **3. Anacardium**  
 7. Leaf lower surface often papillose. Fruits not reniform . . . . . **15. Semecarpus**  
 6. Fruit without a hypocarp.  
 8. Fruits incompletely 2-celled. Seed curved. Leaves usually with dense or sparse, minute, peltate  
 or lobed scales on both surfaces . . . . . **18. Campnosperma**  
 8. Fruits 1-celled. Seed or embryo (if testa confluent with endocarp) straight. Leaves without scales  
 like above.  
 9. Fruit with 3-5 stigmas or vestiges of undeveloped carpels close to one side at the base  
**1. Buchanania, 2. Androtium**  
 9. Fruit without stigmas or such vestiges of undeveloped carpels.  
 10. Fruits subglobose,  $\frac{1}{2}$ - $\frac{2}{3}$  cm  $\varnothing$  . . . . . **20. Rhus**  
 10. Fruits larger, usually longer than wide; if globose or subglobose then (1-) $2\frac{1}{2}$  or more cm  $\varnothing$ .  
 11. Fruits glabrous; flesh juicy and without black varnish. Leaves glabrous, not papillose  
 beneath . . . . . **4. Mangifera**  
 11. Fruits hairy; flesh thin and full of black varnish. Leaves often hairy and/or papillose  
 beneath in most species . . . . . **14. Melanochyla**  
 I. Leaves compound, usually imparipinnate, sometimes tri- or unifoliolate, rarely pseudoparipinnate or  
 paripinnate.  
 12. Leaflets with a distinct, continuous, intra-marginal vein . . . . . **11. Spondias**  
 12. Leaflets without such intra-marginal vein.  
 13. Calyx (much) enlarged and lobes wing-like in fruit . . . . . **21. Parishia**  
 13. Calyx not enlarged in fruit.  
 14. Lower surface of leaflets with domatia.  
 15. Domatia not hairy, each of them like a pit or cavity. Fruits obliquely subglobose, less than  
 1 cm  $\varnothing$  . . . . . **20. Rhus**  
 15. Domatia hairy, each of them consisting of a tuft of hairs.  
 16. Climbers. Fruits broad-ellipsoid or slightly reniform,  $1\frac{1}{4}$ - $1\frac{1}{2}$  by c.  $\frac{1}{3}$  cm; flesh full of black  
 varnish . . . . . **13. Pegia**  
 16. Trees.  
 17. Fruits 1-celled; endocarp coriaceous, not hard . . . . . **17. Pentaspadon**  
 17. Fruits 5-12-celled; endocarp woody and hard.  
 18. Endocarp with an operculum covering each cell . . . . . **8. Dracontomelon**  
 18. Endocarp without such opercula . . . . . **9. Pleiogynium**  
 14. Lower surface of leaflets without domatia.  
 19. Leaflets usually 10-16 pairs. Fruits broad-ellipsoid, obtuse at both ends,  $2\frac{1}{2}$  by  $1\frac{1}{2}$   $2\frac{1}{2}$  cm  
**12. Koordersiodendron**  
 19. Leaflets usually 2-7 pairs, sometimes tri- or unifoliolate.  
 20. Endocarp with 1 (or 2) distinct operculum (opercula) at the apical end.

21. Fruits c. 1 cm long. Seed reniform. Young twigs, leaflets, and inflorescences with stellate hairs **10. Lannea**
21. Fruits larger, 2–2½ cm long. Seed oblong. Young twigs, leaflets, and inflorescences with simple hairs **8. Dracontomelon**
20. Endocarp without distinct operculum (opercula).
22. Fruits scurfy outside, lanceolate, 2½ by 1 cm. Leaflets velutinous on the lower surface **17. Pentaspadon**
22. Fruits glabrous, variously shaped but not lanceolate, less than 1½ by ⅔ cm.
23. Fruits ± oblong, or obliquely broad-ellipsoid; style or its scar excentric.
24. Fruit with style or its scar on one side at the upper ⅓. Terminal leaflet similar to the lateral ones **11. Spondias**
24. Fruit with style or its scar lateral at the apical end. Terminal leaflet usually very small, reduced, or not developed **19. Euroschinus**
23. Fruits obliquely subglobose, or globose; style or its scar terminal.
25. Leaves distinctly imparipinnate, tri- or unifoliolate. Endocarp free from exocarp and mesocarp when ripe **20. Rhus**
25. Leaves pseudoparipinnate or paripinnate. Endocarp united with exocarp and mesocarp when ripe **22. Pistacia**

### 1. BUCHANANIA

SPRENG. in Schrader, J. Bot. (1800) 2 (1801) 234; ROXB. Pl. Corom. 3 (1819) 58; KUNTH, Ann. Sc. Nat. Bot. 2 (1824) 338; HOOK. *f.* in B. & H. Gen. Pl. 1 (1862) 421; MARCH. Rév. Anacard. (1869) 116 & 191; ENGL. in DC. Mon. Phan. 4 (1883) 179; DING HOU, Blumea 24 (1978) 4. — *Coniogeton* BL. Bijdr. (1826) 1156. — **Fig. 3–5.**

Trees. *Leaves* spiral, simple, subcoriaceous, entire, petioled or sessile, mostly with internodal vein(s). *Inflorescences* axillary (also terminal?), paniculate. *Flowers* bisexual. *Calyx* 5- (rarely 4- or 6-)lobed, persistent or caducous. *Petals* 5 (rarely 4 or 6), imbricate, glabrous. *Stamens* twice the number of petals; filaments subulate, sagittate in most of the species. *Disk* shortly cupular, usually sulcate outside (impressions of the filaments), upper margin crenulate. *Carpels* 4–6, free, each 1-ovuled, usually only one fertile. *Ovary* ellipsoid, hairy or glabrous; style short; stigma oblique, truncate; sterile carpels smaller. *Drupe* 1-celled, often with an undeveloped seed; stone thick, woody or bony. *Seed* with testa free from the endocarp; cotyledons free, plano-convex.

Distr. About 25 spp., distributed in tropical Asia, Malesia, Australia, Micronesia, Melanesia, and Polynesia (Samoa).

Ecol. In primary forests, on dryland, temporarily inundated areas, or in peat-swamps, sometimes in secondary forest or on limestone hills; mainly in the lowland, up to c. 600 m.

Nomencl. BUCHANAN (Asiatick Researches 5, 1798, 123–126), in his "Description of the tree called, by the Burmese, Launzan", gave a detailed Latin description for the plant and stated: "I believe it will be found to constitute a new genus; but I do not venture to give it a name, till the European botanists have ascertained, whether or not it be reducible to any known genus of plants". *Launzan* was evaluated two years later by SPRENGEL *l.c.* who based himself on BUCHANAN's description and named this tree *Buchanania lanzan*.

The vernacular name *launzan* was listed by Index Kewensis in the synonymy of *Buchanania*. BARKLEY (Am. Midl. Nat. 28, 1942, 474; Lloydia 2, 1957, 265) proposed to conserve the generic name *Buchanania* over *Launzan*, but this is clearly unnecessary; cf. BACK. & BAKH. *f.* Fl. Java 2 (1965) 147.

Uses. The wood of some species is used for light construction, interior finishing, household implements, canoes (Papua), etc. (cf. VAN ROYEN, Man. For. Trees Papua New Guinea 4, 1964, 9 & 13; LOMBIAO & MENIADO, Forpride Digest 3, 1974, 69).

#### KEY TO THE SPECIES

##### Based on flowering material

1. Anthers not versatile, not sagittate (thecae connate at the base). Leaves reticulately veined. *Ser. Adnatae*.

2. Leaves 8–25 by 3–8 cm; apex acuminate, rarely short-acuminate. Pedicels articulated . . . . . 1. *B. splendens*
2. Leaves  $3\frac{1}{2}$ – $10\frac{1}{2}$  by  $2\frac{1}{4}$ – $4\frac{3}{4}$  cm; apex obtuse, sometimes emarginate. Pedicels not articulated . . . . . 2. *B. microphylla*
1. Anthers versatile, sagittate (thecae separate at the base). Veins reticulate-scalariform in *B. arborescens*. *Ser. Sagittatae*.
3. Filaments bicoloured, contracted and whitish at the apical part (c.  $\frac{1}{3}$  of the length).
4. Flowers  $\frac{3}{4}$ –4 mm pedicelled.
5. Leaf apex short-acuminate or acuminate; blade 9–40 by 3– $12\frac{1}{2}$  cm, veins reticulate-scalariform. Pedicels articulated,  $\frac{3}{4}$ –2 mm . . . . . 3. *B. insignis*
5. Leaf apex usually obtuse or rounded, rarely apiculate, acute, acuminate, or emarginate; blade  $4\frac{1}{2}$ –26(–35) by  $1\frac{3}{4}$ –7(–9) cm; veins reticulate or reticulate-scalariform. Pedicels usually not articulated, (1)–2–4 mm . . . . . 4. *B. arborescens*
4. Flowers sessile, articulated at the base. Leaf apex usually obtuse or rounded, rarely apiculate, acute, acuminate or emarginate, (12)–26–80 by ( $4\frac{1}{2}$ )– $6\frac{1}{2}$ –16 cm; veins reticulate-scalariform.
6. Petiole usually 0 or very short (c.  $\frac{1}{2}$  cm) . . . . . 5. *B. amboinensis*
6. Petiole distinct, ( $1\frac{1}{2}$ )–3–6 cm . . . . . 6. *B. macrocarpa*
3. Filaments concolorous, gradually narrowed towards the apex and not whitish at the apical part.
7. Filaments smooth. Leaves oblanceolate to narrowly oblanceolate, (16)–30–80 by (5)– $6\frac{1}{2}$ –16 cm; petiole distinct, 2–3(–6) cm . . . . . 7. *B. nitida*
7. Filaments papillose. Leaves smaller, obovate-oblong, oblanceolate or spatulate,  $7\frac{1}{2}$ –31 by 4– $10\frac{1}{2}$  cm; petiole usually 0, sometimes up to  $1\frac{1}{2}$ (–3) cm . . . . . 8. *B. sessifolia*

## KEY TO THE SPECIES

## Based on fruiting material

1. Leaf apex acuminate or short-acuminate, rarely apiculate, obtuse, or emarginate.
2. Leaves usually sessile, sometimes with a petiole up to  $1\frac{1}{2}$ (–3) cm. Fruits obliquely subobcordate, 10–13 by 8–11 mm, slightly longer than wide . . . . . 8. *B. sessifolia*
2. Leaves distinctly petioled; petiole  $\frac{1}{2}$ –4(–6) cm. Fruits sublentiform, 7–12 mm  $\varnothing$ .
3. Leaf veins reticulate-scalariform.
4. Leaves (16)–30–80 by (5)– $6\frac{1}{2}$ –16 cm; nerves 31–52 pairs. Fruits c.  $12\frac{1}{2}$  mm  $\varnothing$ . Calyx usually persistent. Pedicels usually not articulated or articulation obscure . . . . . 7. *B. nitida*
4. Leaves 9–40 by 3– $12\frac{1}{2}$  cm; nerves 10–25 pairs. Fruits 7–10 mm  $\varnothing$ . Calyx caducous. Pedicels distinctly articulated . . . . . 3. *B. insignis*
3. Leaf veins reticulate; nerves 8–13 pairs. Fruits c. 11 mm  $\varnothing$ . Calyx caducous. Articulation of pedicels obscure . . . . . 1. *B. splendens*
1. Leaf apex usually obtuse or rounded, rarely apiculate, acute, acuminate, or emarginate.
5. Fruits distinctly pedicelled, usually not articulated at base. Leaves  $3\frac{1}{2}$ –26(–35) by  $1\frac{3}{4}$ –7(–9) cm; nerves 7–18(–30) pairs.
6. Remaining stamens (if they can be found at the base of fruit) with anthers not versatile, not sagittate (thecae connate at the base) . . . . . 2. *B. microphylla*
6. Remaining stamens with anthers versatile, sagittate (thecae separate at the base) . . . . . 4. *B. arborescens*
5. Fruits sessile, articulated at base. Leaves (large) (12)–26–80 by ( $4\frac{1}{2}$ )– $6\frac{1}{2}$ – $16\frac{1}{4}$  cm; nerves 14–27 pairs.
7. Petiole 0 or very short (c.  $\frac{1}{2}$  cm). Fruits 8–11 mm  $\varnothing$  . . . . . 5. *B. amboinensis*
7. Petiole distinct, ( $1\frac{1}{2}$ )–3–6 cm. Fruits larger, 16–21 mm  $\varnothing$  . . . . . 6. *B. macrocarpa*

1. *Buchanania splendens* MIO. Sum. (1861) 524. — *B. platyneura* KURZ, J. As. Soc. Beng. 46, ii (1876) 125; KING, *ibid.* 65, ii (1896) 462. — *B. fragrans* RIDL. Kew Bull. (1933) 195, incl. var. *oblanceolata* RIDL.

Tree up to 30 m. Leaves elliptic-lanceolate, ovate-oblong, or oblanceolate, 8–25 by 3–8 cm, slightly hairy on both surfaces when young, glabrescent, and sometimes seemingly glabrous on older ones; base cuneate; apex acuminate, rarely short-acuminate; nerves 8–13 pairs; veins reticulate; petiole  $\frac{1}{2}$ –3 cm. Panicles  $6\frac{1}{2}$ –10 cm long, hairy, glabrescent; bracts  $\frac{2}{3}$ –1 mm long, hairy outside; pedicels 1– $1\frac{1}{2}$  mm, articulated, articulation obscure in fruit. Flowers white. Calyx caducous, lobes triangular, c.  $\frac{2}{3}$  mm long, puberulous outside. Petals elliptic-oblong, 2– $3\frac{1}{2}$  by  $1\frac{1}{4}$ – $1\frac{1}{2}$  mm. Stamens  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm; filaments 1– $1\frac{1}{4}$  mm, not contracted and whitish in apical part; anthers

$\frac{1}{2}$ – $\frac{2}{3}$  mm, not sagittate. Disk  $\frac{2}{3}$  mm long. Carpels  $1\frac{1}{4}$  mm long. Drupe sublentiform, c. 11 mm  $\varnothing$ .

Distr. Andaman and Nicobar Is., and in Malesia: Sumatra (Asahan, Bencoolen, Simalur) and Borneo (SE. Borneo: Martapura; Sabah: Lahad Datu; Sarawak: Kuching).

Ecol. Lowland forest up to 150 m, once on ultrabasic ridge in secondary forest. Fl. Jan.–May, Aug., Dec.; fr. March, May.

Vern. Sumatra: *awa bonan bonan*, *bonan-bonan-pajo*, *bona ètèn*, *tutun bonan*, Simalur; Borneo: *djingah burung*, Martapura, *hajawak gunung*, Pleihari.

2. *Buchanania microphylla* ENGL. in DC. Mon. Phan. 4 (1883) 185; VIDAL, Phan. Cuming. (1885) 106; Rev. Pl. Vasc. Filip. (1886) 100; PERK. Fragm. Fl. Philip. (1904) 24; MERR. En. Philip. 2 (1923) 466; LOMIBAO & MENIADO, Forpride Digest 3 (1974)

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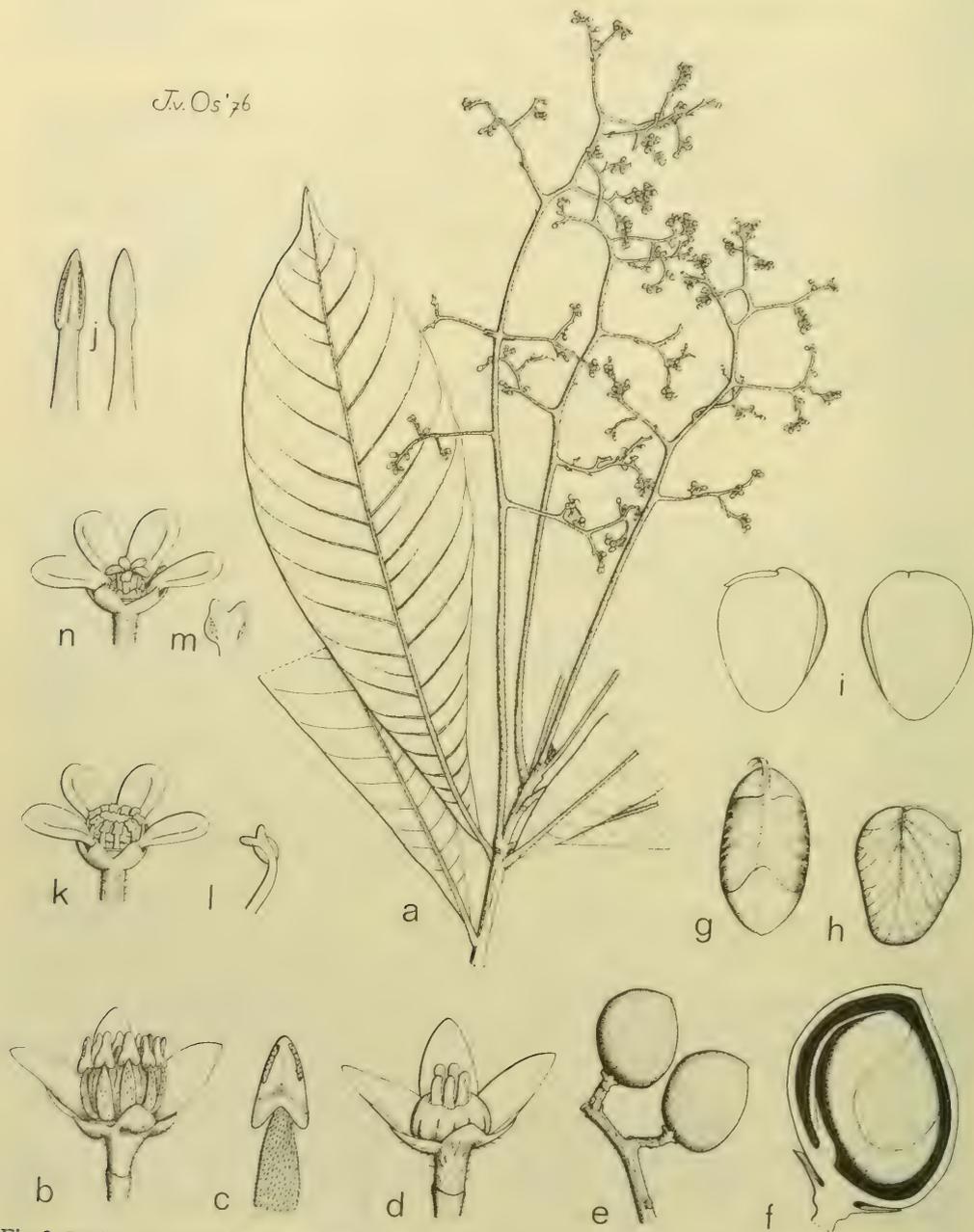


Fig. 3. *Buchanania sessifolia* BL. a. Habit,  $\times 1/2$ , b. flower, 2 petals removed,  $\times 7$ , c. stamen, with papillose filament,  $\times 14$ , d. flower, 2 petals and all stamens removed,  $\times 7$ , e. fruits,  $\times 2$ , f. fruit, half of pericarp removed showing seed, g. seed, viewed from raphe side,  $\times 7$ , h. embryo, side view, i. ditto, opened out, all  $\times 3 1/2$ . — *B. microphylla* ENGL. j. Stamens,  $\times 14$ . — *Androtium astylum* STAPF. k. Flower, 1 petal removed,  $\times 7$ , l. stamen, side view,  $\times 14$ , m. apical part of stamen, inner face view,  $\times 14$ , n. flower with 1 petal and all stamens removed,  $\times 7$  (a-d SAN 40540, e-i SAN 38391, j BS 44652, k-n J. A. R. ANDERSON 4313).

69 (*sphalm.* 'T. *macrophylla*'); DING HOU, *Blumea* 24 (1978) 4. — Fig. 3j.

Tree. *Leaves* elliptic, elliptic-oblong, broad elliptic, rarely obovate,  $3\frac{1}{2}$ – $10\frac{1}{2}$  by  $2\frac{3}{4}$ – $4\frac{3}{4}$  cm, slightly hairy towards the basal part especially on the midrib on both surfaces, glabrescent; base acute or cuneate; apex obtuse, sometimes emarginate; nerves 8–14 pairs, veins reticulate; petiole  $1\frac{1}{2}$ –2 cm. *Panicles*  $1\frac{1}{2}$ –10 cm long, shortly hairy, sometimes glabrescent; bracts ovate to ovate-oblong, sparsely hairy outside; pedicels 1–4 mm, not articulated. *Calyx* caducous, lobes ovate,  $\frac{2}{3}$ –1 mm long, sparsely hairy outside. *Petals* ovate, or elliptic-oblong,  $2\frac{1}{2}$ – $2\frac{3}{4}$  by  $1\frac{1}{4}$ – $1\frac{3}{4}$  mm. *Stamens*  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm; filaments 1– $1\frac{3}{4}$  mm, not contracted and whitish in apical part; anthers  $\frac{1}{2}$ – $\frac{2}{3}$  mm, not sagittate. *Disk*  $\frac{2}{3}$  mm long. *Carpels*  $1$ – $1\frac{1}{2}$  mm long. *Drupe* sublentiform, c. 9 mm Ø.

Distr. China (Hainan) and *Malesia*: Philippines (Palawan, Luzon, Cebu, Panay, and Guimaras).

Ecol. On dry slopes in thickets and secondary forest at low altitude. *Fl. Jan.*, April, June, Dec.; *fr. Jan.*–March.

Vern. *Dodokdöken*, *lañglangós*, *riñgas*, *Ilk.*, *kalapini*, *palinlin*, Tag., *malakok*, Pamp., *palilin*, *paminlin*, *paninglón*, Sbl., *pau*, Pang., *passi*, P.Bis.

Notes. Fruiting and sterile specimens of *B. microphylla* are quite similar to rather 'small' leaved ones of *B. arborescens*; such material cannot be identified with certainty. Fortunately, *B. microphylla* is not common, and is so far known only from the Philippines; besides, fertile material of these two species may sometimes have both flowers and fruits on the same specimen, or fruits with remaining stamens at the base, to facilitate identification.

Some Philippine specimens were wrongly referred to this species (*cf.* DING HOU, *Blumea* 24, 1978, 4).

3. *Buchanania insignis* BL. Mus. Bot. 1 (1850) 184; *Miq. Fl. Ind. Bat.* 1, 2 (1859) 636; ENGL. in DC. Mon. Phan. 4 (1883) 191. — *B. acuminatissima* MERR. Philip. J. Sc. 10 (1915) Bot. 34; En. Philip. 2 (1923) 465.

Tree 10–35 m high and 20–70 cm Ø; occasionally with buttresses up to 4 m high. *Leaves* oblanceolate, obovate-oblong, or elliptic-lanceolate, 9–40 by 3– $12\frac{1}{2}$  cm, slightly hairy beneath especially on the midrib, glabrescent; base attenuate; apex short-acuminate or acuminate; nerves 10–25 pairs, veins reticulate-scalariform; petiole  $1\frac{1}{2}$ –4(–6) cm. *Panicles* 7–24 cm long, hairy, glabrescent; bracts broad-ovate, or lanceolate, c.  $\frac{2}{3}$  mm long, slightly hairy outside; pedicels  $\frac{3}{4}$ –2 mm, articulated. *Flowers* white. *Calyx* caducous, lobes broad-ovate, or subrotund,  $\frac{2}{3}$ –1 mm long. *Petals* oblong, ovate- or elliptic-oblong, 3–4 by 1– $1\frac{1}{2}$  mm. *Stamens* 2– $3\frac{1}{2}$  mm; filaments  $1\frac{1}{2}$ –2 mm, apical part contracted and whitish; anthers  $\frac{3}{4}$ –1 mm, sagittate, lower  $\frac{1}{4}$ – $\frac{1}{3}$  sterile. *Disk*  $\frac{2}{3}$ –1 mm long. *Carpels*  $1\frac{1}{2}$ –2 mm long. *Drupe* red when ripe (KOSTERMANS 5980), sublentiform, 7–10 mm Ø.

Distr. *Malesia*: Borneo (Kalimantan: Kutai, Martapura, Bengkenang, Berauw, Bulungan Mara, Samarinda; Sabah: Lahad Datu) and Philippines (Luzon: Prov. Laguna, Quezon, Tayabas & Camarines; Catanduanes; Bucas Grande I.).

Ecol. In forest, occasionally on limestone, chiefly in the lowland, sometimes up to 400 m. *Fl. March*–Sept.; *fr. May*–Dec.

Vern. Kalimantan: *bindjai*, Martapura, Bengkenang, *ntahurang*, *térantang*, Kutai; Philippines: *balayóhot*, *baliñud*, *baliñghud*, *baliñghasai*, *maguliók*, Tag.

4. *Buchanania arborescens* (BL.) BL. Mus. Bot. 1 (1850) 183, *incl. var. obovata* BL.; *Miq. Fl. Ind. Bat.* 1, 2 (1859) 636; F.-VILL. Nov. App. (1880) 55; MERR. & ROLFE, Philip. J. Sc. 3 (1908) Bot. 108; MERR. Fl. Manila (1912) 300; Philip. J. Sc. 10 (1915) Bot. 35 & 190; HALL. f. Beih. Bot. Centralbl. 34, II (1916) 24; MERR. Sp. Blanc. (1918) 232; En. Philip. 2 (1923) 465; CRAIB, Fl. Siam. En. 1 (1926) 348; KANEH. Form. Trees rev. ed. (1936) 362, f. 318; WHITE, Proc. R. Soc. Queensl. 61 (1950) 56.; TARD. Fl. C. L. & V. 2 (1962) 76; LIU, Ill. Pl. Taiwan 2 (1962) 934, f. 769; LI, Woody Fl. Taiwan (1963) 445, f. 172; BACK. & BAKH. f. Fl. Java 2 (1965) 147; KALKMAN, *Blumea* 13 (1965) 107; ROYEN, Man. For. Trees Papua & N. G. 4 (1966) 9, f. 1; WHITMORE, Guide For. Brit. Solom. Is. (1966) 33; Gard. Bull. Sing. 22 (1967) 3 & 4; MEIJER, Bot. News Bull. F. D. Sandakan 8 (1967) 20, pl.; VERSTEEGH, Med. Landb. Hogesch. Wageningen 71–19 (1971) 22; LOMIBAO & MENIADO, Forpride Digest 3 (1974) 69. — *Coniogeton arborescens* BL. Bijdr. (1826) 1156. — *Prunus? laurifolia* DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 458; *Miq. Fl. Ind. Bat.* 1, 1 (1855) 366; *ibid.* 1, 2 (1859) 458. — *B. decandra* BLANCO, Fl. Filip. (1837) 66, ed. 2 (1845) 48, ed. 3, 1 (1877) 89, t. 63. — *B. longifolia* SPAN. Linnaea 15 (1841) 188; WALP. Rep. 1 (1842) 556; BL. Mus. Bot. 1 (1850) 184; *Miq. Fl. Ind. Bat.* 1, 2 (1859) 636; ENGL. in DC. Mon. Phan. 4 (1883) 188. — *B. florida* SCHAU. Nov. Act. Ac. Caes. Leop.-Car. 19, Suppl. 1 (1843) 481; WALP. Rep. 5 (1845) 416; A. GRAY, Bot. Wilkes U.S. Explor. Exped. (1854) 366, t. 44; *Miq. Fl. Ind. Bat.* 1, 2 (1859) 638; ENGL. in DC. Mon. Phan. 4 (1883) 188, *incl. var. arborescens* ENGL., *var. cumingii* ENGL., *var. lucida* (BL.) ENGL. *et var. petiolaris* (MIQ.) ENGL.; VIDAL, Synopsis Atlas (1883) 22, t. 26, f. C; Phan. Cuming. (1885) 106; Rev. Pl. Vasc. Filip. (1886) 100; KING, J. As. Soc. Beng. 65, ii (1896) 463; K. & V. Bijdr. 4 (1896) 70; KOORD. Minah. (1898) 409; PIERRE, Fl. For. Coch. (1898) t. 378B; MERR. Bull. Bur. For. Philip. 1 (1903) 33; PERK. Fragm. Fl. Philip. (1904) 24; MERR. Philip. J. Sc. 1 (1906) Suppl. 84; BACK. Fl. Bat. (1907) 358; Schoolfl. (1911) 277; RIDL. J. Str. Br. R. As. Soc. n. 59 (1911) 89; LAUT. Bot. Jahrb. 56 (1920) 349. — *Laurocerasus laurifolia* (DECNE) ROEM. Synops. 3 (1847) 91. — *B. lucida* BL. Mus. Bot. 1 (1850) 184; *Miq. Fl. Ind. Bat.* 1, 2 (1859) 636, *incl. var. palembanica* (BL.) MIQ.; Sum. (1861) 523; HOOK. f. Fl. Br. Ind. 2 (1876) 23; PIERRE, Fl. For. Coch. (1898) t. 371B; LECOMTE, Fl. Gén. I.-C. 1 (1908) 9; RIDL. Fl. Mal. Pen. 1 (1922) 518, *incl. var. laxiflora* RIDL.; CRAIB, Fl. Siam. En. 1 (1926) 348; BURK. Dict. (1935) 378; CORNER, Ways. Trees (1940) 102, f. 19, Atlas pl. 3; TARD. Fl. C. L. & V. 2 (1962) 73; KOCHUM. Mal. For. Rec. 17 (1964) 212. — *B.? palembanica* BL. Mus. Bot. 1 (1850) 186; TURCZ. Bull. Soc. Nat. Mosc. 31, i (1858) 473. — *B. subobovata* GRIFF. Notul. 4 (1854) 413. — *B. longifolia* TURCZ. Bull. Soc. Nat. Mosc. 31, i (1858) 472, *non* SPAN. 1841;



Fig. 4. *Buchanania arborescens* (BL.) BL. Courtesy and fotogr. CORNER. Magnification  $\times \frac{1}{5}$ .

F.-VILL. Nov. App. (1880) 55. — *B. petiolaris* MIQ. Fl. Ind. Bat. 1, 2 (1859) 637. — *B. polybotrya* MIQ. l.c. 638. — *B. bancana* MIQ. Sum. (1861) 523. — *B. pseudoflorida* PERK. Fragm. Fl. Philip. (1904) 24. — *B. platyphylla* MERR. Philip. J. Sc. 10 (1915) Bot. 33. — *B. novo-hibernica* LAUT. Bot. Jahrb. 56 (1920) 349. — *B. scandens* LAUT. l.c. 351. — *B. pappuana* C. T. WHITE, Proc. R. Soc. Queensl. 34 (1922) 40. — *B. glaberrima* RIDL. Kew Bull. (1933) 195. — *B. solomonensis* MERR. & PERRY, J. Arn. Arb. 22 (1941) 530. — *B. versteeghii* MERR. & PERRY, l.c. 531. — *B. nabirensis* KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 166. — *B. monticola* KANEH. & HATUS. l.c. — Fig. 4.

Tree 4–35 m high and 10–75(–120) cm Ø; buttresses sometimes present, low, rounded, rarely up to 1 m high, 2 m extending outward from the trunk, and 10 cm thick. Leaves obovate to oblanceolate, or elliptic-oblong,  $4\frac{1}{2}$ –26(–35) by  $1\frac{1}{4}$ –7(–9) cm, hairy beneath especially on the midrib when young, glabrescent; base cuneate to attenuate; apex usually obtuse or rounded, rarely apiculate, acute, or emarginate, rarely acuminate; nerves 7–18(–30) pairs, veins reticulate or reticulate-scalariform; petiole 1–3(–4) cm. Panicles  $5\frac{1}{2}$ –22 cm long, hairy, glabrescent; bracts ovate or subrotund,  $\frac{1}{3}$ – $\frac{2}{3}$  mm long, sparsely hairy outside and ciliate on the margin, glabrescent, or glabrous; pedicels (1)–2–4 mm, usually not articulated. Flowers white. Calyx usually caducous, lobes broad-ovate or subrotund,  $\frac{2}{3}$ –1 mm long. Petals elliptic,  $2\frac{1}{2}$ – $3\frac{1}{2}$  by  $1\frac{1}{4}$ – $1\frac{3}{4}$  mm. Stamens  $2\frac{1}{2}$ –3 mm; filaments  $1\frac{3}{4}$ – $2\frac{1}{2}$  mm, apically contracted and whitish; anthers  $\frac{2}{3}$ –1 mm, sagittate, lower  $\frac{1}{3}$ (– $\frac{1}{2}$ ) sterile. Disk  $\frac{2}{3}$ –1 mm long. Carpels  $1\frac{1}{2}$ –2 mm long. Drupe sublentiform, c. 10 mm Ø.

Distr. Tenasserim, Andamans, Thailand, Indo-China, Formosa, widely distributed throughout Malesia to New Britain, the Solomons, and Australia.

Ecol. Chiefly in lowland forest, along river-banks, near the beach, peat-swamps and dryland, sometimes on limestone hills and in secondary forest, up to 300 m, rarely at 540 m (Sabah). Fl. fr. Jan.–Dec., in Malaya mainly fl. April–June. In flower the crown becomes cream-white and very conspicuous (CORNER).

Uses. The wood is used for interior finishing, light construction, joints, rafters, furniture, boxes, cases, and veneers, all in all of rather inferior quality (HEYNE, Nutt. Pl. 1927, 965). Common names: *balinghasai*, Philippines, *satin-wood*, Papua New Guinea (cf. ROYEN, l.c.; LOMBABO & MENIADO, l.c.). BURKILL l.c. added a few minor uses on tannin bark and leaves for curing head-ache.

Vern. Sumatra: *kělumpang*, *rêngas poja*, *samah*, *M*, *rêngas manuk*, Lampongs, *têrêntang burung*, Palembang; Banka: *mêmpao*, *njuh bunga*, *rêngas manok*, *sisisil padang*, M; Billiton: *pao*, M; Malay Peninsula: *katak hudang*, *kělumpang kêras*, *kêtak udang*, *lêmak kêtam*, *otak hudang* (*daun tumpul*), *pauh pipit*, *puan*, *rêngas ayêr*, *rêngas pasir*, *têrêntang tikus*, *tinggi burung*, M; Java: *gêtasan*, *kokohan*, *opawa*, *pokopoah*, *wuru-gêni*, J, *kaju putil*, *kitañjung*, *ki salim*, *rêngas lakaki*, *rêngas manuk*, *rêngas piit*, S, *popohan*, J & S; Karimon Djawa I.: *buah ingas*; Lesser Sunda Is.: *kêmalapau*, *upêkei*, Sumba, *êmpau*, Flores; Borneo: Brunei: *kêpala tundang*, *rêngas ayom*; Sarawak: *rêngas laut*,

Similajau, *utak udang*, Kuching; Sabah: *balono-balono*, *bingkurud*, *manuk-manuk*, *nanka-nanka*, *salangawan*, Bajau, *baumobono*, *baumu-baumu*, Suluk, *bêluno-bêluno*, M & Suluk, *borong bangalo*, Banggi, *budu-budu*, Sungei, *kapala tundang*, Brunei & M, *kasat*, Brunei & Sungei, *kêpala tundang*, Kedayan, *madsabundu*, *manga-manga*, *samundu*, Dusun, *manga utan*, M, *masa mundu*, Kudat, *salingkawang*, Brunei, Dusun & M, *tangawan*, Brunei, Dusun & Sipitan; Kalimantan: *djinga burung*, *mata udang*, *njatoh bunga*, *otak udang*, *rawa rawa pipit*, M, *djingah pêrkusa*, *moruang*, *rêngas bakei*, Kuala Kapuas, *kopêng*, *mataorang*, *rarangasan*, Kutai, *rawa pipit*, Martapura; Philippines: *anagas*, *bálaŋga*, *tagangtáng*, *unkan*, P.Bis., *alitagtag*, *baliŋgohot*, *baliohod*, *kalampuso*, *upong-upong*, Bik., *anan*, *balins'ud*, Mang., *anam*, *pasig*, Bis., *anugas*, *beobayanó*, *butu-butu*, C.Bis., *antêng*, *langlanges*, *páuan*, *rangsá*, Ilk., *araká*, *gañgá*, Ibn., *arenges*, Isabela, *bagilibas*, *bahai-uhod*, *baliñghásai*, *balitántang*, *balithóh*, *kaming*, *hingas*, *magulioh*, *malaybóhod*, Tag., *balingásai*, Ilk., Tag., Sbl., *balehod*, Camarines, *balinhásai*, Ibn., Ilk., Tag., Ig., *balinh'ai*, *kaming*, Sbl., *balitang*, Camarines, Tayabas, *balunug*, *dilañan*, *malabalino*, *mangapuli*, *manbalino*, Sul., *boróan*, *bulían*, *kaming*, *pakaran*, Pang., *garantang*, Tagb., *gimbulon*, Mindanao, *havan*, Nueva Vizcaya, *hongas*, *malaligas na lalake*, Tayabas, *kalantang*, *malapog*, Palawan, *kaligpo*, Sub., *kanteng*, Ting., *kasabang*, Neg., *lagindingan*, Mag., *maománga*, Sml., *palang*, *papagan*, Cagayan, *palankomog*, Mt Prov., *tarangnisig*, Bag., *uyok*, Ig.; Celebes: *kalêla*, *makuranga*, Minah., *kaposo*, *lokinako*, *morantoboëa*, *ninifo*; Moluccas: *marisin karê'a*, *tamiruan'a*, Talaud Is.; New Guinea: *bahoör*, Animanshasin, *bilou*, Mooi, *korgier*, Tehid, *weekar*, Tor, *woökoi*, Manikiong.

5. *Buchanania amboinensis* MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 117; MERR. Philip. J. Sc. 11 (1917) Bot. 285. — *B. heterophylla* K.SCH. in K.Sch. & Laut. Nachtr. (1905) 300; LAUT. Bot. Jahrb. 56 (1920) 351, f. 1; WHITE, J. Arn. Arb. 10 (1929) 234; MERR. & PERRY, *ibid.* 22 (1941) 531, incl. var. *pubescens* MERR. & PERRY; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 11, f. 2. — *B. aruensis* RIDL. Kew Bull. (1933) 195.

Tree 15–30 m high and 20–30 cm Ø. Leaves obovate-oblong to oblanceolate, 26–64 by 8–16 cm, hairy on both surfaces, especially on the midrib and nerves, glabrescent; base attenuate; apex obtuse or rounded, rarely apiculate; nerves 19–27 pairs, veins reticulate-scalariform; petiole 0 or very short (c. 5 mm). Panicles 14–30 cm long, densely hairy, sometimes glabrescent; bracts ovate-oblong to lanceolate, 1–1 $\frac{1}{2}$  mm long, hairy outside. Flowers white, sessile, articulated at the base. Calyx persistent, lobes broad-ovate or subrotund,  $\frac{2}{3}$ – $1\frac{1}{4}$  mm long, sparsely hairy outside. Petals elliptic or elliptic-oblong,  $2\frac{1}{4}$ – $3\frac{1}{4}$  by  $1\frac{1}{2}$  mm. Stamens  $2\frac{1}{2}$ –3 mm; filaments  $1\frac{1}{2}$ – $2\frac{1}{4}$  mm, contracted and apically whitish; anthers  $\frac{2}{3}$ –1 mm, sagittate, lower  $\frac{1}{4}$ – $\frac{1}{3}$  sterile. Disk  $\frac{2}{3}$  mm long. Carpels  $1\frac{1}{2}$  mm long. Drupe red when ripe, sub-lentiform, 8–11 mm Ø.

Distr. Malesia: Moluccas (Morotai, Halmahera, Buru, Ceram, Ambon), Aru Is., and New Guinea (scattered).

Ecol. In lowland primary forest up to 200 m, once at 600 m. *Fl.* April–Dec.; *fr.* May–Dec.

Vern. Moluccas: *basarar*, Onjob, *fitenu*, Bemb, *hutong utan*, Ambon, *kara*, Kaigori, *karukaruru*, Miniafia, *kumu*, Mawan, *litoco*, Morotai, *niranira*, Rawa, *tjiwivedjai*, Kawerawedje.

6. *Buchanania macrocarpa* LAUT. Bot. Jahrb. 56 (1920) 350; MERR. & PERRY, J. Arn. Arb. 22 (1941) 530; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 13, f. 3; VERSTEEGH, Med. Landb. Hogesch. Wageningen 71–19 (1971) 22. — *B. mollis* LAUT. Nova Guinea 8 (1912) 829; Bot. Jahrb. 56 (1920) 349; KANEH. & HATUS. Bot. Mag. Tokyo 52 (1938) 413; MERR. & PERRY, J. Arn. Arb. 22 (1941) 529; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 14, f. 4. — *B. montana* LAUT. Bot. Jahrb. 56 (1920) 350. — Fig. 5c–h.

Tree 6–37 m high and 8–87 cm Ø, occasionally buttressed. *Leaves* obovate-oblong or oblanceolate, (12–)26–45 by (4<sup>1</sup>/<sub>4</sub>–)9–16<sup>1</sup>/<sub>4</sub> cm, sparsely to densely hairy beneath, sometimes on both surfaces, glabrescent; base cuneate or attenuate; apex obtuse or rounded, rarely apiculate, acute, or emarginate; nerves 14–20 pairs, veins reticulate-scalariform; petiole (1<sup>1</sup>/<sub>2</sub>–)3–6 cm. *Panicles* 8<sup>1</sup>/<sub>2</sub>–25 cm long, hairy, glabrescent; bracts lanceolate, <sup>3</sup>/<sub>4</sub> mm long, pubescent outside. *Flowers* creamish or white, sessile, articulated at the base. *Calyx* persistent, lobes subrotund, <sup>2</sup>/<sub>3</sub>–1 mm long. *Petals* ovate-oblong, 2–2<sup>1</sup>/<sub>2</sub> by 1–1<sup>1</sup>/<sub>2</sub> mm. *Stamens* 1<sup>1</sup>/<sub>2</sub>–1<sup>3</sup>/<sub>4</sub> mm; filaments 1–1<sup>1</sup>/<sub>4</sub> mm, apically contracted and whitish; anthers <sup>3</sup>/<sub>4</sub>–1 mm sagittate, lower <sup>1</sup>/<sub>4</sub>–<sup>1</sup>/<sub>3</sub> mm sterile. *Disk* c. <sup>1</sup>/<sub>2</sub> mm long. *Carpels* 1<sup>1</sup>/<sub>2</sub> mm long. *Drupe* brown, sublentiform, 16–21 mm Ø.

Distr. *Malesia*: Moluccas (Ceram) and New Guinea (scattered); including adjacent islands: Normanby, New Britain, Numfoor, Salawati, Misool, Biak, Aru, and Rossel) & Solomons.

Ecol. In primary forest of low dry or temporarily inundated areas, up to 450 m, once at 900 m (Morobe). *Fl.* Jan.–Oct.; *fr.* Jan.–Dec.

Uses. Similar to those mentioned under *B. arborescens*; sometimes used also for canoes in Sepik and Gulf Distr., Papua New Guinea, but reported to be durable only for a short time (cf. ROYEN, l.c.).

Vern. New Guinea etc.: *ala*, Bilia, *barrabarra*, Usino, *bênggèng*, Manokwari, *bienier*, *Asmat*, *dam* = *damtaris*, Kwesten, *diomo*, Kiwai, *fitum*, Biembi, *floboen*, *klobum*, Mooi, *hèrakuba*, *kèrapuka*, Gulf Distr., *inaandoi*, Biak, *kara*, Dumpu & Kaigori, *karukaruru*, Minafia, *kurus*, Amele, *lagobe*, W. Nakanai, *langara*, Aru, *mek-kinghoog*, Sidei, *mekogo*, Arfak, *mutum*, Muju, *nisriu*, Amberbakan, *uruk*, Mandobo, *porokko*, Manikiong, *sieriew*, Kebar, *sunem*, Madang, *ta'ugapa*, Orokaiwa, *waw-waw*, Karas, *yapa*, Faita.

7. *Buchanania nitida* ENGL. in DC. Mon. Phan. 4 (1883) 193; VIDAL, Phan. Cuming. (1885) 106; Rev. Pl. Vasc. Filip. (1886) 100; PERK. Fragm. Fl. Philip. (1904) 24; MERR. En. Philip. 2 (1923) 466; MERR. & PERRY, J. Arn. Arb. 22 (1941) 533. — *Campnosperma philippinense* MERR. Philip. J. Sc. 60 (1936) 31, cf. STEEN. *ibid.* 91 (1962) 508. — *B.*

*conglomerata* ELMER (ex MERR. En. Philip. 2 (1923) 467, *nom. in syn.*) Leaf. Philip. Bot. 10 (1939) 3679, *descr. angl.* — *B. sorsogonensis* ELMER, l.c. 3681, *descr. angl.* — Fig. 5a–b.

Tree 8–15(–28) m high and 20–30(–35) cm Ø. *Leaves* oblanceolate to narrow-oblanceolate, (16–)30–80 by (5–)6<sup>1</sup>/<sub>2</sub>–16 cm; base cuneate or attenuate; apex acuminate or short-acuminate, rarely apiculate, obtuse, or emarginate; nerves 31–52 pairs, veins reticulate-scalariform; petiole 2–3(–6) cm. *Panicles* up to 40 cm long, pubescent; bracts obovate to oblanceolate, 1<sup>3</sup>/<sub>4</sub>–2<sup>1</sup>/<sub>4</sub> mm, sparsely hairy outside; pedicels 1–1<sup>1</sup>/<sub>2</sub> mm, usually not articulated, or articulation obscure. *Flowers* yellowish. *Calyx* usually persistent, lobes broad-ovate or -elliptic, <sup>2</sup>/<sub>3</sub>–1 mm long, sparsely hairy outside. *Petals* elliptic-oblong, 2<sup>1</sup>/<sub>2</sub>–3 by <sup>3</sup>/<sub>4</sub>–1<sup>1</sup>/<sub>4</sub> mm. *Stamens* 2–3 mm; filaments 1<sup>1</sup>/<sub>4</sub>–2 mm, gradually narrowed towards the apex and not whitish at the apical part; anthers 1–1<sup>1</sup>/<sub>4</sub> mm, sagittate, lower <sup>1</sup>/<sub>4</sub>–<sup>1</sup>/<sub>5</sub> sterile. *Disk* <sup>1</sup>/<sub>2</sub>–1 mm long. *Carpels* 1<sup>1</sup>/<sub>2</sub>–2 mm long. *Drupe* red when ripe, sublentiform, c. 12 mm Ø.

Distr. *Malesia*: Philippines (Mindoro, Luzon, Polillo, Masbate, Samar, Leyte, Biliran, Negros Or., Basilan, Mindanao) and Moluccas (Morotai).

Ecol. In primary forest, rarely in second growth or forest, at low altitude up to 450 m. *Fr.* April–July.

Vern. Philippines: *anam*, *balitangtang*, *liok*, *maguliök*, Tag., *lubilubi*, P.Bis., *managas*, *talagabanug*, Mbo.

8. *Buchanania sessifolia* BL. Mus. Bot. 1 (1850) 184; MIQ. Fl. Ind. Bat. 1, 2 (1859) 637 ('*sessilifolia*'); Sum. (1861) 523; ENGL. in DC. Mon. Phan. 4 (1883) 191; KING, J. As. Soc. Beng. 65, ii (1896) 463; K. & V. Bijdr. 4 (1896) 74; BACK. Schoolfl. (1911) 277; RIDL. Fl. Mal. Pen. 1 (1922) 519; MERR. Pl. Elm. Born. (1929) 166; BURK. Dict. (1935) 378; KOCHUM. Mal. For. Rec. 17 (1964) 213; BACK. & BAKH. f. Fl. Java 2 (1965) 148; DING HOU, Blumea 24 (1978) 5. — *B. acuminata* TURCZ. Bull. Soc. Nat. Mosc. 31, i (1858) 472; HOOK. f. Fl. Br. Ind. 2 (1876) 24; BAKER, J. Bot. 62 (1924) Suppl. 30. — *B. oxyphylla* MIQ. Sum. (1861) 522. — Fig. 3a–i.

Tree up to 42 m high and 80 cm Ø, sometimes buttressed. *Leaves* obovate-oblong, oblanceolate or spatulate, 7<sup>1</sup>/<sub>2</sub>–31 by 4–10<sup>1</sup>/<sub>2</sub> cm, hairy beneath especially on midrib and nerves, rarely on both surfaces, usually glabrescent; base cuneate or attenuate; apex acuminate or short-acuminate, rarely apiculate; nerves 12–25 pairs, veins reticulate-scalariform; petiole usually 0, sometimes up to 1<sup>1</sup>/<sub>2</sub>(–3) cm. *Panicles* 4<sup>1</sup>/<sub>2</sub>–34 cm long, hairy, sometimes glabrescent; bracts lanceolate, c. 1 mm long, hairy on both surfaces; pedicels <sup>1</sup>/<sub>2</sub>–1 mm, articulated. *Flowers* white or whitish yellow. *Calyx* persistent, lobes semiorbicular or triangular, <sup>1</sup>/<sub>2</sub>–1 mm long, hairy outside. *Petals* elliptic, oblong, or ovate-oblong, 2–2<sup>1</sup>/<sub>2</sub> by 1–1<sup>1</sup>/<sub>4</sub> mm. *Stamens* 1<sup>1</sup>/<sub>2</sub>–2 mm; filaments 1–1<sup>1</sup>/<sub>4</sub> mm, papillose, gradually narrowed towards the apex and not whitish in the apical part; anthers <sup>2</sup>/<sub>3</sub>–<sup>3</sup>/<sub>4</sub> mm, sagittate, lower <sup>1</sup>/<sub>4</sub>–<sup>1</sup>/<sub>2</sub> sterile. *Disk* <sup>1</sup>/<sub>2</sub>–<sup>2</sup>/<sub>3</sub> mm long. *Carpels* c. 1 mm long. *Drupe* obliquely subobcordate, 10–13 by 8–11 mm.

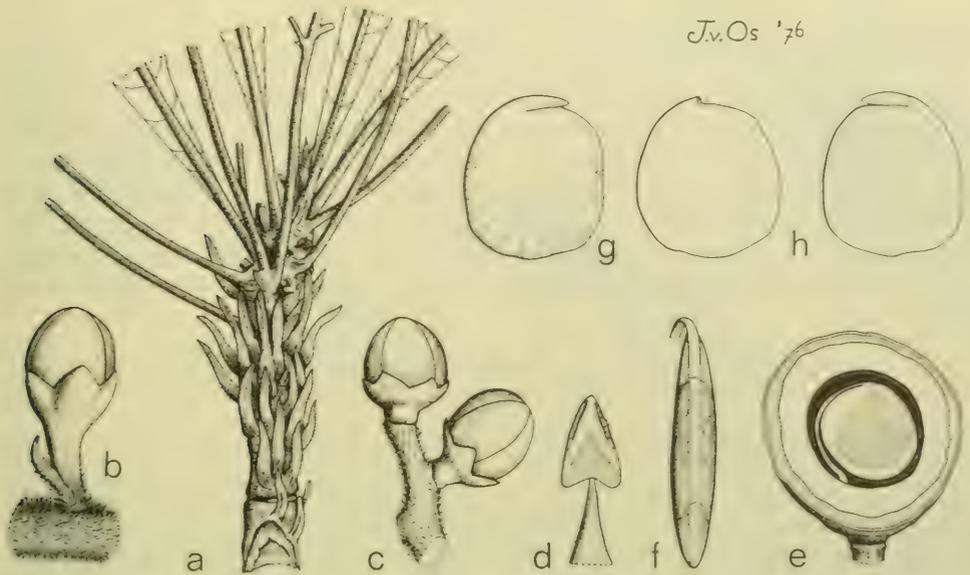


Fig. 5. *Buchanania nitida* ENGL. *a*. Apical part of twig with many scales,  $\times \frac{1}{2}$ , *b*. flower-bud, pedicel not articulated,  $\times 7$ . — *B. macrocarpa* LAUT. *c*. Two flower-buds, pedicels articulated,  $\times 7$ , *d*. stamen,  $\times 14$ , *e*. fruit, half of pericarp removed,  $\times 1\frac{1}{2}$ , *f*. seed, viewed from raphe side,  $\times 3\frac{1}{2}$ , *g*. embryo, lateral view,  $\times 2$ , *h*. embryo, cotyledons separated,  $\times 2$  (*a-b* RAMOS 1617, *c-d* BW 9472, *e-h* BW 1912).

**Distr.** Peninsular Thailand, Laos, and *Malesia*: Sumatra (incl. Simalur & Banka), Malay Peninsula, and Borneo (Brunei, Sarawak, Sabah, SE. Borneo, and incl. Anambas & Natuna Is.).

**Ecol.** Chiefly in forests on dryland, sometimes along river-banks, in wet places or in freshwater swamps, mainly in the lowland, rarely up to c. 1000 m. *Fl.* Jan.–Nov.; *fr.* Febr.–Dec.

**Uses.** Though not durable used for houses (HEYNE, Nutt. Pl. 1927, 965). The sour fruit is eaten by the Jakuns in Malaya (BURKILL *l.c.*).

**Vern.** Sumatra: *kaju itom*, Asahan, *kĕtapang*, *rĕngas balang*, Lampongs, *mĕdangbiŕnga*, W. Coast, *tarantang ajam*, Muara Enim, *pau pipit*, *tarantang burung*, *tarantang munu*, *tĕrĕntang ajam*, *tjĕrĕntang*, Palembang; Malay Peninsula: *bintangos otak udang*, *bintonfar otak udang*, *gĕtak husang*, *hompos tĕba*, *kaju limpudu burung*, *katah udang*, M, *kayu baŕng*, Temuan, *kĕlat samak*, *kĕrtah udang*, *lada lada*, *mĕntango otak udang*, *ota udang*, *poko habong ayam*, *poko la hudung*, *poko pao utan*, *pokoh paoo peepit*, *pokoh tumoohong*, *rĕngas ayam*, *rĕngas pasir*, *sĕrcutang tikus*, M; Borneo: Brunei: *tĕrĕntang tchit*, Iban; Sarawak: *labu*, *lavo*, Kayan, *ĕmpĕdu*, Baram, *tĕrĕntang chit*, Lundu; SE. Borneo: *bindjai hutan*, Tanah Bumbu, *djinga*, Balikpapan, *tohotang*, Dajak; Sabah: *bauno*, Suluk, *bawang-bawang*, *kĕpala tundang*, *tĕrĕntang*, M, *kepisia tundang*, Tawau, *kalut*, *rĕngas bunkit*, Dusun.

#### Dubious & Excluded

*Buchanania latifolia* ROXB. *Fl. Ind. ed.* Wall. 2 (1824) 385; *Hook. f. Fl. Br. Ind.* 2 (1876) 23; ENGL. in DC. *Mon. Phan.* 4 (1883) 182; KURZ, *Fl. Burma* 1 (1887) 307; PIERRE, *Fl. For. Coch.* (1898) t. 370B; LECOMTE, *Fl. Gén. I.-C.* 2 (1908) 10; CRAIB, *Fl. Siam. En.* 1 (1926) 348; TARD. *Fl. C. L. & V.* 2 (1962) 77.

HOOKEE (*l.c.*) mentioned under *B. latifolia* ROXB. that "There is a specimen marked from Malacca in Griffith's Herbarium". ENGLER (*l.c.*) cited "Birna vel Malacca (Griff., n. 1114 in Herb. Kew)" under the same species.

I examined the specimen in question in the Kew Herbarium. It was correctly identified. On it there are two printed labels "Birna and Malacca" and "Malacca", respectively. Therefore, I presume that this specimen was collected in Burma.

*B. latifolia* is characterized by usually broad elliptic to elliptic-oblong leaves, villose beneath and obtuse or emarginate at the apex. So far I have not seen any collection of it from Malesia.

NAVES & FERNANDEZ-VILLAR (Nov. App. 1880, 55) recorded it as occurring in the Philippines, but MERRILL (*En. Philip.* 2, 1923, 467) excluded it from the flora of this region.

*Buchanania novo-guineensis* WARB. *Bot. Jahrb.* 13 (1891) 363 = *Rhyticaryum novoguineense* (WARB.) SLEUMER, *Blumea* 17 (1969) 250 (*Icacina-ceae*).

## 2. ANDROTIIUM

STAPP, Hook. Ic. Pl. (1903) t. 2763. — Fig. 3k-n.

Tree. *Leaves* spiral, simple, entire, petioled. *Inflorescences* axillary, paniculate. *Flowers* bisexual. *Calyx* 5-(or 4)-lobed. *Petals* 5 (or 4), imbricate, glabrous except the sparsely hairy margin. *Stamens* twice the number of petals; filaments subulate; anthers basifixed, with 2 separated anther-cells, overtopped by prolonged, dilated and apically two-lobed connective, lobes pustular especially when young. *Disk* intrastaminal, shortly cupular, crenulate on the margin, glabrous. *Carpels* 5, free, each 1-ovuled, only one fertile. *Ovary* subglobose, pilose; style obscure; stigma oblique; sterile carpels smaller, bent outward. *Drupe* (very young) lentiform (STAPP, *l.c.*).

Distr. Monotypic; so far known only from *Malesia*: Malay Peninsula and Borneo. Ecol. In primary and swamp forests at low altitude.

1. *Androtium astylum* STAPP, Hook. Ic. Pl. (1903) t. 2763; MERR. En. Born. (1921) 349; ANDERSON, Gard. Bull. Sing. 20 (1963) 169. — Fig. 3k-n.

Tree up to 16 m high and c. 17 cm Ø. *Leaves* subcoriaceous, elliptic, broadly ovate, or obovate, 4½-10 by 2-5½ cm, glabrous, sometimes sparsely hairy underneath and glabrescent; base cuneate or obtuse; apex acuminate, rarely emarginate; nerves 5-9 pairs, veins reticulate; petiole 4-8 mm. *Panicles* 1-8½ cm long, puberulous; floral bracts broadly ovate or ovate, ½-1 mm long; pedicels ⅔-1 mm. *Calyx* lobes broadly ovate, ½-¾ mm long. *Petals* white tipped otherwise pink, ovate-oblong or slightly elliptic, 2-3 by ⅔-1 mm. *Stamens* ½-1 mm; anthers c. ⅓ mm long. *Disk*

c. ¼ mm Ø. Fertile *ovary* c. ½ mm Ø, sterile ones smaller.

Distr. *Malesia*: Malay Peninsula (Kluang For. Res.) and Borneo (Sarawak: Lambir Hills, Miri; Loba Kabang, Sibü; Kuching; Semengoh Arboretum; Sampadi; Melinan Gorge, Baram; Kalimantan: W. part, P. Pandan; S. part: Sampit R. region near Kuala Kuajan).

Ecol. In primary and swamp forests at low altitude. *Fl.* April-Sept.

Vern. Borneo: *merambang*, Iban.

Note. It is noteworthy that the only fruit described is by STAPP, and that immature; I have seen 11 collections.

## 3. ANACARDIUM

LINNÉ, Gen. Pl. ed. 5 (1754) 180; Sp. Pl. (1753) 383; MARCH. Rév. Anacard. (1869) 105 & 189; ENGL. in DC. Mon. Phan. 4 (1883) 215. — *Cassuvium* RUMPH. Herb. Amb. 1 (1741) 177, t. 69. — *Acajou* MILLER, Gard. Dict. Abr. ed. 4 (1754). — Fig. 6.

Trees or shrubs. *Leaves* spiral or alternate, simple, petioled. *Inflorescences* terminal, sometimes also in the upper leaf axils, paniculate or sometimes corymbose. *Flowers* unisexual (♂) or bisexual (plants polygamous). *Calyx* 5-lobed. *Petals* 5, imbricate, puberulous on both surfaces. *Stamens* 7-10, unequal, 1 (rarely 2) much stouter and longer, the rest reduced, smaller, all fertile, sometimes some of them imperfect or sterile; filaments subulate, basally connate into a short tube, puberulous with minute glandular hairs; anthers basifixed, ovoid or broadly ellipsoid. *Disk* none. *Ovary* slightly obovoid, glabrous, 1-celled and 1-ovuled, abortive and rudimentary in ♂; style filiform; stigma obscure. *Drupe* 1-celled, on a fleshy, pyriform hypocarp (enlarged receptacle and pedicel). *Seed* with testa free from endocarp; embryo reniform, cotyledons free, plano-convex.

Distr. About 8 spp. in tropical America; one, *A. occidentale* L., widely cultivated in the tropics.

Uses. The fruits of *A. occidentale* are the source of cashew nuts; the fleshy pear-shaped hypocarp known as cashew apple is also edible.

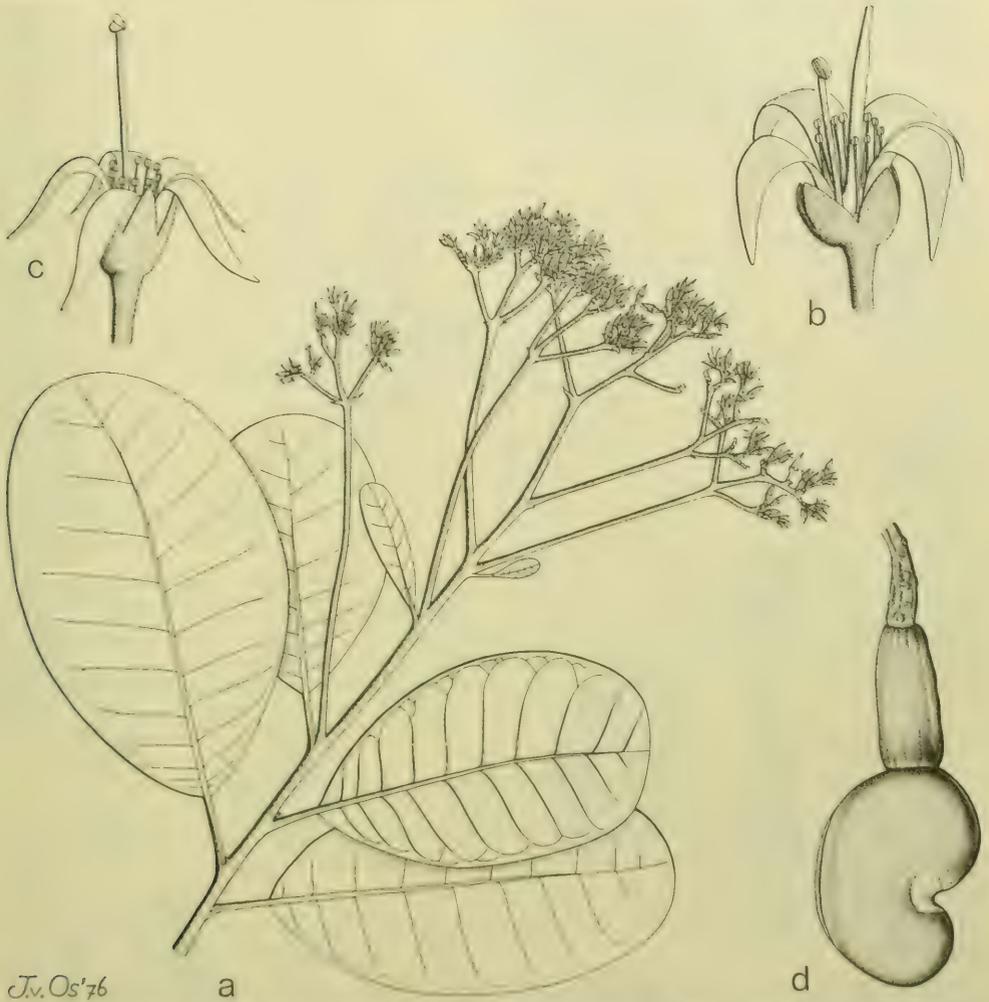


Fig. 6. *Anacardium occidentale* L. a. Habit,  $\times \frac{1}{2}$ , b. bisexual flower,  $\times \frac{3}{2}$ , c.  $\sigma$  flower,  $\times \frac{3}{2}$ , d. young (dried) fruit, nat. size (a-c FRI 5188, d. DING HOÜ 571).

**1. *Anacardium occidentale* LINNÉ, Sp. Pl. (1753) 383; DC. Prod. 2 (1825) 62, incl. var. *indicum* DC.; BL. Bijdr. (1826) 1155; HASSK. Flora 27 (1844) 623; MIQ. Fl. Ind. Bat. 1, 2 (1859) 624; Hook. f. Fl. Br. Ind. 2 (1876) 20; F.-VILL. Nov. App. (1880) 54; ENGL. in DC. Mon. Phan. 4 (1883) 219; VIDAL, Sinopsis Atlas (1883) 22, t. 36, f. B; Phan. Cuming. (1885) 106; Rev. Pl. Vasc. Filip. (1886) 100; ENGL. in E. & P. Nat. Pl. Fam. 3, 5 (1892) 147, f. 94; KING, J. As. Soc. Beng. 65, ii (1896) 479; KOORD. Minah. (1898) 409; MERR. Bull. Bur. For. Philip. 1 (1903) 33; Philip. J. Sc. 1 (1906) Suppl. 84; BACK. Fl. Bat. (1907) 365; LECOMTE, Fl. Gén. I.-C. 2 (1908) 12; BACK. Schooff. (1911) 279; RIDL. J. Str. Br. R. As. Soc. n. 59 (1911) 89; MERR. Fl. Manila (1912) 299; Int. Rumph. (1917) 333; Sp. Blanc.**

(1918) 233; RIDL. Fl. Mal. Pen. 1 (1922) 526; MERR. En. Philip. 2 (1923) 469; CRAIB, Fl. Siam. En. 1 (1926) 345; HEYNE, Nutt. Pl. (1927) 970; BURK. Dict. (1935) 143; CORNER, Ways. Trees (1940) 100, Atlas t. 2; DE WIT, Rumph. Mem. Vol. (1959) 346; TARD. Fl. C. L. & V. 2 (1962) 100, t. 2, f. 5-11; H. F. COPELAND, Phytomorph. 11 (1962) 315, f. 1-25; PURSEGLOVE, Trop. Crops 1 (1968) 19, f. 1; WALKER, Fl. Okin. & S. Ryu Kyu Is. (1976) 663. — *Cassuvium pomiferum* LAMK, Encycl. 1 (1783) 22. — *Cassuvium reniforme* BLANCO, Fl. Filip. (1837) 322; ed. 2 (1845) 227; ed. 3, 2 (1878) 60, t. 116. — Fig. 6.

Tree up to 12 m high and 40 cm  $\varnothing$ , trunk usually crooked. Bark brown, rather smooth. Leaves coriaceous, obovate, sometimes broadly elliptic,

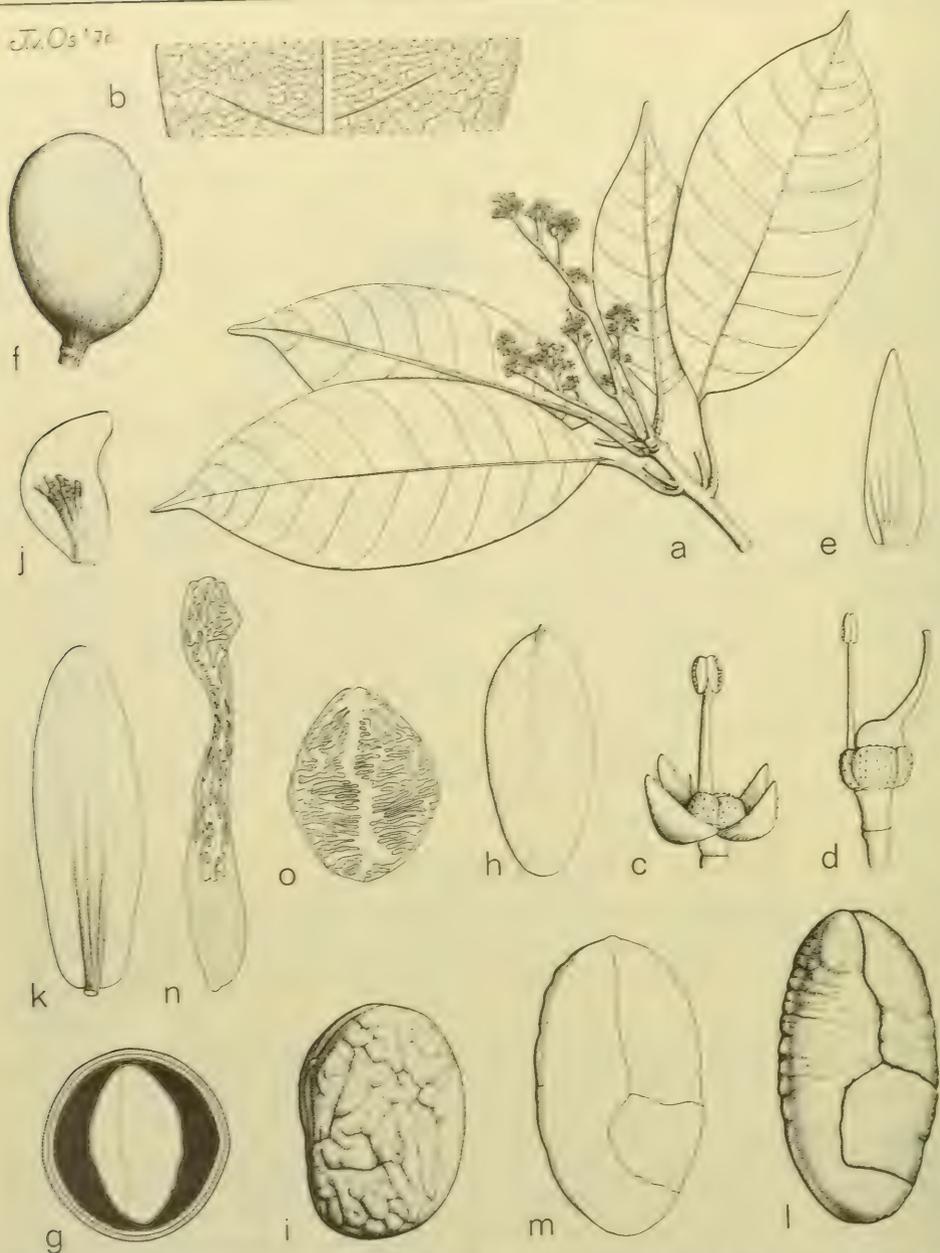


Fig. 7. *Mangifera havilandii* RIDL. *a*, Habit,  $\times 1/2$ , *b*, leaf venation on lower surface, nat. size, *c*, ♂ flower, petals removed, *d*, ♀ flower, calyx and petals removed, *e*, petal, inner surface, all  $\times 7$ , *f*, young fruit, nat. size, *g*, *dito* in CS, *h*, seed, raphe-side view, *i*, young embryo (wrinkled), all  $\times 1 1/2$ . — *M. quadrifida* JACK. *j*, Petal, showing free apical ends of ridges on inner surface,  $\times 7$ . — *M. pajang* KOSTERMANS. *k*, Petal, inner surface, showing confluent ridges stipe-like extending beyond the base,  $\times 7$ , *l*, embryo, side view, with unequal lobed cotyledons,  $\times 1/2$ , *m*, cotyledon, inner surface,  $\times 1/2$ . — *M. gedebe* MIQ. *n*, CS of labyrinthine young seed (with lobed or folded cotyledons),  $\times 1 1/2$ . — *M. inocarpoides* MERR. & PERRY. *o*, CS of labyrinthine seed (with lobed or folded cotyledons), nat. size (*a-e* HAVILAND & HOSE 3368, *f-i* S 16238, *j* KOSTERMANS *s.n. sub.* HLB 954.287-095, *k* KOSTERMANS 12534, *l-m* SAN 34859, *n* KOSTERMANS 14103, *o* BRASS 8462).

4–22½ by 2½–15 cm, glabrous; base cuneate, or obtuse; apex rounded, sometimes slightly emarginate; nerves 8–20 pairs, veins reticulate; petiole ½–2 cm. *Panicles* or sometimes corymbs up to 26 cm long, pubescent, glabrescent; floral bracts ovate-oblong, 5–10 mm long; pedicels 2–5 mm. *Flowers* fragrant, unisexual (♂) and bisexual ones on the same plant. *Calyx* lobes unequal, ovate-lanceolate, 3–5 mm long. *Petals* linear, 7–15 mm long, reflexed at anthesis, at first pale greenish-cream with red stripes, soon turning red. *Stamens* 2–12 mm; anthers ⅔–1 mm long. *Disk* none. *Ovary* c. 1 mm Ø; style 4–12 mm; rudimentary pistil in ♂ 2–3 mm. *Drupe* reniform, 2½–3½ by 1½–2 cm, greyish brown when fresh; hypocarp fleshy, pyriform, 2–3 by 1–2 cm (in fresh state 3–4 times the length of the fruit, shiny, red or yellow, 10–20 by 4–8 cm). *Seed* reniform, 1½–2 by 1 cm.

*Distr.* Tropical America; widely cultivated in the tropics as a fruit tree; in *Malesia* in some places naturalized, for example on the east coast of Malaya (CORNER).

*Ecol.* Often cultivated on sandy soil in dry areas in the villages near the sea coast at low and medium altitude, in some places naturalized on the sandy coast or hills near the sea. *Fl.* Jan.–Dec.; *fr.* Febr.–Nov.

*Uses.* All parts of the plant contain an irritant skin poison, but particularly the seed, or kernel of the nut (CORNER *l.c.*). On heating this substance is destroyed, hence cashew nuts must be roasted before being eaten; the raw nut would sear the lips and cannot be swallowed. The fleshy pear-like cushion on which the nut is so characteristically placed, can be eaten raw: it has a delightful

fragrance, but in Malayan varieties the taste is poor and the juice sets up a slight irritation in the throat, obliging one to cough. Much better varieties occur in tropical America, where the pulpy part of the cashew apple is extensively eaten.

Various parts of the tree are used in native medicine, *etc.*; for more detailed information on uses, cf. HEYNE, BURKILL, and PURSEGLOVE, *ll.cc.*

Vern. *Cashew*, E; Indonesia: *djambu gadjus*, *djambu monjèt*, *d. parang*, *d. sèmpal*, *d. séran*, *djanggus*, *gadjus*, M; Malay Peninsula: *gajus*, *jambu golok*, *kètèrek*, Kelantan & Trengganu; Sumatra: *djambu érang*, *d. monjè*, Minangk., *gadju*, Lamp.; Java: *djambu mèdè*, *d. siki*, S, *djambu métè*, J, *djhambhu monjèt*, Md.; Lesser Sunda Is.: *djambu djipang*, *d. dwipa*, *njambu monjèt*, Bali, *njambuk njèbèt*, Lombok, *buwah monjèt*, Timor; Borneo: *djambu dipa*, Bandj.; Philippines: *balógo*, *bológo*, *kológo*, *sambalduke*, Ilk., *bálubad*, *balúbag*, *balúbar*, *balúbat*, *batúban*, *kachúí*, Tag., *kasóí*, Ibn. & Tag., *kasúí*, Ilk. & Tag., *kasul*, Sulu, *kosing*, Ig.; Celebes: *buwa jakis*, *wojakis*; *djambu daré*, Mak., *djampu sèrèng*, *d. tapési*, Bug., *kanoké*, Nuaulu, *masapana*, Sepa; Moluccas: *buwa jakis*, Halmahera, *buwa jaki*, Ternate, Tidore.

*Note.* COPELAND Jr (*l.c.*) studied the reproductive structure. According to him the summit of the obconical pedicel (the receptacle) bears the floral parts, there is no disk in the flower, and all anthers are fertile. After the study of the vascular system he suggested that the pistil is tricarpellate, but it is so reduced as to have the outward appearance of a single carpel.

#### 4. MANGIFERA

LINNÉ, *Gen. Pl.* ed. 5 (1754) 93; *Sp. Pl.* (1753) 200; HOOK. *f.* in B. & H. *Gen. Pl.* 1 (1862) 420; MARCH. *Rév. Anacard.* (1869) 102 & 188; HOOK. *f.* *Fl. Br. Ind.* 2 (1876) 13; ENGL. in DC. *Mon. Phan.* 4 (1883) 195; PIERRE, *Fl. For. Coch.* (1897) *sub expl.* t. 364 & 365; CORNER, *Ways. Trees* (1940) 106; MUKHERJI, *Lloydia* 12 (1949) 77; DING HOU, *Blumea* 24 (1978) 21. — **Fig. 7–12.**

*Trees.* *Leaves* spiral, simple, entire, glabrous, petioled. *Inflorescences* paniculate, terminal and/or axillary, often crowded at the apex of twigs, sometimes seemingly fasciculate. *Flowers* ♂ or bisexual on the same plant (plants andromonoecious); pedicels articulated. *Calyx* 4- or 5-lobed. *Petals* 4 or 5, imbricate, rarely contorted, glabrous outside, often with excrescences from the glands thickened into ridges on the inner surface, free (except in *M. superba* where they are partly adnate to the disk). *Disk* usually extra-, rarely intrastaminal, short-cupular, pulvinate, or stipe-like, sometimes obsolete in ♂, rarely cylindrical and torus-like (*M. superba*), often lobed, sometimes notched or furrowed, papillose or not. *Stamens* usually 5, rarely 10(–12, *extra-Mal.*), usually 1–2 fertile, the others much shorter and smaller (with imperfect or sterile anthers) or filamentous, very rarely 3–5, or all 5 fertile; filaments free or connate at the base; anthers dorsifixed. *Ovary* 1-celled, glabrous, abortive in ♂; style excentric or lateral; stigma simple, often slightly thicker than the style. *Drupe* 1-celled, resinous; mesocarp often fleshy and thick especially in cultivated *ssp.*; endocarp (or stone) ligneous or fibrous. *Seed* with testa (1 or 2

layers) free from the endocarp, in a few species labyrinthine (testa present in the crevices of lobes or folds of cotyledons); embryo(s) straight; cotyledons plano-convex, mostly smooth, sometimes lobed or folded.

Distr. About 35 *spp.*, in Ceylon, India, Burma, Thailand, Indo-China, and China (Yunnan); throughout *Malesia* to the Solomons. Fig. 8.

One species, *M. indica*, the mango, is widely cultivated in the tropics; several others are cultivated locally in *Malesia* in villages, and may have naturalized beyond their proper native range, so that it is for some species almost impossible to indicate their proper place of origin. The polymorphous *M. odorata* may be a hybrid swarm, originated from hybridization of *M. foetida* and *M. indica*.

Ecol. In forests, usually scattered, chiefly from sea-level to 600 m, more rarely up to 1000 m, occasionally recorded between 1000 and 1800 m. Cultivated *spp.* are grown usually below 600 m.

Mango trees have generally rather thick trunks and often a massive dark-green crown. The largest tree ever recorded is of *M. altissima*, and was collected in Guadalcanal (Solomons), the easternmost limit of the genus; it measured 54 m, with a clear bole of 27 m.

In the forest they occur generally scattered and some appear to be by no means common, some even very rare. *M. gedebe* can occur as a sub-codominant in the *rapak* type of swamp forest; *N. inoarpoides* is recorded as sometimes common in riverine forest.

Taxon. In my precursor (Blumea 24, 1978, 22) I have discussed the subdivision of the genus and concluded that the species can be arranged into two sections.

*Poly-embryony of mango.* The seed of mango, *M. indica*, contains usually only one embryo (mono-embryonic), sometimes more than one (poly-embryonic). In the latter type one seed frequently produces 6–8 seedlings and sometimes as many as 30 have been observed. The extra embryos are adventitious and originate either from the nucellus or by budding from the cotyledons or the hypocotyl. It has been reported that poly-embryonic stocks induce more scion vigour than the mono-embryonic ones and poly-embryonic seedlings transmit their characters to their offspring in a remarkable degree. Poly-embryonic cultivars are reported growing in Burma, Java, Malay Peninsula, the Philippines, Florida, Hawaii, Cuba, Puerto Rico, Jamaica and South Africa. Cf. WESTER, Bull. Bur. Agr. Philip. 18 (1920) 17; SINGH, The Mango (1960, repr. 1968) 22–25.

Morph. So far known the seeds of three species are labyrinthine: the testa of these labyrinth seeds fills the crevices between the transverse folds and lobes of the cotyledons which closely adhere together. See fig. 7n–o. Labyrinth seeds occur in *M. camptosperma* PIERRE (Indo-China), *M. gedebe* (Sumatra, W. Java, Borneo), and *M. inoarpoides* (New Guinea). Cf. VAN HEEL, Blumea 19 (1971) 109.

In *M. pajang* the cotyledons are unequal, one partly embracing the other. Fig. 7l–m.

In several *Mangifera spp.* the leaves have fibers which show upon breaking dried leaves, e.g. *M. caesia*, *M. decandra*, *M. lagenifera*, and *M. superba*.

Uses. One species of *Mangifera*, *M. indica*, is widely cultivated in the tropics for the popular fruit commonly called 'mango'; it has many cultivars. Besides the Indian mango, *M. foetida*, *M. caesia*, and *M. odorata* are in *Malesia* often planted for edible fruits or just as village trees; some other species are cultivated locally, e.g. *M. griffithii*, *M. lagenifera*, *M. longipes*, *M. minor*, *M. pajang*, *M. similis*, etc.

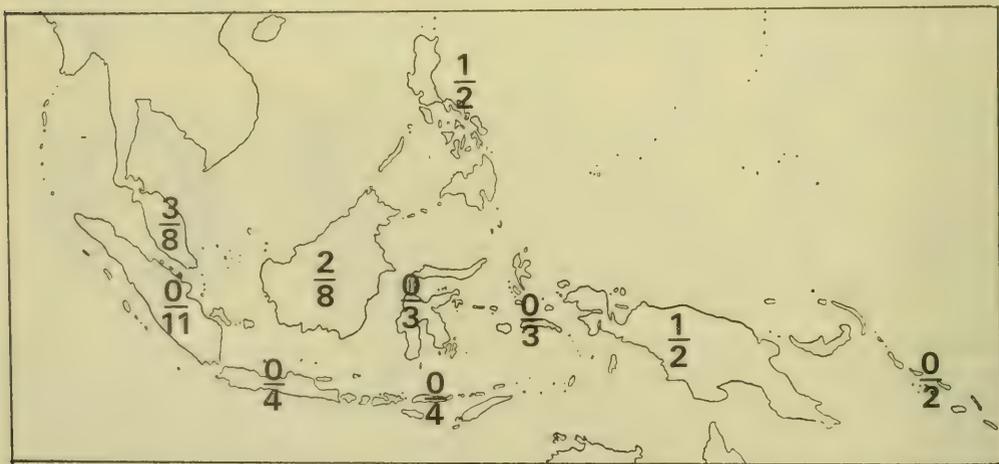


Fig. 8. Density of *Mangifera spp.* in *Malesia*, the number of endemic *spp.* of each island (group) above the hyphen, the number of non-endemic ones below the hyphen. *M. indica* and *M. odorata* left out of consideration as their precise native distribution is unknown.

*M. pajang*, described by KOSTERMANS (Reinwardtia 7, 1965, 20) from Borneo, has globose to ellipsoid fruits c. 15 cm Ø (often more), with yellowish white, sweet-acid pulp. According to him, it "is a well-known cultivated and wild one, related to *Mangifera foetida*". The thick rind of the fruit can be peeled off like a banana when eaten. So far known the fruits "are the largest of the genus *Mangifera* and may reach dimensions of a small coconut". This species deserves special mention here for future experimental breeding in order to improve the quality of the fruit.

The ripe fruits of *M. indica* and some other species are eaten raw. They are also used for making jams, jellies, and preserves. Unripe fruits are used for making pickles, chutneys, vinegar, etc. and sometimes are sliced and sun-dried for grinding into powder or making other preparations.

In *Mangifera* the rind of unripe fruits and sometimes also some other parts of the trees may contain irritant sap and may cause inflammation when touched by susceptible persons. Because of the irritant sap the young fruits of *M. foetida* and *M. odorata* are not eaten by the people. The sap of the barks, even the vapour of freshly bruised tissues, the smoke from a bonfire of their leaves or raindrops from the crown of the following species may affect the skin: *M. caesia*, *M. foetida*, *M. lagenifera*, and *M. odorata*; cf. K. & V. Bijdr. 4 (1896) 97; CORNER, Ways. Trees (1940) 107.

In Java the young leaves of some races of *M. indica* are used as vegetable with the rice.

Trees of some *Mangifera* spp. can attain a large size, e.g. *M. caesia*, *M. foetida*, *M. pajang*, *M. similis*, etc. The timber is used in many ways, e.g. for boards, doors, boxes, planking, etc., but it is not durable.

For more details on uses see HEYNE, Nutt. Pl. (1927) 966-970; BURK. Dict. (1935) 1400-1407; BALAN MENON, Mal. For. 21 (1968) 38.

Vern. Malaysian standard timber name: *machang*.

Notes. Unfortunately the fruit of several species is inadequately known, so no separate key can be provided for fruiting material. Its characters are of different sources, sometimes on dried fruit in the herbarium, sometimes derived from material in liquid, data of field notes, or literature. In this genus it is mostly impossible to identify single fruits or sterile material. Also collections made of fallen fruits combined with twigs from the lower branches may be deceptive, as leaves vary considerably on a single tree; see the note under *M. griffithii*.

In collecting fruiting material it is useful to make notes on colour, smell, size, etc., to section the fruit in various directions and to make notes on the structure of the embryo, and add slices c. 1 cm thick to the herbarium material.

#### KEY TO THE SPECIES

Based mainly on flowering specimens, occasionally using fruit characters

1. Disk short-cupular, rarely pulvinate and concave above, (partly or completely surrounding the ovary in bisexual flowers), usually 4- or 5-lobed, papillose. Filaments free . . . . . 1. SECT. MANGIFERA
2. Stamens 5, 3-5 fertile . . . . . 1. *M. pentandra*
2. Stamens 5 or 4, only 1 (rarely 2) fertile.
3. Flowers 5-merous, very rarely associated with some 4-merous ones.
  4. Inflorescences usually densely branched and flowered, tomentose. Calyx lobes densely puberulous on both surfaces especially outside . . . . . 2. *M. indica*
  4. Inflorescences laxly branched and flowered, puberulous or sparsely puberulous, glabrescent, or glabrous. Calyx lobes sparsely puberulous only outside or glabrous.
  5. Inflorescences and calyx lobes puberulous, rarely glabrescent. Pedicels 1½-2½ mm. Disk pulvinate and concave above. Petals lanceolate. Fruits obliquely subglobose . . . . . 3. *M. longipes*
  5. Inflorescences and calyx lobes glabrous. Pedicels longer, 3-4 mm. Disk short-cupular. Petals narrowly elliptic, or linear. Fruits obliquely oblong . . . . . 4. *M. minor*
3. Flowers 4-merous, very rarely associated with some 5-merous ones.
  6. Petals with apical parts of ridges free from the inner surface.
    7. Free parts of ridges parallel to the surface. Fruits (fresh) yellowish green, globose 5. *M. similis*
    7. Free parts of ridges bent away from the surface. Fruits (fresh) dark purple, broadly ellipsoid 6. *M. quadrifida*
  6. Petals with apical parts of ridges not free from the inner surface.
    8. Inflorescences puberulous or pubescent, sometimes glabrescent. Fruits (fresh) 5½-9 by 4-9 cm (but smaller in *M. griffithii*).
    9. Inflorescences terminal and sometimes also in the apical leaf axils, usually crowded at the apex of the twigs.
      10. Petals ovate- or elliptic-oblong, 1½-2 mm wide . . . . . 7. *M. altissima*
      10. Petals lanceolate, 2/3-1¼ mm wide.
        11. Ridges on the inner surface of the petals merged only at the very base. Seed not labyrinthine 8. *M. griffithii*
        11. Ridges on the inner surface of petals merged at the lower 1-2 mm.
          12. Petals with 3 ridges on the inner surface. Seed with transverse lobes or folds (shown on cross-section) . . . . . 9. *M. inoarpoides*
          12. Petals with 3(5) ridges on the inner surface. Seed with very irregular lobes or folds (shown on cross-section) . . . . . 10. *M. gedebe*
    9. Inflorescences axillary only, often in several successive leaf axils. . . . . 11. *M. parvifolia*

8. Inflorescences glabrous. Fruits smaller (fresh or dried),  $2\frac{1}{2}$ - $3\frac{1}{2}$  by  $1\frac{3}{4}$ - $2\frac{1}{2}$  cm (not known in *M. gracilipes*).
13. Inflorescences terminal sometimes also in the uppermost leaf axil, distinctly paniculate and pyramidal.
14. Petals lanceolate,  $1\frac{1}{4}$  mm wide; ridges 3(-5) on the inner surface. Leaves with 8-12 pairs of nerves; apex acuminate . . . . . 12. *M. havilandii*
14. Petals elliptic, rarely ovate,  $1\frac{1}{2}$ - $2\frac{1}{2}$  mm wide; ridges (3-)5(-7) on the inner surface. Leaves with 14-23 pairs of nerves; apex acute or obtuse . . . . . 13. *M. timorensis*
13. Inflorescences terminal and also in the apical leaf axils, crowded at the apex of the twigs, seemingly fasciculate.
15. Leaves elliptic to elliptic-oblong, obovate-oblong or oblanceolate, (7-)13-19 cm long; veins distinct beneath, faint above . . . . . 14. *M. monandra*
15. Leaves elliptic-lanceolate, 7-10 cm long; veins obscure on both surfaces . . . . . 15. *M. gracilipes*
1. Disk pulvinate, rarely cylindrical and torus-like, often reduced and stipe-like, (at the base of ovary in bisexual flowers), usually not lobed, not papillose, rarely obsolete in ♂. Filaments often connate at the base, sometimes free . . . . . 2. SECT. LIMUS
16. Leaves elliptic to narrowly lanceolate, or obovate to oblanceolate, or spatulate, 5-43 by 2-16 cm, leaf-index usually less than 4.
17. Petals not ridged on the inner surface. Stamens 10: 5 fertile and 5 sterile.
18. Leaves large (usually 27-38 by 12-15 cm); apex mucronate. Flowers reddish or pink. Fertile stamens with one much longer than the others. Fruits ellipsoid . . . . . 16. *M. decandra*
18. Leaves small (8-18 by  $2\frac{1}{2}$ - $4\frac{1}{2}$  cm); apex obtuse or rounded. Flowers deep violet. Fertile stamens ± equal. Fruits pyriform . . . . . 17. *M. lagenifera*
17. Petals distinctly ridged on the inner surface. Stamens 5: 1 (or 2) fertile, 4 (or 3) imperfect or sterile, or all fertile (*M. superba*).
19. Leaves without hair-like fibers shown upon breaking; petiole not flattened. Inflorescences usually glabrous. Petals with 3(-5) ridges confluent at the basal part.
20. Leaves rigidly coriaceous; apex obtuse, rounded, notched, acute, or mucronate; veins invisible or obscure on both surfaces.
21. When fresh: Inner surface of petals pinkish. Ovary ochraceous. Fruits obliquely ovoid, yellowish or greyish green, smooth . . . . . 18. *M. foetida*
21. When fresh: Inner surface of petals purple. Ovary white. Fruits broadly ovoid or globose, brownish, roughish . . . . . 19. *M. pajang*
20. Leaves subcoriaceous, not rigid; apex short-acuminate, acute, rarely obtuse; veins distinct on both surfaces. Fruits dark green, obliquely ovoid or broad-ellipsoid . . . . . 20. *M. odorata*
19. Leaves with hair-like fibers shown upon breaking; petiole flattened. Inflorescences pubescent or tomentose. Petals with only one ridge.
22. Petals 5-8 mm long. Fertile stamens 1 (or 2) . . . . . 21. *M. caesia*
22. Petals 20-25 mm long. Fertile stamens 5 . . . . . 22. *M. superba*
16. Leaves linear, sometimes linear-lanceolate, rarely spatulate, (9-)15-60 by ( $1\frac{1}{4}$ -) $3\frac{1}{2}$ -5 cm, leaf-index more than (7-)10 . . . . . 23. *M. macrocarpa*

### 1. Section Mangifera

DING HOU, *Blumea* 24 (1978) 23.

Disk short-cupular, rarely pulvinate and concave above, (partly or completely surrounding the ovary in bisexual flowers), usually 4- or 5-lobed, papillose. Filaments free at the base.

1. *Mangifera pentandra* HOOK. f. Fl. Br. Ind. 2 (1876) 14; ENGL. in DC. Mon. Phan. 4 (1883) 198; KING, J. As. Soc. Beng. 65, ii (1896) 472; PIERRE, Fl. For. Coch. (1897) t. 364F; RIDL, J. Str. Br. R. As. Soc. n. 59 (1911) 89; Fl. Mal. Pen. 1 (1922) 522; CORNER, Ways. Trees (1940) 111; MUKHERJI, *Lloydia* 12 (1949) 81. — *M. lanceolata* RIDL, J. Str. Br. R. As. Soc. n. 59 (1911) 90; Fl. Mal. Pen. 1 (1922) 522; MUKHERJI, *Lloydia* 12 (1949) 81; DING HOU, *Blumea* 24 (1978) 28.

Tree up to 24 m high. Leaves coriaceous, oblong, oblong-lanceolate, or lanceolate, 12-30 $\frac{1}{2}$  by  $3\frac{3}{4}$ -11 cm; base obtuse or rounded; apex shortly acuminate or acuminate; nerves 12-23 pairs, elevated beneath, distinct above; veins reticulate, distinct on both surfaces; petiole  $1\frac{1}{2}$ - $3\frac{1}{2}$  cm,

biconvex, or flat above. Panicles terminal, pyramidal, 15-30 cm long, pubescent; lateral branches up to 12 $\frac{1}{2}$  cm, densely flowered; floral bracts ovate, 1-2 mm long; pedicels  $\frac{1}{2}$  mm. Flowers cream-white. Calyx 5-lobed, lobes ovate, 2-3 mm long, pubescent outside. Petals 5, elliptic-oblong, 3-4 $\frac{1}{2}$  by  $1\frac{1}{2}$ -2 mm; ridges 5(-7), c.  $\frac{2}{3}$  the length of petals, confluent at the basal  $\frac{1}{3}$ . Disk short-cupular,  $\frac{1}{2}$ -1 mm high,  $1\frac{1}{2}$ -2 mm wide, 5-lobed, papillose. Stamens 5, 3-5 fertile, 1-3 $\frac{3}{4}$  mm; filaments free; anthers oblong,  $\frac{2}{3}$  mm long; staminodes if present very small. Ovary subglobose,  $1\frac{3}{4}$  mm Ø; style subterminal, 2 mm. Sterile pistil in ♂  $\frac{1}{2}$  mm. Drupe (fresh, CORNER, l.c.) oblong,  $7\frac{1}{2}$ -10 by 5-6 $\frac{1}{4}$  cm, ripening green, rather fragrant, flesh watery, pale orange, rather sweet with fewer fibers.

Distr. *Malesia*: Malay Peninsula (Kedah, Perak, Pahang, Johore, and Singapore).

A common village tree in Kedah.

Ecol. In lowland areas and forest near the sea. *Fl.* Febr.; *fr.* Febr.–March.

Vern. *Manga dodol*, *mempelam bemban*, *pauh*, *pauh damar*, *M.*

2. *Mangifera indica* LINNÉ, Sp. Pl. (1753) 200; BURM. *f.* Fl. Ind. (1768) 62; LINNÉ, Syst. Veg. (1774) 242; ROXB. Fl. Ind. ed. Wall. 2 (1824) 435; ed. Carey 1 (1832) 641; BLANCO, Fl. Filip. (1837) 179; ed. 2 (1845) 127; ed. 3, 1 (1877) 229; WALP. Rep. 1 (1842) 555; BL. Mus. Bot. 1 (1850) 193; MIQ. Fl. Ind. Bat. 1, 2 (1859) 628; HOOK. *f.* Fl. Br. Ind. 2 (1876) 13; F.-VILL. Nov. App. (1880) 54; ENGL. in DC. Mon. Phan. 4 (1883) 199; VIDAL, Sinopsis Atlas (1883) 22, t. 36, f. D; Phan. Cuming. (1885) 106; Rev. Pl. Vasc. Filip. (1886) 99; KING, J. As. Soc. Beng. 65, ii (1896) 472; K. & V. Bijdr. 4 (1896) 79; PIERRE, Fl. For. Coch. (1897) t. 361; MERR. Philip. J. Sc. 1 (1906) Suppl. 84; BACK. Fl. Bat. (1907) 361; LECOMTE, Fl. Gén. I.-C. 2 (1908) 18, f. 4; MERR. Philip. J. Sc. 3 (1908) Bot. 80; BACK. Schoofl. (1911) 279; MERR. Fl. Manila (1912) 300; Int. Rumph. (1917) 331; Sp. Blanc. (1918) 232; En. Born. (1921) 349; LAUT. Bot. Jahrb. 56 (1921) 353; RIDL. Fl. Mal. Pen. 1 (1922) 523; MERR. En. Philip. 2 (1923) 468; CRAIB, Fl. Siam. En. 1 (1926) 344; HEYNE, Nutt. Pl. (1927) 967; HOLTUM, Gard. Bull. S. S. 5 (1931) 199; OCHSE & BAKH. Fruit (1931) 9, t. 4–6; KANEH. Bot. Mag. Tokyo 45 (1931) 292; Fl. Micronesica (1933) 185; BURK. Dict. (1935) 1402; CORNER, Ways. Trees (1940) 109, f. 22, Atlas t. 11; MUKHERJI, Lloydia 12 (1949) 83; BROWN, Useful Pl. Philip. 2 (1950) 340, f. 165–166; QUIS. Medic. Pl. Philip. (1951) 538; SHARMA, Phytomorph. 4 (1954) 201; DE WIT, Rumph. Mem. Vol. (1959) 386; SINGH, The Mango (1960, repr. 1968) 13, many figs.; TARD. Fl. C. L. & V. 2 (1962) 90; LIU, Ill. Pl. Taiwan 2 (1962) 935, f. 770; KOCHUM. Mal. For. Rec. 17 (1964) 295; BACK. & BAKH. *f.* Fl. Java 2 (1965) 149; PURSEGLOVE, Trop. Crops 1 (1968) 24, f. 2; WALKER, Fl. Okin. & S. Ryu Kyu Is. (1976) 662, f. 102. — *M. arbor* HERMANN, Mus. Zeyl. (1717) 59–66; BURM. Thes. Zeyl. (1731) 152; LINNÉ, Fl. Zeyl. (1747) 211. — *Manga domestica* RUMPH. Herb. Amb. 1 (1747) 93, t. 25. — *Manga calappa* RUMPH. *l.c.* 96. — *Manga simiarum* RUMPH. *l.c.* — *M. domestica* GAERTN. Fruct. 2 (1790) 95, t. 100. — *M. indica* (*non L.*) BL. Bijdr. (1826) 1157. — *M. linnæi* KORTH, ex HASSK. Cat. Hort. Bog. (1844) 245. — *M. anisodora* BLANCO, Fl. Filip. ed. 2 (1845) 129, ed. 3, 1 (1877) 229. — *M. rostrata* BLANCO, *l.c.* 129, *l.c.* 231, t. 62. — *M. laurina* BL. Mus. Bot. 1 (1850) 195; MIQ. Fl. Ind. Bat. 1, 2 (1859) 629; ENGL. in DC. Mon. Phan. 4 (1883) 202; PIERRE, Fl. For. Coch. (1897) t. 364A; MERR. Int. Rumph. (1917) 331. — *M. kukula* BL. Mus. Bot. 1 (1850) 192, *cum var. num.*

Tree 10–30(–45) m high and up to 60(–120) cm Ø. Bark grey, greyish brown, longitudinally fissured. Leaves subcoriaceous, chartaceous, or membranaceous, variable in size and shape, usually lanceolate, elliptic to narrowly elliptic, 10–30 by 2–9½ cm, glabrous; base acute or cuneate; apex acute to acuminate; nerves 12–30 pairs, elevated on both surfaces; veins reticulate,

distinct on both surfaces; petiole 1½–7½ cm, convex beneath, grooved or flat above. Panicles terminal, sometimes also in the uppermost leaf axil, pyramidal, 6–44 cm long, tomentose; lateral branches up to 15 cm, densely flowered; floral bracts ovate-oblong, 3–5 mm long; pedicels c. 1 mm. Flowers usually greenish yellow or pale cream. Calyx 5-lobed, lobes ovate-oblong or elliptic, densely puberulous on both surfaces especially on the outside. Petals 5, elliptic, elliptic-oblong, or ovate-oblong, 3–5 by 1½–2 mm, 1/2–2/3 the length of petals, confluent often at the lower half. Disk short-cupular, 1–1½ mm high, 1½ mm Ø, 5-lobed or notched, papillate. Stamens 5, 1 (rarely 2) fertile, 2–3 mm; filaments free; anthers ovoid, c. 2/3 mm long; staminodes 1–1½ mm. Ovary obliquely ovoid or subglobose, 1–1½ mm Ø; style excentric, 1½–2 mm. Sterile pistil in ♂ obscure or absent. *Drupe* (fresh) (OCHSE & BAKH. *l.c.*) very variable as to shape, size, and colour, usually ovoid-oblong, very unequal-sided, 4–25 by 1½–10 cm, yellowish green, yellow, or red in many shades when ripe; flesh yellow or orange coloured, juicy, savoury; stone rather thick, with a fibrous coat, very hard. *Seed* not labyrinthine.

Distr. Probably a native of Indo-Burma region (*cf.* MUKHERJEE, J. Linn. Soc. Lond. 55, 1953, 65–83), and widely cultivated throughout the tropics of both hemispheres.

In *Malesia* generally planted as a village tree and cultivated commercially in Malay Peninsula, Java, and the Philippines. Seemingly indigenous or naturalized found in India, Burma, Thailand, Indo-China, and some islands of West Malasia.

Ecol. Generally cultivated below 500 m, escaped or naturalized, or indigenous trees occurring in (primary) forest from the lowland up to 1700 m. CORNER noted that mango trees fruit in the fourth year from seed. *Fl. fr.* Jan.–Dec.

Morph. From the study of the vascular anatomy of the flower of *M. indica*, SHARMA (Phytomorph. 4, 1954, 201–207, f. 1–36) concluded, besides other findings, that (1) the glandular disk “appears to be a receptacular outgrowth”, (2) “the ancestral mango flower had at least two whorls of stamens”, and (3) “. . . the monocarpellary condition appears to have been derived from a tricarpellary condition”.

Nomencl. BLUME distinguished many varieties of *M. indica* and *M. laurina* (Mus. Bot. 1, 1850, 193–197). I have refrained from evaluating these.

Uses. In India the mango has been cultivated for over 4000 years and is now said to have nearly 1000 horticultural varieties or cultivars. There are several institutes and experimental stations for research on this economically important fruit tree. For detailed information on its botany, classification of cultivars, names of (important) cultivars, uses, etc., I refer to the following publications which contain also extensive literature: P. J. WESTER, The Mango. Bull. Bur. Agr. Philip. 18 (1920) 1–70, figs.; K. HEYNE, Nuttige Pflanzen (1927) 967–969; S. K. MUKHERJEE, The Mango. Econ. Bot. 7 (1953) 130–160, figs.; L. B. SINGH, The Mango (1960, repr. 1968) 1–438, figs., Leonard Hill, London.

In Java and Malaya the number of races or varieties *cf.* cultivars is legion, mostly unfixed: that is to say, they do not reproduce themselves truly

from seed, which is why mango growers rely on grafting for retaining valuable trees.

Mango trees fruit in the fourth year from seed, but OCHSE said after 6–8 years.

Vern. (*cf.* OCHSE & BAKH. Fruit, 1931, 9) Sumatra: *balēm, manggi, mēmplan*, Simalur, *bem*, Palembang, *eesem, hampelom, isēm, kapēlam, kapēlom, pēlēm, pēlom*, Lampongs, *kēmpēlam*, Alas, Gajo, *mamplan*, Atjeh & Simalur, *mangga*, Batak & Lampongs, *mopolom, pauh*, Batak, *maga*, Nias, *pēgum, pēngu*, Mentawai; Malay Peninsula: *mangga, mēmpēlam, pauh*; Java: *booaah, mangga* *bapang, m. daging, m. dodōl, m. gajam, m. gēdung, m. gēpēng, m. hurang, m. klapa, m. kopijor, m. manggala, m. pari, m. roti, m. sēngir, m. sēngir gadung, m. taj kuda, m. takulu, m. tjēngkir, m. tjupui, m. wangi, pari, S, djongkoh, mangga daging, m. endōg, pao, pēlēm, p. bapang, p. bētu, p. dodōl wangi, p. endōg, p. gandē, p. gadung, p. gandik, p. gētas, p. kējōng, p. kidang, p. kōpijōr, p. lērak, p. madu, p. poh, p. santōk, p. sēngir, J, kadēper, mangga, m. bēngala, m. daging, m. dodōl, m. madu, m. ubi, m. udang, M, pao gēlèk, p. kētjipet, p. kōlèh, p. kōtjōr, p. tēlor*, Md; Lesser Sunda Is.: *ampēm, poh, gētas*, Bali, *dodo maja, maja malieng, mopalai, palela*, Alor, *oopo, pauh, porgo*, Sumba, *mo, pau*, Flores; Borneo: Sabah: *ba-ab, Dusun, mangga ayēr, m. malina, m. suluk, m. tēlor, pulau manila, M, mēmpalang, mampallam*, Suluk, *ampalam, hampalam, mang(g)a, tēkorang*, Dajak; Philippines: *manga chupadera*, Spanish, *mampalam, mampalang, Sulu, mānga, Ilk.*, Ig., Tag. & Mag., *manggan duluhan, If., māngang kalabān*, Tag., *mangka*, Ig., *pāho*, C.Bis., *pāo*, Bontoc; Celebes: *oai, Sangir, pao, Mandar & Salajar*; Moluccas: *aoo hoowané, apalam, apalané, ayaér, balamo, haoo, mabēlang, mampalang, mango utam, mapoolané, pota-pota*, Ceram, *mangka kētjil*, Obi I., *maplane, maplangé, pawēn*, Ambon, *guawé, lēlit, walè*, Halmaheira, *guwae*, Ternate, Tidore; W. New Guinea: *manilja, pagēr, peebèrèkari*.

**3. *Mangifera longipes*** GRIFF. Notul. 4 (1854) 419; HOOK. *f.* Fl. Br. Ind. 2 (1876) 15; KURZ, Fl. Burma 1 (1877) 303; ENGL. in DC. Mon. Phan. 4 (1883) 201; KING, J. As. Soc. Beng. 65, ii (1896) 473; PIERRE, Fl. For. Coch. (1897) t. 365A; BACK. Schoöfl. (1911) 278; RIDL. Fl. Mal. Pen. 1 (1922) 523; MERR. En. Philip. 2 (1923) 468; BURK. Dict. (1935) 1406; MUKHERJI, Lloydia 12 (1949) 88, f. 1, *incl. var. glabrescens* MUKHERJI, l.c. 89, f. 2 & 27; TARD. Fl. C. L. & V. 2 (1962) 95, t. 3, f. 9–11; KOCHUM. Mal. For. Rec. 17 (1964) 295; BACK. & BAKH. *f.* Fl. Java 2 (1965) 148. — *M. sumatrana* MIQ. Fl. Ind. Bat. 1, 2 (1859) 630. — *M. parish* MIQ. l.c. 631.

Tree up to 20–30(–35) m high and 40–90 cm Ø, very rarely up to 130–150 cm Ø. Buttresses occasionally present, 1–2 m high, 1 m wide. Bark blackish brown, lenticellate, longitudinally cracked. Leaves chartaceous to subcoriaceous, elliptic-lanceolate or lanceolate, 6½–24½ by 2½–6 cm; base cuneate to attenuate; apex acuminate; nerves 10–20 pairs, slightly elevated beneath, distinct above; veins reticulate, faint; petiole 1½–3½(–6) cm, convex beneath, bisulcate or flat above. Panicles terminal and sometimes also in the uppermost leaf axils, pyramidal, 10–40 cm long,

puberulous, rarely glabrescent; lateral branches up to 20 cm, laxly flowered; floral bracts ovate to lanceolate, 1½–2 mm long; pedicels 1½–2½ mm. Flowers greenish white. Calyx 5-lobed, lobes ovate, 2–2½ mm long, sparsely puberulous outside, rarely glabrescent. Petals 5, lanceolate, 3½–5½ by 1–1½ mm; ridges 3(–5), c. ½ the length of the petals, confluent at the basal 1–1½ mm. Disk pulvinate and concave above, ⅔–1 mm high, 1½–2 mm wide, 5-lobed, papillose. Stamens 5, 1 fertile, 2–4 mm; filaments free; anthers ovoid, c. ⅔ mm; staminodes up to ⅔ mm. Ovary subglobose, 1¼–1¾ mm Ø; style excentric, 1–2¼ mm. Sterile pistil in ♂ c. ⅓ mm. Drupe (fresh or dried) obliquely subglobose, 5–10 by 4–8 cm, flesh thin, with one big stone. Seed not labyrinthine.

Distr. *Malesia*: Sumatra, Malay Peninsula, Java, Lesser Sunda Is., Borneo, and Philippines. Sometimes also cultivated near villages.

Ecol. In lowland primary forest, sometimes also in secondary forest, rarely on coral limestone, usually up to 400 m, occasionally at 1000–1500 m. Fl. fr. Febr.–Nov.

Vern. Sumatra: *asam pan*, Kaju Agung, *asam tais*, M, *ampēlam dotan, awa mampalam (uding)*, Simalur, *gērat*, Batak, *kaju mangga bogor*, Tapanuli, *kēdēpir, pau*, Palembang, *mangga tiakar, pauh gadang*, W. Sum.; Malay Peninsula: *boa pow*, M; Java: *mangga pari, parih, parii kumbang*, S, *pēlēm kētjik*, J, *plēm plēm*, M, *pau alas*, Kangean; Lesser Sunda Is.: *manga utan, oposui*, Timor, *pau deamang, pēlam, pēlam buset*, Sumbawa; Borneo: Sarawak: *kuini*, Baran; Kalimantan: *asam hurang, a. pēlipisan*, M, *asam kēpaeng, repies*, Bassap, *asam pau*, Pontianak; Sabah: *lagawa*, Dusun, *mangga ayēr, m. manila, m. tēlor, mēmpēlam, pauh hutan, M, pauh kijang*, Tawau; Philippines: *apali*, Tagb.

**4. *Mangifera minor*** BL. Mus. Bot. 1 (1850) 198; MIQ. Fl. Ind. Bat. 1, 2 (1859) 631; ENGL. in DC. Mon. Phan. 4 (1883) 202; WARB. Bot. Jahrb. 13 (1891) 361; LECOMTE, Fl. Gén. I.-C. 2 (1908) 17; MERR. Int. Rumph. (1917) 331; LAUT. Bot. Jahrb. 56 (1921) 353; LANE-POOLE, For. Res. (1925) 107; WHITE & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 237; WHITE, J. Arn. Arb. 10 (1929) 234; MERR. & PERRY, J. Arn. Arb. 22 (1941) 532; WALKER, For. Brit. Solomon Isl. Protect. (1948) 92; MUKHERJI, Lloydia 12 (1949) 96; KRAEMER, Trees West. Pacif. Reg. (1951) 200, f. 70; DE WIT, Rumph. Mem. Vol. (1959) 386; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 28, f. 10. — *Manga domestica minor* RUMPH. Herb. Amb. 1 (1741) 94.

Tree up to 18–32 m high and 30–90(–120) cm Ø, once recorded with buttresses up to 5 m high, 2 m wide, 5 cm thick (BW 7272). Bark grey, light brown, or brown, deeply vertically fissured, broadly ridged. Leaves chartaceous to subcoriaceous, elliptic-lanceolate to narrowly elliptic, sometimes oblanceolate, 12–19 by 3½–5½ cm; base cuneate; apex acuminate, obtuse, or acute; nerves 10–20 pairs, slightly elevated beneath, distinct above; veins reticulate, faint or obscure; petiole 1–3 cm, biconvex, or slightly concave above. Panicles terminal, sometimes also in the uppermost leaf axil, pyramidal, up to 30 cm long, glabrous; lateral branches up to 16 cm, laxly flowered; floral bracts ovate or lanceolate, 1–2 mm long; pedicels

3–4 mm. *Flowers* yellowish, fragrant. *Calyx* 5-lobed, lobes ovate or ovate-oblong, 2–2½ mm long, glabrous. *Petals* narrowly elliptic, or linear, 5–6 by 1–1½ mm; ridges 3(–5), c. 2/3 the length of petals, confluent at the basal 2–2½ mm. *Disk* short-cupular, 1–1½ mm high, 1–2 mm wide, 5-lobed, papillose. *Stamens* 5, 1 fertile, 2½–5 mm; filaments free; anthers oblong, c. 2/3 mm long; staminodes 1/6–2/3 mm. *Ovary* subglobose, 1½ mm Ø; style excentric, 4 mm. Sterile pistil in ♂ c. 1/3 mm. *Drupe* (fresh or dried) obliquely oblong, 5–10 by 4–6½ cm, flesh thin or nearly fleshless, with one fibrous, large stone. *Seed* not labyrinthine.

*Distr.* Solomons (Guadalcanal, Malaita, San Cristóbal, Santa Isabel, Bougainville) and New Britain; in *Malesia*: New Guinea (scattered throughout), Moluccas (Aru, Ceram, Ambon), Celebes (throughout, incl. Muna & Buton Is.), and Lesser Sunda Is. (Flores, Timor), Micronesia.

Sometimes also planted near villages.

*Ecol.* In lowland primary, sometimes also secondary forest, sometimes up to 400–750 m, occasionally up to 1000–1350 m. *Fl. fr.* Febr.–Dec.

*Uses.* The wood is intermediate hard. It is used for light construction and furniture (*cf.* ROYEN, *l.c.*).

*Vern.* Solomon Is.: *asai*, Kwara'ae name; Lesser Sunda Is.: *upusuplia*, Timor, *pao kodé*; Celebes: *fo karuku*, Muna, *kayu taipa dare*, Sironjong, *taipa dondri*, Bonthain, *taipa wana*, Malili; New Guinea: *auroro*, Vailala, *awu, awuk, kau, Mool, bagitza*, Garaina, *bebi*, Hewa, *bibue*, Dumpu, *bush-mango*, Wanigela, *dua*, Yalu, *ewa*, Buna, *gaja, kwasi*, Aru, *ihara*, Suku, *kawij, kusig* or *kusieg, kust, kuti, kuwia, kuwij, leosi, puoba*, Manokwari, *mangga utan, wasumar*, Rauna, *mogari*, Tapio, *velu*, Amele, *wai*, Karoon, *wewe*, Faita, *wiwo*, Bilia, *yuwii*, Morobe.

5. *Mangifera similis* BL. Mus. Bot. 1 (1850) 200; MIQ. Fl. Ind. Bat. 1, 2 (1859) 633; ENGL. in DC. Mon. Phan. 4 (1883) 207; K. & V. Bijdr. 4 (1896) 84; BACK. Schoofl. (1911) 277; MUKHERJI, Lloydia 12 (1949) 105, f. 12; BACK. & BAKH. f. Fl. Java 2 (1965) 148; DING HOU, Blumea 24 (1978) 29. — *M. torquenda* KOSTERMANS, Reinwardtia 7 (1965) 21, f. 2.

Tree up to 32 m high and 53(–100) cm Ø. Bark light brownish, smooth. *Leaves* coriaceous, elliptic-oblong, lanceolate, or obovate-oblong, 7–21 by 2½–9 cm; base cuneate or attenuate; apex acute to shortly acuminate, rarely acuminate; nerves 14–20 pairs, distinct; veins reticulate, distinct beneath, obscure above; petiole 1–4½(–8½) cm, convex beneath, concave or flat above. *Panicles* terminal, pyramidal, 8–28 cm long, puberulous, sometimes glabrescent; lateral branches up to 10 cm, laxly flowered; floral bracts ovate-oblong, 4 mm long; pedicels ½–1 mm. *Flowers* greenish white, sweetly fragrant. *Calyx* 4-lobed, lobes triangular or ovate, 1½–2½ mm long, puberulous and glabrescent outside. *Petals* 4, ovate, broadly elliptic, or elliptic, 3½–4 by 1½–2 mm; ridges 3(–5), half the length of petals, merged, apical parts free from the surface and parallel to it. *Disk* short-cupular, c. ¼ mm high, 1½ mm wide, 4-lobed, papillose. *Stamens* 4, 1 fertile, 2–5 mm; filaments free; anthers ovoid, 2/3 mm long; staminodes c. ½ mm. *Ovary* subglobose, ¾ mm Ø; style lateral, 1½ mm. Sterile

pistil in ♂ c. 1/3 mm. *Drupe* (fresh) (KOSTERMANS, *l.c.*) globose, smooth, yellowish green, c. 10 cm Ø, flesh pale yellowish, sweet acid. *Seed* not labyrinthine.

*Distr.* *Malesia*: Sumatra (?Gajolands, Bengkalis I., E. Coast, and Palembang), Banka, Kalimantan (Kutai, Balikpapan, Martapura, and Samarinda).

Cultivated in Java and introduced from Banka in Hort. Bog. *sub n.* VI–d–8.

*Ecol.* Lowland forest up to 150 m, once at 1500 m (a doubtful specimen from the Gajolands). *Fl. Aug.*; *fr.* April, July, Sept., Dec.

*Vern.* Sumatra: *faís, fajas, masam humbang, mēmbaljang bubuk, paías, tajas*, M, Palembang, *pēlem kēra = pēnkatjang utan*, Bengkalis; Banka: *asēm rawa, asēm tēlor*; Borneo: *pipit, putaram*, Kutei.

Note. *Mangifera similis* is vegetatively similar to *M. quadrifida* but differs from the latter by (1) the puberulous (not glabrous) inflorescences, (2) the free apical parts of the ridges on the petals parallel to the surface (not bent away from the surface), and (3) yellowish green and globose (not dark purple and ellipsoid) fruits.

6. *Mangifera quadrifida* JACK in Roxb. Fl. Ind. ed. Wall. 2 (1824) 440; WALP. Ann. 1 (1848) 200; HOOK. f. Fl. Br. Ind. 2 (1876) 16; ENGL. in DC. Mon. Phan. 4 (1883) 206, *incl. var. spathulaefolia* (BL.) ENGL. *l.c.* 207; KING, J. As. Soc. Beng. 65, ii (1896) 471; PIERRE, Fl. For. Coch. (1897) t. 364H; MERR. En. Born. (1921) 349; RIDL. Fl. Mal. Pen. 1 (1922) 522; CORNER, Ways. Trees (1940) 111; MUKHERJI, Lloydia 12 (1949) 112, f. 17; KOCHUM. Mal. For. Rec. 17 (1964) 295; DING HOU, Blumea 24 (1978) 28. — *M. rigida* BL. Mus. Bot. 1 (1850) 200; MIQ. Fl. Ind. Bat. 1, 2 (1859) 633; ENGL. in DC. Mon. Phan. 4 (1883) 207, f. 16. — *M. spathulaefolia* BL. Mus. Bot. 1 (1850) 200; MIQ. Fl. Ind. Bat. 1, 2 (1859) 633; MUKHERJI, Lloydia 12 (1949) 113. — *M. langong* MIQ. Sum. (1861) 521; ENGL. in DC. Mon. Phan. 4 (1883) 215; MUKHERJI, Lloydia 12 (1949) 129. — *M. maingayi* HOOK. f. Fl. Br. Ind. 2 (1876) 17; ENGL. in DC. Mon. Phan. 4 (1883) 208; KING, J. As. Soc. Beng. 65, ii (1896) 469; RIDL. Fl. Mal. Pen. 1 (1922) 522; BURK. Dict. (1935) 1406; CORNER, Ways. Trees (1940) 109, *in obs.*; MUKHERJI, Lloydia 12 (1949) 111. — *M. longipetiolata* KING, J. As. Soc. Beng. 65, ii (1896) 470; RIDL. Fl. Mal. Pen. 1 (1922) 522; CORNER, Ways. Trees (1940) 110, f. 22; MUKHERJI, Lloydia 12 (1949) 112; KOCHUM. Mal. For. Rec. 17 (1964) 295. — Fig. 7j.

Tree 10–35 m high and 25–90 cm Ø, once recorded with broad buttresses ½ m high. Bark light brown, rather smooth, or slightly scaly. *Leaves* coriaceous, elliptic to elliptic-lanceolate, ovate-oblong, sometimes oblanceolate, 6½–30 by 3–9 cm; base rounded or cuneate; apex acute, obtuse, rarely acuminate; nerves 7–22 pairs, elevated beneath, faint or distinct above; veins reticulate, rather faint; petiole 1–7 cm (in saplings up to 12½ cm), convex beneath, bicanaliculate, concave, or flat above. *Panicles* terminal and sometimes also in the uppermost leaf axils, pyramidal, up to 25 cm long, glabrous; lateral branches up to 15 cm long, laxly flowered; floral bracts ovate, 3 mm long; pedicels ½–1½ mm. *Flowers* white or

pale greenish white. *Calyx* 4-lobed, lobes ovate to ovate-oblong, 2–3½ mm long, glabrous. *Petals* 4, ovate-oblong or elliptic, 3½–4½ by 1½–2½ mm; ridges 3(–5), half the length of petals, apical parts free from the surface and bent away from it, confluent or close together at the lower 2/3 (sometimes distinct and slightly united at the base when young). *Disk* pulvinate and concave above, 2/3 mm high, 2 mm wide, obscurely shallowly 4-furrowed in bisexual flowers, 4-lobed in ♂. *Stamens* 4, 1 fertile, 2–2½ mm; filaments free; anthers oblong, 1 mm long; staminodes ¾ mm. *Ovary* subglobose, 1½–2 mm Ø; style excentric, 1½–2 mm. Sterile pistil in ♂ ¾ mm. *Drupe* (fresh) dark purple when ripe, broadly ellipsoid, 8–10 by 5½–7 cm, flesh fibrous. *Seed* not labyrinthine.

*Distr. Malesia:* Sumatra (Atjeh, Simalur I., Balai Selasa, Rau, and Pelem Bay), Malay Peninsula (Kelapa, Perak, Pahang, Johore, and Penang), and Borneo (Sabah, Brunei, and Kalimantan).

*Ecol.* Lowland forest, on inundated land or along riversides, rarely on limestone ridges, sometimes up to 900 m, once at 1380 m (in Pahang). *Fl.* Jan.–Nov., *fr.* Febr.–Aug.

*Vern.* Sumatra: *ambatjang rawanghalus*, Balai Selasa, *batjang utan*, *M, bonau*, *b. fuluh*, *b. uding*, Simalur, *putiran*, Palembang; Malay Peninsula: *asam kumbang*, *lêkub*, *pauh*, *M*; Borneo: *asam putarum*, Kalimantan, *ranch ranch*, Brunei.

7. *Mangifera altissima* BLANCO, *Fl. Filip.* (1837) 181; ed. 2 (1845) 129; ed. 3, 1 (1877) 230; *BL. Mus. Bot.* 1 (1850) 199; *Miq. Fl. Ind. Bat.* 1, 2 (1859) 632; *MARCH. Rév. Anacad.* (1869) 189; *ENGL. in DC. Mon. Phan.* 4 (1883) 214; *PIERRE, Fl. For. Coch.* (1897) t. 364E; *MERR. Publ. Gov. Lab. Philip.* n. 17 (1904) 27; *ibid.* n. 27 (1905) 35; *Philipp. J. Sc.* 1 (1906) Suppl. 84; *ibid.* 10 (1915) Bot. 35; *Sp. Blanc.* (1918) 232; *WESTER, Bull. Bur. Agr. Philip.* 18 (1920) 16; *MERR. En. Philip.* 2 (1923) 467; *MUKHERJI, Lloydia* 12 (1949) 106; *BROWN, Usefull Pl. Philip.* 2 (1950) 336, f. 164; *DING HOU, Blumea* 24 (1978) 24. — *Pauw I. Maxima, II. Media, III. Minima* RUMPH. *Herb. Amb. Auct.* (1755) 18, t. 11. — *M. mucronulata* *BL. Mus. Bot.* 1 (1850) 201; *Miq. Fl. Ind. Bat.* 1, 2 (1859) 633; *ENGL. in DC. Mon. Phan.* 4 (1883) 215; *MUKHERJI, Lloydia* 12 (1949) 129. — *M. longipes* (*non* GRIFF.) *F.-VILL. Nov. App.* (1880) 54. — *M. rumphii* *PIERRE, Fl. For. Coch.* (1897) *sub* t. 364E; *MERR. Int. Rumph.* (1917) 331; *HEYNE, Nutt. Pl.* (1927) 969; *MUKHERJI, Lloydia* 12 (1949) 107; *DE WIT, Rumph. Mem. Vol.* (1959) 386. — *Buchanania reticulata* *ELMER, Leaflet. Philip. Bot.* 4 (1912) 1499. — *M. parvifolia* *MERR. Philip. J. Sc.* 20 (1922) 401; *En. Philip.* 2 (1923) 469, *non* *BOERL. & KOORD.* 1910. — *M. salomonensis* *C. T. WHITE* (*ex* *F. S. WALKER, For. Brit. Solomon Isl. Protect.* (1948) 92, *sine descr. lat.*) *J. Arn. Arb.* 31 (1950) 95. — *M. merrillii* *MUKHERJI, Lloydia* 12 (1949) 104, f. 11, new name for *M. parvifolia* *MERR.*

Tree 12–35(–54) m high and 35–80(–100) cm Ø. Bark dark brown, smooth; branchlets angular with prominent leaf-scars. *Leaves* subcoriaceous or coriaceous, elliptic to narrowly elliptic, or oblanceolate, (5–)15½–43 by (2–)3½–11 cm; base cuneate or attenuate; apex acute to acuminate, mucronate, or obtuse; nerves (10–)16–23 pairs, slightly elevated on both surfaces, sometimes more

prominent beneath; veins reticulate, distinct beneath and faint above; petiole 1½–5(–9) cm, slightly biconvex near the base of blade, or flat above. *Panicles* terminal, sometimes also in the apical leaf axils, crowded at the apex of twigs, pyramidal, sometimes seemingly fasciculate, 10–25 cm long, sparsely puberulous, glabrescent; lateral branches up to 14 cm long; floral bracts triangular, 1–1½ mm long; pedicels 2/3–1¼ mm. *Flowers* white or cream-white, fragrant. *Calyx* 4-lobed, lobes ovate or ovate-oblong, 2½–3 mm long, sparsely puberulous outside, glabrescent, or glabrous. *Petals* 4, ovate-oblong, or elliptic, 3½–5 by 1½–2 mm; ridges (3–)5, 1½–3½ the length of petals, confluent at the lower 2/3. *Disk* pulvinate and concave above, or short-cupular, 2/3–1 mm high, 1½–2¼ mm wide, 4-lobed and papillose. *Stamens* 5, 1 fertile, 2–3 mm; filaments free; anthers oblong, c. ¾ mm long; staminodes up to ¾ mm. *Ovary* subglobose, 1–1¼ mm Ø; style 2–3 mm, excentric. Sterile pistil in ♂ 2/3 mm. *Drupe* (fresh) (*WESTER, l.c.*) green to yellowish, semireiform, ellipsoid, or ovoid, 5½–8 by 4–6 cm; flesh fibrous, resinous, acid. *Seed* not labyrinthine.

*Distr. Solomons* (Guadalcanal) and South New Britain; in *Malesia:* New Guinea (scattered in western and northern parts), Moluccas (Tenimber, Key, Halmaheira, Ceram), Philippines (N. Luzon, Mindoro, Sibuyan I.), Celebes (Malili; Baleh Angin), and Lesser Sunda Is. (Alor).

*Ecol.* Chiefly in primary, lowland, inland forest, sometimes in coastal forest, rarely up to 400 m. *Fl.* Jan.–Dec.; *fr.* April–Dec.

*Uses.* The fruits are used in the Philippines for making pickles (*WESTER, l.c.*; *BROWN, l.c.*).

*Vern.* Lesser Sunda Is.: *majakang*, Alor; Celebes: *lumisi*, *mandi*, *Tabela*; Philippines (*fide* *MERRILL*, 1923): *appán*, *banitan*, *Ibn.*, *bunutan*, *Neg.*, *pahahútan*, *páho*, *pahohótan*, *pahótan*, *pangahútan*, *Tag.*, *malapáho*, *Tag.*, *P.Bis.*, *páho*, *Bik.*, *P.Bis.*, *manga-poli*, *Sub.*, *pahútan*, *Sbl.*, *Tag.*, *páo*, *Sbl.*, *pahuhútan*, *Tag.*, *Bik.*, *pangmanggaén*, *Ilk.*, *popouan*, *Pamp.*; Moluccas: *kabawa*, *Sula I.*, *ponga ma mali*, Halmaheira; New Guinea: *binap*, *Kebar*, *mewiejetnik*, *Arafak*, *wa-wa*, *Karas*, *wail mango*, *pidgin*, *waromet*, *Amberbaken*, *weli*, *Madang*, *yanggemas*, *Sepik*.

*Note.* The angular branchlets and prominent leaf-scars, in combination with leaf characters, are useful for recognizing (sterile) collections.

8. *Mangifera griffithii* *HOOK. f.* *Trans. Linn. Soc.* 23 (1860) 168; *Fl. Br. Ind.* 2 (1876) 14; *ENGL. in DC. Mon. Phan.* 4 (1883) 203; *KING, J. As. Soc. Beng.* 65, ii (1896) 468; *PIERRE, Fl. For. Coch.* (1897) t. 364K; *RIDL. Fl. Mal. Pen.* 1 (1922) 521; *BAKER, J. Bot.* 62 (1924) Suppl. 30; *MUKHERJI, Lloydia* 12 (1949) 103; *DING HOU, Blumea* 24 (1978) 25. — *M. microphylla* *GRIFF. ex HOOK. f.* *Fl. Br. Ind.* 2 (1876) 17; *ENGL. in DC. Mon. Phan.* 4 (1883) 209; *KING, J. As. Soc. Beng.* 65, ii (1896) 468; *PIERRE, Fl. For. Coch.* (1897) t. 364L; *RIDL. Fl. Mal. Pen.* 1 (1922) 521; *BURK. Dict.* (1935) 1407; *CORNER, Ways. Trees* 1 (1940) 111; *MUKHERJI, Lloydia* 12 (1949) 102. — *M. sclerophylla* *HOOK. f.* *Fl. Br. Ind.* 2 (1876) 15; *ENGL. in DC. Mon. Phan.* 4 (1883) 205; *KING, J. As. Soc. Beng.* 65, ii (1896) 469; *RIDL. Fl. Mal. Pen.* 1 (1922) 521; *Kew Bull.* (1933) 194; *MUKHERJI, Lloydia* 12

(1949) 103. — *M. beccarii* RIDL. Kew Bull. (1933) 194; MUKHERJI, Lloydia 12 (1949) 105.

Tree up to 30 m high and 100 cm  $\varnothing$ . *Leaves* chartaceous, subcoriaceous, or coriaceous, elliptic or broadly elliptic, elliptic- or obovate-oblong, 5–23 by  $2\frac{1}{2}$ –9 cm; base cuneate or obtuse; apex acute, rarely cuspidate or obtuse; nerves 6–16 pairs, elevated on both surfaces; veins reticulate, distinct below and faint or obscure above; petiole ( $\frac{1}{2}$ –)1–3(–6) cm, convex beneath, concave above. *Panicles* terminal and also in the apical leaf axils, 10–24 cm long, puberulous, crowded at the apex of twigs with the appearance of fascicles, laxly flowered; floral bracts ovate, 2 mm long; pedicels c.  $\frac{1}{2}$  mm. *Flowers* cream-white. *Calyx* 4- (rarely 5-)lobed, lobes broadly ovate,  $1\frac{1}{2}$ –2 mm long, puberulous outside. *Petals* 4 (rarely 5), lanceolate (sometimes ovate when young), 2–3 by  $\frac{2}{3}$ – $1\frac{1}{4}$  mm; ridges 3(–5),  $\frac{1}{2}$ – $\frac{2}{3}$  the length of petals, confluent at the base. *Disk* short-cupular, c. 1 mm high,  $1\frac{1}{2}$  mm wide, 2–4-lobed, papillose. *Stamens* 4 (rarely 5), 1 fertile, 1– $2\frac{1}{2}$  mm; filaments free; anthers ovoid,  $\frac{1}{2}$ – $\frac{2}{3}$  mm long; staminodes up to  $\frac{1}{2}$  mm. *Ovary* subglobose, c.  $1\frac{1}{2}$  mm  $\varnothing$ ; style excentric,  $1\frac{1}{2}$  mm. Sterile pistil in  $\sigma$   $\frac{1}{2}$  mm. *Drupe* (fresh) (CORNER, l.c.) yellow to rose red and finally blackish, broadly ellipsoid or obovoid,  $2\frac{1}{2}$ – $3\frac{1}{2}$  by  $1\frac{1}{2}$ – $2\frac{1}{2}$  cm; flesh pale orange yellow, rather watery, fibrous, sour-sweet. *Seed* not labyrinthine.

Distr. *Malesia*: Sumatra (Palembang), Malay Peninsula (Perak, Pahang, Selangor, Johore, Malacca, Singapore), and Borneo (Sabah, Sarawak). Cultivated in villages in the Malay Peninsula.

Ecol. Scattered in lowland forest, up to 360 m. Fl. Oct., Nov., March; fr. Jan.–Oct.

Vern. Malay Peninsula: *labuk, raba-raba, rawa, M.*

Note. CORNER carefully collected specimens from various heights on a single tree to check the individual variation. The leaves on the lower branches measured 23 by 9 cm and a petiole of  $6\frac{1}{2}$  cm, those from the upper branches were 7 by 4 cm with a petiole of c. 1 cm.

9. *Mangifera inoarpoides* MERR. & PERRY, J. Arn. Arb. 22 (1941) 532; VAN HEEL, Blumea 19 (1971) 109; DING HOU, Blumea 24 (1978) 25. — *M. indica* (non L.) LAUT. Nova Guinea 8 (1910) 297. — Fig. 7o.

Tree up to 12 m high. *Leaves* subcoriaceous, elliptic-lanceolate or narrowly elliptic,  $11\frac{1}{2}$ –26 by  $4\frac{1}{2}$ – $7\frac{1}{2}$  cm; base cuneate to attenuate; apex shortly acuminate to acuminate; nerves 18–27 pairs, slightly elevated on both surfaces; veins reticulate, distinct on both surfaces; petiole  $1\frac{1}{2}$ – $4\frac{1}{2}$  cm, convex beneath, flat above. *Panicles* terminal and sometimes also in the apical leaf-axils, pyramidal, up to 22 cm long, crowded at the apex of twigs, puberulous; lateral branches up to 7 cm long, laxly flowered; floral bracts ovate, 2– $2\frac{1}{2}$  mm long; pedicels  $\frac{1}{2}$ – $\frac{2}{3}$  mm. *Flowers* white. *Calyx* 4-lobed, lobes ovate or ovate-oblong,  $1\frac{1}{2}$ –2 mm long, slightly hairy at the apical part outside. *Petals* 4, lanceolate,  $2\frac{1}{2}$ –4 by  $\frac{2}{3}$ – $1\frac{1}{4}$  mm; ridges 3,  $\frac{1}{3}$ – $\frac{1}{2}$  the length of the petal, confluent at the lower 1– $1\frac{1}{2}$  mm. *Disk* short-cupular,  $\frac{2}{3}$ –1 mm high,  $1\frac{1}{2}$  mm wide, 4-lobed, papillose. *Stamens* 4, 1 fertile,  $1\frac{1}{2}$ –2 mm; filaments free; anthers ovoid,  $\frac{1}{2}$ – $\frac{2}{3}$  mm long; staminodes up to 1 mm. *Ovary*

obliquely subglobose, c. 1 mm  $\varnothing$ ; style lateral, 2 mm. Sterile pistil in  $\sigma$  obscure. *Drupe* (fresh or dried) obliquely subrotund, much compressed,  $6\frac{1}{2}$ –8 by 6 cm; flesh fibrous. *Seed* labyrinthine.

Distr. *Malesia*: New Guinea (southern part).

Ecol. Lowland forest along creeks and rivers at low altitude. Fl. July, Dec.; fr. Dec.

Vern. *Begbegere, Cocodala, wabmu, Pomboa.*

Note. *M. inoarpoides* is closely allied to the West Malesian *M. gedebe*, which has also labyrinthine seeds (VAN HEEL, l.c.).

10. *Mangifera gedebe* MIQ. Sum. (1861) 522; ENGL. in DC. Mon. Phan. 4 (1883) 209; ENDERT, Versl. M.O. Born. Exp. 1925 (1927) 217; TECTONA 25 (1932) 976; MUKHERJI, Lloydia 12 (1949) 100, f. 9; BACK. & BAKH. f. Fl. Java 2 (1965) 149. — Fig. 7n.

Tree up to 30 m high and 60 cm  $\varnothing$ . Bark grey or light brown, smooth or cracked. *Leaves* subcoriaceous, elliptic-oblong or narrowly elliptic,  $5\frac{1}{2}$ –23 by  $2\frac{1}{2}$ –6 cm; base cuneate; apex acuminate; nerves 16–30 pairs, rather fine, slightly thicker than the veins, sometimes hardly distinct from them on the lower surface; veins reticulate, distinct on both surfaces; petiole  $\frac{1}{2}$ –4 cm, convex beneath, concave above. *Panicles* terminal, sometimes also in the apical leaf axils, pyramidal, up to 27 cm long, crowded at the apex of twigs, densely pubescent when young, glabrescent; lateral branches up to 16 cm long, laxly flowered; floral bracts lanceolate, 3–4 mm long; pedicels  $\frac{1}{3}$ – $\frac{1}{2}$  mm. *Flowers* white. *Calyx* 4(–6)-lobed, lobes ovate-oblong, 2–3 mm long, sparsely puberulous outside. *Petals* 4 (rarely 5), lanceolate,  $3\frac{1}{4}$ – $4\frac{1}{2}$  by 1– $1\frac{1}{4}$  mm; ridges 3(–5), c.  $\frac{1}{2}$  the length of petals, confluent at the lower  $1\frac{1}{2}$ –2 mm. *Disk* short-cupular,  $\frac{1}{2}$ –1 mm high, 1– $1\frac{1}{2}$  mm wide, 4-lobed, papillose. *Stamens* 5, 1 fertile, 2–3 mm; filaments free; anthers broad-ovoid,  $\frac{1}{2}$  mm long; staminodes  $\frac{1}{4}$ – $\frac{2}{3}$  mm. *Ovary* subglobose, c. 1 mm  $\varnothing$ ; style excentric,  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm. Sterile pistil in  $\sigma$  c.  $\frac{1}{3}$  mm. *Drupe* (fresh) (BACK. & BAKH. f. l.c.) obliquely subrotund, compressed, 8–9 cm  $\varnothing$ ; flesh thin, fibrous. *Seed* labyrinthine, with testa present in the crevices of the very irregular lobes or folds.

Distr. *Malesia*: Sumatra (Riouw and Lampongs), Borneo (W. Kutai), and W. Java (Bantam: Danu swamp).

Cultivated in Hort. Bog. sub n. VII-D–5 (origin from Sumatra).

Ecol. River-banks and lowland forest, below 100 m. *M. gedebe* is a distinct constituent of the so-called 'rapak' type of swamp forest, which is inundated during most of the year. In such forest there is no peat formation. Associates are *Gluta renghas*, *Ficus retusa*, *Alstonia spathulata*, etc. Fl. June–Sept.; fr. Aug., Nov.

Vern. Sumatra: *gadéper* or *gèdèbè, tajas = putaram, M*; Borneo: *kèpih, rèpih, Kutai*; W. Java: *kèdèpir*.

Note. According to KOSTERMANS (*in sched.*) the fruits are only edible (very sour) when unripe; when ripe, the pulp is too scanty and too hard to be edible.

11. *Mangifera parvifolia* BOERL. & KOORD. in Koord.-Schum. Syst. Verz. 2 (1910) 31; MUKHERJI, Lloydia 12 (1949) 130; DING HOU, Blumea 24 (1978) 28.

Tree up to 29 m high and 55 cm  $\varnothing$ , once recorded 100 cm  $\varnothing$  (BEGUIN 485, BO). *Leaves* subcoriaceous, elliptic or elliptic-oblong, ovate-oblong, or obovate-oblong,  $5\frac{1}{2}$ -11(-15 $\frac{1}{2}$ ) by 2-4(-6) cm; base cuneate or obtuse; apex acuminate, rarely obtuse; nerves 6-10 pairs, slightly elevated beneath, rather faint above; veins obscure, sometimes reticulate and distinct beneath; petiole  $\frac{1}{2}$ -2(-6) cm, convex beneath, bicanaliculate or flat above. *Panicles* axillary only, often in several successive leaf axils, up to 7 cm long, puberulous; lateral branches up to 2 $\frac{1}{2}$  cm long, laxly flowered; floral bracts caducous, not seen; pedicels  $\frac{2}{3}$  mm. *Flowers* greenish white or white. *Calyx* 4-lobed, lobes ovate-oblong,  $1\frac{1}{2}$ -2 mm long, sparsely puberulous outside. *Petals* 4, lanceolate, 3-4 $\frac{1}{2}$  by 1 mm; ridges 3, half the length of petals, confluent at the basal part. *Disk* short-cupular, c.  $\frac{1}{2}$  mm high,  $1\frac{1}{4}$  mm wide, 4-lobed, papillose. *Stamens* 4, 1 fertile, 2-4 mm; filaments free; anthers ovoid,  $\frac{1}{2}$ - $\frac{2}{3}$  mm long; staminodes up to 2 mm. *Ovary* subglobose, c. 1 mm  $\varnothing$ ; style 3 $\frac{1}{2}$  mm, excentric. *Drupe* (dried) broadly elliptic, 3 $\frac{1}{2}$  by 2 cm. *Seed* not labyrinthine.

*Distr. Malesia:* Sumatra (Bengkalis: P. Rang Sang; Indragiri; Palembang; Batu ls.; Banka) and the Malay Peninsula (Singapore).

*Ecol.* In forest on dryland or in temporarily (peat-water-)inundated areas, chiefly occurring a few metres above sea-level, sometimes up to 60 m. *Fl.* Oct.; *fr.* Nov.

*Vern.* Sumatra: *ëmbatjang hutan, gading, mëmpëlëm këra, pêlam kara, rawa(h), sëkira, M.*

*Note.* *M. parvifolia* is allied to *M. griffithii* from Malaya and *M. havilandii* from Borneo, especially in vegetative characters; sterile specimens of these three species are difficult to identify with certainty. When fertile, the axillary, puberulous panicles often occurring in several successive leaf-axils, it is easy to recognize.

**12. *Mangifera havilandii* RIDL.** Kew Bull. (1933) 194; MUKHERJI, Lloydia 12 (1949) 110, f. 15; ANDERSON, Gard. Bull. Sing. 20 (1963) 170; SMYTHIES, Common Sarawak Trees (1965) 5. — *Fig.* 7a-i.

Tree up to 35 m high and 80 cm  $\varnothing$ , occasionally with buttresses up to 1 $\frac{1}{2}$  m high. Bark greyish or light brown, smooth or scaly. *Leaves* coriaceous, elliptic to elliptic-lanceolate, sometimes obovate-oblong, 8-18 by 3-6 $\frac{3}{4}$  cm; base cuneate or attenuate; apex acuminate; nerves 8-12 pairs, distinct on both surfaces, sometimes faint above; veins reticulate, faint, sometimes distinct on both surfaces; petiole ( $\frac{1}{2}$ -1) $\frac{1}{2}$ -4 $\frac{1}{2}$  cm, biconvex, concave or bicanaliculate above. *Panicles* terminal and sometimes also in the uppermost leaf axils, pyramidal, up to 25 cm long, puberulous; lateral branches up to 7 cm long, rather laxly flowered; floral bracts triangular, c.  $\frac{2}{3}$  mm long; pedicels 1 mm. *Flowers* white. *Calyx* 4-lobed, lobes ovate,  $1\frac{1}{2}$ -2 mm long, slightly hairy on the margin especially near the apex. *Petals* 4, lanceolate, 3 $\frac{1}{2}$ -4 by  $1\frac{1}{4}$  mm; ridges 3(-5),  $\frac{1}{2}$ - $\frac{2}{3}$  the length of petals, confluent at the basal 1 mm. *Disk* short-cupular,  $\frac{2}{3}$ -1 mm high, c.  $\frac{3}{4}$  mm wide, 4-lobed, papillose. *Stamens* 4, 1 fertile; filaments free; anthers broadly ellipsoid,  $\frac{1}{2}$ - $\frac{2}{3}$  mm long; staminodes absent or minute. *Ovary* broadly obovoid,  $\frac{2}{3}$  mm  $\varnothing$ ; style excentric,

2-2 $\frac{1}{2}$  mm. Sterile pistil in  $\delta$  c.  $\frac{1}{2}$  mm. *Drupe* (dried) broad-ovoid or -ellipsoid,  $3\frac{1}{4}$ -3 $\frac{1}{2}$  by  $2\frac{1}{4}$  cm, (once recorded the ripe drupe rotund, 3-4 cm  $\varnothing$ , black; flesh pale pink, sweet, KOSTERMANS in sched.). *Seed* not labyrinthine.

*Distr.* *Malesia:* Borneo (widely distributed but scarce).

*Ecol.* Freshwater swamp forest or inundated areas, also in primary lowland forest on dryland, up to 300 m, once at 1500 m (Mt Kinabalu). *Fl.* Oct., Nov.; *fr.* March-Oct.

*Vern.* Sarawak: *asam raba*, Sadong Distr., *buah raba*, *M. raba*, Kuching; Sabah: *asam damaran*, Tungku, *rancha rancha*, Ranau; Kalimantan: *asam bultisan*, Balikpapan, *asam pipit*, *manga rawa*, *rësak rawa*, *tawun*, *M. asam rawa*, Kutai, *bajam lian*, *bar*, Dajak.

**13. *Mangifera timorensis* BL.** Mus. Bot. 1 (1850) 199; MIQ. Fl. Ind. Bat. 1, 2 (1859) 633; ENGL. in DC. Mon. Phan. 4 (1883) 208; DOCT. v. LEEUWEN, Zoocecidia (1926) 325, f. 580; MUKHERJI, Lloydia 12 (1949) 114, f. 19. — *M. glauca* (non BL.) SPAN. Linnaea 15 (1841) 188.

Tree up to 30 m high and 80 cm  $\varnothing$ . Buttresses occasionally present, 2 m high,  $\frac{1}{2}$  m wide. Bark yellowish to dark brown, rough, deeply fissured. *Leaves* subcoriaceous, elliptic-oblong to narrowly elliptic, rarely oblanceolate or lanceolate, (4 $\frac{1}{2}$ -) 16-35 by (2-4)4-9 cm; base cuneate; apex acute or obtuse; nerves 14-23 pairs, distinct beneath, faint above; veins obscure, or reticulate and faint on both surfaces; petiole (1-) $1\frac{1}{2}$ -3 $\frac{1}{2}$ (-5) cm, convex beneath, concave above. *Panicles* terminal and sometimes also in the apical leaf axils, crowded at the apex of twigs, pyramidal, up to 20 cm long, glabrous; lateral branches up to 10 $\frac{1}{2}$  cm long; floral bracts triangular or ovate, c. 1 mm long; pedicels  $\frac{1}{3}$  mm. *Flowers* white. *Calyx* 4-lobed, lobes ovate or elliptic, 2-2 $\frac{1}{2}$  mm long, glabrous. *Petals* elliptic, rarely ovate, 3-4 $\frac{1}{2}$  by  $1\frac{1}{2}$ -2 $\frac{1}{2}$  mm; ridges (3-5)(-7), c.  $\frac{2}{3}$  the length of petals, confluent at the basal  $\frac{2}{3}$ -1 mm. *Disk* short-cupular,  $1\frac{1}{2}$  mm high, 2 $\frac{1}{2}$  mm wide, 4-lobed, papillose. *Stamens* 4, 1 (rarely 2) fertile; filaments free; anthers oblong,  $\frac{2}{3}$  mm long; staminodes up to 1 mm. *Ovary* subglobose, c. 2 mm  $\varnothing$ ; style lateral, 2 mm. Sterile pistil in  $\delta$   $\frac{1}{2}$  mm. *Drupe* (dried) yellowish when ripe, globose or subglobose, 3 $\frac{1}{2}$ -4 $\frac{1}{4}$  cm  $\varnothing$  (hard, not edible, KOSTERMANS in sched.). *Seed* not labyrinthine.

*Distr. Malesia:* Lesser Sunda Is. (Sumbawa, Flores, Sumba, Alor, Timor, Wetar, Leti), Central Celebes (Malili), and Moluccas (Banda and Tenimber Is.).

*Ecol.* In forest, 300-1000 m, rarely in beach forest. *Fl.* March-Dec.; *fr.* Jan., March.

*Vern.* Lesser Sunda Is.: *majakang*, Alor, *manggo latar*, W. Sumbawa, *pautah*, Flores, *upaentui*, Dowong; Celebes: *lumisi*, *morotoiba*, *tamba*, Tobela.

**14. *Mangifera monandra* MERR.** Publ. Gov. Lab. Philip. n. 17 (1904) 28; WESTER, Bull. Bur. Agr. Philip. 18 (1920) 16; MERR. En. Philip. 2 (1923) 468; MUKHERJI, Lloydia 12 (1949) 114, f. 20 & 30, incl. var. *fasciculata* MUKHERJI, l.c. 116, f. 31. — *M. philippinensis* MUKHERJI, l.c. 108, f. 15a-b & 29. Medium-sized tree. *Leaves* subcoriaceous, elliptic,

elliptic-oblong, obovate-oblong or oblanceolate, (7-)13-19 by  $2\frac{3}{4}$ - $4\frac{3}{4}$ -(8 $\frac{1}{4}$ ) cm; base cuneate; apex acute, shortly acuminate, sometimes obtuse; nerves 8-12 pairs, slightly elevated on both surfaces; veins reticulate, distinct beneath, faint above; petiole  $\frac{3}{4}$ - $3\frac{1}{2}$ -(5 $\frac{1}{2}$ ) cm, convex beneath, concave above. *Panicles* terminal and also in the apical leaf axils, crowded at the apex of twigs and seemingly fasciculate, up to 19 cm long, glabrous; lateral branches up to 5 cm long, laxly flowered; floral bracts caducous, not seen. Pedicels  $1\frac{1}{2}$ - $\frac{3}{4}$  mm. *Flowers* white. *Calyx* 4-lobed, lobes ovate or ovate-oblong,  $1\frac{3}{4}$ - $2\frac{1}{4}$  mm long, glabrous. *Petals* 4, ovate-oblong, 3-4 $\frac{1}{2}$  by  $1\frac{1}{2}$ -2 mm; ridges 5(-7),  $\frac{1}{2}$ - $\frac{2}{3}$  the length of petals, confluent at the basal  $\frac{1}{2}$ - $1\frac{1}{2}$  mm. *Disk* short-cupular,  $\frac{3}{4}$ -1 mm high, 1-1 $\frac{1}{2}$  mm wide, slightly 4-lobed, papillose. *Stamens* 4 (or 5), 1 fertile,  $1\frac{1}{2}$ - $3\frac{1}{2}$  mm; filaments free; anthers ovoid-oblong,  $\frac{2}{3}$  mm long; staminodes up to 1 mm. *Ovary* subglobose, c.  $\frac{2}{3}$  mm  $\varnothing$ ; style excentric,  $1\frac{1}{2}$ -3 mm. Sterile pistil in  $\sigma$  c.  $\frac{1}{2}$  mm. *Drupe* (MERRILL, 1904, l.c.) ellipsoid, subcompressed, inequilateral,  $3\frac{1}{2}$  by  $1\frac{3}{4}$  cm; flesh very thin.

Distr. *Malesia*: Philippines (Luzon, Samar, Leyte, Ticao, Guimaras Is.).

Ecol. Lowland primary forest. *Fl.* Febr.-April; *fr.* June-July.

Vern. *Kalamansánai*, *kárig*, Tag., *kurig*, Sam-

bali, *malapáho*, Bik., *paglumbáyan*, *páo*, Ilk., *paglumbóyen*, Pang., *pagsagon*, *pounan*, S.L.Bis.

15. *Mangifera gracilipes* HOOK. f. *Fl. Br. Ind.* 2 (1876) 16; ENGL. in DC. *Mon. Phan.* 4 (1883) 203; KING, J. As. Soc. Beng. 65, ii (1896) 474; RIDL. *Fl. Mal. Pen.* 1 (1922) 523; MUKHERJ, *Lloydia* 12 (1949) 98.

Large tree. *Leaves* subcoriaceous, elliptic-lanceolate, 7-10 by  $2\frac{1}{2}$ -3 cm; base attenuate; apex acuminate; nerves 10-14 pairs, rather faint on both surfaces; veins obscure on both surfaces; petiole  $\frac{3}{4}$ - $2\frac{3}{4}$  cm, convex beneath, concave above. *Panicles* terminal and also in the apical leaf axils, up to 15 cm long, glabrous, crowded at the apex of twigs and seemingly fasciculate; lateral branches up to 2 cm long; pedicels  $\frac{1}{2}$ -1 mm. *Calyx* 4- (rarely 5)-lobed, lobes ovate or broadly ovate, sometimes triangular,  $1\frac{1}{2}$ -2 mm long. *Petals* 4 (rarely 5), ovate-oblong,  $3\frac{1}{2}$ -4 by  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm; ridges 5(-7), c.  $\frac{1}{2}$  the length of petals, confluent at the lower half. *Disk* short-cupular,  $\frac{2}{3}$  mm high, 1-1 $\frac{1}{2}$  mm wide. *Stamens* 4 (rarely 5), 1 fertile,  $1\frac{1}{2}$ - $2\frac{1}{2}$  mm; filaments free; anthers ovoid,  $\frac{2}{3}$  mm long; staminodes very small. *Ovary* subglobose,  $1\frac{1}{2}$  mm  $\varnothing$ ; style excentric, 2 mm. Sterile pistil in  $\sigma$  c.  $\frac{1}{3}$  mm. *Drupe* unknown.

Distr. *Malesia*: Malay Peninsula (Malacca), known only from the type.

## 2. Section Limus

MARCH. Rév. Anacard. (1869) 104 & 188; DING HOU, *Blumea* 24 (1978) 24.

Disk pulvinate, rarely cylindrical and torus-like, often reduced and stipe-like, (at the base of ovary in bisexual flowers), usually not lobed, not papillose, rarely obsolete in  $\sigma$ . Filaments often connate at the base, sometimes free.

16. *Mangifera decandra* DING HOU, *Reinwardtia* 8 (1972) 323, f. 1.

Tree up to 30 m high and 90 cm  $\varnothing$ . Bark reddish brown, cracked. *Leaves* coriaceous, elliptic- or obovate-oblong, or oblanceolate, (17-)27-38 by (7-)12-15 cm; base cuneate or attenuate; apex mucronate; nerves (14-)21-36 pairs, prominent on both surfaces; veins hardly visible; petiole convex beneath, plane above, (1 $\frac{1}{2}$ -)3 $\frac{1}{2}$ -6 cm. *Panicles* terminal, pyramidal, 16-57 cm long, puberulous; lateral branches up to 20 cm long; floral bracts ovate, 3-6 mm long; pedicels 1-2 mm. *Flowers* reddish or pink. *Calyx* 5-lobed, lobes broad-ovate or elliptic,  $1\frac{1}{2}$ -2 mm long, puberulous outside. *Petals* 5, elliptic- or obovate-oblong,  $4\frac{1}{2}$ -6 by  $1\frac{1}{2}$ -2 mm, without ridges on the inner surface. *Disk* cylindrical, stipe-like, c.  $\frac{3}{4}$  mm high in  $\varphi$ , obsolete on  $\sigma$ . *Stamens* 10, 5 fertile, always one long (3-6 mm) and 4 short (2-3 $\frac{1}{2}$  mm); filaments connate at the base; anthers broad-ovoid or -ellipsoid,  $\frac{1}{2}$ - $\frac{3}{4}$  mm; staminodes 1-2 mm. *Ovary* subglobose,  $1\frac{1}{2}$ -2 mm; style excentric, 3-5 mm. Sterile pistil in  $\sigma$  c. 1 mm. *Drupe* (dried) ellipsoid, 9-9 $\frac{1}{2}$  by  $4\frac{1}{2}$  cm. *Seed* not labyrinthine.

Distr. *Malesia*: Sumatra (Karimun, Pakanbaru, Palembang) and Borneo (Sabah: Sandakan, Lungmanis, Sibuga, Tawau, Elphinstone, Kuala

Belait, Beluran; Brunei; Kalimantan: near Mahakam R.; Sarawak: Bintulu).

Ecol. Lowland primary forest, sometimes in freshwater swamp forest, occasionally in secondary forest, up to 100 m, once at c. 340 m. *Fl.* March-May; *fr.* March-Sept.

Vern. Sumatra: *biendjai*, M, *komang bakad*, Palembang; Borneo: Sabah: *beluno*, Dusun, *binjay*, Tidong; Kalimantan: *bindjai*, Kutai & Bandjar, *konjot*, Benua-Dajak.

17. *Mangifera lagenifera* GRIFF. *Notul.* 4 (1854) 414, t. 567, f. 3; HOOK. f. *Fl. Br. Ind.* 2 (1876) 18; ENGL. in DC. *Mon. Phan.* 4 (1883) 211; KING, J. As. Soc. Beng. 65, ii (1896) 476; PIERRE, *Fl. For. Coch.* (1897) t. 365C; PERK. *Fragm. Fl. Philip.* (1904) 25, p.p., *quoad* CUMING 2330; MERR. & ROLF, *Philip. J. Sc.* 3 (1908) Bot. 108; *ibid.* 10 (1915) Bot. 190; RIDL. *Fl. Mal. Pen.* 1 (1922) 525; MERR. *En. Philip.* 2 (1923) 469; CRAIB, *Fl. Siam.* En. 1 (1931) 344; BURK. *Dict.* (1935) 1406; CORNER, *Ways. Trees* 1 (1940) 110, f. 22, Atlas t. 12 & 13; MUKHERJ, *Lloydia* 12 (1949) 118; KOCHUM. *Mal. For. Rec.* 17 (1964) 294; DING HOU, *Blumea* 24 (1978) 26. — Fig. 9.

Tree up to 30 (or more) m high and 75 cm  $\varnothing$ . Bark pale brown or fawn grey, scaly. *Leaves*



Fig. 9. *Mangifera lagenifera* GRIFF. by the main road to Merlimau, Malacca. Courtesy and photogr. CORNER.

coriaceous, obovate, oblanceolate, 8–18 by  $2\frac{1}{2}$ – $4\frac{1}{2}$  cm; apex obtuse or rounded; base attenuate, rarely cuneate; nerves 10–23 pairs, distinct on both surfaces, sometimes obscure above; veins obscure on both surfaces; petiole flattened, without sharp distinction from the lamina, the narrowest part 1–3 cm long. *Panicles* terminal and sometimes also in the apical leaf axils, 16–30 cm long, puberulous; sometimes crowded at the apex of twigs and seemingly fasciculate; floral bracts ovate, 2– $2\frac{1}{2}$  mm long; pedicels  $\frac{2}{3}$ – $1\frac{1}{2}$  mm. *Flowers* deep violet. *Calyx* 5-lobed, lobes broad-ovate or -elliptic,  $1\frac{1}{2}$ –2 mm long, puberulous outside. *Petals* 5, oblong, oblanceolate, or elliptic, 5–6 by  $1\frac{1}{2}$ –2 mm, without ridges on the inner surface. *Disk* pulvinate, stipe-like, c.  $\frac{2}{3}$  mm high. *Stamens* 10, 5 fertile,  $\pm$  equal,  $3\frac{1}{2}$ –5 mm; filaments connate at the base; anthers ovoid-oblong,  $\frac{1}{2}$ – $\frac{2}{3}$  mm long; staminodes c.  $\frac{2}{3}$  mm. *Ovary* obovoid,  $\frac{2}{3}$ – $1\frac{1}{4}$  mm  $\varnothing$ ; style excentric, c. 4 mm. *Drupe* pyriform, c. 11 by 6 cm (dried, 1 coll.); pale dull green or greyish turning brownish, the flesh dirty white to dirty pinkish, sour and stringy (CORNER, *l.c.*).

*Distr. Malesia:* Sumatra (Karimun and Lingga) and Malay Peninsula (Pahang, Perak, Johore, Malacca, and Singapore).

*Ecol.* Lowland forest up to 150 m, sometimes in temporarily inundated places. *Fl.* Jan.–Sept.; according to CORNER frequent in orchards in Malacca.

*Uses.* According to CORNER *l.c.* the coarse fruit of the *lanjut* has little to commend it, but the poisonousness of the sap will preserve, he hopes, the magnificent trees which are scattered throughout the country: a grander being than an old *lanjut* is hard to imagine.

*Vern. Sumatra:* *landjut*, M; Malay Peninsula: *langoot*, *lanjut*, M.

18. *Mangifera foetida* LOUR. *Fl. Coch.* (1790) 160; WILLD. *Sp. Pl.* 1 (1797) 199; ROXB. *Fl. Ind. ed. Wall.* 2 (1824) 440; DC. *Prod.* 2 (1825) 63; BUCH-HAM. *Mem. Wern. Nat. Hist. Soc. (Edinb.)* 5 (1826) 327; HASSK. *Flora* 27 (1844) 622; BL. *Mus. Bot.* 1 (1850) 198, *incl. var. sphaeroidea* BL.; MIQ. *Fl. Ind. Bat.* 1, 2 (1859) 632; HOOK. *f. Fl. Br. Ind.* 2 (1876) 18; KURZ, *Fl. Burma* 1 (1877) 305; ENGL. in DC. *Mon. Phan.* 4 (1883) 212, *incl. var. leschenaultii* (MARCH.) ENGL.; WARB. *Bot. Jahrb.* 13 (1891) 361; KING, *J. As. Soc. Beng.* 65, ii (1896) 474; K. & V. *Bijdr.* 4 (1896) 88; BACK. *Fl. Bat.* (1907) 363; LECOMTE, *Fl. Gén. I.-C.* 2 (1908) 15; RIDL. *J. Str. Br. R. As. Soc. n.* 59 (1911) 89; BACK. *Schoolfl.* (1911) 278; MERR. *Int. Rumph.* (1917) 329; WESTER, *Bull. Bur. Agr. Philip.* 18 (1920) 16; LAUT. *Bot. Jahrb.* 56 (1921) 354; RIDL. *Fl. Mal. Pen.* 1 (1922) 524; CRAIB, *Fl. Siam. En.* 1 (1926) 343; HEYNE, *Nutt. Pl.* (1927) 966; OCHSE & BAKH. *Fruit* (1931) 5, t. 3; RIDL. *Kew Bull.* (1933) 194; MERR. *Comm. Lour.* (1935) 160; BURK. *Dict.* (1935) 1402; CORNER, *Ways. Trees* (1940) 109, f. 22, *Atlas* t. 10; MUKHERJI, *Lloydia* 12 (1949) 120, f. 24; STEPHENS, *Mal. For.* 18 (1955) 205; DE WIT, *Rumph. Mem. Vol.* (1959) 386; TARD. *Fl. C. L. & V.* 2 (1962) 97; KOCHUM. *Mal. For. Rec.* 17 (1964) 294; BACK. & BAKH. *f. Fl. Java* 2 (1965) 149; SMYTHIES, *Common Sarawak Trees* (1965) 5, pl. 1. — *Manga foetida* I RUMPH. *Herb. Amb.* 1 (1741) 98, t. 28. — *M. indica* (non L.) BL. *Bijdr.* (1826)

1157. — *M. foetida* GRIFF. *Notul.* 4 (1854) 419, *nom. illeg., non LOUR.* 1790. — *M. horsfieldii* MIQ. *Fl. Ind. Bat.* 1, 2 (1859) 632. — *M. leschenaultii* MARCH. *Rév. Anacard.* (1869) 189. — **Fig. 10–11.**

Tree 10–40 m high and 30–100 cm  $\varnothing$ . Bark greenish or reddish brown, rough, fissured or scaly. *Leaves* rigidly coriaceous, oblanceolate, elliptic, elliptic-oblong, 14–35 by 6–16 cm (in vegetative or sapling state up to 37–48 by 15– $18\frac{1}{2}$  cm); base cuneate or attenuate; apex obtuse, rounded, sometimes slightly emarginate, rarely acute; nerves 15–33 pairs, prominent beneath, slightly elevated



Fig. 10. *Mangifera foetida* LOUR. in the forest at Puturan, Palembang, S. Sumatra (Photogr. THORENAAR, 1925).



Fig. 11. *Mangifera foetida* LOUR. in the forest at Sg. Rhu Reba, Jason Bay, Johore, showing stem-base without buttresses, typical for the genus. Courtesy and photogr. CORNER.

above; veins invisible or obscure on both surfaces; petiole 2-5(-8) cm (in vegetative or sapling state up to 12 cm), convex beneath, concave or flat above. *Panicles* terminal and sometimes also in the uppermost leaf axil, pyramidal, 10-40 cm long, glabrous; lateral branches up to 20 cm long, rather densely flowered; floral bracts ovate-lanceolate, 4-5 mm long; pedicels c. 1 mm. *Flowers* pinkish or deep red, fragrant. *Calyx* 5-lobed, lobes broadly ovate or ovate, 3-5 mm long, often glabrous, sometimes puberulous outside. *Petals* narrowly lanceolate, 6-9 by  $1\frac{1}{2}$ - $2\frac{1}{2}$  mm; ridges 3, c.  $\frac{1}{2}$  the length of petals, confluent near the base. *Disk* peltate, stipe-like, c. 1 mm high. *Stamens* 5, 1

(rarely 2) fertile, 6-10 mm; filaments connate at the lower  $\frac{1}{4}$ -1 mm; anthers ellipsoid, c.  $\frac{3}{4}$  mm long; staminodes 3-5 mm. *Ovary* subglobose, 1- $1\frac{1}{2}$  mm  $\varnothing$ , (ochraceous when fresh, cf. OCHSE & BAKH. *l.c.*); style excentric,  $5\frac{1}{2}$ -7 mm. *Drupe* (fresh) (OCHSE & BAKH. *l.c.*) yellowish or greyish green, smelling and tasting of turpentine when ripe, obliquely ovoid, 8-10(-18) by 6-7(-12) cm; flesh yellow, fibrous, juicy, savoury, fragrant. *Seed* not labyrinthine.

Distr. Thailand, Indo-China (Vietnam), and *Malesia*: Sumatra, Malay Peninsula, ?Java, Borneo.

Usually cultivated, also in these islands, but also elsewhere in *Malesia*.

Ecol. Widely cultivated in *Malesia*, sometimes as village trees. Escaped or naturalized, or indigenous in dryland lowland forests, rarely at 650-1000 m, very occasionally at c. 1400 m (Pahang, Kinabalu), once at 1800 m (Gajolands).

Uses. CORNER *l.c.* says that the *bachang* can be told by stiff, dark-green leaves, like pieces of cardboard, and by copper-red panicles with inodorous flowers, or by its stinking fruits, which are used in curries or pickles; the sweet variety is palatable raw and could be improved by selection. In flower, the *bachang* is the most beautiful *Mangifera*, with its upright panicles reminding of the horse-chestnut. Trees flower generally about March-April, and again in October in Singapore. It occurs common in orchards. See further HEYNE and BURKILL, *ll.cc.*; the latter noted some minor use of the sap for tattooing and medicinal.

Vern. Sumatra: *abawang dotan*, Simalur, *ambachang*, *sitórngom*, Kesarin, *ambatjang*, Pajakumbuh, *mantjang*, Atjeh, Gajo, *batjang*, *b. maros*, *lémus*, Batak, *bédara*, M, *bèrhul*, Gajo, *médang pèrgam*, *pau puti*, Palembang, *rawa*, Karimon; Malay Peninsula: *bachang*, *buah bachang*, *kurau*, *machai*, *machang*, *mèmbachang*, *mèmpèning*, M; Java: *asam bawang*, *batjang*, *mangga batjang*, M, *ki limus batjang*, *limus (tipung)*, S, *pèlèmb bawang*, *pakil*, *poh*, J; Borneo: *asampajang*, *kédjan lèmah*, *thulik kaki*, Dajak, *asam hambawang*, *a. mas*, Kutai, *asam pamas*, *buah assam*, Iban, *ata*, *baya*, *pèlam*, Kayan, *hambawang*, *mangga batjan*, *tèmpajang*, Balikpapan, *bachang*, *machang*, Kuching, *bangbangan*, Brunei, *hambawang kambat*, Samarinda, *pauh hutan*, *puđan*, *talangtang*, M; Celebes: *dedeko*, *mangga hutan*, *umbawa*, Malili; Moluccas: *pata*, *paté*, Ambon.

19. *Mangifera pajang* KOSTERMANS, Reinwardtia 7 (1965) 20, f. 1a & 1b; MEIJER, Mal. For. 32 (1969) 257, f. 5; Field Guide Trees W. Mal. (1974) 108; DING HOU, Blumea 24 (1978) 27. — Fig. 7k-m.

Tree 15-33 m high, 30-70 cm  $\varnothing$ . Bark grey, rather smooth, or superficially, broadly fissured. *Leaves* rigidly coriaceous, elliptic-oblong, sometimes obovate-oblong, ( $17\frac{1}{2}$ -)28-45 by (7-)10-15 cm (sapling leaves up to 40 by 10 cm; petiole up to 12 cm long); base cuneate to attenuate; apex mucronate or acute; nerves 14-30 pairs, prominent; veins invisible to obscure; petiole ( $2\frac{1}{2}$ -)5-7 cm, convex beneath, grooved or flat above. *Panicles* terminal and sometimes also in the uppermost leaf axils, pyramidal, up to 30 cm long, glabrous; lateral branches up to 18 cm long, rather densely flowered; floral bracts ovate or ovate-oblong,

1 $\frac{1}{4}$ –2 mm long; pedicels c. 1 mm. *Calyx* 5-lobed, lobes ovate, 2 $\frac{1}{2}$ –3 mm long, glabrous. *Petals* 5, purple on the inner surface, pinkish white outside, elliptic-oblong or -lanceolate, sometimes oblanceolate, 7–7 $\frac{1}{2}$  by 2 $\frac{1}{2}$ –3 mm; ridges 3, c.  $\frac{2}{3}$  the length of petals, confluent at the lower 1–1 $\frac{1}{2}$  mm (the united part extending beyond the base of the petal and stipe-like). *Disk* pulvinate, stipe-like, c.  $\frac{1}{2}$  mm high. *Stamens* 5, usually 2 fertile, 6 $\frac{1}{2}$ –7 mm; filaments connate at the base; anthers broad-ovoid, 1 mm long; staminodes up to 5 mm. *Ovary* white when fresh, ellipsoid, c. 1 mm  $\emptyset$ ; style excentric, 6 mm. *Drupe* (fresh) brownish, broad-ovoid or globose, 9 $\frac{1}{2}$ –12(–20) by 6 $\frac{1}{2}$ –9(–15 or more) cm  $\emptyset$ , roughish; fresh yellowish white, fibrous. *Seed* not labyrinthine.

Distr. *Malesia*: Borneo (Sabah: Sandakan, Beaufort, and Sipitang; Brunei; Sarawak: Ulu Dapoi, Kapit; Kalimantan: Kutai and Sangkulirang).

Also cultivated, e.g. at Kuching.

Ecol. Chiefly in primary lowland forest, sometimes found in mixed dipterocarp forest, rarely up to 525 m. *Fl.* Febr., July; *fr.* April, May, Aug., Sept.

Uses. In high esteem for its edible fruit. When eating the fruit, the very thick rind (up to 1 cm) is peeled off the yellowish white, sweet acid pulp like with a banana (KOSTERMANS *l.c.*).

Vern. Sabah & Brunei: *banbangan*, *membang*, *Kedayan*; Sarawak: *embang*, *Kayan*; Kalimantan: *asem pajang*, commonly used, *limum*, *Sangkulirang*.

Notes. Closely related to *M. foetida* from which it is difficult to separate in the dried state. Brownish fruits are in *Mangifera* only known to occur in *M. pajang* and *M. caesia*.

*M. pajang* occurs both in the native state and in cultivation.

JACOBS in the field-notes of his collection n. 5217, from Kapit Distr. (Sarawak), vern. name *embang*, observed that the fruit is in high esteem, and that the trees in the forest have each their 'owner'. From this should not necessarily be concluded that such trees were originally planted in the forest: 'bee-trees' of *Koompassia* in Deli (NE. Sumatra) have, for example, also their 'owner'.

20. *Mangifera odorata* GRIFF. Notul. 4 (1854) 417; HOOK. *f.* Fl. Br. Ind. 2 (1876) 17; ENGL. in DC. Mon. Phan. 4 (1883) 210, *incl. var. pubescens* ENGL.; K. & V. Bijdr. 4 (1896) 85; KING, J. As. Soc. Beng. 65, ii (1896) 474; KOORD. Minah. (1898) 411; MERR. Bull. Bur. For. Philip. 1 (1903) 33; BACK. Fl. Bat. (1907) 362; Schoolfl. (1911) 278; WESTER, Bull. Bur. Agr. Philip. 18 (1920) 15; BROWN, Minor Prod. Philip. For. 2 (1921) 320; RIDL. Fl. Mal. Pen. 1 (1922) 524; MERR. En. Philip. 2 (1923) 468; OCHSE & BAKH. Fruit (1931) 15, t. 7; RIDL. Kew Bull. (1933) 194; BURK. Dict. (1935) 1407; CORNER, Ways. Trees (1940) 111, f. 22; MUKHERJI, Lloydia 12 (1949) 122, f. 25; BACK. & BAKH. *f.* Fl. Java 2 (1965) 149; DING HOU, Blumea 24 (1978) 26. — *M. foetida* var. *kawini* BL. Mus. Bot. 1 (1850) 199, *incl. var. mollis* BL. et var. *bombom* BL.; PIERRE, Fl. For. Coch. (1897) t. 365F (as 365E). — *M. foetida* var. *bakkil* MIO, Fl. Ind. Bat. 1, 2 (1859) 632. — *M. oblongifolia* HOOK. *f.* Fl. Br. Ind. 2 (1876) 16; ENGL. in DC. Mon. Phan. 4 (1883) 204; KING, J. As. Soc. Beng. 65, ii (1896)

473; PIERRE, Fl. For. Coch. (1897) t. 364I; LECOMTE, Fl. Gén. 1-C. 2 (1908) 16; RIDL. Fl. Mal. Pen. 1 (1922) 523; CRAIB, Fl. Siam. En. 1 (1926) 344; BURK. Dict. (1935) 1407; MUKHERJI, Lloydia 12 (1949) 95. — *M. foetida* var. *odorata* (GRIFF.) PIERRE, Fl. For. Coch. (1897) t. 365B. — Fig. 12.

Tree 7–35 m high and 20–80(–100) cm  $\emptyset$ . Bark grey, smooth or fissured. *Leaves* coriaceous, elliptic-lanceolate or lanceolate, 9–35 by 3 $\frac{1}{2}$ –10 cm; base cuneate or obtuse; apex short-acuminate, or acute, rarely obtuse; nerves 15–26 pairs, prominent beneath or on both surfaces; veins reticulate, distinct on both surfaces, especially beneath; petiole 2–5(–7) cm, convex beneath, grooved above. *Panicles* terminal and sometimes also in the uppermost leaf axil, pyramidal, 12–50 cm long, glabrous sometimes sparsely puberulous; lateral branches up to 18 cm long, rather densely flowered; floral bracts ovate or ovate-oblong, 1–2 mm long; pedicels 1 $\frac{1}{2}$ –1 $\frac{3}{4}$  mm. *Flowers* fragrant. *Calyx* 5-lobed, lobes ovate, elliptic, broad-elliptic, rarely lanceolate, 2–3 mm long, glabrous, rarely puberulous outside. *Petals* 5, on the outside at first yellowish white, afterwards becoming red (*cf.* OCHSE & BAKH. *l.c.*), elliptic-oblong or lanceolate, 4–6 by 1 $\frac{1}{2}$ –2 $\frac{1}{2}$  mm; ridges 3(–5), c.  $\frac{2}{3}$  the length of petals, confluent at the lower  $\frac{2}{3}$ . *Disk* pulvinate, stipe-like, c.  $\frac{1}{2}$  mm high, 1 $\frac{1}{4}$  mm wide, 5-lobed, not papillose. *Stamens* 5, 1 (rarely 2) fertile, 2–5 mm; filaments connate at the base; anthers ovoid or oblong, c.  $\frac{2}{3}$  mm long; staminodes  $\frac{1}{2}$ –1 mm. *Ovary* subglobose, c. 1 mm  $\emptyset$ ; style excentric, 2 $\frac{1}{2}$ –3 mm. Sterile pistil in  $\sigma$  minute. *Drupe* (fresh) (OCHSE & BAKH. *l.c.*) dark green, obliquely ovoid or broadly ellipsoid, 10–13 by 7–10; flesh yellow, sweet, fibrous. *Seed* not labyrinthine.

Distr. Native country unknown, possibly of cultivated, hybrid origin, sometimes found in lowland forest in Sumatra, Borneo, and Java, but possibly from planted or naturalized trees. Chiefly found in cultivation.

Ecol. Lowland mixed forest. *Fl.* March–Dec.; *fr.* Sept.–Nov. In Djambi (Central Sumatra) the fruiting season is Jan.–Febr. attracting much game (pigs, elephants, etc.) to the forest, especially to the ladangs. End March RUTTEN (Trop. Natuur 28, 1939, 19, fig.) found numerous seedlings, with lilac young leaves, together with those of *Durio*, in the excrement of elephants.

Uses. Grown for its edible fruit, of which good cultivars exist, *cf.* OCHSE & BAKH. *l.c.*; common in orchards in Malaya (BURKILL, *l.c.*).

Vern. Sumatra: *ambasang*, *ambatjan*, *embasang*, *gorat*, *kooweni*, Batak, *batjang rimbo*, *pèlèm*, Palembang, *kwèni*, Lampongs & Palembang, *mantjant*, Atjeh; Malay Peninsula: *kohini*, *kuini*, *kwini*, *kwining*, M, *bachang bèto*, Semang; Java: *beenè*, *bèni*, *kaèni*, Md., *bèmbèm*, *kawèni*, Md., S, *gandarasam*, *kèbèmbèm*, *kewèni*, M, *kooweni*, *lèngis*, *pakèl*, *pèlèm kuwèni*, *p. poh*, J; Borneo: *binjai*, Sabah, Sandakan, *palipisan*, Kalimantan, Pleihari; Philippines: *huani*, Bis., *kandopi*, Sulu, *uani*, Sulu, C. Bis.

Note. *M. odorata* is a polymorphous species and might comprise a hybrid swarm after hybridization, possibly between *M. indica* and *M. foetida*, with many minor forms. Further field studies and experimental work is required to check this assumption.



Fig. 12. *Mangifera odorata* GRIFF. at Wangi, Sabah (Photogr. MEIJER).

21. *Mangifera caesia* JACK in Roxb. Fl. Ind. ed. Wall. 2 (1824) 441; WALP. Ann. 1 (1848) 200; GRIFF. Not. Pl. As. 4 (1854) 415; MARCH. Rév. Anacard. (1869) 191; HOOK. f. Fl. Br. Ind. 2 (1876) 19; ENGL. in DC. Mon. Phan. 4 (1883) 213; KING, J. As. Soc. Beng. 65, ii (1896) 478; PIERRE, Fl. For. Coch. (1897) t. 364M; MERR. Bull. Bur. Philip. 1 (1903) 33; BACK. Fl. Bat. (1907) 364; Schoolfl. (1911) 278; WESTER, Bull. Bur. Agr. Philip. 18 (1920) 13; MERR. En. Born. (1921) 349; BROWN, Minor Prod. Philip. For. 2 (1921) 320, f. 50; RIDL. Fl. Mal. Pen. 1 (1922) 525; En. Philip. 2 (1923) 468; OCHSE & BAKH. Fruit (1931) 3, pl. 2; BURK. Dict. (1935) 1401; CORNER, Ways. Trees (1940) 108, f. 22, Atlas t. 9; MUKHERJI, Lloydia 12 (1949) 126, *incl. var. verticillata* (C. B. ROB.) MUKHERJI; BROWN, Useful Pl. Philip. 2 (1950) 340; BACK. & BAKH. f. Fl. Java 2 (1965) 149; KOSTERMANS, Reinwardtia 7 (1965) 19, *incl. var. kemanga* (BL.) KOSTERM. *et var. wanji* KOSTERM.; DING HOU, Blumea 24 (1978) 24. — *Manga foetida* II RUMPH. Herb. Amb. 1 (1741) 99. — *M. foetida* (non LOUR.) BL. Bijdr. (1826) 1158. — *M. kemanga* BL. Mus. Bot. 1 (1850) 202; MIQ. Fl. Ind. Bat. 1, 2 (1859) 634; HOOK. f. Trans. Linn. Soc. 23 (1860) 167, t. 23; KING, J. As. Soc. Beng. 65, ii (1896) 477; PIERRE, Fl. For. Coch. (1897) t. 364N; MERR. Int. Rumph. (1917) 330; RIDL. Fl. Mal. Pen. 1 (1922) 525; BURK. Dict. (1935) 1406; MUKHERJI, Lloydia 12 (1949) 124; DE WIT, Rumph. Mem. Vol. (1959) 386. — *M. polycarpa* GRIFF. Not. Pl. As. 4 (1854) 416; HOOK. f. Fl. Br. Ind. 2 (1876) 20; ENGL. in DC. Mon. Phan. 4 (1883) 213. — *M. verticillata* C. B. ROB. Philip. J. Sc. 6 (1911) Bot. 337; ELMER, Leaf. Philip. Bot. 6 (1914) 2381.

Tree up to 35 m high ar 75(–155) cm Ø.

Buttresses occasionally present,  $\frac{1}{5}$  m high, 1 m extending outward. Bark greyish brown, fissured. *Leaves* (sometimes seemingly verticillate towards the end of twigs), coriaceous, elliptic, obovate, ovate-oblong, or lanceolate, 9–30(–41 $\frac{1}{2}$ ) by 3 $\frac{1}{2}$ –10(–12) cm; base cuneate; apex short-acuminate or obtuse; nerves 14–33 pairs, slightly elevated on both surfaces; veins obscure on both surfaces; petiole flattened, 1 $\frac{1}{2}$ –2 $\frac{1}{2}$ (–6) cm. *Panicles* terminal, pyramidal, 15–45(–75) cm long, puberulous; lateral branches up to 15 cm long, densely flowered; floral bracts ovate, 2 mm long; pedicels c. 1 mm. *Flowers* violet or lilac. *Calyx* 5-lobed, lobes ovate, lanceolate, or elliptic, 1 $\frac{1}{2}$ –3 mm, puberulous outside. *Petals* 5, narrow-elliptic or -oblanceolate, 5–8 by 1–1 $\frac{1}{4}$  mm; ridge 1, 2–3 mm long. *Disk* pulvinate, stipe-like,  $\frac{1}{2}$ –1 mm high, not papillose. *Stamens* 5, 1 (or 2) fertile, ( $\frac{1}{2}$ –)4–9 mm; filaments not connate at the base; anthers oblong,  $\frac{1}{2}$  mm long; staminodes  $\frac{1}{3}$ –1 $\frac{1}{2}$  mm. *Ovary* subglobose,  $\frac{1}{3}$ – $\frac{1}{2}$  mm Ø; style slightly excentric, 1–7 mm. Sterile pistil in ♂ up to 1 mm. *Drupe* (fresh) (*cf.* OCHSE & BAKH. *l.c.*; KOSTERMANS *l.c.*) pale brown or brownish-yellow (with rough, scaly or scurfy skin), or green-white (glossy), ellipsoid or pear-shaped, 12–19 by 6–10 cm; flesh yellowish-white, juicy, sour or sour-sweet, coarsely fibrous. *Seed* not labyrinthine.

*Distr. Malesia:* Sumatra, Malay Peninsula.

Cultivated, escaped and naturalized in many other islands of Malesia.

*Ecol.* In lowland primary forest, swamp forest, or in periodically inundated areas along rivers, up to 450 m. *Fl.* Febr.–Dec.; *fr.* Jan.–Dec., in Malaya April–June.

*Uses.* A well-known fruit tree. According to

OCHSE & BAKH. *l.c.* common in orchards in Malacca. There is a sweet fruited variety in Malaya (*binjai manis*) but the strong smell detracts from the enjoyment of it; the sour fruits are used in place of tamarind (CORNER *l.c.*).

Vern. Sumatra: *balam kêmang*, M, *bienglu putih*, Lampongs, *bindjai*, N. region, *kêmang*, *k. hadji*, *mêdang kêmang*, Palembang; Malay Peninsula: *topah*, Kedah, *sêpam*, Perak & Johore, *kolah*, Johore (CORNER), *binjai*, Malacca & Singapore; Java: *bindjai*, *binglo*, *b. putih*, M, *binglu* or *kêmang binglu*, *kêmang*, S; Lesser Sunda Is.: *wani*, Bali; Borneo: Sabah: *balanu*, *buluno(h)*, M, *bundo*, Dusun; Sarawak: *binjai*; Brunei: *bêluno*, *binjai*, Kedayan, *dëndahan*, Iban, *ondo*, Dusun; Kalimantan: *asam hambawang*, M; Philippines: *baluno*, *lôno*, *malôno*, Manobo, *balinut*, *bainu*, Sulu, *bauno*, *bayuno*, C.Bis.

22. *Mangifera superba* HOOK. f. Fl. Br. Ind. 2 (1876) 19; ENGL. in DC. Mon. Phan. 2 (1883) 214; KING, J. As. Soc. Beng. 65, ii (1896) 478; PIERRE, Fl. For. Coch. (1897) t. 365D; RIDL. Fl. Mal. Pen. 1 (1922) 525; MUKHERJI, Lloydia 12 (1949) 128.

Tree up to 30 m high. *Leaves* coriaceous, oblanceolate, spatulate, or elliptic-lanceolate, 17–40 by 5–12 cm; base attenuate; apex acute or obtuse; nerves 18–35 pairs, prominent beneath, slightly elevated above; veins obscure or invisible on both surfaces; petiole 2–4½ cm, flattened. *Panicles* terminal, pyramidal, up to 40(–60) cm long, pubescent; lateral branches up to 15 cm long, densely flowered; floral bracts ovate or ovate-oblong, 10–15 mm long; pedicels 0. *Flowers* lilac. *Calyx* 5-lobed, lobes lanceolate or elliptic-oblong, 11–12 mm long, puberulous outside. *Petals* spatulate or narrowly elliptic, 20–25 by 5 mm, (the central part of the lower 7–8 mm adnate to the disk); ridge only 1, c. 17 mm long. *Disk* cylindrical, torus-like, 7–8 mm long, not lobed, not papillose. *Stamens* 5, all fertile, 8–12 mm; filaments free; anthers ovoid-oblong, ½–¾ mm long. *Ovary* slightly obovoid, 1½ mm Ø; style excentric, 8–15 mm. *Drupe* (dried, one coll.) ellipsoid or sub-obovoid-oblong, 10–15 by 7½–8¾ cm, round in CS; flesh (when fresh) greyish white or pinkish with unpleasant rotten smell. *Seed* not labyrinthine.

Distr. *Malesia*: Malay Peninsula (Johore and Malacca).

Cultivated in Singapore.

Ecol. In lowland forest. Fl. June; fr. May.

Vern. *Beechee*, Singapore.

Notes. As already pointed out by HOOKER f. (*l.c.*) *M. superba* is closely allied with *M. caesia*, in both vegetative and floral characters. It has the largest flowers of *Mangifera* and seems to be a polyploid 'gigas' form of *M. caesia*, from which it can easily be distinguished (see key).

An interesting species, very similar to some species of *Gluta*, e.g. *G. renghas*, by the attachment of the petals, the number of stamens (5, all fertile), and the cylindrical, torus-like disk.

23. *Mangifera macrocarpa* BL. Bijdr. (1826) 1158; WALP. Rep. 1 (1842) 555; BL. Mus. Bot. 1 (1850) 201; MIQ. Fl. Ind. Bat. 1, 2 (1859) 634; ENGL. in DC. Mon. Phan. 4 (1883) 210; K. & V. Bijdr. 4 (1896) 87; PIERRE, Fl. For. Coch. (1897) t. 364D; LECOMTE, Fl. Gén. I.-C. 2 (1908) 16; BACK.

Schoolf. (1911) 277; MUKHERJI, Lloydia 12 (1949) 119; BACK & BAKH. f. Fl. Java 2 (1965) 148; DING HOU, Blumea 24 (1978) 26. — *M. fragrans* MAINGAY ex HOOK. f. Fl. Br. Ind. 2 (1876) 18; KING, J. As. Soc. Beng. 65, ii (1896) 475; RIDL. Fl. Mal. Pen. 1 (1922) 524.

Tree up to 37 m high and 80 cm Ø. Bark pink, rather smooth, or fissured with strips 2–3 cm wide. *Leaves* chartaceous, linear, linear-lanceolate, rarely spatulate, (9–)15–60 by (1¼–)3½–5 cm; base attenuate or acute; apex acuminate; nerves 23–44 pairs, distinct or rather faint on both surfaces; veins reticulate, faint or obscure, rarely distinct on both surfaces; petiole (1½–)3½–7(–11) cm, bicannaliculate or flat above, convex beneath. *Panicles* terminal, pyramidal, up to 20 cm long, glabrous; lateral branches up to 6 cm long, laxly flowered; floral bracts broadly ovate or triangular, 1–1½ mm long; pedicels c. 1¼ mm. (Only ♂ flowers seen). *Calyx* 5-lobed, lobes ovate-oblong, 1¼–4 mm, glabrous. *Petals* 5, lanceolate, 8 by 2¾ mm; ridges 3, c. ¼ the length of petals, confluent at the basal 1 mm. *Disk* pulvinate, c. ½ mm high, 1 mm wide, 5-lobed, not papillose. *Stamens* 5, 1 fertile, 2½ mm; filaments not connate at the base; anthers ovoid-oblong, 1 mm long. Sterile pistil c. ½ mm. *Drupe* (HOOK. f. *l.c.* and BACK & BAKH. f. *l.c.*) obliquely broadly oblong-globose, 8–12 cm long; fresh yellow, fibrous. *Seed* not labyrinthine.

Distr. Lower Thailand (Peninsula), Cambodia (cf. PIERRE), and *Malesia*: Sumatra (East Coast, Palembang, Lampongs), Malay Peninsula (Kelantan, Trengganu, Pahang, Malacca), W. Java, Borneo and neighbouring islands (Sabah, Kalimantan, Anambas Is., Nunukan I.).

Cultivated in Hort. Bog. sub VI–B–8.

Ecol. Lowland forest, occasionally found at c. 700 m.

Vern. Sumatra: *hadju*, *mangga utan*, M; Malay Peninsula: *machang lavid*, M; Java: *gompohr*, S, *kipari*, J, *manga utan*, M; Borneo: *asam*, *mandubus*, M, *kayu basinku*, Sg. Kinabatangan, *jadju*, Siantan I. (Anambas Is.).

Notes. *M. macrocarpa* can be easily recognized by its chartaceous, linear, linear-lanceolate, rarely spatulate leaves, with a leaf index larger than (7–)10. All the (23) collections which I have examined are in sterile state except two.

The fruit was described by BLUME (*l.c.*) as having the size of a child's head. HOOKER f. (*l.c.*) quoting from MAINGAY, stated in the description of *M. fragrans* that the drupe is "obliquely broadly oblong-globose", and ENGLER (*l.c.*), based on MAINGAY's drawing in Kew, recorded its size as 10 cm Ø. Although its shape and size have been mentioned often in literature and sometimes on specimens, so far I have seen only small, young, detached immature fruits (5¼ by 2¾ cm) on the collection SAN 31997a.

KOSTERMANS, in a letter to VAN STEENIS (10–3–1965), stated that trees of this species are sporadic in East Borneo and that in ten years he did not see any of them in flower or fruit, and that the cultivated tree in Bogor has never flowered (cf. also K. & V. *l.c.*).

PIERRE (*l.c.*) recorded this species for Cambodia; however, TARDIEU-BLOT (Fl. C. L. & V. 2, 1962, 85) stated that no specimen of it could be found in the Herbarium at Paris.

## Dubious

*Mangifera taipa* BUCH.-HAM. Mem. Wern. Nat. Hist. Soc. (Edinb.) 5 (1826) 326; MIQ. Fl. Ind. Bat. 1, 2 (1859) 631; MERR. Int. Rumph. (1917) 331; MUKHERJI, Lloydia 12 (1949) 131; DE WIT, Rumph. Mem. Vol. (1959) 386. — *Manga silvestris altera* RUMPH. Herb. Amb. 1 (1741) 97.

MERRILL *l.c.* already stated that this species was based wholly on RUMPHIUS' description and is of doubtful status. In the original literature, the fruit was described as oblong-rotund, outside so coarse or rough as leather ("van buiten zo ruig als leer"), not green but liver-coloured. This may be *M. caesia* JACK.

*Mangifera utana* BUCH.-HAM. Mem. Wern. Nat. Hist. Soc. (Edinb.) 5 (1826) 326; MIQ. Fl. Ind. Bat. 1, 2 (1859) 634; MERR. Int. Rumph. (1917) 330; MUKHERJI, Lloydia 12 (1949) 131; DE WIT, Rumph. Mem. Vol. (1959) 386. — *Manga sylvestris prima* RUMPH. Herb. Amb. 1 (1741) 97, t. 27. — *M. glauca* BL. Bijdr. (1826) 1158; WALP. Rep. 1 (1842) 555;

BL. Mus. Bot. 1 (1850) 201; ENGL. in DC. Mon. Phan. 4 (1883) 214. — *M. membranacea* BL. Mus. Bot. 1 (1850) 195; ENGL. in DC. Mon. Phan. 4 (1883) 215; LAUT. Bot. Jahrb. 56 (1920) 354.

*M. utana* was based wholly on RUMPHIUS' description and his plate 27. MERRILL *l.c.* said that it is a species of doubtful status and that the figure very closely resembles the Philippine form of *M. monandra* MERR.

In the drawing, the leaves, especially their shape and arrangement, and the lax inflorescences resemble those of *M. minor* BL. It might be possible that this species represents a form of escaped *M. indica* L.

## Excluded

*Mangifera xylocarpa* LAUT. Bot. Jahrb. 56 (1920) 354; MUKHERJI, Lloydia 12 (1949) 132, is according to SLEUMER, Fl. Males. I, 7 (1971) 50, = *Merrilliodendron megacarpum* (HEMSL.) SLEUMER (*Icacina-ceae*).

## 5. SWINTONIA

GRIFF. Proc. Linn. Soc. Lond. 1 (1846) 283; DUCHARTRE, Rev. Bot. 2 (1847) 330; HOOK. *f.* in B. & H. Gen. Pl. 1 (1862) 421; MARCH. Rév. Anacard. (1869) 109 & 186; HOOK. *f.* Fl. Br. Ind. 2 (1876) 26; ENGL. in DC. Mon. Phan. 4 (1883) 228. — *Astropetalum* GRIFF. Notul. 4 (1854) 411. — *Anauxanopetalum* T. & B. in Miq. J. Bot. Néerl. 1 (1861) 368. — **Fig. 13-14.**

Trees. *Leaves* spiral, simple, entire, with a slightly thickened, marginal nerve, often papillose beneath, (long) petioled. *Inflorescences* axillary and terminal, paniculate. *Flowers* ♂ (usually dominant and numerous) and bisexual (plants polygamo-andromonoecious), or bisexual only. *Calyx* 5-lobed. Floral axis between calyx and stamens elongated and gynandrophore-like in 2 spp. *Petals* 5, imbricate, persistent, accrescent, usually much enlarged and reflexed in fruit, partly or wholly puberulous on both surfaces, glabrescent. *Disk* extrastaminal, consisting of 5 gland-like lobes, confluent with the base of filaments or alternating with them, glabrous. *Stamens* 5; filaments filiform or subulate, glabrous; anthers dorsifixed. *Ovary* 1-celled, sparsely hairy, abortive in ♂; style distinct, cylindrical; stigma capitellate or rarely slightly thicker than the style. Abortive pistil in ♂ very small, hairy. *Drupe* 1-celled, supported by the 5 usually much enlarged, reflexed, wing-like petals; endocarp coriaceous. *Seed* with testa adherent to the endocarp; embryo straight, cotyledons free, plano-convex.

Distr. About 12 spp., distributed in the Andaman Is., Burma, Thailand, Cambodia, Laos, Vietnam, and *Malesia* (Sumatra, Malay Peninsula, Borneo, and Philippines).

Ecol. Lowland and hill forest, sometimes in swamp or peat-swamp forest, up to c. 750 m, only *S. robinsonii* montane (1050-1650 m).

Vern. Malaysian standard timber name: *perpauh*.

Notes. *Swintonia floribunda* GRIFF. was assigned to the monotypic new genus *Swintonia* in a combined generic and specific description.

The petals of bisexual and ♀ flowers of *Swintonia* gradually enlarge and thicken after anthesis. One should be aware of this increase in size and ascertain their growth stage.

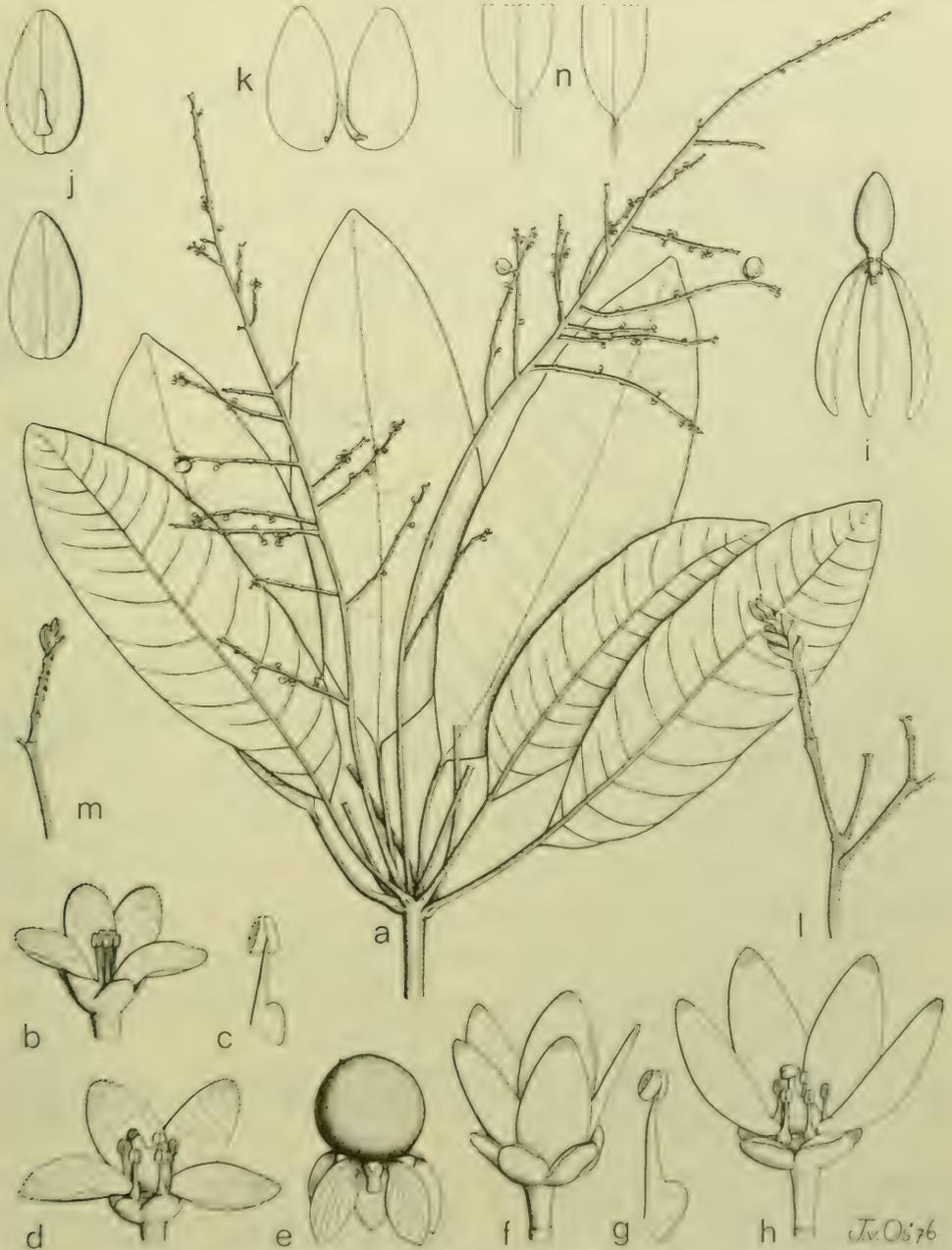


Fig. 13. *Swintonia minutalata* Ding Hou. *a*, Habit,  $\times \frac{1}{2}$ , *b*, ♂ flower, 1 petal removed,  $\times 7$ , *c*, stamen, with attached disk lobe,  $\times 15$ , *d*, ♀ flower, 1 petal removed,  $\times 7$ , *e*, fruit, with enlarged petals, nat. size. — *S. acuta* Esenl. *f*, ♂ flower, *g*, stamen, with attached disk lobe, *h*, ♀ flower, 1 petal removed, all  $\times 7$ , *i*, fruit with much enlarged petals, 2 of them removed,  $\times \frac{1}{2}$ , *j*, embryo, viewed from raphe surface and its opposite side,  $\times 1\frac{1}{2}$ , *k*, embryo, opened,  $\times 1\frac{1}{2}$ . — *S. spicifera* Hook. *f*, *l*, *m*, Branches of inflorescences showing rather crowded bracts or their scars, nat. size. — *S. schwenkii* (T. & B.) T. & B. ex Hook. *f*, *n*, Leaf base,  $\times \frac{1}{2}$  (*a-d* S 14966, *e* S 15180, *f-h* S 20927, *i-k* S 29850, *l-m* FR 17542, *n* KOSTERMANS' Coll. 18).

## KEY TO THE SPECIES

*Based on flowering specimens*

1. Calyx divided almost to the base or more than  $\frac{2}{3}$  (or to *c.*  $\frac{1}{2}$  in *S. schwenkii*) of its length. Floral axis between calyx and stamens obscure. Gland-like disk lobes confluent with the base of filaments.
  2. Papillae on the lower surface of the leaves always distinct, covering also the nerves.
    3. Petiole grooved or flat above. Petals 3–3½ mm long, densely puberulous on both surfaces
      3. Petiole terete at the lower  $\frac{2}{3}$ – $\frac{1}{2}$  and flat above at the upper  $\frac{1}{3}$ – $\frac{1}{2}$ . Petals 1½–2½ mm long, sparsely puberulous on both surfaces . . . . . **1. *S. glauca***
      2. Petals 1½–2½ mm long, sparsely puberulous on both surfaces . . . . . **2. *S. minutalata***
    4. Petals densely puberulous on both surfaces. Usually the lower  $\frac{2}{3}$ – $\frac{1}{2}$  of the petiole terete, more rarely wholly terete. Leaf-margins sometimes joining each other at the base . . . . . **3. *S. schwenkii***
    4. Petals sparsely puberulous at the apical part on both surfaces. Petiole semiterete: flat, grooved, or bisulcate above, or biconvex. Leaf-margins separate from each other at the base.
      5. Petals claw-like contracted at the base . . . . . **4. *S. foxworthyi***
      5. Petals cuneate or obtuse at the base . . . . . **5. *S. acuta***
  1. Calyx divided to  $\frac{1}{5}$ – $\frac{1}{3}$  of its length. Floral axis between calyx and stamens distinct, elongated, and like a gynandrophore. Gland-like disk lobes alternating with stamens.
    6. Terminal parts of branches in the inflorescences usually laxly branched, with spacious internodes, loosely flowered.
      7. Pedicels very short, up to *c.* 1 mm. Floral axis 2–2½ mm long. Stamens 4½ mm. Stigma slightly thicker than the style . . . . . **6. *S. robinsonii***
      7. Pedicels distinct, (1½–)2½–4 mm. Floral axis 1½ mm long. Stamens 2–3½ mm. Stigma capitellate . . . . . **7. *S. floribunda***
    6. Terminal parts of branches in the inflorescences not or little branched, with very short or obscure internodes, densely flowered . . . . . **8. *S. spicifera***

## KEY TO THE SPECIES

*Based on fruiting specimens*

1. Enlarged petals below the globose drupe  $\frac{3}{4}$ –1¼ cm long, not longer than the latter.
  2. Lower surface of leaves distinctly papillose. Petiole (3½–6½ cm) terete at the lower  $\frac{2}{3}$ – $\frac{1}{2}$  and flat above in upper  $\frac{1}{3}$ – $\frac{1}{2}$  . . . . . **2. *S. minutalata***
  2. Lower surface of leaves not papillose. Petiole (1½–3½ cm) flat above . . . . . **6. *S. robinsonii***
1. Enlarged petals below the drupe 3½–9 cm long, much longer than the latter.
  3. Drupe globose or subglobose.
    4. Papillae distinct on the lower surface of the leaves. Calyx divided almost to the base . . . . . **4. *S. foxworthyi***
    4. Papillae obscure or indistinguishable on the lower surface of the leaves. Calyx divided to  $\frac{1}{3}$ – $\frac{1}{4}$  of its length . . . . . **7. *S. floribunda***
  3. Drupe ellipsoid or ovoid-oblong.
    5. Usually the lower  $\frac{2}{3}$ – $\frac{1}{2}$  of the petiole terete, rarely the whole petiole. Leaf-margins sometimes joining each other at the base . . . . . **3. *S. schwenkii***
    5. Petiole semiterete: flat, grooved, or bicanaliculate above, or biconvex. Leaf-margins separate from each other at the base.
      6. Terminal parts of the branches in the infructescences usually laxly branched, with spacious internodes. Papillae distinct on the lower surface of the leaves.
        7. Nerves on the lower surface of the leaves distinctly papillose . . . . . **1. *S. glauca***
        7. Nerves on the lower surface of the leaves not papillose . . . . . **5. *S. acuta***
      6. Terminal parts of the branches in the infructescences not or little branched, with very short or obscure internodes. Papillae very compact, obscure or indistinguishable on the lower leaf surface . . . . . **8. *S. spicifera***

**1. *Swintonia glauca*** ENGL. Bot. Jahrb. 1 (1880) 44; in DC. Mon. Phan. 4 (1883) 230, t. 5, f. 13–16; MERR. En. Born. (1921) 349; ANDERSON, Gard. Bull. Sing. 20 (1963) 171.

Tree up to 18(–30) m high and 30(–49) cm Ø. Buttresses occasionally present, up to 1½ m high. Bark grey or pinkish brown, smooth, somewhat flaky. Leaves subcoriaceous, lanceolate, rarely elliptic, 6–15 by 2¾–6 cm, glabrous; occasionally with glabrous, dome-like domatia; papillae distinct, all over the lower surface except the midrib; base cuneate or obtuse (margins separate); apex

acuminate, rarely acute; nerves 8–16 pairs; veins reticulate, some slightly parallel and cross-bar-like, rather faint; petiole 2½–4 cm, semiterete, grooved or flat above. *Panicles* up to 30 cm long, ferruginous-puberulous; terminal parts of branches laxly branched, with spacious internodes, loosely flowered; floral bracts lanceolate to linear, 2–5½ mm long; pedicels *c.* 4 mm. *Flowers* white, scented. *Calyx* divided almost to the base; lobes oblong or slightly elliptic, 2–2½ mm long. Floral axis between calyx and stamens not elongated. *Petals* elliptic to elliptic-lanceolate, 3–3½ by

$1\frac{1}{2}$  mm, truncate or obtuse at the base; densely puberulous on both surfaces and also papillose inside. *Disk* lobes confluent with the base of filaments. *Stamens*  $1-1\frac{1}{4}$  mm; anthers broadly ellipsoid, *c.*  $\frac{1}{2}$  mm long. Abortive pistil in  $\sigma$  *c.* 1 mm long. *Ovary* subglobose, *c.*  $\frac{2}{3}$  mm  $\varnothing$ ; style  $\frac{2}{3}$  mm; stigma capitate. *Drupe* ellipsoid,  $1\frac{3}{4}-2\frac{1}{2}$  by  $\frac{3}{4}-1\frac{1}{2}$  cm; enlarged petals narrowly elliptic, *c.*  $5\frac{1}{2}$  by  $1\frac{3}{4}$  cm.

*Distr. Malesia:* Central E. Sumatra (Indragiri) and Borneo (Brunei; Sarawak: Kuching, Bau, Lundu, Serian, Loba Kabang, Binatang, Kapit; Sabah: Beaufort, Tawau, Kuala Belait; Kalimantan: Sambas, Montalat, Bulungan, Bt Singkadjang, Mahakam Lirung).

*Ecol.* Primary peat-swamp forest, sometimes in undulating lowland dipterocarp forest, or on riverbanks, up to 700 m. *Fl.* May, Sept.–Dec.; *fr.* Nov., Jan.

*Vern. Sumatra:* *rēngas tiōng*, M; Borneo: Sarawak: *pētoh*, *pitoh*, *sēlan pētoh*, *sikat tilong*, Milanau, *pitoh bukit*, *raba chit*, *rēngas pitoh*, Iban, *sēlano rēngas*, Kuching; Sabah: *tēlautjap laki*, M.

**2. Swintonia minutilata** DING HOU, *Blumea* 24 (1978) 38. — *S. spicifera* (non Hook. f.) SMYTHIES, *Common Sarawak Trees* (1965) 13. — *Fig. 13a–e.*

Tree up to 25 m high and 50 cm  $\varnothing$ . Buttresses occasionally present, 1 m high. Bark smooth. *Leaves* subcoriaceous, elliptic-lanceolate,  $11\frac{1}{2}-22\frac{1}{2}$  by  $3-6\frac{1}{2}$  cm, glabrous; papillae distinct, all over the lower surface except the midrib; base cuneate (margins separate); apex acuminate; nerves 12–20 pairs; veins reticulate, rather faint; petiole  $3\frac{1}{2}-6\frac{1}{2}$  cm, terete in the lower  $\frac{2}{3}-\frac{1}{2}$  and flat above in the upper  $\frac{1}{3}-\frac{1}{2}$ . *Panicles* 22–26 cm long, puberulous; terminal parts of branches laxly branched, with spacious internodes, loosely flowered; floral bracts ovate,  $\frac{1}{2}-\frac{2}{3}$  mm long; pedicels *c.* 1 mm. *Calyx* divided almost to the base, lobes suborbicular,  $\frac{2}{3}-1$  mm  $\varnothing$ . Floral axis between calyx and stamens not elongated. *Petals* broadly elliptic or elliptic,  $1\frac{1}{2}-2\frac{1}{2}$  by  $1-1\frac{1}{2}$  mm, cuneate at the base, sparsely puberulous, glabrescent, on both surfaces, sometimes also papillose at the base inside. *Disk* lobes confluent with the base of filaments. *Stamens*  $\frac{3}{4}-1\frac{1}{4}$  mm; anthers oblong, *c.*  $\frac{1}{3}$  mm long. *Ovary* globose, 1 mm  $\varnothing$ ; style  $\frac{1}{2}$  mm; stigma capitate. Abortive pistil in  $\sigma$  *c.*  $\frac{1}{3}$  mm long. *Drupe* globose, *c.*  $1\frac{1}{2}$  cm  $\varnothing$ ; enlarged petals elliptic, or ovate-oblong,  $\frac{3}{4}-1\frac{1}{4}$  by  $\frac{1}{3}-\frac{2}{3}$  cm.

*Distr. Malesia:* Borneo (Sarawak: Semengoh Arboretum and Bako National Park; E. Kalimantan: Nunukan I.).

*Ecol.* Primary lowland forest, up to *c.* 100 m. *Fl.* June, Oct.; *fr.* Oct.–Dec.

*Vern. Njala*, Nunukan I., *pētoh*, *rēngas*, Iban.

**3. Swintonia schwenkii** (T. & B.) T. & B. (*Cat. Hort. Bot.* (1866) 230, *nomen*; KURZ, *J. As. Soc. Beng.* 39, ii (1870) 75, *nomen*, in note) *ex* HOOK. *f. Fl. Br. Ind.* 2 (1876) 26; KURZ, *J. As. Soc. Beng.* 45, ii (1876) 207; ENGL. in DC. *Mon. Phan.* 4 (1883) 232, t. 5, f. 17–19; in E. & P. *Nat. Pl. Fam.* 3, 5 (1892) 148; KING, *J. As. Soc. Beng.* 65, ii (1896) 489; MERR. *En. Born.* (1921) 350; RIDL, *Fl. Mal. Pen.* 1 (1922) 533; CRAIB, *Fl. Siam. En.* 1 (1926) 353; TARD. *Fl. C. L. & V.* 2 (1962) 108;

KOCHUM. *Mal. For. Rec.* 17 (1964) 354; SMYTHIES, *Common Sarawak Trees* (1965) 13, pl. 4; MEIJER, *Bot. News Bull. F. D. Sandakan* 8 (1967) 32; DING HOU, *Blumea* 24 (1978) 39. — *Astropetalum sp. 1* GRIFF. *Notul.* 4 (1854) 411; *l.c. Pl. As.* 4 (1854) t. 565, f. 2b–d. — *Anauxanopetalum schwenkii* T. & B. in *Miq. J. Bot. Néerl.* 1 (1861) 368. — *Fig. 13n.*

Tree up to 45(–53) m high and 70(–120) cm  $\varnothing$ . Buttresses up to 3 m high, 5 m wide, 15 cm thick. Bark grey-brown, dark reddish green, smooth or dipped, sometimes deeply fissured. *Leaves* chartaceous to thin-coriaceous, narrowly elliptic, rarely elliptic, 7–12(–16) by  $3-4\frac{1}{2}$ (–6) cm, glabrous; occasionally with glabrous, dome-like domatia; papillae very compact, obscure or indistinguishable (rarely distinct on young ones); base obtuse or cuneate (sometimes the margins joining with each other); apex shortly acuminate; nerves 14–21 pairs; veins reticulate, some slightly parallel and cross-bar-like, often faint; petiole  $3\frac{1}{2}-6$  cm, all or usually the lower  $\frac{2}{3}-\frac{1}{2}$  terete, sometimes flat or grooved above in the upper  $\frac{1}{3}-\frac{1}{2}$ . *Panicles* 8–14 cm long, puberulous and glabrescent; terminal parts of branches laxly branched, with spacious internodes, loosely flowered; floral bracts ovate,  $\frac{2}{3}-1$  mm long; pedicels  $\frac{1}{2}$  mm. *Flowers* white. *Calyx* divided to *c.*  $\frac{1}{2}$  of its length, lobes slightly triangular or obovate, *c.*  $\frac{3}{4}$  mm long. Floral axis between calyx and stamens not elongated. *Petals* elliptic to elliptic-lanceolate, or obovate-oblong, 2–3 by  $\frac{3}{4}-1$  mm, cuneate at the base; densely puberulous on both surfaces. *Disk* lobes confluent with the base of filaments. *Stamens*  $\frac{3}{4}-1\frac{1}{4}$  mm; anthers oblong,  $\frac{1}{3}$  mm long. *Ovary* subglobose,  $\frac{2}{3}$  mm  $\varnothing$ ; style  $\frac{3}{4}-1$  mm; stigma capitate. Abortive pistil in  $\sigma$  *c.*  $\frac{1}{2}$  mm long. *Drupe* ovoid-oblong or ellipsoid,  $1\frac{3}{4}-2$  by  $\frac{3}{4}-1$  cm; enlarged petals linear-oblong,  $5\frac{1}{2}-7$  by  $\frac{3}{4}-1$  cm.

*Distr. Burma*, Thailand, Cambodia, and *Malesia:* Sumatra (Tapanuli: P. Morsala; Pariaman, Kuantan, Indragiri, Moro I.), Malay Peninsula (Kedah, Trengganu, Pahang, Selangor, Negri Sembilan, Malacca, Johore, Penang, Singapore), Borneo (Sarawak: Serian, Lundu, Kuching, Baram; Sabah: Lahad Datu; Kalimantan: Melawi Tjatit, Bulungan, Kutai).

Cultivated in Hort. Bog. *Sub n.* XI–M–11.

*Ecol.* Rain-forest, rarely in secondary or kerangas forest, occasionally on ultrabasic or on coral limestone, from the lowland up to 700 m. *Fl.* Jan.–Dec.; *fr.* Febr.–March, July–Aug., Oct.

*Vern. Sumatra:* *ambago*, Batak, *emas*, *galagensa*, M, *madang buluh kasak*, Pariaman; Malay Peninsula: *bēlang kasan*, *mēnbatu*, *mērpauh*, *paupau*, *tualang*, M; Borneo: *baba chit*, Iban, *pitoh bukit*, *rēngas pitoh*, Lundu, *rēngas*, Kutai.

**4. Swintonia foxworthyi** ELMER, *Leaf. Philip. Bot.* 5 (1913) 1751; MERR. *En. Philip.* 2 (1923) 469.

Tree up to 40 m high and 1 m  $\varnothing$ . Buttresses occasionally present, up to 3 m high,  $1\frac{1}{4}$  m wide, 10 cm thick. Bark reddish, dark brown, smooth, or slightly flaky. *Leaves* chartaceous to subcoriaceous, elliptic, narrowly elliptic, rarely lanceolate, 5–15 by  $1\frac{1}{2}-5\frac{1}{2}$  cm, glabrous; occasionally with glabrous, dome-like domatia; papillae distinct on the lower surface except on the midrib and nerves; base cuneate or obtuse (margins separate); apex

acuminate, sometimes obtuse; nerves 9–16 pairs; veins reticulate, some slightly parallel and cross-bar-like, faint; petiole  $1\frac{1}{2}$ – $5\frac{1}{2}$  cm, subterete, usually flat above. *Panicles* up to 19 cm long, sparsely puberulous, glabrescent, or glabrous; terminal parts of branches laxly branched, with spacious internodes, loosely flowered. *Flowers* (only bisexual ones seen) white. *Calyx* divided almost to the base, lobes broadly ovate, c. 1 mm long. Floral axis between calyx and stamens not elongated. *Petals* obovate, rarely elliptic, 2–3 by  $1$ – $1\frac{1}{2}$  mm, contracted at the base, sparsely puberulous on both surfaces at the apical part, usually also papillose at the base inside. *Disk* lobes confluent with the base of filaments. *Stamens* c. 1 mm; anthers oblong-ellipsoid,  $\frac{1}{2}$  mm long. *Ovary* subglobose, c.  $\frac{2}{3}$  mm  $\varnothing$ ; style  $\frac{1}{3}$  mm; stigma capitate. *Drupe* globose or subglobose,  $1\frac{1}{4}$ – $1\frac{3}{4}$  cm  $\varnothing$ ; enlarged petals pink when fresh, narrowly elliptic or oblanceolate,  $5\frac{1}{2}$ – $7\frac{1}{2}$  by  $(1)$ – $1\frac{1}{2}$ – $1\frac{3}{4}$ – $(2\frac{1}{4})$  cm.

*Distr. Malesia:* Sumatra (W. Coast), Borneo (Brunei; Sarawak: Bt Batu, Bt Gaharu, Limbang, Bintulu, Kapit; Sabah: Beaufort, Sandakan), and the Philippines (Mt Pulgar, Palawan).

*Ecol.* Primary forest, mixed dipterocarp forest, and kerangas forest, at 60–600 m. *Fl.* Jan., April; *fr.* Jan., May, Aug., Oct.

Fruits are sometimes galled into globose bodies  $2\frac{1}{2}$  cm  $\varnothing$ .

*Vern.* Borneo: *pitoh*, Iban, *rēngas bukit*, Brunei; Philippines: Palawan: *lomarau*, Kuy.

**5. *Swintonia acuta*** ENGL. Bot. Jahrb. 1 (1880) 44; in DC. Mon. Phan. 4 (1883) 232; MERR. En. Born. (1921) 349; SMYTHIES, Common Sarawak Trees (1965) 13. — *S. schwenkii* var. *beccarii* ENGL. Bot. Jahrb. 1 (1880) 44; in DC. Mon. Phan. 4 (1883) 232. — *S. luzoniensis* MERR. & ROLFE, Philip. J. Sc. 3 (1908) Bot. 109; MERR. En. Philip. 2 (1923) 470. — *S. acuminata* MERR. Philip. J. Sc. 10 (1915) Bot. 35; En. Philip. 2 (1923) 469. — Fig. 13f–k.

Tree up to 30(–45) m high and 65(–93) cm  $\varnothing$ . Buttresses occasionally present, 3 m high, 2–3 m wide. Bark grey, red-brown, or black, rather smooth, or narrowly and shallowly furrowed. *Leaves* chartaceous or subcoriaceous, elliptic to elliptic-lanceolate, ovate-oblong or lanceolate, (5–)7–16 by  $(1\frac{3}{4})2\frac{3}{4}$ –6 cm, glabrous; occasionally with glabrous, dome-like domatia; papillae distinct, rather compact, sometimes obscure, on the lower surface except on the midrib and nerves; base cuneate or decurrent (margins separate); apex acute to acuminate; nerves 9–19 pairs; veins reticulate, some slightly parallel and cross-bar-like, often distinct; petiole  $1\frac{1}{2}$ –5 cm, flat, slightly concave, or bicanaliculate above, convex beneath. *Panicles* up to 27 cm long, puberulous, glabrescent, or glabrous; terminal parts of branches laxly branched, with spacious internodes, loosely flowered; floral bracts ovate to lanceolate,  $\frac{3}{4}$ – $1\frac{3}{4}$  mm long; pedicels  $\frac{1}{3}$ –2 mm. *Flowers* white. *Calyx* divided almost to the base, lobes suborbiculate or broadly obovate,  $1$ – $1\frac{1}{2}$  mm long. Floral axis between calyx and stamens not elongated. *Petals* elliptic, obovate, or oblanceolate,  $2\frac{1}{2}$ – $3\frac{1}{2}$  by  $\frac{3}{4}$ – $1\frac{1}{2}$  mm, cuneate or obtuse at the base, sparsely puberulous at the apical part on both surfaces, usually glabrescent, sometimes also sparsely papillose at the lower half inside. *Disk* lobes confluent

with the base of filaments. *Stamens*  $\frac{3}{4}$ – $1\frac{3}{4}$  mm; anthers broadly ovoid or ellipsoid,  $\frac{1}{3}$ – $\frac{1}{2}$  mm long. *Ovary* globose or subglobose,  $\frac{1}{2}$ –1 mm  $\varnothing$ ; style  $\frac{1}{2}$  mm; stigma capitate. Abortive pistil in  $\delta$  c.  $\frac{1}{2}$  mm long. *Drupe* ellipsoid, 1–2 by  $\frac{2}{3}$ – $1\frac{3}{4}$  cm; enlarged petals reddish when fresh, narrowly elliptic or oblanceolate, 4–6 by  $\frac{2}{3}$ – $1\frac{1}{2}$  cm.

*Distr. Malesia:* Borneo (Sarawak: Baram, Kuching, Bako National Park, Apoh R., Paku, Sampadi Hill, Marudi, Stabut, Kapit, Anap, Mt Sengghai, Nanga Pelagos; Sabah: Sandakan, Sipitang, Lahad Datu; Kalimantan: Melawai, Bulungan, Sg. Tanggi, Martapura, Berouw, Sebalouw = Sebalau, Kutai, Nunukan I.) and the Philippines (Camiguin I., Luzon, Palawan).

*Ecol.* Lowland forest, sometimes up to 750 m, occasionally on flat swampy land, on river-banks, or on coral limestone rocks. *Fl.* April, July, Sept., Nov.; *fr.* Jan.–Dec.

*Vern.* Borneo: Sarawak: *maban*, Dayak, *pitoh*, *p. ai*, *rēngas-pito*, Iban, *rēngas*, Land Dayak, *rēngas gunong*, *r. pētoh*, M; Brunei: *bitoh*, Iban; Sabah: *mēdang*; Kalimantan: *langhei*, Martapura; Philippines: *kahnis*, Tag.

**6. *Swintonia robinsonii*** RIDL. J. Str. Br. R. As. Soc. n. 54 (1910) 37; Fl. Mal. Pen. 1 (1922) 532.

Tree up to  $10\frac{1}{2}$  m high and 26 cm  $\varnothing$ . Bark reddish brown, with shallow big dipsles and loose, roundish, thin scales. *Leaves* coriaceous, elliptic or lanceolate, 10– $18\frac{1}{2}$  by  $3\frac{1}{2}$ –5 cm, glabrous, not papillose on the lower surface; base acute or obtuse (margins separate); apex acute or acuminate; nerves 12–17 pairs; veins reticulate, faint; petiole  $1\frac{1}{2}$ – $3\frac{1}{2}$  cm, semiterete, flat above. *Panicles* 8–17 cm long, puberulous, glabrescent; terminal parts of branches laxly branched, with spacious internodes, loosely flowered; floral bracts ovate to ovate-oblong, 3– $4\frac{1}{2}$  mm long; pedicels obscure or very short, up to c. 1 mm. *Flowers* white. *Calyx* divided to c.  $\frac{1}{3}$  of its length, lobes triangular, c. 1 mm long. Floral axis between calyx and stamens elongated like a gynandrophore, 2– $2\frac{1}{2}$  mm long. *Petals* lanceolate or elliptic, 5–7 by 2– $2\frac{1}{2}$  mm, truncate or obtuse at the base; sparsely puberulous outside, densely puberulous and papillose inside. *Disk* lobes alternate with stamens. *Stamens*  $4\frac{1}{2}$  mm; anthers oblong, c. 1 mm long. *Ovary* subglobose, c.  $\frac{1}{2}$  mm  $\varnothing$ ; style  $1\frac{3}{4}$ – $2\frac{1}{2}$  mm; stigma slightly thicker than the style. Abortive pistil 1 mm long. *Drupe* globose, c.  $1\frac{1}{2}$  cm  $\varnothing$ ; enlarged petals elliptic, small,  $\frac{3}{4}$ –1 by  $\frac{2}{5}$  cm.

*Distr. Malesia:* Malay Peninsula (Pahang: G. Tahan; S. Kelantan: G. Rabong).

*Ecol.* Forest on steep ridge slopes, 1050–1650 m. *Fl.* March, June, July; *fr.* June–July.

According to WHITMORE (*in sched.*) frequent on steep ridge slopes on Mt Rabong and dominating a stretch of forest there at c. 1450 m.

*Vern.* *Pauh gunong*, M.

*Notes.* This is one of the two species of this genus in Malesia with very small enlarged petals on the fruit, the other being *S. minutalata*, similarly as those of the Indo-Chinese *S. pierrei* HANCE (*cf.* TARD.-BLOT, Fl. C. L. & V. 2, 1962, 112, t. 5, f. 2–8).

I have seen 7 collections, of which 6 from Mt Tahan, Pahang, and one from Mt Rabong, S. Kelantan.

7. *Swintonia floribunda* GRIFF. Proc. Linn. Soc. Lond. 1 (1846) 283; MARCH. Rév. Anacard. (1869) 109 & 186 ('*florida*'). — *Astropetalum* sp. 2 GRIFF. Notul. 4 (1854) 412. — *S. griffithii* KURZ, J. As. Soc. Beng. 39, ii (1870) 75; *ibid.* 45, ii (1876) 207; HOOK. f. Fl. Br. Ind. 2 (1876) 26; TARD. Fl. C. L. & V. 2 (1962) 110, t. 4, f. 1-6. — *S. helferi* HOOK. f. Fl. Br. Ind. 2 (1876) 26; KURZ, J. As. Soc. Beng. 45, ii (1876) 207. — *S. penangiana* KING, J. As. Soc. Beng. 65, ii (1896) 490; RIDL. Fl. Mal. Pen. 1 (1922) 533; KOCHUM. Mal. For. Rec. 17 (1964) 353. — *S. puberula* PEARSON, Kew Bull. (1906) 3; RIDL. Fl. Mal. Pen. 1 (1922) 532.

Tree up to 30(-45) m high and 50(-90) cm  $\varnothing$ , sometimes with steep plank buttresses up to 2 m high, often slightly sinuous or angular. Bark light greyish to reddish brown, shallowly fissured. *Leaves* chartaceous to subcoriaceous, elliptic to narrowly elliptic, oblong or obovate-oblong,  $5\frac{1}{2}$ -16(-25) by 2-5(-6) cm, glabrous, not papillose beneath; base cuneate (margins separate); apex acuminate; nerves 8-28 pairs; veins reticulate, faint; petiole 1-6 $\frac{1}{2}$  cm, semiterete, sulcate or flat above. *Panicles* 8-18 cm long, puberulous, glabrescent, or glabrous; terminal parts of branches laxly branched, with spacious internodes, loosely flowered; floral bracts ovate,  $\frac{3}{4}$ -1 $\frac{1}{4}$  mm long; pedicels rather long, (1 $\frac{1}{2}$ -)2 $\frac{1}{2}$ -4 mm. *Flowers* light green-yellowish or white. *Calyx* divided to  $\frac{1}{3}$ - $\frac{1}{4}$  of its length, lobes suborbicular,  $\frac{1}{2}$ - $\frac{2}{3}$  mm long. Floral axis between calyx and stamens elongated and like a gynandrophore, 1 $\frac{1}{2}$  mm long. *Petals* oblong or obovate-oblong, 3 $\frac{1}{2}$ -4 by 1-2 mm, cuneate at the base, puberulous on both surfaces, sometimes glabrescent or almost glabrous outside. *Disk* lobes alternate with stamens. *Stamens* 2-3 $\frac{1}{2}$  mm; anthers oblong,  $\frac{1}{2}$ - $\frac{3}{4}$  mm long. *Ovary* ovoid, c.  $\frac{1}{2}$  mm  $\varnothing$ ; style 1 $\frac{1}{2}$ -2 $\frac{1}{2}$  mm; stigma capitate. *Drupe* globose or subglobose, 1 $\frac{1}{4}$ -1 $\frac{3}{4}$  cm  $\varnothing$ ; enlarged petals red when fresh, narrowly oblong to linear, 3 $\frac{3}{4}$ -9 by 1-1 $\frac{1}{4}$  cm.

Distr. Burma, Andaman Is. (?), Thailand, Vietnam, and *Malesia*: Sumatra (Atjeh, E. & W. Coast, Indragiri, Riouw-Lingga Arch.) and Malay Peninsula (Kedah, Kelantan, Pahang, Negri Sembilan, Selangor, Johore, Langkawi, Penang).

Ecol. Lowland forest up to 270 m, sometimes at 850 m, occasionally on limestone; almost in a pure stand at G. Raya, Langkawi. *Fl.* May-June, Sept.-Jan.; *fr.* March-May, Aug., Dec.-Jan.

Vern. Sumatra: *bagel*, *mirah*, Atjeh, *kẽdongong rabuk*, M; Malay Peninsula: *kijang*, *mak pauh*, *mẽppauh*, *mupoh*, *pauh*, M.

8. *Swintonia spicifera* HOOK. f. Fl. Br. Ind. 2 (1876) 27; ENGL. in DC. Mon. Phan. 4 (1833) 233, t. 5, f. 20-23; in E. & P. Nat. Pl. Fam. 3, 5 (1892) 148, f. 93; KING, J. As. Soc. Beng. 65, ii (1896) 490, *incl. var. scortechini* KING, l.c. 491; RIDL. Fl. Mal. Pen. 1 (1922) 532; HEYNE, Nutt. Pl. (1927) 972; BURK. Dict. (1935) 2111; KOCHUM. Mal. For. Rec. 17 (1964) 154; MEIJER, Bot. News Bull. F. D. Sandakan 8 (1967) 32. — Fig. 131-m, 14.

Tree up to 36(-54) m high and 80(-100) cm  $\varnothing$ , occasionally ridged (ridges 250 by 20 by 3 cm). Bark dark brown or purplish brown, dipped or fissured. *Leaves* coriaceous, elliptic-oblong, rarely ovate, or oblanceolate,  $5\frac{1}{2}$ -18(-23) by 2 $\frac{1}{2}$ -5(-6) cm, glabrous, occasionally with glabrous, dome-

like domatia; papillae very compact, obscure, or indistinguishable on the lower surface; base cuneate (margins separate); apex acute, acuminate, or obtuse; nerves 11-15(-22) pairs; veins reticulate, some slightly parallel and cross-bar-like, often faint; petiole 1 $\frac{1}{2}$ -5 cm, semiterete, flat or slightly



Fig. 14. *Swintonia spicifera* HOOK. f. Characteristic bark. In Malaya (Photogr. DING HOU).

convex above. *Panicles* 6 $\frac{1}{2}$ –22 cm long, puberulous, glabrescent, or glabrous; terminal parts of branches not or little branched, with very short or obscure internodes, densely flowered; floral bracts ovate, broadly elliptic, or suborbicular, 2–4 mm long; pedicels c. 1 $\frac{1}{2}$  mm. *Flowers* pale or greenish yellow. *Calyx* divided to  $\frac{1}{5}$ – $\frac{1}{3}$  of its length, lobes suborbiculate or transverse-oblong,  $\frac{1}{2}$ – $\frac{3}{4}$  mm long. Floral axis between calyx and stamens elongated and like a gynandrophore, c. 1 mm long. *Disk* lobes alternate with the stamens. *Stamens* 1 $\frac{1}{2}$ –2 $\frac{1}{2}$  mm; anthers oblong,  $\frac{1}{2}$ – $\frac{2}{3}$  mm long. *Ovary* broadly ellipsoid or obovoid, c.  $\frac{1}{2}$  mm

$\emptyset$ ; style 2 $\frac{1}{2}$  mm; stigma slightly thicker than the style. Abortive pistil in  $\delta$  c.  $\frac{2}{3}$  mm long. *Drupe* ellipsoid, 2–2 $\frac{1}{2}$  by 1 $\frac{1}{2}$  cm; enlarged petals red when fresh, oblong-lanceolate, 3 $\frac{1}{2}$  by 1–1 $\frac{1}{2}$  cm.

*Distr. Malesia:* Sumatra (Palembang, Riouw and Lingga Arch.) and Malay Peninsula (Kedah, Perak, Negri Sembilan, Johore, Malacca, Penang).

*Ecol.* Lowland forests, up to 500 m. *Fl.* Febr., May, Oct., Nov.; *fr.* Febr.–April, Sept.

*Uses.* Furnishes a good timber (HEYNE, BURKILL).

*Vern.* Sumatra: *kerete*, M; Malay Peninsula: *mupus*.

## 6. GLUTA

LINNÉ, Mant. 2 (1771) 293; MARCH. Rév. Anacard. (1869) 110 & 187; ENGL. in DC. Mon. Phan. 4 (1883) 224; KING, J. As. Soc. Beng. 65, ii (1896) 480; BURK. Gard. Bull. S. S. 5 (1931) 224; DING HOU, Blumea 24 (1978) 8. — *Stagmaria* JACK, Descr. Mal. Pl. 3 (1822) 12, repr. in Hook. Comp. Bot. Mag. 1 (1836) 267. — *Syndesmis* WALL. in Roxb. Fl. Ind. ed. Wall. 2 (1824) 314. — *Melanorrhoea* WALL. Pl. As. Rar. 1 (1829) 9; MARCH. Rév. Anacard. (1869) 112 & 185; ENGL. in DC. Mon. Phan. 4 (1883) 234, *incl. sect.*; KING, J. As. Soc. Beng. 65, ii (1896) 483, *incl. sect.* — **Fig. 15–28.**

Trees, rarely large shrubs. *Leaves* spiral, scattered, sometimes aggregate in pseudo-whorls, simple, coriaceous, entire, petioled, rarely subsessile or sessile. *Inflorescences* axillary, paniculate; bracts and bracteoles ovate to lanceolate, usually caducous; pedicels sometimes articulated. *Flowers* bisexual. *Calyx* calyptriform, circumscissile or bursting irregularly at anthesis, caducous. Floral axis between calyx and ovary often elongated and enlarged (described as *torus* here). *Petals* (4 or) 5(–8), imbricate and/or contorted sometimes even on the same specimen, rarely valvate, caducous, or persistent and (much) enlarged in fruit. *Stamens* (4 or) 5(–7), 10, or  $\infty$ , inserted on the torus; filaments filiform, glabrous or hairy; anthers dorsifixed. *Disk* 0. *Ovary* sessile or stiped (between ovary and stamens), 1-celled, glabrous or hairy; style distinct, filiform; stigma slightly thicker than the style. *Drupe* 1-celled, sometimes stalked, sometimes supported by the much enlarged, wing-like petals. *Seed* with testa adherent to the endocarp; embryo straight, rarely slightly curved; cotyledons free, or incompletely fused and partly free only on one side.

*Distr.* About 30  *spp.* in Madagascar (1  *sp.*), India (Deccan Peninsula and Andaman Is.), Burma, Thailand, Indo-China, China (?Hainan), throughout *Malesia* (so far not found in the Lesser Sunda Is. and Philippines; in New Guinea only 1  *sp.*). **Fig. 16.**

*Ecol.* Mixed dryland forest, peat-swamps, and riverine forest, chiefly in the lowland and hills, by exception up to 1200 m.

*G. renghas* and *G. velutina* can be co-dominants in lowland swampy habitats in the lowest course of the rivers.

Recognition of *rengas* trees in the field is mostly easy by making cuts or bruises on the plant (twigs, bark, wood) after which a darkening to pitch-black coagulent resin exudes (see p. 407 under dermatitis and fig. 22).

*Taxon.* Originally when few species were known, the gene.  *Gluta* and *Melanorrhoea* were well distinguished, although as early as 1869 MARCHAND anticipated their ultimate fusion. In the course of years this has now come true after several ‘anomalous’ species have been described: stamens may vary from 5, 10 to many; cotyledons may be free or partly fused; petals may be accrescent or not, with intermediate stages; the torus may be cylindrical or swollen; the style is terminal or excentric; the calyx is circumscissile calyptriform or spathaceous, with an intermediate. This independent reticulate variation makes it



Fig. 15. *Gluta papuana* Ding Hou. *a.* Habit,  $\times \frac{1}{2}$ , *b.* flower-bud, *c.* flower-bud showing calyx bursting into two lobes, *d.* flower (calyx fallen off) with one petal removed, *e.* petal, inside view, all  $\times 3\frac{1}{2}$ , *f.* fruit,  $\times \frac{1}{2}$ , *g.* embryo, showing cotyledons united on one side,  $\times \frac{1}{2}$  (*a* SCHODDE & CRAVEN 4492, *b-e* NGF 38963, *f-g* NGF 18316).

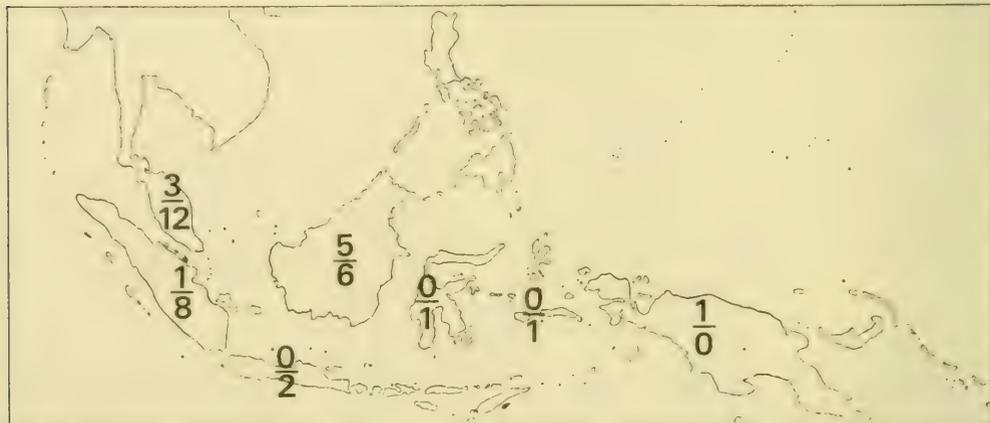


Fig. 16. Species density of *Gluta* in Malesia; above the hyphen the number of endemic *spp.*, below it the number of non-endemic ones in each island (group). Note absence in the Philippines and Lesser Sunda Is.

impossible to distinguish more than one genus and defeats also distinction of sections (cf. DING HOU, *Blumea* 24, 1978, 8–9, f. 1g–h). Wood-anatomically there is, according to Mr. L. S. V. MURTHY (Kuching), no distinction between *Gluta* and *Melanorrhoea* (DING HOU, *l.c.* 10). Also according to BAKSI (in Ferguson & Muller, ed., 'The evolutionary significance of the exine', 1976, 379–405, pl. 1–8, f. 1–2) most species of the two genera belong to one basic pollen type from which two specializations can be derived, but it is evident that the two genera cannot be distinguished palynologically (DING HOU, *l.c.* 12).

Uses. The seeds of *G. reinghas* and *G. velutina* can be eaten after roasting (BURKILL, *l.c.* 230). The heartwood of some species, e.g. of *G. reinghas*, *G. elegans*, *G. wrayi*, etc., is reddish brown and beautiful for handsome furniture, but it is hardly used due to the toxic properties of the resinous exudate.

C. J. STEFELS ('Rapport inzake het onderzoek van enige Houtsoorten ten aanzien van hun weerstand tegen paalwormaanastasting' Fak Fak, 1957, typed report, in Dutch) made some observations on resistance against marine borers. A log of '*Gluta*' (Fak Fak, Budidi R., BW 3135), now identified as *G. papuana*, was tested. After 7 months the sapwood was infected, while the heartwood remained sound. As in this species the sapwood/heartwood ratio is unfavourable, it is not suitable for wharf piling (extr. kindly by W. VINK).

Vern. Malaysian standard timber name: *rengas*.

#### KEY TO THE SPECIES

##### Based on flowering specimens

1. Calyx detaching at anthesis circumscissile from the base and falling off in one piece as a calyptra. Stamens  $\infty$ , except 5 or (8–)10 in 3 *spp.*
2. Stamens  $\infty$  (c. 20–100).
3. Ovary hairy. Leaves pubescent beneath, especially on the midrib, nerves, and veins.
4. Inflorescences accompanied by mature leaves. Petals obovate-oblong or -lanceolate
4. Inflorescences appearing before the leaves or accompanied by some young ones. Petals elliptic-lanceolate or lanceolate
3. Ovary glabrous (rarely scurfy in *G. rugulosa*). Leaves glabrous, rarely slightly hairy beneath when young, glabrescent.
5. Mature flower-bud or calyptra-shaped calyx more than 3 mm wide. Petals contorted or imbricate. Stamens more than 35.
6. Apex of the calyptra-shaped calyx obtuse, acute, or acuminate.
7. Pedicels not articulated. Ovary with a shorter stipe (between ovary and stamens)  $1\frac{1}{2}$ –2 mm long.
8. Calyx usually with a tuft of hairs at the apex, sometimes puberulous outside when young and glabrescent except the apical part. Petals oblanceolate, 11–16 mm long . . . . . 3. *G. aptera*
8. Calyx densely puberulous outside. Petals elliptic-oblong or ovate-oblong,  $7\frac{1}{2}$ –9 mm long . . . . . 4. *G. rugulosa*
7. Pedicels articulated. Ovary with a stipe (between ovary and stamens) (2–)3–5 mm long . . . . . 5. *G. beccarii*
6. Apex of the calyptra-shaped calyx rostrate . . . . . 6. *G. rostrata*
5. Mature flower-bud or calyptra-shaped calyx  $1\frac{1}{2}$ –2 mm wide. Petals almost valvate except at the apical part. Stamens c. 20(–28) . . . . . 7. *G. macrocarpa*
2. Stamens 5–10.

9. Stamens (8-)10. Leaves distinctly petioled ( $\frac{3}{4}$ - $2\frac{1}{2}$  cm); nerves 9-18 pairs, distinct beneath.  
 10. Inflorescences puberulous, glabrescent. Pedicels  $1\frac{1}{2}$ - $2\frac{1}{2}$  mm, articulated. Petals contorted or imbricate . . . . . 8. *G. curtisii*
10. Inflorescences glabrous. Pedicels 8-16 mm, not articulated. Petals valvate . . . . . 9. *G. oba*
9. Stamens 5. Leaves with obscure or very short petiole (c.  $\frac{1}{3}$  cm); nerves 17-27 pairs, prominent beneath . . . . . 10. *G. malayana*
1. Calyx bursting irregularly at anthesis: toothed or lobed, and/or splitting on one side (spathaceous), and then detaching circumscissile. Stamens (4 or) 5 (or) 6).
11. Ovary hairy.
12. Petals with the basal  $\frac{3}{4}$ -3 mm longitudinally adnate to the cylindric torus. Pedicels not articulated.
13. Petals 5- $7\frac{1}{2}$  mm long. Leaves usually pseudo-verticillate.
14. Petals densely puberulous on both surfaces. Torus c.  $1\frac{1}{2}$  mm long. Stipe of the ovary 1- $1\frac{1}{2}$  mm long; style terminal . . . . . 11. *G. torquata*
14. Petals puberulous outside and densely papillose usually at the lower half inside. Torus 1- $1\frac{1}{4}$  mm long. Stipe of the ovary obscure; style lateral . . . . . 12. *G. sabahana*
13. Petals 8-13 mm long. Leaves scattered.
15. Petals narrowly elliptic, 8-9 by  $1\frac{1}{4}$ -2 mm . . . . . 13. *G. laxiflora*
15. Petals narrowly oblanceolate, 10-13 by  $2\frac{1}{2}$  mm . . . . . 14. *G. wrayi*
12. Petals with the base attached to the base of the pulvinate torus, not adnate. Pedicels articulated . . . . . 15. *G. wallichii*
11. Ovary glabrous.
16. Torus  $3\frac{1}{2}$ -7 mm long. Pedicels not articulated. Petals puberulous outside (except in *G. elegans*).
17. Inflorescences branched from the apical part. Flowers crowded at the end of branchlets . . . . . 16. *G. capituliflora*
17. Inflorescences branched almost from the base. Flowers laxly arranged on the branchlets.
18. Petals with the basal 5-6 mm completely adnate to the torus . . . . . 17. *G. lanceolata*
18. Petals with the central part of the basal  $3\frac{1}{2}$ - $5\frac{1}{2}$  mm adnate to the torus.
19. Torus  $3\frac{1}{2}$  mm long. Leaves with slightly elevated nerves, sometimes hardly distinguishable from the veins on both surfaces . . . . . 18. *G. tavoyana*
19. Torus 5-6 mm long. Leaves with slightly elevated nerves distinguishable from the veins on both surfaces . . . . . 19. *G. elegans*
16. Torus  $\frac{2}{3}$ -3 mm long. Pedicels articulated. Petals glabrous outside.
20. Calyx puberulous outside. Leaf apex acuminate. Large shrub or small tree up to 10 m high . . . . . 20. *G. velutina*
20. Calyx glabrous except sparsely hairy at the apex. Leaf apex obtuse, rounded, or slightly emarginate, rarely cuspidate. Tall trees.
21. Torus  $\frac{2}{3}$ - $1\frac{1}{4}$  mm long. Petals  $6\frac{1}{2}$ - $7\frac{1}{2}$  mm long . . . . . 21. *G. papuana*
21. Torus 2-3 mm long. Petals  $7\frac{1}{2}$ -13 mm long . . . . . 22. *G. renghas*

## KEY TO THE SPECIES

## Based on fruiting specimens

1. Fruit subtended by wing-like, enlarged petals.
2. Fruit smooth.
3. Enlarged petals on the fruit 1-3 cm long.
4. Stamens or their scars c. 20-∞.
5. Leaves pubescent beneath and on the midrib and nerves above. Stamens or their scars ∞ . . . . . 2. *G. pubescens*
5. Leaves glabrous. Stamens or their scars c. 20(-28) . . . . . 7. *G. macrocarpa*
4. Stamens or their scars 5 . . . . . 10. *G. malayana*
3. Enlarged petals on the fruit 5-9 cm long.
6. Fruit globose, c.  $1\frac{1}{2}$  cm Ø. Stamens or their scars ∞ or (8-)10.
7. Stamens or their scars ∞ . . . . . 5. *G. beccarii*
7. Stamens or their scars (8-)10 . . . . . 8. *G. curtisii*
6. Fruit ovoid or ellipsoid, c.  $1\frac{1}{2}$  by 1 cm. Stamens or their scars 5 . . . . . 15. *G. wallichii*
2. Fruit wrinkled and scurfy . . . . . 4. *G. rugulosa*
1. Fruit usually without wing-like, enlarged petals.
8. Fruit on a centric stalk, globose or subglobose.
9. Fruit smooth.
10. Stamens or their scars 5 or 10.
11. Stamens or their scars 5.
12. Leaves 7-13 $\frac{1}{2}$ (-18) cm wide; petiole up to 2 cm. Fruit with a distinct stalk (c. 1- $1\frac{1}{2}$  cm); cotyledons free.
13. Mature leaves with pubescent midrib on both surfaces; petiole obscure or very short (c.  $\frac{1}{3}$  cm) . . . . . 10. *G. malayana*
13. Mature leaves with glabrous midrib on both surfaces. Petiole  $\frac{1}{4}$ -2 cm . . . . . 11. *G. torquata*
12. Leaves  $1\frac{1}{4}$ - $4\frac{1}{2}$  cm wide; petiole ( $2\frac{1}{2}$ )- $3\frac{1}{2}$ - $7\frac{1}{2}$  cm. Fruit on an obscure stalk; cotyledons incompletely fused, free on one side . . . . . 17. *G. lanceolata*

11. Stamens or their scars 10 . . . . . 9. *G. oba*  
 10. Stamens or their scars many (c. 20-∞).  
 14. Fruit on a stalk  $\frac{3}{4}$ -1 $\frac{3}{4}$  cm long. Stamens or their scars c. 20(-28). . . . . 7. *G. macrocarpa*  
 14. Fruit on a shorter stalk c.  $\frac{1}{2}$  cm long. Stamens or their scars more than 35.  
 15. Leaves pubescent beneath, especially on the midrib and veins . . . . . 1. *G. speciosa*  
 15. Leaves usually glabrous, sometimes pubescent beneath when young, glabrescent 3. *G. aptera*  
 9. Fruit wrinkled, lenticellate, or scurfy.  
 16. Fruit surface much wrinkled, with irregularly tuberculate ridges, crests, or protuberances.  
 17. Cotyledons free. Large shrub or small tree up to 10 m high . . . . . 20. *G. velutina*  
 17. Cotyledons incompletely fused, free on one side. Tall tree . . . . . 22. *G. renghas*  
 16. Fruit surface not wrinkled, but lenticellate or scurfy.  
 18. Fruit densely lenticellate; cotyledons free . . . . . 6. *G. rostrata*  
 18. Fruit scurfy; cotyledons incompletely fused, free on one side . . . . . 18. *G. tavoyana*  
 8. Fruit on an excentric stalk (except centric in *G. pubescens* and *G. wrayi*), variously shaped, often laterally flattened.  
 19. Fruit smooth.  
 20. Leaves pubescent beneath. Stamens or their scars ∞. Cotyledons free. . . . . 2. *G. pubescens*  
 20. Leaves glabrous. Stamens or their scars 5. Cotyledons incompletely fused, free on one side.  
 21. Leaf apex acuminate. Free part of the cotyledons 1 $\frac{1}{2}$ -2 $\frac{1}{2}$  cm deep . . . . . 19. *G. elegans*  
 21. Leaf apex rounded, slightly emarginate, rarely cuspidate. Free part of the cotyledons 3-3 $\frac{1}{4}$  cm deep . . . . . 21. *G. papuana*  
 19. Fruit scurfy.  
 22. Fruit erect. (Cotyledons incompletely fused, free part  $\frac{1}{2}$ - $\frac{3}{4}$  cm deep; free part/solid part = c. 1 : 4) . . . . . 14. *G. wrayi*  
 22. Fruit not erect but bent obliquely or horizontally.  
 23. Petiole usually very short,  $\frac{1}{4}$ - $\frac{3}{4}$  cm, sometimes some leaves with petiole up to 1 $\frac{1}{2}$ (-2) cm. Free part of cotyledons c. 1 cm deep (free part/solid part = c. 1 : 2-3 $\frac{1}{2}$ ) . . . . . 12. *G. sabahana*  
 23. Petiole 1-5 cm. Free part of cotyledons 1 $\frac{1}{2}$ -3 $\frac{3}{4}$  cm deep.  
 24. Free part of cotyledons 1 $\frac{1}{2}$ -2 cm deep (free part/solid part = c. 1 : 1-2) . . . . . 13. *G. laxiflora*  
 24. Free part of cotyledons 2 $\frac{3}{4}$ -3 $\frac{3}{4}$  cm deep (free part/solid part = c. 3 : 1) 16. *G. capituliflora*

1. *Gluta speciosa* (RIDL.) DING HOU, *Blumea* 24 (1978) 21. — *Melanorrhoea speciosa* RIDL. Kew Bull. (1933) 197; ANDERSON, Gard. Bull. Sing. 20 (1963) 171; SMYTHIES, Common Sarawak Trees (1965) 9.

Tree up to 40 m high and 80 cm Ø. Buttresses 1 $\frac{1}{2}$  m high,  $\frac{1}{3}$  m wide, 5-7 $\frac{1}{2}$  cm thick. Bark dark brown, irregularly fissured. *Leaves* coriaceous, obovate, 5-17 $\frac{1}{2}$  by 3-9 cm; pubescent beneath, especially on the midrib and nerves, often glabrous above except pubescent on the midrib; base cuneate; apex rounded or emarginate; nerves 10-22 pairs, prominent below, flat but distinct above; veins reticulate, or transverse and parallel, often distinct on both surfaces; petiole 1-2 cm. *Panicles* up to 18 cm long, tomentose; pedicels 10-20 mm, not articulated. *Flower-buds* ellipsoid, 10-12 by 5 mm, obtuse. *Calyx* 10-12 mm long, circumscissile, densely puberulous outside. *Petals* white, red at the base, imbricate, obovate-oblong or -lanceolate, 10-15 by 3-5 mm, puberulous outside. *Stamens* pink, c. 100, 7-10 mm; filaments hairy; anthers oblong,  $\frac{3}{4}$  mm long. *Torus* subglobose, 1 $\frac{1}{2}$  mm Ø. *Ovary* obovoid, 2 $\frac{1}{2}$  mm long, densely hairy; stipe c. 1 mm; style terminal, 3 mm. *Drupe* on a centric stalk (c.  $\frac{1}{2}$  cm), subglobose, 2-3 cm Ø, smooth; without enlarged petals; embryo subglobose, 1 $\frac{1}{2}$ -2 cm Ø; cotyledons free.

Distr. *Malesia*: Borneo (Brunei and Sarawak).

Ecol. Lowland forest on drylands and in swamps. *Fl.* March-May; *fr.* May-July.

Vern. *Rêngas*, M.

2. *Gluta pubescens* (RIDL.) DING HOU, *Blumea* 24 (1978) 15. — *Melanorrhoea pubescens* RIDL. Fl. Mal. Pen. 1 (1922) 530. — *Melanorrhoea* sp. CORNER, *Ways. Trees* (1940) 121. — Fig. 17.

Deciduous tree, up to 24(-45) m high and 34 cm

Ø, occasionally with buttresses. Bark dark rich brown, very flaky and shaggy with large elongated jagged pieces separating from below upwards and overlapping. *Leaves* coriaceous, elliptic or obovate, 9-17 by 3 $\frac{1}{2}$ -8 $\frac{1}{2}$  cm; pubescent beneath especially on the midrib, nerves and veins; glabrous above except pubescent on the midrib and nerves; base cuneate; apex rounded or emarginate; nerves 11-18 pairs, prominent beneath, distinct above; veins scalariform, distinct beneath, faint above; petiole 1-2 $\frac{1}{2}$ (-3 $\frac{1}{2}$ ) cm. *Panicles* up to c. 14 cm long, appearing before leaves or accompanied by some young ones, pubescent; pedicels 9-14 mm long, articulated. *Flower-buds* ovoid-oblong, 11-13 by 6-7 mm, acuminate. *Calyx* 11-13 mm long, circumscissile, puberulous outside. *Petals* white, contorted, elliptic-lanceolate or lanceolate, 9-13 by 3-4 mm, puberulous outside, sparsely puberulous near the base inside. *Stamens* c. 60, 3-7 mm; filaments sparsely hairy; anthers oblong or broadly ellipsoid, c.  $\frac{2}{3}$  mm long. *Torus* subglobose, 1 $\frac{1}{2}$ -2 mm Ø. *Ovary* subglobose, 1 $\frac{1}{2}$ -2 mm Ø, sparsely hairy; stipe 1 $\frac{1}{2}$ -2 mm; style terminal or slightly excentric, 2 $\frac{1}{4}$ -5 mm. *Drupe* on a centric stalk (c. 1 $\frac{1}{2}$  cm), transverse-oblong, 2-2 $\frac{1}{2}$  by 3 $\frac{1}{2}$ -4 $\frac{1}{2}$  cm, smooth; sometimes with enlarged wing-like petals (narrowly elliptic, 1 $\frac{1}{4}$  by  $\frac{1}{4}$  cm); embryo transverse-oblong, 1 $\frac{1}{2}$  by 3-4 cm; cotyledons free.

Distr. *Malesia*: Sumatra (Tapanuli) and Malay Peninsula (Trengganu, Pahang, Johore, Malacca).

Ecol. Dryland and swamp forest at low altitude, sometimes found up to 600 m. *Fl.* March-June; *fr.* May, July. CORNER observed in Trengganu the trees to shed their leaves in Oct.-Nov. and flower on the bare twigs before the new leaves unfold.

Vern. *Kərbau jalang*, *rêngas*, *sisèk tênggiling*, *sumpah biawak*, M.



Fig. 17. *Gluta pubescens* (RIDL.) DING HOU. The scaly rengas, 'kerbau jalang', along the Mawai-Jemaluang Road, E. Johore, alongside the palm *Pholidocarpus kingianus* RIDL. The only species with this kind of peculiar bark-shedding, mentioned as *Melanorrhoea* sp. by CORNER, Ways. Trees (1940) 121 (Photogr. CORNER).

3. *Gluta aptera* (KING) DING HOU, *Blumea* 24 (1978) 12. — *Melanorrhoea aptera* KING, *J. As. Soc. Beng.* 65, ii (1896) 487; RIDL, *Fl. Mal. Pen.* 1 (1922) 531; KOCHUM, *Mal. For. Rec.* 17 (1964) 297. — *Melanorrhoea inappendiculata* KING, *J. As. Soc. Beng.* 65, ii (1896) 488; RIDL, *Fl. Mal. Pen.* 1 (1922) 531; SMYTHIES, *Common Sarawak Trees* (1965) 9, pl. 3. — *Melanorrhoea tricolor* RIDL, *Kew Bull.* (1933) 196; ANDERSON, *Gard. Bull. Sing.* 20 (1963) 171; SMYTHIES, *Common Sarawak Trees* (1965) 9.

Tree up to 40 m high and 60 cm  $\varnothing$ . Buttresses occasionally present, up to  $1\frac{1}{2}$  m high,  $\frac{1}{3}$  m wide,  $7\frac{1}{2}$  cm thick. Bark brown, rather smooth. *Leaves* coriaceous, obovate to obovate-oblong, or elliptic, 4–29(–37 $\frac{1}{2}$ ) by  $2\frac{1}{2}$ – $10\frac{1}{2}$ (– $15\frac{1}{2}$ ) cm; usually glabrous, sometimes the young ones pubescent beneath especially on the midrib, nerves and veins, and also on the midrib above, glabrescent; base cuneate, rarely attenuate; apex rounded, emarginate, sometimes acute; nerves 12–23 pairs, prominent beneath, distinct or faint above; veins reticulate, or transverse and parallel, slightly elevated beneath, faint above; petiole ( $\frac{1}{2}$ –) $1\frac{1}{2}$ – $2\frac{1}{2}$  cm. *Panicles* up to 32 cm long, pubescent especially when young, glabrescent, sometimes glabrous; pedicels 10–22 $\frac{1}{2}$  mm, not articulated. *Flower-buds* ovoid to ovoid-oblong, or ellipsoid, 7–15 by 5 mm, obtuse or acute. *Calyx* 7–15 mm long, circumscissile, usually with a tuft of hairs at the apex, sometimes puberulous outside when young, glabrescent except the apical part. *Petals* white, then changing to red from base upwards (cf. ANDERSON S 12433), imbricate or contorted, oblanceolate, 11–16 by  $3\frac{1}{2}$ –5 mm, puberulous outside, sparsely hairy and slightly papillose near the base inside, sometimes glabrescent. *Stamens* c. 100, 8–11 mm; filaments white, changing to bright blue (cf. ANDERSON 12433), hairy; anthers oblong,  $\frac{2}{3}$ –1 mm. *Torus* broadly ovoid,  $1\frac{1}{2}$ –2 mm  $\varnothing$ . *Ovary* broadly ellipsoid, obovoid, or obliquely subglobose, 1– $1\frac{1}{2}$  mm  $\varnothing$ , glabrous; stipe  $\frac{1}{2}$ –2 mm; style subterminal,  $2\frac{1}{2}$ –5 mm. *Drupe* on a centric stalk (c.  $\frac{1}{2}$  cm), globose or subglobose,  $2\frac{1}{2}$ – $3\frac{1}{2}$  cm  $\varnothing$ , brown, smooth; usually without enlarged petals; embryo subglobose,  $1\frac{3}{4}$ – $2\frac{3}{4}$  cm  $\varnothing$ ; cotyledons free.

Distr. *Malesia*: widely distributed in Sumatra, the Malay Peninsula, and Borneo.

Ecol. Dryland and peat-swamp forest, secondary growths, sometimes on sandstone, up to 650 m, rarely up to 1200 m. *Fl. fr.* Jan.–Nov.

Vern. *Rengas*, *r. paya*, *M, ungan*, *Dayak*.

4. *Gluta rugulosa* DING HOU, *Blumea* 24 (1978) 16. — Fig. 18a–d.

Tree up to c. 30 m high. *Leaves* coriaceous, obovate to oblanceolate, 6–27 $\frac{1}{2}$  by  $4\frac{1}{2}$ – $10\frac{1}{2}$  cm; glabrous on both surfaces, sometimes the lower surface slightly puberulous when young, glabrescent; base decurrent; apex rounded, sometimes slightly emarginate; nerves 11–21 pairs, prominent beneath, flat above; veins reticulate, or transverse and parallel, distinct beneath, faint above; petiole 0–1 cm. *Panicles* 5–14(–25) cm long, puberulous; pedicels 5–7 mm, not articulated. *Flower-buds* ovoid or ellipsoid, 7–8 by  $3\frac{1}{2}$ –4 mm, shortly acuminate. *Calyx* 7–8 mm long, circumscissile, densely puberulous outside. *Petals* imbricate, elliptic-oblong or ovate-oblong,  $7\frac{1}{2}$ –9 by  $2\frac{3}{4}$ – $3\frac{1}{2}$  mm, densely puberulous outside, papillose in the

lower part inside. *Stamens*  $\infty$  (c. 40); filaments  $3\frac{1}{2}$ –4 mm, hairy; anthers oblong, c. 1 mm long. *Torus* subglobose, c.  $1\frac{1}{2}$  mm  $\varnothing$ . *Ovary* broadly ellipsoid, c. 1 mm long, scurfy; stipe 1– $1\frac{1}{2}$  mm; style terminal, 3–4 mm. *Drupe* sessile, globose, c.  $3\frac{1}{2}$  cm  $\varnothing$ , light brown, scurfy, wrinkled; enlarged, wing-like petals elliptic-lanceolate,  $2\frac{1}{2}$ –3 by  $\frac{1}{4}$ –1 cm; embryo subglobose, c.  $2\frac{1}{2}$  cm  $\varnothing$ ; cotyledons free.

Distr. *Malesia*: Borneo (Brunei; Sabah: Sipitang, Kuala Belait; Sarawak: Baram Distr.; Kalimantan: Kuala Kapuas, Pontianak).

Ecol. Lowland forest or on forest-edges, up to 150 m. *Fl. March*, Nov.; *fr.* April, Aug., Sept.

Vern. *Hembodja*, Pontianak, *umpoh*, Kuala Kapuas.

5. *Gluta beccarii* (ENGL.) DING HOU, *Blumea* 24 (1978) 13. — *Melanorrhoea beccarii* ENGL. *Bot. Jahrb.* 1 (1880) 45; in DC. *Mon. Phan.* 4 (1883) 237, t. 5, f. 6–8; ANDERSON, *Gard. Bull. Sing.* 20 (1963) 170; SMYTHIES, *Common Sarawak Trees* (1965) 9, pl. 2; MEIJER, *Bot. News Bull. F. D. Sandakan* (1967) 27, pl.

Tree up to 33 m high and 72 cm  $\varnothing$ . Buttresses up to  $1\frac{1}{4}$  m high,  $\frac{1}{2}$  m wide,  $7\frac{1}{2}$  cm thick. Bark grey, reddish or dark brown, rather smooth. *Leaves* coriaceous, obovate, or elliptic, 7–12 $\frac{1}{2}$  by  $3\frac{1}{2}$ –6 cm, glabrous, sometimes puberulous beneath especially on the midrib and nerves; base cuneate; apex obtuse, or emarginate, rarely acute; nerves 9–18 pairs, distinct on both surfaces; veins reticulate, some transverse, distinct beneath, rather faint above; petiole  $\frac{1}{2}$ – $2\frac{1}{2}$  cm. *Panicles* 9–15 cm long, puberulous; pedicels  $2\frac{3}{4}$ –8 mm, articulated. *Flower-buds* ovoid-oblong, 8–12 by 5–7 mm, shortly acuminate. *Calyx* pinkish-purple, 8–12 mm long, circumscissile, puberulous outside. *Petals* white, changing to dark pink, contorted, narrowly elliptic, 12–14 by 3–4 mm, puberulous outside, glabrous inside. *Stamens* c. 70, 5–10 mm; filaments sparsely hairy. *Torus* subglobose, c.  $1\frac{1}{2}$  mm  $\varnothing$ . *Ovary* subglobose, c. 1 mm  $\varnothing$ , glabrous; stipe (2)–3–5 mm; style terminal, 3–5 mm. *Drupe* (bright purplish-red when fresh) on a centric stalk ( $1$ – $1\frac{1}{4}$  cm), subglobose, c.  $1\frac{1}{2}$  cm  $\varnothing$ , smooth; wing-like, enlarged petals (bright pinkish or red) narrowly oblanceolate or elliptic-oblong, 5–6 by  $1\frac{1}{4}$ – $1\frac{3}{4}$ (– $2\frac{1}{2}$ ) cm; embryo subglobose,  $1\frac{1}{4}$  cm  $\varnothing$ ; cotyledons free.

Distr. *Malesia*: Malay Peninsula (Trengganu, Malacca) and Borneo (Brunei; Sabah: Beaufort, Tenom, Lahad Datu; Sarawak: Bako Nat. Park, Simanggang, Binatang, Sibul, Bintulu).

Ecol. Peat-swamps, heath forest, and dryland forest up to 100 m. *Fl. Dec.*–June; *fr.* Jan.–Oct.

Vern. *Rengas kerangas*, *r. paya*, Sarawak.

6. *Gluta rostrata* DING HOU, *Blumea* 24 (1978) 15.

Tree up to 20 m high and 65 cm  $\varnothing$ . Buttresses 2 m high,  $1\frac{1}{2}$  m wide, 6 cm thick. Bark greyish red-brown, rough. *Leaves* coriaceous obovate-oblong, oblanceolate, sometimes elliptic,  $7\frac{1}{2}$ –16 by  $2\frac{1}{2}$ – $6\frac{1}{2}$  cm, glabrous; base attenuate; apex obtuse, rounded, or emarginate; nerves 9–14 pairs, slightly elevated beneath, flat and distinct above; veins reticulate, usually distinct on both surfaces, sometimes obscure above; petiole  $\frac{1}{2}$ – $1\frac{3}{4}$  cm. *Panicles*  $9\frac{1}{2}$ – $13\frac{1}{2}$  cm long, puberulous; pedicels 10–27 $\frac{1}{2}$

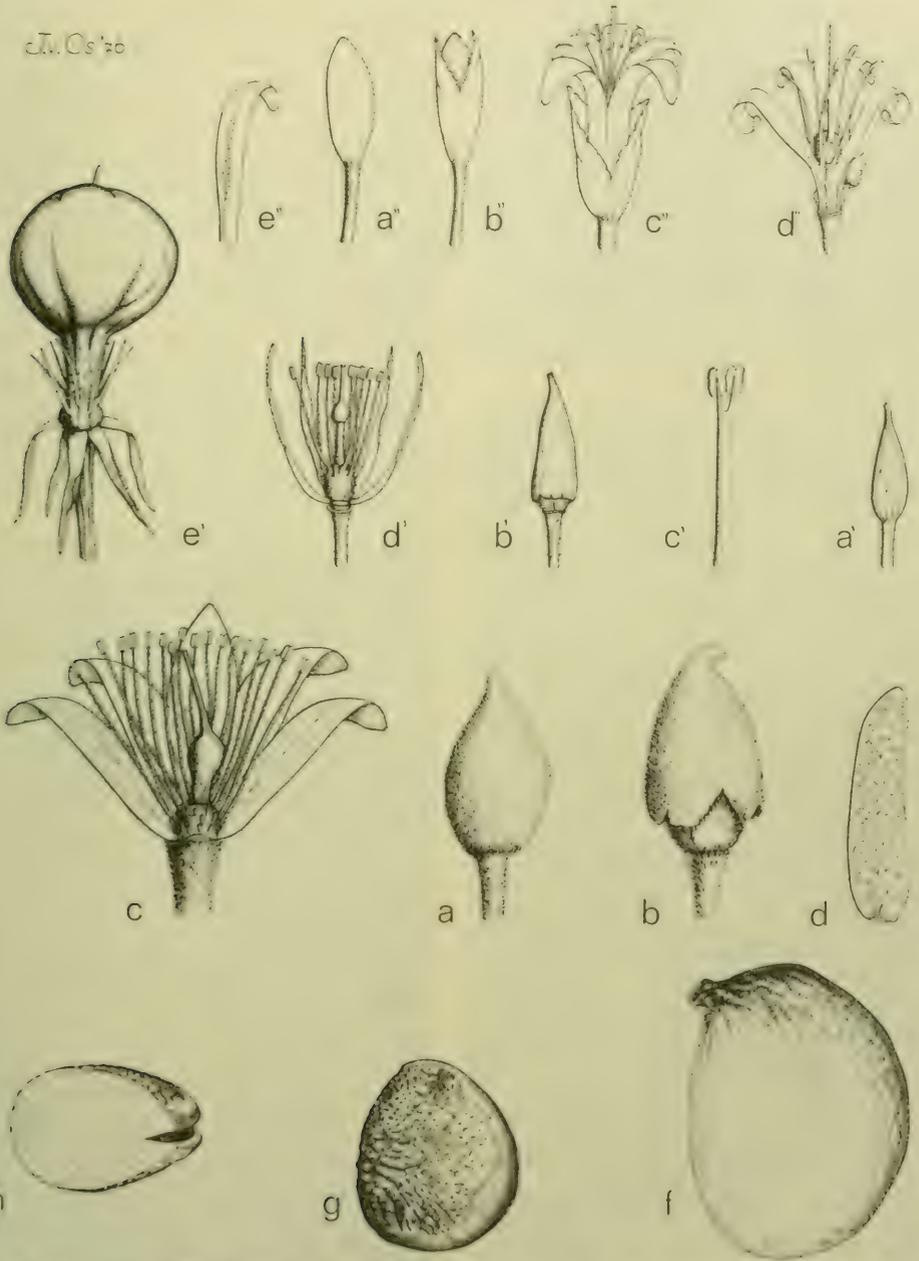


Fig. 12. *Gluta rugulosa* DING HO. *a.* Flower-bud, *b.* flower, showing calyx splitting circumscissile, *c.* flower (calyx fallen off), 1 petal and some stamens removed, *d.* petal, all  $\times 3\frac{1}{2}$ . — *G. oba* (MERR.) DING HO. *a'*. Flower-bud,  $\times 3\frac{1}{2}$ , *b'*. flower, showing calyx splitting circumscissile around base,  $\times 3\frac{1}{2}$ , *c'*. abnormal stamens,  $\times 7$ , *d'*. flower (calyx fallen off), 1 petal and 1 stamen removed,  $\times 3\frac{1}{2}$ , *e'*. (young) fruit,  $\times 3\frac{1}{2}$ . — *G. sabahana* DING HO. *a''.* Flower-bud, *b''.* flower, showing calyx bursting into two lobes, *c''.* open flower, *d''.* flower, a great deal of calyx and 1 petal removed, *e''.* petal, all  $\times 3\frac{1}{2}$ , *f''.* fruit, *g''.* embryo, side view, *h''.* CS of embryo, showing cotyledons free on one side, all  $\times \frac{1}{2}$  (*a-d* HO 41, *a'-b'*, *d'-e'* CHEW WEE LER 1346, *c'* SAN 16161, *a''-e''* SAN 40615, *f''-h''* SAN 19696a).

mm, not articulated. *Flower-buds* lanceolate, 12–15 by  $3\frac{1}{2}$ – $4\frac{1}{2}$  mm, rostrate. *Calyx* 12–15 mm long, circumscissile, puberulous outside. *Petals* imbricate, elliptic-oblong, sometimes lanceolate, 7–12 by  $2\frac{1}{2}$ –4 mm, densely hairy outside, sparsely hairy and papillose at the base inside. *Stamens*  $\infty$  (more than 100); filaments  $2\frac{3}{4}$ –7 mm, sparsely hairy; anthers oblong, c.  $\frac{2}{3}$  mm long. *Torus* subglobose, c.  $1\frac{1}{2}$  mm  $\varnothing$ . *Ovary* subglobose,  $\frac{1}{2}$ – $\frac{3}{4}$  mm  $\varnothing$ , glabrous; stipe 1– $2\frac{1}{2}$  mm; style  $2\frac{1}{2}$ – $3\frac{1}{2}$  mm, terminal. *Drupe* sessile, globose, 3–4 cm  $\varnothing$ , brown, densely lenticellate; embryo depressed-globose,  $1\frac{3}{4}$ – $2\frac{3}{4}$  cm  $\varnothing$ ; cotyledons free.

Distr. *Malesia*: Sumatra (Atjeh, Tapanuli, Muara Pedjangki, P. Gelang, Indragiri).

Ecol. Lowland forest and marshy places, from sea-level to 60 m. *Fl.* May, June; *fr.* May–June, Sept.–Oct.

Vern. *Rəngai, rəngas, rəngé, M.*

7. *Gluta macrocarpa* (ENGL.) DING HOU, *Blumea* 24 (1978) 140. — *Melanorrhoea macrocarpa* ENGL. in DC. Mon. Phan. 4 (1883) 236; RIDL. Fl. Mal. Pen. 1 (1922) 530; MERR. Pl. Elm. Born. (1929) 42.

Tree up to 45 m high and 80 cm  $\varnothing$ . Buttresses occasionally present, 3–6 m high, 1–2 m wide. Bark grey or rusty, smooth or scaly. *Leaves* subcoriaceous, elliptic-oblong to lanceolate, or obovate-oblong, 10–19 by 3– $8\frac{1}{2}$  cm, glabrous; base cuneate; apex shortly acuminate, or rounded; nerves 12–15 pairs, elevated beneath, flat above; veins reticulate, or transverse and parallel, often faint on both surfaces; petiole 1–3 cm. *Panicles* up to 15 cm long, pubescent; pedicels 1– $3\frac{1}{2}$  mm, articulated. *Flower-buds* ovoid-oblong or lanceolate, 5–6 by  $1\frac{1}{2}$ –2 mm, acuminate. *Calyx* 5–6 mm long, circumscissile, puberulous outside. *Petals* white, yellow at the base, almost valvate except at the apical part, lanceolate to linear, 4–7 by  $\frac{3}{4}$ –1 mm, puberulous outside, sparsely hairy and papillose at the lower half inside. *Stamens* usually c. 20 with a few filamentous staminodes, very rarely up to 28,  $5\frac{1}{2}$ –6 mm; filaments sparsely hairy; anthers ovoid or oblong, c.  $\frac{2}{3}$  mm long. *Torus* subglobose, c. 1 mm  $\varnothing$ . *Ovary* broadly ellipsoid, c. 1 mm  $\varnothing$ , glabrous; stipe 1–3 mm; style terminal,  $1\frac{1}{4}$ – $2\frac{1}{2}$  mm. *Drupe* on a centric stalk ( $\frac{2}{3}$ – $1\frac{3}{4}$  cm), subglobose, 2–4 cm  $\varnothing$ , brown, reddish brown, or purplish black, smooth; wing-like, enlarged petals rarely present, narrowly elliptic or oblanceolate, up to 3 by  $\frac{1}{2}$  cm; embryo subglobose,  $1\frac{3}{4}$ –3 cm  $\varnothing$ ; cotyledons free.

Distr. *Malesia*: Malaya (Langkawi Is., Perak, Trengganu, Selangor) and Borneo (Sabah: Tawau, Nunukan I.; Sarawak: Anap; Kalimantan: Balikpapan).

Ecol. Primary and mixed dipterocarp forest, sometimes on sandy ridges, from the lowland up to 1200 m. *Fl.* May, July, Oct.; *fr.* July, Oct., Dec.–Jan.

Vern. *Rəngas, M.*

8. *Gluta curtisii* (OLIV.) DING HOU, *Blumea* 24 (1978) 13. — *Melanorrhoea curtisii* OLIV. in Hook. Ic. Pl. 16 (1886) t. 1513; KING, J. As. Soc. Beng. 65, ii (1896) 486; RIDL. Fl. Mal. Pen. 1 (1922) 530; BURK. Dict. (1935) 1437; CORNER, Ways. Trees (1940) 120, f. 27.

Tree up to 30 m high and 80 cm  $\varnothing$ . Buttresses occasionally present, up to  $2\frac{1}{2}$  m high, 10 cm thick. Bark brown, flaky. *Leaves* coriaceous, elliptic-oblong, rarely oblanceolate, 8–14 by  $2\frac{1}{2}$ – $4\frac{1}{2}$  cm, glabrous; base cuneate or attenuate; apex obtuse, sometimes shortly acuminate, rarely emarginate; nerves 9–18 pairs, slightly elevated beneath, flat, distinct or faint above; veins reticulate, or transverse and parallel, distinct beneath or on both surfaces, sometimes faint above; petiole  $1\frac{1}{2}$ – $2\frac{1}{4}$  cm. *Panicles* 6–17 cm long, puberulous, glabrescent; pedicels  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm, articulated. *Flower-buds* lanceolate, 5–6 by  $1\frac{1}{2}$ –2 mm, acuminate. *Calyx* 5–6 mm long, circumscissile, sparsely puberulous outside, densely hairy at the apical part on both surfaces. *Petals* white or pale lilac, contorted or imbricate, narrowly lanceolate, or linear,  $4\frac{1}{2}$ –6 by 1 mm, densely puberulous outside, papillose at the central part inside. *Stamens* (8–)10, 3–4 mm; filaments sparsely hairy; anthers oblong, c.  $\frac{1}{2}$  mm long. *Torus* subglobose, 1– $1\frac{1}{4}$  mm  $\varnothing$ . *Ovary* subglobose, c.  $\frac{1}{2}$  mm  $\varnothing$ , glabrous; stipe 1–2 mm; style terminal. *Drupe* on a centric stalk ( $\frac{2}{3}$ – $1\frac{1}{2}$  cm); wing-like, enlarged petals narrowly oblanceolate, 5–9 by  $1\frac{1}{2}$ –2 mm; embryo subglobose, c. 1 cm  $\varnothing$ ; cotyledons free.

Distr. *Malesia*: Malay Peninsula (Kedah, Perak, Kelantan, Pahang, Penang).

Ecol. Mixed forest, from the lowland up to 1200 m. *Fl.* March–Nov.; *fr.* May–July.

Uses. Timber is hard and red (BURKILL, l.c. 1437); logs are left in the forest for weathering before extraction.

Vern. *Rəngas, r. marah keluang, M.*

9. *Gluta oba* (MERR.) DING HOU, *Blumea* 24 (1978) 14. — *Melanorrhoea oba* MERR. J. Str. Br. R. As. Soc. n. 77 (1917) 190; En. Born. (1921) 350; SMYTHIES, Common Sarawak Trees (1965) 9. — Fig. 18a'–e'.

Tree up to 30 m high, 60 cm  $\varnothing$ . Buttresses up to  $1\frac{1}{4}$  m high,  $\frac{2}{3}$  m wide, 10 cm thick. Bark bright grey or brownish, scaly. *Leaves* coriaceous, elliptic, broadly elliptic, or obovate, 5–14 by  $2\frac{1}{4}$ –8 cm; glabrous; base cuneate or attenuate; apex obtuse, sometimes slightly acute; nerves 9–11 pairs, slightly elevated beneath, distinct above; veins reticulate, distinct beneath, sometimes faint above; petiole  $\frac{3}{4}$ – $1\frac{1}{2}$  cm. *Panicles* up to 20 cm long, glabrous; pedicels 8–16 mm, not articulated. *Flower-buds* lanceolate, c. 6 by 2 mm, acuminate. *Calyx* c. 6 mm long, circumscissile, glabrous except hairy at the apical part on both surfaces. *Petals* white, valvate, linear or spatulate, 6–7 by  $\frac{3}{4}$  mm, puberulous outside. *Stamens* 10, 3–5 mm; filaments sparsely hairy; anthers oblong,  $\frac{3}{4}$  mm long. *Torus* ellipsoid,  $1\frac{1}{2}$ –2 mm long. *Ovary* subglobose,  $\frac{3}{4}$ –1 mm  $\varnothing$ , glabrous; stipe 1– $1\frac{1}{2}$  mm; style 1– $1\frac{1}{2}$  mm, terminal. *Drupe* on a centric stalk (1– $1\frac{3}{4}$  cm), subglobose, 3–4 cm  $\varnothing$ , dark brown, smooth; without wing-like, enlarged petals; embryo subglobose,  $2\frac{1}{2}$ –3 cm  $\varnothing$ ; cotyledons free.

Distr. *Malesia*: Borneo (Sabah: Lahad Datu, Leila, Sepilok; Sarawak: Matang, Santubong, Semengoh Arboretum, Bako Nat. Park, Sadong).

Ecol. Lowland forest, sometimes on ultrabasic soil. *Fl.* Febr.–April; *fr.* April, Sept., Oct.

Vern. *Oba, rəngas.*

**10. *Gluta malayana* (CORNER) DING HOU**, *Blumea* 24 (1978) 14. — *Melanorrhoea pilosa* RIDL. Kew Bull. (1931) 448, *nom illeg.*, *non* LECOMTE, 1908. — *Melanorrhoea malayana* CORNER, Gard. Bull. S. S. 10 (1939) 261, *nom. nov.* for *M. pilosa* RIDL.; Ways. Trees (1940) 120; KOCHUM. Mal. For. Rec. 17 (1964) 297. — Fig. 19.

Big deciduous tree up to 45 m high, with heavy dome-like crown and steep and rather narrow buttresses. Bark pinkish grey to light greyish fawn, with fine, close, transverse furrows, becoming slightly dippled scaly (CORNER). *Leaves* coriaceous, obovate-oblong, elliptic, or elliptic-lanceolate, 16 $\frac{1}{2}$ –32 by 7–14 cm, pubescent on both surfaces when young, usually glabrescent except especially on the midrib and nerves; base cuneate; apex obtuse, sometimes acute, or emarginate; nerves 17–27 pairs, prominent beneath, distinct or faint above; veins reticulate, or transverse and parallel, often distinct on both surfaces; petiole obscure or very short (c.  $\frac{1}{3}$  cm). *Panicles* up to 23 $\frac{1}{2}$  cm long, appearing before or with the young leaves; pedicels 1 $\frac{1}{2}$ –4 mm, not articulated. *Flower-buds* ovoid-oblong, 3 $\frac{1}{2}$ –5 by 1 $\frac{1}{4}$ –2 mm, acuminate. *Calyx* 3 $\frac{1}{2}$ –5 mm long, circumscissile, puberulous outside.



Fig. 19. *Gluta malayana* (CORNER) DING HOU. A huge tree with high buttresses at Chaar, Johore (Photogr. CORNER).

*Petals* imbricate, lanceolate or linear, 3–5 by 1–1 $\frac{1}{2}$  mm, puberulous outside, papillose and pilose inside; the central part of the lower  $\frac{2}{3}$  mm longitudinally adnate to the torus. *Stamens* 5, c. 2 $\frac{3}{4}$  mm, filaments hairy; anthers oblong, c.  $\frac{1}{2}$  mm long. *Torus* cylindrical, c. 1 mm long. *Ovary* subglobose,  $\frac{1}{2}$ – $\frac{3}{4}$  mm  $\varnothing$ , glabrous; stipe  $\frac{1}{3}$ –1 mm; style terminal,  $\frac{1}{3}$ –1 $\frac{1}{2}$  mm. *Drupe* on a centric stalk (1 $\frac{1}{4}$ –1 $\frac{1}{2}$  cm), subglobose, c. 3 $\frac{1}{4}$  cm  $\varnothing$ , brown or dark brown, smooth; sometimes with wing-like, enlarged, lanceolate petals, 1–2 by  $\frac{1}{3}$  cm, rose-red when fresh; embryo subglobose, c. 2 $\frac{1}{2}$  cm  $\varnothing$ ; cotyledons free.

Distr. *Malesia*: Sumatra (Bengkalis, Karimun) and Malay Peninsula (Pahang, Johore).

Ecol. Lowland forest. *Fl.* Febr., April; *fr.* Jan.–May.

Vern. *kərbau jělang, rěngas, M, kilakap*, Bengkulu.

**11. *Gluta torquata* (KING) TARD.** *Adansonia* 1 (1961) 195, t. 1, f. 15. — *Melanorrhoea torquata* KING, J. As. Soc. Beng. 65, ii (1896) 486; RIDL. Fl. Mal. Pen. 1 (1922) 531; STEPHENS, Mal. For. 18 (1955) 160; KOCHUM. Mal. For. Rec. 17 (1964) 297.

Tree up to 30 m high and 1 $\frac{1}{4}$  m  $\varnothing$ . Buttresses occasionally present, steep, up to 3 m high,  $\frac{1}{2}$  m wide. Bark light brown, finely dippled. *Leaves* (pseudo-whorled) coriaceous, obovate, obovate-oblong, or broadly elliptic, 15–24(–35) by 9–13 $\frac{1}{2}$  (–18) cm, glabrous, sometimes puberulous on the lower surface especially on the midrib and nerves when young, glabrescent; base cuneate; apex round or slightly emarginate; nerves 16–29 pairs, prominent beneath, slightly elevated above; veins reticulate, or transverse and parallel, often faint on both surfaces, sometimes distinct beneath; petiole  $\frac{3}{4}$ –2 cm. *Panicles* 17–30 cm long, tomentose; pedicels 2 $\frac{1}{2}$ –4 $\frac{1}{2}$  mm, not articulated. *Flower-buds* ovoid, 2–3 by 1 $\frac{1}{2}$ –2 mm, obtuse. *Calyx* 2–3 mm, bursting irregularly (sometimes hanging round the pedicel like a loose collar), puberulous outside. *Petals* white, imbricate, oblanceolate, lanceolate, or narrow-oblong, 5–6 by 1–1 $\frac{1}{2}$  mm, densely puberulous on both surfaces; basal part  $\frac{3}{4}$ –1 mm longitudinally adnate to the torus. *Stamens* 5, 5 mm; filaments pilose; anthers oblong,  $\frac{3}{4}$  mm long. *Torus* cylindrical, c. 1 $\frac{1}{2}$  mm long. *Ovary* subglobose, c. 1 mm  $\varnothing$ , pilose; stipe 1–1 $\frac{1}{2}$  mm; style terminal, 1 $\frac{1}{2}$ –2 mm. *Drupe* on a centric stalk (c. 1 cm), subglobose, 3 $\frac{3}{4}$  cm  $\varnothing$ , brown, smooth; without wing-like, enlarged petals; embryo subglobose, 2 $\frac{3}{4}$ –3 cm  $\varnothing$ ; cotyledons free.

Distr. *Malesia*: Sumatra (Tapanuli) and Malay Peninsula (Perak, Dindings, Selangor, Johore).

Ecol. Lowland forest. *Fl.* Febr.–March; *fr.* June.

Vern. *Rěngas těrbanjalang, M, sitorngom horbodjalang*, Tapanuli.

**12. *Gluta sabahana* DING HOU**, *Blumea* 24 (1978) 16. — Fig. 18a"–h".

Tree up to 30 m high and 60 cm  $\varnothing$ . Buttresses occasionally present, up to  $\frac{1}{2}$  m high, 1 m wide, 15 cm thick. Bark dark brown, smooth. *Leaves* (pseudo-whorled) coriaceous, oblanceolate, or narrowly elliptic, 13–23 by 3–8 cm, glabrous; base cuneate to decurrent; apex acuminate, sometimes acute; nerves 9–15 pairs, distinct on both surfaces; veins

reticulate, often faint on both surfaces; petiole often very short,  $\frac{1}{4}$ – $\frac{3}{4}$  cm, sometimes some leaves with petiole up to  $1\frac{1}{2}$  cm. *Panicles* 7–15 cm long, puberulous; pedicels 3–6 mm, not articulated. *Flower-buds* ellipsoid, 4– $5\frac{1}{2}$  by  $1\frac{1}{2}$ –2 mm, obtuse. *Calyx* 4– $5\frac{1}{2}$  mm long, bursting irregularly, puberulous outside. *Petals* whitish or pale yellow, imbricate, oblanceolate, 5– $7\frac{1}{2}$  by 1– $1\frac{1}{4}$  mm, puberulous outside, densely papillose usually at the lower half inside; the basal c. 1 mm longitudinally adnate to the torus. *Stamens* 5(–7), 5–6 mm; filaments glabrous; anthers oblong, 1– $1\frac{1}{4}$  mm. *Torus* cylindrical, 1– $1\frac{1}{4}$  mm long. *Ovary* obovoid, 1– $1\frac{1}{2}$  mm long, puberulous; stipe obscure; style lateral, 3–4 mm. *Drupe* on an obscure, excentric stalk, obliquely broadly ellipsoid,  $7\frac{1}{2}$ –9 by 5– $6\frac{1}{2}$  by  $3\frac{1}{2}$ –5 cm, brownish, scurfy; embryo subreniform, 3– $4\frac{1}{2}$  by 5 cm; cotyledons incompletely fused, free on one side, free part c. 1 cm deep.

Distr. *Malesia*: Borneo (Sabah: Sepilok, Kinabatangan, Tawau, Mostyn).

Ecol. Lowland forest, sometimes in swampy places. *Fl.* Febr.–Sept.; *fr.* May–Dec.

Vern. *Rēngas*, M, *rēngas mangga*, Kadayan.

### 13. *Gluta laxiflora* RIDL. Kew Bull. (1933) 196.

Tree up to 24 m high and 60 cm  $\varnothing$ . Buttresses occasionally present, low and round. Bark rust brown and light grey mottled, flaky. *Leaves* coriaceous, elliptic-lanceolate, rarely oblanceolate, 9–28 by 3–9 cm, glabrous; base cuneate, sometimes unequal; apex acuminate; nerves 11–17 pairs, prominent beneath, slightly elevated or flat above; veins reticulate, usually distinct beneath, sometimes distinct on both surfaces; petiole 2–5 cm. *Panicles* up to 12 cm long, puberulous; pedicels 4–6 mm, not articulated. *Flower-buds* ellipsoid, 5 by  $2\frac{1}{2}$  mm, obtuse. *Calyx* 5 mm long, bursting irregularly, puberulous outside. *Petals* imbricate, narrowly elliptic, 8–9 by  $1\frac{1}{4}$ –2 mm, puberulous outside, papillate inside; basal  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm longitudinally adnate to the torus. *Stamens* 5 (or 6),  $4\frac{1}{2}$ – $5\frac{1}{2}$  mm; filaments glabrous; anthers oblong, c.  $1\frac{1}{2}$  mm long. *Torus* cylindrical, 2–3 mm long. *Ovary* obovoid,  $1\frac{1}{2}$  mm long, puberulous; stipe obscure; style lateral, 4 mm. *Drupe* on an obscure, excentric stalk, obliquely ellipsoid or broadly ellipsoid,  $7\frac{1}{2}$ –9 by 5–6 cm, brown or reddish brown, scurfy; embryo subreniform, 5– $6\frac{1}{2}$  by 3– $4\frac{1}{2}$  cm; cotyledons incompletely fused, free on one side, free part  $1\frac{1}{2}$ –2 cm deep.

Distr. *Malesia*: Borneo (Brunei; Sarawak: Baram R., Bintulu, Kapit, Tatau).

Ecol. Lowland primary or mixed dipterocarp forest. *Fl.* March; *fr.* May, June, Dec.

Vern. *Rēngas*.

14. *Gluta wrayi* KING, J. As. Soc. Beng. 65, ii (1896) 482; RIDL, J. Str. Br. R. As. Soc. n. 49 (1907) 16, *excl. descr. fr.*; Fl. Mal. Pen. 1 (1922) 528; BURK, Gard. Bull. S. S. 5 (1931) 226; Dict. (1935) 1080; TARD, Fl. C. L. & V. 2 (1962) 122, t. 5, f. 1; KOCHUM, Mal. For. Rec. 17 (1964) 264. — *G. virosa* RIDL, J. Str. Br. R. As. Soc. n. 75 (1917) 27; Fl. Mal. Pen. 1 (1922) 528. — *Mangifera* sp. KING, J. As. Soc. Beng. 65, ii (1896) 479, *in note*, *quoad* KING's Coll. 7744.

Tree up to 30 m high and 85 cm  $\varnothing$ , occasionally with steep plank buttresses up to 3 m high. Bark

brown, green- or orange-brown, rugose or shallowly dimpled. *Leaves* subcoriaceous, elliptic to elliptic-lanceolate, rarely oblanceolate, (6–)10–26 by ( $1\frac{3}{4}$ –) $3\frac{1}{2}$ –9 cm, glabrous; base cuneate or attenuate; apex acuminate; nerves 9–14 pairs, slightly elevated beneath, faint above; veins often distinct on both surfaces; petiole  $\frac{2}{3}$ – $4\frac{1}{2}$  cm. *Panicles* up to 8 cm long, puberulous; pedicels 2–6 mm, not articulated. *Flower-buds* ellipsoid, 8–9 by 2–3 mm, acuminate. *Calyx* 8–9 mm long, bursting irregularly, puberulous outside. *Petals* white, 5 (or 6), imbricate, narrowly oblanceolate, 10–13 by  $2\frac{1}{2}$  mm, puberulous outside, papillose on the inside; the basal 1–3 mm longitudinally adnate to the torus. *Stamens* 5 (or 6), 7 mm; filaments glabrous; anthers oblong,  $1\frac{1}{4}$  mm long. *Torus* cylindrical,  $1\frac{1}{2}$ –4 mm long. *Ovary* broadly obovoid, 2 mm long, densely puberulous; stipe obscure; style lateral, 6 mm. *Drupe* on an obscure, centric stalk, ellipsoid,  $6\frac{1}{2}$ –7 by 3– $4\frac{1}{2}$  cm (10– $12\frac{1}{2}$  by  $7\frac{1}{2}$  cm, *cf.* BURKILL, l.c. 227), light brown or brown; scurfy; without enlarged petals; embryo ellipsoid, 3– $4\frac{1}{2}$  by  $1\frac{3}{4}$ –3 cm; cotyledons incompletely fused, free on one side, free part  $\frac{1}{2}$ – $\frac{3}{4}$  cm deep.

Distr. Peninsular Thailand, S. Vietnam, and *Malesia*: Malay Peninsula (Perak, Dindings, Kelantan, Trengganu, Selangor, Penang).

Ecol. Lowland forests, sometimes on granite ridges, up to c. 800 m. *Fl.* Jan.–March; *fr.* March–Nov.

Uses. The timber is beautiful deep red with black concentric bands sometimes called Straits mahogany (Burkill, l.c.).

Vern. *Rēngas*, r. *ayēr*, M, r. *kērbau jalang*, Malaya.

15. *Gluta wallichii* (HOOK. f.) DING HOU, Blumea 24 (1978) 21. — *Melanorrhoea wallichii* HOOK. f. Fl. Br. Ind. 2 (1876) 25; ENGL. in DC. Mon. Phan. 4 (1883) 235; KING, J. As. Soc. Beng. 65, ii (1896) 485; RIDL, Fl. Mal. Pen. 1 (1922) 529, f. 52; HEYNE, Nutt. Pl. (1927) 973; BURK, Dict. (1935) 1438; CORNER, Gard. Bull. S. S. 10 (1939) 260; Ways, Trees (1940) 120 ("*wallichiana*"); KOCHUM, Mal. For. Rec. 17 (1964) 298. — *Melanorrhoea maingayi* HOOK. f. Fl. Br. Ind. 2 (1876) 25; ENGL. in DC. Mon. Phan. 4 (1883) 235; KING, J. As. Soc. Beng. 65, ii (1896) 484. — *Swintonia obtusifolia* ENGL. in DC. Mon. Phan. 4 (1883) 231; MERR. EN. BORN. (1921) 350. — *Melanorrhoea woodsiana* SCORT. ex KING, J. As. Soc. Beng. 65, ii (1896) 485; RIDL, Fl. Mal. Pen. 1 (1922) 530; CORNER, Gard. Bull. S. S. 10 (1939) 261; Ways, Trees (1940) 120, f. 27; KOCHUM, Mal. For. Rec. 17 (1964) 298; SMYTHIES, Common Sarawak Trees (1965) 9. — *Swintonia elmeri* MERR. Pl. Elm. Born. (1929) 167. — Fig. 20–22.

Large, evergreen tree up to 45 m high and 70 cm  $\varnothing$ . Buttresses  $1\frac{1}{2}$ –4 m high,  $\frac{1}{2}$ –1 m wide, 8–10 cm thick. Bark greyish brown, flaky, or distinctly rugose-fissured. *Leaves* coriaceous, obovate-oblong, elliptic-lanceolate, or elliptic,  $8\frac{1}{2}$ – $34\frac{1}{2}$  by 4–14 cm, glabrous, sometimes tomentose and glabrescent beneath; base cuneate, sometimes obtuse; apex obtuse, acuminate, sometimes slightly emarginate; nerves 9–24 pairs, prominent beneath, distinct above; veins reticulate-scalariform, distinct on both surfaces; petiole 2–6 cm. *Panicles*  $16\frac{1}{2}$ –33



Fig. 20. *Gluta wallichii* (HOOK. f.) DING HOU. Cultivated in Hort. Bog. VII-D-75a, from Riau, March 1958.

cm long, pubescent, sometimes glabrescent; pedicels  $2\frac{1}{2}$ -3 mm, articulated. *Flower-buds* ovoid,  $3-3\frac{3}{4}$  by  $1\frac{3}{4}$ -2 mm, obtuse. *Calyx* red,  $3-3\frac{3}{4}$  mm long, bursting irregularly, puberulous outside. *Petals* white, imbricate, ovate-oblong, lanceolate, or elliptic, 4-7 by  $1\frac{3}{4}$ - $2\frac{1}{2}$  mm, villose on both surfaces. *Stamens* 5,  $2\frac{1}{3}$ -4 mm; filaments pilose, glabrescent; anthers oblong,  $\frac{3}{4}$  mm long. *Torus* pulvinate, c.  $1\frac{1}{2}$  mm  $\varnothing$ . *Ovary* subglobose, c.  $1\frac{1}{2}$  mm  $\varnothing$ , pilose; stipe obscure; style lateral,  $2-2\frac{1}{4}$  mm. *Drupe* on an obscure, centric stalk, ovoid or ellipsoid, c.  $1\frac{1}{2}$  by 1 cm, smooth, brownish; wing-like, enlarged petals red, elliptic-oblong or -lanceolate,  $5\frac{1}{4}$ -8 by  $1\frac{1}{4}$ - $1\frac{1}{4}$  cm; embryo ovoid or broadly ellipsoid, c.  $1\frac{1}{4}$  by  $\frac{3}{4}$  cm; cotyledons free.

*Distr. Malesia:* widely distributed in Sumatra, Malay Peninsula, and Borneo (Brunei, Sabah, Sarawak, Kalimantan).

*Ecol.* Swampy or dryland forest, in peat-swamp forest in Palembang often co-dominant (HEYNE), sometimes on limestone, in Malaya common on hillsides, up to 500 m. *Fl. fr.* Jan.-Dec.

In the south of Malaya trees flower early in the year, about a month after the Christmas rains have ceased. The shabby green, rather narrow crowns are then whitened with blossom and are rendered prominent throughout the forest. Trees may be deciduous, perhaps, in northern Malaya (CORNER, *l.c.*).

*Uses.* ENDERT (Tectona 13, 1920, 123) finds the heartwood a superior timber and in Malaya judgement is similar, but a great objection against its use is that it retains long its *renghas*-poison quality (HEYNE, *l.c.* 973). The fruit is mixed into dart-poison by the Besi in Malaya (BURKILL, *l.c.*).

*Vern.* Malaya: *rēngas*, *r. ayēr*, *r. burung*, *r. kērbau jalang*, *r. manuk*, *r. paya*, *r. sumpah blawak*, M; Borneo: *r. tujung*, Kutai.



Fig. 21. *Gluta wallichii* (Hook. f.) DING HOU. Trengganu, Malaya; showing fissured bark, white sapwood with darkening resin stains and dark red-brown heartwood (Photogr. DING HOU (773)).

16. *Gluta capituliflora* DING HOU, *Blumea* 24 (1978) 13. — *G. cambodiana* (non PIERRE) BURK. Bull. Gard. S. S. 5 (1931) 229.

Tree up to 24 m high and 49 cm  $\varnothing$ , occasionally with short buttresses up to  $\frac{2}{3}$  m high. Bark brown, smooth. Leaves subcoriaceous, elliptic to narrowly elliptic, or lanceolate, 5–17 $\frac{1}{2}$  by 1–5 $\frac{1}{2}$  cm; base cuneate to attenuate; apex acute to acuminate; nerves 6–14 pairs, slightly elevated on both surfaces; veins rather fine, reticulate, distinct on both surfaces; petiole 1–2(–3) cm. Panicles 8–10 $\frac{1}{2}$  cm long, puberulous; pedicels c.  $\frac{1}{4}$  mm, not articulated. Flowers crowded at the end of branchlets. Calyx 4–5 mm long, bursting irregularly, puberulous outside. Petals imbricate, narrowly elliptic, 9–10 by 1 $\frac{3}{4}$ –2 mm, puberulous outside, papillose inside. Stamens 5, 5–7 mm; filaments

glabrous; anthers oblong,  $\frac{1}{2}$ – $\frac{2}{3}$  mm. Torus cylindrical, 3 $\frac{1}{2}$ –4 mm long. Ovary obliquely ellipsoid, c. 1 mm long, glabrous; stipe  $\frac{3}{4}$ –1 mm; style lateral, 3–4 mm. Drupe bent almost horizontally, on a lateral stalk (c.  $\frac{1}{2}$  cm), broadly ellipsoid, 6–8 $\frac{1}{2}$  by 4–5 $\frac{3}{4}$  by 3 $\frac{1}{2}$ –4 $\frac{3}{4}$  cm, light brown, scurfy; embryo subreniform, 5 $\frac{1}{2}$ –7 by 3 $\frac{1}{2}$ –4 $\frac{1}{2}$  by 2 $\frac{1}{2}$ –3 cm; cotyledons incompletely fused, free on one side, free part 2 $\frac{3}{4}$ –3 $\frac{3}{4}$  cm deep.

Distr. Malesia: Malay Peninsula (Trengganu, Kelantan).

Ecol. Primary forest, sometimes along riverbanks, up to 300 m. Fl. Oct.; fr. June, July.

17. *Gluta lanceolata* RIDL. J. Str. Br. R. As. Soc. n. 49 (1907) 17; Fl. Mal. Pen. 1 (1922) 527; BURK. Gard. Bull. S. S. 5 (1931) 228.



Fig. 22. Same as in fig. 21, cut tree with dark exudate of resin.

A big tree. *Leaves* subcoriaceous, narrowly elliptic, or lanceolate, 11–19(–27) by  $1\frac{3}{4}$ – $4\frac{1}{2}$  cm, glabrous; base attenuate; apex acuminate, rarely obtuse; nerves 9–15 pairs, rather fine, slightly elevated on both surfaces, sometimes hardly distinct from the veins; veins reticulate, distinct or faint on both surfaces; petiole ( $2\frac{1}{2}$ –) $3\frac{1}{2}$ – $7\frac{1}{2}$  cm. *Panicles* 7–9 cm long, puberulous; pedicels 1–2 mm, not articulated. *Calyx* 5– $5\frac{1}{2}$  mm long, bursting irregularly, puberulous outside. *Petals* imbricate, narrowly oblanceolate, 10– $12\frac{1}{2}$  by  $1$ – $1\frac{1}{4}$  mm, puberulous outside and at the apical part inside, papillose on the central part inside; the basal 5–6 mm narrowed and completely adnate to the torus. *Stamens* 5, 6– $7\frac{1}{2}$  mm; filaments glabrous; anthers oblong, c. 1 mm long. *Torus* cylindrical, 6–7 mm long. *Ovary* subglobose, c. 1 mm  $\emptyset$ , glabrous; stipe obscure; style lateral, 3–4 mm. *Drupe* on an obscure, centric stalk, globose, c.  $3\frac{1}{2}$  cm  $\emptyset$ , black, shining;

without enlarged petals; embryo subglobose, c.  $2\frac{1}{2}$  cm  $\emptyset$ ; cotyledons incompletely fused, free on one side, free part c. 1 cm deep.

*Distr. Malesia:* Malay Peninsula (Kedah, Penang), only three collections seen.

*Ecol.* Mixed rain-forest, up to 450 m. *Fl.* June; *fr.* Sept.

18. *Gluta tavoyana* WALL. ex HOOK. *f.* Fl. Br. Ind. 2 (1876) 22; KURZ, Fl. Burma 1 (1877) 309; ENGL. in DC. Mon. Phan. 4 (1883) 226; CRAIB, Fl. Siam. En. 1 (1926) 347; TARD. Fl. C. L. & V. 2 (1962) 123, t. 4, f. 9–13. — *Syndesmis* sp. GRIFF. Notul. 4 (1854) 410. — *G. elegans* var. *helferi* HOOK. *f.* Fl. Br. Ind. 2 (1876) 22; ENGL. in DC. Mon. Phan. 4 (1883) 225; KING, J. As. Soc. Beng. 65, ii (1896) 481. — *G. elegans* var. *curtisii* BURK. Gard. Bull. S. S. 5 (1931) 228.

Tree up to 30 m high and 30 cm  $\emptyset$ . *Leaves*

subcoriaceous, obovate-oblong, elliptic-oblong, or lanceolate, 5–16(–30) by  $2\frac{1}{2}$ – $5\frac{1}{2}$ (–8) cm; base cuneate; apex obtuse, acute, rarely acuminate; nerves 7–20 pairs, slightly elevated, sometimes hardly distinguishable from the fine, distinct, reticulate veins on both surfaces; petiole  $1\frac{1}{2}$ –4 cm. *Panicles* up to  $15\frac{1}{2}$  cm long, puberulous; pedicels

2– $5\frac{1}{2}$  mm, not articulated. *Flower-buds* ellipsoid,  $5\frac{1}{2}$ –7 by 2–3 mm, acuminate. *Calyx* scarlet,  $5\frac{1}{2}$ –7 mm long, bursting irregularly, puberulous outside. *Petals* white, imbricate, oblanceolate or narrowly elliptic, 9–11 by  $1\frac{3}{4}$ – $2\frac{1}{4}$  mm, puberulous outside, papillose on the middle part inside; the central part of the basal  $3\frac{1}{2}$  mm longitudinally



Fig. 23. *Gluta elegans* (WALL.) HOOK. f. at P. Langkawi, Malaysia (Photogr. VAN BALGOOY, Febr. 1975).

adnate to the torus. *Stamens* (4 or) 5, 5–8 mm; filaments glabrous; anthers oblong, c. 1 mm long. *Torus* cylindrical, 3½ mm long. *Ovary* broadly ellipsoid or globose, c. 1 mm Ø, glabrous; stipe obscure; style lateral, 4–5 mm. *Drupe* on a centric stalk (c. ¾ cm), globose, c. 3½ cm Ø, brown, scurfy; without enlarged petals; embryo globose, c. 2½ cm Ø; cotyledons imperfectly fused, free on one side, free part 1½–2/3 cm deep.

Distr. Andaman Is. (?), Burma, Thailand, Vietnam, China (?Hainan), and *Malesia*: Malay Peninsula (Johore, Penang) and E. Sumatra (Lingga and Singkep Is.).

Ecol. Lowland and beach forest, up to 300 m. Fl. Febr., July; fr. Oct.

Vern. *Mirah*, k., M.

**19. *Gluta elegans* (WALL.) HOOK. f. Fl. Br. Ind. 2 (1876) 22; KURZ, Fl. Burma 1 (1877) 310; ENGL. in DC. Mon. Phan. 4 (1883) 225; KING, J. As. Soc. Beng. 65, ii (1896) 481; RIDL, Fl. Mal. Pen. 1 (1922) 527; BURK. Gard. Bull. S. S. 5 (1931) 227, excl. var. *curtisii* BURK.; Dict. (1935) 1079; CORNER, Ways. Trees (1940) 118, f. 25; KOCHUM, Mal. For. Rec. 17 (1964) 264. — *Syndesmis elegans* WALL. in Roxb. Fl. Ind. ed. Wall. 2 (1824) 315; Cat. (1829) n. 1003. — Fig. 23.**

Tree up to 20 m high and 26 cm Ø. Bark grey, smooth. Young foliage intensely violet. *Leaves* subcoriaceous or coriaceous, elliptic to elliptic-lanceolate, rarely oblanceolate, 6–17½ by 2–6½ cm, glabrous; base attenuate or acute; apex acuminate; nerves 7–14 pairs, slightly elevated on both surfaces; veins reticulate, distinct on both surfaces; petiole (¾–)1½–4(–6½) cm. *Panicles* 4–7 cm long, sparsely puberulous; pedicels 4–7 mm, not articulated. *Flower-buds* ellipsoid, 5–7½ by 2–3½ mm, obtuse. *Calyx* red or pink, 5–7½ mm long, bursting irregularly, glabrous, very rarely sparsely puberulous outside. *Petals* white, imbricate, narrowly lanceolate or oblanceolate, 11–15 by 1¼–2 mm, glabrous, except the ciliate margin and papillose at the central part inside; the central part of the basal 4½–5½ mm longitudinally adnate to the torus. *Stamens* 5, 6–7½ mm; filaments glabrous; anthers oblong, c. 1 mm long. *Torus* cylindrical, 5–6 mm long. *Ovary* subglobose or obliquely ovoid, c. 1 mm Ø, glabrous; stipe c. 1 mm; style lateral, 5–9 mm. *Drupe* on a lateral stalk (c. ¾ cm), obliquely ovoid or broadly ellipsoid, rather flat, blackish, 3½–5½ by 3–4½ by 1¾–3 cm, smooth, blackish; without enlarged petals; embryo similar the drupe in shape, 2½–3½ by 2–3 by 1½–2 cm; cotyledons incompletely fused, free on one side, free part 1½–2½ cm deep.

Distr. Peninsular Thailand and *Malesia*: Malay Peninsula (Perak, Kelantan, Trengganu, Penang, Langkawi).

Ecol. Lowland forest, up to 300 m. Young foliage is intensely violet (CORNER, l.c.). Fl. July, Sept., Dec.–Febr.; fr. Febr., March, Oct.

Vern. *Rengas*, r. *kérbán jalang*, r. *putah*, M.

Note. Flowers were deformed in some specimens; such a flower, 3–6 mm long, consists of petal-like floral parts.

**20. *Gluta velutina* BL. Mus. Bot. 1 (1850) 183; MERR. En. Born. (1921) 349; BURK. Gard. Bull. S. S. 5 (1931) 225; Dict. (1935) 1080; CORNER,**

*Ways. Trees* (1940) 118; TARD. Fl. C. L. & V. 2 (1962) 119. — *Syndesmis coarctata* GRIFF. Notul. 4 (1854) 409; Icon. 4 (1854) t. 567, f. 1. — *G. coarctata* HOOK. f. Fl. Br. Ind. 2 (1876) 22; ENGL. in DC. Mon. Phan. 4 (1883) 227; KING, J. As. Soc. Beng. 65, ii (1896) 482; RIDL, J. Str. Br. R. As. Soc. n. 49 (1908) 16; *ibid.* n. 59 (1911) 89; LECOMTE, Fl. Gén. I.-C. 2 (1908) 21; BAKER, J. Bot. 62 (1924) Suppl. 30; CRAIB, Fl. Siam. En. 2 (1926) 346. — *Gluta* sp. ENDERT, Tectona 13 (1920) 127. — Fig. 24–26.

Large shrub or small tree up to 10 m high, sometimes with branched stilt-roots up to 1 m high. Bark pinkish brown, rather smooth. *Leaves* coriaceous, elliptic-oblong, narrowly elliptic, or oblanceolate, 12–32 by 5–8 cm, glabrous; base cuneate; apex acuminate; nerves 16–32 pairs, slightly elevated on both surfaces; veins reticulate, distinct below, rather faint above; petiole (0–)1/3–1 cm. *Panicles* 5–12 cm long, puberulous; pedicels



Fig. 24. *Gluta velutina* BL. at Sg. Mungkanyoh (Photogr. MEIJER, July 1966).

$1/2$ –1 mm, articulated. *Flower-buds* ovoid-oblong or ellipsoid, 2 by  $1-1\frac{1}{2}$  mm, obtuse. *Calyx* 2 mm long, puberulous outside. *Petals* white or pink at edges, imbricate or contorted, oblanceolate or elliptic-oblong, 7–9 by 2–3 mm, glabrous; the central part of the basal  $1\frac{1}{2}$ –2 mm adnate to the torus. *Stamens* 5, 4–5 mm; filaments glabrous; anthers oblong, c. 1 mm long. *Torus* cylindrical,  $1\frac{1}{2}$ –2 mm long. *Ovary* subglobose,  $1-1\frac{1}{2}$  mm  $\varnothing$ , glabrous; stipe c.  $1/2$  mm; style excentric, c. 3 mm. *Drupe* on a centric stalk (c.  $1/2$  cm),  $4\frac{1}{2}$ – $7\frac{1}{2}$  cm  $\varnothing$ , pale brown, with irregularly tuberculate ridges especially towards the base; without enlarged petals; embryo subglobose, 4–7 cm  $\varnothing$ ; cotyledons free.

Distr. Burma, Thailand, Vietnam, and *Malesia*: Sumatra, Malay Peninsula, Borneo, and W. Java (once).

Ecol. Common along edges of tidal rivers on submerged mud-banks in the freshwater or slightly brackish zone; standing in the water, with submerged trunk except at low tide, associated with *Barringtonia conoidea* and *Pandanus helicopus*, a most characteristic bush in the tidal reaches of the river above the *Nypa* palm stands (CORNER, *l.c.*). *Fl. fr.* Jan.–Dec.

Uses. The timber is similar to that of *G. renghas* but of smaller dimension; see further BURKILL, *l.c.*

Vern. *Pong pong*, *rèngas*, *r. ayèr*, *r. pantai*, M, *r. pèndèk*, Palembang.

Note. The only collection in W. Java is FORBES 1169 which was correctly identified by E. G. BAKER, *l.c.* He collected it at Tjilaki, near Pengalengan (Priangan), at c. 350 m, recording it to be a great tree of which the bark exuded excoxiating sap; vern. name *rèngas djahat* or *dahu*. It is remarkable that it has never been collected again.

21. *Gluta papuana* DING HOU, *Blumea* 24 (1977) 14. — *Gluta sp.* ROYEN, *Man. For. Trees Papua & N. G.* 4 (1964) 25, f. 9; VERSTEEGH, *Med. Landb. Hogesch. Wageningen* 71–19 (1971) 37. — Fig. 15.

Tree up to 31 m high and 50 cm  $\varnothing$  (up to 50 by 2 m, cf. ROYEN, *l.c.*). Occasionally with steeply rising buttresses 1–3 m high. Bark grey brown to dark red, smooth, peeling off in small round scales. *Leaves* coriaceous, elliptic, broadly elliptic, or obovate-oblong, 7– $20\frac{1}{2}$  by 3– $10\frac{1}{2}$  cm, glabrous; base cuneate; apex rounded, slightly emarginate, rarely cuspidate; nerves 12–17 pairs, slightly elevated below, distinct above; veins reticulate, distinct or faint beneath, faint above; petiole 1– $2\frac{1}{2}$  cm. *Panicles* up to 30 cm long, puberulous when young, glabrescent, or glabrous; pedicels articulated, 1–3 mm. *Flower-buds* ovoid or ellipsoid,  $3-3\frac{1}{2}$  by  $1\frac{1}{2}$ –2 mm, obtuse. *Calyx* 3– $3\frac{1}{2}$  mm long, bursting irregularly, glabrous except sparsely hairy at the apex. *Petals* white, imbricate, elliptic or obovate-oblong,  $6\frac{1}{2}$ – $7\frac{1}{2}$  by  $2\frac{1}{2}$ –3 mm. *Stamens* 5 (or 6),  $4\frac{1}{2}$ –5 mm; filaments glabrous; anthers



Fig. 25. *Gluta velutina* BL. at low tide in tidal freshwater swamp forest, Sg. Sedili, Johore, showing its peculiar stem-base architecture (Photogr. CORNER).



Fig. 26. *Gluta velutina* BL. on riverside, Sg. Sedili, Johore, at high tide in freshwater swamp forest, in front some *Pandanus helicopus* GRIFF. (Photogr. CORNER).

oblong, c. 1 mm long. *Torus* cylindrical,  $\frac{2}{3}$ – $1\frac{1}{4}$  mm. *Ovary* subglobose, c.  $\frac{3}{4}$  mm  $\varnothing$ , glabrous; stipe  $\frac{2}{3}$ – $1\frac{1}{4}$  mm; style lateral, 2– $2\frac{1}{2}$  mm. *Drupe* on an obscure, excentric stalk, bent almost horizontally, subreniform,  $6\frac{1}{2}$ –8 by  $5\text{--}5\frac{1}{4}$  by  $2\text{--}2\frac{1}{2}$  cm, light to dark brown, (recorded bluish black when fresh), smooth; without enlarged petals; embryo subreniform,  $3\frac{1}{2}$ –4 by  $5\frac{1}{2}$ –7 by  $1\frac{1}{4}$ – $2\frac{1}{4}$  cm; cotyledons incompletely fused, free on one side, free part  $3\text{--}3\frac{3}{4}$  cm deep.

*Distr.* *Malesia*: New Guinea (W. & S. Divisions of W. New Guinea and Fak-Fak; Gulf and Western Districts in E. New Guinea).

*Ecol.* Seasonally inundated forests along rivers, freshwater swamps, forests on well drained soils, or secondary forest. *Fl.* Febr., Oct.; *fr.* March, June, Sept.

*Uses.* The thin, moderately hard, reddish brown, grained heartwood has been used specially for keels of canoes and for carving, and is also suitable for corbels and sleepers (*cf.* C. L. LEEFERS, *Verslag van Bosopname Boven-Digoel*, typed report, 1958, appendix 1).

*Vern.* *Bamuri*, Kikori, dial., *dae diri*, Kiunga, *hekakoro*, Gulf Distr., *idjerah*, Asmat lang., *kiejeri*, Tehid lang., *miaré*, Mor., *mie*, Djair, *u*, Awiju.

*Note.* The resinous sap of this species has irritant effects and causes blisters in contact with the skin (*cf.* E. E. VAN DER ZEE, *Verslag Boedidi-Waja River*, typed report, 1956, p. 4, appendix 4 & 7).

22. *Gluta renghas* LINNÉ, *Mant.* 2 (1771) 293, *sphalm.* 'benghas'; BL. *Bijdr.* (1826) 1159; *Mus. Bot.* 1 (1850) 182, f. 39; ENGL. in DC. *Mon. Phan.* 4 (1883) 225, t. 6, f. 1–6; K. & V. *Bijdr.* 4 (1896) 94, *incl. var. petiolata* K. & V.; KING, *J. As. Soc. Beng.* 65, ii (1896) 480; BACK, *Fl. Bat.* (1907) 367; Schooffl. (1911) 280; MERR. *En. Born.* (1921) 346; RIDL. *Fl. Mal. Pen.* 1 (1922) 527; ENDERT, *M. O. Born. Exp.* 1925 (1927) 224, f. 84; HEYNE, *Nutt. Pl.* (1927) 972; BURK. *Gard. Bull. S. S.* 5 (1931) 224; *Dict.* (1935) 1079; CORNER, *Ways. Trees* (1940) 118, f. 26; ADELB. *Blumea* 6 (1948) 325, *excl. syn.*; KOCHUM. *Mal. For. Rec.* 17 (1964) 264; BACK. & BAKH. *f. Fl. Java* 2 (1965) 150. — *Arbor vernicis* RUMPH. *Herb. Amb.* 2 (1741) 259, t. 86. — *Stagmaria verniciflua* JACK *ex* HOOK. *Comp. Bot. Mag.* 1 (1836) 267. — **Fig. 27–28.**

Large tree up to 50 m high and 115 cm  $\varnothing$ , sometimes buttressed when old. Bark light fawn brown, or greyish when old, dipped scaly with small flakes. *Leaves* coriaceous, elliptic-oblong or narrowly elliptic, or oblanceolate, 12–28(–36) by  $4\text{--}7\frac{1}{2}$ (–9) cm, glabrous; base cuneate, sometimes subcordate; apex obtuse; nerves 17–30 pairs, elevated on both surfaces; veins reticulate, distinct on both surfaces; petiole 0–3 cm. *Panicles* 6–25 cm long, glabrous, sometimes sparsely puberulous and glabrescent; pedicels articulated, 3–6 mm. *Flowerbuds* ellipsoid, 3–4 by  $1\frac{1}{2}$ – $1\frac{3}{4}$  mm, obtuse. *Calyx* 3–4 mm long, bursting irregularly, glabrous,



Fig. 27. *Gluta renghas* L. during dry season in temporary inundated swamp forest, with narrowly buttressed, thickened stem-bases, covered with dried mud to c. 2 m high; in front C. N. A. DE VOOGD. Rawa Bodjong, West Java (Photogr. VAN STEENIS, Oct. 1941).

sometimes sparsely puberulous at the apex. *Petals* white, contorted, elliptic-lanceolate, oblanceolate, or linear,  $7\frac{1}{2}$ –13 by 2–3 mm, glabrous outside, papillose inside; the central part of the basal 2–3 mm longitudinally adnate to the torus. *Stamens* 5, 4–5½ mm; filaments glabrous; anthers oblong,  $\frac{2}{3}$ –1 mm long. *Torus* cylindrical, 2–3 mm long. *Ovary* subglobose, 1–1½ mm  $\varnothing$ , glabrous; stipe 0–¾ mm; style lateral, 2½–3½ mm. *Drupe* on a centric stalk (c. ½ cm), subglobose, 3½–5 cm  $\varnothing$ , pinkish brown, with irregular crests and protuberances; without enlarged petals; embryo subglobose, 2–3½ cm  $\varnothing$ ; cotyledons incompletely fused, free on one side, free part c. ⅓ cm deep.

*Distr. Malesia*: widely distributed in Sumatra, Malay Peninsula, Java, Borneo, and Celebes; once found in E. Ceram (Moluccas).

*Ecol.* Chiefly in coastal regions, in peat-swamps, occasionally inundated areas, gregarious along river-banks, at low altitude, sometimes in inland forest up to 800 m (Palembang). *Fl.* May–Dec.; *fr.* Jan.–Dec.

*G. renghas* is one of the important constituents of the *rapak* type of swamp forest, that is swamp forest without peat formation and sometimes temporarily seasonally with a low water level, associated with *spp.* of *Coccoceras*, *Alstonia*, other *Gluta spp.*, *Ficus retusa*, *Mangifera gedebe*, *Lagerstroemia*, etc. It is also very common on and near levees of sluggish downstream rivers, leaning from the river-banks in the freshwater tidal reaches. In such deep marshy places the stem-base is often conically thickened (ENDERT, l.c.).

*Uses.* The timber is very strong, durable, red-

dish brown, and with splendid markings. It has been used for building material of houses and canoes and for making handsome furniture. See HEYNE, *l.c.*

CORNER *l.c.* remarked, however, that the heartwood is not red-brown as in the other *Gluta spp.*, but pale pinkish.

The seed can be eaten after roasting (BURKILL).

Vern. *Rengas*, M, very commonly used name. Sumatra: *kaju rengas suloh*, Lampongs, *rengas burung*, Palembang; Malaya: *r. ayër*, *r. jitong*, M; Java: *ingas*, *rengas-tembaga*, J; Borneo: *djingah*, M, *djinga rengas*, Sg. Kapuas, *rengas burung*, Kutai, *timoho*, Sg. Sabadai.

Notes. RUMPHIUS (*l.c.*) introduced plants of this species into Ambon. So far, I saw from the Moluccas only one sterile specimen (bb 25866, BO, a tree 37 m high and 45 cm Ø) collected in primary forest, E. Ceram. It was indicated on the field label as not planted. Fertile material from this area is desirable.

There are several big trees of this species cultivated in the low ground in front of the Library, University of Singapore. These may have been raised from seeds brought by RIDLEY from Pahang in 1890 (BURKILL, *l.c.*).

#### Excluded

*Gluta orgyalis* BLANCO, Fl. Filip. ed. 2 (1845) 451; ed. 3, 3 (1879) 49 is according to MERRILL, Publ. Gov. Lab. Philip. n. 27 (1905) 75; Sp. Blanc. (1918) 220; En. Philip. 2 (1923) 421 = *Cleistanthus orgyalis* (BLANCO) MERR. (*Euphorbiaceae*).



Fig. 28. Massive tree of *Gluta renghas* L. near Subah (Photogr. BEUMÉE, March 1919).

## 7. BOUEA

MEISN. Pl. Vasc. Gen. (1837) Tab. Diagn. 75 & Comment. 55; ENGL. in DC. Mon. Phan. 4 (1883) 238; AIRY SHAW, Kew Bull. 20 (1966) 87; DING HOU, Blumea 24 (1978) 4. — *Cambessedea* W. & A. Prod. 1 (1834) 170, in note, non KUNTH, 1824. — *Tropidopetalum* TURCZ. Bull. Soc. Nat. Mosc. 32, i (1859) 265, cf. FEDTSCHENKO, Svensk Bot. Tidskr. 19 (1926) 493. — *Matania* GAGNEP. Not. Syst. 13 (1948) 189. — **Fig. 29.**

Trees. Branchlets slightly 4-angular, usually flat towards the nodes. Terminal and axillary buds prominent. *Leaves* decussate, simple, entire, petioled. *Inflorescences* axillary, rarely also terminal, paniculate. *Flowers* ♂ and bisexual (plants polygamo-andromonoecious). *Calyx* 3–5-lobed. *Petals* 3–5, imbricate, glabrous, lengthwise keeled. *Stamens* 3–5; filaments subulate, glabrous; anthers basifixed, ovoid-oblong. *Disk* round, flat or slightly concave, sometimes obscure, glabrous. *Ovary* ovoid or subglobose, 1-celled and 1-ovuled, puberulous or glabrous; style short; stigma round and flat, sometimes 2- or 3-grooved; sterile pistil minute in ♂. *Drupe* 1-celled; endocarp fibro-crustaceous. *Seed* with testa adherent to the endocarp; embryo straight, cotyledons free, plano-convex.

Distr. About 3 spp., in tropical SE. Asia and *Malesia* (Sumatra, Malay Peninsula, W. Java, and Borneo).

Ecol. In lowland forest, up to c. 300 m, sometimes cultivated at higher altitude.

Notes. *Bouea* is the only genus of this family with decussate leaves. They are rather variable in size and shape and are not very useful for specific distinction; I had to reduce several names. Flower and fruit characters are fairly uniform.

I examined the pollen grains of both species; they appear to be very similar in size and structure.

CORNER (Ways. Trees, 1940) noted that, when fresh, the fruit is like a plum or small mango, yellow, pulpy, with a fibrous leathery stone showing, when cut across, the bright purple cotyledons in the big seed.

He said furthermore, that sterile material might be mistaken for *Garcinia*, *Eugenia*, *Olea*, *Austrobuxus*, and *Memecylon*, but the resinous smell of the broken twigs or crushed leaves and the pointed buds at once distinguish it. *Eugenia* when dried should have pellucid dots in the leaves and *Garcinia* pellucid resinous ducts.

## KEY TO THE SPECIES

1. Leaves small, usually 2–15 by 1–5 cm. Terminal (vegetative) buds lanceolate or narrowly lanceolate, 5–10 by  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm, outer pair of scales the longest . . . . . 1. *B. oppositifolia*  
 1. Leaves large, usually  $14\frac{1}{2}$ –30 by 5–8 cm. Terminal (vegetative) buds broad-ovoid or ovoid, 4–6 by  $3\frac{1}{2}$ –5 mm, outer pair of scales usually shorter than the total length of bud . . . . . 2. *B. macrophylla*

1. *Bouea oppositifolia* (ROXB.) MEISN. Pl. Vasc. Gen. (1837) Comment. 55; WALP. Rep. 1 (1842) 556; HASSK. Flora 27 (1844) 624; BL. Mus. Bot. 1 (1850) 204; MIQ. Fl. Ind. Bat. 1, 2 (1859) 635; ADELB. Blumea 6 (1948) 326; TARD. Fl. C. L. & V. 2 (1962) 126; KOCHUM. Mal. For. Rec. 17 (1964) 211; AIRY SHAW, Kew Bull. 20 (1966) 87; MEIJER, Bot. News Bull. F. D. Sandakan 8 (1967) 19. — *Mangifera oppositifolia* ROXB. (Cat. Hort. Beng. 1814, 18, *nomen*) Fl. Ind. ed. Wall. 2 (1824) 434; ed. Carey 2 (1832) 640; DC. Prod. 2 (1825) 63; BL. Bijdr. (1826) 1157; MERR. Lingn. Sc. J. 9 (1930) 39, *incl. var. microphylla* (GRIFF.) MERR.; TARD. Fl. C. L. & V. 2 (1962) 128, t. 8, f. 8–13, *incl. var. roxburghii* (PIERRE) TARD. — *B. angustifolia* BL. Mus. Bot. 1 (1850) 204; MIQ. Fl. Ind. Bat. 1, 2 (1859) 635; ENGL. in DC. Mon. Phan. 4 (1883) 241. — *B. myrsinoides* BL. Mus. Bot. 1 (1850) 204; MIQ. Fl. Ind. Bat. 1, 2 (1859) 635. — *B. burmanica* GRIFF. Pl. Cantor in J. As. Soc. Beng. 23 (1854)

repr. p. 14; HOOK. f. Fl. Br. Ind. 12 (1876) 21; KURZ, Fl. Burma 1 (1877) 306; ENGL. in DC. Mon. Phan. 4 (1883) 240, *incl. var. microphylla* (GRIFF.) ENGL.; KING, J. As. Soc. Beng. 65, ii (1896) 465; K. & V. Bijdr. 4 (1896) 101; PIERRE, Fl. For. Coch. (1897) t. 366B, *incl. var. kurzii* PIERRE *et var. roxburghii* PIERRE; LECOMTE, Fl. Gén. I.-C. 2 (1908) 27; BACK. Schoolfl. (1911) 280; PARKINSON, For. Fl. Andaman Is. (1923) 141; CRAIB, Fl. Siam. En. 1 (1926) 346; HEYNE, Nutt. Pl. (1927) 973. — *B. microphylla* GRIFF. Pl. Cantor in J. As. Soc. Beng. 23 (1854) repr. p. 15; Notul. 4 (1854) 423; RIDL. Fl. Mal. Pen. 1 (1922) 519; BURK. Dict. (1935) 355; CORNER, Ways. Trees (1940) 101, f. 18. — *B. diversifolia* MIQ. Sum. (1861) 522; ENGL. in DC. Mon. Phan. 4 (1883) 241, t. 6, f. 12. — *Matania laotica* GAGNEP. Not. Syst. 13 (1948) 189, f. 89: 10–19. — **Fig. 29f–g.**

Tree up to 32 m high and 75 cm  $\varnothing$ . Bark grey, green, light brown to purple brown, or red, fissured.

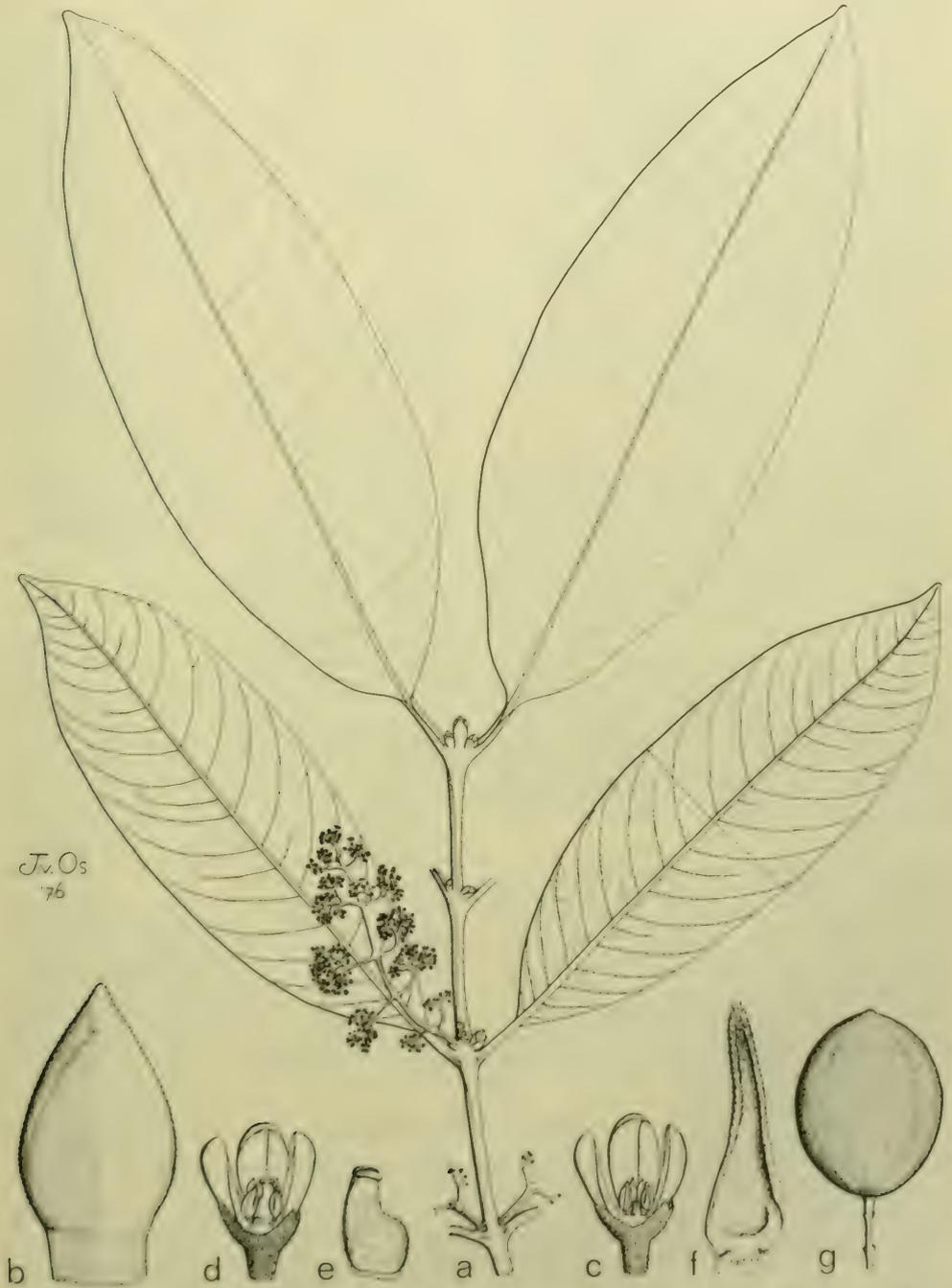


Fig. 29. *Bouea macrophylla* GRIFF. a. Habit,  $\times 1/2$ , b. bud scale, c.  $\delta$  flower, 1 petal removed, d. bisexual flower, 1 petal removed,  $\times 7$ , e. pistil,  $\times 14$ . — *B. oppositifolia* (RONB.) MELISN. f. Bud scale,  $\times 7$ , g. young fruit (a-b KING'S Coll. 679, c-e JACOBS s.n., f KOSTERMANS & ANTA 531, g CURTIS s.n.).

Terminal (vegetative) buds lanceolate to narrowly lanceolate, 5–10 by  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm, scales of the outer pair the longest. *Leaves* coriaceous, elliptic to elliptic-oblong, lanceolate, or obovate to oblanceolate, 2–15 by 1–5 cm (on sterile specimens up to  $22\frac{1}{2}$  by  $5\frac{1}{2}$  cm), glabrous; base acute to cuneate, or obtuse; apex acuminate, rarely obtuse; nerves 8–14(–26) pairs, veins hardly visible, sometimes faint, reticulate; petiole  $\frac{1}{2}$ –1 cm. *Panicles*  $2\frac{1}{2}$ –6 cm long; pedicels 0–2 mm. *Flowers* white, pale yellow to yellow. *Calyx* lobes broadly ovate,  $\frac{1}{2}$ – $2\frac{1}{3}$  mm long. *Petals* oblong or obovate-oblong, slightly variable in size,  $1\frac{1}{2}$ – $2\frac{1}{4}$  by  $\frac{3}{4}$ –1 mm. *Stamens*  $\frac{2}{3}$ –1 mm; anthers apiculate. *Disk* small, thin, c.  $\frac{2}{3}$  mm  $\varnothing$ . *Ovary* c.  $\frac{1}{2}$  mm  $\varnothing$ . *Drupe* (fresh) broadly ellipsoid, c.  $2\frac{1}{2}$  by  $1\frac{1}{2}$  cm, yellow, orange, or red when ripe.

Distr. Burma, Andaman Is., Thailand, Laos, Vietnam, Cambodia, China (Yunnan & Hainan), and *Malesia*: Sumatra (incl. Banka & Billiton), Malay Peninsula, and Borneo.

Ecol. In lowland forest up to 600 m. *Fl.* Jan.–Nov.; *fr.* March–Nov.

CORNER *l.c.* noted that trees of this species give, probably, the densest shade of any tree in Malaya. Growth is slow, and it is excellent for parks. Many of the young violet leaves habitually fall off, when only half-grown.

Uses. Fruits are edible and are sometimes made into preserve when in a half ripe state (*cf.* ALVINS 720).

According to HEYNE *l.c.* the timber is heavy, hard and durable and very useful for various purposes.

Vern. Sumatra: *kaju-rusun, kunangan, raman burung*, M; *raman padi, r. utan, rieden daun*; Banka: *gandaria, raman, uris, urisan*, M; Malay Peninsula: *gemia, kemunia, kundang, kudang rumenia, mērapoh rumenia, pokō rummiyah, rambainya, ramunia, romaniah, rumboi-nigor, rumenia, rumia*, M; Borneo: *asam djanar, bandjar*, M; *kēdjauw lépang, tampusu*, Dayak; *ramania pipipi*, Samarinda; *umpas*, SE. Borneo.

2. *Bouea macrophylla* GRIFF. Pl. Cantor in J. As. Soc. Beng. 23 (1854) repr. p. 15; Notul. (1854) 420; Ic. Pl. As. 4 (1854) t. 567, f. 4; ENGL. in DC. Mon. Phan. 4 (1883) 239, t. 6, f. 9–11; KING, J. As. Soc. Beng. 65, ii (1896) 465; K. & V. Bijdr. 4 (1896) 98; KOORD. Minah. (1898) 409; BACK. Fl. Bat. (1907) 369; Schooifl. (1911) 280; RIDL. Fl. Mal. Pen. 1 (1922) 520; FEDTSCHENKO, Svensk Bot. Tidskr. 19 (1926) 493; CRAIB, Fl. Siam. En. 1 (1926) 346; HEYNE, Nutt. Pl. (1927) 973; OCHSE & BAKH. Fruit

(1931) 1, t. 1; BURK. Dict. (1935) 355; CORNER, Ways. Trees (1940) 101, Atlas t. 11; KOCHUM. Mal. For. Rec. 17 (1964) 210; BACK. & BAKH. f. Fl. Java 2 (1965) 150. — *B. gandaria* BL. (Mus. Bot. 1, 1850, 204, proposed alternative name) *ex* MIO. Fl. Ind. Bat. 1, 2 (1859) 635; ADELB. Blumea 6 (1948) 326. — *Tropidopetalum javanicum* TURCZ. Bull. Soc. Nat. Mosc. 32, i (1859) 265; *cf.* FEDTSCHENKO, Svensk Bot. Tidskr. 19 (1926) 493. — **Fig. 29a–e.**

Tree up to 27 m high and 55 cm  $\varnothing$ . Bark light greyish brown, or dark coloured, finely fissured. Terminal (vegetative) buds broadly ovoid or ovoid, 4–6 by  $3\frac{1}{2}$ –5 mm, scales of outer pair usually shorter than the total length of bud. *Leaves* coriaceous, ovate-oblong to lanceolate, or elliptic to narrowly elliptic, ( $11\frac{1}{2}$ –)  $14\frac{1}{2}$ –30 by (4–)5–8 cm (on sterile specimens up to 45 by 13 cm), glabrous; base acute to cuneate, rarely obtuse; apex acute to acuminate; nerves 15–25 pairs, veins reticulate, sometimes faint; petiole  $1$ – $2\frac{1}{2}$  cm. *Panicles*  $4\frac{1}{2}$ –10(– $12\frac{1}{2}$ ) cm long; pedicels 0–2 mm. *Flowers* light yellowish green or light yellow, soon becoming brown. *Calyx* lobes broadly ovate, c.  $\frac{2}{3}$  mm long. *Petals* oblong, or oblong-obovate,  $1\frac{1}{2}$ – $2\frac{1}{2}$  by c. 1 mm. *Stamens*  $\frac{2}{3}$ –1 mm; anthers apiculate. *Disk* small, thin, c.  $\frac{2}{3}$  mm  $\varnothing$ . *Ovary* c.  $\frac{1}{2}$  mm  $\varnothing$ . *Drupe* (fresh, *cf.* OCHSE & BAKH. *l.c.*) subglobose,  $3\frac{1}{2}$ –5 by 3–4 cm, yellow or orange when ripe; cotyledons blue-violet.

Distr. *Malesia*: Sumatra (E. Coast: Langkat, one coll.), Malay Peninsula (Perak, Pahang, Malacca), and W. Java.

Also cultivated in Mauritius, Sumatra, the Malay Peninsula, West & Central Java, Borneo, and Ambon as a village fruit tree.

Ecol. Lowland forest up to 300 m; in cultivation up to 800 m. *Fl.* June–Nov.; *fr.* March, June.

Uses. *Gandaria* is an estimable fruit tree. In cultivation it thrives best on a light pervious soil, preferably below 500 m (OCHSE & BAKH. *l.c.*).

The ripe, yellow, plum-like fruits are eaten raw or steamed; they have a rather acid taste; they serve for an excellent compote. Young fruits are sometimes pickled and used for sambal. Young leaves are eaten with rice.

The timber of this species is not very good and only used for minor purposes (HEYNE *l.c.*), but BURKILL *l.c.* defines it as durable.

Vern. Sumatra: *ramania*, Langkat; Malay Peninsula: *asam suku, kondongan, kundang(an), k. hutan, mēdang asam, pakō kundangan, rembungia, rēmēnya, rumenia, rumia, sērapoh, sērapok, sētar*, M; Java: *gandaria*, J, M, S, *djantakē, gunarjah, kēndarah*, S, *djatakē*, J, S, *pao gandaria*, Md.

## 8. DRACONTOMELON

BL. Mus. Bot. 1 (1850) 231; ENGL. in DC. Mon. Phan. 4 (1883) 250; WILKINSON, Ann. Mag. Nat. Hist. XIII, 9 (1966) 429; J. Nat. Hist. 1967(4), p. 505; *ibid.* 1968(2), p. 39. — *Comeurya* BAILL. Adansonia 10 (1872) 329. — **Fig. 30–33.**

Trees. *Leaves* spiral, imparipinnate, petioled. *Leaflets* opposite, subopposite, or alternate, entire, often with hairy domatia. *Inflorescences* paniculate, axillary or terminal. *Flowers* bisexual. *Calyx* 5-lobed. *Petals* 5, valvate but imbricate at the apical part, puberulous outside or on both surfaces, or glabrous. *Stamens* 10, those

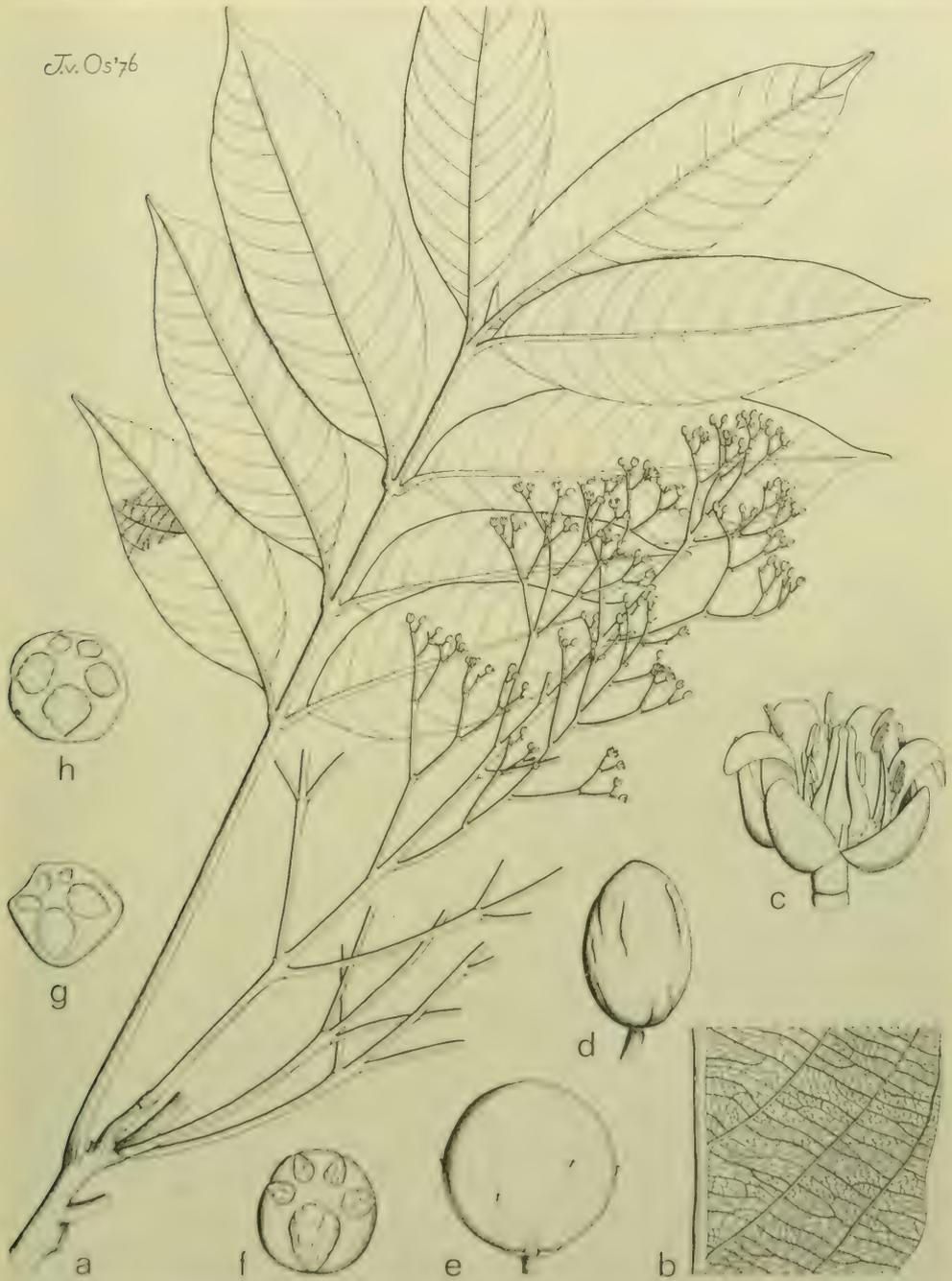


Fig. 30. *Dracontomelon costatum* Bl. a. Habit,  $\times \frac{1}{3}$ , b. venation on lower leaf surface,  $\times 1\frac{1}{3}$ , c. flower, one stamen cut,  $\times 7$ , d. fruit, nat. size. — *D. dao* (BIANCO) MERR. & ROLFE. e. Fruit, with style remains, nat. size, f-h. endocarp from different angles, showing opercula of large fertile loculi and abortive, small ones, nat. size (a-c BALAJADIA 7070, d KOSTERMANS 13229, e-f DING HOU 729, g ELMER 13456, h HB 11807).

opposite the calyx lobes longer than those alternate with them; filaments subulate, glabrous; anthers dorsifixed. *Disk* intrastaminal, discoid or shortly cupular, hairy, glabrescent, or glabrous. *Pistil* composed of 5 carpels, 1–4 of them abortive; carpels free but connate at the basal and apical parts. *Ovary* 5-celled, hairy and glabrescent; styles 5, connate at the apical part; stigmas capitate, stigmatic face lateral. *Drupe* 5-celled, or seemingly 1-celled by abortion, each cell with a distinct operculum; endocarp woody, hard. *Seed* with testa free from the endocarp; embryo straight, cotyledons free, plano-convex.

Distr. About 8 *spp.*, distributed from continental Asia (India, Burma, Thailand, Cambodia, and China) throughout *Malesia* to W. Polynesia (Fiji).

Ecol. In forests, usually at low altitudes.

Uses. *Dracontomelon* is sometimes planted in villages because of the fruit which has a small amount of a rather acid, juicy, edible pulp around a large endocarp (stone). The trees also provide very decorative timber.

Vern. Malaysian standard timber name: *senkuang*.

#### KEY TO THE SPECIES

1. Leaflets with hairy domatia. Disk hairy. Drupe globose or depressed-globose, distinctly 5-celled.
2. Petals 7–10 mm long. Ovary oblong-ellipsoid or slightly obovoid,  $c. \frac{2}{3}$  (sometimes in young flowers  $c. \frac{1}{2}$ ) the length of pistil. Drupe globose,  $1\frac{3}{4}$ – $2\frac{1}{2}$ (– $3\frac{1}{2}$ ) cm  $\varnothing$ ; endocarp 1– $1\frac{3}{4}$  cm  $\varnothing$ , often smooth . . . . . **1. *D. dao***
2. Petals  $4\frac{1}{2}$ –5 mm long. Ovary depressed-globose,  $c. \frac{1}{3}$  the length of pistil. Drupe depressed-globose, 3– $5\frac{1}{2}$  cm  $\varnothing$ ; endocarp 3–5 cm  $\varnothing$ , with numerous, irregular processes . . . . . **2. *D. lenticulatum***
1. Leaflets without domatia. Disk glabrous. Drupe ovoid or broadly ellipsoid, seemingly 1-celled (due to abortion) . . . . . **3. *D. costatum***

**1. *Dracontomelon dao*** (BLANCO) MERR. & ROLFE, Philip. J. Sc. 3 (1908) Bot. 108 ('*Dracontomelon*'); MERR. Sp. Blanc. (1918) 234; En. Philip. 2 (1923) 471; HEYNE, Nutt. Pl. (1927) 975; BROWN, Useful Pl. Philip. 2 (1950) 334, f. 161; WILKINSON, J. Nat. Hist. 1968(2), p. 45, in text, f. 6A–C & E; RENDLE, World Timbers 3 (1970) 70; VERSTEEGH, Med. Landb. Hogesch. Wageningen 71–19 (1971) 31; DING HOU, Blumea 24 (1978) 6. — *Pomum draconum* RUMPH. Herb. Amb. 1 (1741) 157, t. 58. — *Pomum draconum sylvestre* RUMPH. l.c. 159, t. 59. — *Poupartia mangifera* BL. Bijdr. (1826) 1160, *nom. illeg.*, *excl. syn.* — *Paliurus dao* BLANCO, Fl. Filip. (1837) 174; ed. 2 (1845) 122; ed. 3, 1 (1877) 219. — *Paliurus edulis* BLANCO, Fl. Filip. (1837) 173. — *Paliurus lamiyo* BLANCO, Fl. Filip. ed. 2 (1845) 122; ed. 3, 1 (1877) 218, *p. p.* — *D. mangiferum* (BL.) BL. Mus. Bot. 1 (1850) 231, f. 42, *nom. illeg.*; HOOK. f. Fl. Br. Ind. 2 (1876) 43; ENGL. in DC. Mon. Phan. 4 (1883) 251, *incl. var. puberulum* (MIQ.) ENGL.; K. & V. Bijdr. 4 (1896) 114, *incl. var. pubescens* K. & V.; KING, J. As. Soc. Beng. 65, ii (1896) 513; PIERRE, Fl. For. Coch. (1898) t. 374A; KOORD. Minah. (1898) 410; BACK. Schoolf. (1911) 281; RADLK. Denkschr. K. Ak. Wiss. Wien 89 (1913) 129; MERR. Int. Rumph. (1917) 333; LAUT. Bot. Jahrb. 56 (1920) 355; RIDL. Fl. Mal. Pen. 1 (1922) 543; PARKINSON, For. Fl. Andaman Is. (1923) 142; LANE-POOLE, For. Res. (1925) 106; DOCT. v. LEEUWEN, Zoococciada (1926) 321, f. 571; HEYNE, Nutt. Pl. (1927) 976; BURK. Dict. (1935) 859; CORNER, Ways. Trees (1940) 104, f. 21, Atlas t. 5; KRAEMER, Trees W. Pac. Reg. (1951) 193; BROWNE, For. Trees Sarawak & Brunei (1955) 47; JAPING, Houtsoorten N. G. 1 (1961) 11; TARD. Adansonia 1 (1961) 55, t. 1, f. 12–16; Fl. C. L. & V. 2 (1962) 146,

t. 11, f. 12–16; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 21, f. 7; KOCHUM. Mal. For. Rec. 17 (1964) 243; WILKINSON, J. Nat. Hist. 1968(2), p. 40, in text, f. 5E–F & 7A. — *D. sylvestre* BL. Mus. Bot. 1 (1850) 231; ENGL. in DC. Mon. Phan. 4 (1883) 252; MERR. Int. Rumph. (1917) 333; En. Philip. 2 (1923) 472; KRAEMER, Trees W. Pac. Reg. (1951) 195, f. 67 & 68. — *D. puberulum* MIQ. Sum. (1861) 524; BACK. & BAKH. f. Fl. Java 2 (1965) 151; STREIMAN, Timber Species Leaflet. P.N.G. 5 (1974) f. A & B. — *Comeurya cumingianum* BAILL. Adansonia 10 (1872) 330. — *D. cumingianum* BAILL. Bull. Soc. Linn. Paris 1 (1877) 122; ENGL. in DC. Mon. Phan. 4 (1883) 254. — *D. laxum* K.Sch. in K.Sch. & Holtr. Fl. Kais. Wilh. Land (1889) 65. — *D. edule* (BLANCO) SKEELS, Bull. U.S. Dep. Agr. Bur. Pl. Ind. 261 (1912) 52; MERR. En. Philip. 2 (1923) 471; BROWN, Useful Pl. Philip. 2 (1950) 336, f. 162 & 163. — *D. edule* MERR. Philip. J. Sc. 10 (1915) Bot. 33, *non* SKEELS, 1912; KALKMAN, Timber Spec. Neth. N. G. (1959) 15. — *D. lamiyo* MERR. Sp. Blanc. (1918) 234. — *D. brachyphyllum* RIDL. Kew Bull. (1933) 202; MEIJER, Bot. News Bull. F. D. Sandakan 8 (1967) 22. — Fig. 30e–h, 31, 32.

Deciduous tree up to 43(–55) m high and 90 (–150) cm  $\varnothing$ . Buttresses up to 5 m high,  $2\frac{1}{2}$  m wide, 15 cm thick. Bark greyish brown, not fissured, scaly, peels in irregularly patches. *Leaves* with 4–9 pairs of leaflets; rachis 6–25(–44) cm, petiole 3–16(–23) cm, both puberulous or pubescent, glabrescent, or glabrous. *Leaflets* chartaceous to subcoriaceous, elliptic-oblong, oblong, ovate-oblong to lanceolate, sometimes oblanceolate,  $4\frac{1}{2}$ –20(–27) by  $2\frac{1}{4}$ –7(–10 $\frac{1}{2}$ ) cm, usually glabrous on both surfaces; lower surface with hairy domatia, sometimes pubescent (or only on the midrib),



Fig. 31. *Dracontomelon dao* (BLANCO) MERR. & ROLFE. Large tree, with tree climber; Lahad Datu, Sabah (Photogr. MEIJER, April 1967).

glabrescent; base obliquely rounded, rarely subcordate; apex shortly acuminate, sometimes caudate; nerves 3–10 pairs; veins reticulate, some obliquely cross-bar-like; petiolules 0– $\frac{1}{3}$  cm, the terminal one  $\frac{1}{4}$ – $1\frac{3}{4}$  cm, puberulous. *Panicles* up to 50 cm long, pubescent, glabrescent; branches up to 37 $\frac{1}{2}$  cm long; floral bracts ovate, 1–1 $\frac{1}{2}$  mm long, puberulous on both surfaces; pedicels  $\frac{1}{3}$ –2 mm. *Flowers* white or greenish white. *Calyx* lobes ovate-oblong, 4–5 mm long, sparsely puberulous outside. *Petals* oblanceolate, sometimes elliptic-lanceolate, 7–10 by 1 $\frac{1}{2}$ –2 mm. *Stamens* 5 $\frac{1}{2}$ –7 mm; anthers oblong or ovoid-oblong, 1–1 $\frac{1}{4}$  mm long. *Disk* c. 2 $\frac{1}{2}$  mm  $\varnothing$ , puberulous. *Pistil* 5 $\frac{1}{2}$ –6 $\frac{1}{2}$  mm long. *Ovary* oblong-ellipsoid or slightly obovoid, c.  $\frac{2}{3}$  (sometimes in young flowers c.  $\frac{1}{2}$ ) the length of the pistil, 1 $\frac{1}{2}$ –2 mm  $\varnothing$ . *Drupe* globose, 1 $\frac{3}{4}$ –2 $\frac{1}{2}$ (–3 $\frac{1}{2}$ ) cm  $\varnothing$ , larger when fresh; dingy brown when ripe, distinctly 5-celled; endocarp lentiform, 1–1 $\frac{3}{4}$  cm  $\varnothing$ , often smooth,

sometimes slightly irregularly 5-angular. *Seed* conical,  $\frac{3}{4}$ –1 cm long.

Distr. India (east part and Andaman Is.), Burma, Thailand, Cambodia, S. China, scattered all through *Malesia*, and Solomon Is.

Sometimes planted in villages.

Ecol. Only in high-rainfall areas, although sometimes with a short dry season, in evergreen to slightly deciduous forest on well-drained to poorly drained soils, in levee forest, secondary forest, rather common but mostly scattered, at low altitude, rarely at 500–1000 m. *Fl. fr.* Jan.–Dec.

According to CORNER *l.c.* the leaves are in Malaya shed after dry weather, the trees having evidently two seasons, one about July–August, the other about December–January. The buds open before all the old leaves have fallen and inflorescences are produced at the base of the new shoots (in the axils of scale leaves) before the foliage.

Nomencl. *Poupartia mangifera* BL. 1826 is an



Fig. 32. *Dracontomelon dao* (BLANCO) MERR. & ROLFE. F. R. Tjuratjabe, near Bangsari, W. of Djember, East Java. Buttresses cut for making cart-wheels (Photogr. KALSHOVEN).

illegitimate name as BLUME cited three earlier names in synonymy, viz *Mangifera pinnata* L. f. (1781), *Spondias mangifera* WILLD. (1799) and *Spondias amara* LAMK (1796), which all refer to *Spondias pinnata* (L. f.) KURZ. In 1850 BLUME removed these synonyms and named the species *Dracontomelon mangiferum* BL., but again mentioned under this name an older synonym (*Poupartia pinnata* BLANCO, 1837) making the combination illegitimate.

Uses. The timber is rather soft, rather light to moderately heavy, little durable. The sapwood is pale and subject to insect attack. The heartwood varies considerably from greyish brown, usually with dark grey to black bands, to almost black. Boles have a mean maximum branch-free height of 25 m, a mean maximum d.b.h. of 80–100 cm, but they are usually heavily buttressed. The timber is in demand for matched sliced veneers, but also suitable for rotary veneers; also suitable for paneling, furniture, quality cabinet work, flooring, boxes, matches. Trade names: *sengkuang* (Malaysia), *paldao* (Philippines), *dar* (West New Guinea), *New Guinea Walnut* (Papua New Guinea).

A handsome and ornamental tree which could be used effectively for avenues.

The fruit is inferior and sought mostly by children. Flowers and leaves may also be eaten as a vegetable (CORNER *l.c.*). The bark is possibly of medicinal value (BURKILL).

Vern. Sumatra: *anglip ètem*, *dau-pajo*, Simalur, *bèka*, *landur*, *surian kèli*, Palembang, *kiking*, M; Malaya: *bèngkuang*, *chèngkuang*, *mati awak*, *sakal*, *sèkuan*, *sèngkuang*, *sèpul*, *surgan*, M; Java: *dahu*, S & Md, *dau*, *langsèp alas*, *theuòh*, Md, *gijubuk*, J, *rahan*, *rahu*, *rao*, *rau*, J & Md; Lesser Sunda Is.: *kasuang*, Sumbawa, *rau*, Flores; Borneo: Sarawak: *sangkuang*, Miri, *ingkawang*, Kuching; Sabah: *sankuang*, Iban, Kedayan & M, *sarunsab*, Dusun, *sorosob*, Jesselton, *suronsub*, Dusun Rungus, *tarosoup*, Dusun Kinabatangan, *tehrèngzeb*, Kratom; Kalimantan: *djakan*, Dayak, *sangkuwang* = *urui*, Sg. Pantung, *sèngkuang* or *singkuang*, *talantjap*, M; Philippines (cf. MERRILL, 1923, *l.c.*): *adúas*, *anangging-puti*, *lámio*, *malafyo*, *maliyan*, *olandág*, Tag., *alauhau*, Bik., S.L.Bis., *anduong*, *makau*, Mbo, *batuan*, Bis., *bili-bili*, P.Bis., *bio*, Pang., *dáo*, Tag., Bik., P. Bis., S.L.Bis., *habas*, C.Bis., *hamarak*, *kamarak*, *makadaég*, Ilk., *kalauhau*, Bik., *kiakia* S.L.Bis., *lupigi*, Ibn., *makau*, Mag., *mamakau*, Mbo, Bag., *ulandang*, *ulandug*, Kuy.; Celebes: (*bua*) *rao*, *dewu*, *lolomao*, *rau* = *mabiru*, Manado, *koili*, Minah., *rago*, Muna I., *wuarau takau*, Tobela, *begamiohik*, *biohiki*, *nganin*, Morotai, *ngamè*, *ngawé*, Ternate, *leombawi*, Talaud I., *ngamè*, *taulaté*, Halmahere, *tarpati*, Banda; New Guinea: *alaisoi*, Madang, *ameu*, Nemo, *arouwsawu*, Kwesten, *aua*, Vailala, *daa*, Amberbaken, *damoni*, Motu, *djaap* = *jaap*, *tjaap*, Hattam, *dorea*, W. Evara, *fa*, *faula*, Amele, *gain*, Jal, *imbur*, Onjob, *kumbui*, Karoon, *los*, Mooi, *rou*, Bembli, Rawa, Madang, *onomba*, Binendele, *rou*, Madang, *senai*, Manikiong, *taa*, Andai, *touu*, Sko, *touuw*, Tko, *ufaka*, Minufia, *wehm*, Bogia.

CORNER *l.c.* called this village fruit tree the Argus Pheasant Tree; it has five equatorial, oval flecks on the fruit, and because of this characteristic, resembling the markings of the feathers of the Argus

pheasant, the Malays give it the vernacular name *se(n)kuan(g)*.

2. *Dracontomelon lenticulatum* WILKINSON, J. Nat. Hist. 1967(4), p. 505, f. 1–3. — *Dracontomelon* sp. LANE-POOLE, For. Res. (1925) 106. — *D. edule* (non BLANCO) SKEELS ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 19, f. 6.

Tree up to 37 m high and 120 cm Ø. Buttresses up to c. 3½ m high, 1¼ m wide. Bark grey-green to brown, irregularly fissured. Leaves with 4–9 pairs of leaflets; rachis 22–57 cm, petiole 4½–23 cm, both pubescent, glabrescent, or glabrous. Leaflets chartaceous or subcoriaceous, ovate-oblong, 22½–32½ by 5–12¾ cm, glabrous except for the hairy domatia; base slightly unequally obtuse; apex shortly acuminate; nerves 7–15 pairs; veins reticulate, some obliquely cross-bar-like; petiolules ½–1 cm, the terminal one up to 1½ cm. Panicles up to 30 cm long, pubescent, glabrescent; branches up to 11 cm long; floral bracts ovate, 1–1½ mm long, puberulous on both surfaces; pedicels ½–2 mm. Flowers whitish green. Calyx lobes ovate-oblong, c. 3 mm long, puberulous outside. Petals ovate-oblong, sometimes lanceolate, 4½–5 by 1¼–2¼ mm. Stamens 3–4 mm; anthers ovoid, 1–1¼ mm long. Disk 3–3½ mm Ø, puberulous. Pistil 3½–4 mm long. Ovary depressed-globose, c. ½ the length of pistil, 2–3 mm Ø. Drupe depressed-globose, 2 cm long and 3–5½ cm Ø, up to 5½ cm long and 6½–7 cm Ø when fresh, dark brown when ripe, distinctly 5-celled; endocarp lentiform, 3–5 cm Ø, with numerous, irregular processes. Seed broadly ovoid, ¾–1 cm long.

Distr. *Malesia*: New Guinea (West: Nabire, one coll.; East: Sepik, Central and Morobe Distr.).

Cultivated in the Botanic Garden at Lae.

Ecol. Lowland rain-forest, common on raised alluvial flats and on swampy ground. Fl. Sept.–Oct.; fr. March, July, Sept.

Vern. *Habere*, Suku, *urau*, Vailala.

3. *Dracontomelon costatum* BL. Mus. Bot. 1 (1850) 232; Miq. Fl. Ind. Bat. 1, 2 (1859) 639; ENGL. in DC. Mon. Phan. 4 (1883) 252; MERR. Pl. Elm. Born. (1929) 168; WILKINSON, J. Nat. Hist. 1968(2), p. 39, f. 1–4, 5A–D, 6D. — Fig. 30a–d.

Tree up to 30(–35) m high and 60(–80) cm Ø. Buttresses occasionally present, up to 5 m high, c. 2 m wide, thin. Bark light brown, smooth. Leaves with 4–7 pairs of leaflets; rachis 10–35 cm long, petiole 8–25 cm, both sparsely puberulous, glabrescent, or glabrous. Leaflets coriaceous, elliptic-lanceolate, broad-elliptic, sometimes ovate to lanceolate, 6–22 by 3½–9½ cm, glabrous above, lower surface puberulous on the midrib and nerves, glabrescent, or glabrous, without domatia; base cuneate, sometimes unequal; apex acuminate, sometimes acute, rarely obtuse; nerves 10–16 pairs; veins reticulate-scalariform; petiolules ½–1¼ cm, the terminal one up to 4 cm. Panicles up to 35(–70) cm long, puberulous, glabrescent; branches up to 30 cm long; floral bracts triangular, ½–1 mm long, puberulous on both surfaces; pedicels c. ½ mm. Flowers light green or pale yellow. Calyx lobes elliptic, 3 mm long, puberulous outside. Petals ovate-oblong, 4–4½ by 1½–1¾ mm. Stamens 2–3 mm long; anthers oblong or ovoid-oblong,



Fig. 33. Localities of *Dracontomelon costatum* BL.

*c.* 1 mm long. *Disk* *c.* 2 mm  $\varnothing$ , glabrous. *Pistil* 3–3½ mm long. *Ovary* oblong-ellipsoid, *c.* ½ the length of pistil, 1½ mm  $\varnothing$ . *Drupe* ovoid or broadly ellipsoid, 2–2½ cm long and *c.* 1½ cm  $\varnothing$ , black when ripe, seemingly 1-celled (due to abortion);

endocarp ovoid or broadly ellipsoid, *c.* 1½ cm  $\varnothing$ , smooth. *Seed* oblong, *c.* ⅔ cm long.

*Distr. Malesia:* Sumatra (Djambi, Simalur) and Borneo (Sabah: Sandakan, Lung Mangis, Kinabatangan, Tawao; Brunei; Kalimantan: Kutai, Sangkulirang, Samarinda, Balikpapan, Pleihari, Muaratewe, Martapura, Melawi). Fig. 33.

*Ecol.* Primary forest, from the lowland up to 100 m, sometimes occurring on sandstone or limestone. *Fl.* April, Aug.–Oct.; *fr.* Jan., May–July.

*Vern.* Sumatra: *sēnlang*, *s. buluk*, *s. dēlok*, *s. ētēm*, *s. uding*, Simalur; Borneo: *bēsēngkiang*, Dajak, *katēp*, M, *landur*, Bassap Dajak, *pistanak*, Pleihari, *pitanak*, Bekumpai, *sēnkuang*, Samarinda, *tēkosoi*, Kutai.

*Note.* WILKINSON (*l.c.*) gave a detailed description and discussion on the structure of the flowers, fruits, and seeds.

#### Excluded

*Dracontomelon? cuspidatum* BL. Mus. Bot. 1 (1850) 232; MIO. Fl. Ind. Bat. 1, 2 (1859) 640, is according to H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 349, 351 = *Dacryodes rostrata* (BL.) H. J. LAM (*Burseraceae*).

*Dracontomelon papuanum* LAUT. in K. Sch. & Laut. Nachtr. (1905) 301; Bot. Jahrb. 56 (1920) 356, is according to LEENHOUTS, Fl. Males, 1, 7 (1976) 820 = *Protium macgregorii* (F. M. BAILEY) LEENH. (*Burseraceae*).

## 9. PLEIOGYNIUM

ENGL. in DC. Mon. Phan. 4 (1883) 255; A. C. SMITH, Contr. U.S. Nat. Herb. 37 (1967) 76. — **Fig. 34.**

Trees. *Leaves* imparipinnate, very rarely paripinnate, petioled. *Leaflets* opposite, entire. *Inflorescences* axillary, paniculate, sometimes the ♀ racemose or spiciform. *Flowers* often unisexual (plants often dioecious). *Calyx* 5-(rarely 4- or 6-)lobed. *Petals* 5 (rarely 4 or 6), imbricate. *Stamens* 10 (rarely 8–12), twice the number of petals; filaments filiform-subulate, glabrous; anthers slightly oblong or ovoid, abortive or imperfect in ♀. *Disk* annular-pulvinate, sometimes slightly convex, crenulate. *Ovary* 5–12-celled; styles 5–12, divergent; stigmas spatulate. Abortive pistil in ♂ rudimentary. *Drupe* 5–12-celled, 5–12-seeded; endocarp hard, woody. *Seed* with testa free from the endocarp; embryo slightly curved, cotyledons free, plano-convex.

*Distr.* Species 2 or 3, distributed in the Pacific Is. (Tonga, Cook I., Fiji, Solomon Is.), Australia (Queensland), and Malesia (New Guinea, Moluccas, Lesser Sunda Is., Celebes, Philippines, Borneo).

If Australian botanists are correct in reducing *P. cerasiferum* PARKER to *P. solandri*, the genus consists of one widely distributed Indo-Australian species and one endemic in Fiji.

*Ecol.* Lowland forest, sometimes up to 560 m, rarely at 750–970 m.

1. *Pleiogyonium timoriense* (DC.) LEENH. Blumea 7 (1952) 159; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 32, f. 12; A. C. SMITH, Contr. U.S. Nat. Herb. 37 (1967) 77, *in note*. — *Icica timoriensis* DC. Prod. 2 (1825) 78. — *Spondias solandri* BENTH. Fl. Austr. 1 (1863) 492. — *Spondias pleiogyna* F.V.M. Fragm. 4 (1864) 78. — *P. solandri* (BENTH.) ENGL. in DC. Mon. Phan. 4 (1883) 255, t. 7, f.

1–10; BAILEY, Queensl. Fl. 1 (1899) 324, t. 12; MERR. Philip. J. Sc. 4 (1909) Bot. 284; BAILEY, Compr. Cat. Queensl. Pl. (1913) 124; MERR. En. Philip. 2 (1923) 471; PARKER, For. Fl. Punjab ed. 2 (1924) 118; LANE-POOLE, For. Res. (1925) 107; WHITE & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 237; KRAEMER, Trees W. Pac. Reg. (1951) 202, f. 71. — *Owenia cerasifera* (?non F.V.M. 1857)

T. V. Os'76

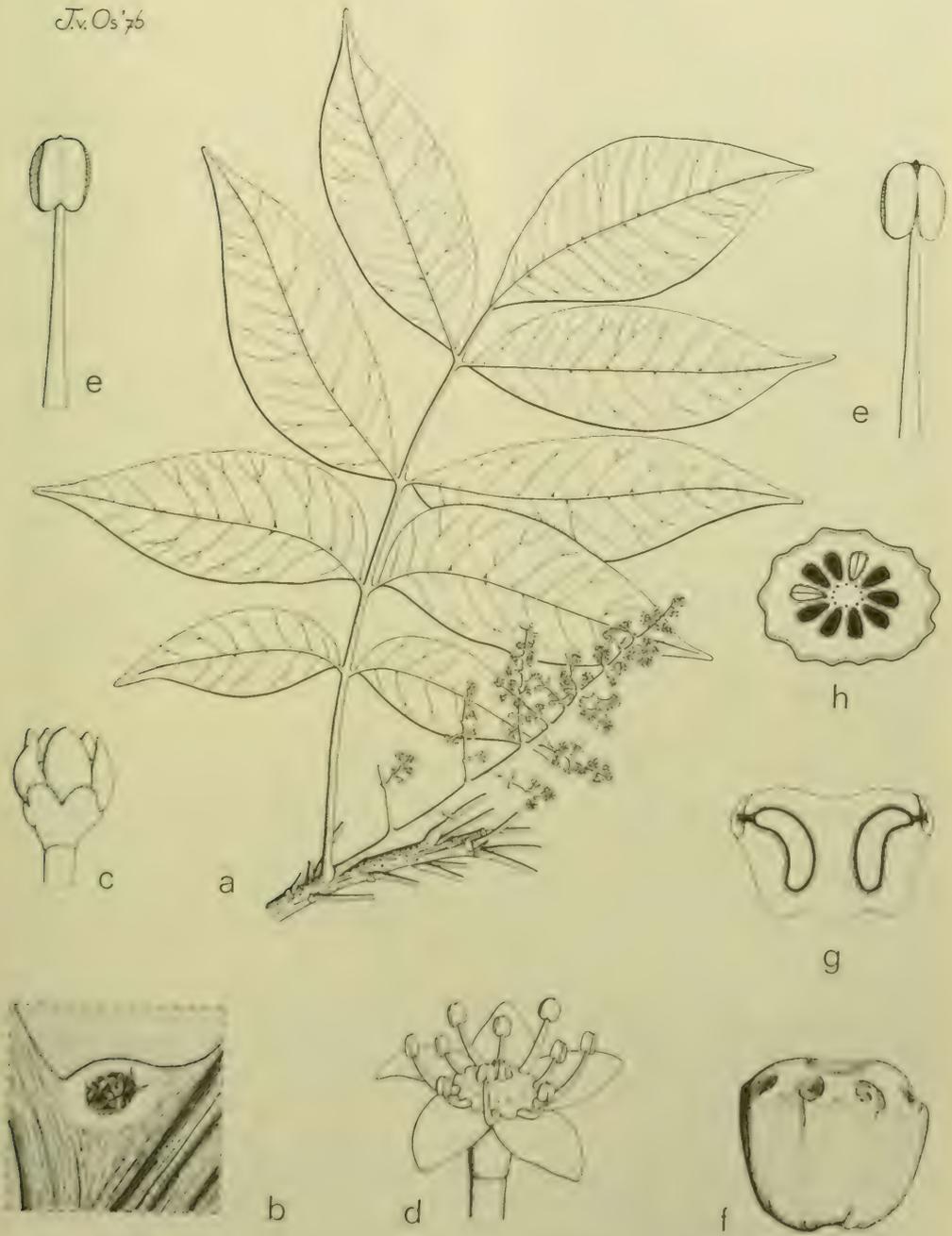


Fig. 34. *Pleio gynium timoriense* (DC.) LIESH. a. Habit,  $\times 1/2$ , b. domatium,  $\times 27$ , c. flower-bud,  $\times 7$ , d. flower,  $\times 7$ , e. stamens, viewed from two sides,  $\times 14$ , f. endocarp, side view, g. ditto in LS, h. ditto in CS, all  $\times 1 1/2$  (a-e C.H.B. III-E-3, f-g C.H.B. III-E-48, h SLEUMER s.n.).

HEMSL. Bot. Chall. 1 (1885) 132; THIS.-DYER, J. Linn. Soc. Bot. 21 (1885) 373 ('*cerasifolia*'). — *P. papuanum* C. T. WHITE, Proc. R. Soc. Queensl. 45 (1933) 27, t. 3; J. Arn. Arb. 31 (1950) 95. — Fig. 34.

Tree up to 36(–48) m high and 75 cm  $\varnothing$ . Buttresses sometimes present, up to c. 2 $\frac{1}{2}$  m high. Bark dark-grey or grey-brown, flaky, fissured. Young branchlets usually puberulous, pubescent, or tomentose, glabrescent. Leaves with 3–6 pairs of leaflets, rachis 4–30 cm, petiole 3–12 cm, both puberulous, pubescent or tomentose, sometimes glabrescent, or glabrous. Leaflets elliptic-oblong to lanceolate, sometimes ovate, or obovate-oblong, 3 $\frac{1}{2}$ –13 $\frac{1}{2}$  by 2 $\frac{1}{4}$ –6 cm; glabrous, sometimes sparsely or moderately hairy especially on the midrib and nerves on both surfaces (rarely only on the lower surface); with hairy domatia; base unequal, cuneate, or decurrent, sometimes obtuse; apex acute, acuminate, sometimes obtuse, or cuspidate; nerves 8–11 pairs, veins reticulate; petioles  $\frac{1}{2}$ –1 cm, the terminal one 1–4 cm. Inflorescences:  $\sigma$  up to 30 cm long, branches up to 8 $\frac{1}{2}$  cm long, many-flowered;  $\varphi$  rather simple, usually short, 2–3 $\frac{1}{2}$  cm long, rarely up to 15 cm long, few-flowered; floral bracts triangular,  $\frac{1}{4}$ –1 $\frac{1}{2}$  mm long; pedicels very short, up to c.  $\frac{2}{3}$  mm, articulated. Flowers greenish yellow. Calyx lobes suborbicular,  $\frac{1}{2}$ – $\frac{3}{4}$  mm long. Petals ovate-oblong,  $\frac{1}{4}$ –3 by 1–2 $\frac{1}{2}$  mm. Stamens 2–3 mm, usually those opposite the calyx lobes longer than those opposite the petals; anthers  $\frac{1}{2}$ – $\frac{2}{3}$  mm, thecae free at the lower  $\frac{1}{3}$ – $\frac{1}{2}$ , connective distinct, brown or dark brown, sometimes slightly prolonged beyond the thecae. Sterile or imperfect stamens in  $\varphi$   $\frac{2}{3}$ –1 mm. Disk 1 $\frac{1}{2}$ –1 $\frac{3}{4}$  mm  $\varnothing$ . Ovary subglobose, c. 1 mm  $\varnothing$ , glabrous; styles c.  $\frac{1}{2}$  mm. Sterile pistil in  $\sigma$   $\frac{1}{3}$ –1 mm. Drupe broadly obovoid, 1 $\frac{1}{2}$ –1 $\frac{3}{4}$  by

1 $\frac{1}{2}$ –2 cm, red to dark brown when ripe, smooth and glabrous, obtuse or truncate at the top, the lower  $\frac{2}{3}$  lengthwise ridged, with distinct scars of styles at the apical end; endocarp rather smooth, slightly smaller than the dried drupe. Seed  $\frac{3}{4}$ –1 $\frac{1}{4}$  by  $\frac{1}{3}$  cm.

Distr. Pacific Is. (Tonga & Cook Is., cf. A. C. SMITH, 1967, p. 77), Solomon Is. (Santa Cruz), Fiji, Australia (Queensland), and *Malesia*: New Guinea (West: Warsamson & Hollandia; Papua New Guinea: Sepik, Madang, Morobe, Port Moresby, and Central Distr.), Moluccas (Obi, Halmahera, Key), SE. Celebes (Kendari, 1 coll.), Philippines (Luzon, 1 coll.), Borneo (Sabah, 1 coll.), Lesser Sunda Is. (Timor, Flores, Sumba, Wetar, Timubar).

Cultivated in Hort. Bog. under n. III-E-3, 9, 48 and 48<sup>2</sup>; III-K-21<sup>2</sup>; XI-B-IV-19.

Ecol. Lowland forest, sometimes up to 560 m, rarely at 750–970 m. Very scattered, in many islands only once collected. Fl. fr. March–Dec.

Vern. Lesser Sunda Is.: *indjo wato*, *lindu watu*, Sumba; New Guinea: *aidzak*, Jal, Madang, *aledzula*, Kasimin, Angoram, *ameya*, Gavien, Angoram, *umbut*, Maprik, Wewak, *vasapa*, Suku, *woigiek*, Mooi.

Note. From Queensland I have seen material of this species (O'FARRELL 73, HYLAND 4822, 5644, N. H. SPECK 1687, STORY & YAPP 78). In Australian literature the species was called *P. solandri* (BENTH.) ENGL. (based on *Spondias solandri* BENTH. 1863) and more recently *P. cerasiferum* PARKER, For. Fl. Punjab ed. 2 (1924) 118, 560 (based on *Owenia cerasifera* F.V.M. 1857, cultivated in India). Australian botanists are of opinion that these refer to one species; if that is true the name adopted here is the correct one.

## 10. LANNEA

A. RICHARD in Guillemain c.s. Fl. Sénég. Tent. 1 (1831) 153, *nom. cons.* — *Haberlia* DENNST. Schlüss. Hort. Mal. (1818) 30. — *Odina* ROXB. (Hort. Beng. 1814, 29) Fl. Ind. ed. Carey 2 (1832) 293; ENGL. in DC. Mon. Phan. 4 (1883) 263. — *Wirtgenia* JUNGH. ex HASSK. Flora 25 (1842) Beibl. ii: 46; *ibid.* 27 (1844) 624; Cat. Hort. Bog. (1844) 247, p.p., *nom. invalid.*, non SCHIMPER, 1842. — *Calesiam* ADANS. Fam. 2 (1763) 446, *nom. rejic.* — *Kokkia* ZIPP. ex BL. Mus. Bot. 1 (1850) 206, *pro syn.* — Fig. 35–37.

Trees, shrubs or undershrubs (*extra-Mal.*). Indumentum of stellate hairs. Leaves spiral, imparipinnate (rarely tri- or unifoliolate in *extra-Mal. spp.*), petioled. Inflorescences paniculate or  $\pm$  spiciform, axillary or pseudo-terminal, appearing before (or at the same time in *extra-Mal. spp.* with) the leaves. Flowers unisexual (plants dioecious). Calyx 4-lobed. Petals 4, imbricate, glabrous. Stamens 8; filaments subulate, glabrous; anthers dorso-basifixed, ovoid, abortive and small in  $\sigma$ . Disk intrastaminal, round, flat or concave. Ovary ovoid or oblong, 4-celled, usually 1 (or 2) fertile; styles 4, short; stigmas small, subglobose. Sterile pistil in  $\sigma$  small. Drupe 1–4-celled, usually 1- (or 2-)seeded; endocarp woody, with 1 (or 2) operculum (opercula). Seed with testa free from the endocarp; embryo straight, cotyledons free, plano-convex.

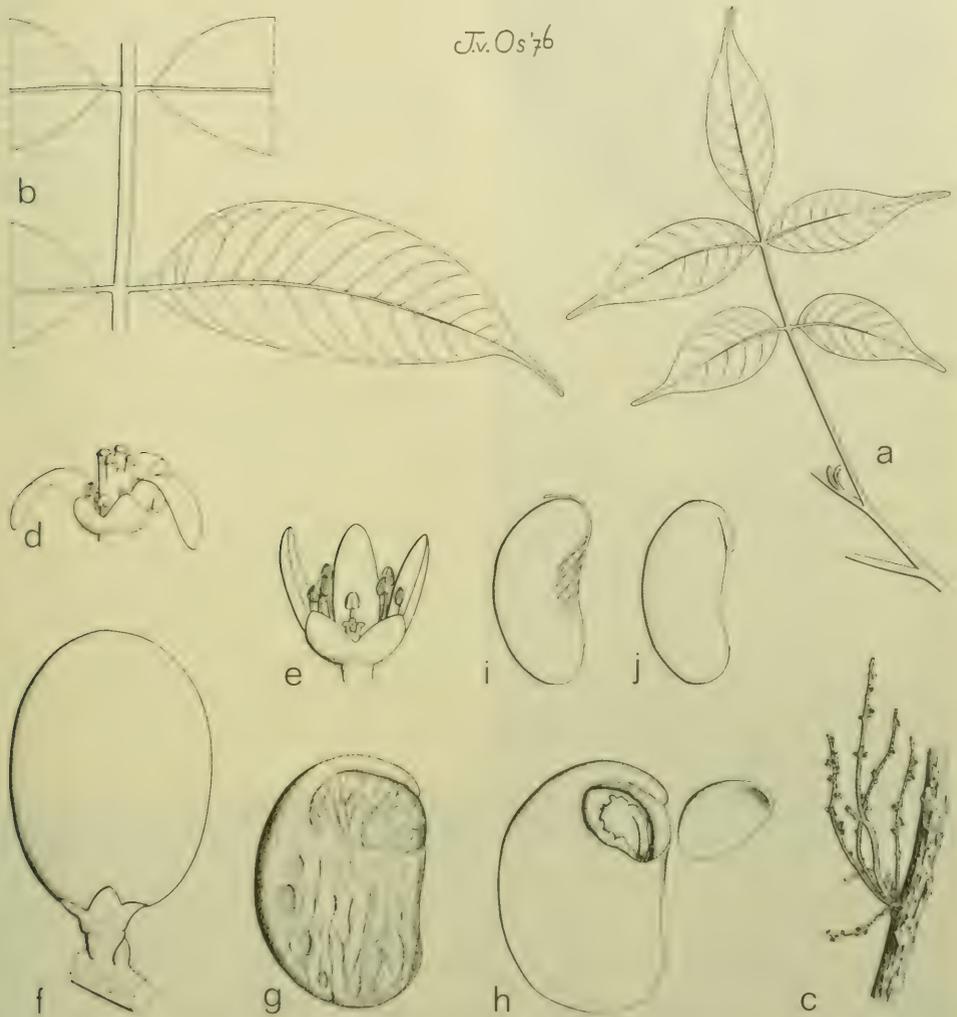


Fig. 35. *Lansea coromandelica* (HOULT.) MERR. a. Young twig with one young leaf, b. part of leaf, c. flowering bare twig, all  $\times 1/2$ , d.  $\delta$  flower, 1 petal removed,  $\times 7$ , e.  $\beta$  flower, 1 petal and 1 stamen removed,  $\times 7$ , f. fruit, g. stone, side view, showing depressions on surface and operculum of one fertile cell, h. stone with operculum opened; seed with part of testa removed showing radicle, i. seed, side view, j. embryo, side view, all  $\times 3 1/2$  (a, c, d VAN SLOOTEN 2036, b DOCTERS VAN LEEUWEN 5138, e MARS LALL 17415(?), f-j G. PANIGRAHI 11317).

Distr. About 40 spp., chiefly distributed in tropical and South Africa, 1 sp. in tropical Asia and Malesia (Sumatra, Malay Peninsula, Java, Lesser Sunda Is., Celebes).

*Lansea* is not indigenous in Malesia; it has been introduced from Asia.

Ecol. Along roadsides and inhabited places at low altitude, largely confined to the seasonal areas.

Nomencl. *Wirtgenia* JUSQU. ex HASSK. was not validly published, as HASSKART mentioned this name only in the synonymy under *Spondias*. JUNGHIUS, who put his MSS at HASSKART's disposal, distinguished two species, *W. octandra* which is *Lansea*, and *W. decandra* which is *Spondias pinnata*.

Note. It would be desirable to compare the Asian species with those described from Africa and check whether it is distinct from the African ones.

1. *Lannea coromandelica* (HOUTT.) MERR. J. Arn. Arb. 19 (1938) 353; ADELB. Reinwardtia 3 (1954) 150; BACK. & BAKH. f. Fl. Java 2 (1965) 152; AIRY SHAW & FORMAN, Kew Bull. 21 (1967) 19. — *Kalesiam* RHEEDE, Hort. Mal. 4 (1683) 67, t. 32. — *Dialium coromandelicum* HOUTT. Nat. Hist. II, 2 (1774) 39, t. 5, f. 2. — *Haberlia grandis* DENNST. Schlüss. Hort. Mal. (1818) 30. — *Odina wodier* ROXB. (Hort. Beng. 1814, 29, *nom. nud.*) Fl. Ind. ed. Carey 2 (1832) 293; W. & A. Prod. 1 (1834) 171; WIGHT, Ic. (1838) t. 60; THW. En. Pl. Zeyl. (1858) 78; MIQ. Fl. Ind. Bat. 1, 2 (1859) 622; BEDD. Fl. Sylv. (1871) t. 123; HOOK. f. Fl. Br. Ind. 2 (1876) 29; ENGL. in DC. Mon. Phan. 4 (1883) 267, t. 8, f. 27–29, *incl. var. wirtgenii*; KING, J. As. Soc. Beng. 65, ii (1896) 501; K. & V. Bijdr. 4 (1896) 140; BACK. Fl. Bat. (1907) 376; LECOMTE, Fl. Gén. I-C. 2 (1908) 34; BACK. Schooffl. (1911) 282; PARKINSON, For. Fl. Andaman Is. (1923) 140; CRAIB, Fl. Siam. En. 2 (1926) 352. — *Spondias wirtgenii* HASSK. Flora 25 (1842) Beibl. ii: 46; *ibid.* 27 (1844) 624; Cat. Hort. Bog. (1844) 247; MIQ. Fl. Ind. Bat. 1, 2 (1859) 622. — *Wirtgenia octandra* JUNGH. ex HASSK. Flora 27 (1844) 624, *nom. invalid.* — *Odina gummiifera* BL. Mus. Bot. 1 (1850) 206, *nom. illeg.* — *Tapiria wodier* MARCH. Rév. Anacard. (1869) 162. — *Calesiam grande* (DENNST.) O. K. Rev. Gen. Pl. 1 (1891) 151. — *L. grandis* (DENNST.) ENGL. in E. & P. Nat. Pfl. Fam. Nachtr. 1 (1897) 213; HEYNE, Nutt. Pl. (1927) 976; BURK. Dict. (1935) 1313. — *L. wodier* ADELB. Blumea 6 (1948) 326; TARD. Fl. C. L. & V. 2 (1962) 141, t. 10, f. 7–11. — Fig. 35–37.

Deciduous tree, usually of small size, 6–10 m high, sometimes up to 20 m high and 45 cm Ø. Young branchlets, leaves, and inflorescences densely rusty stellate-hairy, glabrescent; twigs

thick, with large leaf-scars. *Leaves* with 3–7 pairs of leaflets, 10–25 cm long. *Leaflets* opposite, elliptic-oblong, broadly elliptic, ovate, or ovate-oblong, 4–11½ by 2½–4½ cm, entire, puberulous beneath especially on midrib and nerves, glabrescent; base cuneate; apex acuminate; nerves 8–11 pairs, veins usually hardly visible, rarely faint, reticulate; petiolules very short (up to c. ½ cm), terminal one up to 3 cm. *Inflorescences* appearing before the leaves, crowded at the apical part of a branch, or on a short-shoot (seemingly fasciculate) in the axil of a leaf-scar, spiciform, sometimes branched and paniculiform, 7–25 cm long; floral bracts triangular, c. 1 mm long. *Flowers* yellowish green, tinged with red, subsessile. *Calyx* lobes triangular, c. 1 mm long. *Petals* elliptic or oblong, 2–2½ by 1–1¼ mm. *Stamens* 2–2½ mm, abortive ones in ♀ 2/3–1¼ mm. *Disk* c. 1 mm Ø. *Ovary* c. 2/3 mm Ø. Abortive pistil in ♂ ½–1 mm long. *Drupe* broadly ellipsoid, sometimes slightly subreniform, c. 1 by 2/3 cm, red when ripe. *Seed* reniform, c. 2/3 by 1/3 cm.

Distr. India, Ceylon, Thailand, Burma, Indo-China, China (Hainan), in *Malesia* introduced, cultivated, escaped and locally more or less naturalized.

Often cultivated in Java, in Malaya on roadsides in the Settlements (BURKILL, *l.c.*).

Ecol. In lowland forest, occasionally found up to 900–1200 m. The leaves are shed in dry weather or in the dry season and the trees then flower on the bare twigs or as the new leaves develop, but inflorescences are very inconspicuous (CORNER, *l.c.*) Fl. Jan.–Dec.; fr. Febr., April.

BACKER (1907, 376–377) confirmed the note by VALETON that in Java fruits are almost absent, and three observed were immature. He found near Jakarta only ♂ flowers. I confirm lack of fruit



Fig. 36. *Lannea coromandelica* (HOUTT.) MERR. as a roadside tree, bare during dry season, as usual variously cut and damaged by borers; as soon as rains set in flowers appear on bare branches. Bali (Photogr. DE VOOGD).

setting in Malesia, though I have seen many ♂ flowers.

Uses. According to HEYNE (Nutt. Pl. 1927, 976) easily propagated by cuttings and used for living fences; also in the drier parts used as a roadside tree. Especially after injuries of the bark and trimmings masses of glassy-white exudate of hardening gum appear which may give leafless trees an eerie appearance. The gum is of inferior quality. Otherwise the tree has only some minor local occasional uses; the leaves can be eaten as a vegetable. In India the 'wodier wood' and also the gum is variously used (BURKILL).

Vern. Malaya: *kayu kuda*, *kẽdongdong*, M, *wodier*, Tamil.; Sumatra: *kaju-kuda*, N.Sum.; Java: *djavarán*, *kaju-djaran*, J, *palimphing*, *santẽn*, M; Lesser Sunda Is.: *reo*, Timor.



Fig. 37. Maltreated stem of *Lannea coromandelica* (HOULT.) MERR. with large clumps of exudate. Angke, near Jakarta (Photogr. VAN STEENIS, 1940).

## 11. SPONDIAS

LINNÉ, Gen. Pl. ed. 5 (1754) 174; Sp. Pl. (1753) 371; MARCH. Rév. Anacard. (1869) 19 & 156; ENGL. in DC. Mon. Phan. 4 (1883) 242; in E. & P. Nat. Pfl. Fam. 3, 5 (1892) 150; AIRY SHAW & FORMAN, Kew Bull. 21 (1967) 2. — *Solenocarpus* W. & A. Prod. 1 (1834) 171. — *Wirtgenia* JUNGH. ex HASSK. Flora 25 (1842) Beibl. ii: 46; *ibid.* 27 (1844) 624; Cat. Hort. Bog. (1844) 247, *p.p.*, *nom. inval.*, *non* SCHIMPER, 1842. — *Evia* COMMERS. (ex JUSS. Gen. Pl. 1789, 373, *pro syn.*) ex BL. Mus. Bot. 1 (1850) 233. — *Skoliosigma* LAUT. Bot. Jahrb. 56 (1920) 356. — **Fig. 38–40.**

Trees, wholly or partly deciduous, rarely hemi-epiphytes. *Leaves* spiral, imparipinnate, rarely bipinnate (*extra-Mal.*), or simple (*extra-Mal.*), petioled. *Leaflets* alternate, subopposite, or opposite, entire, serrate, crenate, or crenulate, in most *spp.* with a distinct and slightly thickened, intra-marginal vein. *Inflorescences* paniculate, rarely racemiform, terminal and/or axillary, appearing before the leaves or accompanied by very young ones. *Flowers* bisexual, or unisexual (*extra-Mal.*). *Calyx* 5-(or 4)-lobed. *Petals* 5 (or 4), valvate, glabrous. *Stamens* 10 (or 8); filaments subulate or filiform, glabrous, or papillose (*extra-Mal.*); anthers dorsifixed. *Disk*

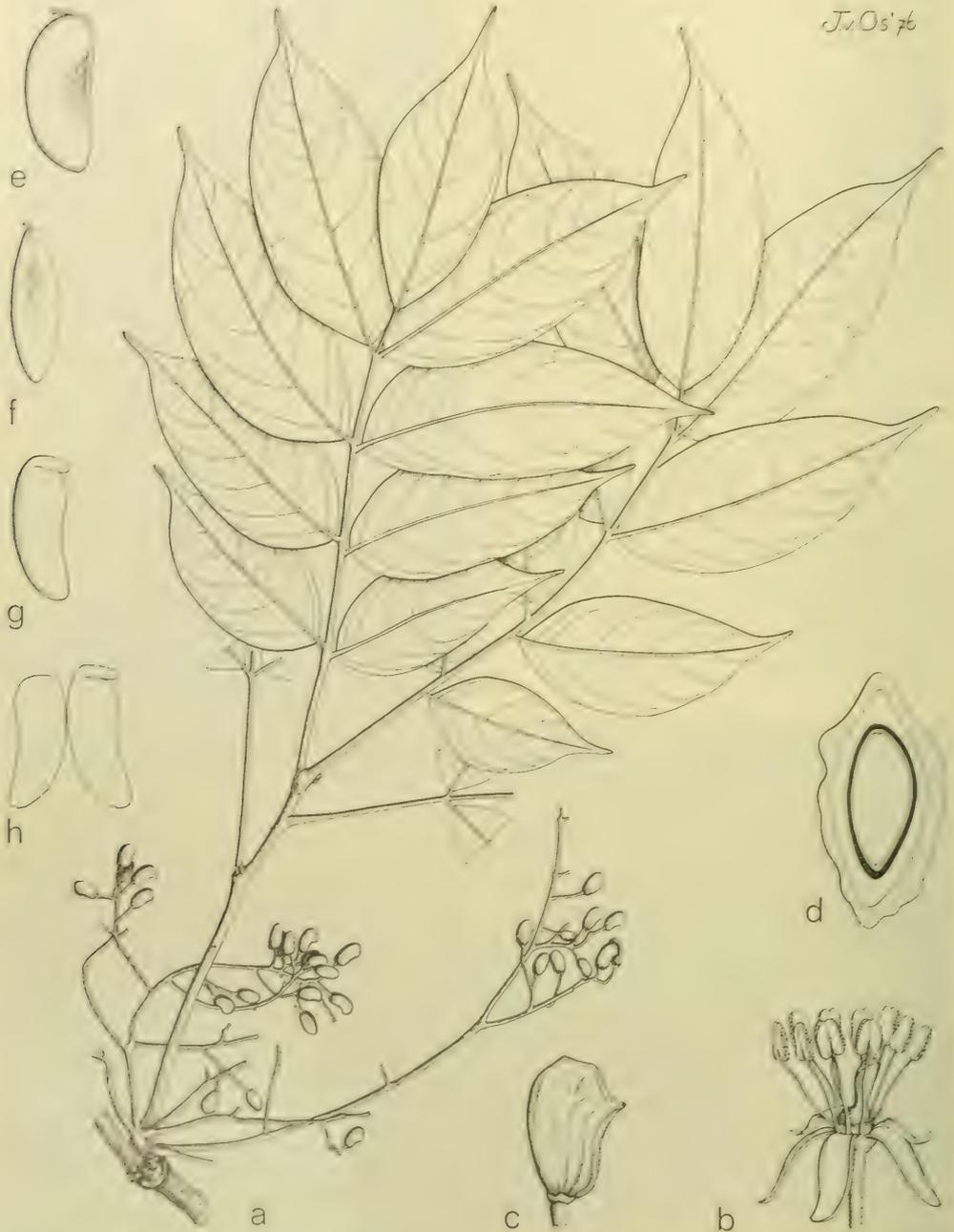


Fig. 34. *Spondias philippinensis* (ELMER) AIRY SHAW & FORMAN. a. Habit,  $\times \frac{1}{2}$ , b. flower,  $\times 7$ , c. fruit,  $\times 2\frac{1}{2}$ , d. CS of fruit,  $\times 7$ , e-f. side and face views of seed, g. embryo, side view, h. ditto, opened, all  $\times 3\frac{1}{2}$  (a, c-h S 30058, b S 18355).

intrastaminal, shortly cupular, or round and flat, crenulate, glabrous, or papillose (*extra-Mal.*). Ovary 5- (or 4-), or 1-celled, glabrous; styles 5 (or 4) and free, or 1; stigma(s) often shortly spathulate. *Drupe* 5- (or 4-), or 1-celled; endocarp woody, hard, sometimes almost bony when dry. *Seed* with testa free from the endocarp; embryo straight or slightly curved, cotyledons free, plano-convex.

Distr. Species 10, in the *Indo-Malesian* and American tropics; four of them, *i.e.* *S. cytherea*, *S. pinnata*, *S. purpurea*, and *S. mombin*, are often (widely or locally) cultivated in the tropics.

Ecol. Lowland forest, sometimes at higher altitude.

Uses. Cultivated for the edible fruit which is generally sour, though some varieties are sweet or have a mawkish taste; it is eaten, usually after cooking, as pickles or flavouring. All parts of the plants have a foetid smell of turpentine when broken or bruised; the smell differs in each species and is characteristic. The flowers are honey-sweet like those of mango. Hog-plum trees flower and fruit throughout the year, though chiefly after dry weather. The inflorescences develop at the ends of the bare twigs either before the new leaves or with them and the fruits dangle from the leafy twigs. Flower and fruit are generally to be seen together on the same tree (CORNER, Ways, Trees, 1940).

Notes. AIRY SHAW & FORMAN (Kew Bull. 21, 1967, 1-19, t. 1 & 2, f. 1-3) in their study of the genus *Spondias* stated that in tribe *Spondiadeae* the genera *Solenocarpus*, *Allospodias*, and *Spondias* differ from other members by the valvate aestivation of the petals; in these three genera, *Solenocarpus* was only distinguished from the two others by having a monocarpellary ovary (against the ovary being composed of 5 or 4, occasionally more or only 3, united carpels). They concluded that "there is such a lack of correlation between the various characters that an adequate basis for the recognition of more than one genus is wanting"; therefore, they reduced *Solenocarpus* and *Allospodias* to *Spondias*.

The endocarp of most species has the most complex structure in the *Anacardiaceae*. AIRY SHAW & FORMAN already described their macromorphological structure in detail and gave illustrations for those species with material available (*l.c.* f. 1-2). According to them, the endocarp appears to consist of two zones: (1) an inner, hard, woody layer with irregular (5 or 4) flanges which are either rather smooth or bear sparse to numerous, radiating, straight or curved, spinose or fibrous processes, and (2) an outer layer which is composed of loose or dense bundles coalesced into a simple or complex network; these two layers are connected with each other by the flanges, or spinose and fibrous processes (*cf.* AIRY SHAW & FORMAN, *l.c.* f. 1-2; fig. 39 in the present revision; also note under *S. cytherea*).

#### KEY TO THE SPECIES

1. Leaflets with a distinct intra-marginal vein. Ovary 5-(or 4)-celled; style 5 (or 4), free. *Drupe* more than 1½ by 1¼ cm in dry state, straight, 5-(or 4)-celled.
2. Leaves and inflorescences glabrous.
3. Flowers distinctly pedicelled (usually 1¼-4 mm). Flanges of the hard part of the endocarp often indirectly connected with the peripheral layer of meshes by numerous spinose and fibrous processes
  1. *S. cytherea*
  3. Flowers sessile or subsessile. Flanges of the hard part of the endocarp partly or wholly and directly connected with the peripheral layer of meshes . . . . . 2. *S. pinnata*
2. Leaves and inflorescences puberulous.
4. Inflorescences (accompanied by mature leaves) terminal, sometimes also in the apical leaf axils, up to 50 cm long, many-flowered. Flowers white. *Drupe* orange when ripe . . . . . 3. *S. mombin*
4. Inflorescences (appearing before the leaves) axillary, up to 4 cm long, few-flowered. Flowers reddish or purplish. *Drupe* usually purple when ripe. . . . . 4. *S. purpurea*
1. Leaflets without an intra-marginal vein. Ovary 1-celled; style 1. *Drupe* small, *c.* 1 by ½ cm in dry state, slightly curved, 1-celled . . . . . 5. *S. philippinensis*

1. *Spondias cytherea* SONNERAT, Voy. Ind. Or. & Chine 3 (1782) 242, t. 123; GAERTN. Fruct. 2 (1791) 101, t. 103; OCHSE & BAKH. Fruit (1931) 19, t. 8; BURK. Dict. (1935) 2067; CORNER, Ways, Trees (1940) 115, Atlas t. 14; ADELB. Blumea 6 (1948) 326; DE WIT, Rumph. Mem. Vol. (1959) 406; AIRY SHAW & FORMAN, Kew Bull. 21 (1967) 10, f. 2: 3 & 4; VERSTEEGH, Med. Landb. Hogesch. Wageningen 71-19 (1971) 56. — *Condodium* RUMPH. Herb. Amb. 1 (1741) 161, t. 60. — *Condodium malaccense* RUMPH. *l.c.* 162, t. 61. — *S. dulcis* SOLAND. (*ex* PARKINSON, J. Voy. S. Seas, 1773, 39) *ex* FORST. f. Pl. Escul. (1786) 33; Prod. (1786) 34; HOOK. f. Fl. Br. Ind. 2 (1876) 42; ENGL. in DC. Mon. Phan. 4 (1883) 246; WARB.

Bot. Jahrb. 13 (1891) 362; K. & V. Bijdr. 4 (1896) 108; KOORD. Minah. (1898) 412; K.SCH. Notizbl. Berl.-Dahl. 2 (1898) 125; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 411; RIDL. J. Str. Br. R. As. Soc. n. 45 (1906) 186; BACK. Fl. Bat. (1907) 374; LECOMTE, Fl. Gén. I.-C. 2 (1908) 29; BACK. Schoolfl. (1911) 281; MERR. Int. Rumph. (1917) 332; LAUT. Bot. Jahrb. 56 (1920) 355; LANE-POOLE, For. Res. (1925) 108; CRAIB, Fl. Siam. En. 1 (1926) 355; WHITE & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 237; HEYNE, Nutt. Pl. (1927) 974; KRAEMER, Trees W. Pac. Reg. (1951) 206; MERR. Chron. Bot. 14 (1954) 360; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 39, f. 15; BACK. & BAKH. f. Fl. Java 2 (1965) 151. — *Poupartia*

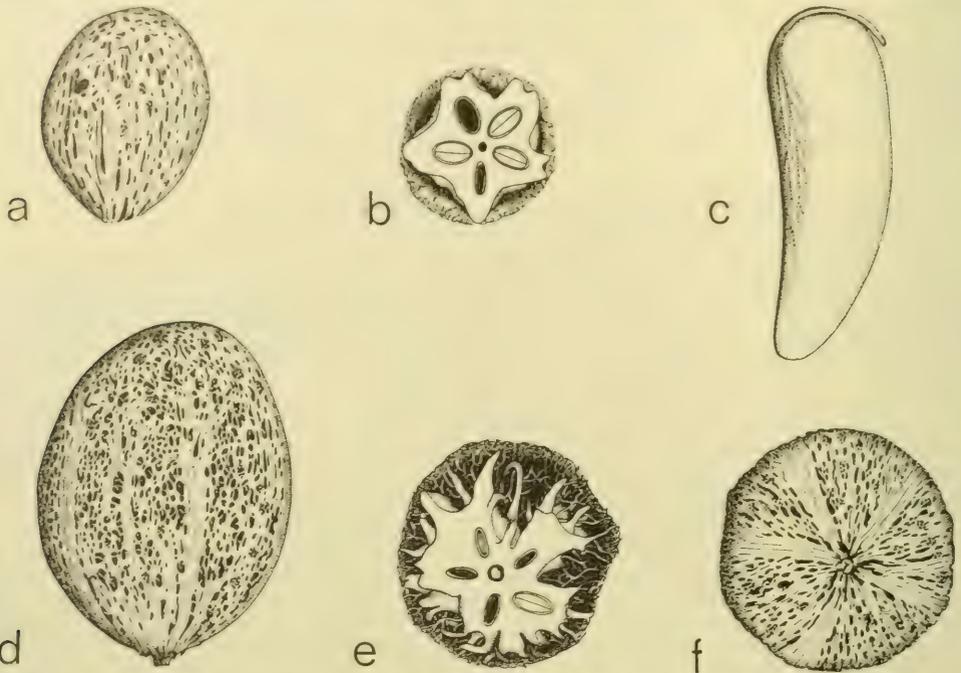


Fig. 39. *Spondias pinnata* (L. f.) KURZ. a. Endocarp, b. ditto in CS, both  $\times 1.3$ , c. seed, side view,  $\times 5$ . — *S. cytherea* SONNERAT. d. Endocarp, e. ditto in CS, f. ditto, viewed from base, all  $\times 1.3$  (a-c PNH 18650, d-f D. A. POWELL 58).

*dulcis* (FORST. f.) BL. Bijdr. (1826) 1161, *quoad nomen, nom. illeg.* — *Evia dulcis* (FORST. f.) COMM. ex BL. Mus. Bot. 1 (1850) 233. — *Evia amara* var. *tuberculosa* BL. l.c. 235; MIQ. Fl. Ind. Bat. 1, 2 (1859) 641. — *S. mangifera* var. *tuberculosa* (BL.) ENGL. in DC. Mon. Phan. (1883) 249. — Fig. 39d-f.

Tree usually up to 25 m high and 45 cm  $\varnothing$ , sometimes up to 45 m high and 90 cm  $\varnothing$ . Buttresses sometimes present,  $1/2$ – $1\frac{1}{2}$  m high,  $1$ – $2\frac{1}{2}$  m wide, 4–10 cm thick. Bark greyish, light to reddish brown, shallowly fissured. *Leaves* with 4–10 pairs of leaflets, glabrous; rachis 11–20 cm, petiole 9–15 cm. *Leaflets* chartaceous to subcoriaceous, ovate-oblong to lanceolate, ( $5\frac{1}{2}$ –) $7\frac{1}{2}$ –15(–25) by ( $1\frac{1}{2}$ –)3–5 cm; base unequal, oblique, obtuse, or cuneate; apex shortly acuminate to acuminate; margin entire, serrate, or crenulate; nerves 14–24 pairs, joining with an intra-marginal vein; veins reticulate; petiolules up to  $3/4$  cm, the terminal one 1–3 cm. *Inflorescences* appearing before leaves or accompanied by very young ones only, paniculate, terminal, up to 35 cm long, glabrous, branches up to 20 cm long; floral bracts lanceolate to linear,  $2/3$ – $1\frac{1}{4}$  mm; pedicels usually  $1\frac{1}{4}$ –4 mm, sometimes also some shorter ones. *Flowers* cream or white. *Calyx* lobes triangular,  $1/2$  mm long. *Petals* ovate-oblong,  $2\frac{1}{2}$ – $2\frac{3}{4}$  by  $1$ – $1\frac{1}{4}$  mm. *Stamens* 2 mm; anthers oblong,  $3/4$ –1 mm long. *Disk* shortly cupular, c. 1 mm  $\varnothing$ . *Ovary* subglobose, c.  $3/4$  mm  $\varnothing$ , 5-(or 4)-celled; styles 5 (or 4), free, c.  $3/4$  mm. *Drupe* (fresh) ellipsoid, or oblong, 4–10 by 3–8 cm,

bright orange when ripe, straight, 5-(or 4)-celled; scars of styles 5 (or 4), lateral, at the apical end. Flanges of the endocarp often indirectly connected with a peripheral layer of meshes by numerous spinose and fibrous processes.

*Distr.* Throughout *Indo-Malesia*, also widely cultivated in the Indo-Australian and other tropics.

It is impossible to give the exact area of indigenous occurrence of the 'Otaheite Apple', as this species is so much planted, also in native clearings, that there is little means to distinguish between indigenous and naturalized occurrence. But in many islands it is found in primary forest, notably in New Guinea where such trees may be rather common and of great size (30–40 m tall).

*Ecol.* In New Guinea rather common in lowland primary, sometimes secondary, forest, sometimes up to 1000 m, usually occurring on well drained soil, sometimes in flood plains, rarely on limestone with a thin clay cover. *Fl.* Jan.–March, July–Nov.; *fr.* Jan.–Dec.

OVERBECK recorded (Trop. Natuur 27, 1938, 93, photogr.) severe attacks by caterpillars leading to complete leafless trees. The leaves suffer sometimes severe attacks by a specific beetle (OCHSE & BAKH. Fruit, 1931, 20).

According to OCHSE *kedongdong* flowers from June to August, and fruits are ripe from January to April.

*Uses.* According to HEYNE l.c. the timber is useless. The chief use is the fruit which is mostly used as compote. HEYNE says that it may have

perspectives to become popular if further domesticated. The tree may fruit when 4 years old (BURKILL). Young leaves are eaten steamed (OCHSE & BAKH. Veg. D.E.I. 1931, 45).

Vern. Solomon Is.: *air*, Kwar'ae. New Britain: *babe*. Sumatra: *kédongdong*, Batak, M. *kédongdong las*, Lampong Kaliahna, *dudungdung-tjind*, Palembang; Malay Peninsula: *great hog-plum*, E. *kédongdong*, M.; Java: *dédongdong*, *kédangdang*, M, J, S, Md, *kédongdong manis*, *klontjeng*, M, *dédongdong-sēm*, *pelenjing*, J; Lesser Sunda Is.: *ahang*, *ehé*, *léheéng*, *lédém*, Flores, *eentji*, Sumbawa, *makong*, Alor, *woa indjoong maradda*, Sumba; Celebes: *kadondo*, *kadongdong*, Manado, *golo*, Muna; Moluccas: *ustubal*, E. Ceram, *otjo*, Tidore, *tjotjo*, Ternate, *wis*, M; New Guinea: *aimeniek* = *awimink*, *Mooi*, *arama*, *baramijan*, *warea*, Kaigori, *bemoui*, Manokwari, *bikato*, Waria, *dien*, Karoon, *gi*, Rawa, *gungkia*, Kaigulin, *huneg*, Madang, *hunek*, Amele, *iopeia*, Vailala, *juwut*, Kemptuk, *kanures*, Biak, *kara*, Evara, *karisi*, Wandammen Penins., *kédondong utan*, Numfoor, *maar*, *mur*, Kebar, *ona*, Mawan, *pehjet*, *wutiel*, Bembé, *sutiek*, Manikiong, *unumi*, Mekeo, *wain*, Jal, *witosu*, Nemo.

Notes. In New Guinea there is a wild form with smaller, more sour, but edible fruits ('*kedondong utan*' = *wild kedondong*).

The endocarp of good cultivars of *S. cytherea* has a rather 'small', hard, inner zone which connects to a (delicate) peripheral zone by numerous, radiating, straight or curved, spinose and fibrous processes. The outer zone can be easily torn or peeled off from the inner one. It has been illustrated without the outer or peripheral zone (cf. GAERTNER, *l.c.*, t. 103; ENGLER in E. & P. Nat. Pl. Fam. 3, 5, 1892, f. 99; AIRY SHAW & FORMAN, *l.c.*, f. 2: 3 & 4); actually, it also possesses such a zone or layer. Sometimes, one may find (bare) endocarps without the peripheral layer preserved in the herbarium; such endocarpa, which might have been cleaned by eating or by washing away the parenchymatous tissue, may give a wrong impression of its structure.

Fortunately, I found some endocarps (e.g. POWELL 58, L), evidently cleaned by nature or by bacteria, with a beautifully preserved peripheral layer of meshes (fig. 39d-f); such a layer can also be observed from a preserved, dried fruit by carefully removing the exocarp and mesocarp. Fresh fruit can easily be cleaned by boiling in a solution of 5% NaOH to show the peripheral layer of the endocarp.

2. *Spondias pinnata* (L. f.) KURZ, Prelim. Rep. For. & Veg. Pegu (1875) App. A. xlii & B. 42; MERR. Int. Rumph. (1917) 332, *quoad nom.*; Sp. Blanc. (1918) 233; En. Philip. 2 (1923) 470; CRAIB, Fl. Siam. En. 1 (1926) 356; HEYNE, Nutt. Pl. (1927) 975; KANEH. Bot. Mag. Tokyo 45 (1931) 292; Fl. Micron. (1933) 190, t. 9, f. 2; BURK. Dict. (1935) 2067; CORNER, Ways. Trees (1940) 116; BROWN, Useful Pl. Philip. 2 (1950) 350, f. 171; KRAEMER, Trees W. Pac. Reg. (1951) 205, f. 73; DE WIT, Rumph. Mem. Vol. (1959) 407, *quoad nom.*; TARD. Fl. C. L. & V. 2 (1962) 133, t. 8, f. 1-7; AIRY SHAW & FORMAN, Kew Bull. 21 (1967) 8, f. 2: 1 & 2. — *Mangifera pinnata* LINNÉ f. Suppl. (1781) 156. — *S. mangifera* WILLD. Sp. Pl. 2 (1799) 751; WIGHT, Ill. Ind. Bot. 1 (1840) t. 76; HOOK. f. Fl. Br. Ind. 2

(1876) 42; ENGL. in DC. Mon. Phan. 4 (1883) 248; WARB. Bot. Jahrb. 13 (1891) 362; TRIMEN, Handb. Fl. Ceyl. 1 (1893) 327; K. & V. Bijdr. 4 (1896) 104, *incl. var. javanica* K. & V. *l.c.* 105; KOORD. Minah. (1898) 413; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 411; BACK. Fl. Bat. (1907) 373; Schooff. (1911) 281; LAUT. Bot. Jahrb. 56 (1920) 355; PARKINSON, For. Fl. Andaman Is. (1923) 141. — *Poupartia dulcis* (non (FORST. f.) BL.) BL. Bijdr. (1826) 1161, *quoad specim., excl. syn.* — *Poupartia pinnata* BLANCO, Fl. Filip. (1837) 393; ed. 2 (1845) 274; ed. 3, 2 (1878) 146. — *Wirtgenia decandra* JUNGH. ex HASSK. Flora 25 (1842) Beibl. ii: 46; *ibid.* 27 (1844) 624, *nom. inval.* — *Evia acida* BL. Mus. Bot. 1 (1850) 234, f. 41; MIQ. Fl. Ind. Bat. 1, 2 (1859) 640. — *Evia amara* COMMERS. ex BL. Mus. Bot. 1 (1850) 234; MIQ. Fl. Ind. Bat. 1, 2 (1859) 641. — *S. dulcis var. acida* (BL.) ENGL. in DC. Mon. Phan. 4 (1883) 247. — Fig. 39a-c, 40.

Tree 20-25(-40) m high and 30-50(-150) cm Ø, sometimes 35-50 m high and 100-150 cm Ø. Buttresses occasionally present. Bark grey, smooth. Leaves (1-5-6(-8) pairs, glabrous, rachis 5-22 cm, petiole 4<sup>1</sup>/<sub>2</sub>-15<sup>1</sup>/<sub>2</sub> cm. *Leaflets* chartaceous to subcoriaceous, elliptic-oblong, 7-15 by 2<sup>1</sup>/<sub>2</sub>-5 cm; base rounded or obtuse, obliquely, abruptly cuneate to attenuate; apex abruptly acuminate; margin crenate or serrate, or entire; nerves 12-25 pairs, joining with an intra-marginal vein; veins reticulate; petiolules up to 1 cm, the terminal one up to 2<sup>1</sup>/<sub>2</sub> cm. *Inflorescences* appearing before the leaves or accompanied by very young ones only, paniculate, terminal, rarely also axillary, up to 40 cm long, glabrous, branches up to 15 cm long; floral bracts ovate to linear, 1-3<sup>1</sup>/<sub>2</sub> mm long. *Flowers* sessile or subsessile. *Calyx* lobes triangular, c. 1<sup>1</sup>/<sub>2</sub> mm long. *Petals* ovate-oblong or elliptic-oblong, 2<sup>1</sup>/<sub>2</sub>-3 by 1-1<sup>1</sup>/<sub>2</sub> mm. *Stamens* 1<sup>1</sup>/<sub>4</sub>-1<sup>3</sup>/<sub>4</sub> mm; anthers broadly ovoid, c. 2<sup>1</sup>/<sub>3</sub> mm long. *Disk* shortly cupular, c. 1 mm Ø. *Ovary* subglobose, c. 3<sup>1</sup>/<sub>4</sub> mm Ø, 5-(or 4)-celled; styles 5 (or 4), free, c. 1<sup>1</sup>/<sub>2</sub> mm. *Drupe* (fresh) ellipsoid, or ellipsoid-oblong, 2<sup>1</sup>/<sub>4</sub>-5 by 2<sup>1</sup>/<sub>2</sub>-3<sup>1</sup>/<sub>2</sub> cm, yellow-orange when ripe, straight, 5-(or 4)-celled; scars of styles 5 (or 4), lateral, at the apical end. Flanges of endocarp rather smooth (with some fibrous processes), partly or wholly and directly connected with a peripheral layer of meshes.

Distr. *Indo-Malesia*, especially in Java and the Philippines, but difficult to ascertain where it is precisely native because of its wide cultivation and tendency to naturalize; KOORDERS & VALETON (*l.c.* 105) recorded it as wild in Java but whether this means native is uncertain, as fruit trees are, especially in West Java, planted in clearings and humas which may be abandoned later.

Ecol. Besides in cultivated state, found in primary and mixed forests, also secondary forest, in teak-forest, savannahs, and in dry areas, sometimes on limestone, from the lowland up to 500 m, once at 900 m. *Fl.* May-Jan.; *fr.* Febr.-Nov.

CORNER recorded the fruit ripening yellow brown to orange brown or greyish brown, smelling of rotting apples.

Uses. According to HEYNE (*l.c.* 975) both timber and fruit are of inferior quality. He mentioned also some minor medicinal uses made of different parts of the plant.

Vern. Malay Peninsula: *əmbrah*, *əmhrah*,



Fig. 40. *Spondias pinnata* (L. f.) KURZ. Fruiting, in Ceylon (Photogr. WORTHINGTON).

*kědongdong*, M, *grik*, Perak; Java: *kědongdong*, M, *kadongdong*, *k. leuweung*, S, *kědongdong*, *klontjing*, J, *kadungdung*, Md; Lesser Sunda Is.: *kadongdong*, *katjěmtjěm*, Bali, *intji*, Bima; Philippines: *adúas*, *alubihon*, *libás*, Tag., *alambihód*, C.Bis., *alubihód*, Bis., *alubuid*, Kuy., *baliud*, Tagk., *kalabahid*, Mbo, *lannó*, Ibn., *lannu*, Neg. & Ibn., *libás*, P.Bis., Sulu, Mag., *lubas*, Bik.; Celebes: *liwas*, Minah., *golo*, Muna, *ontjo*, Toradja, *karungrung*, Makas., *dao katji*, *katjang*, Bugin.; Moluccas: *uriolo*, S.Ceram, *urital*, *uritolo*, Nusalaut, *goriodo*, *kris*, *ngulu*, Halmah., *ngudu*, Ternate.

3. *Spondias mombin* LINNÉ, Sp. Pl. (1753) 371; BURK. Dict. (1935) 2067; CORNER, Ways. Trees (1940) 115; ADELB. Blumea 6 (1948) 326; BACK. & BAKH. f. Fl. Java 2 (1965) 151; AIRY SHAW & FORMAN, Kew Bull. 21 (1967) 11, f. 2: 5 & 6; CROAT, Ann. Mo. Bot. Gard. 61 (1974) 487. — *S. lutea* LINNÉ, Sp. Pl. ed. 2 (1762) 613; ENGL. in DC. Mon. Phan. 4 (1883) 244; K. & V. Bijdr. 4 (1896) 111; BACK. Fl. Bat. (1907) 371; Schoolfl. (1911) 280; HEYNE, Nutt. Pl. (1927) 975.

Tree up to 25 m high and 75–80 cm Ø. Buttresses absent. Bark grey or light brown, rugged with corky, spine-like projections and knobs. *Leaves* 3–10 pairs; rachis 6–25 cm, petiole 2½–7 cm, both puberulous. *Leaflets* chartaceous, slightly asymmetric, ovate-elliptic, elliptic, or elliptic-oblong, (3–)5–14(–20) by (1¼–)3–6(–7) cm, puberulous on the midrib, nerves and veins below, and on the midrib above, glabrescent; base obliquely obtuse or cuneate; apex acuminate; margin entire; nerves 8–14 pairs, joining with an intra-marginal vein; veins reticulate; petiolules ½–⅔ cm, the terminal one up to 2½ cm. *Inflorescences* accompanied by mature leaves, paniculate, terminal, sometimes also in the apical leaf axils, up to 50 cm long, puberulous, glabrescent; branches up to 20 cm long; floral bracts ovate to lanceolate, ½–5 mm long; pedicels 1–2¼ mm. *Flowers* white. *Calyx* lobes triangular or deltoid, c. ⅓ mm long. *Petals* oblanceolate or oblong, 2½–3½ by 1¼–1½ mm. *Stamens* 2½–3 mm; anthers ovoid, c. 1 mm long. *Disk* round and flat, c. 1¼ mm Ø. *Ovary* ovoid, c. 1 mm Ø, 5- (or 4-)celled; styles 5 (or 4), free,

c.  $\frac{2}{3}$  mm. *Drupe* (fresh) ellipsoid or broad-obovoid, 3–5 by c.  $2\frac{1}{2}$  cm, orange when ripe, straight, 5-(or 4)-celled; scars of styles 5 (or 4), lateral, at the apical end. Flanges of the endocarp (with fibrous processes) partly or wholly and directly connected with a peripheral layer of meshes, sometimes with cavities alternating with loculi (shown in a median, transverse section).

Distr. Native of tropical America. Cultivated in the tropics; locally cultivated in *Malesia* (Sumatra, Malay Peninsula, and Java).

Ecol. Lowland forests and along the inner border of tidal forests. *Fl.* Jan.–June, Sept.–Oct.; *fr.* March, Aug.

Uses. According to HEYNE (Nutt. Pl. 1927) occasionally planted as a shade tree. The thick bark can be used for making stamps. The fruits have an acid taste and are useless.

4. *Spondias purpurea* LINNÉ, Sp. Pl. ed. 2 (1762) 613; F.-VILL. Nov. App. (1880) 55; ENGL. in DC. Mon. Phan. 4 (1883) 243; VIDAL, Sinopsis Atlas (1883) 22, t. 27, f. B; MERR. Publ. Gov. Lab. Philip. n. 6 (1904) 22; Fl. Manila (1912) 301; Sp. Blanc. (1918) 233; En. Philip. 2 (1923) 471; BROWN, Useful Pl. Philip. 2 (1950) 350, f. 172 & 173; AIRY SHAW & FORMAN, Kew Bull. 21 (1967) 12, f. 2: 7 & 8. — *S. dulcis* (non FORST. f.) BLANCO, Fl. Filip. (1837) 390; ed. 2 (1845) 273; ed. 3, 2 (1878) 143, t. 132; MERR. Publ. Gov. Lab. Philip. n. 27 (1905) 36. — *S. lutea* (non L.) ? F.-VILL. Nov. App. (1880) 55; MERR. Publ. Gov. Lab. Philip. n. 6 (1904) 22; Philip. J. Sc. 1 (1906) Suppl. 84; HEYNE, Nutt. Pl. (1927) 975; BURK. Dict. (1935) 2067; CORNER, Ways. Trees (1940) 115. — *S. mombin* (non L.) BURK. Dict. (1935) 2067; CORNER, Ways. Trees (1940) 115 ('*monbin*').

Tree up to 10(–25) m high and 30(–80) cm  $\varnothing$ . Buttresses absent. Bark greyish or brown, smooth. *Leaves* 4–12 pairs; rachis 6–12 cm, petiole  $2\frac{1}{2}$ –4 cm, both puberulous. *Leaflets* chartaceous, obliquely elliptic or elliptic-oblong, 2–5 $\frac{1}{2}$  by 1–2 $\frac{1}{2}$  cm; puberulous on the midrib, nerves and veins below, and on the midrib above, glabrescent; base obliquely cuneate; apex acute to acuminate; margin obscurely crenulate especially at the upper half, or entire; nerves 6–10 pairs, joining with an intramarginal vein; veins reticulate; petiolules short,  $\frac{1}{4}$ – $\frac{1}{2}$  cm, the terminal one c.  $\frac{3}{4}$  cm. *Inflorescences* appearing before the leaves, paniculate or racemiform, axillary, up to 4 cm long, slightly puberulous; branches c. 1 cm long, few-flowered; floral bracts 1–1 $\frac{1}{2}$  mm long; pedicels 2–4 mm. *Flowers* reddish or purplish. *Calyx* lobes triangular, c.  $\frac{1}{2}$  mm long. *Petals* ovate-oblong, 3–4 by 1 $\frac{1}{2}$ –2 mm. *Stamens* 3 mm; anthers ovoid, c.  $\frac{1}{2}$  mm long. *Disk* shortly cupular, c. 1 mm  $\varnothing$ . *Ovary* subglobose, c.  $\frac{3}{4}$  mm  $\varnothing$ , 5-(or 4)-celled; styles 5 (or 4), free, c.  $\frac{3}{4}$  mm. *Drupe* (fresh) oblong, obovoid, or ovoid,  $2\frac{1}{2}$ –4 by 2 cm, purple-red or dark purple, or yellow (cultivar) when ripe; scars of styles 5 (or 4), lateral, at the apical end. Flanges of the endocarp (with fibrous processes) partly or wholly and directly connected with a peripheral layer of meshes, sometimes with cavities alternating with loculi (shown in a median, transverse section).

Distr. Native of tropical America. Now pantropical in cultivation.

Ecol. Little cultivated in *Malesia* except in the Philippines where it was introduced by the Spaniards; now found in many provinces, especially abundant in the region immediately south of Manila. According to CORNER (*sub S. lutea l.c.*) the trunk and branches are thickly set with blunt, light brown, corky spines and knobs, the trunk of old trees becoming widely and deeply fissured with hard, narrow, uneven ridges or toothed flanges.

Uses. Cultivated for the fruit which tastes sweet, if mawkish. The fruit is pleasantly fragrant, like plums in turpentine! (CORNER). HEYNE *l.c.* noted that the solid bark is in Java used for making stamps, but the fruit is not esteemed; the latter is called *hog-plum*, E, *varkenspruim*, D.

Vern. Philippines: *saguélas*, *sarguélas*, Ilk., *saraguélas*, Ibn., *sereguélas*, C.Bis., *sineguélas*, *sirihuélas*, Tag., *siriguélas*, Bik.; all of them are corruptions of the Spanish *ciruela* = plum. Java.: *kadongdong sabrang*, k. *tjina*, k. *tjutjuk*, S.

5. *Spondias philippinensis* (ELMER) AIRY SHAW & FORMAN, Kew Bull. 21 (1967) 15, f. 2: 13 & 14; DING HOU, Blumea 24 (1978) 38. — *Pegia philippinensis* ELMER, Leaf. Philip. Bot. 8 (1919) 3100; STEEN, J. Bot. 72 (1934) 11. — *Skoliotigma defolians* LAUT. Bot. Jahrb. 56 (1920) 356, f. 2. — *Euroschinus ledermannii* LAUT. *l.c.* 360. — *Phebochiton philippinense* (ELMER) MERR. En. Philip. 2 (1923) 472; Pl. Elm. Born. (1929) 168. — *Pentapadon teleianthera* RIDL. Kew Bull. (1933) 199. — *Solenocarpus philippinensis* (ELMER) KOSTERM. New & Crit. Malays. Pl. 3 (1955) 1; JACOBS, Acta Bot. Neerl. 10 (1961) 106. — Fig. 38.

Hemi-epiphyte, recorded as a liana up to 30 m high and 7 cm  $\varnothing$ , sometimes an epiphytic shrub or a terrestrial shrub up to  $2\frac{1}{2}$  m high and 3 cm  $\varnothing$ , a small tree up to 12 m high and 10 cm  $\varnothing$ , rarely a large tree up to 45 m high with buttresses rarely present up to  $\frac{1}{3}$  m high, 1 m wide, 10 cm thick; bark grey to blackish, smooth. *Leaves* 1–4 pairs; rachis  $3\frac{3}{4}$ –13 cm, petiole 4–12 cm, both puberulous, glabrescent. *Leaflets* chartaceous or subcoriaceous, elliptic-, ovate-oblong, or ovate, 6–13 $\frac{1}{2}$  by 3 $\frac{1}{2}$ –6 cm; sparsely puberulous on midrib and nerves on both surfaces, glabrescent, or almost glabrous; base obtuse; apex acuminate; margin entire; nerves 7–9 pairs, without an intramarginal vein; veins reticulate; petiolules up to  $\frac{1}{3}$  cm, the terminal one  $\frac{1}{2}$ –1 $\frac{1}{2}$ (–3) cm. *Inflorescences* appearing before the leaves or accompanied by young leaves, paniculate, terminal and/or axillary, 8–15 cm long, puberulous, glabrescent, or almost glabrous; branches up to 10 cm long; floral bracts lanceolate,  $\frac{2}{3}$ –1 $\frac{1}{2}$  mm long; pedicels 1 $\frac{1}{4}$ –2 $\frac{1}{2}$  mm. *Flowers* white. *Calyx* lobes triangular, c.  $\frac{1}{3}$  mm long. *Petals* elliptic-lanceolate, sometimes obovate-oblong,  $2\frac{1}{2}$ –3 by 1 mm. *Stamens* 1 $\frac{1}{4}$ –3 $\frac{1}{2}$  mm; anthers ellipsoid, c. 1 mm long. *Disk* shortly cupular, c. 1 mm  $\varnothing$ . *Ovary* subglobose,  $\frac{1}{2}$ – $\frac{3}{4}$  mm  $\varnothing$ , 1-celled; style 1,  $\frac{2}{3}$ –1 mm. *Drupe* (dried) = oblong, slightly curved, c. 1 by  $\frac{1}{2}$  cm, yellowish when ripe, 1-celled; scar of the style 1, lateral, at the upper  $\frac{1}{3}$ . Endocarp smooth, without flanges and a peripheral layer of meshes.

Distr. *Malesia*: Sumatra (Simalur, Sibolangit, Mt Si-anak-anak), Borneo (scattered), Philippines

(Luzon, Mindoro, Samar, Leyte, Mindanao), New Guinea (Vogelkop Peninsula, Bomberai Peninsula, Sepik Distr.).

Ecol. Primary forest, forest borders, sometimes on river-banks or on limestone, 30–400 m. *Fl.* March–May, Aug., Sept.; *fr.* April–Nov.

As mentioned, SHAW & FORMAN *l.c.* ascribe the immense variation in habit to the frequent

occurrence as a hemi-epiphyte, similarly as is observed in certain species of *Fagraea*, *Ficus*, *Schefflera*, and *Wightia*.

Uses. The small fruits are edible but sour.

Vern. Borneo: Sabah: *basisihan*, *këkim*, *mëmpas*, Dusun Kinabatangan; Sarawak: *rorsa rorsa*; Brunei: *kaya ala*, Iban. New Guinea: *kemba*, Tehid.

## 12. KOORDERSIODENDRON

ENGL. in Koord. Minah. = *Med. Lands Pl. Tuin* 19 (1898) 410. — *Koordersina* KUNTZE in Post & Kuntze, *Lexic. Gen. Phanerog.* (1903) 310, *nom. illeg.* — **Fig. 41–42.**

Trees. *Leaves* spiral, imparipinnate, petioled. *Leaflets* subopposite, entire. *Inflorescences* axillary, paniculate. *Flowers* bisexual. *Calyx* 5-lobed. *Petals* 5, imbricate, glabrous. *Stamens* 10; filaments subulate, glabrous; anthers subglobose. *Disk* intrastaminal, round and flat, 10-notched. *Ovary* subglobose, longitudinally deeply 5-furrowed (carpels incompletely connate), densely hairy, 5-celled, usually only one fertile; styles 5, short; stigmas small. *Drupe* 1(–3)-celled by abortion; endocarp cartilaginous. *Seed* with testa free from the endocarp; embryo straight, cotyledons free, plano-convex.

Distr. Monotypic. *Malesia*: Borneo, Philippines, Celebes, Moluccas, W. New Guinea.

Ecol. In lowland forests.

Vern. Malaysian standard timber name: *ranggu*; Indo-Malesian name: *mugis*.

Note. KUNTZE (*l.c.*) changed the generic name *Koordersiodendron* into *Koordersina* because the composition of the former is very long (“*nom. del. sesquipedale*”).

**1. *Koordersiodendron pinnatum*** (BLANCO) MERR. *Bull. For. Bur.* 1 (1903) 33; *Publ. Gov. Lab. Philip.* n. 35 (1906) 73; *Philip. J. Sc.* 1 (1906) Suppl. 85; *Sp. Blanc.* (1918) 232; *En. Born.* (1921) 350; *En. Philip.* 2 (1923) 470; HEYNE, *Nutt. Pl.* (1927) 974; KRAEMER, *Trees W. Pac. Reg.* (1951) 197, f. 69; SMYTHIES, *Common Sarawak Trees* (1965) 3; VERSTEEGH, *Med. Landb. Hogesch. Wageningen* 71–19 (1971) 41, t. 3; MEIJER, *Field Guide Trees W. Malesia* (1974) 107, f. 14. — *Helicteres pinnata* BLANCO, *Fl. Filip.* (1837) 384. — *Cyrtocarpa quinquestyla* BLANCO, *Fl. Filip.* ed. 2 (1845) 269; ed. 3, 2 (1878) 135. — *Odina speciosa* BL. *Mus. Bot.* 1 (1850) 206; MIQ. *Fl. Ind. Bat.* 1, 2 (1859) 623; VIDAL, *Phan. Cuming.* (1885) 106; *Rev. Pl. Vasc. Filip.* (1886) 101, *incl. var. multijuga* VIDAL. — *Odina multijuga* VIDAL, *Sinopsis Atlas* (1883) 22, t. 37, f. A. — *K. celebicum* ENGL. in *Koord. Minah.* (1898) 410; BOERL. *Jc. Bog.* 1, 4 (1901) 55, t. 94 & 95; PERK. *Fragm. Fl. Philip.* (1904) 25. — *Lannea speciosa* (BL.) ENGL. *ex PERK.* *Fragm. Fl. Philip.* (1904) 26; LAUT. *Bot. Jahrb.* 56 (1920) 356. — *K. papuanum* KANEH. & HATUS. *Bot. Mag. Tokyo* 56 (1942) 167, f. 9. — **Fig. 41–42.**

Tree up to 45 m high and 80(–150) cm Ø. Buttresses sometimes present, up to 2 m high, 1½ m wide, 10 cm thick. Bark dark brown or black, shallowly or deeply fissured. *Leaves* (6–)10–16 pairs, 50–80 cm long (herb. specimens). *Leaflets* chartaceous, ovate-oblong to narrowly oblong, 3–20 by 1½–5½ cm; pubescent when

young, glabrescent; base obtuse; apex acuminate; nerves 10–24 pairs, veins reticulate; petiolules 3–5 mm, the terminal one up to 17 mm. *Panicles* up to 50 cm long, puberulous, glabrescent; floral bracts ovate or triangular, 2/3–1½ mm long; pedicels c. 1 mm. *Flowers* white or yellowish green. *Calyx* lobes broadly ovate, 2/3–1 mm long. *Petals* obovate-oblong or elliptic, 2–3 by 1–1½ mm. *Stamens* 2/3–1 mm; anthers c. ¼ mm long, connective distinct, slightly protruding above the thecae. *Disk* 1½–2 mm Ø. *Ovary* c. ½ mm Ø. *Drupe* broadly ellipsoid, ± compressed, 2½–4 by 1½–2½ cm, yellowish when ripe. *Seed* ellipsoid, compressed, c. 2½ by 1½ cm.

Distr. *Malesia*: Borneo, Philippines (Luzon to Mindanao), Celebes (also Muna), Moluccas (Morotai, Talaud, Halmahera, Sula, Ceram, Key, Aru Is.), W. New Guinea (incl. Misool).

Ecol. Lowland forest, rarely up to 460 m, once at 800 m (Malili, Central Celebes), usually on dryland, occasionally in inundated places. *Fl.* Jan.–Nov.; *fr.* Febr.–Dec.

Uses. The wood has crossed, often wavy grain and fine texture. It is fairly heavy and its specific gravity is 0.67–0.85 air dry and over 1 when green. It is moderately durable when exposed or in contact with the soil and is suitable for flooring, general house construction, furniture, and cabinet making. The exudate (gum) is used in local medicine. *Cf.* HEYNE, *l.c.*; SALVERDA, *Rapport Exped. ZW. Nieuw Guinea* (1937) 86; KRAEMER, *l.c.*; KALKMAN,

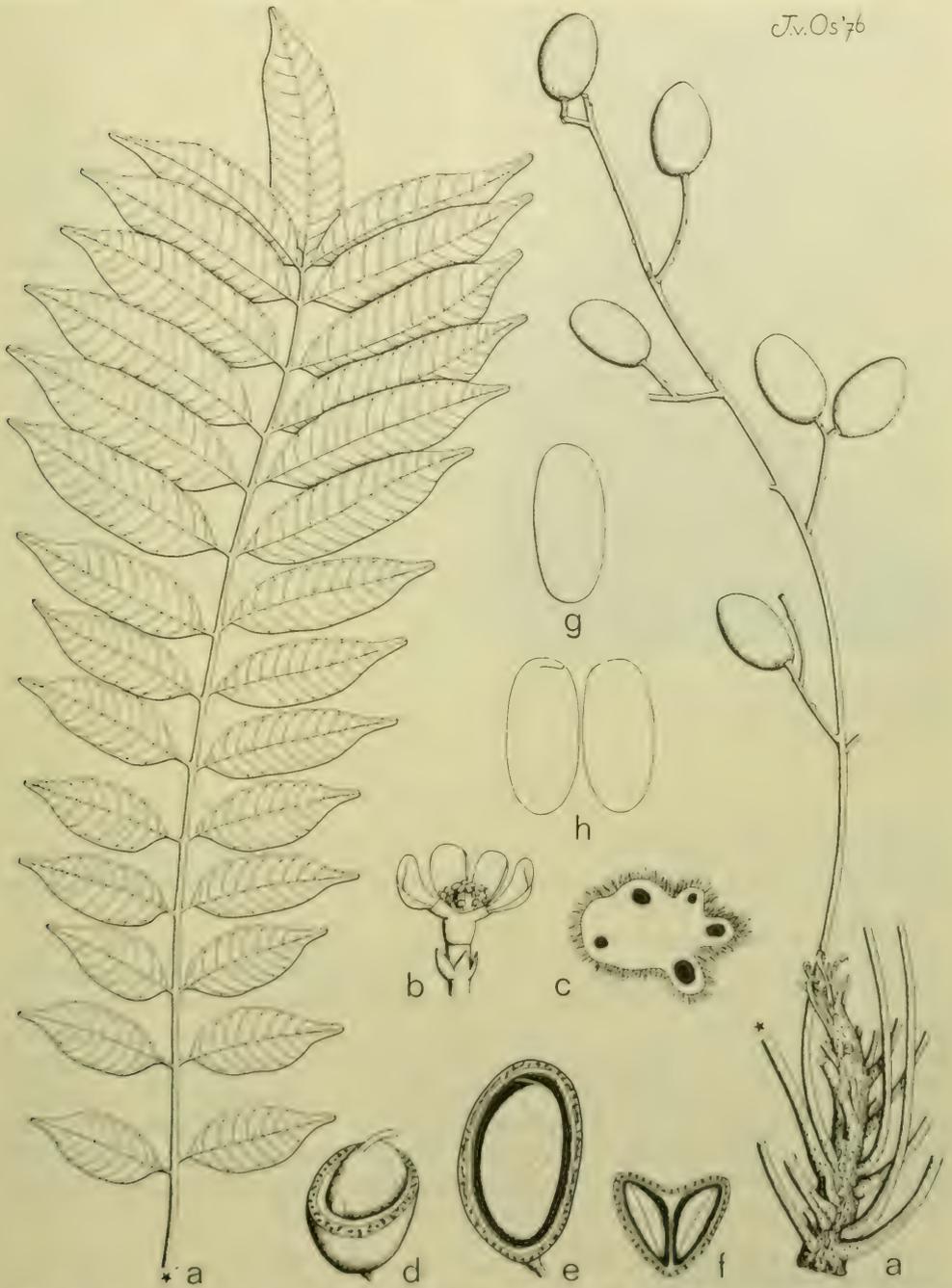


Fig. 41. *Koordersiodendron pinnatum* (BLANCO) MERR. *a.* Habit,  $\times \frac{1}{2}$ , *b.* flower, 1 petal removed,  $\times 7$ , *c.* CS of gynoecium showing 5 incompletely connate carpels,  $\times 30$ , *d.* fruit, upper half of pericarp removed, showing seed and resin-canals, *e.* fruit, lateral half of pericarp removed, showing seed and resin-canals, *f.* section of fruit showing two (usually only one) seeds developed, *g.* embryo, *h.* ditto, opened, all nat. size (*a, d-h* SAN 36433, *b-c* SAN 76303).



Fig. 42. Colossal tree of *Koordersiodendron pinnatum* (BLANCO) MERR. in S. Celebes (Photogr. VAN ZIJLL DE JONG).

Timber Species of Neth. New Guinea (1959) 18.

Vern. Borneo: *benjonong*, *kaluan*, *kamiding*, *koluon*, *ranggu*, *suren*, M; *blakai*, Bulungan; *kalamiring*, *maset*, *melimudjam*, *tabu hitam*, Kutai; Philippines (cf. MERRILL, 1923 *l.c.*; KRAEMER, *l.c.*): *amúgis*, Tag., Bik., C.Bis., *ambúgis*, *dangila*, *múgis*, Tag., *gagil*, *magalibas*, Sul., *hamoges* or *hamogis*, *koro*, Catanduanes, *kalantas-colorado*, Cotabato, *kalumanog*, *lako-lako*, *sambalágan*, *sambalabúan*, Bis., *bangkási*, *bangkalári*, *kantingen*, *orís*, *salga*, *sárga*, *taligáan*, *tirong*, *urís*, *urísán*, Ilk., *karogkog*, Bik., *kia-kia*, Cebu, *magmakopa*, Misamis, *bugis*, *maguahod*, Davao, *barok*, *pamalatangán*, Sorsogon, *maguyabud*, Mbo, Mand., *malabanais*, *marabaniás*, *palapiás*, Pang., *mariganda*, *samboan*, Agusan, *molato*, Abra, *orisen*, Tarlac, *sabu-uauan*, *sambuláian*, Mbo, *sambuláuan*, S.L.Bis., P.Bis., *sambuláun*, P.Bis., *sinambuaóan*, C.Bis., *urísán*, Ibn.; Celebes: *gui*, Muna I., *bowang*, *bowis*, *hahito*, *hihito*, (*kaju*) *bugis*, *mawowis*, *nai*, *patago*, *wochis*, *wowis*, Minah., *ore*, Malili; Moluccas: *buwis'a*, Talaud I., *hopi*, Sula I.; *kaju buwaja*, Ceram, *krie*, Key I., *kuru*, Morotai, *kuruhu*, *puro*, Halmaheira; New Guinea: *dabiar*, Adi I., *murwan*, Kebar, *biepau*, *gerepow*, *grepao*, *grepau*, *marowan*, Manokwari, *itesom*, *jukeson*, *maruai babi*, *selbut*, Sorong.

Trade names: *ranggu*, Sabah, *amugis*, Philippines, *grepau*, W. New Guinea.

### 13. PEGIA

COLEBROOKE, Trans. Linn. Soc. I, 15 (1827) 364; STEEN. J. Bot. 72 (1934) 10. — *Phlebochiton* WALL. Trans. Med. Phys. Soc. Calc. 7 (1835) 230; ENGL. in DC. Mon. Phan. 4 (1883) 262. — Fig. 43.

Scandent shrubs or climbers. *Leaves* alternate, imparipinnate, petioled. *Leaflets* opposite or subopposite, entire, or crenate (*extra-Mal.*). *Inflorescences* paniculate, axillary and/or terminal. *Flowers* unisexual and bisexual (plants polygamous). *Calyx* (4- or) 5-lobed. *Petals* (4 or) 5, imbricate, or subvalvate (*extra-Mal.*), glabrous. *Stamens* (8-)10, 5 opposite calyx lobes and 5 opposite petals; filaments filiform, glabrous; anthers subglobose, sterile in ♀. *Disk* intrastaminal, annular, flat, slightly notched. *Ovary* immersed in the disk, (4- or) 5-celled, only one fertile; styles (4 or) 5, united; stigmas (4 or) 5, very small. Sterile pistil in ♂ small, apically (4- or) 5-lobed. *Drupe* 1-celled; endocarp crustaceous. *Seed* with testa free from the endocarp; embryo straight, cotyledons free, plano-convex.

Distr. Species 3, distributed in India, Burma, Thailand, Laos, Vietnam, China (Kwangtung & Kwangsi), and *Malesia* (Borneo).

Ecol. In forests from lowlands up to 1500 m.

1. *Pegia sarmentosa* (LECOMTE) HAND.-MAZZ. *Sinensia* 3 (1933) 187; STEEN. J. Bot. 72 (1934) 10; TARD. Fl. C. L. & V. 2 (1962) 153, t. 9, f. 1-3. —

*Phlebochiton sarmentosum* LECOMTE, Bull. Soc. Bot. Fr. 54 (1907) 528; Fl. Gén. I.-C. 2 (1908) 32. — Fig. 43.

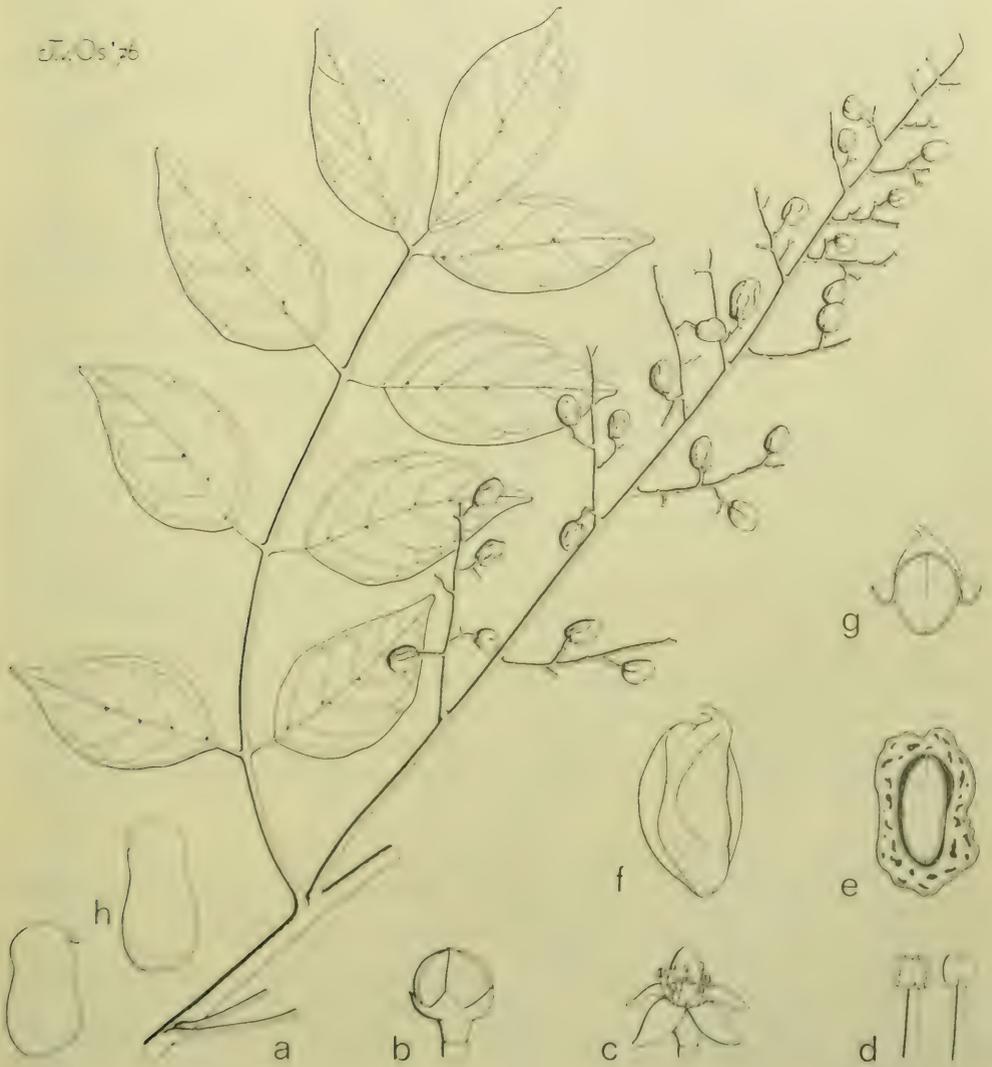


Fig. 43. *Pegia sarmentosa* (Lecomte) Hand.-Mazz. a. Habit,  $\times \frac{1}{2}$ , b. flower-bud,  $\times 7$ , c. flower,  $\times 7$ , d. stamens,  $\times 14$ , e. LS of fruit,  $\times 2\frac{1}{2}$ , f. young seed, g. ditto, CS of upper half, h. embryo, opened, all  $\times 3\frac{1}{2}$  (a SAN 23391, b-d CLEMENS 26652, e-h SAN 23391).

Climber. *Leaves* with a strong odour, with (1-)3-4 pairs of leaflets; petiole 4-5 cm. *Leaflets* chartaceous, ovate, elliptic, 4-12½ by 2¼-6 cm, often with hairy domatia; base obtuse, sometimes cuneate, rarely subcordate; apex acuminate; nerves 5-7 pairs, veins reticulate; petiolules ½-1 cm. *Panicles* up to 37 cm long, puberulous; floral bracts lanceolate, ⅔-¾ mm long; pedicels ⅔-1½ mm, articulate. *Flowers* cream coloured. *Calyx* lobes deltoid, ½ mm long. *Petals* ovate, 1¼-2 by ¾-1¼ mm. *Stamens* ¾-1 mm; anthers c. ⅓ mm long; staminodes in ♀ ⅔ mm. *Disk* c.

1 mm Ø. *Ovary* subglobose, ⅔ mm Ø. Sterile pistil in ♂ small, c. ½ mm long. *Drupe*s broadly ellipsoid, 1¼-1½ by c. ½ cm, slightly oblique, flesh full of dark-brown sap (even in dried drupes). *Seed* subreniform, c. 1¼ by ⅔ cm (young seed seemingly winged).

*Distr.* S. China, Laos, Vietnam; *Malesia*: Borneo (Sabah: Sandakan, Elopwa, Mt Kinabalu, Tawau; Kalimantan: W. Samarinda, E. Kutai, Berau).

*Ecol.* In forests, from the lowland up to 1500 m. *Fl.* April, Sept. -Nov.; *fr.* May-Dec.

*Vern.* *Akar puteh, kobut godom, Sabah.*

#### 14. MELANOCHYLA

HOOK. *f. Fl. Br. Ind.* 2 (1876) 38; ENGL. in DC. *Mon. Phan.* 4 (1883) 469; in E. & P. *Nat. Pfl. Fam.* 3, 5 (1892) 176; KING, *J. As. Soc. Beng.* 65, ii (1896) 502; DING HOU, *Blumea* 24 (1978) 29. — **Fig. 44-46.**

Trees, in low-lying or swampy forest frequently with stilt-roots. *Leaves* spiral, simple, entire, beneath usually papillose, petioled. *Inflorescences* paniculate, terminal and/or axillary with bracts and bracteoles; pedicels articulated. *Flowers* usually unisexual (plants dioecious). *Hypanthium* (receptacle) cupuliform, puberulous outside, slightly accrescent in fruit and adnate to the very base of it. *Calyx* 5-(or 4-)lobed. *Petals* 5 (or 4), imbricate (at least at the upper half), sometimes slightly overlapping (and seemingly valvate), puberulous outside, villous or woolly on the inner surface. *Stamens* 5 (or 4); filaments subulate, free or the lower part laterally connate with the petals, villous; anthers oblong, dorsifixed, imperfect or abortive in ♀. *Disk* slightly intrastaminal, rim-like, 5-(or 4-)notched or -lobed, glabrous. *Ovary* superior, sometimes partly or rarely completely concealed in the cup-shaped receptacle (seemingly semi-inferior or inferior), 1-celled, usually densely hairy; style distinct, stigmas 3. Abortive pistil in ♂ very small or 0. *Drupe* 1-celled, mesocarp and endocarp full of black varnish, endocarp thick and hard. *Seed* with testa adherent to the endocarp; embryo straight, cotyledons free, planoconvex.

*Distr.* *Malesia*: 17 spp., in Sumatra, Malay Peninsula, Borneo, and Java.

It may occur also in Peninsular Thailand.

*Ecol.* Chiefly in lowland forests, sometimes occurring in swampy land, and on sandstone or limestone, rarely found in montane forest up to 1350 m.

As in *Gluta* and *Semecarpus* the sap may be very irritant to susceptible persons.

*Vern.* Malaysian standard timber name: *rengas*.

*Notes.* The petals are distinctly imbricate, but occasionally the overlapping in mature flowers is rather slight, which may have led HOOKER to describe them as valvate in the original description.

*Melanochyla* is the only Malesian genus of *Anacardiaceae* in which the flowers have a shorter or longer, cup-like to tubular hypanthium formed by the hollow receptacle (and calyx?); the structure of the vascular bundles invites here to study. Through this the ovary seems to be inferior, but really it is always superior.

#### KEY TO THE SPECIES

*The characters of papillae and stomata used in the key were examined under a binocular microscope at a magnification of × 32 or × 64. See fig. 45*

1. Leaves cordate or auricled, or subcordate (sometimes slightly truncate, rarely obtuse, or cuneate) at the base; petiole obscure, 0-1¼ cm.
2. Lower surface of leaves pubescent especially on nerves and veins; distinctly papillose. Drupe with dense, rusty-hairy processes (insect-gall-like) . . . . . 1. *M. fulvinervis*
2. Lower surface of leaves glabrous; not papillose. Drupe without processes as above . . . . . 2. *M. auriculata*



Fig. 44. *Melanochyla borneensis* (RIDL.) DING HOU. a. Habit,  $\times \frac{1}{2}$ , b. ♀ flower,  $\times 3\frac{1}{2}$ , c. ditto in LS,  $\times 3\frac{1}{2}$ , d. fruit, e. ditto in CS, both nat. size, f. embryo,  $\times 1\frac{1}{2}$ , g. ditto, opened,  $\times 1\frac{1}{2}$ . — *M. beccariana* OLIVER. h. ♂ Flower in LS,  $\times 3\frac{1}{2}$  (a-e S 25369, d-g S 32590, h SAN 21255).

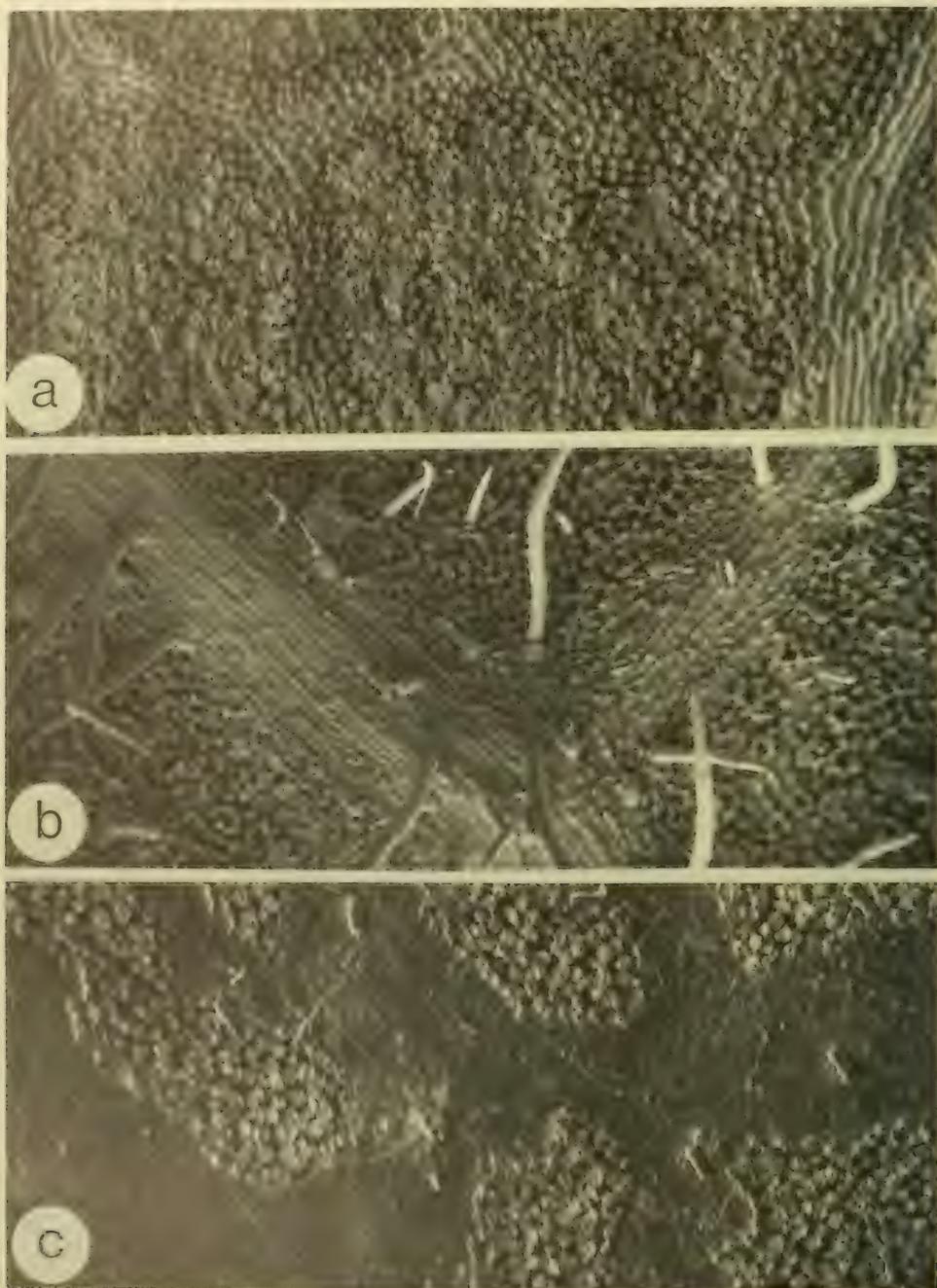


Fig. 45. Stereoscan photomicrographs showing papillae on underside of leaves of *Melanochyla* species. *a. M. caesia* (BL.) DING HOU evenly distributed, *b. M. beccariana* OLIVER only between the veins and with a few hairs, *c. M. fulvinervis* (BL.) DING HOU in groups. All  $\times 125$  (*a* SAN 36406, *b* SAN 34715, *c* SAN 22680) (Photogr. H. KAMMERAAT, Leiden Geological Institute).

1. Leaves usually cuneate to attenuate (rarely obtuse or slightly subcordate) at the base; petiole distinct, usually  $1\frac{1}{2}$ -8 cm ( $\frac{3}{4}$ - $1\frac{1}{4}$  cm in *M. minutiflora*).
3. Leaves glabrous on both surfaces.
4. Inflorescences axillary only, shorter than the petiole. Hypanthium 3-4 mm long. Papillae distinct on the lower leaf surface. Drupe broadly ellipsoid, or ovoid, 3 by 2 cm, apex apiculate . . . . . 3. *M. axillaris*
4. Inflorescences terminal and axillary (rarely axillary only on ♀), much longer than the petiole. Hypanthium less than  $2\frac{1}{4}$  mm long.
5. Lower surface of leaves with very distinct papillae. (Branchlets whitish. Drupe unknown)
4. *M. semecarpoides*
5. Lower surface of leaves not papillose, or with very compact, obscure papillae (rarely fine and compact on young leaves in *M. castaneifolia*).
6. Inflorescences with large bracts (7-8 mm long). Petals 4- $4\frac{1}{2}$  mm long. Ovary flat and round, c.  $2\frac{1}{2}$  mm Ø. Stomata invisible on lower leaf surface. Drupe subglobose, 2- $2\frac{1}{2}$  by  $1\frac{1}{2}$ -2 cm, apex rounded . . . . . 5. *M. bractea*
6. Inflorescences with small or minute bracts ( $\frac{2}{3}$ -4 mm long). Petals  $1\frac{1}{2}$ -3 mm long. Ovary subglobose or globose, c. 1 mm Ø. Stomata visible on the lower leaf surface.
7. Petiole puberulous at the lower  $\frac{1}{2}$ - $1\frac{1}{2}$  cm. Drupe ellipsoid or ovoid, 2 by 1- $1\frac{1}{4}$  cm, apex acute . . . . . 6. *M. angustifolia*
7. Petiole glabrous.
8. Branchlets brown or dark brown, pubescent. Leaves brown to reddish brown and shining above. Filament of the stamen brown. Drupe broadly ellipsoid,  $1\frac{1}{2}$  by 1 cm, apex obtuse . . . . . 7. *M. nitida*
8. Branchlets light yellowish white or light greyish, glabrous. Leaves usually yellowish green and shining above. Filament of the stamen whitish at the apical part. Drupe unknown . . . . . 8. *M. castaneifolia*
3. Leaves densely or sparsely hairy on the lower surface, sometimes glabrescent but then always remaining sparsely hairy on the midrib and nerves.
9. Leaves bullate above; veins scalariform. Drupe thickly velvety; indumentum c.  $3\frac{1}{2}$  mm thick . . . . . 9. *M. bullata*
9. Leaves not bullate, almost flat above. Veins reticulate or reticulate-scalariform. Drupe thinly velvety; indumentum less than  $1\frac{1}{4}$  mm thick.
10. Leaves with densely reticulate-scalariform venation prominent on the lower surface. Lower  $\frac{1}{2}$ - $1\frac{1}{2}$  mm of the filaments united with the petals. Drupe broadly ellipsoid or ovoid,  $1\frac{1}{2}$ - $2\frac{1}{2}$  by  $1\frac{1}{4}$ - $2\frac{1}{4}$  cm, apex obtuse . . . . . 10. *M. densiflora*
10. Leaves with loosely reticulate or reticulate-scalariform venation slightly elevated or obscure on the lower surface. Filaments free from the petals (except in *M. beccariana*).
11. Leaves not papillose on the lower surface. Flowers small, 2- $2\frac{1}{2}$  mm long. Drupe subglobose, c.  $1\frac{1}{4}$  cm Ø . . . . . 11. *M. minutiflora*
11. Leaves distinctly papillose on the lower surface. Flowers larger,  $3\frac{1}{2}$ -9(-12) mm long.
12. Lower surface of leaves with papillae in prominent groups (often horse-shoe-shaped), separated by broad bands of veins and veinlets. Inflorescences axillary only. Drupe broadly ellipsoid or subglobose,  $2\frac{3}{4}$ -3 by 2- $2\frac{1}{2}$  cm . . . . . 12. *M. borneensis*
12. Lower surface of leaves with rather uniformly distributed papillae. Inflorescences terminal, or terminal and axillary.
13. Flowers (5-7-9(-12) mm long. Lower  $\frac{3}{4}$ - $1\frac{1}{2}$  mm of filaments laterally united with the petals; ovary almost completely immersed in the receptacle. (Drupe broadly ellipsoid or ovoid  $2\frac{1}{2}$ -3 by  $1\frac{1}{4}$ - $2\frac{1}{4}$  cm) . . . . . 13. *M. beccariana*
13. Flowers  $3\frac{1}{2}$ -7 mm long. Filaments free. Ovary not immersed in the receptacle.
14. Hypanthium c.  $\frac{1}{2}$  mm long. Anthers c. 1 mm long. Abortive pistil in ♂ minute, glabrous. Drupes ovoid or ellipsoid, 1- $1\frac{3}{4}$  mm Ø, indumentum  $\frac{2}{3}$  mm thick . . . . . 14. *M. elmeri*
14. Hypanthium longer,  $\frac{3}{4}$ - $2\frac{1}{4}$  mm long. Anthers  $\frac{1}{2}$ - $\frac{3}{4}$  mm long.
15. Leaves tomentose on the lower surface, especially dense on midrib and nerves. Abortive pistil in ♂ 0, replaced by a tuft of hairs. Drupe globose or subglobose,  $2\frac{1}{4}$ -3 cm Ø, indumentum c.  $\frac{1}{6}$  mm thick . . . . . 15. *M. tomentosa*
15. Leaves sparsely hairy on the lower surface, usually glabrescent except on midrib and nerves.
16. Hypanthium  $1\frac{1}{4}$ - $2\frac{1}{4}$  mm long. Abortive pistil in ♂ conical,  $\frac{1}{2}$  mm long, hairy. Drupe broadly ellipsoid,  $1\frac{1}{2}$ - $2\frac{1}{2}$  cm Ø, indumentum c.  $\frac{1}{6}$  mm thick . . . . . 16. *M. caesia*
16. Hypanthium  $\frac{1}{4}$ -1 mm long. Abortive pistil in ♂ minute or 0, glabrous. Drupe broadly ovoid, 2- $2\frac{1}{4}$  cm Ø, indumentum c.  $\frac{1}{3}$  mm thick. . . . . 17. *M. kunstleri*

1. *Melanochyla fulvinervis* (BL.) DING HOU, *Blumea* 24 (1978) 32, f. 1e-f. — *Semecarpus fulvinervis* BL. *Mus. Bot.* 1 (1850) 189; *MIO. Fl. Ind. Bat.* 1, 2 (1859) 627; cf. STEEN. *Blumea* 11 (1961) 132. — *M. rugosa* KING, *J. As. Soc. Beng.* 65, ii (1896) 505; RIDL. *Fl. Mal. Pen.* 1 (1922) 540; KOCHUM. *Mal. For. Rec.* 17 (1964) 296. — **FIG. 45c.**  
Tree up to 25 m high and 40 cm Ø, occasionally

with equal plank buttresses up to  $\frac{2}{3}$  m high. Bark brown or dark brown, rather smooth. Branchlets light brown and tomentose. Leaves subcoriaceous, obovate to oblanceolate, elliptic to narrowly elliptic, 10 $\frac{1}{2}$ -38 by 3 $\frac{1}{2}$ -14 cm; shining and glabrous above, pubescent especially on nerves and veins below, sometimes midrib villose below or on both surfaces; papillae distinct, separated by veins



Fig. 46. *Melanochyla bracteata* KING, stilt-rooted, the trunk base tapering downwards. Sedili R., Johore (Photogr. CORNER, Febr. 1935).

and veinlets into groups on the lower surface; base subcordate, sometimes slightly truncate, rarely obtuse or cuneate; apex shortly caudate, acuminate, cuspidate, acumens up to 3 cm long; nerves 18–32 pairs, veins reticulate-scalariform, distinct below, faint or obscure above; petiole  $2/3$ – $1/4$  cm, tomentose. *Panicles* terminal, up to 18 cm long, rusty pubescent; bracts triangular to linear,  $3/4$ – $1$  mm long; bracts triangular,  $1/4$ – $2$  mm long. *Flowers* white, subsessile,  $4$ – $4\frac{1}{2}$  mm long. *Hypanthium*  $2/3$ – $1$  mm long. *Calyx* lobes triangular,  $2/3$ – $1$  mm long. *Petals* ovate to lanceolate,  $2\frac{1}{2}$ – $3\frac{1}{2}$  by  $1\frac{1}{2}$ – $2$  mm, flat. *Stamens*  $1\frac{1}{2}$ – $2$  mm; filaments free; anthers  $2/3$ – $3/4$  mm long. Imperfect or abortive stamens in ♀ 2 mm. *Disk* obscurely 5-notched. *Ovary* conical,  $1\frac{1}{2}$ – $2$  mm Ø; style 1 mm; stigmas discoid. Abortive pistil in ♂ minute, hairy. *Drupe* ellipsoid or subglobose, 3–4 by  $2\frac{1}{2}$ – $3$  cm, with dense, rusty-hairy, insect-gall-like processes up to c. 7 mm long.

Distr. *Malesia*: Malay Peninsula (Perak, Trengganu, Kelantan, Pahang, Selangor, Johore) and Borneo (Sarawak: Limbang and Semengoh Arboretum; Sabah: Tawau; Kalimantan: Mt Prarawin, Sanggau, Balikpapan, Kutai, Nunukan I.).

Ecol. Lowland forest, sometimes in montane forest up to 1200 m (W. Kutai). *Fl.* Oct.; *fr.* May–June, Sept.–Nov.

Vern. *Rengas*, M.

Note. The fruit is very characteristic for the present species by the rusty-hairy, dense processes all over its surface. They seem, at first glance, to be insect-galls. However, the feature is a normal morphological character for this species as can be observed on either a longitudinal or transverse section of the ovary.

2. *Melanochyla auriculata* HOOK. *f.* *Fl. Br. Ind.* 2 (1876) 39; ENGL. in *DC. Mon. Phan.* 4 (1883) 470; KING, *J. As. Soc. Beng.* 65, ii (1896) 505; RIDL. *Fl. Mal. Pen.* 1 (1922) 540; BURK. *Dict.* (1935) 1434; CORNER, *Ways. Trees* (1940) 119; KOCHUM. *Mal. For. Rec.* 17 (1964) 296.

Tree up to 30 m high and 68 cm Ø. Buttresses 2 m high, 1 m wide, 10 cm thick. Bark grey to dark brown, smooth or irregularly cracked. Branchlets brown or reddish brown, pubescent, glabrescent. *Leaves* coriaceous, obovate to narrowly obovate, or narrowly elliptic, (6–)22–62(–87) by (3–)6–15 (–16 $\frac{1}{2}$ ) cm; glabrous and shining on both surfaces; not papillose on the lower surface; base cordate or auricled, rarely obtuse, cuneate, or truncate; apex acuminate, cuspidate, rarely obtuse; nerves (8–)25–35 pairs; veins reticulate-scalariform, distinct beneath, faint above; petiole 0–1 cm, if present, puberulous. *Panicles* terminal, 15–63 cm long, pubescent, glabrescent; bracts triangular,  $1/3$ – $2/3$  mm long. *Flowers* white, sessile or subsessile,  $3\frac{1}{2}$ – $4$  mm long. *Hypanthium* c.  $2/3$  mm long. *Calyx* lobes ovate-oblong, 1– $1\frac{1}{4}$  mm long. *Petals* elliptic or elliptic-lanceolate,  $2\frac{1}{2}$ – $3$  by 1– $1\frac{1}{2}$  mm, slightly longitudinally ridged inside. *Stamens* c. 2 mm; filaments free, brown; anthers  $2/3$  mm long. *Disk* 5- (or 4-)lobed. Abortive pistil in ♂ 0, replaced by a tuft of hairs. *Ovary* subglobose,  $2\frac{1}{2}$  mm Ø; style c. 1 mm; stigmas capitate. Imperfect or abortive stamens in ♀  $1/4$  mm. *Drupe*

depressed-globose or slightly oblong, 2– $3\frac{1}{2}$  by 2– $2\frac{1}{2}$  cm, rusty-hairy; apex obtuse or rounded.

Distr. *Malesia*: Malay Peninsula (Kelantan, Pahang, Malacca, Johore, Singapore) and Borneo (Sabah: Mt Kinabalu, Beaufort, Sandakan, Mostyn, Tawau; Kalimantan: Bulungan, Sangkulirang).

Ecol. In forest on swampy or dry lowland, rarely up to 1500 m. *Fl.* March–May, Sept., Dec.; *fr.* June, Nov., Dec.

Vern. *Kərbau jalang*, *rėngas lanjoh*, *r. lisang*, M.

Note. The lower leaf surface is smooth, without papillae. Under the binocular at a magnification of  $\times 32$  or  $\times 64$  one can observe the stomata or pore-like depressions each with one stoma situated at its bottom.

3. *Melanochyla axillaris* RIDL. *Kew Bull.* (1933) 198; DING HOU, *Blumea* 24 (1978) 29.

Tree up to 24 m high and 20 cm Ø. Buttresses sometimes present, up to  $1/2$  m high,  $1/2$  m wide, thin. Branchlets light brown, velvety, glabrescent. *Leaves* coriaceous, oblanceolate, 18–67 by 4–16 $\frac{1}{2}$  cm, glabrous on both surfaces; papillae distinct on the lower surface; base attenuate; apex obtuse, sometimes acute; nerves 21–37 pairs; veins reticulate-scalariform, distinct below, faint above; petiole 3–8 cm, the lower  $1\frac{1}{2}$ –3(–5) cm thickened and rusty-velvety. *Panicles* axillary only, 1–3 cm long; bracts lanceolate,  $1\frac{1}{2}$ – $2$  mm long; pedicels 0–2 mm. *Flowers* 7–9 mm long. *Hypanthium* 3–4 mm long. *Calyx* lobes triangular or ovate, 2 mm long. *Petals* oblong or obovate-oblong, 4–5 by  $1\frac{1}{4}$ – $1\frac{3}{4}$  mm, flat. *Stamens*  $3\frac{1}{2}$  mm; filaments brown, the lower  $1\frac{1}{2}$ – $2$  mm united with the petals; anthers  $2/3$ – $3/4$  mm long. *Disk* 5-lobed. Imperfect or abortive stamens in ♀ 2 mm. *Ovary* subglobose,  $1\frac{1}{2}$ – $2$  mm Ø, gradually narrowed into a very short style; stigmas capitate. Abortive pistil 0 in ♂, replaced by a tuft of hairs. *Drupe* broadly ellipsoid, or ovoid, 3 by 2 cm, rusty-pubescent; apex apiculate.

Distr. *Malesia*: Borneo (Sarawak: Kuching and Lundu), 5 collections.

Ecol. Primary lowland or mixed dipterocarp forest, up to 450 m. *Fl.* April, Nov.; *fr.* Jan., April.

4. *Melanochyla semecarpoides* DING HOU, *Blumea* 24 (1978) 33.

Small tree 6 m high and c. 8 cm Ø. Branchlets whitish, glabrous. *Leaves* chartaceous, elliptic-oblong or -lanceolate, 16 $\frac{1}{2}$ –25 by 6–10 cm, glabrous; papillae distinct on the lower surface; base cuneate; apex acuminate; nerves 11–16 pairs, veins reticulate, distinct below, obscure above; petiole  $1\frac{1}{4}$ – $2\frac{1}{2}$  cm, glabrous. *Panicles* terminal, 18–21 cm long, slightly puberulous; bracts triangular,  $1/3$ – $2$  mm long. *Flowers* (♂) pale green, subsessile,  $4\frac{3}{4}$  mm long. *Hypanthium* 2 mm long. *Calyx* lobes triangular, 2 mm long. *Petals* triangular,  $2\frac{1}{3}$  by 2 mm, longitudinally ridged inside. *Stamens*  $1\frac{1}{3}$  mm; filaments light brown, free; anthers  $1/2$ – $2/3$  mm. *Disk* 5-notched. Abortive pistil in ♂ obscure, shortly hairy. ♀ *Flowers* and fruit unknown.

Distr. *Malesia*: Borneo (Sarawak: Ulu Mayeng, Kakus), once collected.

Ecol. In mixed dipterocarp forest on basalt hillside, up to c. 200 m. *Fl.* July.

5. *Melanochyla bracteata* KING, J. As. Soc. Beng. 65, ii (1896) 506; RIDL. Fl. Mal. Pen. 1 (1922) 540; KOCHUM. Mal. For. Rec. 17 (1964) 296. — Fig. 46.

Tree up to 30 m high and 65 cm  $\varnothing$ , occasionally with stilt-roots. Buttresses up to 2 m high. Branchlets light brown, scurfy. *Leaves* coriaceous, elliptic or oblanceolate, 6–15(–20) by  $2\frac{1}{2}$ – $4\frac{1}{2}$ (– $10\frac{1}{2}$ ) cm, glabrous, shining above, dull beneath; papillae very compact, obscure on the lower surface; base cuneate, rarely slightly obtuse; apex acuminate, acute, rarely obtuse; nerves 6–14 pairs, veins reticulate, some transverse and slightly parallel; petiole ( $\frac{1}{2}$ – $1\frac{1}{2}$ – $2$ (– $4\frac{1}{2}$ ) cm, the lower  $\frac{1}{2}$ – $2\frac{2}{3}$  (often slightly thickened and) puberulous; bracts triangular, 7–8 mm long, floral bracts ovate, 3–5 mm long; pedicels  $\frac{1}{3}$ –2 mm. *Flowers* 7–9 mm long, *Hypanthium* 2 mm long. *Calyx* lobes triangular,  $2\frac{1}{2}$ –3 mm long. *Petals* lanceolate, 4–6 by  $1\frac{1}{4}$ – $1\frac{3}{4}$  mm, flat. *Stamens* 3–4 mm; filaments free, reddish brown; anthers c.  $2\frac{2}{3}$  mm long. Imperfect or abortive stamens in  $\varnothing$   $2\frac{1}{2}$  mm. *Disk* obscurely 5-notched. *Ovary* flat and round,  $2\frac{1}{2}$  mm  $\varnothing$ ; style 3 mm; stigmas capitellate. Abortive pistil 0 in  $\delta$ , replaced by a tuft of hairs. *Drupe* subglobose, 2– $2\frac{1}{2}$  by  $1\frac{1}{2}$ –2 cm, pubescent, glabrescent; apex rounded.

Distr. *Malesia*: Sumatra (Atjeh, Tapanuli, Indragiri), Malay Peninsula (Perak, Pahang, Selangor, Johore, Singapore), and Borneo (Sarawak; Kalimantan: Landak R.).

Ecol. Lowland dryland or swampy forest. *Fl.* Dec.–March; *fr.* Febr., Sept., Dec.

Vern. *Rengas alus*, M, *silungham bos*, Batak.

6. *Melanochyla angustifolia* HOOK. f. Fl. Br. Ind. 2 (1876) 39; ENGL. in DC. Mon. Phan. 4 (1883) 469; KING, J. As. Soc. Beng. 65, ii (1896) 506; RIDL. Fl. Mal. Pen. 1 (1922) 541.

Tree up to 30 m high and 1 m  $\varnothing$ . Buttresses up to 2 m high. Bark greenish grey or reddish brown, smooth or slightly surface cracked. Branchlets light brown, pubescent. *Leaves* subcoriaceous, oblanceolate, or elliptic to narrowly elliptic,  $17\frac{1}{2}$ –29 by  $4\frac{1}{2}$ – $11\frac{1}{2}$  cm, glabrous and shining on both surfaces, not papillose on the lower surface; base cuneate to attenuate; apex shortly acuminate to acuminate; nerves 12–22 pairs, veins reticulate-scarinate, distinct below, faint above; petiole  $2\frac{1}{2}$ – $6\frac{3}{4}$  cm, thickened and puberulous at the lower  $\frac{1}{2}$ – $1\frac{1}{2}$  cm. *Panicles* terminal, up to 32 cm long, puberulous; bracts lanceolate to linear, 1–4 mm, floral bracts triangular,  $\frac{1}{3}$ – $\frac{3}{4}$  mm long. *Flowers* white or yellow, subsessile, 2– $2\frac{1}{2}$  mm long. *Hypanthium*  $\frac{1}{2}$ –1 mm long. *Calyx* lobes triangular,  $\frac{1}{2}$ – $2\frac{2}{3}$  mm long. *Petals* oblong, elliptic, lanceolate, or oblanceolate,  $1\frac{1}{2}$ – $2\frac{1}{2}$  by  $\frac{3}{4}$ – $1\frac{1}{4}$  mm, flat. *Stamens*  $1\frac{1}{4}$ –2 mm; filaments brown, free; anthers  $\frac{1}{3}$  mm long. Imperfect or abortive stamens in  $\varnothing$  c. 1 mm. *Disk* 5-(or 4)-notched. *Ovary* globose, c. 1 mm  $\varnothing$ ; style 1– $1\frac{1}{4}$  mm; stigmas capitellate. Abortive pistil 0 in  $\delta$ , replaced by a tuft of hairs. *Drupe* (rather young) ellipsoid or ovoid, 2 by 1– $1\frac{1}{4}$  cm, shortly hairy, or scurfy; apex acute.

Distr. *Malesia*: Malay Peninsula (Perak, Kelantan, Trengganu, Selangor, Negri Sembilan, Malacca, Johore, Penang) and Borneo (Sarawak: Limbang, Kapit; Sabah: Beluran).

Ecol. Lowland forest, sometimes in seasonal swamp forest or in secondary forest, up to 300 m.

*Fl.* May, July, Sept.–Nov.; *fr.* April–July, Dec.  
Vern. *Poko kain pari pari*, *rengas*, M.

7. *Melanochyla nitida* KING, J. As. Soc. Beng. 65, ii (1896) 507; RIDL. Fl. Mal. Pen. 1 (1922) 541; KOCHUM. Mal. For. Rec. 17 (1964) 296.

Tree up to 12 m high. Branchlets brown or dark brown, pubescent. *Leaves* subcoriaceous, elliptic-oblong to narrowly elliptic, rarely oblanceolate, 6– $27\frac{1}{2}$  by 2–8 cm, shining above, rather dull beneath, glabrous; not papillose on the lower surface; base cuneate to attenuate; apex shortly acuminate, sometimes cuspidate; nerves 8–23 pairs, veins reticulate, some transverse and slightly parallel, distinct below, faint above; petiole (the lower  $\frac{1}{3}$ – $\frac{1}{2}$  slightly thickened) 1–3 cm, glabrous. *Panicles* terminal or axillary, up to 23 cm long, pubescent; bracts deltoid,  $2\frac{2}{3}$ – $1\frac{1}{2}$  mm long. *Flowers* subsessile, 4 mm long. *Hypanthium* 1 mm long. *Calyx* lobes deltoid, 1 mm long. *Petals* elliptic-lanceolate,  $2\frac{1}{4}$ –3 by 1 mm, flat. *Stamens* 2– $2\frac{1}{2}$  mm; filaments brown, basal  $\frac{1}{2}$  mm laterally united with the petals; anthers  $\frac{1}{2}$  mm long. Imperfect or abortive stamens c.  $1\frac{1}{2}$  mm. *Disk* 5-lobed. *Ovary* subglobose, c. 1 mm  $\varnothing$ ; style c. 1 mm; stigmas capitellate. Abortive pistil in  $\delta$  conical, c.  $\frac{1}{2}$  mm long, hairy. *Drupe* broadly ellipsoid,  $1\frac{1}{2}$  by 1 cm, pubescent or scurfy; apex obtuse.

Distr. *Malesia*: Malay Peninsula (Perak, Penang).

Ecol. Forest up to 360 m. *Fl.* Oct.

8. *Melanochyla castaneifolia* DING HOU, *Blumea* 24 (1978) 32.

Tree 9–24 m high and  $12\frac{1}{2}$ –26 cm  $\varnothing$ . Bark smooth. Branchlets light yellowish white or light greyish, glabrous. *Leaves* chartaceous to subcoriaceous, elliptic-oblong or -lanceolate, or ovate-oblong, 6–14 by 2–5 cm, glabrous; papillae on the lower surface very compact, obscure (rarely fine and compact on young leaves); base attenuate or cuneate; apex shortly acuminate to acuminate, sometimes acute; nerves 6–15 pairs, veins reticulate, distinct beneath, rather faint above; petiole in the lower half slightly thickened, 1– $2\frac{1}{2}$  cm, glabrous. *Panicles* terminal or axillary, 6–15 cm long, puberulous; bracts triangular,  $\frac{1}{2}$ –1 mm long; pedicels  $\frac{1}{2}$ – $1\frac{1}{2}$  mm. *Flowers* yellow, 4 mm long. *Hypanthium*  $\frac{1}{3}$ – $\frac{3}{4}$  mm long. *Calyx* lobes triangular, 1– $1\frac{1}{4}$  mm long. *Petals* elliptic, oblong, ovate, or obovate-oblong.  $1\frac{2}{3}$ –3 by  $2\frac{2}{3}$ – $1\frac{3}{4}$  mm, slightly longitudinally thickened at the central part inside. *Stamens*  $2\frac{1}{4}$  mm; filaments free, brown except whitish at the apical part; anthers  $\frac{2}{3}$  mm long. Imperfect or abortive stamens in  $\varnothing$  c. 1 mm. *Disk* 5-lobed. *Ovary* globose, c. 1 mm  $\varnothing$ ; style c.  $\frac{2}{3}$  mm; stigmas capitellate. Abortive pistil in  $\delta$  very small, c.  $\frac{1}{3}$  mm long, glabrous. *Drupe* unknown.

Distr. *Malesia*: Borneo (Sarawak: Mt Mentagai, Bintulu; Sabah: Sandakan, Lamag).

Ecol. On ridges in lowland primary forest, up to 100 m. *Fl.* April–July.

9. *Melanochyla bullata* DING HOU, *Blumea* 24 (1978) 31, f. 1a–d.

Tree 10–30 m high and 19–83 cm  $\varnothing$ . Buttresses sometimes present,  $2\frac{1}{2}$  m high,  $1\frac{1}{2}$  m wide, thin. Bark grey-brown or brown, smooth, or scaly, rarely fissured. Branchlets light brown, tomentose, usually

glabrescent. *Leaves* coriaceous, oblanceolate or obovate-oblong,  $13\frac{1}{2}$ -42 by 5-9 cm, glabrous and shining above, tomentose beneath; papillae distinct on the lower surface; base cuneate or attenuate; apex cuspidate or acuminate; nerves (15-33-38 pairs, veins scalariform, elevated beneath, impressed above (leaves bullate); petiole (thickened)  $1\frac{1}{2}$ -3 cm, tomentose, sometimes glabrescent. *Panicles* terminal, 15-17 cm long; bracts ovate to narrowly lanceolate or linear, (acrescent ?), up to 20 mm long; floral bracts ovate, *c.*  $1\frac{1}{2}$  mm long. *Flowers* (young) yellowish, sessile,  $5\frac{2}{3}$  mm long. *Hypanthium*  $\frac{1}{2}$ -1 mm long. *Calyx* lobes triangular,  $1\frac{1}{2}$ -2 mm long. *Petals* ovate or ovate-oblong,  $1\frac{1}{2}$ -2 by  $\frac{2}{3}$  mm, thickened at the lower  $\frac{2}{3}$  mm inside. *Stamens*  $1\frac{1}{3}$  mm; filaments brown, free; anthers  $\frac{2}{3}$  mm long. *Disk* obscurely 5-notched. Abortive pistil in  $\delta$  minute, glabrous.  $\text{♀}$  Flowers not seen. *Drupe* ovoid,  $3\frac{1}{2}$ -4 $\frac{1}{2}$  by 2-2 $\frac{1}{3}$  cm, thickly velvety (*c.*  $3\frac{1}{2}$  mm thick); apex acute or shortly acuminate.

Distr. *Malesia*: Borneo (Sarawak: Lundu; Sabah: Tawau; Kalimantan: Berouw, Sibatic I.).

Ecol. Forest, from the lowland up to 500 m. *Fl.* April; *fr.* Oct., Dec.

Vern. *Rengas*, Tawau & Berouw.

**10. *Melanochyla densiflora* KING, J. As. Soc. Beng. 65, ii (1896) 503; RIDL. Fl. Mal. Pen. 1 (1922) 539; DING HOU, Blumea 24 (1978) 32.**

Tree up to 30 m high and 90 cm  $\text{\O}$ . Bark grey-brown, smooth. Branchlets tomentose, glabrescent. *Leaves* coriaceous, elliptic-oblong, sometimes obovate-oblong to oblanceolate,  $10\frac{1}{2}$ -21 $\frac{1}{2}$ (-47) by 4-9 $\frac{1}{2}$ (-12 $\frac{1}{2}$ ) cm (on saplings up to 42 by 7 $\frac{1}{2}$  cm), glabrous above, tomentose beneath; papillae on the lower surface often compact and obscure, sometimes distinct (powder-like); base obtuse or cuneate; apex acute or obtuse; nerves 14-25 pairs, veins (densely) reticulate-scalariform, prominent below, faint above; petiole (the lower  $\frac{1}{3}$ - $\frac{1}{2}$  slightly thickened)  $1\frac{1}{2}$ -3 $\frac{1}{2}$  cm (on saplings up to 7 $\frac{1}{2}$  cm), pubescent. *Panicles* terminal or axillary, up to 25 cm long, tomentose; bracts triangular, 2 mm long, floral bracts deltoid, *c.*  $\frac{2}{3}$  mm long. *Flowers* ( $\delta$ ) yellowish white, subsessile,  $3\frac{1}{2}$ -5 $\frac{1}{2}$  mm long. *Hypanthium* 1-1 $\frac{1}{2}$  mm long. *Calyx* lobes triangular, 1-1 $\frac{1}{2}$  mm long. *Petals* elliptic-oblong or oblanceolate,  $2\frac{1}{2}$ -4 by 1-1 $\frac{1}{2}$  mm, flat. *Stamens* 2-2 $\frac{1}{2}$  mm; filaments brown, the lower  $\frac{1}{2}$ -1 $\frac{1}{2}$  mm laterally united with the petals; anthers  $\frac{2}{3}$ - $\frac{3}{4}$  mm. *Disk* obscurely 5-notched. Abortive pistil 0, replaced by a tuft of hairs.  $\text{♀}$  Flowers not seen. *Drupe* broadly ellipsoid or ovoid,  $1\frac{1}{2}$ -3 $\frac{1}{2}$  by  $1\frac{1}{4}$ -2 $\frac{1}{2}$  cm, dark brown velvety (indumentum  $\frac{1}{2}$ -1 mm thick); apex obtuse.

Distr. *Malesia*: Malay Peninsula (Perak, Johore) and Borneo (Sarawak: Bario, Sinrok R.; Sabah: Mt Kinabalu, Sandakan, Sepompa; Kalimantan: Berouw); Sumatra (Atjeh).

Ecol. Primary forest, from the lowland up to 1350 m. *Fl.* Febr., July, Oct.-Nov.; *fr.* March, Dec.

Vern. Sarawak: *kayu lau*, Kelabit; Sabah: *rengas*, M.

**11. *Melanochyla minutiflora* DING HOU, Blumea 24 (1978) 33.**

Tree 9-13 $\frac{1}{2}$  m high and 15-30 cm  $\text{\O}$ . Bark grey or brown, scaly. Branchlets puberulous. *Leaves*

chartaceous, elliptic-oblong,  $10\frac{1}{2}$ -16 $\frac{1}{2}$  by 3 $\frac{1}{4}$ -5 cm, glabrous above, slightly puberulous on midrib and nerves beneath; not papillose beneath; base cuneate or attenuate; apex acuminate or caudate; nerves 11-15 pairs, veins reticulate-scalariform, distinct below, obscure above; petiole slightly thickened at the lower  $\frac{1}{2}$ - $\frac{2}{3}$ ,  $\frac{3}{4}$ -1 $\frac{1}{4}$  cm, puberulous. *Panicles* terminal or axillary, 5-6 cm long, puberulous; bracts triangular,  $\frac{1}{2}$ -1 $\frac{1}{2}$  mm long. *Flowers* ( $\delta$ ) yellow, sessile, 2-2 $\frac{1}{2}$  mm long. *Hypanthium*  $\frac{1}{2}$ - $\frac{3}{4}$  mm long. *Calyx* lobes triangular, *c.*  $\frac{2}{3}$  mm long. *Petals* elliptic-oblong, or oblanceolate, 1-1 $\frac{1}{2}$  by  $\frac{1}{2}$ - $\frac{2}{3}$  mm, slightly longitudinally thickened at the central part inside. *Stamens*  $1\frac{1}{3}$  mm; filaments free, reddish brown, sometimes whitish at the apical part; anthers  $\frac{1}{3}$ - $\frac{1}{2}$  mm long. *Disk* 5-notched. Abortive pistil 0 in  $\delta$ , replaced by a tuft of hairs.  $\text{♀}$  Flowers not seen. *Drupe* subglobose, *c.*  $1\frac{1}{4}$  cm  $\text{\O}$ , thinly velvety; apex obtuse or rounded.

Distr. *Malesia*: Borneo (Sabah: Sandakan, Lamag, Tawau).

Ecol. Lowland primary forest, up to *c.* 100 m. *Fl.* June; *fr.* May.

Vern. *Rengas*, M.

**12. *Melanochyla borneensis* (RIDL.) DING HOU, Blumea 24 (1978) 31, pl. II, 4. — *Nothopegia borneensis* RIDL. Kew Bull. (1933) 197. — Fig. 44a-g.**

Tree up to 24 m high and 90 cm  $\text{\O}$ . Bark mottled dark grey and black, smooth. Branchlets brown or dark brown, puberulous. *Leaves* coriaceous, elliptic, elliptic-oblong, or obovate, 9-28 $\frac{1}{2}$  by 5 $\frac{1}{2}$ -12 cm; glabrous above except puberulous on the midrib and nerves below; papillae in prominent (often horse-shoe-shaped) groups separated by broad bands of veins and veinlets; base obtuse or cuneate; apex acute, acuminate, or cuspidate; nerves 18-24 pairs, veins reticulate-scalariform, distinct below, obscure above; petiole (thickened) 1-3 $\frac{1}{2}$  cm, puberulous or tomentose. *Panicles* axillary, up to 15 cm long; bracts lanceolate, 5 mm long; floral bracts deltoid,  $\frac{3}{4}$ -1 $\frac{1}{4}$  mm long. *Flowers* (young) yellowish, sessile, *c.* 5 mm long. *Hypanthium*  $2\frac{1}{2}$ -3 mm long. *Calyx* lobes deltoid or triangular, 1-1 $\frac{1}{2}$  mm long. *Petals* ovate, *c.* 3 by  $1\frac{3}{4}$  mm, flat. *Stamens*  $2\frac{1}{2}$ -3 mm; filaments brown, free; anthers  $\frac{1}{2}$  mm long. Imperfect or abortive stamens in  $\text{♀}$  *c.* 2 mm. *Disk* 4-(or 5)-lobed. *Ovary* round and flat, slightly convex above, 1 $\frac{1}{2}$ -2 mm  $\text{\O}$ ; style 2 mm; stigmas discoid. Abortive pistil minute in  $\delta$ , hairy. *Drupe* broadly ellipsoid, subglobose,  $2\frac{3}{4}$ -3 by 2-2 $\frac{1}{2}$  cm, puberulous (indumentum *c.*  $\frac{1}{6}$  mm thick); apex acute or obtuse.

Distr. *Malesia*: Borneo (Sarawak: Kuching and Semengoh Arboretum; trees *n.* 810, 4552, 5703).

Ecol. Lowland dipterocarp forest, up to 100 m. *Fl.* Aug.-Sept.; *fr.* Sept.-Nov.

Vern. *Rengas*, M.

Note. Easily distinguished from other species by the coriaceous leaves with distinct papillae on the lower surface in prominent often horse-shoe-shaped groups separated by broad bands of veins and veinlets.

**13. *Melanochyla beccariana* OLIVER in HOOK. Ic. Pl. 24 (1894) t. 2313, incl. var. *breviflora* OLIVER;**

MERR. EN. BORN. (1921) 351. — *M. ferruginea* MERR. J. Str. Br. R. As. Soc. n. 86 (1922) 322. — Fig. 44h, 45b.

Tree up to 25 m high and 30 cm  $\varnothing$ . Bark brownish or purplish, smooth. Branchlets brown to dark brown, pubescent. *Leaves* subcoriaceous or coriaceous, elliptic, elliptic-oblong, or obovate-oblong, sometimes narrowly lanceolate, 9–30(–42) by 4–14 $\frac{1}{2}$ (–17) cm, glabrous above except the pubescent midrib, pubescent beneath; papillae distinct beneath; base cuneate; apex obtuse, mucronate, sometimes emarginate; nerves 14–25 pairs, veins reticulate-scalariform, elevated beneath, rather faint above; petiole (the lower half slightly thickened) 1 $\frac{1}{2}$ –3 cm, puberulous. *Panicles* terminal and sometimes also in the upper leaf axils, up to 33 cm long, tomentose; bracts linear, up to 15 mm long; floral bracts triangular,  $\frac{3}{4}$ –1 mm long. *Flowers* subsessile, whitish grey, (5–)7–9(–12) mm long. *Hypanthium* (1 $\frac{1}{2}$ –)3 $\frac{1}{2}$ –5 mm long. *Calyx* lobes triangular or ovate-oblong, 1 $\frac{1}{2}$ –3 mm long. *Petals* ovate-oblong or lanceolate, 3 $\frac{1}{2}$ –5 by 1 $\frac{1}{4}$ –1 $\frac{1}{2}$  mm. *Stamens* 2–2 $\frac{1}{4}$  mm; filaments brown, the lower  $\frac{3}{4}$ –1 $\frac{1}{2}$  mm united laterally with the petals; anthers 1–1 $\frac{1}{4}$  mm long. Imperfect or abortive stamens in  $\varnothing$  1 $\frac{1}{2}$ –2 mm. *Disk* 5-lobed. *Ovary* deeply or almost completely concealed in the receptacle (seemingly inferior); style 2–4 mm; stigmas capitellate. Abortive pistil in  $\delta$  minute, hairy. *Drupe* broadly ellipsoid or ovoid, 2 $\frac{1}{2}$ –3 by 1 $\frac{1}{4}$ –2 $\frac{1}{4}$  cm, rusty velvety (indumentum c.  $\frac{3}{4}$  mm thick); apex obtuse or acute.

Distr. *Malesia*: Borneo (Sarawak: Kuching; Sabah: Sandakan, Kuala Belait, Mt Kinabalu; Kalimantan: western part).

Ecol. In forest from the lowland up to 1500 m, occasionally in marshy places. *Fl.* April, July; *fr.* April–May, Sept.–Nov.

Vern. *Rengas*, M.

14. *Melanochyla elmeri* MERR. Un. Cal. Publ. Bot. 15 (1929) 169.

Tree up to 30 m high and 40 cm  $\varnothing$ . Buttresses sometimes present, up to 2 m high,  $\frac{1}{2}$  m wide, 5 cm thick. Bark light brown to black, smooth or finely fissured. Branchlets brown, pubescent. *Leaves* subcoriaceous or coriaceous, obovate-oblong, oblong, or narrowly elliptic, (8 $\frac{1}{2}$ –)12–30 by (3–)5–12 cm; glabrous above except the pubescent midrib, pubescent or tomentose beneath especially dense on the midrib and nerves, glabrescent; papillae on the lower surface distinct, sometimes compact and obscure; base cuneate; apex shortly acuminate or acuminate; nerves 16–35 pairs, veins scalariform or reticulate-scalariform, distinct beneath, rather faint above; petiole in the lower  $\frac{1}{2}$ – $\frac{1}{3}$  often slightly thickened, 1 $\frac{1}{2}$ –4 $\frac{1}{2}$  cm, pubescent, glabrescent. *Panicles* terminal and axillary, up to 35 cm long, pubescent; bracts ovate to ovate-oblong, 1 $\frac{1}{2}$ –5 mm long; floral bracts triangular, 1–1 $\frac{3}{4}$  mm long. *Flowers* yellowish white or white, sessile or subsessile, 4–6 $\frac{1}{2}$  mm long. *Hypanthium* c.  $\frac{1}{2}$  mm long. *Calyx* lobes ovate or ovate-oblong, 1 $\frac{1}{4}$ –2 mm long. *Petals* oblong or oblanceolate, 3–5 by  $\frac{3}{4}$ –1 $\frac{1}{2}$  mm, longitudinally ridged inside. *Stamens* 3–3 $\frac{1}{2}$  mm; filaments brown, sometimes whitish at the apical part, free; anthers c. 1 mm long. Imperfect or abortive stamens in  $\varnothing$  c. 2 $\frac{1}{2}$  mm. *Disk* 5-lobed.

*Ovary* conical, 1 $\frac{1}{2}$  mm  $\varnothing$ ; style 1 mm; stigmas capitellate. Abortive pistil in  $\delta$  minute, glabrous. *Drupe* ovoid or ellipsoid, 1 $\frac{1}{2}$ –2 $\frac{1}{2}$  by 1–1 $\frac{3}{4}$  cm, rusty-puberulous (indumentum  $\frac{2}{3}$  mm thick); apex acute or obtuse.

Distr. *Malesia*: Borneo (Brunei; Sarawak: Kuching, Gunong Gading; Sabah: Mt Kinabalu, Beluran, Beaufort, Sandakan, Tawau; Kalimantan: Berouw, Tandjong Banko region, Kutai, Sangkulirang, Balikpapan).

Ecol. Lowland forest, below 200 m, in Mt Kinabalu at 1500 m (2 coll.), occasionally on limestone or in swampy forest temporarily inundated by freshwater. *Fl.* May–July, Sept.–Nov.; *fr.* April–Aug.

Vern. *Rengas*, M, *r. hitam*, Brunei.

15. *Melanochyla tomentosa* HOOK. f. Fl. Br. Ind. 2 (1876) 38; in Hook. Ic. Pl. 13 (1879) t. 1292 & 1293; ENGL. in DC. Mon. Phan. 4 (1883) 470, excl. ZOLLINGER 800 from Java; KING, J. As. Soc. Beng. 65, ii (1896) 503; RIDL. Fl. Mal. Pen. 1 (1922) 539; BURK. Dict. (1935) 1434.

Tree up to 13 m high and 25 cm  $\varnothing$ . Buttresses occasionally present up to 1 m high. Branchlets light brown, tomentose. *Leaves* coriaceous, elliptic-lanceolate or obovate-oblong, 19–35 by 6 $\frac{1}{2}$ –10 cm; glabrous above except the pubescent midrib, tomentose beneath especially dense on the midrib and nerves; papillae distinct on the lower surface; base rounded or slightly subcordate; apex acuminate, sometimes cuspidate; nerves 20–35 pairs, veins reticulate-scalariform, distinct beneath, faint above; petiole  $\frac{1}{2}$ –2 $\frac{1}{2}$  cm, tomentose. *Panicles* terminal, up to 30 cm long, tomentose; bracts ovate-oblong or lanceolate, 3–4 mm long; floral bracts deltoid,  $\frac{1}{3}$  mm long. *Flowers* ( $\delta$ ) sessile, 3 $\frac{1}{2}$  mm long. *Hypanthium*  $\frac{3}{4}$ –1 mm long. *Calyx* lobes triangular,  $\frac{1}{2}$ – $\frac{3}{4}$  mm long. *Petals* elliptic or elliptic-lanceolate, 2–3 by  $\frac{3}{4}$ –1 mm, flat. *Stamens* 1 $\frac{1}{4}$ –1 $\frac{3}{4}$  mm; filaments brown, free; anthers  $\frac{1}{2}$  mm long. *Disk* 5-lobed. Abortive pistil 0 in  $\delta$ , replaced by a tuft of hairs.  $\varnothing$  Flowers not seen. *Drupe* globose or subglobose, 2 $\frac{3}{4}$ –3 cm  $\varnothing$ , rusty-pubescent (indumentum very thin); apex rounded.

Distr. *Malesia*: Malay Peninsula (Dindings, Malacca, Johore).

Ecol. Lowland forest. *Fl.* March; *fr.* June, Nov.

Vern. *Laga, pokô kumbal bunang, p. sulumah*, M.

16. *Melanochyla caesia* (BL.) DING HOU, Blumea 24 (1978) 31. — *Semecarpus caesia* BL. Mus. Bot. 1 (1850) 189; MIQ. Fl. Ind. Bat. 1, 2 (1859) 627. — *M. maingayi* HOOK. f. Fl. Br. Ind. 2 (1876) 39; KING, J. As. Soc. Beng. 65, ii (1896) 504; RIDL. Fl. Mal. Pen. 1 (1922) 540; BURK. Dict. (1935) 1434. — *Semecarpus heterophylla* var. *caesia* ENGL. in DC. Mon. Phan. 4 (1883) 487. — *M. tomentosa* var. *glabrescens* K. & V. Bijdr. 4 (1896) 133 & 135; BACK. Schoolf. (1911) 283; RIDL. Fl. Mal. Pen. 1 (1922) 539. — *M. tomentosa* (non HOOK. f.) K. & V. Bijdr. 4 (1896) 132, *quoad syn.* & ZOLLINGER 800; BACK. & BAKH. f. Fl. Java 2 (1965) 154. — Fig. 45a.

Tree 15–27 m high and 20–26 cm  $\varnothing$ . Buttresses occasionally present,  $\frac{2}{3}$  m high, 1–1 $\frac{1}{2}$  m wide, thin. Bark reddish, smooth. Branchlets brown, pubescent, glabrescent. *Leaves* subcoriaceous or

coriaceous, oblanceolate, elliptic to narrowly elliptic, 8–41 by 2–10 cm; glabrous and shining above, sparsely pubescent below, usually glabrescent except on the midrib and nerves; papillae distinct, compact on the lower surface; base cuneate to attenuate, rarely obtuse; apex acuminate, sometimes cuspidate; nerves 16–26 pairs, veins reticulate-scalariform, distinct below, faint above; petiole in the lower  $\frac{1}{2}$ – $\frac{1}{3}$  slightly thickened,  $\frac{1}{2}$ –4 cm, pubescent, glabrescent. *Panicles* terminal or axillary, up to 26 cm long, pubescent, glabrescent; bracts triangular or linear, 2–10 mm long; floral bracts triangular,  $\frac{1}{2}$ –1 mm long. *Flowers* subsessile,  $4\frac{1}{2}$ –7 mm long. *Hypanthium*  $1\frac{3}{4}$ – $2\frac{1}{4}$  mm long. *Calyx* lobes triangular, 1– $1\frac{3}{4}$  mm long. *Petals* white or yellow, oblong, elliptic, ovate-oblong, rarely obovate-oblong, 2–5 by  $1\frac{1}{4}$ – $1\frac{1}{2}$  mm, longitudinal ridged inside. *Stamens* 2–3 mm; filaments brown, free; anthers  $\frac{1}{2}$ – $\frac{2}{3}$  mm. Imperfect or abortive stamens in ♀ 1– $1\frac{3}{4}$  mm. *Disk* 5-lobed. *Ovary* round and flat,  $2\frac{1}{2}$ –3 mm  $\varnothing$ ; style 2 mm; stigmas capitate. Abortive pistil in ♂ conical,  $\frac{1}{2}$  mm long, hairy. *Drupe* broadly ellipsoid,  $2$ – $3\frac{1}{2}$  by  $1\frac{1}{2}$ – $2\frac{1}{2}$  cm, rusty short-hairy; apex obtuse.

Distr. *Malesia*: Sumatra (Taram), Malay Peninsula (Perak, Selangor, Malacca), W. Java (scattered), Borneo (Sarawak: Anap, Kapit; Sabah: Sandakan, Lamag).

Ecol. Primary forest, mixed dipterocarp forest, sometimes on sandstone, from the lowland up to 1200 m. *Fl.* Aug.–Oct.; *fr.* Aug., Oct., Nov.

Vern. *Rēngas*, M, S.

17. *Melanochyla kunstleri* KING, J. As. Soc. Beng. 65, ii (1896) 504; RIDL. Fl. Mal. Pen. 1 (1922) 539; KOCHUM. Mal. For. Rec. 17 (1964) 296.

Tree up to 30 m high and 1– $1\frac{1}{4}$  m  $\varnothing$ . Equal plank buttresses occasionally present, up to 1 m high. Bark grey black, smooth or shallowly fissured. Branchlets light to dark brown, puberulous, glabrescent. *Leaves* coriaceous, elliptic-oblong or lanceolate, or oblanceolate,  $8\frac{1}{2}$ –18 by  $2\frac{1}{2}$ – $5\frac{1}{2}$  cm, shining and glabrous above, pubescent beneath especially on the midrib and nerves; papillae distinct on the lower surface; base attenuate; apex shortly acuminate; nerves 14–28 pairs, veins scalariform, distinct below, obscure above; petiole 1–2 cm, puberulous. *Panicles* terminal and axillary, 14–18 cm long, puberulous; bracts ovate to lanceolate, 3–4 mm long; floral bracts deltoid,  $\frac{1}{2}$  mm long. *Flowers* (♂) white or yellow, sessile, 4– $4\frac{1}{2}$  mm long. *Hypanthium*  $\frac{3}{4}$ –1 mm long. *Calyx* lobes deltoid,  $\frac{3}{4}$ –1 mm long. *Petals* elliptic-lanceolate, 3– $3\frac{1}{2}$  by 1– $1\frac{3}{4}$  mm, longitudinally ridged inside. *Stamens*  $2\frac{1}{2}$  mm; filaments brown, free; anthers  $\frac{3}{4}$  mm long. *Disk* obscurely 5-notched. Abortive pistil minute or 0, glabrous or not replaced by a tuft of hairs. ♀ Flowers not seen. *Drupe* broadly ovoid,  $2\frac{1}{2}$ –3 by 2– $2\frac{3}{4}$  cm, golden velvety (indumentum c.  $\frac{1}{3}$  mm thick); apex obtuse.

Distr. *Malesia*: Malay Peninsula (Perak, Trengganu, Pahang, Singapore).

Ecol. Lowland forest, sometimes on sandstone ridges or in secondary forest, up to 150 m. *Fl.* June, Oct.–Nov.; *fr.* Oct.

Vern. *Rēngas*, M.

## 15. SEMECARPUS

LINNÉ *f. Suppl.* (1781) 25; MARCH. *Rév. Anacard.* (1869) 69 & 168; ENGL. in DC. *Mon. Phan.* 4 (1883) 472; TARD. *Fl. C. L. & V.* 2 (1962) 156. — *Oncocarpus* ASA GRAY, *Bot. U.S. Expl. Exped.* 1 (1854) 364; C. B. ROB. *Philip. J. Sc.* 6 (1911) Bot. 339. — *Nothopegiopsis* LAUT. *Bot. Jahrb.* 56 (1920) 363. — *Melanocommia* RIDL. *Kew Bull.* (1933) 198. — **Fig. 47–55.**

Trees, sometimes treelets or shrubs, rarely unbranched (*S. magnificus*, rarely in *S. curtisii*, *S. bunburyanus*). *Leaves* simple, spiral or alternate, sometimes subverticillate, entire, often papillose on the lower surface, petioled. *Inflorescences* terminal and/or axillary, rarely cauliflorous, paniculate, rarely raceme-like; pedicels articulated, sometimes at the base. *Flowers* unisexual or rarely bisexual (plants dioecious or rarely polygamous), ♀ ones usually larger than the ♂. *Calyx* 5-(or 4)-lobed. *Petals* 5 (or 4), imbricate, or rarely valvate. *Stamens* 5 (or 4); filaments subulate, glabrous; anthers dorsifixed. Imperfect or sterile stamens in ♀ similar to fertile ones but (much) smaller and shorter. *Disk* intrastaminal, round, flat (or slightly convex above), shallowly dish-shaped, short-cupular (or rarely funnel-shaped), often 5-(or 4)-notched, usually hairy above, sometimes glabrous (except sometimes the central part or rudimentary pistil in ♂). *Ovary* superior, 1-celled, usually densely hairy, glabrescent, rarely glabrous; styles 3, often hairy near the base, terminal, divergent; stigma transverse-oblong or subreniform. Rudimentary pistil in ♂



Fig. 47. *Semecarpus bumbyranus* GIBBS. a. Habit,  $\times \frac{1}{2}$ , b. flower-bud, c.  $\sigma$  flower, d.  $\rho$  flower, e. pistil in LS, all  $\times 7$ , f. fruit,  $\times 3$  (a, d, e AMDJAH 476, b-c SAN 12642, f SAN 32886).

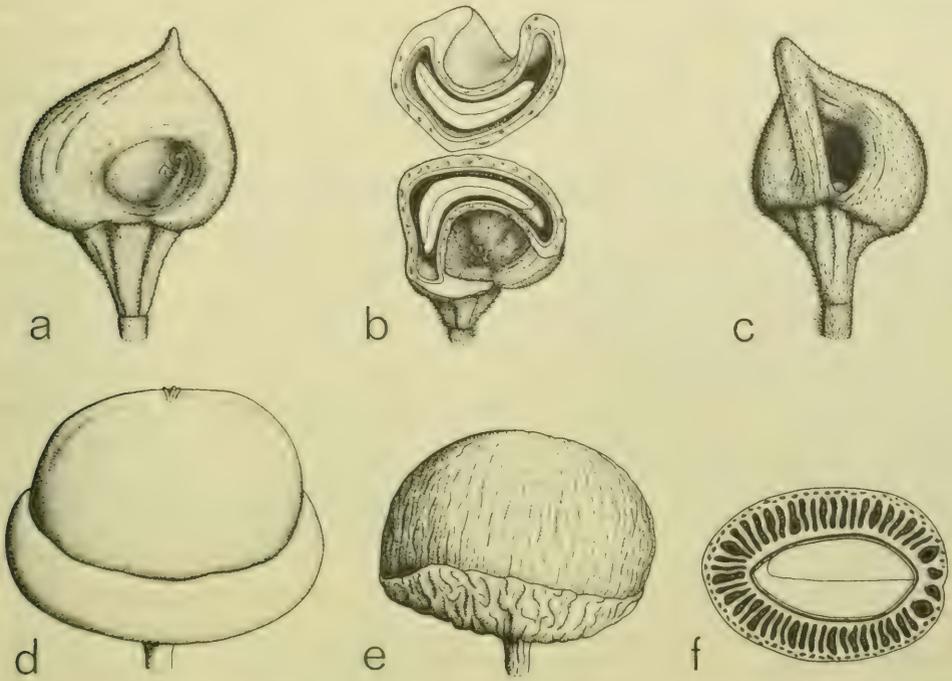


Fig. 48. *Semecarpus aruensis* ENGL. Some developmental stages of an insect shelter on the outer surface of fruit. *a*, Fruit, shallow depression on one side with several insect eggs in it, *b*, fruit, cut into halves, showing the curved pericarp and seed, and insect eggs in the depression, *c*, deformed fruit showing a cavity-like insect shelter on the outer surface formed by the incurved pericarp. All  $\times 1.3$ . — *S. curtisii* KING. *d*, Fresh fruit seated on the fleshy hypocarp, *e*, dried fruit, with shrunken hypocarp, *f*, fruit in CS, showing resin-canals and cavities. All  $\times 2$  (*a* PULLEN 1092, *b-c* HOOGLAND 3956, *d-f* VAN BALGOOY 2635).

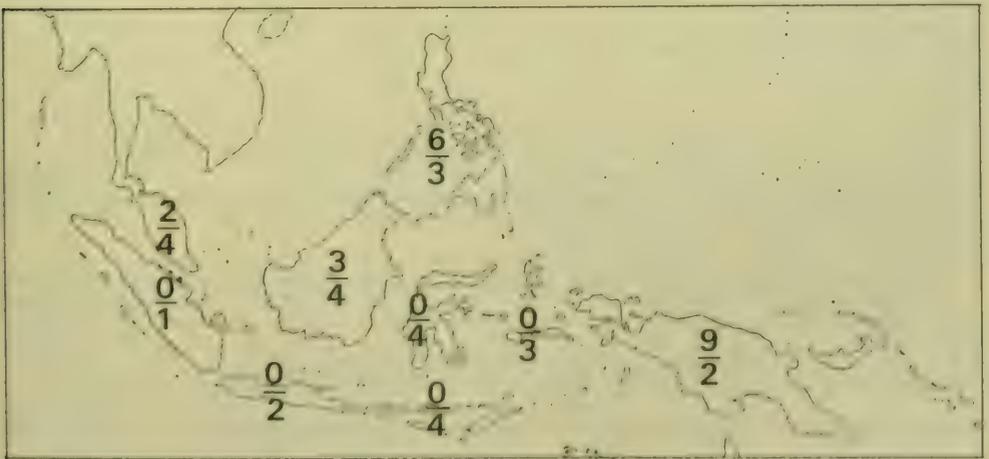


Fig. 49. Species density of *Semecarpus* L. f. in Malesia; above the hyphen the endemic, below it the non-endemic species in each island (group).

minute or 0, or replaced by a tuft of hairs. *Drupe* 1-celled, often laterally compressed, seated on a distinct, fleshy hypocarp (formed by the calyx and floral axis) which is sometimes cupular whereby the fruit is seemingly slightly semi-inferior; exocarp and mesocarp fleshy, loaded with acrid resin; endocarp crustaceous. *Seed* with testa free from the endocarp; embryo straight; cotyledons free, plano-convex.

*Distr.* A genus with c. 60 *spp.*, chiefly in Indo-Malesia, distributed in India, Ceylon, Burma, Thailand, Indo-China, Formosa, throughout *Malesia*, to Australia, Micronesia, the Solomon Islands, New Caledonia, and Fiji. Fig. 49.

*Ecol.* In primary forest at low and medium altitude, sometimes occurring in montane forest up to 1950 m, and occasionally found in periodically inundated regions or peat-swamp forest, monsoon forest, teak forest, or secondary forest, on limestone hills, or in ultrabasic areas.

Most species belong to the middle storey or attain the subcanopy, but some do not go beyond the lower storey, or are even small and unbranched (*spp.* 1 & 2) cycloidal and large-leaved. Of several *spp.* (13, 14, 27, 30) it is recorded that their twigs are hollowed and inhabited by ants, but the myrmecophilous habit is not compulsory for the plant.

*Notes.* Taxonomically this is a very difficult genus, for which there are two main reasons. The species are mostly dioecious, rarely polygamous, and flowering takes place simultaneous, so that herbarium specimens only represent one stage, and one has almost never flowers and fruit together. Furthermore both flowers and leaves are rather 'monotonous' and do not offer a great deal of 'characters'. A second cause is the fact that several species are fairly variable geographically.

For these reasons the framing of an overall key for the whole of Malesia based freely on flower and fruit characters appeared not very practical for identification. Instead I have provided keys for partial areas, sometimes for each area one for fruiting and another for flowering material.

In addition these keys are preceded by a short synopsis of characteristic ('spotting') characters which are diagnostic for a limited number of species.

Size of fruit in descriptions is always derived from dried specimens unless stated otherwise.

### Synopsis of spotting characters

*Species are indicated by their numbers*

Single-stemmed (recorded on field label): 1, 15 & 17 (*p.p.*).

Leaves subverticillate: 1, 2, 17 (*p.p.*).

Leaves very narrow, 10-20 by  $\frac{1}{2}$ - $1\frac{1}{2}$  cm: 3.

Leaves entirely glabrous: 2, 3, 6, 8, 9.

Leaf lower surface without distinct papillae: 2, 5, 6.

Leaf lower surface with papillae in distinct groups: 18.

Inflorescences (at least in part) cauliflorous: 1, 2, 5, 6.

Flower-buds longer than wide: 17, 18, 19, 20.

Petals glabrous outside: 6, 8, 9, 18.

Petals valvate: 1, 2, 4( $\pm$ ), 6, 7, 9( $\pm$ ), 17, 19, 20, 22, 24.

Petals densely hairy (sericeous or villous) outside: 1, 5, 7, 21, 22, 23, 24, 25.

Hypocarp wider than long (cupular to discoid): 8, 16, 20, 21, 29.

### KEY TO THE SPECIES

*Sumatra, Malaya, Java, and neighbouring islands*<sup>1</sup>

1. Papillae on the lower leaf surface indistinct or obscure. Petals valvate . . . . . 6. *S. longifolius*
1. Papillae on the lower leaf surface usually distinct. Petals imbricate (at least at the apex in *S. prainii*).
2. Papillae<sup>2</sup> usually surrounding the endings of veinlets and arranged in groups . . . . . 18. *S. lucens*
2. Papillae not as above, rather evenly arranged.
3. Leaves pubescent or velutinous on the lower surface.
4. Leaf apex obtuse, sometimes slightly emarginate, or acute. Petals with c. 8 longitudinal veins. Hypocarp obconical, stalk-like . . . . . 26. *S. cochinchinensis*
4. Leaf apex shortly and abruptly acuminate. Veins of petals invisible. Hypocarp short-cupular or discoid . . . . . 29. *S. velutinus*
3. Leaves glabrous, or sometimes sparsely puberulous on the lower surface.
5. Petals only imbricate at the apex. Hypocarp obconical, stalk-like. Leaf veins reticulate . . . . . 9. *S. prainii*
5. Petals imbricate. Hypocarp discoid. Leaf veins reticulate, or some cross-bar-like and subparallel.

(1) The delimitation of the areas in the partial keys is in accordance with map 1 in this Flora vol. 1 (1950) facing page C, here also reproduced in fig. 1.

(2) For the terminology of arrangement of papillae compare fig. 45.

6. Flower after falling leaving a short stalk of  $1/2$ -3 mm. (Exine of pollen grains reticulate) 15. *S. curtisii*  
 6. Flower after falling leaving no distinct stalk. (Exine of pollen grain striate) 16. *S. heterophyllum*

## KEY TO THE SPECIES

*Borneo and neighbouring islands*

1. Inflorescences or infructescences axillary, depauperate-paniculate or racemose-like. Hypocarp stalk-like . . . . . 4. *S. borneensis*  
 1. Inflorescences or infructescences terminal, sometimes also axillary, often much branched.  
 2. Leaves glabrous, sometimes sparsely puberulous or pubescent on the lower surface.  
 3. Papillae on the lower leaf surface concentrated in small groups in the areolae, separated by veins and veinlets. Hypocarp obconical . . . . . 10. *S. forstenii*  
 3. Papillae on the lower leaf surface rather uniform, not concentrated into such groups in the areolae. Hypocarp discoid . . . . . 16. *S. heterophyllum*  
 2. Leaves densely, sometimes sparsely, tomentose or pubescent, velutinous, rarely hispidulous, on the lower surface.  
 4. Flower-buds subglobose. Petals imbricate. Hypocarp obconical (solid) . . . . . 28. *S. cuneiformis*  
 4. Flower-buds oblong or ellipsoid. Petals valvate. Hypocarp discoid, short-cupular, or funnel-shaped (hollow).  
 5. Petals glabrous, rarely puberulous outside. Disk round and flat in ♂. Fertile anthers  $(1-1\frac{1}{4}-1\frac{1}{2}$  mm long . . . . . 17. *S. bunburyanus*  
 5. Petals puberulous outside. Disk short-cupular in ♂. Fertile anthers  $1/2-3/4$  mm long.  
 6. Leaves tomentose and usually glabrescent on the lower surface. Petals elliptic-oblong, or lanceolate, sometimes  $\pm$  oblong,  $3\frac{1}{2}-5$  by  $1-1\frac{1}{2}$  mm . . . . . 19. *S. glaucus*  
 6. Leaves velutinous on the lower surface. Petals ovate-oblong or lanceolate,  $2\frac{1}{2}-3\frac{1}{2}$  by  $2/3-1\frac{1}{4}$  mm . . . . . 20. *S. rufovelutinus*

## KEY TO THE SPECIES

*Philippines*

1. Papillae on the lower leaf surface indistinct or obscure. Fertile anthers  $1-1\frac{1}{4}$  mm long. Fruits glabrous; hypocarp pulvinate or obconical-cylindric . . . . . 6. *S. longifolius*  
 1. Papillae on lower leaf surface usually distinct.  
 2. Leaves very narrow,  $1/2-1\frac{1}{2}$  cm wide . . . . . 3. *S. stenophyllum*  
 2. Leaves much broader, usually more than 5 cm wide.  
 3. Flower-buds oblong. Fertile anthers  $(1-1\frac{1}{4}-1\frac{1}{2}$  mm. Fruits almost glabrous; hypocarp funnel-shaped or short-cupular . . . . . 17. *S. bunburyanus*  
 3. Flower-buds subglobose or globose. Fertile anthers  $2/3-3/4$  mm long. Fruits hairy; hypocarp pulvinate or obconical.  
 4. Petals valvate. Fruit apex truncate, or slightly concave.  
 5. Leaves  $(17-21-46(-60)$  by  $(8-13-20$  cm, lower surface pubescent . . . . . 24. *S. macrophyllum*  
 5. Leaves smaller, 6-22 by  $3\frac{1}{2}-8\frac{1}{2}$  cm, lower surface glabrous, sometimes sparsely puberulous, glabrescent . . . . . 7. *S. trachyphyllum*  
 4. Petals imbricate. Fruit apex obtuse or rounded.  
 6. Petals sericeous outside. Fruits velutinous . . . . . 25. *S. densiflorus*  
 6. Petals puberulous or sparsely puberulous outside. Fruits pubescent or sparsely hairy.  
 7. Leaves with 5-10 pairs of nerves. Flower or fruit after falling leaving a distinct stalk  $1\frac{1}{2}-8$  mm long. Fruits  $c. 2/3$  cm  $\varnothing$  . . . . . 12. *S. paucinervius*  
 7. Leaves with 10-25 pairs of nerves. Flower or fruit after falling leaving no stalk or an obscure one.  
 8. Leaf apex acute, shortly or abruptly acuminate, obtuse, rarely retuse; lower surface densely, sometimes sparsely, tomentose or pubescent, glabrescent, or glabrous. Fruits  $3/4-1$  cm  $\varnothing$  . . . . . 28. *S. cuneiformis*  
 8. Leaf apex acuminate or subcaudate; lower surface puberulous. Fruits  $1\frac{1}{2}-1\frac{3}{4}$  cm  $\varnothing$  . . . . . 31. *S. glauciphyllum*

## KEY TO THE SPECIES

*Lesser Sunda Is., Celebes, Moluccas, and neighbouring islands*

## Flowering material

1. Papillae on the lower leaf surface indistinct or obscure. Petals valvate, glabrous . . . . . 6. *S. longifolius*  
 1. Papillae on the lower leaf surface usually distinct. Petals imbricate, hairy outside.  
 2. Papillae in small groups in the areolae . . . . . 10. *S. forstenii*  
 2. Papillae rather uniform, not separated into groups as above.  
 3. Veins of leaves reticulate-scalariform . . . . . 14. *S. cassuvium*  
 3. Veins of leaves reticulate, some cross-bar-like.  
 4. Leaves densely, sometimes sparsely tomentose or pubescent, glabrescent, rarely glabrous on the lower surface . . . . . 28. *S. cuneiformis*  
 4. Leaves glabrous, sometimes sparsely puberulous beneath . . . . . 16. *S. heterophyllum*

## KEY TO THE SPECIES

*Lesser Sunda Is., Celebes, Moluccas, and neighbouring islands*

## Fruiting material

1. Hypocarp discoid, wider than long.
  2. Fruits subglobose, rounded at the apex; sparsely puberulous, glabrescent. Leaf veins reticulate, some cross-bar-like. . . . . **16. *S. heterophyllus***
  2. Fruits broadly obovoid, concave at the apex; velutinous, sometimes glabrescent. Leaf veins reticulate-scalariform . . . . . **14. *S. cassuvium***
1. Hypocarp obconical or pulvinate, stalk-like, longer than wide, or  $\pm$  equal in length and width.
  3. Papillae on the lower leaf surface indistinct or obscure. Fruits 1-2<sup>1</sup>/<sub>2</sub> by 1-2 cm, glabrous . . . . . **6. *S. longifolius***
  3. Papillae on the lower leaf surface distinct.
    4. Leaves glabrous, sometimes sparsely puberulous or pubescent on the lower surface; papillae in small groups in the areolae. Fruits 3-4 by 2-3<sup>1</sup>/<sub>2</sub> cm, velutinous, glabrescent . . . . . **10. *S. forstenii***
    4. Leaves densely, sometimes sparsely tomentose or pubescent, glabrescent, rarely glabrous on the lower surface; papillae rather uniform, not separated into small groups as above. Fruits smaller, 1-1<sup>1</sup>/<sub>4</sub> by <sup>3</sup>/<sub>4</sub>-1 cm, sparsely hairy, glabrescent . . . . . **28. *S. cuneiformis***

## KEY TO THE SPECIES

*New Guinea and neighbouring islands*

## Flowering material

1. Leaves subverticillate, in a terminal whorl or clustered at intervals. Inflorescences cauliflorous and/or axillary. Petals valvate.
  2. Unbranched shrub-like treelet or slender tree. Papillae distinct on the lower leaf surface. Lateral branches of the inflorescences usually at right angles with the main axis . . . . . **1. *S. magnificus***
  2. Branched shrub or tree. Papillae indistinct or obscure on the lower leaf surface. Lateral branches of the inflorescences obliquely ascending . . . . . **2. *S. nidificans***
1. Leaves spaced, spiral. Inflorescences often terminal, and/or axillary, rarely also cauliflorous. Petals imbricate (except in *S. aruensis*).
  3. Petals glabrous outside. Leaves (26-)40-52(-100) by 12<sup>1</sup>/<sub>2</sub>-17(-24) cm; apex obtuse or rounded . . . . . **8. *S. papuanus***
  3. Petals hairy (puberulous or sericeous) outside.
    4. Papillae indistinct on the lower leaf surface. Lateral branches of inflorescences  $\pm$  perpendicular to the main axis . . . . . **5. *S. lamii***
    4. Papillae distinct on the lower leaf surface. Lateral branches of inflorescences obliquely ascending.
      5. Papillae on the lower leaf surface separated into small groups by veins and veinlets . . . . . **10. *S. forstenii***
      5. Papillae on the lower leaf surface not like above, but rather uniform.
        6. Petals valvate . . . . . **22. *S. aruensis***
        6. Petals imbricate.
          7. Petals with 15-20 longitudinal veins . . . . . **27. *S. brachystachys***
          7. Petals with c. 4-12 longitudinal veins.
            8. Petals sericeous outside.
              9. Leaves with 15-32 pairs of nerves; apex rounded or slightly apiculate; veins much elevated beneath. Petals with c. 4 longitudinal veins . . . . . **21. *S. bracteatus***
              9. Leaf with 10-15 pairs of nerves; apex abruptly acuminate-rostrate; veins distinct beneath. Petals with c. 7 longitudinal veins . . . . . **23. *S. rostratus***
            8. Petals puberulous outside.
              10. Leaves 5-8(-18) cm long; nerves 5-10 pairs; veins reticulate. ♀ Flower sessile, after falling leaving a short stalk 3-5 mm long . . . . . **11. *S. albicans***
              10. Leaves larger, 10-48 cm long; nerves 9-26 pairs; veins reticulate-scalariform, or reticulate and some cross-bar-like. ♀ Flower pedicelled (1-3 mm), after falling not leaving a short stalk.
                11. Leaf apex obtuse, sometimes slightly apiculate . . . . . **13. *S. australiensis***
                11. Leaf apex acute or acuminate, sometimes obtuse, rarely slightly emarginate.
                  12. Leaves 15-22 cm long. Petals with c. 12 longitudinal veins. . . . . **14. *S. cassuvium***
                  12. Leaves larger, (23<sup>1</sup>/<sub>2</sub>-)35-48 cm long. Petals with c. 8 longitudinal veins . . . . . **30. *S. schlechteri***

## KEY TO THE SPECIES

*New Guinea and neighbouring islands*

## Fruiting material

1. Leaves subverticillate, in a terminal whorl or clustered at intervals. Infructescences cauliflorous and/or axillary.
  2. Unbranched shrub-like treelet or slender tree. Papillae distinct on the lower leaf surface. Fruit obovoid or ellipsoid, 3-3<sup>1</sup>/<sub>2</sub> cm long . . . . . **1. *S. magnificus***

2. Branched shrub or tree. Papillae indistinct or obscure on the lower leaf surface. Fruits unknown  
2. *S. nidificans*
1. Leaves spaced, spiral. Infructescences often terminal, and/or axillary, rarely also cauliflorous.
3. Papillae indistinct or obscure on the lower leaf surface.
4. Fruits  $2\frac{1}{2}$ - $3\frac{1}{2}$  cm  $\varnothing$ ; hypocarp obconical  $1-1\frac{1}{2}$  cm  $\varnothing$  . . . . . 5. *S. lamii*
4. Fruits wider,  $4\frac{1}{4}$ - $5$  cm  $\varnothing$ ; hypocarp short-cupular,  $3-3\frac{1}{4}$  cm  $\varnothing$  . . . . . 8. *S. papuanus*
3. Papillae distinct on the lower leaf surface.
5. Hypocarp discoid, short-cupular, or funnel-shaped.
6. Fruits almost glabrous . . . . . 13. *S. australiensis*
6. Fruits pubescent, puberulous, or velutinous.
7. Leaf apex rounded or slightly apiculate; veins on lower leaf surface much elevated. Fruits velutinous; apex apiculate, sometimes concave at the top . . . . . 21. *S. bracteatus*
7. Leaf apex acute or acuminate, sometimes obtuse, rarely slightly emarginate.
8. Fruits velutinous; apex concave . . . . . 14. *S. cassuvium*
8. Fruits pubescent, glabrescent; apex obtuse. . . . . 30. *S. schlechteri*
5. Hypocarp pulvinate or obconical.
9. Papillae on lower leaf surface separated into small groups in the areolae . . . . . 10. *S. forstenii*
9. Papillae rather uniform on the lower leaf surface.
10. Leaf apex obtuse, rounded, acute, sometimes shortly or abruptly acuminate.
11. Leaves with 5-10 pairs of nerves . . . . . 11. *S. albicans*
11. Leaves with 22-32 pairs of nerves . . . . . 27. *S. brachystachys*
10. Leaf apex shortly acuminate, slightly rostrate, or abruptly acuminate-rostrate.
12. Fruit apex shortly acuminate; hypocarp  $1-1\frac{1}{2}$  by  $1-1\frac{1}{2}$ (-2) cm . . . . . 22. *S. aruensis*
12. Fruit apex acuminate-rostrate; hypocarp  $2\frac{2}{3}$  by  $2\frac{1}{3}$  cm . . . . . 23. *S. rostratus*

1. *Semecarpus magnificus* K.SCH. in K.Sch. & Holtr. Fl. Kais. Wilh. Land (1889) 65; K.Sch. & LAUT. Fl. Schutzgeb. (1900) 411; LAUT. Nova Guinea 8 (1910) 299, (1912) 830; Bot. Jahrb. 56 (1920) 368, f. 5; MERR. & PERRY, J. Arn. Arb. 22 (1941) 537; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 37, f. 16; HALLÉ, Biotropica 6 (1974) 45, f. 5. — *S. undulatus* C. T. WHITE, Proc. R. Soc. Queensl. 34 (1922) 41; J. Arn. Arb. 10 (1929) 234. — Fig. 50.

Unbranched treelet or slender tree, (2)-4-6 (-10) m high and 5-12 $\frac{1}{2}$  cm  $\varnothing$ . Bark grey-brown or brown, finely striate, or with fairly deep longitudinal fissures. Leaves subverticillate, usually in a terminal, flat spreading crown, sometimes clustered at intervals near the apex, coriaceous, obovate-lanceolate, 47-135 by 9-26 cm; above glabrous, beneath tomentose or pubescent, glabrescent, sometimes almost glabrous; papillae distinct, covering the lower surface except the midrib, nerves, and thicker veins; base attenuate or decurrent; apex acute, rarely acuminate; nerves up to 56 pairs, elevated below, distinct above; veins reticulate-scalariform, slightly elevated below, distinct or faint above; petiole (0)-2-6(-9 $\frac{1}{2}$ ) cm, the lowest leaves with the longest petioles. Panicles cauliflorous, usually borne on the lower part of stem, up to 80 cm long, pubescent, glabrescent; lateral branches up to 15 cm, usually at right angles with the main axis; bracts small, lanceolate or triangular, 1-1 $\frac{1}{4}$  mm long; pedicels very short. Flower-buds subglobose. Calyx lobes triangular,  $\frac{3}{4}$ -1 $\frac{1}{4}$  mm long. Petals valvate, elliptic-oblong or lanceolate, 2 $\frac{1}{2}$ -3 by 1-1 $\frac{1}{2}$  mm, with several longitudinal veins, sericeous outside. Stamens 3 $\frac{1}{4}$  mm; anthers ovoid,  $\frac{2}{3}$  mm long. Imperfect or sterile stamens in  $\varnothing$  1 $\frac{1}{2}$  mm. Disk round, flat, 1-1 $\frac{1}{2}$  mm  $\varnothing$ , glabrous (except the central part or rudimentary pistil densely hairy). Ovary subglobose, densely pubescent, c. 3 mm  $\varnothing$ ; styles c. 1 mm long. Drupe obovoid or ellipsoid, 3-3 $\frac{1}{2}$  by 1 $\frac{1}{4}$ -2 $\frac{1}{4}$  cm, pubescent, glabrescent; apex

obtuse; hypocarp obconical, stalk-like,  $1\frac{1}{2}$ -2 $\frac{1}{4}$  by  $1\frac{1}{2}$ -1 $\frac{3}{4}$  cm.

Distr. *Malesia*: New Guinea (scattered between Hollandia and Milne Bay Distr.).

Ecol. Common in forest undergrowth of dry land forest, sometimes in forest along rivers or in inundated areas, from the lowland up to 500 m, very rarely at 900 m, once at 1200 m. Fl. April-Sept., Dec.

Vern. *Dodoari*, *sowowari*, Kamtuk lang., *merwehyi*, Orne lang., *wunyub*, Sepik.

2. *Semecarpus nidificans* (LAUT.) DING HOU, Blumea 24 (1978) 36. — *Nothopegiopsis nidificans* LAUT. Bot. Jahrb. 56 (1920) 363, f. 4.

Shrub or small tree up to 5 m high. Bark grey to reddish brown, with fairly deep longitudinal fissures. Leaves subverticillate, arranged on the branches at intervals of  $\frac{1}{2}$ - $\frac{3}{4}$  of the length of leaves, like nests, subcoriaceous, linear or oblanceolate, 34-73 by 8-16(-23 $\frac{1}{2}$ ) cm, glabrous on both surfaces; papillae beneath indistinct or obscure; base attenuate, obtuse or subauriculate; apex acuminate; nerves 23-50 pairs, conspicuous on both surfaces; veins reticulate, distinct on both surfaces; petiole very short,  $\frac{1}{2}$ - $\frac{2}{3}$  cm. Panicles axillary, sometimes also cauliflorous, 3-20(-55) cm long, sparsely puberulous, glabrescent, or sometimes glabrous; lateral branches obliquely ascending, up to 14 cm; bracts lanceolate,  $\frac{2}{3}$ -1 mm long; pedicels 0. Flower-buds globose. Calyx lobes deltoid,  $\frac{1}{3}$ - $\frac{2}{3}$  mm long. Petals valvate, ovate or broad-elliptic, 1 $\frac{1}{2}$ -3 by 1-2 mm, with several longitudinal veins, puberulous outside. Stamens c. 1 mm; anthers oblong-ovoid,  $\frac{1}{2}$  mm long. Disk round, flat, c.  $\frac{2}{3}$  mm  $\varnothing$  in  $\sigma$ , 1 $\frac{1}{2}$ -2 $\frac{1}{4}$  mm  $\varnothing$  in  $\varnothing$ , pilose above. Imperfect or sterile stamens in  $\varnothing$  c. 1 $\frac{1}{2}$  mm. Ovary globose, 1 $\frac{1}{4}$ -2 $\frac{1}{2}$  mm  $\varnothing$ , pilose; styles  $\frac{2}{3}$  mm long. Drupe unknown.

Distr. *Malesia*: New Guinea (Mamberamo R., Sepik, Central and Gulf Distr.).



Fig. 50. *Semecarpus magnificentus* K.SCH. in fruit. Morobe Distr., Papua New Guinea. Courtesy Bot. Div. Lae (NGF 46762).

Ecol. In forest of alluvium and dryland, 10–560 m. *Fl.* Jan.–March, June–July.  
Vern. *Uwapull*, Sepik Distr.

**3. *Semecarpus stenophyllus* MERR.** Philip. J. Sc. 30 (1926) 407; DING HOU, *Blumea* 24 (1978) 37.

Shrub or small tree, up to 6 m high and 8 cm  $\varnothing$ . *Leaves* spaced, spiral, subcoriaceous, very narrowly elliptic,  $10\frac{1}{2}$ –20 by  $1\frac{1}{2}$ – $1\frac{1}{2}$  cm, from the middle gradually narrowed towards both ends, glabrous; papillae distinct, covering the lower surface except the midrib, nerves, and thicker veins; base attenuate; apex acuminate; nerves 22–45 pairs or more, slightly elevated below, faint above; veins reticulate, distinct below, faint above; petiole  $1\frac{1}{2}$ – $1\frac{1}{2}$  cm. *Panicles* terminal, up to c. 10 cm long, young parts slightly pubescent, glabrescent; lateral branches up to  $3\frac{1}{2}$  cm, obliquely ascending; bracts lanceolate,  $\frac{2}{3}$ –1 mm long; pedicels 0. Flower-bud (only one observed, not dissected) subglobose. *Calyx* lobes triangular. *Petals* imbricate, sparsely puberulous outside. *Drupe* obliquely broad-ovoid, c. 1 by 1 cm, sparsely pubescent, glabrescent; apex obtuse; hypocarp red when fresh (MERRILL, *l.c.*), pulvinate, c.  $\frac{1}{2}$  by  $\frac{2}{3}$  cm.

Distr. *Malesia*: Philippines (Samar; Luzon; Isabela Prov.).

Ecol. In a thicket on a river-bank, 150 m. *Fr.* April, June.

This stenophyllous species belongs apparently to the category of rheophytes, growing along small streams in places subject to sudden and brief overflow when the streams are in spate after heavy rains (*cf.* MERRILL).

**4. *Semecarpus borneensis* MERR.** J. Str. Br. R. As. Soc. n. 86 (1922) 323; DING HOU, *Blumea* 24 (1978) 35.

Shrub or small tree, c. 3 m high. *Leaves* spaced, spiral, subcoriaceous, elliptic, elliptic-oblong, obovate-oblong, or oblanceolate, 7–20 by  $3\frac{1}{2}$ –8 cm; upper surface glabrous, sometimes sparsely hairy, lower surface tomentose; papillae distinct, covering the lower surface except the midrib, nerves, and veins; base acute; apex shortly acuminate, sometimes apiculate; nerves 10–16 pairs, prominent beneath, faint above; veins reticulate, slightly elevated below, obscure above; petiole 1–2 cm. *Panicles* axillary at the apical end of twigs, depauperate-paniculate or raceme-like, up to 20 cm long, tomentose; lateral branches obliquely ascending, up to 3 cm; bracts linear, 2–3 mm long; pedicels  $\frac{1}{3}$  mm. Flower-buds globose. *Calyx* lobes triangular,  $\frac{2}{3}$  mm long. *Petals* valvate except slightly imbricate at the apex, elliptic or ovate-elliptic, c. 2 by 1 mm, puberulous outside. *Stamens*  $1\frac{1}{2}$  mm; anthers ovoid-oblong,  $\frac{2}{3}$  mm long. *Disk* round, flat, c. 1 mm  $\varnothing$ , pilose above.  $\varphi$  Flowers not seen. *Drupe* (young) broad-ellipsoid, c.  $\frac{3}{4}$  by  $\frac{2}{3}$  cm, pubescent; apex obtuse; hypocarp obconical, stalk-like, c.  $\frac{1}{2}$  by  $\frac{1}{3}$  cm.

Distr. *Malesia*: Borneo (Sabah: near Kudat, and near Ranau, Mt Kinabalu).

Ecol. One collection on a dry slope near Kudat at 20 m and another in forest at Ranau, Mt Kinabalu, at 600 m. *Fl.* July, Nov.; *fr.* July.

Vern. *Kalob-kalob*, Ranau, *rungas*, Kudat.

**5. *Semecarpus lamii* SLIS**, Nova Guinea 14 (1924) 98.

Tree 14–28 m high and 19–40 cm  $\varnothing$ . Bark grey, greyish green, light orange, or red, rather smooth, sometimes shallowly fissured. *Leaves* spaced, spiral, subcoriaceous, obovate- or elliptic-oblong, 9–35 by  $4\frac{1}{2}$ –15 cm; above pubescent on the midrib; beneath pubescent, glabrescent, papillae indistinct; base cuneate; apex acute or acuminate; nerves 10–17 pairs, prominent beneath, distinct or faint above; veins reticulate or transverse, distinct beneath, faint above; petiole 2–4 cm long. *Panicles* axillary, terminal, or cauliflorous, up to 20 cm long, densely pubescent; lateral branches up to 4 cm,  $\pm$  perpendicular to the main axis; bracts triangular, ovate,  $\frac{1}{2}$ –1 mm long; pedicels very short. Flower-buds globose.  $\sigma$  *Flowers*: *Calyx* lobes triangular, c.  $\frac{1}{2}$  mm long. *Petals* white, imbricate, elliptic, c. 2 by 1 mm, with several longitudinal veins, sericeous outside. *Stamens*  $2\frac{1}{2}$  mm; anthers ovoid, c.  $\frac{2}{3}$  mm long. *Disk* round, flat, c.  $\frac{3}{4}$  mm  $\varnothing$ , pubescent above.  $\varphi$  *Flowers* not seen. *Drupe* yellow when ripe, broad-ellipsoid or -ovoid,  $3\frac{1}{2}$ – $5\frac{1}{2}$  by  $2\frac{1}{2}$ – $3\frac{1}{2}$  cm; puberulous, glabrescent; apex obtuse; hypocarp obconical, stalk-like, 1– $2\frac{1}{4}$  by 1– $1\frac{1}{2}$  cm.

Distr. *Malesia*; New Guinea (Sorong, Nabire, Pionier Bivak, Uta, Hollandia, Central and Madang Distr.).

Ecol. Lowland rain-forest and occasionally in rocky river gully, up to 200 m. *Fl.* March, July; *fr.* Febr., March, Sept., Oct.

Vern. *Ama*, Arzo, *ko*, Mooi, *siqualat*, Jal, *tamu*, Njau, *weadi*, Motu dial.

**6. *Semecarpus longifolius* BL.** Mus. Bot. 1 (1850) 188; MIQ. Fl. Ind. Bat. 1, 2 (1859) 627; ENGL. in DC. Mon. Phan. 4 (1883) 496. — *Holigarna longifolia* (non ROXB. 1820,  *nec* W. & A. 1834) SPAN. Linnaea 15 (1841) 188. — *Buchanania halmaherae* MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 117. — *S. gigantifolia* VIDAL, Sinopsis (1883) 22, t. 36, f. A; F.-VILL. Nov. App. (1883) 350; MERR. Bull. For. Bur. Philip. 1 (1903) 33; Publ. Gov. Lab. Philip. n. 6 (1904) 5; PERK. Fragm. Fl. Philip. (1904) 26; MERR. Philip. J. Sc. 1 (1906) Suppl. 85; Sp. Blanc. (1918) 21; En. Philip. 2 (1923) 474; BROWN, Useful Pl. Philip. 2 (1950) 347, f. 169; LI, Pac. Sc. 7 (1953) 183; LIU, Ill. Pl. Taiwan 2 (1962) 945, f. 780; LI, Woody Fl. Taiwan (1963) 451, f. 175. — *S. euphlebia* MERR. Philip. J. Sc. 7 (1912) Bot. 283; En. Philip. 2 (1923) 473. — *S. lanceolata* MERR. Philip. J. Sc. 7 (1912) Bot. 284; En. Philip. 2 (1923) 474. — *S. vernicifera* HAYATA & KAWAKAMI in Hayata, Ic. Pl. Form. 2 (1932) 108; KANEH. Form. Trees rev. ed. (1936) 367, f. 322. — *S. testaceus* ELMER, Leaf. Philip. Bot. 10 (1939) 3682, *descr. angl.*

Tree up to 20 m high and 30 cm  $\varnothing$ , rarely small and unbranched up to 5 m high. Bark dark brown, finely fissured. *Leaves* spaced, spiral, coriaceous, oblanceolate, elliptic-lanceolate, rarely narrowly elliptic, ( $18\frac{1}{2}$ –)34–85(–125) by ( $4\frac{1}{2}$ –) $8\frac{1}{2}$ –21(–28) cm, glabrous on both surfaces; papillae indistinct or obscure beneath; base attenuate, sometimes slightly auriculate; apex acute or acuminate; nerves 20–42 pairs, prominent below, distinct above; veins reticulate-scalariform, distinct on

both surfaces, sometimes faint above; petiole (0–)1<sup>1</sup>/<sub>4</sub>–4<sup>1</sup>/<sub>2</sub>(–9) cm. *Panicles* cauliflorous, axillary, sometimes terminal, up to 34 cm long, puberulous, glabrescent; lateral branches obliquely ascending, up to 8<sup>1</sup>/<sub>2</sub>(–28) cm; bracts ovate or ovate-oblong, <sup>1</sup>/<sub>3</sub>–1<sup>1</sup>/<sub>2</sub> mm long; pedicels <sup>2</sup>/<sub>3</sub>–1 mm. Flowerbuds subglobose. *Flowers* white. *Calyx* lobes crescent-shaped, <sup>1</sup>/<sub>2</sub>–1 mm long. *Petals* valvate, elliptic or ovate-oblong, 4–5 by 2 mm, with c. 8 longitudinal veins, glabrous. *Stamens* 3<sup>1</sup>/<sub>2</sub>–5 mm; anthers broad-ovoid or ovoid-oblong, 1–1<sup>1</sup>/<sub>4</sub> mm long. Imperfect or sterile stamens 2<sup>1</sup>/<sub>2</sub>–3 mm. *Disk* round, flat, 1–2 mm Ø, pilose above, glabrescent, or glabrous. *Ovary* subglobose, c. 2 mm Ø, glabrous or sparsely pubescent; styles 1–1<sup>1</sup>/<sub>2</sub> mm. *Drupe* subglobose, 1–2<sup>1</sup>/<sub>2</sub> by 1–2 cm, glabrous; apex rounded or slightly apiculate; hypocarp pulvinate or obconical-cylindric, stalk-like, <sup>1</sup>/<sub>2</sub>–2 by <sup>2</sup>/<sub>3</sub>–1<sup>3</sup>/<sub>4</sub> cm.

Distr. Formosa (E. & Lanyu) and *Malesia*; Philippines (Luzon, Oriental Mindoro, Mindanao), Celebes (Malili, Matana Lake, Wangiwangi, Lamangiso, Pangkadjene; Kabaena, Tukang Besi, Saleijer Is.), and Moluccas (Sula Is.: Mangoli; Halmahera, Buru). E. Java (Tangkil, once coll.), Lesser Sunda Is. (Timor: Roti). Fig. 51.



Fig. 51. Localities of *Semecarpus longifolius* BL.

Cultivated in Hort. Bog. *sub n.* VIII-E-20a.

Ecol. Lowland forest, sometimes up to 300 m. *Fl.* Jan.–March, June, July; *fr.* Jan.–Dec.

Vern. Philippines: *anagás*, *anagás-babáe*, *ligás*, Tag., *isip*, Ign., *libás*, *topo*, Bik., *manalú*, Sul.

7. *Semecarpus trachyphyllus* PERK. *Fragm. Fl. Philip.* (1904) 29. — *S. macrothyrsa* PERK. *l.c.* 26; MERR. *En. Philip.* 2 (1923) 412. — *Oncocarpus ferruginea* C. B. ROB. *Philip. J. Sc.* 6 (1911) Bot.

340. — *Oncocarpus trachyphylla* MERR. *En. Philip.* 2 (1923) 476.

Tree 10–15 m high and 12–22<sup>1</sup>/<sub>2</sub> cm Ø. *Leaves* spaced, spiral, subcoriaceous or coriaceous, elliptic, elliptic-lanceolate, oblanceolate, rarely obovate, 6–22 by 3<sup>1</sup>/<sub>2</sub>–8<sup>1</sup>/<sub>2</sub> cm; glabrous above, lower surface glabrous or sometimes sparsely puberulous (simple and stellate hairs), glabrescent; papillae distinct, rather compact, covering the lower surface except the midrib, nerves, and veins; base cuneate or attenuate; apex shortly or abruptly acuminate, rarely rounded; nerves 8–19 pairs, elevated beneath, distinct above; veins reticulate, or transverse and subparallel, distinct on both surfaces; petiole 1–3 cm. *Panicles* terminal, sometimes axillary, 10–24 cm long, densely pubescent; lateral branches obliquely ascending, up to 14 cm; bracts lanceolate, c. 2<sup>1</sup>/<sub>2</sub> mm long; pedicels very short. Flower-buds subglobose. *Calyx* lobes crescent-shaped, <sup>1</sup>/<sub>2</sub>–<sup>3</sup>/<sub>4</sub> mm long. *Petals* valvate, ovate-oblong or slightly elliptic, 3 by 1<sup>1</sup>/<sub>2</sub> mm, with several longitudinal veins, densely pubescent outside. *Stamens* 3–3<sup>1</sup>/<sub>2</sub> mm; anthers broadly ovoid, c. <sup>2</sup>/<sub>3</sub> mm long. Imperfect or sterile stamens in ♀ c. 1<sup>1</sup>/<sub>2</sub> mm. *Disk* round, flat or slightly concave above, c. 1<sup>1</sup>/<sub>2</sub> mm Ø, pilose above. *Ovary* subglobose, c. 4<sup>1</sup>/<sub>2</sub> mm Ø, densely pubescent; style c. <sup>1</sup>/<sub>2</sub> mm long. *Drupe* broadly obovoid, 1<sup>1</sup>/<sub>2</sub>–2<sup>1</sup>/<sub>2</sub> by 1<sup>1</sup>/<sub>2</sub>–2<sup>1</sup>/<sub>2</sub> cm, pubescent, sometimes glabrescent; apex truncate or slightly concave; hypocarp pulvinate, stalk-like, <sup>1</sup>/<sub>2</sub>–1 by <sup>1</sup>/<sub>2</sub> cm.

Distr. *Malesia*; Philippines (Luzon, Samar, Mindanao).

Ecol. Primary lowland forest. *Fl.* May, June; *fr.* Jan.–Dec.

Vern. Arangas, *malaligas*, Tag., *kamirig*, Ilk., *ligas*, Bag., *nugas*, S.L.Bis., *uagotomak*, Mbo.

8. *Semecarpus papuanus* LAUT. *Nova Guinea* 8 (1912) 829; *Bot. Jahrb.* 56 (1920) 368; DING HOU, *Blumea* 24 (1978) 36.

Tree up to 29 m high and 50 cm Ø. Bark greenish grey, weakly fissured. *Leaves* spaced, spiral, coriaceous, obovate to oblanceolate, (26–)40–52 (–100) by 12<sup>1</sup>/<sub>2</sub>–17(–24) cm, glabrous on both surfaces; papillae often indistinct or obscure on the lower surface; base cuneate or attenuate; apex obtuse or rounded; nerves 22–24 pairs, elevated beneath, flat but distinct above; veins reticulate, or transverse to the nerves, distinct on both surfaces; petiole 2<sup>1</sup>/<sub>2</sub>–9<sup>1</sup>/<sub>2</sub> cm. *Panicles* terminal, or cauliflorous (?), up to 52(–78) cm long, pubescent, glabrescent, or glabrous; lateral branches up to 35 cm, obliquely ascending; bracts broad-ovate, 1<sup>1</sup>/<sub>2</sub> mm long; pedicels 0 or very short. Flower-buds globose or subglobose. *Calyx* lobes crescent-shaped and c. <sup>1</sup>/<sub>2</sub> mm long in ♂; triangular and c. 1<sup>1</sup>/<sub>2</sub> mm long in ♀. *Petals* imbricate, broad-elliptic or elliptic, c. 2 by 1–1<sup>1</sup>/<sub>2</sub> mm on ♂, ovate, 2<sup>1</sup>/<sub>4</sub> by 1<sup>1</sup>/<sub>4</sub> mm in ♀, with c. 6 longitudinal veins, glabrous. *Stamens* c. 1<sup>1</sup>/<sub>2</sub> mm; anthers ovoid, c. <sup>2</sup>/<sub>3</sub> mm long. Sterile or imperfect stamens in ♀ c. <sup>3</sup>/<sub>4</sub> mm. *Disk* round, flat, 1<sup>1</sup>/<sub>4</sub>–1<sup>1</sup>/<sub>2</sub> mm Ø, pubescent or pilose above. *Ovary* dome-shaped, c. <sup>3</sup>/<sub>4</sub> mm Ø, pubescent; styles <sup>1</sup>/<sub>2</sub> mm. *Drupe* broad-ovoid, 5–5<sup>1</sup>/<sub>2</sub> by 4<sup>1</sup>/<sub>4</sub>–5 cm, almost glabrous; apex obtuse; hypocarp short-cupular, c. 2<sup>1</sup>/<sub>4</sub> by 3–3<sup>1</sup>/<sub>4</sub> cm.

Distr. *Malesia*; New Guinea (Sorong, Hollandia, Lorentz R., Sepik, Morobe and Gulf Distr.).

Ecol. Primary lowland forest, also in marshy or alluvial areas, sometimes in montane forest at 750–1350 m. Fr. May–July, Sept.

Vern. *Ko-u*, *Mooi*, *santung*, *Nimburam lang*.

9. *Semecarpus prainii* KING, J. As. Soc. Beng. 65, ii (1896) 511; PARKINSON, For. Fl. Andaman Is. (1923) 140; HEND. Gard. Bull. S. S. 3 (1924) 291; RIDL. Fl. Mal. Pen. 5 (1925) 303.

Tree up to 15 m high. *Leaves* spaced, spiral, coriaceous, obovate-oblong or oblanceolate,  $10\frac{1}{2}$ – $15\frac{1}{2}$  (–26) by  $4\frac{1}{2}$ – $6\frac{1}{2}$  (–8) cm, glabrous on both surfaces; papillae compact, covering the lower surface except the midrib, nerves, and veins; base attenuate; apex shortly and abruptly acuminate; nerves 16–24 pairs, prominent beneath, slightly elevated above; veins reticulate, distinct on both surfaces; petiole  $1\frac{1}{2}$ –3 cm. *Panicles* terminal and axillary, 15–35 cm long, young parts puberulous, glabrescent; lateral branches up to 18 cm, obliquely ascending; bracts lanceolate,  $\frac{3}{4}$ – $3\frac{1}{2}$  mm long; pedicels 0. Flower-buds subglobose. *Calyx* lobes triangular,  $\frac{3}{4}$ –1 mm long. *Petals* imbricate at the apex, otherwise valvate, ovate-oblong, c.  $3\frac{1}{2}$  by  $1\frac{1}{2}$  mm, veins invisible, glabrous. *Stamens* 2 mm; anthers broad-ellipsoid, c.  $\frac{1}{2}$  mm  $\varnothing$ . *Disk* round, flat, c. 1 mm  $\varnothing$ , glabrous (except the pilose central part or rudimentary pistil). *Ovary* subglobose, c. 1 mm  $\varnothing$ , densely pubescent; style c.  $\frac{1}{2}$  mm. *Drupe* obliquely broadly obovoid, c.  $1\frac{1}{2}$  by  $1\frac{1}{4}$  cm, glabrous; apex obtuse; hypocarp obconical, c.  $\frac{3}{4}$  by  $\frac{1}{2}$  cm.

Distr. Andamans and *Malesia*: Malay Peninsula (Perak and Pahang).

Ecol. Lowland forest, up to 240 m. Fl. March.

10. *Semecarpus forstenii* BL. Mus. Bot. 1 (1850) 188; MIQ. Fl. Ind. Bat. 1, 2 (1859) 626; ENGL. in DC. Mon. Phan. 4 (1883) 486; MERR. Int. Rumph. (1917) 334; LAUT. Bot. Jahrb. 56 (1920) 370; HEYNE, Nutt. Pl. (1927) 891; DE WIT, Rumph. Mem. Vol. (1959) 405. — *Cassuvium silvestre* s. *Lau Lassi* (e *Ternate*) RUMPH. Herb. Amb. 1 (1741) 180. — *S. roxburghii* BL. Mus. Bot. 1 (1850) 188; MIQ. Fl. Ind. Bat. 1, 2 (1859) 629; ENGL. in DC. Mon. Phan. 4 (1883) 485. — *S. scabrada* BL. Mus. Bot. 1 (1950) 189, incl. var. *elongata* BL.; MIQ. Fl. Ind. Bat. 1, 2 (1859) 627; ENGL. in DC. Mon. Phan. 4 (1883) 485. — *S. congestiflora* K.SCH. & LAUT. Fl. Schutzgeb. (1900) 412, p.p. — *S. laxiflora* K.SCH. in K.Sch. & Laut. Fl. Schutzgeb. Nachtr. (1905) 302; LAUT. Bot. Jahrb. 45 (1911) 361, incl. var. *glabrescens* LAUT.; Nova Guinea 8 (1912) 830; Bot. Jahrb. 56 (1920) 372; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 169. — *S. uncata* SLIS, Nova Guinea 14 (1924) 98, t. 8; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 170. — *S. decipiens* MERR. & PERRY, J. Arn. Arb. 22 (1941) 539; KRAEMER, Trees W. Pac. Reg. (1951) 204, f. 72.

Tree 8–40 m high and 10–53 cm  $\varnothing$ . Bark greyish, greenish brown, or reddish brown, smooth. *Leaves* spaced, spiral, chartaceous to subcoriaceous, elliptic-oblong to lanceolate, sometimes obovate-oblong, (7–)14–37 by  $(3\frac{1}{2}$ –) $5\frac{1}{2}$ – $13\frac{1}{2}$  cm; upper surface glabrous; lower surface glabrous, sometimes sparsely puberulous or pubescent; papillae distinct, covering the lower surface except the midrib, nerves, veins, and veinlets (seemingly being separated into small groups); base cuneate; apex

acute, sometimes obtuse, or abruptly acuminate; nerves 10–24 pairs, prominent beneath, flat and distinct above; veins reticulate, or transverse and subparallel, distinct beneath, distinct or faint above; petiole 1– $3\frac{1}{2}$  cm. *Panicles* terminal, rarely also axillary,  $(4\frac{1}{2}$ –)9–30 cm long, pubescent; lateral branches obliquely ascending, up to 22 cm; bracts lanceolate, c. 1 mm long; pedicels 0 or very short. Flower-buds subglobose. *Calyx* lobes triangular,  $\frac{1}{2}$ – $\frac{2}{3}$  mm long. *Petals* white, imbricate, ovate-oblong or slightly elliptic,  $2$ – $2\frac{1}{2}$  by  $1$ – $1\frac{1}{2}$  mm, puberulous outside, with c. 7 longitudinal veins. *Stamens*  $2\frac{1}{2}$  mm; anthers broad-ovoid,  $\frac{1}{2}$ – $\frac{2}{3}$  (–1) mm long. Imperfect or sterile stamens in  $\varnothing$   $1\frac{1}{2}$  mm. *Disk* round, flat,  $\frac{2}{3}$ –1 mm  $\varnothing$ , pilose above. *Ovary* subglobose,  $1\frac{3}{4}$  mm  $\varnothing$ , velutinous; styles c.  $\frac{1}{2}$  mm long. *Drupe* broad-ellipsoid, or -obovoid, rarely  $\pm$  transverse-oblong, 3–4 by  $2$ – $3\frac{1}{2}$  cm, velutinous, glabrescent; apex apiculate or slightly rostrate; hypocarp obconical,  $\frac{3}{4}$ –1 by  $\frac{1}{2}$ –1 cm.

Distr. Solomon Is. (throughout but scattered); *Malesia*: Borneo, Philippines, Celebes, Moluccas, New Guinea, and Bismarck Archipelago. Fig. 52.



Fig. 52. Localities of *Semecarpus forstenii* BL.

Ecol. Lowland forest up to 800 m, sometimes up to 1200 m, rarely in occasionally inundated areas, or on limestone. Fl. fr. May–Jan.

Uses. HEYNE l.c. recorded the wood useful for prahus in the Moluccas.

Vern. Celebes: *sibotu*, *Muna*; Moluccas: *laulasi*, *Ternate*, *sèsè*, *Halmahera*, *tafal*, *Aru*; New Guinea: *beng-geng*, *Hattam*, *riruas*, *Numfoor*, *sanapajaar*, *Wandammen*, *sij* & *sijkwa*, *Manikiong*.

11. *Semecarpus albicans* LAUT. Bot. Jahrb. 59 (1925) 536.

Tree (3–)15–20 m high. Bark brownish, fissured. *Leaves* spaced, spiral, chartaceous, elliptic or elliptic-lanceolate, rarely obovate-oblong, 5–8 (–18) by  $2$ – $3\frac{1}{2}$  (– $6\frac{1}{2}$ ) cm, glabrous except sometimes with short, stellate hairs beneath; papillae distinct, rather uniformly covering the lower surface except midrib and nerves; base cuneate; apex obtuse, acute, sometimes shortly acuminate; nerves 5–10 pairs, slightly elevated beneath, flat above; veins reticulate, rather faint beneath, obscure above; petiole  $1$ – $1\frac{1}{2}$  (–3) cm. *Panicles* terminal and/or

axillary at the upper part of the twigs, 4–11 cm long, puberulous; lateral branches obliquely ascending, 3–7 cm; bracts triangular or ovate,  $\frac{1}{3}$ –1 mm long; pedicels 0 (♀ flower after falling leaving a stalk of 3–5 mm). Flower-buds globose. *Calyx* lobes triangular, *c.*  $\frac{1}{3}$  mm long. *Petals* imbricate, elliptic, 2– $2\frac{3}{4}$  by 1– $1\frac{1}{2}$  mm, puberulous outside, with *c.* 7 longitudinal veins. *Stamens* *c.* 2 mm long; anthers ovoid, *c.*  $\frac{1}{2}$  mm long. Imperfect or sterile stamens in ♀  $\frac{3}{4}$ – $1\frac{1}{4}$  mm. *Disk* round, flat or slightly convex above, *c.*  $\frac{3}{4}$  mm Ø in ♂ (*c.* 2 mm Ø in ♀), pilose above. *Ovary* subglobose, *c.*  $1\frac{1}{2}$  mm Ø, densely puberulous; styles  $\frac{2}{3}$  mm. *Drupe* depressed-globose, 2 cm long and wide, puberulous, glabrescent; apex apiculate; hypocarp  $1\frac{1}{2}$  by  $\frac{3}{4}$ – $1\frac{1}{4}$  cm.

Distr. *Malesia*: New Guinea (Augusta R.; Babo, Rossel, and Sudest Is.).

Ecol. Forests, 10–400 m. *Fl.* Aug.; *fr.* Oct.

**12. *Semecarpus paucinervius* MERR.** Philip. J. Sc. 7 (1912) Bot. 286; En. Philip. 2 (1923) 475; DING HOU, *Blumea* 24 (1978) 36. — *S. obtusata* ELMER, Leaf. Philip. Bot. 5 (1913) 1752; MERR. En. Philip. 2 (1923) 475.

Tree up to 20 m high and 60 cm Ø. *Leaves* spaced, spiral, chartaceous to subcoriaceous, obovate-oblong, 5– $12\frac{1}{2}$  by 2– $5\frac{1}{2}$  cm, upper surface glabrous; lower surface sparsely puberulous on nerves and veins, glabrescent; papillae rather compact, covering the lower surface except the midrib, nerves, and veins; base cuneate; apex rounded or obtuse; nerves 5–10 pairs, prominent beneath, faint, sometimes distinct above; veins reticulate, distinct beneath, faint above; petiole  $\frac{1}{2}$ – $1\frac{3}{4}$  cm. *Panicles* terminal and also in the upper leaf axils, 12–22 cm long, sparsely puberulous, glabrescent; lateral branches obliquely ascending, up to 12 cm; bracts lanceolate,  $\frac{3}{4}$ – $1\frac{3}{4}$  mm long; pedicels *c.*  $\frac{1}{2}$  mm (after falling the flower leaves a distinct stalk  $1\frac{1}{2}$ –8 mm long). Flower-buds globose. *Calyx* lobes triangular,  $\frac{1}{2}$ –1 mm long. *Petals* imbricate, ovate-oblong or elliptic, 2–4 by 1–2 mm, sparsely puberulous outside with several distinct, longitudinal veins. *Stamens* 3 mm; anthers broad-ovoid,  $\frac{3}{4}$  mm long. Imperfect or sterile stamens in ♀  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm. *Disk* round, flat, 1– $1\frac{1}{2}$  mm Ø, pilose above. *Ovary* dome-shaped, 2 mm Ø, pubescent; styles *c.*  $\frac{1}{4}$  mm. *Drupe* subglobose, *c.*  $\frac{2}{3}$  cm Ø, pubescent; apex obtuse or rounded; hypocarp obconical, *c.*  $\frac{2}{5}$  by  $\frac{1}{5}$  cm.

Distr. *Malesia*: Philippines (Palawan: Mt Pulgar and Mt Victoria) and Borneo (Sabah: Kudat and Kota Belud).

Ecol. Lowland primary forest, sometimes along streams, rarely in sand dunes along the seashore. *Fl.* Febr., April; *fr.* May.

Note. This species can be recognized by the obovate-oblong leaves with rounded or obtuse apex and only 5–10 pairs of nerves, and the subsessile flower which after falling leaves a distinct stalk ( $1\frac{1}{2}$ –8 mm long).

**13. *Semecarpus australiensis* ENGL.** in DC. Mon. Phan. 4 (1883) 482; BAILEY, Queensl. Fl. 1 (1899) 323; LAUT. Bot. Jahrb. 56 (1920) 366; WHITE & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 237; DOMIN, Bibl. Bot. 22 (1927) 892; C. T. WHITE, J. Arn. Arb. 10 (1929) 234. — *S. congestiflora*

K.SCH. & LAUT. Fl. Schutzgeb. (1900) 412, *p.p.*; LAUT, Bot. Jahrb. 56 (1920) 366.

Tree (7–)15–24(–40) m high and (8–)27–60(–80) cm Ø, occasionally with short buttresses, rarely myrmecophilous. Bark variously light grey, fawn, or brown, rather smooth, or scaly. *Leaves* spaced, spiral, coriaceous or chartaceous, elliptic-oblong, broad-elliptic, sometimes obovate-oblong, 11–32 by 7–17 cm (up to 41 by 18 cm on a vegetative branch), glabrous, sometimes sparsely hairy on the nerves and veins beneath; papillae distinct, rather compact, covering the lower surface except the midrib, nerves, and veins; base cuneate; apex obtuse, sometimes slightly apiculate; nerves 10–22 pairs, conspicuous beneath, distinct above; veins reticulate, or transverse and subparallel, distinct beneath, faint above; petiole (1–) $2\frac{1}{2}$ –3 cm. *Panicles* terminal, sometimes also in the leaf axils at the end of twigs, rarely cauligerous, 14–35 cm long, puberulous, glabrescent; lateral branches obliquely ascending, up to 12(–20) cm; bracts triangular,  $\frac{2}{3}$  mm long; pedicels up to 3 mm. Flower-buds subglobose. *Calyx* lobes triangular,  $\frac{1}{2}$ – $\frac{2}{3}$  mm long. *Petals* white or cream-white, imbricate, ovate, ovate-oblong,  $2\frac{1}{2}$ –4 by  $1\frac{1}{2}$ –2 mm, puberulous outside, with *c.* 10 distinct, longitudinal veins. *Stamens* 3 mm; anthers broad-ovoid,  $\frac{2}{3}$  mm long. Imperfect or sterile stamens *c.* 2 mm. *Disk* round, flat,  $1\frac{1}{2}$ –2 mm Ø, covered sparsely with inflexed hairs except the central part or rudimentary pistil with erect hairs in ♂, or velutinous in ♀, usually glabrescent. *Ovary* subglobose, 2 mm Ø, densely pubescent; styles 1 mm. *Drupe* subglobose, 2– $3\frac{1}{2}$  by 3–5 cm, almost glabrous; apex slightly apiculate; hypocarp funnel-shaped,  $\frac{1}{2}$ – $1\frac{1}{2}$  by  $1\frac{1}{4}$ –2 cm.

Distr. Australia (Cape York, Yirrkaka, Rockingham Bay); in *Malesia*: Aru Is., New Guinea (Gelieb, Fly R., Merauke, Isuarava, Morobe Distr., Sepik, Central Distr., Milne Bay Distr.; Normanby I.), and New Britain.

Ecol. In rain- and monsoon-forest, occasionally in secondary forest and on limestone terraces, usually in the lowland, sometimes at 450–1350 m. *Fl.* March–Aug.; *fr.* Febr., June–Nov.

Vern. New Guinea: *doga*, Gelieb, *ekipatila*, Doura, *hombigo*, Orokaiva, *huna*, Suku, *ingas*, *marint*, *nengaroro*, Sepik, *uwe*, Wapi.

Note. The size of the leaves on the flowering twig of DARBYSHIRE 282 (L) varies from 13 by 6 cm to 27 by  $9\frac{1}{2}$  cm and one detached leaf on that specimen measures 41 by 18 cm.

**14. *Semecarpus cassuvium* ROXB.** (Hort. Beng. 1814, 22; SPRENG. Syst. Veg. 1, 1825, 936) Fl. Ind. ed. Carey 2 (1832) 85; BL. Mus. Bot. 1 (1850) 187; MIQ. Fl. Ind. Bat. 1, 2 (1859) 626; ENGL. in DC. Mon. Phan. 4 (1883) 487; C. B. ROB. Philip. J. Sc. 7 (1912) Bot. 413 & 418; MERR. Int. Rumph. (1917) 334; HEYNE, Nutt. Pl. (1927) 980; BURK. Dict. (1935) 1991; DE WIT, Rumph. Mem. Vol. (1959) 404. — *Cassuvium silvestre* RUMPH. Herb. Amb. 1 (1741) 179, t. 70. — *Anacardium longifolium* LAMK, Encycl. 1 (1783) 139, *quoad syn.* Rumph. — *S. anacardium* var. *angustifolium* DC. Prod. 2 (1825) 62.

Tree, sometimes treelet, 4– $26\frac{1}{2}$  m high and 3–40 cm Ø, sometimes myrmecophilous. *Leaves* spaced, spiral, chartaceous to subcoriaceous,

elliptic, elliptic-lanceolate, or obovate-oblong, 15–22 by  $7\frac{1}{2}$ – $10\frac{1}{2}$  cm; upper surface glabrous; lower surface glabrous, sometimes sparsely puberulous, glabrescent; papillae distinct, covering lower surface except the midrib, nerves, and some of the veins; base cuneate; apex acute or acuminate, sometimes obtuse, rarely slightly emarginate; nerves 10–26 pairs, prominent beneath, distinct above; veins reticulate-scalariform, distinct on both surfaces, sometimes faint above; petiole 2–4 cm. *Panicles* terminal, 10–31(–60) cm long, pubescent, glabrescent; lateral branches obliquely ascending, up to 15(–28) cm; bracts triangular, 1– $1\frac{1}{2}$  mm long; pedicels 0–1 mm. Flower-buds globose. *Flowers* white. *Calyx* lobes triangular,  $\frac{3}{4}$ –1 mm long. *Petals* imbricate, ovate or ovate-oblong, 2 by  $1\frac{1}{4}$  mm in ♂ ( $3\frac{1}{2}$ – $4\frac{1}{2}$  by  $1\frac{1}{4}$ –3 mm in ♀), puberulous outside, with c. 12 rather faint, longitudinal veins. *Stamens* 2– $2\frac{1}{2}$  mm; anthers broad-ovoid, c.  $\frac{1}{2}$  mm long. Imperfect or sterile stamens in ♀ c. 2 mm. *Disk* round, flat, or shallowly dish-shaped, c. 1 mm ⌀ in ♂ ( $3\frac{1}{2}$  mm ⌀ in ♀), covered with inflexed hairs in ♂, velutinous in ♀. *Ovary* dome-shaped, c.  $2\frac{1}{2}$  mm ⌀, velutinous; styles c. 1 mm. *Drupe* broad-obovoid, sometimes transverse-oblong, 2– $2\frac{3}{4}$  by  $1\frac{3}{4}$ –3 cm, velutinous, sometimes glabrescent; concave at the top; hypocarp discoid,  $\frac{1}{2}$ –1 by 1–2 cm.

*Distr. Malesia:* Lesser Sunda Is. (Sumba, once), Celebes (one coll., unlocalized), Moluccas (Morotai, Sula Is., Ceram, Ambon, Buru I., Banda), and New Guinea (Lorentz R., Asmat region, Canys R.,

Sepik, Morobe, Northern, Eastern and Milne Bay Districts, and Normanby I.).

In Herb. Bog. there is a collection, TEYSMANN 2344 HB, said to have come from Sumatra. I assume it is mislocalized.

*Ecol.* In lowland primary forest, sometimes up to 600 m, occasionally found on level land inundated in the wet season, or in secondary forest at 15–60 m. *Fl.* March–June, Sept.; *fr.* June–July, Oct.

*Uses.* RUMPHIUS reported that the smallish hypocarp remains green and is eaten; the very young (white) leaves can be eaten raw, although otherwise the sap of every part is very poisonous; it is used as a black dye in the Moluccas (HEYNE *l.c.*).

*Vern. Lesser Sunda Is.:* *rotta*, Sumba; Moluccas: *enga*, Mangoli, *kayu saku*, *lenat*, *linat*, *rinat*, Ambon, *lewer*, Banda; New Guinea: *akah*, Asmat, *duapua*, Upper Waria, *hombigo*, Orokaiva lang., *wunyup*, Sepik Distr.

15. *Semecarpus curtisii* KING, J. As. Soc. Beng. 65, ii (1896) 509; RIDL. J. Str. Br. R. As. Soc. n. 59 (1911) 91; HEND. Gard. Bull. S. S. 3 (1924) 290, *incl. var. brevipetiolata* HEND.; RIDL. Fl. Mal. Pen. 5 (1925) 302. — Fig. 48d–f, 53.

Small tree, (c.  $3\frac{1}{2}$ –)5–10 m high, rarely unbranched. *Leaves* spaced, spiral, coriaceous, obovate-oblong, oblanceolate, sometimes spatulate, (11–)23 $\frac{1}{2}$ –49(–100) by ( $4\frac{1}{2}$ –)7–12(–20) cm; upper surface glabrous; lower surface glabrous,



Fig. 53. *Semecarpus curtisii* KING, in fruit, held by Dr D. LEE, June 1975; Ulu Langat, above Pansoon, at c. 100 m altitude. Unbranched treelet, c.  $3\frac{1}{2}$  m high; fruit orange-yellow, hypocarp soft, fleshy (Photogr. VAN BALGOOY (2635)).

sometimes sparsely puberulous on midrib, nerves, and veins; papillae distinct, covering the lower surface except the midrib, nerves, and thicker veins; base cuneate to attenuate; apex shortly acuminate, sometimes acute, rarely obtuse; nerves 14–38 pairs, rarely more, prominent beneath, distinct above; veins reticulate, or some transverse and subparallel, slightly elevated on both surfaces; petiole (0)–2<sup>1</sup>/<sub>2</sub>–7<sup>1</sup>/<sub>2</sub>(–10) cm. *Panicles* terminal and often also in the leaf axils at the apical part of twigs, up to 57 cm long, puberulous, sometimes glabrescent, or glabrous; lateral branches obliquely ascending, up to 32 cm; bracts linear, 1–1<sup>1</sup>/<sub>2</sub> mm; pedicels <sup>1</sup>/<sub>3</sub>–<sup>1</sup>/<sub>2</sub> mm long. Flower-buds subglobose. *Calyx* lobes triangular, <sup>1</sup>/<sub>3</sub>–<sup>1</sup>/<sub>2</sub> mm long. *Petals* imbricate, ovate-oblong or elliptic-oblong, sometimes lanceolate, 2<sup>1</sup>/<sub>2</sub>–3 by 1–1<sup>1</sup>/<sub>2</sub> mm, sparsely puberulous outside, sometimes glabrescent, with several longitudinal veins. *Stamens* 1<sup>1</sup>/<sub>2</sub>–3 mm; anthers broad-ovoid, <sup>1</sup>/<sub>2</sub>–<sup>2</sup>/<sub>3</sub> mm long. Imperfect or sterile stamens in ♀ 1–1<sup>1</sup>/<sub>2</sub> mm. *Disk* round, flat, puberulous above, rarely glabrescent. *Ovary* subglobose, 1<sup>1</sup>/<sub>2</sub>–1<sup>2</sup>/<sub>3</sub> mm Ø, densely puberulous; styles 1<sup>1</sup>/<sub>4</sub> mm. *Drupe* subglobose, or sometimes transverse-oblong, 1<sup>1</sup>/<sub>4</sub>–1<sup>1</sup>/<sub>2</sub> by 1<sup>1</sup>/<sub>2</sub>–1<sup>3</sup>/<sub>4</sub> cm, sparsely puberulous; apex rounded; hypocarp discoid or short-cupular, <sup>3</sup>/<sub>4</sub>–1<sup>1</sup>/<sub>4</sub> by 1<sup>1</sup>/<sub>2</sub> cm.

Distr. Peninsular Thailand and *Malesia*: Malay Peninsula (Perlis, Kedah, Pahang, Selangor, Negri Sembilan, Johore, Singapore, and Langkawi Is.).

Ecol. Lowland forest. *Fl.* Febr.–April, Aug., Sept., Dec.; *fr.* Nov.–May.

Field-note. I made the following notes on fresh material from Ulu Langat, Selangor, sent by Dr VAN BALGOOY (his coll. 2635): Fruits light yellowish, sparsely hairy, subglobose (c. 2 cm long and wide), the lower <sup>2</sup>/<sub>3</sub> cm united with the light orange, fleshy, short-cupular hypocarp (c. 1 cm long and 2<sup>1</sup>/<sub>4</sub> cm Ø).

**16. *Semecarpus heterophyllus* BL.** Mus. Bot. 1 (1850) 187, *incl. var. major* BL., *var. angusta* BL. *et var. recurva* BL.; MIQ. Fl. Ind. Bat. 1, 2 (1859) 625; ENGL. in DC. Mon. Phan. 4 (1883) 486; K. & V. Bijdr. 4 (1896) 124; BACK. Schoolfl. (1911) 284; BAKER, J. Bot. 62 (1924) Suppl. 30; RIDL. Fl. Mal. Pen. 5 (1925) 302; DOCT. v. LEEUWEN, Zoocercidia (1926) 326, f. 582; HEYNE, Nutt. Pl. (1927) 981; BURK. Dict. (1935) 1992; ADELB. Blumea 6 (1948) 326; BACK. & BAKH. f. Fl. Java 2 (1965) 154. — *S. anacardium* (non L. f.) BL. Bijdr. (1826) 1156. — *Melanochyla tomentosa* (non HOOK. f.) ENGL. in DC. Mon. Phan. 4 (1883) 470, *quoad* ZOLLINGER 800. — *S. albescens* (non KURZ) K. & V. Bijdr. 4 (1896) 129; BACK. Schoolfl. (1911) 284. — *S. cinerea* H. H. W. PEARSON, Kew Bull. (1906) 4. — *S. glabrescens* HEINE in Fedde, Rep. 54 (1951) 235; MEIJER, Bot. News Bull. F. D. Sandakan 8 (1967) 31.

Tree up to 22 m high and 60 cm Ø, rarely reaching to 32 m high and 110 cm Ø. Bark greyish brown, rather smooth. *Leaves* spaced, spiral, very variable in shape, texture, and size, subcoriaceous to coriaceous, elliptic to narrow-elliptic, obovate or oblanceolate, (3<sup>1</sup>/<sub>2</sub>)–11–62 by (1<sup>1</sup>/<sub>2</sub>)–5–18 cm; usually glabrous on both surfaces, sometimes sparsely puberulous beneath; papillae distinct, rarely obscure, covering the lower surface except the midrib, nerves, and thicker veins; base cuneate,

or obtuse; apex acute, obtuse, sometimes apiculate, or slightly emarginate; nerves (6)–10–25 pairs, prominent beneath, distinct above; veins reticulate, or some transverse and subparallel, slightly elevated beneath, faint above; petiole <sup>1</sup>/<sub>2</sub>–6(–9) cm. *Panicles* terminal and sometimes also axillary at the end of twigs, 10–47 cm long, tomentose, glabrescent; lateral branches obliquely ascending; bracts triangular, <sup>1</sup>/<sub>2</sub>–1 mm long; pedicels 0. Flower-buds globose. *Calyx* lobes triangular, <sup>1</sup>/<sub>2</sub>–1 mm long. *Petals* imbricate, ovate-oblong, or slightly elliptic, 2–4 by 1<sup>1</sup>/<sub>4</sub>–2<sup>1</sup>/<sub>2</sub> mm, puberulous outside, with c. 9 distinct, longitudinal veins. *Stamens* 2<sup>1</sup>/<sub>2</sub>–3<sup>1</sup>/<sub>2</sub> mm; anthers broad-ovoid, c. <sup>2</sup>/<sub>3</sub> mm long. Imperfect or sterile stamens 1<sup>3</sup>/<sub>4</sub>–2 mm. *Disk* round, flat, c. 1 mm Ø in ♂ (c. 3 mm Ø in ♀). *Ovary* subglobose, 1<sup>1</sup>/<sub>4</sub>–3 mm Ø, densely puberulous; styles 1<sup>1</sup>/<sub>2</sub> mm. *Drupe* subglobose, 1<sup>3</sup>/<sub>4</sub>–2 by 1<sup>1</sup>/<sub>2</sub>–2 mm, sparsely puberulous, glabrescent; apex rounded; hypocarp discoid, <sup>3</sup>/<sub>4</sub>–1 by 1<sup>1</sup>/<sub>2</sub>–1<sup>3</sup>/<sub>4</sub> cm.

Distr. *Malesia*: Sumatra (Simalur I., Priaman, Lampong, Palembang), Malay Peninsula (Karim I.), Java (scattered), Lesser Sunda Is. (Flores), Borneo (Sabah: Mt Kinabalu; Kalimantan: Sg. Mandai) and SW. Celebes (Baleh Angin).

Ecol. In forest, from the lowland up to 1800 m, under everwet or seasonal climatic conditions, common in teak forest in many places in Central and East Java from 0–500 m, usually in montane forest at 800–1200 m (rarely below 900 m) in West and Central Java, in Sabah exclusively on Mt Kinabalu from 1350–1800 m. *Fl. fr.* Jan.–Dec.

Vern. Sumatra: *lungas dëlök*, *l. pajo*, Simalur; Java: *ingas*, *il bogom*, *i. kapur*, *i. këbo*, *i. tëlík*, *lëntang përit*, *yëlik*, *J*, *rëngas*, *S & J*, *r. putih*, *M*, *r. gunung*, *r. wubung*, *S*.

**17. *Semecarpus bunburyanus* GIBBS, J. Linn. Soc. Bot. 42 (1914) 67. — *S. subsessilifolia* MERR. Philip. J. Sc. 14 (1919) 411; EN. Philip. 2 (1923) 475. — *S. oblanceolatus* MERR. J. Str. R. As. Soc. n. 86 (1921) 272. — *S. scaberulus* MERR. Un. Cal. Publ. Bot. 15 (1929) 169. — Fig. 47.**

Tree (rarely unbranched treelet or shrub), (1<sup>1</sup>/<sub>2</sub>)–5–15 m high and 5–21 cm Ø (young tree sometimes with divaricate spines, 3–5 cm long, near the base). *Leaves* spaced, spiral (sometimes subverticillate on unbranched treelets or shrubs), subcoriaceous to coriaceous, obovate-oblong to oblanceolate, rarely very narrow-oblanceolate, 15–49(–100) by (3<sup>1</sup>/<sub>2</sub>)–7<sup>1</sup>/<sub>2</sub>–17(–22) cm; upper surface glabrous; lower surface puberulous, sometimes hispidulous, usually glabrescent; papillae distinct, rarely compact and obscure, covering lower surface except the midrib and nerves; base cuneate to attenuate; apex acuminate, sometimes cuspidate; nerves (6)–18–35 pairs, prominent beneath, flat or slightly elevated above; veins reticulate-scalariform, elevated below, distinct, sometimes faint above; petiole (0)–<sup>1</sup>/<sub>2</sub>–4(–8) cm. *Panicles* terminal, up to 35 cm long, tomentose or pubescent, glabrescent; lateral branches obliquely ascending, up to 24 cm; bracts lanceolate, <sup>1</sup>/<sub>3</sub>–<sup>1</sup>/<sub>2</sub> mm long; pedicels <sup>1</sup>/<sub>3</sub>–1<sup>1</sup>/<sub>2</sub> mm. Flower-buds oblong. *Flowers* greenish white or white. *Calyx* lobes triangular, <sup>1</sup>/<sub>2</sub>–1 mm long. *Petals* valvate, elliptic, elliptic-oblong, or lanceolate, 3<sup>1</sup>/<sub>2</sub>–5 by 1–1<sup>1</sup>/<sub>4</sub> mm, glabrous rarely puberulous outside, with several longitudinal veins. *Stamens* 2<sup>1</sup>/<sub>2</sub> mm; anthers

ovoid-oblong, (1-)1 $\frac{1}{4}$ -1 $\frac{1}{2}$  mm long. Imperfect or sterile stamens 1 $\frac{1}{2}$  mm. *Disk* in ♂: round, flat,  $\frac{2}{3}$ -1 mm  $\varnothing$ , glabrous, rarely sparsely pilose above; in ♀: short-cupular, 2-3 $\frac{3}{4}$  mm  $\varnothing$ , glabrous. *Ovary* conical, 1 $\frac{1}{2}$ -2 mm  $\varnothing$ , pilose and/or papillose; styles  $\frac{3}{4}$ -1 mm. *Drupe* subglobose,  $\frac{3}{4}$ -2 by  $\frac{2}{3}$ -1 $\frac{1}{2}$  cm, almost glabrous; apex rounded; hypocarp funnel-shaped or short-cupular, sometimes seemingly obconical and stalk-like when young,  $\frac{1}{2}$ -1 by  $\frac{1}{2}$ -1 $\frac{1}{2}$  cm.

*Distr. Malesia:* Borneo (Sabah & Sarawak; Kalimantan: G. Muara Tagal, Sebuku R., Sg. Iking, Kelai R., Kutai, Pembuangan, Samarinda) and Philippines (Panay, Palawan).

*Ecol.* Forest, usually at low and medium altitude, also at 1000-1500 m (Mt Kinabalu), sometimes in periodically inundated regions, occasionally found in ultrabasic areas and on coral limestone. *Fl.* Jan.-Dec.; *fr.* June, Nov.

*Vern. Borneo:* Sabah: *angas, bubunsa, Dusun, rēngas badiri*, Kedayan, *r. bēduri*, Bajau, *r. bēlukar*, Kinabatangan; Kalimantan: *dessem*, eastern part, *rēngas burung*, Kutai.

**18. *Semecarpus lucens* KING, J. As. Soc. Beng. 65, ii (1896) 510; RIDL, Fl. Mal. Pen. 1 (1922) 543.**

Tree up to 21 m high and 50 cm  $\varnothing$ . *Leaves* spaced, spiral, coriaceous, broad-elliptic, or obovate, 10-17 by 5 $\frac{1}{2}$ -9 $\frac{1}{2}$  cm; glabrous above; lower surface sparsely puberulous, glabrescent; papillae distinct, covering the lower surface, except the midrib, nerves, veins, and veinlets, usually surrounding the endings of veinlets and arranged in groups; base cuneate, sometimes unequal; apex obtuse, shortly and abruptly acuminate, or mucronate, rarely emarginate; nerves 10-15 pairs, conspicuous below, distinct above; veins reticulate, some transverse to the nerves; petiole 1 $\frac{1}{2}$ -5 cm. *Panicles* terminal and axillary, sparsely puberulous, glabrescent, up to 28 cm long; lateral branches obliquely ascending, up to 15 cm; bracts lanceolate,  $\frac{1}{2}$ -2 $\frac{1}{4}$  mm; pedicels *c.*  $\frac{1}{3}$  mm. Flower-buds  $\pm$  oblong. *Flowers* yellowish white. *Calyx* lobes triangular,  $\frac{1}{3}$ - $\frac{1}{2}$  mm long. *Petals* imbricate, ovate-oblong, *c.* 2 by 1 mm, glabrous, with several faint, longitudinal veins. *Stamens* 1 $\frac{1}{2}$ -2 mm; anthers oblong,  $\frac{1}{2}$ - $\frac{2}{3}$  mm. Imperfect or sterile stamens in ♀  $\frac{3}{4}$ -1 mm. *Disk* shallowly dish-shaped,  $\frac{3}{4}$ -1 $\frac{3}{4}$  mm  $\varnothing$ , puberulous above. *Ovary* conical, *c.* 1 mm  $\varnothing$ , densely pubescent; styles *c.*  $\frac{3}{4}$  mm long. *Drupe* (very young) ovoid, densely pubescent, with a stalk-like hypocarp.

*Distr. Malesia:* Malay Peninsula (Perak, Selangor).

*Ecol.* Forest, from the lowland up to 900 m. *Fl.* Jan., Oct.

**19. *Semecarpus glaucus* ENGL. in DC. Mon. Phan. 4 (1883) 478, t. 15, f. 24 & 25. — Fig. 54.**

Tree (rarely treelet), up to 25 m high and 18 cm  $\varnothing$ . Bark grey-brown, smooth. *Leaves* spaced, spiral, subcoriaceous, elliptic-oblong or narrow-elliptic, sometimes oblanceolate, (7-)12 $\frac{1}{2}$ -26 $\frac{1}{2}$  (-46) by (2 $\frac{1}{2}$ -)4 $\frac{1}{2}$ -8 $\frac{1}{2}$  (-13) cm; upper surface glabrous except the tomentose midrib; lower surface tomentose, usually glabrescent; papillae distinct, rarely obscure, covering the lower surface except the midrib and nerves; base cuneate to attenuate; apex acuminate, sometimes short-

acuminate, rarely cuspidate; nerves 10-17 pairs, prominent below, distinct above; veins reticulate, distinct on both surfaces, sometimes faint above; petiole  $\frac{1}{2}$ -1 $\frac{1}{2}$  (-4 $\frac{1}{2}$ ) cm. *Panicles* terminal, 11-35 cm long, tomentose; lateral branches obliquely ascending, 2 $\frac{1}{2}$ -20 cm; bracts linear, 1 $\frac{1}{2}$ -3 mm long; pedicels up to 2 $\frac{1}{4}$  mm. Flower-buds oblong or ellipsoid. *Flowers* yellowish green. *Calyx* lobes triangular,  $\frac{1}{3}$ - $\frac{2}{3}$  mm long. *Petals* valvate, elliptic-oblong or lanceolate, sometimes  $\pm$  oblong, 3 $\frac{1}{2}$ -5 by 1-1 $\frac{1}{2}$  mm, puberulous outside, with several faint or obscure, longitudinal veins. *Stamens* 3 $\frac{1}{2}$ -5 mm; anthers oblong,  $\frac{1}{2}$ - $\frac{3}{4}$  mm long. Imperfect or sterile stamens 2 $\frac{1}{2}$  mm. *Disk* short-cupular,  $\frac{3}{4}$ -1 $\frac{1}{4}$  mm  $\varnothing$  in ♂ (*c.* 2 mm  $\varnothing$  in ♀), velutinous inside. *Ovary* dome-shaped, *c.* 2 mm  $\varnothing$ , velutinous. *Drupe* (young) broad-ellipsoid, 1 by  $\frac{1}{5}$  cm, velutinous, glabrescent; apex obtuse; hypocarp discoid,  $\frac{2}{5}$  by  $\frac{1}{2}$  cm.

*Distr. Malesia:* Borneo, widely distributed but scattered, in Sarawak, Sabah, and Kalimantan.

*Ecol.* Lowland forest, mixed peat-swamp forest, or inundated placed along river-banks, rarely on limestone hills, up to 450 m. *Fl.* Dec.-Aug.; *fr.* March, July, Sept.

*Vern. Kērawas kēlulut, rēngas, Iban.*

**20. *Semecarpus rufovelutinus* RIDL, Kew Bull. (1933) 199. — *Melanocommia borneensis* RIDL, l.c. 198.**

Tree up to 7 m high and 15 cm  $\varnothing$ , rarely up to 20 m high. Bark brownish, irregularly fissured. *Leaves* spaced, spiral, coriaceous, elliptic to elliptic-lanceolate, obovate or obovate-oblong, 10-32 $\frac{1}{2}$  by 6-11 $\frac{1}{2}$  cm, glabrous above, velutinous beneath; papillae distinct, covering the lower surface except the midrib and nerves; base obtuse; apex acute, short-acuminate, cuspidate, rarely rounded; nerves 10-20 pairs, conspicuous beneath, distinct above; veins reticulate, some cross-bar-like and subparallel; petiole  $\frac{1}{2}$ -2 $\frac{3}{4}$  cm. *Panicles* terminal and sometimes also axillary, 7-34 cm long, velutinous; lateral branches obliquely ascending, 1 $\frac{1}{2}$ -19 cm; bracts lanceolate to narrow-lanceolate, 1-4 mm long; pedicels up to 1 mm. Flower-buds oblong. *Calyx* lobes triangular,  $\frac{3}{4}$ -1 mm long. *Petals* valvate, ovate-oblong or lanceolate, 2 $\frac{1}{2}$ -3 $\frac{1}{2}$  by  $\frac{2}{3}$ -1 $\frac{1}{4}$  mm, puberulous outside, with several longitudinal veins. *Stamens* 4 $\frac{1}{2}$  mm; anthers ovoid or oblong,  $\frac{3}{4}$  mm long. Imperfect or sterile stamens in ♀ 3 mm. *Disk* short-cupular, 1-1 $\frac{1}{2}$  mm  $\varnothing$  in ♂ (*c.* 2 $\frac{1}{4}$  mm  $\varnothing$  in ♀), pilose on the inner surface. *Ovary* subglobose, *c.* 2 mm  $\varnothing$ , velutinous; styles 1 $\frac{1}{4}$  mm. *Drupe* subglobose, 1-1 $\frac{1}{2}$  by 1 $\frac{1}{2}$ -1 $\frac{3}{4}$  cm, velutinous; apex rounded; hypocarp discoid or short-cupular, *c.*  $\frac{1}{3}$  by 1 $\frac{1}{4}$ -1 $\frac{1}{2}$  cm.

*Distr. Malesia:* Borneo (Sabah: Beaufort; Sarawak: Miri, 85 km upstream from Marudi, Upper Rejang R., Bintulu, Baram, Kapit, Bau; Kalimantan: Sanggau, Mt Kenepai, Mt Klam).

*Ecol.* Chiefly in lowland forest, sometimes up to *c.* 500 m, occasionally in thick secondary forest on steep slopes of river valley or on limestone. *Fl.* March, July, Sept.; *fr.* July-Aug.

*Vern. Godonong, rangas, Iban, nga, Brawan.*

**21. *Semecarpus bracteatus* LAUT. Bot. Jahrb. 56 (1920) 372; DING HOU, Blumea 24 (1978) 35,**



Fig. 54. *Semecarpus glaucus* ENGL. in flower. Kuching (Photogr. DING HOU (560)).

pl. III, 6. — *S. archboldianus* MERR. & PERRY, J. Arn. Arb. 22 (1941) 541.

Tree 21–32 m high and 42–80 cm  $\varnothing$ . Bark light yellowish brown, longitudinally fissured. *Leaves* spaced, spiral, rigidly coriaceous, rather brittle, obovate to oblanceolate, or elliptic-oblong, 9–38 by  $4\frac{1}{2}$ – $13\frac{1}{2}$  cm (up to 55–100 by 15–27 cm on vegetative branches); upper surface glabrous except the pubescent midrib; lower surface pubescent or puberulous; papillae distinct, covering the lower surface except the midrib, nerves, veins or veinlets; base cuneate or slightly obtuse; apex rounded or slightly apiculate; nerves 15–32 pairs, prominent beneath, impressed above; veins reticulate-scalariform, much elevated beneath, distinct above; petiole 1– $3\frac{1}{2}$ –(6) cm. *Panicles* terminal, up to 30(–60) cm long, tomentose; lateral branches obliquely ascending, up to 13(–18) cm; bracts ovate or lanceolate, 2–4 mm long; pedicels 0. Flower-buds globose. *Calyx* lobes triangular, c.  $\frac{1}{2}$  mm long in  $\delta$  ( $3\frac{1}{2}$ –4 mm in  $\varphi$ ). *Petals* imbricate, elliptic, ovate, or ovate-oblong, c. 2 by 1 mm in  $\delta$  (5 by  $2\frac{3}{4}$  mm in  $\varphi$ ), sericeous outside, with c. 4 longitudinal veins. *Stamens*  $3\frac{1}{2}$  mm; anthers broad-ovoid,  $\frac{2}{3}$  mm long. Imperfect or sterile stamens c. 2 mm. *Disk* round, flat, c. 1 mm  $\varnothing$  in  $\delta$  (3–4 mm  $\varnothing$  in  $\varphi$ ), pubescent above. *Ovary* globose, 3 mm  $\varnothing$ , velutinous; styles c. 2 mm. *Drupe* subglobose, 2–4 by  $2\frac{1}{2}$ – $4\frac{1}{2}$  cm (up to  $4\frac{1}{2}$ – $6\frac{1}{2}$  cm  $\varnothing$  in fresh state), velutinous; apex apiculate, sometimes concave at the top; hypocarp short-cupular,  $1\frac{1}{4}$  by  $2\frac{1}{2}$  cm.

Distr. *Malesia*; New Guinea (Idenburg R., Manokwari, Hollandia, Sorong, Madang Distr., Eastern Highlands Distr., Northern Distr., and Central Distr.).

Ecol. Primary lowland forest, on ridge slopes, along rivers, or in alluvial areas, up to 150 m, rarely at 1230–1950 m; occasionally in secondary forest. *Fl.* May, July, Oct.; *fr.* Febr., Aug.

There are many rusty-hairy, globose insect-galls,  $\frac{1}{3}$ – $\frac{1}{2}$  cm  $\varnothing$ , on the lower leaf surface of BW 2772.

Vern. *Bengeng*, Hattam, *inamonta*, *Fore-Atigina*, *nanno*, *Anona*, *owu*, *Mooi*, *rigi*, *rupei*, *Nemo*, *si*, Manikiong.

22. *Semecarpus aruensis* ENGL. in DC. Mon. Phan. 4 (1883) 484. — *S. hirtiflora* RIDL. Trans. Linn. Soc. Bot. II, 9 (1916) 33. — *S. nubigena* LAUT. Bot. Jahrb. 56 (1920) 367. — *S. fulvo-villosa* LAUT. l.c. 371; MERR. & PERRY, J. Arn. Arb. 22 (1941) 538; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 169. — Fig. 48a–c.

Small tree, sometimes a shrub, 3–14 m high. Bark light brown, fissured. *Leaves* spaced, spiral, chartaceous or subcoriaceous, obovate to oblanceolate, sometimes narrow-oblanceolate, rarely elliptic, (10–)15–28(– $34\frac{1}{2}$ ) by ( $3\frac{1}{2}$ –)5– $8\frac{1}{2}$  (–15) cm; upper surface glabrous but sometimes pubescent on midrib, nerves, and veins; lower surface pubescent, papillae distinct, covering the surface except the midrib and nerves; base cuneate to attenuate, sometimes rounded; apex short-acuminate or slightly rostrate; nerves (10–)17–25 pairs, prominent beneath, slightly immersed or flat, sometimes faint above; veins reticulate, some oblique or perpendicular to the nerves, slightly elevated below, distinct sometimes faint above;

petiole 1–2(– $3\frac{1}{2}$ ) cm. *Panicles* terminal and/or axillary, rarely raceme-like,  $3\frac{1}{2}$ –27(–38) cm long; lateral branches obliquely ascending, up to 4(–10) cm; bracts ovate or triangular, lanceolate, or linear,  $1\frac{1}{2}$ – $4\frac{1}{2}$  mm long; pedicels 0 or very short in  $\delta$  (2 mm in  $\varphi$ ). Flower-buds subglobose. *Flowers* white. *Calyx* lobes triangular,  $\frac{1}{2}$ –1 mm long. *Petals* valvate, elliptic, or ovate-oblong, 2–3 by  $1\frac{1}{2}$  mm in  $\delta$  (c.  $4\frac{1}{2}$  by 2 mm in  $\varphi$ ), sericeous outside, with 6–10 longitudinal veins. *Stamens*  $1\frac{1}{2}$ –4 mm; anthers broad-ovoid, c.  $\frac{2}{3}$  mm long. Imperfect or sterile stamens c. 2 mm. *Disk* round, flat, c. 1 mm  $\varnothing$  in  $\delta$  (c.  $2\frac{1}{2}$  mm  $\varnothing$  in  $\varphi$ ), densely pubescent above. *Ovary* subglobose, c. 2 mm  $\varnothing$ , velutinous; style  $1\frac{3}{4}$  mm long. *Drupe* broad-ovoid or ovoid, 2– $3\frac{1}{4}$  by  $1\frac{1}{2}$ –2 cm, velutinous; apex short-acuminate; hypocarp obconical or pulvinate especially when young,  $1\frac{1}{2}$  by  $1\frac{1}{2}$  cm, sometimes deformed and discoid up to 2 cm  $\varnothing$ .

Distr. *Malesia*: Arad Is. and New Guinea (widely distributed but scattered).

Ecol. Lowland forest, sometimes on river-banks, up to 175 m, rarely up to 300 m. *Fl.* Febr.–Oct.; *fr.* Febr., March, Aug.–Nov.

The fruit has a pocket- or pit-like insect-shelter formed on the outer surface (see p. 399 and fig. 48c). So far, I found such an insect-shelter only on fruits of the present species.

23. *Semecarpus rostratus* VALETON, Bull. Dép. Agr. Ind. Néerl. 10 (1907) 29; l.c. Bog. 3 (1908) 151, t. 259; LAUT. Nova Guinea 8 (1910) 299; *ibid.* 8 (1912) 830; Bot. Jahrb. 56 (1920) 367; MERR. & PERRY, J. Arn. Arb. 22 (1941) 538.

Small tree up to 8 m high, or shrub  $1\frac{1}{2}$  m high. *Leaves* spaced, spiral, coriaceous, elliptic, obovate, or oblanceolate, 8–22(–29) by  $3\frac{1}{2}$ –8(– $9\frac{1}{2}$ ) cm; glabrous except the pubescent midrib and nerves above, densely or sparsely pubescent beneath, usually glabrescent; papillae distinct, covering the lower surface except the midrib, nerves, and veins; base cuneate; apex abruptly acuminate-rostrate (acumen up to 4 cm long); nerves 10–15 pairs, prominent below, distinct sometimes faint above; veins reticulate, some perpendicular to the nerves, distinct beneath, faint above; petiole  $\frac{3}{4}$ – $1\frac{1}{4}$ –(3) cm. *Panicles* terminal rarely also axillary, sometimes seemingly racemose, 6–10 cm long, pubescent; lateral branches obliquely ascending, up to  $4\frac{1}{2}$  cm; bracts lanceolate,  $\frac{3}{4}$ – $1\frac{1}{2}$  mm long; pedicels 0 or very short. Flower-buds globose. *Calyx* lobes triangular,  $\frac{1}{2}$ – $\frac{2}{3}$  mm long. *Petals* imbricate, ovate, sometimes elliptic,  $1\frac{3}{4}$ – $2\frac{1}{2}$  by  $1\frac{1}{4}$  mm, sericeous outside, with c. 7 longitudinal veins. *Stamens*  $2\frac{1}{2}$ –3 mm; anthers ovoid,  $\frac{1}{2}$  mm long. Imperfect or sterile stamens in  $\varphi$  c. 2 mm. *Disk* round, flat, 1–2 mm  $\varnothing$ , velutinous above. *Ovary* conical,  $1\frac{1}{4}$  mm  $\varnothing$ , velutinous; styles c. 1 mm. *Drupe* yellow, ovoid,  $2\frac{1}{2}$  by 2 cm, velutinous, glabrescent; apex acuminate-rostrate; hypocarp obovoid, waxy yellow when fresh,  $2\frac{2}{3}$  by  $2\frac{1}{3}$  cm.

Distr. *Malesia*: New Guinea (Etna Bay, Fly R., Utumbuwe, Utakwa R. to Mt Carstensz, Uta, Merauke, Alkmaar, Gulf Distr.) and New Britain.

Ecol. Forest along river-banks, in swampy area, and in alluvial forest, up to 210 m. *Fl.* June–Sept.; *fr.* Dec.–Jan., May–June.

24. *Semecarpus macrophyllus* MERR. Bull. For. Bur. Philip. 1 (1903) 33; DING HOU, Blumea 24 (1978) 36. — *Oncocarpus macrophylla* C. B. ROB. Philip. J. Sc. 6 (1911) Bot. 340; MERR. En. Philip. 2 (1923) 476. — *S. surigaensis* MERR. Philip. J. Sc. 17 (1921) 272; En. Philip. 2 (1923) 475.

Tree up to 8 m high. *Leaves* spaced, spiral, subcoriaceous, obovate-oblong or elliptic, (17-) 21-46(-60) by (8-)13-20 cm; upper surface glabrous except the pubescent midrib and nerves; lower surface pubescent; papillae distinct, covering the lower surface, except the midrib and nerves; base cuneate; apex abruptly acuminate; nerves 16-22 pairs, prominent below, distinct above; veins reticulate, some  $\pm$  perpendicular to the nerves, slightly elevated below, distinct above; petiole 1-3 cm. *Panicles* terminal, up to 50 cm long, tomentose, sometimes glabrescent; lateral branches obliquely ascending, up to 30 cm; bracts ovate, 1-2 $\frac{3}{4}$  mm long; pedicels 0 or very short. Flower-buds globose. ♂ *Flowers*: *Calyx* lobes triangular,  $\frac{1}{2}$ - $\frac{3}{4}$  mm long. *Petals* valvate, lanceolate or elliptic-lanceolate, 3 by 1 mm, sericeous outside, with c. 6 longitudinal veins. *Stamens* 2-3 mm; anthers ovoid, c.  $\frac{2}{3}$  mm long. *Disk* shallowly dish-shaped, c. 1 mm  $\varnothing$ , pilose above. ♀ *Flowers* not seen. *Drupe* broadly obovoid, 2 $\frac{1}{2}$ -3 $\frac{1}{2}$  by 2-2 $\frac{1}{2}$  cm, velutinous; apex truncate; hypocarp pulvinate,  $\frac{1}{3}$  by  $\frac{1}{2}$  cm.

Distr. *Malesia*: Philippines (Butuan, Samar, Surigao, Mindoro).

Ecol. Forests on dryland or along streams, at low altitude. *Fl.* Oct.; *fr.* June.

25. *Semecarpus densiflorus* (MERR.) STEEN. Philip. J. Sc. 91 (1962) 508. — *Oncocarpus densiflorus* MERR. Philip. J. Sc. 11 (1916) Bot. 191; En. Philip. 2 (1923) 476.

Tree up to 10 m high and 50 cm  $\varnothing$ . *Leaves* spaced, spiral, subcoriaceous, obovate, obovate-oblong, or elliptic, 6 $\frac{1}{2}$ -15 by 3 $\frac{1}{4}$ -6 cm; above glabrous except the sparsely puberulous midrib, beneath sparsely puberulous, usually glabrescent, papillae distinct, covering the surface except the midrib, nerves, and veins; base cuneate or attenuate; apex acute, sometimes abruptly acuminate; nerves 8-12 pairs, elevated beneath, distinct above; veins reticulate, distinct beneath, rather faint above; petiole  $\frac{3}{4}$ -1 $\frac{1}{4}$  cm. *Panicles* terminal, sometimes also axillary, 3-7 cm long, densely tomentose; lateral branches obliquely ascending, up to 2 $\frac{1}{2}$  cm; bracts ovate, ovate-elliptic, or elliptic,  $\frac{1}{2}$ -2 mm long; pedicels 0. Flower-buds subglobose. ♂ *Flowers*: *Calyx* lobes triangular, c. 1 mm long. *Petals* imbricate, oblong-elliptic, 2 $\frac{1}{2}$ -4 by 1-1 $\frac{1}{2}$  mm, sericeous outside, with c. 5 longitudinal veins. *Stamens* 3-5 mm; anthers c.  $\frac{2}{3}$  mm long. *Disk* round, flat, c. 1 mm  $\varnothing$ , pilose above. ♀ *Flowers* not seen. *Drupe* (young) broad-obovoid, c. 1 $\frac{1}{4}$  by  $\frac{3}{4}$  cm, velutinous; apex obtuse; hypocarp pulvinate, c.  $\frac{2}{3}$  cm long and wide.

Distr. *Malesia*: Philippines (Sorsogon, Albay, San Mateo, and Surigao).

Ecol. Forest, up to 800 m. *Fl.* May, Sept., Nov.; *fr.* Febr.-March, June.

Vern. *Matapok*, Samar.

26. *Semecarpus cochinchinensis* ENGL. in DC. Mon. Phan. 4 (1883) 489; RIDL. Fl. Mal. Pen. 1

(1922) 542; TARD. Fl. C. L. & V. 2 (1962) 160, t. 12, f. 2-5. — *S. glomerulata* RIDL. J. Str. Br. R. As. Soc. n. 54 (1910) 39 & 91; *ibid.* n. 59 (1911) 91; Fl. Mal. Pen. 1 (1922) 542.

Tree 8-15 m high. *Leaves* spaced, spiral, subcoriaceous, obovate or obovate-oblong, 10-20 by 4-12 $\frac{1}{2}$  cm; sparsely puberulous above, pubescent beneath, sometimes glabrescent; papillae distinct, covering the lower surface except the midrib, nerves, and thicker veins; base cuneate or attenuate; apex obtuse, sometimes slightly emarginate, or acute; nerves 9-16 pairs, elevated beneath, slightly elevated above; veins reticulate, distinct on both surfaces; petiole  $\frac{1}{2}$ -2 cm. *Panicles* terminal, up to 52 cm long; densely tomentose; lateral branches obliquely ascending up to 35 cm; bracts triangular or lanceolate,  $\frac{1}{3}$ -3 mm; pedicels very short, c.  $\frac{1}{6}$  mm. Flower-buds globose. *Calyx* lobes triangular, c.  $\frac{1}{2}$  mm long. *Petals* imbricate, ovate-oblong, 1 $\frac{3}{4}$ -2 $\frac{1}{2}$  by 1-1 $\frac{1}{2}$  mm, glabrous rarely sparsely puberulous outside, with c. 8 longitudinal veins. *Stamens* 2-3 mm; anthers broad-ovoid, c.  $\frac{1}{2}$  mm long. Imperfect or sterile stamens in ♀ c. 1 $\frac{1}{2}$  mm. *Disk* round, flat or slightly concave above, 1-1 $\frac{1}{2}$  mm  $\varnothing$ , glabrous except the central part or rudimentary pistil pilose in ♂. *Ovary* subglobose, c. 1 mm  $\varnothing$ , pubescent; styles c. 1 mm. *Drupe* subglobose, 2 $\frac{1}{3}$ -1 by  $\frac{2}{3}$  cm, sparsely hairy, glabrescent; apex rounded; hypocarp obconical, stalk-like,  $\frac{1}{3}$ - $\frac{1}{2}$  by  $\frac{2}{5}$  cm.

Distr. Scattered in Thailand, Cambodia, Laos, and Vietnam; in *Malesia*: Malay Peninsula (Langkawi, Perlis, Kedah).

Ecol. Lowland forest, open woods, near the shore, sometimes on limestone. *Fl.* Febr., Nov.; *fr.* March.

27. *Semecarpus brachystachys* MERR. & PERRY, J. Arn. Arb. 22 (1941) 540.

Tree 5-25 m high and 8-47 cm  $\varnothing$ , sometimes myrmecophilous. Buttresses occasionally present, thick, equal, up to c. 1 m high. Bark grey or light brown, flaky. *Leaves* spaced, spiral, subcoriaceous, oblanceolate, or elliptic, 15-55 by 11 $\frac{1}{2}$ -18 cm; sparsely puberulous (with short, simple and stellate hairs) or subglabrous on both surfaces; papillae distinct, covering the lower surface except the midrib, nerves, and veins; base cuneate or attenuate; apex obtuse or rounded, sometimes abruptly acuminate; nerves 22-32 pairs, conspicuous beneath, distinct above; veins reticulate, some cross-bar-like; petiole (1-)3-4 $\frac{1}{2}$ (-6) cm. *Panicles* terminal, up to 32 cm long, pubescent; lateral branches obliquely ascending, up to 23 cm; bracts triangular or lanceolate, 1 $\frac{1}{4}$ -5 mm long; pedicels 0. Flower-buds globose. *Flowers* greenish white or yellowish. *Calyx* triangular, c.  $\frac{2}{3}$  mm long. *Petals* imbricate, ovate-oblong or elliptic, 2 $\frac{1}{4}$ -4 $\frac{1}{2}$  by 1-3 mm, puberulous outside, with 15-20 longitudinal veins. *Stamens* c. 3 mm; anthers broad-ovoid, c.  $\frac{2}{3}$  mm long. Imperfect or sterile stamens in ♀ c. 2 mm. *Disk* round, flat, c. 1 mm  $\varnothing$  in ♂ (c. 3 mm  $\varnothing$  in ♀), pilose above. *Ovary* dome-shaped, 3-3 $\frac{1}{2}$  mm  $\varnothing$ , densely pubescent; styles c. 2 mm. *Drupe* orange-green when fresh, subglobose, 4 $\frac{1}{2}$  by 3 $\frac{1}{2}$ -4 $\frac{1}{2}$  cm, pubescent; apex rounded; hypocarp obconical, c. 1 $\frac{1}{4}$  by 1 cm.

Distr. Solomon Is. (Choiseul, Vella Lavella, Gizo, Kolombangara, Santa Ysabel, Guadalcanal,

Malaita, San Cristoval) and *Malesia*: New Guinea (Nabire, Manokwari, Japen I., Lorentz R., Uta, Sepik Distr., Morobe Distr., Milne Bay Distr.).

Ecol. Well-drained lowland primary or secondary forest, sometimes on riversides and in swampy primary forest, up to 200 m. *Fl.* April–Dec.; *fr.* Aug.–Jan.

Vern. Solomon Is.: *kwaitasi*, Kwara'ae name; New Guinea: *duapa*, Upper Waria, *sij*, Manikiong.

28. *Semecarpus cuneiformis* BLANCO, *Fl. Filip.* (1837) 220; ed. 2 (1845) 155; ed. 3, 1 (1877) 276, t. 75; MERR. *Philip. J. Sc.* 7 (1912) Bot. 279; *Fl. Manila* (1912) 299; *Sp. Blanc.* (1918) 235; BROWN, *Min. Prod. Philip. For.* 2 (1921) 320; MERR. *En. Philip.* 2 (1923) 473; BROWN, *Useful Pl. Philip.* 2 (1950) 344, f. 168. — *S. anacardium* (non L. f.) BLANCO, *Fl. Filip.* (1837) 216; ed. 2 (1845) 152; ed. 3, 1 (1877) 275. — *S. perrottetii* MARCH. *Rév. Anacard.* (1869) 169, *incl. var. glabra* MARCH.; ENGL. in *DC. Mon. Phan.* 4 (1883) 480; VIDAL, *Rev. Pl. Vasc. Filip.* (1886) 101; MERR. *Bull. For. Bur. Philip.* 1 (1903) 33; PERK. *Fragm. Fl. Philip.* (1904) 28. — *S. philippinensis* ENGL. in *DC. Mon. Phan.* 4 (1883) 481; VIDAL, *Phan. Cuming.* (1885) 106; *Rev. Pl. Vasc. Filip.* (1886) 101; MERR. *Publ. Gov. Lab. Philip. n.* 35 (1906) 75; *Philip. J. Sc.* 7 (1912) Bot. 290; *En. Philip.* 2 (1923) 475. — *S. albescens* (non KURZ) VIDAL, *Phan. Cuming.* (1885) 106; *Rev. Pl. Vasc. Filip.* (1886) 101; MERR. *Publ. Gov. Lab. Philip. n.* 35 (1906) 75; *Philip. J. Sc.* 1 (1906) Suppl. 85. — *S. elmeri* PERK. *Fragm. Fl. Philip.* (1904) 26; MERR. *En. Philip.* 2 (1923) 473. — *S. merrilliana* PERK. *Fragm. Fl. Philip.* (1904) 27; MERR. *En. Philip.* 2 (1923) 474. — *S. micrantha* PERK. *Fragm. Fl. Philip.* (1904) 27; MERR. *Philip. J. Sc.* 7 (1912) Bot. 290; *En. Philip.* 2 (1923) 474. — *S. taftiana* PERK. *Fragm. Fl. Philip.* (1904) 28. — *S. obtusifolia* MERR. *Philip. J. Sc.* 7 (1912) Bot. 286; *En. Philip.* 2 (1923) 475. — *S. whitfordii* MERR. *Philip. J. Sc.* 7 (1912) Bot. 288; *En. Philip.* 2 (1923) 475. — *S. megabotrys* MERR. *Philip. J. Sc.* 7 (1912) Bot. 285; *En. Philip.* 2 (1923) 474. — *S. pilosa* MERR. *Philip. J. Sc.* 7 (1912) Bot. 287. — *S. ferruginea* MERR. *Philip. J. Sc.* 14 (1919) 412; *En. Philip.* 2 (1923) 474. — *S. lanceolatus* RIDL. *Kew Bull.* (1933) 199 & 491, *non* MERR. 1912. — *S. thyrsoides* ELMER, *Leaf. Philip. Bot.* 9 (1934) 3179. — *S. ridleyi* MERR. *Webbia* 6 (1950) 317, new name for *S. lanceolatus* RIDL.

Tree up to 20 m high and 50 cm  $\varnothing$ , rarely treelet 4 m high and 10 cm  $\varnothing$ . *Leaves* spaced, spiral, subcoriaceous or coriaceous, obovate-oblong or oblanceolate, elliptic or elliptic-lanceolate, rarely narrow-elliptic, 8–35 by 2–9 cm (up to 43 by 16 cm on vegetative twigs); upper surface glabrous, rarely sparsely puberulous, lower surface densely sometimes sparsely tomentose, pubescent or puberulous, glabrescent, rarely glabrous; papillae distinct, covering the lower surface except the midrib, nerves, and thicker veins; base cuneate, or obtuse; apex variable, acute, shortly and abruptly acuminate, obtuse, rounded, rarely retuse; nerves 11–25 pairs, prominent beneath, flat above; veins reticulate, some cross-bar-like, slightly elevated beneath, distinct or faint above; petiole  $1\frac{1}{2}$ – $3\frac{1}{2}$ (–5) cm. *Panicles* terminal, sometimes also axillary, up to 40 cm long, tomentose or pubescent; lateral branches obliquely ascending,

up to 20 cm long; bracts ovate to linear,  $\frac{1}{3}$ –3 mm; pedicels 0 or very short. Flower-buds subglobose. *Flowers* greenish white. *Calyx* lobes triangular,  $\frac{1}{2}$ –1 mm long. *Petals* imbricate, ovate-oblong, or elliptic,  $1\frac{1}{2}$ –3 by  $2\frac{2}{3}$ – $1\frac{1}{2}$  mm, puberulous outside, sometimes glabrescent, with several longitudinal veins. *Stamens*  $2\frac{1}{2}$ –3 mm; anthers broad-ovoid, c.  $\frac{2}{3}$  mm long. Imperfect or sterile stamens in  $\varnothing$  c. 1 mm. *Disk* round, flat sometimes slightly convex above, 1–2 mm  $\varnothing$ , pilose above. *Ovary* dome-shaped, c. 2 mm  $\varnothing$ , densely pubescent; styles c. 1 mm. *Drupe* ovoid or broad-ellipsoid,  $1$ – $1\frac{1}{4}$  by  $\frac{3}{4}$ –1 cm, sparsely hairy, glabrescent; apex obtuse; hypocarp obconical,  $\frac{1}{2}$ – $\frac{2}{3}$  by  $\frac{1}{2}$  cm.

*Distr. Malesia*: N. Borneo (Sabah: Lahad Datu, Mostyn, Semporna), Philippines (Palawan, Mindoro, Luzon, Romblon, Cebu, Leyte, Panay, Negros, Guimaras, Mindanao), Celebes (Manado, Gorontalo, Tomoni, Palopo, Tjamba, Bonthain, and the Kabaena, Muna & Buton Is.), and Lesser Sunda Is. (Sumbawa) and Formosa. Fig. 55.

Ecol. In dry thickets, primary and secondary forest in the lowland, sometimes up to 600–700 m, occasionally up to c. 1200 m. *Fl. fr.* Jan.–Dec.

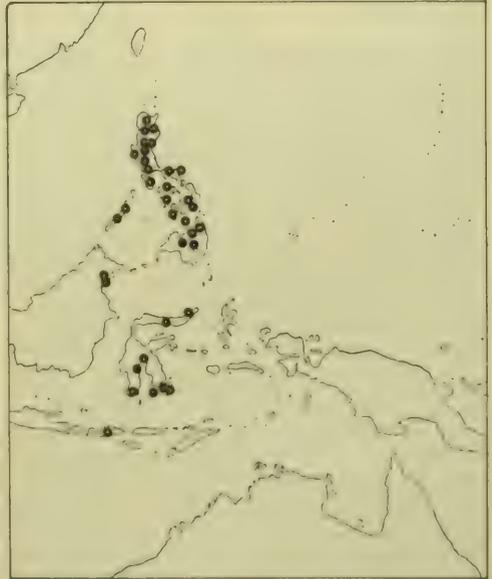


Fig. 55. Localities of *Semecarpus cuneiformis* BLANCO in Malesia.

Vern. (*vide* MERRILL, 1923) Philippines: *agás*, *anagás*, P.Bis., *britá*, Sub., *dañgá*, Bag., *duñgas*, *loñgás*, C.Bis., *hanagas*, *lañgás*, Bis., *ingas*, Bik., *kaming*, Sbl., *kaming*, *malamangga*, Pamp., *kamiding*, Ig., *kamiling*, Ting., *kamiring*, Ibn., Ilk., *libás*, Bon., Tag., *ligás*, Tag., Pamp., *pakan*, Bon.

29. *Semecarpus velutinus* KING, *J. As. Soc. Beng.* 65, ii (1896) 508; RIDL. *Fl. Mal. Pen.* 1 (1922) 541; TARD. *Fl. C. L. & V.* 2 (1962) 164.

Tree up to 18 m high. *Leaves* spaced, spiral, coriaceous, obovate-oblong, oblanceolate, rarely

elliptic, 12–29(–34½) by 6–11½ cm; glabrous above except the slightly pubescent midrib, velutinous beneath; papillae distinct, covering the lower surface except the midrib, nerves, and some thicker veins; base cuneate or attenuate; apex shortly and abruptly acuminate; nerves 15–24 pairs, prominent beneath, distinct above; veins reticulate-scalariform, elevated beneath, faint above; petiole ¾–4½ cm. *Panicles* terminal and axillary, up to 24 cm long; lateral branches obliquely ascending, up to 9 cm, tomentose; bracts triangular, ⅓–½ mm long; pedicels c. ⅔ mm. Flower-buds globose. ♂ *Flowers*: *Calyx* lobes triangular, ½ mm long. *Petals* imbricate, elliptic, c. 2 by 1 mm, puberulous outside, glabrescent, veins not visible. *Stamens* 2¼–3 mm; anthers broad-ovoid, c. ½ mm long. *Disk* round, flat, c. 1 mm Ø, pilose above. ♀ *Flowers* not seen. *Drupe* subglobose, 1–1½ by 1¼–1½ cm, velutinous; apex obtuse; hypocarp short-cupular or discoid, ¼–½ by 1–1⅓ cm.

Distr. S. Vietnam (TARDIEU, l.c.) and *Malesia*: Malay Peninsula (Perak, Selangor, Johore, Kemaman, Malacca) & Sumatra (E. & Riouw).

Ecol. Lowland forest. *Fl.* March–May; *fr.* March, Nov.

**30. *Semecarpus schlechteri* LAUT.** Bot. Jahrb. 56 (1920) 370. — *S. myrmecophila* LAUT. l.c. 366.

Tree 8–30 m high and 10–30 cm Ø, sometimes myrmecophilous. Bark fawn green, or pale brown, cracked or fissured. *Leaves* spaced, spiral, subcoriaceous or coriaceous, sometimes chartaceous, oblanceolate or obovate-oblong, (23½–)35–48 by (9–)14–18 cm; glabrous, sometimes sparsely puberulous beneath on midrib, nerves, and veins; papillae distinct, covering the lower surface except the midrib, nerves, and thicker veins; base cuneate; apex acute or acuminate, sometimes obtuse, rarely slightly emarginate; nerves 12–26 pairs, prominent beneath, slightly elevated or flat above; veins reticulate-scalariform distinct and slightly elevated on both surfaces; petiole 2½–4 cm. *Panicles* terminal, up to 55 cm long, pubescent; lateral branches obliquely ascending, up to 30 cm long; bracts triangular, ½–1 mm long; pedicels 0 in ♂ (2–3 mm in ♀). Flower-buds globose. *Flowers* pale green or cream-coloured. *Calyx* lobes triangular, c. ⅔ mm long. *Petals* imbricate, ovate-oblong, elliptic, or broad-ovate, 2¼ by ¾–1 mm in ♂ (4–5 by 2½–3 mm in ♀), puberulous outside, with c. 8 longitudinal veins. *Stamens* 2–3 mm; anthers ovoid, c. ⅔ mm long. Imperfect or sterile stamens in ♀ c. 2½ mm. *Disk* round, flat, 1–1½ mm Ø, pilose above. *Ovary* subglobose, c. 2 mm Ø, pubescent; styles 1¼ mm. *Drupe* obliquely obovoid, ¾ by 1¼ cm, pubescent, glabrescent; apex obtuse; hypocarp short-cupular, c. 1¼ by 1½ cm.

Distr. *Malesia*: New Guinea (Obefia, Van Rees Mts, Hollandia, Mamberamo, Sepik, Madang, Morobe, Central, and Milne Bay Districts).

Ecol. Usually in lowland forest by streams, on edge of swamps, in inundated areas or on flat alluvial, sometimes in forest up to 1200 m. *Fl.* March–Nov.; *fr.* July.

Vern. *Bang*, *Bembi*, *barasi*, *Garaina*, *caube*, *Dawa Dawa*, *jukoh*, *Rawa*, *yuko*, *Mongodia*, *karra*, *Kaigorin*, *kombudane*, *Gurumbu*, *utur*, *Mawan*, *woilelesia*, *Madang*.

**31. *Semecarpus glauciphyllus* ELMER**, Leaf. Philip. Bot. 4 (1912) 1501; MERR. En. Philip. 2 (1923) 474; DING HOU, *Blumea* 24 (1978) 35. — *S. acuminatissima* MERR. Philip. J. Sc. 7 (1912) Bot. 282. — *S. oblongifolius* QUIS. Philip. J. Sc. 76 (1944) 43, non THW. 1859.

Undershrub or small tree, up to 3 m high and 2½ cm Ø, sometimes a tree up to 15 m high. Bark yellowish grey, smooth. *Leaves* spaced, spiral, chartaceous or subcoriaceous, elliptic-oblong to lanceolate, sometimes obovate-oblong, or oblanceolate, (8–)20–30 by (3–)6–9 cm; glabrous rarely puberulous above, puberulous beneath; papillae rather compact, obscure, rarely distinct, covering the lower surface except the midrib, nerves, and veins; base acute or cuneate; apex acuminate or subcaudate; nerves 10–17 pairs, prominent beneath, flat above; veins reticulate, some perpendicular to nerves, slightly elevated beneath, faint above; petiole 1–2½ cm. *Panicles* terminal, 7–25 cm long, pubescent; lateral branches obliquely ascending, 2–10 cm; bracts lanceolate or linear, 1–1½ mm; pedicels ⅓ mm. Flower-buds globose. *Calyx* lobes triangular or broad-ovate, c. ½ mm long. *Petals* imbricate, ovate, rarely elliptic, 2–3 by 1–1½ mm, puberulous outside, with c. 8 longitudinal veins. *Stamens* c. 2½ mm; anthers ovoid, c. ⅔ mm long. Imperfect or sterile stamens in ♀ c. 1¼ mm. *Disk* round, flat, c. 1 mm Ø, pilose above. *Ovary* conical, densely pubescent, c. 1¼ mm Ø; styles c. 1 mm. *Drupe* subglobose, 1¼–1½ by 1½–1¾ cm, pubescent, glabrescent; apex obtuse; hypocarp pulvinate, c. ⅔ cm long and wide.

Distr. *Malesia*: Philippines (Tayabas, Sibuyan, Samar, Mindanao).

Ecol. Lowland forest, sometimes along rivers, up to c. 200 m. *Fl.* Jan.; *fr.* April–June, Dec.–Jan. Vern. *Masukal*, Tag.

#### Cultivated

***Semecarpus anacardium* L. f.**; cf. BURKILL, Dict. (1935) 1991.

An Indian tree introduced in Africa and eastwards to china. It is grown in the Botanic Garden at Singapore and may be found in cultivation in Malaya according to BURKILL, who gave abundant notes on it.

#### Doubtful

***Semecarpus obovatus* (ELMER) STEEN.** Philip. J. Sc. 91 (1962) 508; DING HOU, *Blumea* 24 (1978) 37. — *Dichapetalum obovatum* ELMER, Leaf. Philip. Bot. 2 (1908) 483. — *Oncocarpus obovatus* MERR. Philip. J. Sc. 14 (1919) 413; En. Philip. 2 (1923) 476.

Described from a specimen with one immature fruit from Mt Banahao, Lucban, Tayabas Prov., Luzon (ELMER 7931), later supplemented with a ♂-flowered collection from the type locality (QUISUMBING 1346). It cannot be properly placed from the descriptions and no material has been traced.

#### Excluded

***Semecarpus engleriana* LAUT.** in K.Sch. & Laut. Fl. Schutzgeb. Nachtr. (1905) 303; Bot. Jahrb. 55 (1920) 370; cf. DING HOU, *Blumea* 24 (1978) 38, belongs probably to a species of *Rhysotoechia* RADLK. (*Sapindaceae*).

Jv. Os '76



Fig. 56. *Drimycarpus luridus* (Hook. f.) DING HOU. *a.* Habit, nat. size, *b.* ♂ flower (5-merous), 3 petals and 2 stamens removed, *c.* very young fruit crowned by the floral parts, 1 staminode removed, *d.* ♀ flower, *e.* ditto in LS, all  $\times 7$ , *f.* young fruit,  $\times 1\frac{1}{2}$ , (*a* CURTIS 3594, *b* WRAY f. 3294, *c* SAN 36038, *d e* VIDAL 5203, *f* KOSTERMANS 7231).

## 16. DRIMYCARPUS

HOOK. *f.* in B. & H. Gen. Pl. 1 (1862) 424; MARCH. Rév. Anacard. (1869) 67 & 171; ENGL. in DC. Mon. Phan. 4 (1883) 471. — **Fig. 56.**

Trees. *Leaves* spiral, petioled, simple, entire, with a rather thick, distinct marginal nerve, papillose beneath. *Inflorescences* axillary and/or terminal, paniculate, sometimes racemose. *Flowers* unisexual or rarely bisexual (plants dioecious or polygamous). *Calyx* 5-(or 4-)lobed. *Petals* 5 (or 4), imbricate, glabrous except sparsely short hairy on the margin. *Stamens* 5 (or 4); filaments subulate, glabrous; anthers dorsifixed, broadly ovoid, imperfect or abortive in ♀. *Disk* intrastaminal, round, slightly concave, 5-(or 4-)notched, glabrous. *Ovary* inferior, abortive and rudimentary in ♂, 1-celled and 1-ovuled; style short, cylindrical; stigmas 3, capitate. *Drupe* 1-celled, crowned with remaining floral parts, mesocarp resinous; endocarp coriaceous. *Seed* with testa adherent to the endocarp; embryo straight, cotyledons free, plano-convex.

Distr. Two or more  *spp.*, distributed in India, Sikkim, Bhotan, Burma, Thailand, Vietnam, and *Malesia* (Sumatra, Malay Peninsula, Borneo).

Ecol. Forest from the lowland up to 1000 m (rarely up to 2000 m in Sikkim).

Note. In sterile state specimens of *Melanochyla*, *Mangifera*, and *Semecarpus* can hardly be distinguished to the genus. Also sterile specimens of *Drimycarpus* are very similar, but they can be sorted out by the presence of a distinct marginal nerve, which does not occur in the other genera.

**1. *Drimycarpus luridus*** (HOOK. *f.*) DING HOU, *Blumea* 24 (1978) 6. — *Semecarpus lurida* HOOK. *f.* Fl. Br. Ind. 2 (1876) 34; ENGL. in DC. Mon. Phan. 4 (1883) 496. — *Swintonia lurida* KING, J. As. Soc. Beng. 65, ii (1896) 491; RIDL. Fl. Mal. Pen. 1 (1923) 533. — *Semecarpus glabra* RIDL. Fl. Mal. Pen. 5 (1925) 303. — **Fig. 56.**

Tree up to 20(–30) m high and 47 cm Ø, rarely a shrub c. 2 m high. Bark greyish or light brown, smooth, or deeply fissured. *Leaves* subcoriaceous or coriaceous, elliptic or oblanceolate, 9–20(–28) by 2½–5(–8½) cm; glabrous on both surfaces, except the lower surface with sparse, reddish brown, short trichomes; base cuneate or attenuate; apex shortly and abruptly acuminate, or caudate; nerves (9–)16–20 pairs, fused with a distinct marginal nerve, often with 1–4 internodal veins (usually shorter and weaker than the normal nerves), both slightly elevated beneath, distinct above; veins reticulate, rarely some perpendicular to the nerves, distinct on both surfaces, sometimes faint above; petiole 1½–2½ cm. *Inflorescences* 4–29 cm long, often terminal, sometimes also axillary, usually profusely branched (in ♂), puberulous, glabrescent; lateral branches up to 18 cm; bracts triangular, ½–1 mm long. ♂ *Flowers* sessile or subsessile, white, pale greenish yellow, or yellow, once recorded pink. *Calyx* lobes triangular, ½–2/3 mm long. *Petals* ovate or ovate-oblong, 1½–2 by

2/3–1 mm, veins invisible. *Stamens* unequal in length (sometimes 2 long and 3 short), 1½–2½ mm; anthers 1/3–1/2 mm. Rudimentary pistil very small. ♀ *Flowers* not seen. *Fruit* ± transverse-oblong, 1–1¼ by 1¼–1⅔ cm.

Distr. *Malesia*: Sumatra (East Coast, Karimun, Indragiri Uplands, Sibolangit), Malay Peninsula (Perak, Penang, Malacca), and Borneo (Sabah: Sepik, Kudat, Lahad Datu, Kinabatangan; Sarawak: Mt Mersing; Kalimantan: E. Kutai).

Ecol. Primary forest, sometimes mixed dipterocarp forest, rarely in secondary forest, from the lowland up to 1000 m. *Fl.* Febr.–June, Sept.–Dec.; *fr.* June, Sept.

Uses. The timber is used for beams and was recorded to be durable (ALVINS 899).

Vern. Malay Peninsula: *pako tanjong*, M; Borneo: Sabah: *kuduran*, Dusun-Tambunan; Sarawak: *renghas*, Iban; Kalimantan: *rengas alois*, M.

Note. This species resembles very much the SE. Asian *D. racemosus* (ROXB.) HOOK. *f. ex* MARCH. (1869); the leaves of the latter show, however, a fairly distinct cross-bar-like venation. For this reason, and the fact that I have not yet seen any specimen with ♀ flowers, and fruit has not yet been collected in Sumatra and Malaya, I have kept both species tentatively apart.

## 17. PENTASPADON

HOOK. *f.* Trans. Linn. Soc. 23 (1860) 168; ENGL. in DC. Mon. Phan. 4 (1883) 293; CORNER, Gard. Bull. S. S. 10 (1939) 261. — *Nothoprotium* MIQ. Sum. (1861) 527; Ann. Mus. Bot. Lugd.-Bat. 3 (1869) 89; MARCH. Rév. Anacard. (1869) 90, 183. — *Microstemon* ENGL. Bot. Jahrb. 1 (1881) 376; in DC. Mon. Phan. 4 (1883) 294; TARD. Fl. C. L. & V. 2 (1962) 190. — **Fig. 57–58.**

*Jv. Os 76*

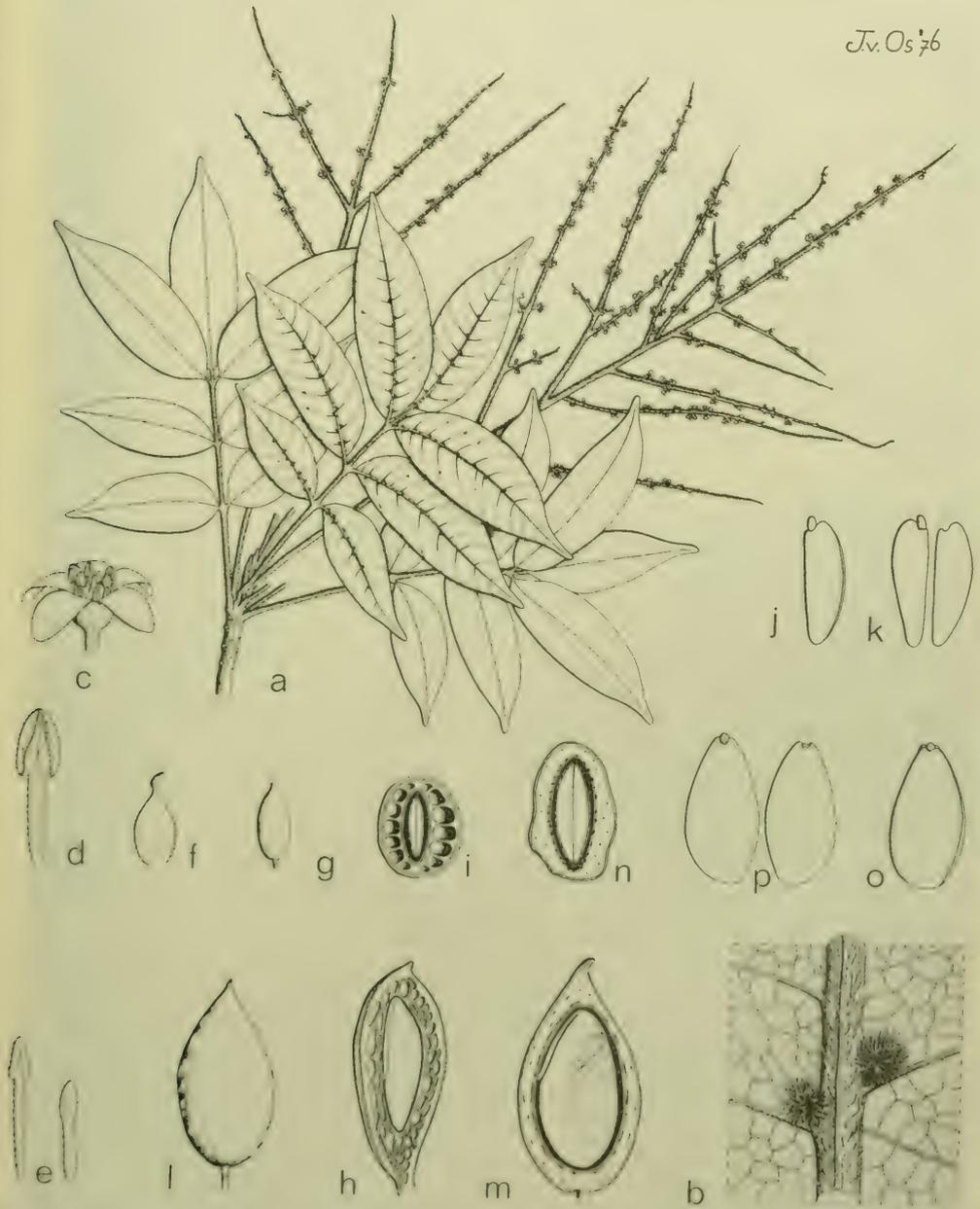


Fig. 57. *Pentaspadon curtisii* (KING) CORREIA. a. Habit,  $\times \frac{1}{2}$ , b. small portion of lower surface of leaflet showing domatia,  $\times 15$ , c. flower,  $\times 7$ , d. stamen, e. staminodes, f. pistil, all  $\times 20$ , g. fruit,  $\times \frac{1}{2}$ , h. ditto with half of pericarp removed, showing suspended seed and resin-canals, i. CS of fruit, j. embryo, side view, k. embryo, opened, all  $\times 1\frac{1}{2}$ . — *P. motleyi* HOOK. f. l. Fruit,  $\times \frac{1}{2}$ , m. ditto with half of pericarp removed, showing suspended seed and resin-canals, n. ditto in CS, o. embryo, side view, p. ditto, opened, all  $\times \frac{1}{4}$  (a-f CURTIS 2620, g-k SF 21376, l CUADRA A1458, m-p SCHUT K26).



Fig. 58. *Pentaspadon motleyi* Hook. f. in primary forest in Palembang, S. Sumatra (Photogr. THORENAAR, 1925).

Mostly large, deciduous trees. *Leaves* spiral, imparipinnate, petioled. *Leaflets* ± opposite, chartaceous or thinly coriaceous, entire, often with hairy domatia. *Inflorescences* axillary, panicate. *Flowers* bisexual. *Calyx* 5-lobed. *Petals* 5, imbricate, papillose on both surfaces. *Stamens* 5, opposite the calyx lobes and alternate with 5 staminodes (absent in *extra-Mal. sp.*), all inserted at the outer base of the disk; filaments subulate, papillose; anthers basi- or dorsifixed, ovoid or ellipsoid; staminodes filamentous or like small stamens. *Disk* shortly cupular and 10-grooved outside, or discoid and crenulate. *Ovary* subglobose, pilose, usually glabrescent, 1-celled; style short, stigma subglobose or slightly 2-grooved or -lobed. *Drupe* 1-celled, purplish then black; endocarp thin, subcoriaceous. *Seed* with testa free from the endocarp; cotyledons free, plano-convex or flat.

Distr. Species 6, in SE. Asia (Thailand, Vietnam), *Malesia* (Sumatra, Malay Peninsula, Borneo, the Moluccas, and New Guinea), and the Solomon Is.

Ecol. Lowland forest, sometimes in seasonally inundated places.

CORNER observed that "*pelong* or *pelajau* trees are easily recognized by their graceful, feathery crowns, but it would seem difficult to identify them further were it not for their very characteristic bushy inflorescences which decay slowly and thus, as they lie on the ground beneath the trees, render them easy of recognition."

TAXON. MARCHARD *l.c.* was the first to identify *Nothoprotium* MIQ., which was assigned to *Burseraceae*, with *Pentaspadon*; he accepted the latter name, being under the impression that it had priority. CORNER (Gard. Bull. S. S. 10, 1939) demonstrated that the distinction of *Microstemon* ENGL. was due to erroneous observation.

Uses. The timber of *P. motleyi* and *P. velutinus* (trade name for both species in Malaya: *pelong*) is reported to be non-durable. The wood is moderately hard and moderately heavy and is used for cheap flooring; cf. DESCH, Mal. For. Rec. 15 (1957) 15-17.

An oil, obtained from *P. officinalis* (= *P. motleyi*), known as *minyak plang* in Perak, Malaya, *m. pelandjau* in Borneo, is used for curing certain skin diseases; cf. KING, J. As. Soc. Beng. 65, ii (1896) 500; HEYNE, Nutt. Pl. (1927) 977. CORNER (Ways. Trees, 1940, 113) says that "the oil in Malaya is obtained by hacking a basin-like cavity in one side of the trunk and allowing the oil to drain slowly into it, exactly as *damar* is collected from *Dipterocarpus* trees." LANE-POOLE (For. Res. 1925, 499) reported that the wood of *P. motleyi* contains abundant oil which is heavy and misty brown in colour and "resembles motor lubricating oil as used for cylinders". He did not mention any use of it.

The fruits of *P. motleyi* are edible after boiling.

Vern. Malaysian standard timber name: *pelajau*.

#### KEY TO THE SPECIES

1. Lower surface of leaflets velutinous, without domatia . . . . . 1. *P. velutinus*
1. Lower surface of leaflets glabrous, or puberulous and usually glabrescent except sometimes on the midrib, nerves, and veins, with distinct, hairy domatia (rarely absent in *P. motleyi*).
2. Anthers bent towards the center and almost perpendicular to the filaments. Drupe ovoid or ovoid-oblong, 3-5 by 2-2<sup>3</sup>/<sub>4</sub> cm . . . . . 2. *P. motleyi*
2. Anthers erect. Drupe smaller, ellipsoid, 2-2<sup>1</sup>/<sub>2</sub> by 3<sup>1</sup>/<sub>4</sub>-1 cm . . . . . 3. *P. curtisii*

1. *Pentaspadon velutinus* HOOK. f. Fl. Br. Ind. 2 (1876) 28; CORNER, Gard. Bull. S. S. 10 (1939) 262; Ways. Trees (1940) 113; JACOBS, Acta Bot. Neerl. 10 (1961) 105; KOCHUM, Mal. For. Rec. 17 (1964) 330. — *Microstemon velutina* ENGL. Bot. Jahrb. 1 (1881) 376; in DC. Mon. Phan. 4 (1883) 294, t. 9, f. 37-42; KING, J. As. Soc. Beng. 65, ii (1896) 498; CRAIB, Fl. Siam. En. (1926) 358.

Tree up to 60 m high and 45 cm Ø. Buttresses steep, up to c. 2<sup>1</sup>/<sub>2</sub> m high. Bark grey, light yellowish brown or reddish brown, smooth, with distinct adherent scales. *Leaves* with 3-5 pairs of leaflets, reddish pink when young. *Leaflets* chartaceous, elliptic-oblong or -lanceolate, 6-11 by 2<sup>1</sup>/<sub>2</sub>-3<sup>1</sup>/<sub>2</sub> cm; upper surface with midrib velutinous, the rest pubescent or puberulous and glabrescent, lower surface velutinous; domatia absent; base obtuse

or cuneate; apex acuminate; nerves 9-12 pairs, petiolules up to c. 4 mm, the terminal one up to 15 mm. *Panicles* up to 22 cm long, velutinous; bracts lanceolate, 1<sup>1</sup>/<sub>2</sub>-1 mm long; pedicels 1<sup>1</sup>/<sub>2</sub>-1 mm. *Flowers* whitish to pink. *Calyx* lobes broadly ovate, 1<sup>1</sup>/<sub>2</sub>-2<sup>2</sup>/<sub>3</sub> mm long. *Petals* obovate, 1<sup>1</sup>/<sub>2</sub>-2 by 1-1<sup>1</sup>/<sub>4</sub> mm. *Stamens* 2<sup>2</sup>/<sub>3</sub>-1 mm; anthers bent towards the center and almost perpendicular to the filaments. *Disk* 2<sup>2</sup>/<sub>3</sub> mm Ø. *Ovary* c. 1<sup>1</sup>/<sub>4</sub> mm Ø. *Drupe* ovoid-oblong, 2<sup>1</sup>/<sub>2</sub> by 1 cm, scurfy. *Seed* ovoid-oblong, compressed, 2 by 2<sup>2</sup>/<sub>3</sub> cm.

Distr. Peninsular Thailand and *Malesia*: Sumatra (Padang Uplands, W. Indragiri, Muara Serange, Kwantan Distr.), Malay Peninsula (Perak, Kelantan, Pahang, Negri Sembilan, Malacca).

Ecol. Lowland forest of dryland, on river-banks,

in periodically inundated places or seasonal swamps, up to 350 m. *Fl.* Jan.–May, Sept., Oct.; *fr.* May, July.

CORNER (1940) observed that on hillsides “tall trees with their crowns covered with pale flesh-pink inflorescences are to be seen scattered among the *tualang* trees (*Koompassia excelsa*); such are the pink *pelong* trees. How often they flower we do not know but believe that it is once a year contemporaneous with the *tualang* and pink *Cassia nodosa*.”

Vern. Sumatra: *pēladjau*, M; Malay Peninsula: *kayu plong*, *pēlajau*, *pēlang*, *pēlong*, *pēlong bēludu*, *poko shinghe*, *shinghe*, M.

Note. CORNER (Gard. Bull. S. S. 10, 1939, 261) rightly pointed out that the stigma of the present species is not 3-lobed as described and shown in the drawings by ENGLER (in 1883, *cf.* t. 9, f. 39 & 40).

2. *Pentaspadon motleyi* HOOK. *f.* Trans. Linn. Soc. 23 (1860) 168; ENGL. in DC. Mon. Phan. 4 (1883) 294, t. 9, f. 30–36; MERR. En. Born. (1921) 351; RIDL. Fl. Mal. Pen. 1 (1922) 538; LANE-POOLE, For. Res. (1925) 109; HEYNE, Nutt. Pl. (1927) 977; JACOBS, Acta Bot. Neerl. 10 (1961) 106; BACK. & BAKH. *f.* Fl. Java 2 (1965) 152; MEIJER, Bot. News Bull. F. D. Sandakan 8 (1967) 30. — *Nothoprotium sumatranum* MIQ. Sum. (1861) 527; Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 90. — *P. officinalis* HOLMES ex KING, J. As. Soc. Beng. 65, ii (1896) 499; RIDL. Fl. Mal. Pen. 1 (1922) 537; BURK. Dict. (1935) 1692; CORNER, Ways. Trees (1940) 113; KOCHUM. Mal. For. Rec. 17 (1964) 330. — *Rhus novoguineensis* LAUT. Nova Guinea 8 (1910) 298. — *P. moszkowskii* LAUT. Bot. Jahrb. 56 (1920) 358, f. 3. — *P. minutiflora* B. L. BURTT, Kew Bull. (1935) 305. — Fig. 571–p, 58.

Tree up to 50 m high and 70 cm Ø. Buttresses up to 5 m high, 4 m wide, and 6 cm thick. Bark greyish white, light brown or brown, smooth to rough, shallowly fissured, and irregularly flaked. *Leaflets* 4–5 pairs, thinly coriaceous, ovate- or elliptic-oblong, sometimes obovate-oblong, or elliptic-lanceolate,  $5\frac{1}{2}$ –13(–18) by  $2$ – $5\frac{1}{2}$ (– $6\frac{1}{2}$ ) cm; glabrous, sometimes puberulous on both surfaces, glabrescent except on the midrib, nerves, and veins, domatia often present (rarely absent), distinct, hairy; base obtuse; apex acuminate; nerves 8–15 pairs; petiolules 3–6 mm, the terminal one up to 12 mm. *Panicles* up to 31 cm long, tomentose, glabrescent and sometimes seemingly glabrous; bracts lanceolate,  $\frac{1}{2}$ – $\frac{2}{3}$  mm long; pedicels  $\frac{1}{3}$  mm. *Flowers* cream-coloured. *Calyx* lobes broadly ovate,  $\frac{1}{2}$ – $\frac{2}{3}$  mm long. *Petals* obovate-oblong,  $1\frac{1}{2}$ – $2\frac{1}{2}$  by  $1$ – $1\frac{1}{2}$  mm. *Stamens*  $2\frac{1}{3}$ –1 mm; anthers bent towards the center and almost perpendicular to the filaments. *Disk*  $\frac{2}{3}$ –1 mm Ø. *Ovary*  $\frac{1}{2}$ – $\frac{3}{4}$  mm Ø. *Drupe* ovoid or ovoid-oblong,

3–5 by  $2$ – $2\frac{3}{4}$  cm, scurfy. *Seed* ovoid-oblong, compressed,  $2\frac{1}{2}$ –4 by 1–2 cm.

Distr. Solomon Is. (Bougainville, Choiseul, Ysabel) and *Malesia*: Sumatra, Malay Peninsula, Borneo, Moluccas, and New Guinea.

Ecol. Lowland forest on banks of rivers or streams, sometimes in seasonally inundated places (*cf.* ENDERT, Tectona 13, 1920, 131), in swamp forest, or in secondary forest, up to 75 m, rarely up to 300 m. *Fl.* March–Dec.; *fr.* Jan.–Dec.

CORNER observed that in Malaya “the trees shed their leaves and flower with the new foliage twice a year, about March to May and again about October to November. The crown is whitened by the fragrant blossom.”

Uses. See under the genus for timber and oil. Seeds are eaten fresh or roasted (*cf.* HEYNE, *l.c.* 978). See for other uses BURKILL *l.c.*

Vern. Sumatra: *mail*, *pēla(n)djau*, *pladjau*, M; Malay Peninsula: *kēdongong*, *pahong*, *pēlajau*, *pēlong*, *pēlong lichin*, *shinghe*, M; Borneo: *djuping*, *Dajak*, *ēmpit*, *ēmpelandjau*, *kēdongong*, *Tawau*, *lējut*, *Karimata*, *panjau*, *Iban*, *pēlajau*, *Beaufort*, *pēladjau*, *pilajau*, *M*, *plajau*, *Bintulu*, *polajo*, *Kuching*, *praju*, *Serian*, *tampison*, *Dusun*, *ypie*, *Kuching*; New Guinea: *ailala*, *auro*, *bowwie*, *ibelaka*, *senai*, *sinai*, *Manikiong*, *bowei*, *Taniba*, *darwan*, *Biak*, *inene*, *Evara*, *kwancler*, *Wain*, *laai*, *lae*, *laien*, *lain*, *Mooi*, *laleva*, *Kikori*, *lufaru*, *Kiwai*.

3. *Pentaspadon curtisii* (KING) CORNER, Gard. Bull. S. S. 10 (1939) 262. — *Microstemon curtisii* KING, J. As. Soc. Beng. 65, ii (1896) 498; RIDL. Fl. Mal. Pen. 1 (1922) 537; CRAIB, Fl. Siam. En. (1926) 358; TARD. Fl. C. L. & V. 2 (1962) *in obs.*, t. 17, f. 13. — Fig. 57a–k.

Tree up to c. 13 m high. *Leaflets* (1)–3–4(–5) pairs, chartaceous, elliptic-lanceolate or lanceolate, 6–11 by  $2$ – $3\frac{3}{4}$  cm, puberulous on both surfaces, usually glabrescent except sometimes on the midrib, nerves and veins; base cuneate or rounded; apex acuminate; nerves 9–16 pairs, petiolules c. 2 mm, the terminal one longer. *Panicles* up to 23 cm long, pubescent; bracts lanceolate,  $\frac{1}{6}$  mm long; pedicels c.  $\frac{1}{2}$  mm. *Calyx* lobes broadly ovate,  $\frac{1}{3}$ – $\frac{1}{2}$  mm long. *Petals* broadly elliptic or ovate,  $1\frac{1}{2}$  by  $\frac{3}{4}$ –1 mm. *Stamens* c. 1 mm; anthers erect. *Disk* c. 1 mm Ø. *Ovary* c.  $\frac{3}{4}$  mm Ø. *Drupe* ellipsoid,  $2$ – $2\frac{1}{2}$  by  $\frac{3}{4}$ –1 cm, scurfy. *Seed* lanceolate, compressed,  $1\frac{1}{5}$  by  $\frac{1}{3}$  cm.

Distr. Peninsular Thailand and *Malesia*: Malay Peninsula (Kedah: Langkawi I.), only 4 collections seen.

Ecol. On limestone at sea-level; on P. Langgun, NW. Langkawi, a complete dominant, in Dec.–Febr. conspicuous by the white stems and bare crown carrying towards the end of the dry season abundant flowers and just emerging leaves (VAN BALGOOY). *Fl.* June; *fr.* Aug., Nov.

## 18. CAMPNOSPERMA

THWAITES in Hook. J. Bot. Kew Misc. 6 (1854) 65, *nom. cons.*; MARCH. Rév. Anacard. (1869) 71 & 172; ENGL. in DC. Mon. Phan. 4 (1883) 316; CORNER, Gard. Bull. S. S. 10 (1939) 253; STEEN. Fl. Mal. Bull. n. 3 (1948) 74; DING HOU,

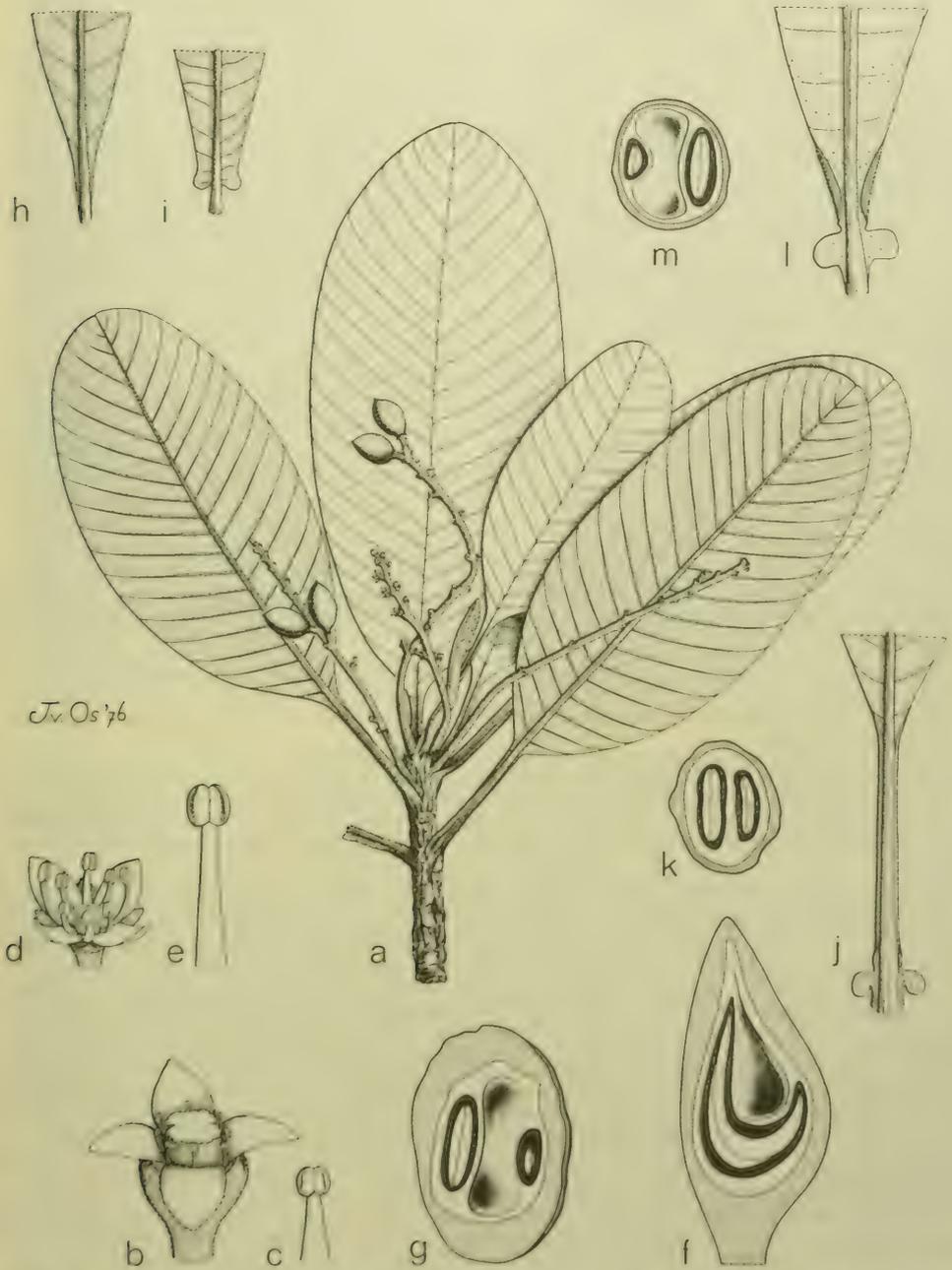


Fig. 59. *Camposperma coriaceum* (JACK) HALL, f. ex STEEN. a. Habit,  $\times \frac{1}{2}$ , b. ♀ flower,  $\times 7$ , c. imperfect or sterile stamen,  $\times 14$ , d. ♂ flower,  $\times 7$ , e. stamen,  $\times 14$ , f. LS of fruit,  $\times 3\frac{1}{2}$ , g. CS of fruit,  $\times 3\frac{1}{2}$ . — *C. montanum* LAUR. h. Basal part of leaf,  $\times \frac{1}{2}$ . — *C. squamatum* RIDG. i. Basal part of leaf,  $\times \frac{1}{2}$ . — *C. auriculatum* (BL.) HOOK. f. j. Basal part of leaf,  $\times \frac{1}{2}$ , k. CS of fruit,  $\times 3\frac{1}{2}$ . — *C. brevipetiolatum* VOLKENS. l. Basal part of leaf,  $\times \frac{1}{2}$ , m. CS of fruit,  $\times 3\frac{1}{2}$  (a-e, f-g SCHODDI 4425, d-e DING HOU 780, h HOOGLAND & CRAVEN 10839, i S 24140, j KEP 77625, k KORTERMANS 9055, l BW 1931, m BW 10515).

Blumea 24 (1978) 5. — *Coelopyrum* JACK, Mal. Misc. 2, 7 (1822) 65, *nom. rejic.* — Fig. 59–62.

Trees, with distinct *Terminalia*-branching (fig. 61). *Leaves* spiral, simple, coriaceous, entire, petioled, usually with minute, peltate or lobed scales on both surfaces, glabrescent; areolae with dendroid blind vein-ends. *Inflorescences* axillary, paniculiform, sometimes with rather simple, scant, short branches and seemingly racemose. *Flowers* unisexual and rarely bisexual (plants polygamo-dioecious). *Calyx* (3- or) 4- (or 5-)lobed. *Petals* (3 or) 4 (or 5), imbricate, glabrous (except sometimes with lobed, hair-like scales on the outer surface). *Stamens* twice the number of petals, epipetalous ones shorter than those alternate with them; filaments subulate, glabrous; anthers dorso-basifixed, broadly ellipsoid, sterile in ♀. *Disk* round and flat in ♂, shortly cupular in ♀, angular or slightly crenulate. *Ovary* subglobose, 1-celled, scurfy; style short or obscure; stigma patent, discoid, usually irregularly lobed. Sterile pistil in ♂ very small. *Drupe* incompletely 2-celled by a vertical, solid or hollow septum protruding and elongating from the apical end; endocarp hard and woody. *Seed* 1, with testa free from the endocarp; embryo curved, cotyledons free, slightly plano-convex or rather flat.

Distr. About 10 *sp.*, in South America (Brazil) and Central America (Panama), Madagascar (1 *sp.*) and the Seychelles (1 *sp.*), SE. Asia (Ceylon, Thailand), through *Malesia* (Sumatra, Malay Peninsula, Borneo, Celebes, Moluccas, New Guinea) to Micronesia and Melanesia.

Ecol. Forming monospecific stands or (co-)dominant in (peat-, sago-)swamps (fig. 60) to common or rare in forest on well-drained soils; also in secondary forest; apparently a strong light demander and regenerating more abundantly in more open or in disturbed habitats; mostly in the lowland, but also up to 1600 m.

When growing in swamps *C. coriaceum* develops often prop-roots as well as slender-kneed pneumatophores over 1 m high.

The fruits are eaten by birds, especially by pigeons (CORNER, 1940).

In New Guinea *C. brevipetiolatum* and *C. coriaceum* occur in a wide range of habitats between 0 and 500 m. In forest on well-drained soils and on soils inundated for very short periods, these species occur with low frequencies (less than 5% of the trees). The frequency can be higher in forest which is inundated for longer periods and it increases gradually to 100% of the canopy layer in some types of swamp forest. Fig. 60.

*Campnosperma*-swamp forest occurs throughout the wet-tropical parts of New Guinea. In areas with a lower annual rainfall and a distinct dry season, the *Campnosperma* species are replaced by *Melaleuca* as the predominant species in swamp forest. In the Port Moresby area this replacement is distinct, whereas in the Fly River area the geographical segregation is less distinct probably due to the more gradual climatic transitions (but here *C. montanum* is also reported from *Melaleuca*-swamp!).

Where *Campnosperma* is predominant (80–100%) in the canopy, the lower story often consists of sago; the soil is inundated up to c. 1–1½ m for at least 5 months per year and peat formation occurs regularly; at the end of the dry season the water table is at the soil surface or only slightly below, that is, the soil is permanently waterlogged. Through a stage with an open canopy, with sago palms, and with *Thoracostachyum*, *Campnosperma* becomes scattered (with a few other species) in the margins of deeper, herbaceous swamps. In many reports on *Campnosperma*-dominated swamp forest or on pure *Campnosperma* stands the association with sago, pandans, *Thoracostachyum* (sometimes *Mapania*), *Scleria*, and *Nepenthes* is mentioned. Near the coast *Campnosperma* forest occurs only in non-tidal freshwater swamps.

According to LUNDQUIST (1941), the *Campnosperma* trees in the centre of pure stands attain a mean d.b.h. of only 25 cm and almost never exceed 40 cm; towards the margins of the stands the trees are somewhat heavier and diameters of 40 to 80 cm can be reached.

From the reports and vegetation maps it is not clear whether *C. brevipetiolatum* and *C. coriaceum* can occur together in pure '*Campnosperma*' stands, but apparently this can happen. "Some stands consist of both species in about equal proportions" (PALMANS, 1976).

*C. montanum* has a far wider altitudinal range (0–1500 m) than the species just mentioned and accordingly occurs also in several types of submontane forest.

For Malaya, WYATT-SMITH (1959) listed *C. auriculatum* as one of the species not strictly belonging to the oligotrophic peat-swamp forest, but depending on the presence of eutrophic water. This agrees with the observation by ENDERT (1920) that in the Musi Delta, Sumatra, *C. coriaceum* is predominant in the peat-swamp, whereas *C. auriculatum* prefers forests inundated seasonally by rivers. Several authors list *C. auriculatum* with species of secondary (swamp) forest.



Fig. 60. Permanent, stagnant, non-tidal freshwater swamp forest consisting of tall *Camptosperma* trees and undergrowth of sago (from CSIRO Land Res. Ser. n. 23, 1969, pl. 4). Kerama-Vailala area, Papua New Guinea. Courtesy CSIRO, Div. of Land Use Research.

In Malesia *Camptosperma* is sometimes associated with the very similarly looking *Terminalia cope-landii* ELMER; in the Solomon Is. *C. brevipetiolatum* is often associated with *Terminalia brassii* EXELL. — W. VINK.

*Literature:* ENDERT, Tectona 13 (1920) 119; SALVERDA, Rapport Expl. Z.W.-Nieuw Guinea (1937) 18, 44; CORNER, Ways. Trees (1940) 103; RAND & BRASS, Bull. Am. Mus. Nat. Hist. 77 (1940) 370b, pl. XL-1; LUNDQUIST, Verslag Bosexpl. N. G. (1941) 51; ARCHBOLD, RAND & BRASS, Bull. Am. Mus. Nat. Hist. 79 (1942) 235a; BROWNE, For. Trees Sar. Brun. (1955) 46; WYATT-SMITH, Mal. For. 22 (1959) 9; PEEL, *ibid.* 22 (1959) 71, 86; *ibid.* 23 (1960) 163; ANDERSON, Gard. Bull. Sing. 20 (1963) 170; ROBBINS & PULLEN, Land Research Ser. (C.S.I.R.O.) 15 (1965) 108; ROBBINS, *ibid.* 22 (1968) 118, 121, pl. 4-1; SAUNDERS, *ibid.* 22 (1968) 127; PAIJMANS, *ibid.* 23 (1969) 102, 107, 110, 114, 158, pl. 4-1; HEYLIGERS, *ibid.* 30 (1972) 81, 87, pl. 4-2; PAIJMANS (ed.), New Guinea Vegetation. Canberra (1976) 46.

*Field characters.* Generally a tendency to flat-topped crowns. Main branches in tiers; tendency to divide bole into several large ascending limbs, each of which may have a sub-crown (fig. 61), but apparently this is not a specific character. *C. auriculatum* has green foliage, yellowish old leaves, and a light bark; *C. brevipetiolatum* fits this picture (old leaves not reported); *C. coriaceum* has brownish green foliage, red old leaves, and generally a darker to dark and more strongly fissured bark; *C. montanum* has dark green foliage, red old leaves, and a light bark.

Smaller limbs and branchlets with *Terminalia*-branching. Leaves clustered. Leaves on vegetative shoots much larger than those on fertile shoots.

The exudate in the bark can be absent or present and then in small drops to abundant-flowing. Its colour is variable; *C. squamatum*: pale yellowish (one record only); *C. montanum*: clear watery to white milky turning purplish or black; *C. auriculatum*, *C. brevipetiolatum*, and *C. coriaceum*: clear to milky and colourless, cream, white, or red.

Open *Camptosperma*-swamp forest, consisting of species with a sparse crown and light bark, gives from the air the impression of a forest of dead trees. — W. VINK.

*Uses.* The timber of all species is of the same grade; it is soft, light (specific gravity 0.3-0.5; reported as 0.7 by KRAEMER, 1951), yellowish pink to pinkish grey, easy to peel, sometimes containing some silica, planing somewhat fuzzy, easy to impregnate, not durable. Not suitable for construction work; suitable for packing cases, crates, planks, canoes, match-boxes (reports on match-sticks are disagreeing), splints, peeled veneers (not for faces?), drawing boards, and wooden shoes. Logs float.



Fig. 61. *Campnosperma auriculatum* (BL.) Hook. f. A fairly young *terentang* by the road from Ayer Hitam to Segamat, Johore. Courtesy and photogr. CORNER.

The wood produces oil in small quantities (see under the species; cf. also DING HOU, *Blumea* 24, 1978, 5-6).

*Literature:* DEN BERGER, *Med. Proefstation Boschwezen* 13 (1926) 88; FOXWORTHY, *Mal. For. Rec.* 3 (1927) 143 & 144; THOMAS, *Mal. For.* 13 (1950) 88-90; KRAEMER, *Trees W. Pac. Reg.* (1951) 191; BROWNE, *For. Trees Sar. Brun.* (1955) 47; DESCH, *Mal. For. Rec.* 15 (1957) 26-29; BALAN MENON, *Mal. For.* 21 (1958) 40; KALKMAN, *Timber Species in Neth. New Guinea* (1959) 13; JAPING, *Houtsoorten N. G.* 1 (1961) 9; VAN ROYEN, *Man. For. Trees Papua & N. G.* 4 (1964) 18; HEGNAUER, *Chemotax. Pfl.* 3 (1964) 96.

Vern. Standard Indonesian/Malaysian timber name: *tērētan*(g); New Guinea: *Camposperma*.

## KEY TO THE SPECIES

1. Leaves distinctly auricled at the base (auricles sometimes obscure on leaves of young twigs or sapling on *C. auriculatum*; sometimes obscure or wanting on leaves of young or fertile twigs in *C. brevipetiolatum*). Fruits 6-8 mm long.
2. Leaf-base gradually, narrowly decurrent, the lower very narrowly winged part petiolar between the proper blade and the auricles (fig. 59j). Fruits in transverse section showing a solid septum
  1. *C. auriculatum*
2. Leaf-base gradually, broadly decurrent, without such narrowly winged petiole (fig. 59l). Fruits in transverse section showing a hollow septum
  2. *C. brevipetiolatum*
1. Leaves not auricled (except forming amplexicaul auricles on sapling leaves in *C. squamatum*; sometimes (obscurely) auricled on vegetative leaves in *C. montanum*). Fruits 11-18 mm long.
3. Leaf-base distinctly set off against a distinct petiole 2-8 cm long (fig. 59a). Fruits in transverse section showing a hollow septum
  3. *C. coriaceum*
3. Leaf-base either gradually tapering towards the insertion or petiole up to  $\frac{3}{4}$  cm.
4. Leaf-base broad, petiole up to  $\frac{3}{4}$  cm (fig. 59i). Calyx lobed to  $\frac{1}{2}$  of its length. Fruits in transverse section showing a hollow septum
  4. *C. squamatum*
4. Leaf-base gradually tapering to the base (fig. 59h). Calyx lobed almost to the base. Fruits in transverse section showing a solid septum
  5. *C. montanum*

**1. *Camposperma auriculatum* (BL.) HOOK. f. Fl. Br. Ind.** 2 (1876) 41; ENGL. in DC. *Mon. Phan.* 4 (1883) 320, t. 11, f. 22-25; KING, *J. As. Soc. Beng.* 65, ii (1896) 495; RIDL, *Fl. Mal. Pen.* 1 (1922) 534, *incl. var. wallichii* (KING) RIDL.; BURK. *Dict.* (1935) 421; CORNER, *Gard. Bull. S. S.* 10 (1939) 253; WAYS, *Trees* (1940) 104, f. 20, *Atlas*, t. 4; MERR. & PERRY, *J. Arn. Arb.* 22 (1941) 535; SETTEN, *Mal. For.* 19 (1956) 32; KOCHUM. *Mal. For. Rec.* 17 (1964) 222; SMYTHIES, *Common Sarawak Trees* (1965) 2; MEIJER, *Field Guide Trees W. Mal.* (1974) 105; DING HOU, *Blumea* 24 (1978) 5. — *Buchanania auriculata* BL. *Mus. Bot.* 1 (1850) 185; MIQ. *Fl. Ind. Bat.* 1, 2 (1859) 637. — *Buchanania oxyrhachis* MIQ. *Sum.* (1861) 524. — *C. griffithii* (non MARCH.) HOOK. f. *Fl. Br. Ind.* 2 (1876) 41, *excl. typ.*; ENGL. in DC. *Mon. Phan.* 4 (1883) 320; KING, *J. As. Soc. Beng.* 65, ii (1896) 494. — *C. oxyrhachis* ENGL. in DC. *Mon. Phan.* 4 (1883) 319; RIDL, *J. Str. Br. R. As. Soc. n.* 59 (1911) 38; *Fl. Mal. Pen.* 1 (1922) 534; BURK. *Dict.* (1935) 421; CORNER, *Gard. Bull. S. S.* 10 (1939) 253. — *C. wallichii* KING, *J. As. Soc. Beng.* 65, ii (1896) 497; BAKER, *J. Bot.* 62 (1924) *Suppl.* 30; WYATT-SMITH, *Mal. For. Rec.* 3 (1927) 143, *photogr.*; THOMAS, *Mal. For.* 13 (1950) 88, t. 8. — *Fig. 59j-k, 61.*

Tree up to 38 m high and 80(-135) cm  $\varnothing$ . Buttresses absent or up to 1 m high,  $1\frac{1}{2}$  m wide, 10-20 cm thick. Bark white to fawn, hoop-marked, smooth or shallowly fissured and/or papery flaky. Young foliage pinkish brown to brownish green, mature foliage green, old leaves withering yellow to brownish yellow. *Leaves* obovate to oblanceolate, 12-63 by 5-20 cm (up to 72(120) by 18(25) cm on vegetative twigs or sapling), pubescent on both surfaces when young,

glabrescent and sometimes almost glabrous except the basal part; base narrowly decurrent and forming a pair of auricles (sometimes obscure on leaves of young twigs or saplings) near the insertion; apex obtuse, sometimes emarginate; nerves 16-23(-50) pairs, veins reticulate-scalariform, usually more distinct on the lower surface; petiole obscure. *Panicles* up to 50 cm long, profusely branched, branches up to 20 cm; bracts triangular, c.  $\frac{1}{3}$  mm long; pedicels  $\frac{2}{3}$ - $\frac{3}{4}$  mm. *Flowers* lemon yellow. *Calyx* lobes triangular,  $\frac{1}{3}$ - $\frac{1}{2}$  mm long. *Petals* broadly elliptic or ovate, 1-1 $\frac{1}{2}$  by  $\frac{1}{2}$ - $\frac{2}{3}$  mm. *Stamens*  $\frac{1}{2}$ -1 $\frac{1}{4}$  mm; staminoles in  $\varnothing$  shorter and smaller. *Disk*  $\frac{1}{2}$ -1 $\frac{1}{4}$  mm  $\varnothing$ . *Ovary* subglobose, c.  $\frac{3}{4}$  mm  $\varnothing$ . *Drupe* subglobose, 6-8 by 5-6 mm, dull reddish purple when ripe; septum solid.

*Distr.* Peninsular Thailand and *Malesia*: widely distributed in Sumatra, Bangka, the Malay Peninsula, and Borneo.

*Ecol.* Co-dominant to rare in freshwater (peat-) swamps to common or rare in mixed primary forest on well-drained soils, also in secondary forest, from 5-1000 m, once at 1600 m (W. Kutai). *Fl. fr.* Jan.-Dec.

*Uses.* The timber is used for making canoes (ENDERT, *Tectona* 18, 1925, 80). Exudate from the wood is called *terentang-oil* (HEGNAUER, *Chemotax. Pfl.* 3, 1964, 96), which is harmful to some persons (CORNER, 1940).

Mr. K. M. KOCHUMMEN (Kepong, *in litt.* 25-3-76) informed me that there is no information regarding its (local) uses in Malaya. He said that one of their officers once got a bad attack of irritation similar to that of *rengas* on his hands by getting into contact with the oil.

Vern. Sumatra: *antubus*, *doubuho*, Tapanuli,

*bajut uding silai*, Simalur, (*kayu*) *tumbus*, E.Coast, *kédawan* = *tong*, Bencoolen, *médang rimooëng*, Atjeh, *tambus*, *tarantang*, W. Coast, *tèrèntang*, *t. putih*, M, *tètang*, Pehal; Malay Peninsula: *napan*, *sèrèntang*, *tèrèntan(g)*, *t. putih*, M; Borneo: *hamtangen*, Sampit, *manlanga*, Dajak & Kedayan, *tapau*, Dajak.

2. *Campnosperma brevipetiolatum* VOLKENS, Bot. Jahrb. 31 (1902) 466; LAUT. Bot. Jahrb. 56 (1920) 359; LANE-POOLE, For. Res. (1925) 106; KANEH. Bot. Mag. Tokyo 45 (1931) 292; Fl. Micron. (1933) 184, f. 75; WALKER, For. Br. Sol. Is. Prot. (1948) 90; KRAEMER, Trees W. Pac. Reg. (1951) 191; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 16, f. 5; WHITMORE, Phil. Trans. R. Soc. Lond. ser. B, 255 (1965) 265; Guide For. Br. Sol. Is. (1966) 34; Gard. Bull. Sing. 22 (1967) 4; VERSTEEGH, Med. Landb. Hogesch. Wageningen 71-19 (1971) 23; HALLÉ, Biotropica 6 (1974) 47, f. 6. — *C. brassii* MERR. & PERRY, J. Arn. Arb. 22 (1941) 535. — Fig. 591-m.

Tree up to 48 m high and 120 (exceptionally to 220) cm Ø. Buttresses absent or up to 2½(-4) m high, 2(-4) m wide, 15(-20) cm thick. Bark grey to cream, smooth but pustularly lenticellate, in large trees often fawn to light brown and scaly, less often shallowly fissured. Young leaves sometimes copper-tinted below, mature foliage green. *Leaves* oblanceolate, 14-56 by 4½-17½ cm (up to 73 by 27 cm on vegetative twigs), densely pubescent on both surfaces when young, usually glabrescent except the basal part; base broadly, gradually decurrent, forming a pair of auricles (sometimes obscure or wanting on leaves of young or fertile twigs) near the insertion; apex obtuse or emarginate, sometimes shortly acuminate; nerves 17-28 pairs, veins reticulate-scalariform, distinct sometimes rather faint on both surfaces; petiole very short. *Panicles* up to 44 cm long, profusely branched, branches up to 19 cm; sometimes with rather simple, short branches and seemingly racemose; bracts triangular, c. 1 mm long; pedicels c. ½ mm. *Flowers* cream-coloured or yellow. *Calyx* lobes triangular, c. ½ mm long. *Petals* broadly ovate, 1-1½ by ¾-1 mm. *Stamens* 2/3-1½ mm; staminodes in ♀ shorter and smaller. *Ovary* subglobose, c. 2/3 mm Ø. *Drupe* subglobose or globose, 5-7 mm Ø, through red to (purplish) black when ripe; septum hollow.

Distri. Micronesia (Caroline Is.: Palau, Kusaie, Yap, Ponape), Melanesia (New Ireland, New Britain, widely distributed in the Solomon Is. and in Santa Cruz Is.), and Malesia: New Guinea (widely distributed), Moluccas (Talaud, Ambon), and Celebes (Malili & Muna I.).

Ecol. Dominant or co-dominant in freshwater (peat- and sago-)swamps to scattered or rare in mixed primary forest on well-drained soils, also in secondary forest; in the Solomon Is. '*Campnosperma*-forest' is also reported from slopes from the lowland up to c. 450 m. *Fl. fr.* Jan.-Dec.

HOSOKAWA has made extensive studies on the important role this species plays in the forests of the Carolines where it can be associated with some other co-dominants (*Pandanus*, *Elaeocarpus*, etc.). See his abundantly illustrated papers in *Vegetatio* 5 (1954) 351-360; *Mem. Fac. Sc. Kyushu Un. E.* 1 (1954) 199-243; *Proc. 8th Pac. Sc. Congr. Manila* 4

(1957) 473-481 dealing with the sociology of these *Campnosperma* forest types.

In the Solomons forests are found which are dominated by one or a few species of big trees such as *C. brevipetiolatum*, *Endospermum medullosum*, and *Gmelina moluccana*. WHITMORE *l.c.* stated that, according to recent studies in timber-felling areas and in natural high forest, "seedlings of these species cannot grow up in shade but come up gregariously and vigorously in clearings".

Uses. The timber is used for making canoes (1, 3, 4). The wood yields *diumu*-oil (Papuan Delta) or *tigaso*-oil (Lake Kutubu), which has some economic significance to the local people and is rubbed on the skin as an antiparasiticum (2, 4, 6, 7); the oil has also been used as medicine for harness sores on horses (5). — References: (1) LANE-POOLE, For. Res. Papua & N. G. (1925) 18; (2) *l.c.* 60 & 106; (3) *l.c.* 62; (4) SALVERDA, Rapport Expl. Z. W. Nieuw Guinea (1937) 18 (as '*C. zauriculatum*'); (5) VAN ROYEN, Man. For. Trees Papua & N. G. (1964) 2; (6) HEGNAUER, Chemotax. Pfl. 3 (1964) 96; (7) PAUMANS & PULLEN, Land Res. Ser. CSIRO 23 (1969) 128.

Vern. Solomon Is.: *ketekete*, Kwara'ae; Santa Cruz Is.: *ngolobis*, Vanikoro. Malesia: New Guinea: *aibekon*, *aibikom*, Biak, *belakwar*, Waskuk, *gral*, Wagu, *inderie*, *inderrie*, Manikiong, *iruba*, Garaina, *kuwar*, Wersar, *kwata*, Lower Sepik, *mongso*, Arfak, *nolie*, Sko, *rie*, Oransbari, *rieuw*, Hattam, *sallam*, Tor, *saram*, Berik, Kw'sten, Tor, *sari*, Wandammen, *saripi*, Samber, *seliek*, *teles*, Mooi, *singawa*, Rabaul, *siluga*, Central Sepik, *siriu*, Amberbaken, *siruga*, Buna, *sriuu*, Sidei, *tjeh*, Asmat, *well*, Wewak; Moluccas: *lakuoëng*, Ambon, *tamiruan'a*, Talaud; Celebes: *dalipo*, Malili.

Note. Detached leaves or those on young (sterile) twigs, without distinct auricles, of the present species are similar to big vegetative leaves of *C. montanum*, and cannot be identified with certainty.

3. *Campnosperma coriaceum* (JACK) HALL. *f. ex* STEEN. Fl. Mal. Bull. n. 3 (1948) 74; KOCHUM. Mal. For. Rec. 17 (1964) 223; SMYTHIES, Common Sarawak Trees (1965) 3; ROBBINS & PULLEN, Land Res. Ser. CSIRO 15 (1965) 108; MEIJER, Bot. News Bull. F. D. Sandakan 8 (1967) 21; DING HOU, Blumea 24 (1978) 5. — *Coelopyrum coriaceum* JACK, Mal. Misc. 2, 7 (1822) 65. — *Buchanania macrophylla* Bl. Mus. Bot. 1 (1850) 185; MIQ. Fl. Ind. Bat. 1, 2 (1859) 637. — *Buchanania racemiflora* MIQ. Sum. (1861) 523. — *C. griffithii* MARCH. Rév. Anacard. (1869) 174; HOOK. f. Fl. Br. Ind. 2 (1876) 41, *quoad typus*; ENGL. in DC. Mon. Phan. 4 (1883) 320, *quoad typus*; KING, J. As. Soc. Beng. 65, ii (1896) 494, *quoad typus*; RIDL. Fl. Mal. Pen. 1 (1922) 534; CORNER, Gard. Bull. S. S. 10 (1939) 254. — *C. macrophylla* HOOK. f. Fl. Br. Ind. 2 (1876) 41; ENGL. in DC. Mon. Phan. 4 (1883) 316; LAUT. Bot. Jahrb. 56 (1920) 359; CORNER, Gard. Bull. S. S. 10 (1939) 254; Ways. Trees (1940) 104; MERR. & PERRY, J. Arn. Arb. 22 (1941) 534; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 167. — *Campnosperma?* sp. RAND & BRASS, Bull. Am. Mus. Nat. Hist. 77 (1940) 370, t. 40, f. 1. — Fig. 59a-g, 62.

Tree(let) up to 40 m high and 90 cm Ø, but usually smaller; occasionally with buttresses up to

$1\frac{3}{4}$  m high,  $\frac{3}{4}$  m wide, 5 cm thick; when growing in swamps often with prop-roots at the base as well as with slender-kneed loop roots or pneumatophores to over 1 m high (fig. 62). Bark grey, ochre, brown, or light red to almost (purplish) black, (smooth or) vertically cracked or closely to distantly fissured, rarely scaly. *Leaves* elliptic, elliptic-oblong, rarely obovate-oblong,  $5\frac{1}{2}$ -40 by  $2\frac{1}{2}$ -19 cm; densely pubescent, sometimes glabrescent beneath, glabrous above; base acute to cuneate; apex obtuse, sometimes emarginate; nerves 10-36 pairs, veins reticulate-scalariform, distinct or sometimes rather faint beneath, faint or obscure above; petiole distinct, 2-8 cm. *Panicles* up to 35 cm long, profusely branched, branches up to 10 cm, sometimes with rather simple, scant, short branches and seemingly racemose; bracts

triangular,  $1-2\frac{1}{2}$  mm long; pedicels very short or obscure. *Flowers* greenish yellow or yellow. *Calyx* lobes slightly triangular,  $\frac{3}{4}$ -1 mm long. *Petals* broadly ovate or ovate, c.  $1\frac{3}{4}$  by  $1-1\frac{1}{2}$  mm. *Stamens*  $1-1\frac{1}{2}$  mm; staminodes in ♀ shorter and smaller. *Disk*  $\frac{3}{4}$ - $1\frac{1}{3}$  mm Ø. *Ovary* subglobose, c.  $\frac{3}{4}$  mm Ø. *Drupe* ovoid, 12-18 by  $8-16\frac{1}{2}$  mm, black when ripe; septum hollow.

*Distr. Malesia:* widely distributed in Sumatra, Lingga, Banka, Malay Peninsula, Borneo, and New Guinea; not yet found in Celebes and the Moluccas.

*Ecol.* Dominant in freshwater (peat-, sago-) swamps to scattered or rare in mixed primary forest on well-drained soils, sometimes in secondary forest, from the lowland up to 500 m, once found at 1000 m (Kalabit Highlands, Sarawak). *Fl. fr.* Jan.-Dec.



Fig. 62. *Camposperma coriaceum* (JACK) HALL. f. ex STEEN. with loop roots at Pontian, Pengkalan Raya, Johore (Photogr. CORNER, 1939).

Uses. ROBBINS & PULLEN *l.c.* recorded *tigaso*-oil for this species (see also *sub C. brevipetiolatum*) which is "traded extensively throughout the Southern Highlands (of Papua New Guinea) to the north as a body oil for 'sing-sing' decoration". It is possible, however, that this record relates to either *C. brevipetiolatum* or *C. montanum*.

Vern. Sumatra: *ambatjang rawang*, W. Coast, *menggajuran*, *tèrèntang*, M, *mèranti ajèr*, Tapanuli, *mèranti lèbar daun*, E. Coast, *tèrèntang-malung*, Banka; Malay Peninsula: *pèlok kèlinting*, *tèrèntang simpoh*, *t. kèlinting*, M; Borneo: *tèrèntang*, Brunei & M; New Guinea: *eem*, Asmat, *kilius*, Amele.

Note. Specimens of the present species can be easily recognized even in sterile condition by the leaves having a distinct (long) petiole, many pairs of patent and straight nerves, and being densely hairy beneath even at old age, only rarely becoming finally glabrescent.

4. *Camposperma squamatum* RIDL. Kew Bull. (1933) 197; SMYTHIES, Common Sarawak Trees (1965) 3; MEIJER, Bot. News Bull. F. D. Sandakan 8 (1967) 21. — *C. auriculata* (non HOOK. *f.*) KING, J. As. Soc. Beng. 65, ii (1896) 495; RIDL, Fl. Mal. Pen. 1 (1922) 534. — *C. minor* CORNER, Gard. Bull. S. S. 10 (1939) 255; Ways, Trees (1940) 104, f. 20. — *C. montana* (non LAUT.) ANDERSON, Gard. Bull. Sing. 20 (1963) 141 & 170; KOCHUM, Mal. For. Rec. 17 (1964) 222. — Fig. 59i.

Tree(let) up to 30 m high and 60 cm Ø. Buttresses occasionally present, narrow, up to 1 m high, rarely stilt roots present. Bark white to grey-brown, smooth or shallowly fissured and/or papery flaky. *Leaves* oblanceolate to spatulate, or elliptic, 6–30(–61) by 2–8(–11) cm, up to by 14 cm on sapling; glabrous, exceptionally pubescent on the lower surface; base decurrent towards near the insertion and ending abruptly (forming amplexicaul auricles on sapling leaves); apex obtuse, sometimes emarginate, very rarely acute or shortly acuminate; nerves 8–21 pairs, veins reticulate or reticulate-scalariform, distinct on both surfaces; petiole very short ( $1/5$ – $3/4$  cm). *Panicles* 4–29 cm long, scantily branched, branches up to 5 cm, sometimes with rather simple, short branches and seemingly racemose; bracts triangular,  $c. 2/3$  mm long; pedicels  $c. 1/3$  mm. *Flowers* light yellow or yellowish green. *Calyx* lobes triangular,  $1/3$ – $3/4$  mm long. *Petals* ovate,  $1 1/3$ –2 by 1– $1 1/2$  mm. *Stamens*  $2/3$ –2 mm; staminodes in ♀ shorter and smaller. *Disk* 1– $1 2/3$  mm Ø. *Ovary* subglobose,  $c. 1$  mm Ø. *Drupe* subglobose, 12–17 by 10–15 mm, green speckled white (? never red) (CORNER, 1940) or dark green (BURKILL 2154); septum hollow.

Distr. *Malesia*: Malay Peninsula (Trengganu, Kelantan, Pahang, Selangor, Johore, Singapore) and Borneo (Sarawak: Kuching, Loba Kabang, Sg. Mas, Baram, Sibul, Bintulu; Sabah: Mt Tavai; Kalimantan: Bulongan, Sampit).

Ecol. Common to rare in lowland (peat-)swamps to mixed primary forest on well-drained soils, also in heath forest, 3–1200 m. *Fl. fr.* Jan.–Dec.

Vern. Malay Peninsula: *tèrèntang*, *t. bukit*, *t. daun kèchil*, M; Borneo: *kayu mansan*, *tèrèntang*, Sarawak.

5. *Camposperma montanum* LAUT. Bot. Jahrb. 56

(1920) 359; MERR. & PERRY, J. Arn. Arb. 22 (1941) 533; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 167; KRAEMER, Trees W. Pac. Reg. (1951) 190, f. 66; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 18; DING HOU, Blumea 24 (1978) 5. — Fig. 59h.

Shrub  $2 1/2$ –4 m high to tree up to 30 m and 60 cm Ø; sometimes slightly buttressed. Bark grey (to light brown), smooth and pustularly lenticellate but also shallowly fissured and/or somewhat scaly. Young foliage pink to red, mature foliage dark green, old leaves withering red. *Leaves* lanceolate, elliptic-lanceolate, or obovate-oblong,  $4 1/2$ –23 by 2–9 cm (up to 64 by  $14 1/2$  cm on vegetative twigs), pubescent on both surfaces at the basal part when young, glabrescent, sometimes almost glabrous; base gradually decurrent towards the insertion, sometimes (obscurely) auriculate on vegetative leaves; nerves 5–12 pairs (up to 24 pairs on vegetative leaves); veins usually reticulate, sometimes reticulate-scalariform, distinct on both surfaces; petiole 0– $1 1/2$  cm. *Panicles* up to 10 cm long, scantily branched, with rather simple, short branches (up to  $3 1/2$  cm long) and seemingly racemose; bracts triangular,  $1/2$ – $3/4$  mm long; pedicels  $2/3$ –1 mm. *Flowers* light yellow or yellow. *Calyx* lobes triangular,  $2/3$ –1 mm long. *Petals* ovate,  $c. 2$  by  $1 1/4$  mm. *Stamens*  $c. 1 1/2$  mm; staminodes in ♀ shorter and smaller. *Disk* 1– $1 1/2$  mm Ø. *Ovary* subglobose,  $c. 3/4$  mm Ø. *Drupe* ovoid or subglobose, 11–15 by 7–11 mm, red to dark red or black when ripe; septum solid.

Distr. *Malesia*: Moluccas (Ternate, Halmaheira, Morotai, Ambon) and New Guinea (West: West-, Hollandia-, and South Division; East: Sepik, Western and Southern Highlands), New Britain (Omoi), and New Ireland.

Ecol. Common to rare in freshwater (*Melaleuca*-, sago-)swamps, seasonally inundated to well drained mixed lowland and submontane forest, *Lithocarpus*-, *Nothofagus*-, and *Agathis*-forest, even in mossy forest; sometimes in secondary forest, on limestone, or shrubby on marshy limestone silt; 0–1500 m. *Fl.* Febr.–Dec.; *fr.* Febr.–Sept.

Uses. DORNSTREICH (*in sched.*) reported that sap from the tree is tapped, used and traded as body and hair oil (see also *sub C. coriaceum*) while leaves are used to pack sago, meat, or fish for cooking on hot stones in earthen ovens.

Vern. Moluccas: *hotong otan*, Ambon; New Guinea: *alep*, Muju, *kaauwe*, Tanah Merah, *ketukar*, Tehid, *kutur*, Mandobo, *sabek*, Mooi, *siemchat*, *siemegat*, Maibrat, *sobrowanye*, *tsobala*, Sepik, su, Kiunga, *tiesenur*, Asmat, *tsesegene*, Kutubu.

Notes. Fruit-like insect galls were observed (BRASS & VERSTEEGH 12541 & BW 6498), which have the floral parts crowned at the top instead of at the base as in a normal fruit.

Young branchlets bear very small leaves and axillary inflorescences resembling much-branched panicles (VAN ROYEN & SLEUMER 5814).

#### Excluded

*Camposperma acutiauris* BOERL. & KOORD. in Koord.-Schum. Syst. Verz. 2 (1910) 32 (type: Sumatra, KOORDERS 20929, BO, L), according to VAN STEENIS (Tectona 22, 1929, 1340) = *Tristania* (*Myrtaceae*). The isotype in Leiden was annotated by him (March 1959) as *Tristania cf. whiteana* GRIFF.



Fig. 63. *Luroschinus papuanus* MIDD. & PERRY. *a*, Habit,  $\times \frac{1}{2}$ , *b*, bud, *c*, LS of  $\delta$  bud, *d*,  $\delta$  flower, calyx lobes and petals removed, *e*, petal, inner surface, all  $\times 7$ , *f*, pistil,  $\times 15$ , *g*, ditto in LS,  $\times 15$ , *h*, fruit,  $\times 3\frac{1}{2}$ , *i*, ditto in LS,  $\times 3\frac{1}{2}$  (*a-e* BRASS 25476, *f-g* HOOGLAND 3375, *h-i* LAE 51313).

## 19. EUROSCHINUS

HOOK. *f.* in B. & H. Gen. Pl. 1 (1862) 422; MARCH. Rév. Anacard. (1869) 59; ENGL. in DC. Mon. Phan. 4 (1883) 321. — **Fig. 63.**

Trees, very rarely shrubs. *Leaves* spiral, paripinnate, petioled. *Leaflets* alternate or subopposite, entire. *Inflorescences* axillary, rarely cauliflorous, sometimes terminal (*extra-Mal. spp.*), paniculate. *Flowers* unisexual or bisexual (plants polygamous). *Calyx* 5-(or 4-)lobed. *Petals* 5 (or 4), imbricate, glabrous. *Stamens* twice the number of petals; filaments subulate, glabrous; anthers basifixed, oblong, reduced or abortive in ♀. *Disk* intrastaminal, shortly cupular in ♂, round and flat in ♀. *Ovary* ovoid, 1-celled and 1-ovuled; style short; stigmas 3; ovary abortive and small in ♂. *Drupe* 1-celled; endocarp crustaceous. *Seed* with testa free from the endocarp; embryo straight, cotyledons free, plano-convex.

Distr. Species 6, four of them in New Caledonia, one in Australia, and one in *Malesia* (New Guinea) and New Britain.

Ecol. In forests from lowland to c. 500 m, sometimes up to c. 1000 m.

Note. The leaves in this genus are invariably paripinnate, the rachis showing a distinct extension above the insertion of the highest leaflet. Fig. 63a. This structure is unique among *Malesian Anacardiaceae*.

**1. *Euroschinus papuanus* MERR. & PERRY, J. Arn. Arb. 29 (1948) 158; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 23, f. 8. — Fig. 63.**

Tree up to 30 m high and 67 cm  $\varnothing$ , very rarely shrubby c. 2 m high (*cf.* CARR 14726, at 1050 m). Buttresses occasionally present up to c. 1½ m high. Bark brownish grey, finely fissured. Twigs sometimes inhabited by ants and hollow. *Leaves* with (3-)5-6(-8) pairs of leaflets; rachis 12-46 cm, petiole 7-26 cm, both tomentose, glabrescent, or glabrous. *Leaflets* coriaceous, elliptic to elliptic-lanceolate or ovate to lanceolate, 4½-23(-32) by 3-9(-15) cm; upper surface glabrous except sometimes tomentose on the midrib; lower surface pubescent (sometimes only on the midrib), glabrescent, or glabrous; base cuneate; apex obtuse or slightly emarginate, rarely abruptly acuminate; nerves 7-19 pairs, veins reticulate-scalariform; petiolules ½-1½ cm. *Panicles* up to 28 cm long, pubescent, glabrescent, branches up to 10 cm long; bracts linear, 1-1¾ mm; pedicels c. ¾ mm. *Flowers* white. *Calyx* lobes triangular, c. ⅔ mm long. *Petals* elliptic, or obovate-oblong, 1½-3¼ by ⅔-1¼ mm. *Stamens* c. 2 mm; anthers ⅔-1 mm, abortive and smaller in ♀. *Disk* c. 1 mm  $\varnothing$ . *Ovary* subglobose, c. ¾ mm  $\varnothing$ , glabrous; style c. ½ mm; stigmas subglobose; ovary abortive and small in ♂. *Drupe* obliquely broad-ellipsoid, ⅔-1 by ½-⅔ cm, blackish purple when ripe, with an excentric scar of the style.

Distr. *Malesia*: New Guinea and neighbouring islands (Hollandia; Sepik, Madang, Morobe, Northern, Central, and Milne Bay Districts; New Britain, Normanby and Misima Is.). Fig. 64.

Ecol. Forests of inundated areas and dryland, up to 540 m, sometimes up to c. 1000 m. *Fl.* March-Sept.; *fr.* March-Oct.

Vern. *Auru, ongoi, Orokaiva, enal, timol, Amele, garuve, Faita, manai, Dumpu, sugun, Bilia, talak, Sko.*

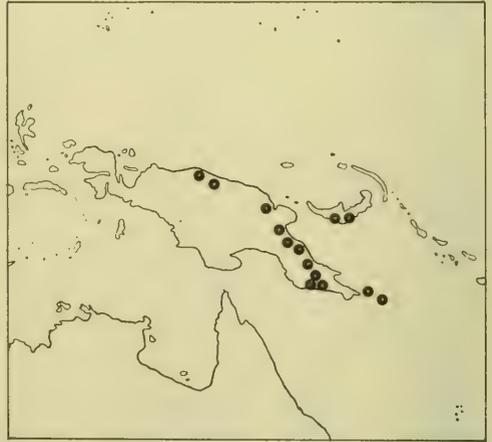


Fig. 64. Localities of *Euroschinus papuanus* MERR. & PERRY.

## 20. RHUS

(TOURNEFORT, Inst. Rei Herb. 1700, 611) LINNÉ, Gen. Pl. ed. 5 (1754) 129; Sp. Pl. 1 (1753) 265; MARCH. Rév. Anacard. (1869) 84 & 179; ENGL. Bot. Jahrb. 1 (1881) 378; in DC. Mon. Phan. 4 (1883) 376; BARKLEY, Ann. Mo. Bot. Gard. 24 (1937)

312; BRIZICKY, J. Arn. Arb. 44 (1963) 62; DING HOU, Blumea 24 (1978) 34. — *Toxicodendron* (TOURNEFORT, Inst. Rei Herb. 1700, 610) MILLER, Gard. Dict. abridged ed. 4 (1754), ed. 8 (1768); BARKLEY, Ann. Mo. Bot. Gard. 24 (1937) 417; GILLIS, Rhodora 73 (1971) 161. — *Melanococca* BL. Mus. Bot. 1 (1850) 236. — *Duckera* BARKLEY, Am. Midl. Nat. 28 (1942) 472, *nom. superfl.* — **Fig. 65–67.**

Erect or scandent shrubs, trees, or lianas, sometimes hemi-epiphytic, mostly deciduous. *Leaves* spiral, imparipinnate, trifoliolate, unifoliolate, rarely simple (*R. borneensis*), petioled; venation (in Mal. *spp.*) not reticulate, no areolae. *Leaflets* usually opposite or subopposite, entire, rarely crenate-dentate; without or with (glabrous pit-like) domatia (fig. 65b–c), or sometimes with a spot-like group of reddish brown papillae or glands (fig. 65h–i) in the axils of the nerves beneath. *Inflorescences* paniculate, rarely racemose and few-flowered, terminal, axillary, sometimes pseudoterminal (then terminal bud of the twig present). *Flowers* unisexual or bisexual (plants dioecious, sometimes polygamous, or polygamodioecious). *Calyx* 5-lobed. *Petals* 5, imbricate, glabrous, rarely hairy on the inner surface. *Stamens* 5; filaments subulate, glabrous; anthers dorsifixed, imperfect or sterile in ♀. *Disk* intrastaminal, discoid, shortly cupular, or round and flat. *Ovary* 1-celled, abortive in ♂; style short, distinct or obscure; stigmas 3, free or united, capitate or obscure. Pistillode in ♂ very small. *Drupe* 1-celled; endocarp coriaceous, crustaceous or bony. *Seed* with the testa adhering to the endocarp or free from it; embryo straight, cotyledons free, flat.

Distr. Widely distributed in the temperate zones of both hemispheres extending in the subtropics and tropics, abundant in seasonal and dry areas, but surprisingly poorly occurring in Australia where it is only represented in Queensland by 2 *spp.*, of which 1 endemic (and a closely related monotypic genus *Rhodospaera*); throughout *Malesia*, also in West Pacific Is.

Since ENGLER (1883) revised the genus it has not been monographed in its entirety. The number of species is difficult to estimate, but will probably run to c. 200.

Ecol. In *Malesia* usually in primary or montane forest, sometimes in savannahs, in mossy and inundated forest, or in secondary forest, from sea-level up to 2400 m.

Several species may occur obviously as hemi-epiphytes, e.g. *R. caudata*, *R. lenticellosa*, *R. linguata*, and *R. nodosa*, similarly as in *Spondias*.

Taxon. Recently two American authors proposed to split the genus. GILLIS *l.c.* recognized again *Toxicodendron* on generic rank with 3 American and 2 Asian *spp.*, but also 1 American–Asian *sp.* BARKLEY *l.c.* (1942) distinguished a genus *Duckera* BARKLEY, which he based on *Rhus sect. Melanocarpeae* ENGL.; but ENGLER had already based this on the genus *Melanococca* BL. 1850, so that *Duckera* is superfluous and illegitimate. It has already been reduced to *Rhus* by BRIZICKY (1963) who is in favour of keeping the genus *Rhus* in the large sense, with which I agree.

The genus has been subdivided into a few subgenera and sections, but I refrain from an opinion as this can only be considered in the scope of an entire revision of the genus.

Phylog. From an elaborate study of the African species DIELS (Bot. Jahrb. 24, 1898, 568–646, 8 fig., t. 14) concluded that *Rhus* has already in the Old Tertiary migrated from India towards Africa, during which extension form development was mostly in the vegetative parts with manifold adaptation to various extra-tropical climatic conditions.

Uses. No uses known of native species. Growing the Sino-japanese lacquer yielding *R. vernicifera* DC. has been unsuccessful (BURKILL) and suggestions to attempt this quite unrealistic (HEYNE).

Note. Among the species are unifoliolate ones. Their leaflet is articulated. *R. borneensis* has, however, really simple leaves lacking any articulation.

#### KEY TO THE SPECIES

1. Leaves simple (not unifoliolate) . . . . . 9. *R. borneensis*
1. Leaves compound; imparipinnate, trifoliolate, or unifoliolate.
  2. Leaflets with glabrous pit-like domatia in the axils between nerves and midrib on the lower surface; apex caudate to linguulate.
    3. Leaflets 13–24 by 5–7½ cm. Branchlets conspicuously lenticellate . . . . . 6. *R. lenticellosa*
    3. Leaflets smaller, 4–10 by 1¼–3¾ cm. Branchlets rather smooth.

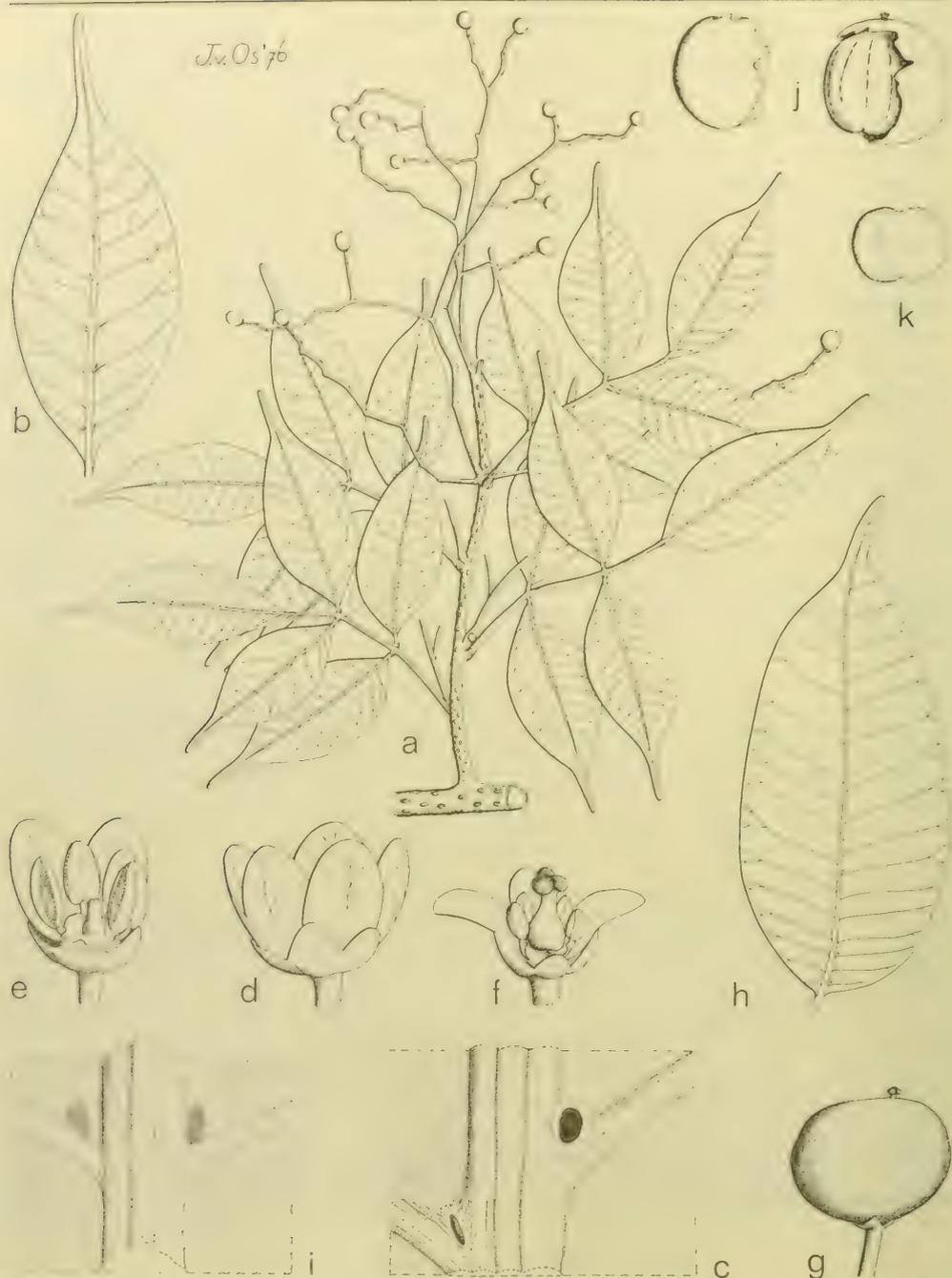


Fig. 65. *Rhus caudata* LAUT. a. Habit,  $\times \frac{1}{2}$ , b. lower surface of leaflet with domatia, nat. size, c. ditto, enlarged,  $\times 15$ , d. ♂ flower, e. ditto, one calyx lobe, 3 petals and 1 stamen removed, f. ♀ flower, 2 petals and 1 stamen removed, all  $\times 7$ , g. fruit,  $\times 3\frac{1}{2}$ . — *R. nodosa* BL. h. Lower leaf surface showing (pseudo-) domatia, groups of glands, nat. size, i. ditto, enlarged,  $\times 15$ . — *R. lamprocarpa* MERR. & PERRY. j. Fruit, with almost half of exocarp broken off showing the seed still enveloped by the mesocarp, k. endocarp, side view, both  $\times 3\frac{1}{2}$  (a-c, g NGF 41529, d-e NGF 39947, h-i S 16547, j-k CLEMENS 8256).

4. Leaves (1-5)(-7)-foliolate, terminal petiolule ( $1\frac{1}{2}$ - $1\frac{3}{4}$ - $2\frac{1}{2}$  cm. Anthers c. 1 mm long. (Pollen grains rather smooth) **7. R. caudata**
4. Leaves unifoliate and or trifoliate, terminal petiolule very short, c.  $\frac{1}{2}$  cm. Anthers c.  $\frac{1}{2}$  mm long. (Pollen grains conspicuously reticulate) **8. R. linguata**
2. Leaflets without glabrous pit-like domatia in the axils between nerves and midrib on the lower surface; apex acute, acuminate, or obtuse.
5. Leaflets crenate-dentate. Petals sparsely pilose on the inner surface. Fruits densely puberulous **1. R. chinensis**
5. Leaflets entire (very rarely some of them irregularly dentate in *R. lamprocarpa*). Petals glabrous (except in *R. taitensis*). Fruits glabrous.
6. Inflorescences terminal, sometimes also with some axillary ones in the leaf axils at the end of twigs, very rarely axillary only. Petals sparsely pilose on the inner surface. Fruits black when ripe **2. R. taitensis**
6. Inflorescences axillary and or pseudoterminal (then terminal bud of the twig present). Petals glabrous. Fruits not black when ripe.
7. Old leaflets pubescent on both surfaces (without a group of reddish brown papillae or glands in the axils between nerves and midrib on the lower surface). Ovary sparsely hairy **5. R. lamprocarpa**
7. Old leaflets almost glabrous on both surfaces. Ovary glabrous.
8. Petals  $1-1\frac{1}{2}$  by  $2\frac{1}{3}$  mm. Leaflets usually with a spot consisting of a group of reddish brown papillae or glands in the axils of the nerves beneath. Small tree or shrub . . . **3. R. succedanea**
8. Petals 2-3 by  $1\frac{1}{4}-1\frac{1}{2}$  mm. Leaflets rarely with papillae or glands as above. Scandent shrub or liana, sometimes small shrub or tree. . . **4. R. nodosa**

**1. *Rhus chinensis*** MILLER, Gard. Dict. ed. 8 (1768) *sub n.* 7; MERR. Contr. Arn. Arb. 8 (1934) 91; Comm. Lour. (1935) 244; TARD. Fl. C. L. & V. 2 (1962) 182. — *R. semialata* MURRAY, Comm. Soc. Goett. 5 (1784) 27, t. 3; DC. Prod. 2 (1825) 67; ENGL. in DC. Mon. Phan. 4 (1883) 380; BACK. Schoofl. (1911) 283; HEYNE, Nutt. Pl. (1927) 979; MERR. J. Arn. Arb. 9 (1928) 3, t. 11. — *R. javanica* (non L.) THUNB. Fl. Jap. (1785) 121; LOUR. Fl. Coch. (1790) 183; CRAIB, Fl. Siam. En. 1 (1926) 342; WALKER, Fl. Okin. & S. Ryu Kyu Is. (1976) 661, f. 103.

Small tree or shrub, 4-12 m high and 6-18 cm Ø. Leaves imparipinnate, with 4-6 pairs of leaflets; rachis 10-30 cm, sometimes winged, petiole 8-11 cm, both tomentose. Leaflets subcoriaceous, ovate-oblong, rarely ovate or lanceolate, 5-15 by  $2\frac{1}{2}$ -8 cm; margin crenate-dentate; lower surface tomentose and also distinctly papillose, without domatia; upper surface tomentose on the midrib, the rest sparsely hairy; base unequal, cuneate, in terminal leaflets sometimes attenuate or decurrent; apex acute or acuminate; nerves 14-20 pairs, veins reticulate-scalariform, distinct below, rather faint above; lateral petiolules 0 or very short, terminal one  $2\frac{1}{2}$ - $3\frac{1}{2}$  cm. Inflorescences paniculate, terminal, very rarely also in one or more leaf axils at the end of a twig, up to 40 cm long, tomentose, branches up to 25 cm; bracts triangular to lanceolate,  $\frac{1}{3}$ -1 mm long; pedicels  $\frac{1}{3}$ - $2\frac{1}{3}$  mm. Flowers white or pale yellow-green. Calyx lobes triangular, c.  $\frac{2}{3}$  mm long. Petals broad-elliptic or oblong,  $2-2\frac{1}{4}$  by  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm, sparsely pilose on the inner surface. Stamens 2 mm; anthers broad-ellipsoid,  $\frac{2}{3}$ - $\frac{3}{4}$  mm long; staminodes in ♀ 1- $1\frac{1}{2}$  mm. Disk discoid or short-cupular, c.  $\frac{3}{4}$  mm Ø. Ovary globose, c.  $\frac{1}{2}$  mm Ø, densely puberulous; pistil-lobes in ♂ c.  $\frac{3}{4}$  mm long. Drupe subglobose, c. 5 mm Ø, densely puberulous; exocarp separating from mesocarp in ripe fruits.

Distr. Widely distributed in temperate and subtropical Asia: India, Burma, Thailand, Laos, Cambodia, Vietnam, China, Taiwan, Ryu Kyu, Japan, and Malesia: Sumatra (Toba Lands, Sibolangit).

Cultivated in Java.

Ecol. In primary and secondary forest and thickets, 900-1200 m; in China (Yunnan) up to 3200 m. Fl. July-Oct.; fr. March, Sept.-Nov.

Uses. Imported galls are in use as medicine (cf. HEYNE, l.c. 979).

Vern. Sumatra: *batu babru*, E. Coast, *kaju bane pora*, k. *pora-pora*, k. *si hurpak*, Lumban Lobu, *martipos*, Toba-Batak.

**2. *Rhus taitensis*** GUILLEMIN, Ann. Sc. Nat. II, 7 (1837) 361; MERR. En. Philip. 2 (1923) 473; KANEH. Bot. Mag. Tokyo 45 (1931) 292; Fl. Micron. (1933) 185, f. 76; CHRISTOPHERSEN, Bull. Bish. Mus. 128 (1935) 127; MERR. & PERRY, J. Arn. Arb. 22 (1941) 536; ROYEN, Man. For. Trees Papua & N. G. 4 (1964) 36, f. 13; BACK. & BAKH. f. Fl. Java 2 (1965) 153. — *Melanococca tomentosa* BL. Mus. Bot. 1 (1850) 236; Miq. Fl. Ind. Bat. 1, 2 (1859) 674. — *R. simarubaefolia* A. GRAY, U.S. Expl. Exp. (1856) 367, t. 44; ENGL. in DC. Mon. Phan. 4 (1883) 450, *incl. var. taitensis* (GUILLEMIN) ENGL.; VIDAL, Phan. Cuming. (1885) 105; Rev. Pl. Vasc. Filip. (1886) 99; LANE-POOLE, For. Res. (1925) 107. — *Otonychium retusum* Miq. Fl. Ind. Bat. 1, 2 (1859) 572, *sub Sapindaceae*; cf. DING HOU, Blumea 24 (1978) 34. — *R. rufa* T. & B. Nat. Tijd. N. I. 27 (1863) 52; ADELB. Blumea 6 (1948) 326. — *R. panaciformis* F.v.M. Fragm. 7 (1869) 22. — *R. retusa* ZOLL. ex (T. & B. Cat. Hort. Bog. 1866, 230, *nomen*) ENGL. in DC. Mon. Phan. 4 (1883) 450, *nom. illeg.*, *incl. var. blumei* ENGL.; K. & V. Bijdr. 4 (1896) 119; KOORD. Minah. (1898) 412, *incl. var. rufa* (T. & B.) K. & V.; BACK. Schoofl. (1911) 282; LAUT. Bot. Jahrb. 56 (1920) 362; C. T. WHITE, J. Arn. Arb. 10 (1929) 235; GUILLAUMIN, *ibid.* 12 (1931) 242; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 169. — *R. engleriana* WARB. Bot. Jahrb. 13 (1891) 363. — *Duckera taitensis* (GUILLEMIN) BARKLEY, Lilloa 23 (1950) 253.

Tree up to 30 m high and 70 cm Ø. Buttresses sometimes present,  $\frac{1}{2}$ - $1\frac{1}{2}$  m high, 1-3 m wide, 5-10 cm thick. Bark grey-brown or brown, smooth to rough, finely superficially fissured. Leaves

imparipinnate, (7-)13-15(-21)-foliolate; rachis 20-50 cm, petiole 8-15 cm, both puberulous or tomentose. *Leaflets* chartaceous to subcoriaceous, elliptic to elliptic-lanceolate or ovate to lanceolate, 4-20 by 1½-6½(-8½) cm, entire; without domatia; puberulous especially on the midrib, nerves and veins below, sometimes also on the upper surface especially on midrib and nerves; base slightly unequal, obtuse or slightly cuneate; apex acute, acuminate, or obtuse; nerves 9-16 pairs; veins reticulate, some  $\pm$  perpendicular to the nerves, faint on both surfaces, sometimes distinct below; lateral petiolules c. ½ cm, terminal one up to 3 cm. *Inflorescences* paniculate, terminal, sometimes also with some axillary ones in the leaf axils at the end of twigs, very rarely axillary only, up to 30 cm long, puberulous to tomentose, branches up to 26 cm; bracts triangular to linear, ⅓-1 mm long; pedicels very short, c. ⅓ mm. *Flowers* cream white, rarely pink. *Calyx* lobes slightly triangular, 1-1½ mm long. *Petals* ovate to ovate-oblong, sometimes broad-elliptic, 1¾-2 by 1-1¼ mm, sparsely pilose on the inner surface. *Stamens* 1-2¾ mm; anthers broad-ovoid, c. ¾ mm long; staminodes in ♀ c. ½ mm. *Disk* discoid, ⅔-1¼ mm Ø. *Ovary* subglobose, c. 1 mm Ø, papillose; pistillode in ♂ c. ⅔ mm long. *Drupe* subglobose, 4-8 mm Ø, black when ripe, exocarp not separating from the mesocarp in ripe fruits.

*Distr.* Polynesia (Tahiti, Niue Is., Fiji), Micronesia (Palau, Yap, Ponape), Solomon Is., Australia (Queensland: Rockingham Bay), New Britain to Malesia. In *Malesia* widely distributed in East Java (Besuki), Lesser Sunda Is. (Flores, Sumba, Alor, Wetar, Timor, Tanimbar), Philippines (Bohol I., Mindanao), Celebes (Minahassa), Moluccas (Talaud, Ternate, Ceram, Key Is.), and New Guinea. Fig. 66.

Cultivated in Hort. Bog. sub III-E-50, VI-B-19, VI-B-76. In West Java near Bogor escaped from the Botanic Garden.

*Ecol.* Primary, dryland rain-forest, also in inundated forest along rivers, sometimes in clearings, secondary forest, or savannahs, rarely in forest on ultra-basic rock or on limestone; from sea-level up to 1950 m. *Fl. fr.* Febr.-Dec.

*Vern.* Fiji: *manawi*; Solomon Is.: *akwasi*, Kwara'ae, *panasihu*, Bougainville. Java: *ki mējan*, Bogor, *tjēmbawak*, *tombawa*, J; Lesser Sunda Is.: *dwa puē*, *kaingait*, Tanimbar, *enggo*, Sumbawa, *goré*, *kare*, Flores, *wala*, Sumba; Moluccas: *nanitu*, Talaud, *njego*, Ternate; New Guinea: *ba*, Amele, *baib*, Karkar I., *bas*, Utu, *jiem*, *djiem*, Kebar lang., *elna*, Melpa, *eluwa*, Hagen, *eruget*, Rai Coast, *fore*, Onjob, *gerum*, Maibrat lang., *gjēwo*, *upit utsju*, Papuan, *ibaamkatgat*, *juarambruum*, Kemtuk, *kie-em*, Mooi lang., *kwaia*, Minufia, *mo*, Karoon lang., *ono*, Waria, *orena*, Laruni, *pajungbulung*, Doromena lang., *priejij*, Hattam lang., *sika*, Rawa, *samuwin*, Biak lang., *sietseka*, *siska*, Manikiong lang., *tabilemabo*, Kutubu lang.

*Notes.* For unknown reasons the name *R. retusa* ZOLL. remained for a long time a *nom. in sched.* ENGLER's acceptance of it was illegitimate by mentioning the earlier *R. rufa* in the synonymy.

*Otonychium retusum* MIQ. was based on an anonymous ♂ flowering specimen from Java, which MIQUEL referred to a Sapindaceous genus. RADLKOEFER correctly referred this to *Rhus* (Sapind. Holl.-Ind. 1877, 14; Pf. R. Heft. 98, 1934, 1462). A specimen named by MIQUEL could not be traced in BO, L, and U. At Leiden there is one specimen named *R. retusa* ZOLL. in BLUME's handwriting to which MIQUEL noted that it did not belong to that order (*i.e.* *Anacardiaceae*) with reference to his Fl. Ind. Bat.

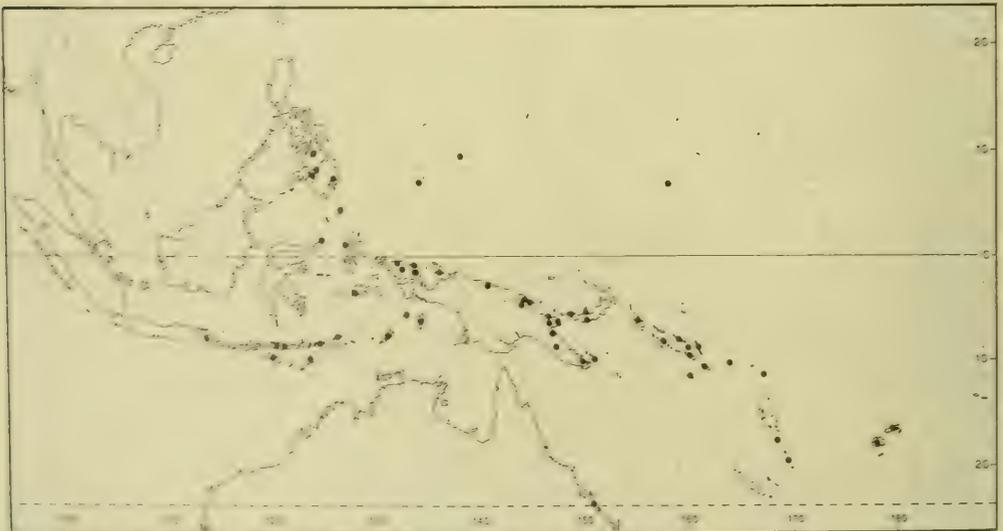


Fig. 66. Localities of *Rhus taitensis* GUILLEMIN (locality in Tahiti not drawn).

3. *Rhus succedanea* LINNÉ, Mant. 2 (1771) 221; WIGHT, Ic. 2 (1842) t. 560; HASSK. Flora 25 (1842) Beibl. ii: 45, incl. var. *discolor* HASSK.; *ibid.* 27 (1844) 618; HOOK. f. Fl. Br. Ind. 2 (1876) 12; ENGL. in DC. Mon. Phan. 4 (1883) 399; BACK. Schoolfl. (1911) 283; CRAIB, Fl. Siam. En. 1 (1926) 342; BURK. Diet. (1935) 1905; LIU, Ill. Pl. Taiwan 2 (1962) 940, f. 775; LI, Woody Fl. Taiwan (1963) 449, f. 174; BACK. & BAKH. f. Fl. Java 2 (1965) 154; WALKER, Fl. Okin. & S. Ryu Kyu Is. (1976) 660, f. 102. — *R. pubigera* BL. Bijdr. (1826) 1165. — *Toxicodendron succedanea* MOLDENKE, Phytologia 2 (1946) 142; TARD. Fl. C. L. & V. 2 (1962) 185, t. 16, f. 1-4.

Small tree or shrub up to 7 m high, rarely up to 15 m high and 50 cm  $\varnothing$ . Leaves imparipinnate, with (2-)3-4(-6) pairs of leaflets; rachis ( $1\frac{1}{2}$ -)8-27 cm, petiole 4-6 cm, both slightly puberulous, or glabrous. Leaflets membranous to chartaceous, lanceolate, elliptic-lanceolate, rarely linear,  $3\frac{1}{4}$ -8 by  $1\frac{1}{4}$ - $2\frac{1}{2}$  cm, entire, glabrous above, on the lower surface sparsely pubescent especially on the midrib and nerves, glabrescent, almost glabrous when old, usually with a group of reddish brown papillae or glands in the axils of the nerves; base obliquely cuneate, sometimes obtuse, in terminal leaflet rarely decurrent; apex acuminate; nerves 10-30 pairs, veins reticulate, rather faint on both surfaces; lateral petiolules  $\frac{1}{10}$ - $\frac{1}{5}$ (- $\frac{1}{2}$ ) cm, terminal one  $\frac{1}{2}$ - $1\frac{1}{2}$  cm. Inflorescences paniculate, axillary, up to 24 cm long, sparsely puberulous, glabrescent, branches up to 10 cm; bracts triangular, c.  $\frac{1}{3}$  mm long; pedicels ( $1\frac{1}{2}$ -)2-3 mm.

Flowers cream white. Calyx lobes triangular,  $\frac{1}{2}$ - $\frac{2}{3}$  mm long. Petals ovate or slightly oblong,  $1-1\frac{1}{2}$  by  $\frac{2}{3}$  mm (recorded 2-5 mm long by BACKER & BAKH. f. l.c.), glabrous. Stamens  $1\frac{1}{2}$ - $2\frac{1}{2}$  mm; anthers broad-ovoid,  $\frac{2}{3}$ -1 mm long, rarely abortive. Disk slightly discoid, c.  $\frac{3}{4}$  mm  $\varnothing$ . Ovary subglobose, c.  $\frac{2}{3}$  mm  $\varnothing$ , glabrous, rarely abortive. Drupe subglobose, 5-8 mm  $\varnothing$ , dull yellowish when ripe; exocarp separating from mesocarp in ripe fruits.

Distr. India, Burma, Thailand, Laos, Cambodia, Vietnam, China (also Hongkong & Hainan), Japan, Ryu Kyu Is., Taiwan, and Malesia: N. Sumatra (Atjeh: Gajo Lands, Mt Losir; West Coast: Mt Sago), 2 collections.

In Java formerly rarely cultivated; Cult. Hort. Bog. sub. n. XV-J-B-XXX-9, 9a, from Java.

Ecol. Open slopes or by streams in montane forest, 900-2200 m. Fl. April; fr. Aug.

Note. In collecting this species in the Gajo Lands Dr & Mrs DE WILDE and their companions suffered from a badly swollen face, ears, and hands, accompanied by bad itching; they did not get blisters!

4. *Rhus nodosa* BL. Bijdr. (1826) 1164; BACK. Schoolfl. (1911) 283; BACK. & BAKH. f. Fl. Java 2 (1965) 153. — *R. perakensis* SCORT. ex King, J. As. Soc. Beng. 65, ii (1896) 500; RIDL. Kew Bull. (1933) 193. — *Toxicodendron nodosum* GILLIS, Rhodora 73 (1971) 168, f. 26 & 28. — Fig. 65h-i, 67.

Scandent shrub, or liana, up to 15 m high, sometimes small shrub or tree,  $1\frac{1}{2}$ -9 m high.



Fig. 67. *Rhus nodosa* BL. at Kuching (Photogr. DING HOU).

*Leaves* copper-red when young, imparipinnate, with (1-)2-3(-5) pairs of leaflets; rachis 4-10 cm, petiole 4<sup>1</sup>/<sub>2</sub>-6 cm, both glabrous. *Leaflets* subcoriaceous, ovate, elliptic, or elliptic-lanceolate, 4-15 by 1<sup>3</sup>/<sub>4</sub>-6 cm, entire; lower surface sparsely puberulous when young, glabrescent, almost glabrous when old, rarely with a group of reddish brown papillae or glands in the axils of the nerves; upper surface glabrous; base cuneate or attenuate, sometimes obtuse, terminal one decurrent; apex acuminate; nerves 12-23 pairs, veins reticulate, rather faint on both surfaces, sometimes distinct beneath; lateral petiolules 0-<sup>3</sup>/<sub>4</sub> cm, of terminal leaflet 0-2<sup>1</sup>/<sub>4</sub> cm. *Inflorescences* paniculate, axillary or pseudoterminal, up to 40 cm long, sparsely puberulous, glabrescent, or glabrous, branches up to 7<sup>1</sup>/<sub>2</sub> cm; bracts triangular, <sup>1</sup>/<sub>3</sub>-<sup>1</sup>/<sub>2</sub> mm long; pedicels <sup>1</sup>/<sub>2</sub>-2 mm. *Flowers* cream, light or yellowish green. *Calyx* lobes triangular, <sup>2</sup>/<sub>3</sub>-<sup>3</sup>/<sub>4</sub> mm long. *Petals* ovate or elliptic, 2-3 by 1<sup>1</sup>/<sub>4</sub>-1<sup>1</sup>/<sub>2</sub> mm, glabrous. *Stamens* 1<sup>1</sup>/<sub>2</sub>-2 mm; anthers ovoid, c. 1 mm long; staminodes in ♀ c. 1 mm. *Disk* discoid, 1-1<sup>1</sup>/<sub>4</sub> mm Ø. *Ovary* subglobose, c. 1 mm Ø, glabrous; pistillode in ♂ c. <sup>3</sup>/<sub>4</sub> mm long. *Drupe* subglobose, subreniform, 5-7 by 5-8 mm, colour variable, in shades of red to buff; exocarp separating from mesocarp in ripe fruits.

*Distr. Malesia:* Malay Peninsula, Sumatra (Bencoolen: Batang Baru; West Coast: G. Talang), Java (Nirmala, Bogor, Bangas, G. Batu, G. Tjikoraj, G. Sembung, Tjidadap, Pekalongan), Borneo (Sarawak: Mt Hose, Long Kapa, Kalabit Highlands, Kuching, Baram, Bau; Kalimantan: E. Kutai), and SW. Celebes (Makale, Makassar).

*Ecol.* Primary forest, open rocky jungle, on river-banks, in ravines, in disturbed vegetation at margins of peat-swamp forest, sometimes on limestone ridges, from the lowland up to 1400 m. *Fl.* July-Nov.; *fr.* March, June-Nov.

From the variation in habit one might conclude that this species is sometimes a hemi-epiphyte.

*Vern.* Sumatra: *kalodan*, G. Talang, *sitakan nan djantèn*, M; Java: *tébél katjè*, S.

**5. *Rhus lamprocarpa* MERR. & PERRY, J. Arn. Arb. 29 (1948) 159. — Fig. 65j-k.**

Tree up to 15 m high and 27 cm Ø, once recorded 45-50 cm Ø. Bark light grey, grey-brown, deeply fissured and ridged. *Leaves* imparipinnate, with 3-4(-5) pairs of leaflets; rachis 5-11<sup>1</sup>/<sub>2</sub> cm, petiole 3-6 cm, both pubescent. *Leaflets* chartaceous to subcoriaceous, elliptic- or ovate-oblong, 4<sup>1</sup>/<sub>2</sub>-13 by 2<sup>1</sup>/<sub>2</sub>-5<sup>1</sup>/<sub>2</sub> cm, entire, very rarely some of them irregularly dentate; lower surface rather more densely pubescent than the upper surface, especially on the midrib, nerves, and veins, without a group of reddish brown papillae or glands in the axils between nerves and midrib; nerves 10-16 pairs; veins reticulate, distinct below, obscure above; base obliquely rounded or slightly cuneate; apex acute or acuminate; lateral petiolules <sup>1</sup>/<sub>3</sub>-<sup>3</sup>/<sub>4</sub> cm, terminal one <sup>1</sup>/<sub>2</sub>-1<sup>1</sup>/<sub>2</sub> cm. *Inflorescences* paniculate, axillary, sometimes pseudo-terminal, up to 15 cm long, puberulous, glabrescent, branches up to 5 cm; bracts lanceolate, <sup>1</sup>/<sub>3</sub>-1 mm long; pedicels c. 1 mm. *Flowers* cream white. *Calyx* lobes triangular, c. 1 mm long. *Petals* oblong or oblong-elliptic, 2-2<sup>1</sup>/<sub>4</sub> by 1-1<sup>1</sup>/<sub>4</sub> mm, glabrous. *Stamens* 1<sup>1</sup>/<sub>2</sub> mm; anthers ovoid, 1-1<sup>1</sup>/<sub>4</sub> mm long; stami-

nodes in ♀ c. 1 mm. *Disk* round and flat or discoid, c. 1<sup>1</sup>/<sub>4</sub> mm Ø. *Ovary* subglobose, c. <sup>2</sup>/<sub>3</sub> mm, sparsely hairy; pistillode in ♂ c. <sup>1</sup>/<sub>2</sub> mm long. *Drupe* subglobose, c. 5 mm Ø, glabrous, pale brown to bronze when ripe, exocarp separating from mesocarp in ripe fruits.

*Distr. Malesia:* New Guinea (Morobe and E. Highlands Distr.).

*Ecol.* Open grassy hills, hill scrub-forest, and forest along river-banks, 240-1800 m. *Fl.* Aug.-Jan.; *fr.* June.

*Vern.* *Vaka-ono*, *valoi-patep*, *wolo*, Morobe Distr.

**6. *Rhus lenticellosa* LAUT. Nova Guinea 8 (1910) 297; Bot. Jahrb. 56 (1920) 361, incl. var. *pentaphylla* LAUT. et var. *monophylla* LAUT.**

Shrub 5 m high, or liana up to 30 m high. *Leaves* unifoliolate or with 1-2 pairs of leaflets, glabrous; rachis, if present, up to 5 cm; petiole 4-7 cm. *Leaflets* chartaceous to subcoriaceous, ovate- or elliptic-oblong, or lanceolate, 13-24 by 5-7<sup>1</sup>/<sub>2</sub> cm, entire, with glabrous pit-like domatia; base cuneate; apex caudate to linguulate, acumen up to 1<sup>1</sup>/<sub>2</sub>(-2) cm; nerves 15-21 pairs, veins reticulate, faint or distinct on both surfaces; lateral petiolules c. <sup>1</sup>/<sub>2</sub> cm, terminal one up to 4 cm. *Inflorescences* paniculate, axillary or pseudo-terminal, up to 38 cm long, glabrous, branches up to 8 cm; bracts triangular, c. <sup>1</sup>/<sub>2</sub> mm long; pedicels 1<sup>1</sup>/<sub>2</sub>-2 mm. *Flowers* yellowish green or yellowish. *Calyx* lobes triangular, c. <sup>1</sup>/<sub>2</sub> mm long. *Petals* elliptic, 2-2<sup>1</sup>/<sub>2</sub> by 1-1<sup>1</sup>/<sub>2</sub> mm, glabrous. *Stamens* c. 1<sup>1</sup>/<sub>2</sub> mm; anthers ovoid, c. <sup>3</sup>/<sub>4</sub> mm long; staminodes in ♀ c. 1 mm. *Disk* discoid, 1-1<sup>1</sup>/<sub>4</sub> mm Ø. *Ovary* globose, c. <sup>2</sup>/<sub>3</sub> mm Ø, glabrous; pistillode in ♂ c. <sup>2</sup>/<sub>3</sub> mm long. *Drupe* subglobose, c. 5 by 7 mm, brownish, red-brown or red-black when ripe; exocarp separating from mesocarp in ripe fruits.

*Distr. Malesia:* New Guinea (Siriwo R., Lorentz R., Sepik Distr., and Southern Highlands Distr.).

*Ecol.* Primary forest, sometimes in sago swamps or on river-banks, 200-800 m. *Fl.* May, July-Nov.; *fr.* June, Sept., Oct.

The variation in habit leads to the assumption that this species may occur as a hemi-epiphyte.

*Vern.* *Pfenegabe*, Kutubu.

Note. The leaves of JACOBS 9263 from the Southern Highlands Distr., Papua New Guinea, are all 1-foliolate, while in other collections of this species such leaves were always found together with the 3- and/or 5-foliolate ones.

**7. *Rhus caudata* LAUT. Bot. Jahrb. 56 (1920) 362. — Fig. 65a-g.**

Epiphytic shrub or small tree, 4-8 m high, or a liana. *Leaves* with 2(-3) pairs of leaflets, rarely 1-foliolate, glabrous; rachis 2<sup>1</sup>/<sub>2</sub>-6 cm, petiole 2-3<sup>1</sup>/<sub>2</sub> cm. *Leaflets* chartaceous, elliptic, or elliptic-lanceolate, 5-9 by 2-3<sup>3</sup>/<sub>4</sub> cm, entire, with glabrous pit-like domatia; base acute or cuneate; apex caudate to linguulate, acumen 1-1<sup>3</sup>/<sub>4</sub> cm long; nerves 8-15 pairs, veins reticulate, distinct below, obscure above; lateral petiolules <sup>1</sup>/<sub>5</sub>-<sup>3</sup>/<sub>4</sub> cm, terminal one (<sup>1</sup>/<sub>2</sub>-)1<sup>3</sup>/<sub>4</sub>-2<sup>1</sup>/<sub>2</sub> cm. *Inflorescences* paniculate, axillary, sometimes pseudo-terminal, up to 17 cm long, sparsely puberulous, glabrescent, branches up to 9 cm; bracts ovate, <sup>1</sup>/<sub>3</sub>-<sup>2</sup>/<sub>3</sub> mm long; pedicels

$1\frac{1}{2}$ - $4\frac{1}{2}$  mm. *Flowers* yellowish. *Calyx* lobes triangular,  $\frac{2}{3}$ -1 mm long. *Petals* elliptic, rarely obovate or ovate,  $2$ - $2\frac{3}{4}$  by  $1$ - $1\frac{3}{4}$  mm, glabrous. *Stamens*  $1\frac{1}{2}$ -2 mm; anthers ovoid, c. 1 mm long; staminodes in ♀  $\frac{1}{3}$ - $\frac{3}{4}$  mm. *Disk* discoid,  $\frac{2}{3}$ - $1\frac{1}{4}$  mm Ø. *Ovary* subglobose, c.  $\frac{2}{3}$  mm Ø, glabrous; pistillode in ♂ c.  $\frac{1}{2}$  mm long. *Drupe* subglobose, c. 7 mm Ø, deep red; exocarp separating from mesocarp in ripe fruits.

Distr. *Malesia*: New Guinea (West: Biak I., Apalapsilli; East: Sepik, Western and Southern Highlands Districts).

Ecol. Mossy montane forest with many epiphytes, in forest dominated by *Podocarpus* or *Nothofagus*, or in mixed forest, 900-2400 m, once found on wet coastal coral limestone ridge at 10 m (Biak I.). *Fl.* March, Aug.-Dec.; *fr.* Aug., Oct., Dec.

This species may obviously occur as a hemiepiphyte.

Vern. *Pukhabou*, Southern Highlands Distr.

**8. *Rhus linguata* SLIS**, Nova Guinea 14 (1924) 97; FORMAN, Kew Bull. 19 (1965) 419. — *Perrottetia caudata* RIDL. Trans. Linn. Soc. Bot. II, 9 (1916) 31, non *Rhus caudata* LAUT.

Shrub  $2\frac{1}{2}$  m, sometimes epiphytic. *Leaves* 1-foliolate and/or 3-foliolate; petiole  $1\frac{1}{2}$ -3 cm, sparsely puberulous, glabrescent. *Leaflets* subcoriaceous, elliptic to narrowly elliptic, 4-10 by  $1\frac{1}{4}$ - $3\frac{1}{2}$  cm, entire, glabrous, rarely sparsely puberulous on the midrib beneath, with glabrous pit-like domatia; base cuneate to attenuate; apex caudate to lingulate, acuminate  $1\frac{1}{4}$ -2 cm long; nerves 10-17 pairs, veins reticulate, faint or obscure on both surfaces; petiolules very short, c.  $\frac{1}{5}$  cm. *Inflorescences* axillary, paniculate, rarely racemose and few-flowered,  $2\frac{1}{2}$ -11 cm long, glabrous, branches up to 3(-6) cm; bracts ovate, c.  $\frac{2}{3}$  mm long; pedicels 4-5 mm. *Flowers* cream colored. *Calyx* lobes triangular,  $\frac{1}{2}$ - $\frac{3}{4}$  mm long. *Petals* elliptic,  $1\frac{1}{2}$ -2 by 1 mm, glabrous. *Stamens* c. 1 mm; anthers ovoid, c.  $\frac{1}{2}$  mm long; staminodes in ♀ c.  $\frac{1}{2}$  mm. *Disk* shortly cupular, c. 1 mm Ø. *Ovary* subglobose, c.  $\frac{1}{2}$  mm Ø, glabrous; pistillode in ♂ c.  $\frac{1}{2}$  mm long. *Drupe* (young) subglobose, 3 by 4 mm, purple-red.

Distr. *Malesia*: West New Guinea (Wissel Lakes, Mt Helwig, Perameles Bivouac and Utakwa R. region).

Ecol. Forest, 1100-1770 m. *Fl.* May, Nov.-Dec.; *fr.* May.

Vern. *Jejawor*, Kapauku lang.

**9. *Rhus borneensis* STAPP**, Trans. Linn. Soc. Bot. II, 4 (1894) 142; MERR. En. Born. (1921) 351. — *Toxicodendron borneense* GILLIS, *Rhodora* 73 (1971) 164, f. 25 & 26.

Shrub or small tree up to 3 m high. *Leaves* simple (not unifoliolate), subcoriaceous, obovate to oblanceolate, or elliptic,  $3\frac{3}{4}$ -16 by  $2$ - $6\frac{1}{2}$  cm, entire, glabrous, rarely sparsely puberulous on both surfaces; sometimes with a group of reddish brown papillae or glands in the axils between nerves and midrib beneath; base cuneate or attenuate; apex acuminate, slightly acute, sometimes mucronate, or rarely obtuse; nerves 10-22 pairs, veins  $\pm$  perpendicular to the nerves, rather faint on both surfaces; petiole  $0$ - $\frac{1}{2}$  cm. *Inflorescences* axillary, paniculate, up to 14 cm long, puberulous, glabrescent, branches up to 4 cm; bracts triangular to lanceolate,  $1\frac{1}{4}$ -2 mm long; pedicels  $1\frac{1}{2}$ -3 mm. *Calyx* lobes triangular,  $\frac{2}{3}$  mm long. *Petals* elliptic,  $2$ - $2\frac{3}{4}$  by  $1$ - $1\frac{1}{2}$  mm, glabrous. *Stamens* c.  $1\frac{1}{2}$  mm; anthers ovoid, c. 1 mm long; staminodes in ♀  $\frac{3}{4}$ -1 mm. *Disk* flat and round, c. 1 mm Ø. *Pistil* c.  $1\frac{1}{2}$  mm long. *Ovary* ovoid, c. 1 mm Ø, glabrous; pistillode in ♂ c.  $\frac{2}{3}$  mm long. *Drupe* (young) subglobose, 5-7 mm Ø.

Distr. *Malesia*: Borneo (Sabah: Mt Kinabalu; Sarawak: Kalabit Highlands, Bario; Kalimantan: Peak of Balikpapan).

Ecol. Primary and mossy forest, sometimes on sandstone, 1200-2000 m. *Fl.* April-June; *fr.* June-Aug.

#### Cultivated

***Rhus verniciflua* STOKES**, Bot. Mat. Med. 2 (1812) 164. — *R. vernicifera* DC. Prod. 2 (1825) 68; K. & V. Bijdr. 4 (1896) 121; BACK. Schoolfl. (1911) 283; HEYNE, Nutt. Pl. (1927) 979, was formerly introduced from Japan in the Botanic Gardens at Bogor and Tjibodas and may occur cultivated.

#### Excluded

*Rhus densiflora* BL., nom. in sched. ex Java (L.), served as the type of *Schmidelia mutabilis* BL. Rumphia 3 (1843) 140; *Allophylus mutabilis* (BL.) BOERL. is according to LEENHOUTS, Blumea 15 (1967) 341 = *Allophylus cobbe* (L.) RAEUSCHL. (Sapindaceae).

*Rhus javanica* LINNÉ, Sp. Pl. (1753) 265, is according to MERRILL, J. Arn. Arb. 9 (1928) 3, pl. 10 = *Brucea javanica* (L.) MERR. (*Simaroubaceae*).

## 21. PARISHIA

HOOK. f. Trans. Linn. Soc. 23 (1860) 169; Fl. Br. Ind. 2 (1876) 29; ENGL. in DC. Mon. Phan. 4 (1863) 308; CORNER, Ways. Trees (1940) 112. — *Astronium* JACQ. sect. *Parishia* (HOOK. f.) MARCH. Rév. Anacard. (1869) 177. — Fig. 68.

(Deciduous) Trees. *Leaves* spiral, imparipinnate, petioled. *Leaflets* subopposite or opposite, entire, mostly with internodal veins. *Inflorescences* paniculate, axillary and/or terminal. *Flowers* unisexual (plants dioecious). *Calyx* 4-lobed, greatly enlarged in fruit. *Petals* 4, imbricate, glabrous or sparsely hairy on the outer sur-

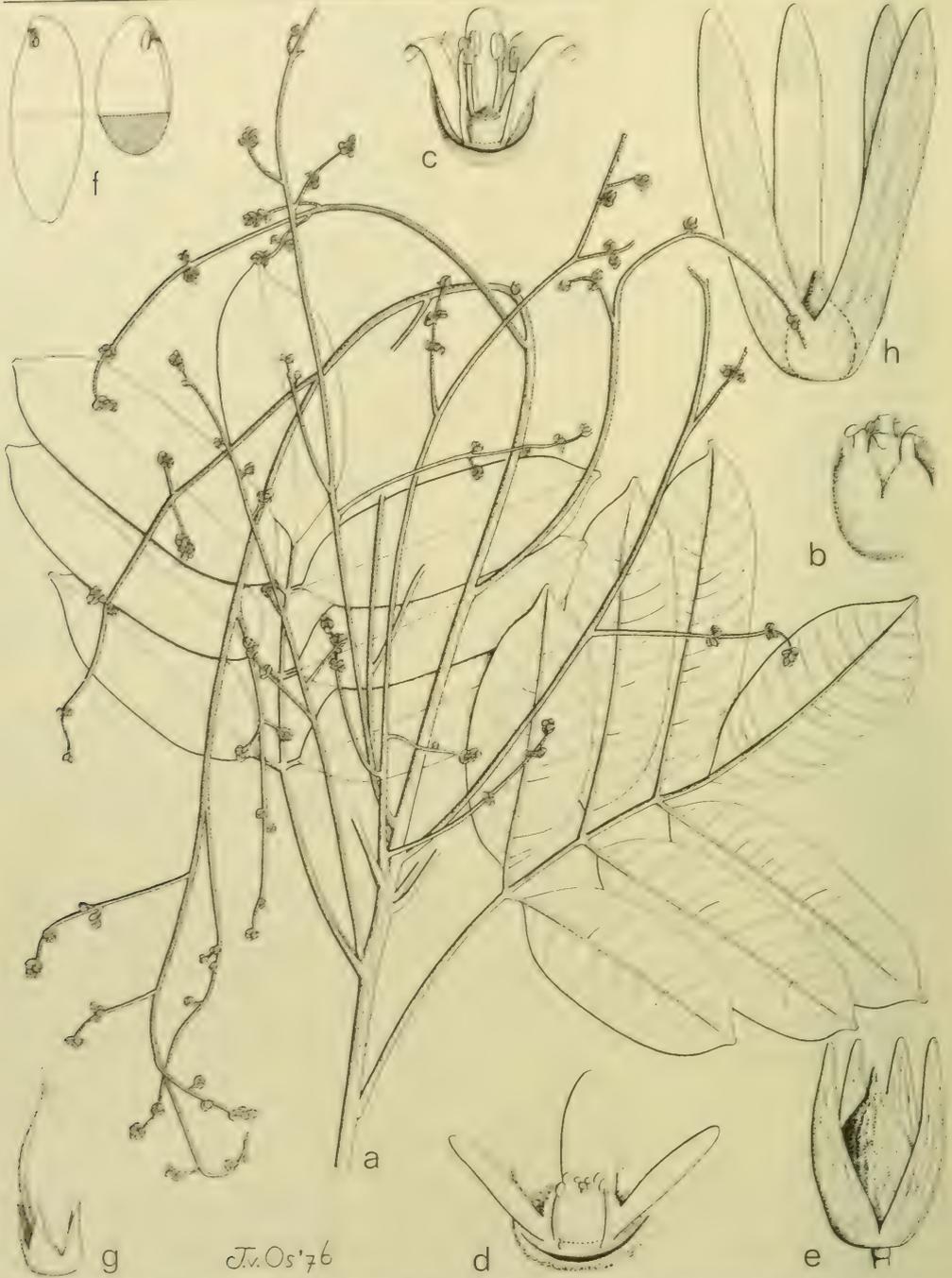


Fig. 68. *Parishia paucijuga* ENGL. a. Habit,  $\times \frac{1}{2}$ , b.  $\sigma$  flower, c. ditto, 2 calyx lobes and 1 petal removed, d.  $\pi$  flower, 2 calyx lobes and 1 petal removed, all  $\times 3\frac{1}{2}$ , e. fruit with enlarged calyx lobes,  $\times \frac{1}{2}$ , f. embryo, opened, 1 cotyledon cut halfway to show its CS, nat. size. — *P. sericea* RIDL. g. Fruit with enlarged calyx lobes,  $\times \frac{1}{2}$ . — *P. maingayi* HOOK. f. h. Fruit with enlarged calyx lobes,  $\times \frac{1}{2}$  (a KEP 105198, b-c KEP 7914, d KEP 105018, e-f RIDLEY 6720, g S 15817, h CF 1137).

face. *Stamens* 4, filaments long, often thin, glabrous; anthers usually ovoid, rarely oblong, dorsifixed or dorso-basifixed, abortive in ♀. *Disk* intrastaminal, hairy, round or slightly 4-angular, flat or discoid, 4-notched or -lobed; or pulvinate and 4-grooved. *Ovary* 1-celled, densely hairy; style 3-(rarely 4-)lobed; stigmas 3 (rarely 4). Sterile pistil in ♂ very small. *Drupe* 1-celled, densely brown hairy; subtended by the enlarged calyx, the 4 lobes wing-like; endocarp cartilaginous. *Seed* with testa adhering to the endocarp; embryo straight, cotyledons free, plano-convex.

Distr. Species 5, in the Andaman Is., Burma, Thailand, and *Malesia*: Sumatra, Malay Peninsula, Borneo, and the Philippines.

Ecol. Usually in dryland forest, also on inundated river-banks and in freshwater swamps, in the lowland, rarely higher from 600-1450 m.

Vern. Malaysian standard timber name: *lelayang*.

Notes. CORNER (*l.c.*) stated under *Parishia*: "It seems that all Malayan species are deciduous and flower before or with the new leaves. *P. insignis*, however, (like *Firmiana*) matures even its fruits while the crown is bare of leaves".

Among Malesian *Anacardiaceae*, *Parishia* is the only genus in which the fruit is subtended by the much enlarged, wing-like calyx. From the material examined, it appears that after fertilization the increase in size of the calyx takes place much more rapidly than the development of fruit.

The shape, texture, size, indumentum, etc. of the leaflets are very variable in this genus. Specimens consisting of sterile material, young bare infructescences or ♀ inflorescences, or detached young fruits are very difficult to name with certainty.

#### KEY TO THE SPECIES

##### Based on flowering material

1. Leaflets with symmetric base; petiolules grooved or the margins incurved above. Petals obovate to oblanceolate, oblong, or narrowly oblong, 3-8 by 1-2 mm. Anthers dorsifixed.
  2. Leaflets 4-12 pairs, coriaceous, nerves 14-20 pairs.
    3. Stamens inserted in the grooves at the lower half of the disk . . . . . 1. *P. maingayi*
    3. Stamens inserted at the base of the disk . . . . . 2. *P. sericea*
  2. Leaflets usually 2-3 pairs, thin-coriaceous, nerves 9-11 pairs . . . . . 3. *P. paucijuga*
1. Leaflets usually with asymmetric or oblique base; petiolules, if present, flat or convex above. Petals broadly ovate, ovate-oblong, or elliptic to elliptic-oblong, 3-5 by 1½-3 mm. Anthers dorso-basifixed.
  4. Flowers distinctly pedicelled, pedicels 2-5(-7) mm. Calyx lobes 2/3 or more the length of the calyx . . . . . 4. *P. insignis*
  4. Flowers subsessile. Calyx lobes c. 1/3 the length of the calyx . . . . . 5. *P. malabog*

#### KEY TO THE SPECIES

##### Based on fruiting material

1. Mature fruits ellipsoid, 4-6 cm long, longer or as long as the enlarged calyx; wing-like calyx lobes 2-5 cm long.
  2. Enlarged calyx slightly shorter than or as long as the fruit, tube c. 1/2 cm long, lobes narrowly oblong, 3½-5 by 1/2-1¼ cm. Leaflets 5-7; nerves 9-11 pairs . . . . . 3. *P. paucijuga*
  2. Enlarged calyx much shorter than the fruit, tube c. 3/4 cm long, lobes oblong or lanceolate, 2-3 by 1/2-1 cm. Leaflets 9-11(-15); nerves 14-20 pairs . . . . . 2. *P. sericea*
1. Mature fruits ovoid or subglobose, 1½-2½ cm long, several times shorter than the enlarged calyx; wing-like calyx lobes 5½-10½(-16) cm long.
  3. Leaflets with symmetric base; petiolules grooved or the margins incurved above. Enlarged calyx tube on fruit 1½-2¾ cm long . . . . . 1. *P. maingayi*
  3. Leaflets with usually asymmetric or oblique base; petiolules, if present, flat or convex above.
    4. Fruits distinctly 1/2-1½ cm pedicelled; enlarged calyx tube c. 1/2 cm long. Leaflets sparsely puberulous to rusty-pubescent beneath . . . . . 4. *P. insignis*
    4. Fruits subsessile; enlarged calyx tube c. 1½ cm long. Leaflets glabrous . . . . . 5. *P. malabog*

1. *Parishia maingayi* HOOK. f. Fl. Br. Ind. 2 (1876) 30; ENGL. in DC. Mon. Phan. 4 (1883) 310; KING, J. As. Soc. Beng. 65, ii (1896) 493; RIDL. Fl. Mal. Pen. 1 (1922) 535; CORNER, Ways. Trees (1940) 112; MERR. J. Arn. Arb. 35 (1954) 140; KOCHUM. Mal. For. Rec. 17 (1964) 323. — *P. oblongifolia*

MERR. Philip. J. Sc. 14 (1919) 413; EN. Philip. 2 (1923) 473. — *P. elmeri* MERR. Pl. Elm. Born. (1929) 168. — *P. polycarpa* RIDL. Kew Bull. (1933) 200. — *P. minor* RIDL. *l.c.* 201 — Fig. 68h. Tree up to 40(-55) m high and 84(-93) cm Ø. Bark cracked or fissured. Buttresses up to 1½ m

high,  $1\frac{1}{4}$  m extending outward from the trunk, and 15 cm thick. *Leaves* with (4-7)-12 pairs of leaflets; petiole, rachis and petiolules puberulous, sometimes glabrescent. *Leaflets* coriaceous, shining and glabrous above, sometimes puberulous or pubescent beneath, lanceolate, elliptic, or ovate-oblong, 3-17 (-28 $\frac{1}{2}$ ) by  $1\frac{3}{4}$ -7 $\frac{1}{2}$ (-8) cm; basesymmetric, cuneate or rounded; apex acuminate; nerves 15-20 pairs, slightly elevated or distinct below, visible above; veins reticulate, distinct or visible below, obscure above; petiolules grooved or the margins incurved above, lateral ones  $\frac{1}{3}$ - $\frac{3}{4}$  cm, terminal one up to  $2\frac{1}{4}$  cm. *Panicles* up to 50 cm long, rusty-pubescent; branches up to 20 cm; bracts ovate, 2-3 $\frac{1}{2}$  mm long, puberulous outside, sometimes also towards the base inside; pedicels ( $\frac{1}{2}$ -)1 $\frac{1}{2}$ -3 mm. *Flowers* white. *Calyx* 2 $\frac{1}{4}$ -6 mm long, densely appressed-hairy on both surfaces; lobes triangular, unequal,  $\frac{1}{3}$ -2 mm long. *Petals* oblanceolate, or narrowly oblong, 5-8 by 1-2 mm, sometimes sparsely hairy on the outer surface. *Stamens* 3 $\frac{1}{2}$ -4 mm, inserted in the grooves at the lower half of the disk; anthers ovoid, c. 1 mm long; sterile stamens in ♀ c. 2 mm. *Disk* pulvinate and 4-grooved, c.  $1\frac{1}{4}$  mm Ø in ♂; fleshy and discoid, c. 2 $\frac{1}{2}$  mm Ø in ♀. *Ovary* conical, c.  $1\frac{1}{2}$  mm Ø; style c. 1 mm; stigmas capitate. *Drupe* ovoid or broad-ellipsoid,  $1\frac{1}{2}$ -2 $\frac{1}{2}$  by 1-1 $\frac{1}{2}$  cm, apical part gradually narrowed into a beak; enlarged calyx pubescent on both surfaces, tube  $1\frac{1}{2}$ -2 $\frac{3}{4}$  cm long, lobes (or wings, red when fresh) narrowly oblong, 6-10 $\frac{1}{2}$ (-16) by 1-1 $\frac{1}{2}$ (-2 $\frac{1}{4}$ ) cm. *Seed* subglobose,  $\frac{3}{4}$ -1 $\frac{1}{4}$  cm Ø.

*Distr. Malesia:* Sumatra (Atjeh, Tapanuli, East Coast, Indragiri, Palembang), Malay Peninsula (Perak, Pahang, Singapore), Borneo (Sarawak: Kuching, Mt Santubong, Bau, Miri, Bintulu, Bergark, Lundu, Laba Kabang; Brunei; Sabah: Sepilok, Sandakan, Lahad Datu, Mt Silan, Sipitang, Beaufort, Tawao, Tenom, Mt Kinabalu; Kalimantan: Melawi, Mempawah, E. Kutai, Tarakan I., Nunukan I.), and Philippines (Panay, Sibuyan).

*Ecol.* Dryland, also mixed dipterocarp forest, on inundated river-banks and in freshwater swamp sometimes on limestone or ultrabasic soil, in the lowland, rarely higher, from 600-1450 m (Mt Kinabalu). *Fl. fr.* Jan.-Nov.

*Vern.* Sumatra: *bulu, parak, tapah*, Palembang, *surèn*, East Coast, *sèpol*, M; Borneo: *layang-layang, mimpas onggit*, Sabah, *keramu*, M, *lampong*, Brunei, *nyatoh pipit, pokuok, rēngas susu, upie, upi kēranges, upi payi*, Sarawak; Philippines: *bulábog*, P.Bis.

## 2. *Parishia sericea* RIDL. Kew Bull. (1933) 201. — Fig. 68g.

Tree up to 25 m high and 40 cm Ø. Bark scaly. Buttresses occasionally present, up to  $1\frac{1}{2}$  m high,  $1\frac{1}{2}$  m extending outward and 10 cm thick. *Leaves* with 4-5(-7) pairs of leaflets; petiole, rachis and petiolules puberulous, sometimes glabrescent. *Leaflets* coriaceous, shining and glabrous above except sometimes sparsely puberulous on the midrib towards the base, pubescent and glabrescent beneath; ovate-oblong, ovate, lanceolate, sometimes elliptic-oblong or obovate-oblong, 6 $\frac{1}{2}$ -17 by 3 $\frac{1}{4}$ -6 $\frac{1}{2}$  cm; base symmetric, obtuse or rounded; apex acute to acuminate; nerves 14-20 pairs, elevated and prominent below, visible or obscure

above; veins loosely reticulate, faint or obscure on both surfaces; petiolules grooved or the margins incurved above, lateral ones  $\frac{3}{4}$ -1 cm, terminal one  $1\frac{1}{4}$ -4 cm. *Panicles* up to 44 cm long, densely pubescent, loosely branched, branches up to 14 cm long; bracts ovate to lanceolate, c. 2 mm long, densely puberulous outside, glabrous inside; pedicels 0- $\frac{3}{4}$  mm. *Calyx* 3 mm long, hairy on both surfaces; lobes triangular, c.  $1\frac{1}{2}$  mm long. *Petals* oblanceolate, glabrous, 5 by  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm. *Stamens* c. 3 mm, inserted at the base of the disk; anthers ovoid, c.  $\frac{2}{3}$  mm long. *Disk* pulvinate and 4-grooved,  $1\frac{1}{2}$ -1 $\frac{3}{4}$  mm Ø. ♀ Flowers not seen. *Drupe* ± ellipsoid, 5-5 $\frac{3}{4}$  by  $1\frac{1}{4}$  cm; apex acuminate; enlarged calyx brown or dark brown hairy on both surfaces, tube c.  $\frac{3}{4}$  cm long, lobes oblong or lanceolate, 2-3 by  $1\frac{1}{2}$ -1 cm. *Seed* ellipsoid, c. 3 by  $1\frac{1}{2}$  cm.

*Distr. Malesia:* Borneo (Sarawak: Kuching, Bintulu; Sabah: Lahad Datu, Ranau).

*Ecol.* Lowland forest, sometimes in ultrabasic areas, and once at 750 m. *Fl.* Febr.; *fr.* Dec.

*Vern.* *Layang layang*, Lahad Datu.

## 3. *Parishia paucijuga* ENGL. in DC. Mon. Phan. 4 (1883) 309, t. 10, f. 25-27; RIDL. Fl. Mal. Pen. 1 (1922) 536; CORNER, Ways. Trees (1940) 113, f. 23 (right); KOCHUM. Mal. For. Rec. 17 (1964) 324. — Fig. 68a-f.

Tree up to 30 m high and 60 cm Ø. Bark fissured, sometimes flaky. Buttresses occasionally present. Young parts puberulous or pubescent, sometimes glabrescent. *Leaves* usually with 2-3 pairs of leaflets; petiole, rachis and petiolules puberulous, sometimes glabrescent. *Leaflets* thin-coriaceous, shining and glabrous above, glabrous or sparsely puberulous beneath; elliptic, lanceolate, rarely obovate-oblong, 5-13 $\frac{1}{2}$  by  $1\frac{1}{2}$ -6 $\frac{1}{2}$  cm; base symmetric, cuneate; apex short-acuminate; nerves 9-11 pairs, distinct or faint on both surfaces; veins finely reticulate, distinct below, visible or obscure above; petiolules grooved or the margins incurved above, lateral ones  $\frac{1}{2}$ -1 cm, terminal one  $1\frac{1}{2}$ -2 $\frac{1}{2}$  cm. *Panicles* up to 55 cm long, pubescent, loosely branched, branches up to 25 cm; bracts triangular, 2-5 mm long, usually densely hairy outside and slightly hairy inside; pedicels 0- $\frac{2}{3}$  mm. *Flowers* white. *Calyx* 3-4 $\frac{1}{2}$  mm long, densely hairy on both surfaces; lobes triangular, 2-3 mm long. *Petals* obovate-oblong or oblong, 3-6 by  $1\frac{1}{2}$ -2 mm, sometimes sparsely hairy outside. *Stamens* inserted at the base of the disk, 3-3 $\frac{1}{2}$  mm; anthers oblong,  $\frac{3}{4}$ -1 mm long; sterile stamens in ♀ c. 2 mm. *Disk* pulvinate and 4-grooved in ♂,  $1\frac{3}{4}$ -2 mm Ø; discoid in ♀,  $2\frac{1}{2}$ -3 mm Ø. *Ovary* conical, c. 2 mm Ø; style c.  $1\frac{3}{4}$  mm; stigmas capitate. *Drupe* ellipsoid, 4-6 by 2 cm; apex attenuate, sometimes beak-like; enlarged calyx pubescent on both surfaces, tube c.  $\frac{1}{2}$  cm long, lobes (or wings) narrowly oblong,  $3\frac{1}{2}$ -5 by  $1\frac{1}{2}$ -1 $\frac{1}{4}$  cm. *Seed* ellipsoid,  $1\frac{3}{4}$ -3 by 1-1 $\frac{1}{2}$  cm.

*Distr. Malesia:* Sumatra (Tapanuli), Malay Peninsula (Dindings, Malacca, Johore, Penang, Singapore), and Borneo (Sarawak: Lundu; Brunei).

*Ecol.* Lowland forest, sometimes in swamp forest, up to 200 m. *Fl.* March-April; *fr.* Febr.-March, July-Nov.

*Vern.* *Sèpul*, M; Sumatra: *barat daja*, Batak; Borneo: *semèmdoh*, Brunei.

4. *Parishia insignis* HOOK. f. Trans. Linn. Soc. 23 (1860) 170, t. 26; Fl. Br. Ind. 2 (1876) 30; ENGL. in DC. Mon. Phan. 4 (1883) 309, t. 10, f. 21-24, *incl. var. andamensis* ENGL.; King, J. As. Soc. Beng. 65, ii (1896) 492, *incl. var. pubescens* KING *et var. tomentosa* KING; RIDL. J. Str. Br. R. As. Soc. n. 59 (1911) 91; Fl. Mal. Pen. 1 (1922) 536; PARKINSON, For. Fl. Andaman Is. (1923) 142; BURK. Dict. (1935) 1668; CORNER, Ways. Trees (1940) 112, f. 23 (left); KOCHUM. Mal. For. Rec. 17 (1964) 324. — *Astronium insigne* MARCH. Rév. Anacard. (1869) 177. — *P. pubescens* HOOK. f. Fl. Br. Ind. 2 (1876) 30; ENGL. in DC. Mon. Phan. 4 (1883) 310; KING, J. As. Soc. Beng. 65, ii (1896) 493; RIDL. Fl. Mal. Pen. 1 (1922) 535; CORNER, Ways. Trees (1940) 113; KOCHUM. Mal. For. Rec. 17 (1964) 323. — *P. rosea* RIDL. J. Str. Br. R. As. Soc. n. 59 (1911) 90; Fl. Mal. Pen. 1 (1922) 536. — *P. borneensis* RIDL. Kew Bull. (1933) 200. — *P. lowei* RIDL. l.c. 201.

Tall tree, up to 50 m high and 70 cm Ø. Bark shallowly fissured, finely cracked. Buttresses up to 4 m high, c. 2 m extending outward from the trunk. Young parts rusty-pubescent. *Leaves* with 4-6 pairs of leaflets; petiole, rachis, and petiolules sparsely puberulous to rusty-pubescent or tomentose, sometimes glabrescent. *Leaflets* thinly coriaceous, sparsely puberulous to rusty-pubescent or tomentose, sometimes glabrescent except on the midrib and nerves on both surfaces; ovate-oblong to lanceolate, elliptic, rarely ovate,  $4\frac{1}{2}$ -15 by 3-7 cm; base asymmetric or oblique, rounded, obtuse, cuneate, or subcordate; apex acute to acuminate; nerves 4-9 pairs, elevated beneath, visible above; veins reticulate-scalariform or reticulate, distinct or visible on both surfaces; petiolules, if present, flat or convex above, lateral ones up to  $\frac{1}{2}$  cm, the terminal one 1-3 $\frac{1}{4}$  cm. *Panicles* up to 54 cm long, rusty-pubescent or tomentose, much branched, branches up to 19 cm; bracts triangular, lanceolate or narrowly elliptic,  $2\frac{3}{4}$ -3 $\frac{1}{2}$  mm long, puberulous outside, glabrous inside; pedicels 2-5(-7) mm. *Calyx*  $2\frac{1}{2}$ -4 $\frac{1}{2}$  mm long, puberulous on both surfaces; lobes triangular, unequal, 2-3 mm long. *Petals* broad-ovate to ovate-oblong, or elliptic, 3-5 by  $1\frac{3}{4}$ -3 mm, sometimes slightly hairy outside. *Stamens*  $2\frac{1}{2}$ -4 mm; anthers ovoid, c.  $\frac{3}{4}$  mm long; sterile stamens in ♀ c.  $1\frac{1}{2}$  mm. *Disk* fleshy, flat, round or slightly 4-angular, or discoid, hairy, 2-2 $\frac{3}{4}$  mm Ø. *Ovary* conical, c.  $1\frac{1}{2}$  mm Ø; style  $1\frac{1}{2}$  mm; stigmas capitate. *Drupe* subglobose, 1-1 $\frac{1}{2}$  by  $\frac{3}{4}$ -1 $\frac{1}{4}$  cm, apiculate or beaked; enlarged calyx sparsely puberulous, tube c.  $\frac{1}{2}$  cm long, lobes (or wings) narrowly oblong, 7-8 $\frac{1}{2}$  (-12 $\frac{1}{2}$ ) by  $\frac{3}{4}$ -1 $\frac{1}{2}$  cm. *Seed* broad ellipsoid or subglobose, c.  $\frac{3}{4}$  by  $\frac{1}{2}$  cm.

Distr. Andaman Is., Burma (Mergui), Thailand (Kaw Pipi, Bachaw, Satul, Kao Taknam, Telo Udang, Panji I.), and *Malesia*: Sumatra (East Coast, Djambi, Indragiri, Palembang), Malay Peninsula (Kedah, Kelantan, Perak, Pahang, Johore, Langkawi, Penang, Malacca, Singapore), and Borneo (Sarawak: Kuching, Betong, Simangayan, Bintulu, Triso Peninsula; Brunei; Sabah: Sandakan, Sipitang, Lahad Datu; Kalimantan:

Palo, Gontranah, Tg. Kimarun, Berouw, Kutai, Balikpapan).

Ecol. Dryland forest in the lowland, occasionally in inundated places or in peat-swamps, rarely on limestone (Langkawi), up to 280 m. Fl. Jan.-May, Sept. -Nov.; fr. Jan., March-July, Nov.

Its leaves turn red, then fall, and after this it flowers (BURKILL).

Uses. BURKILL l.c. gave some remarks on the timber, which is very light.

Vern. Sumatra: *balām tēmbaga*, *kaju sēpa*, *spah bēngkarung*, *surian rimbo*, Palembang, *bochalang*, *ipah bēngkarung*, *peonggai*, *sombē*, M; Malay Peninsula: *kayu poutianak*, Johore, *sapoi*, *sēpui*, *sēpul*, Perak, *sēpul*, *suryan*, M; Borneo: *babigurus*, M, *gansiung buhis*, Dajak, *haram*, *kēmbajau*, Palo, *lomu kujang*, SE. Borneo, *mēdang sorukan*, Tenggara, *upi paya*, Sarawak.

5. *Parishia malabog* MERR. Philip. J. Sc. 7 (1912) Bot. 281; En. Philip. 2 (1923) 472; J. Arn. Arb. 35 (1954) 140; AIRY SHAW & FORMAN, Kew Bull. 21 (1967) 19. — *Spondias romblonensis* ELMER, Leaf. Philip. Bot. 10 (1939) 3683, *descr. angl.*

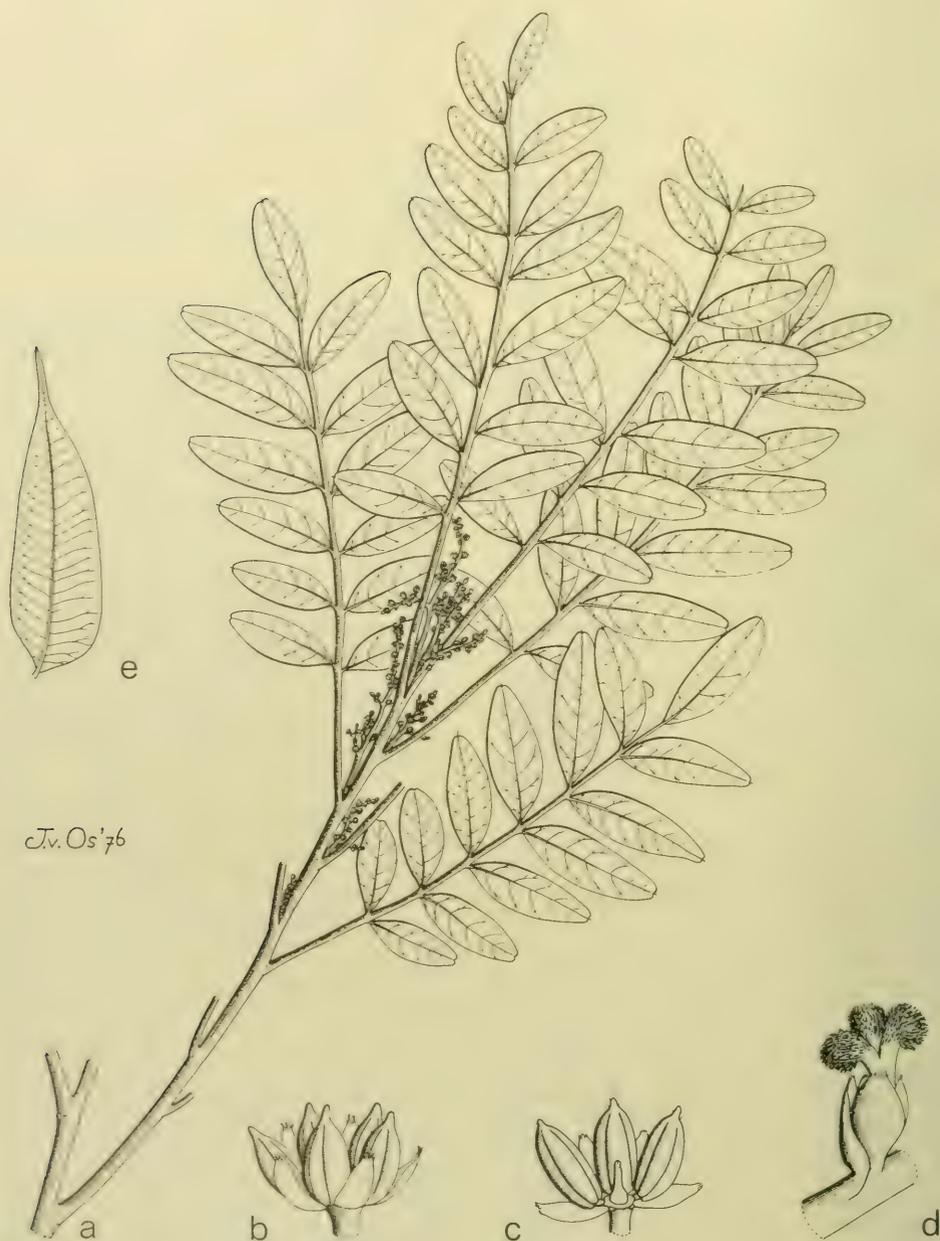
Tree up to 25 m high and 60 cm Ø. *Leaves* with 4-7 pairs of leaflets, glabrous. *Leaflets* coriaceous, ovate-oblong to lanceolate, sometimes broadly ovate, 5-16 by  $1\frac{1}{2}$ -8 cm; base asymmetric or oblique, obtuse, subcordate, or cuneate; apex acuminate; nerves 5-14 pairs, slightly elevated below, distinct above; veins reticulate, distinct on both surfaces; petiolules flat or convex above, lateral ones  $\frac{1}{3}$ -1 $\frac{3}{4}$  cm, terminal one up to  $2\frac{1}{2}$  cm. *Panicles* up to 35 cm long, slightly puberulous, glabrescent; branches up to 8 cm; bracts suborbicular, c.  $\frac{1}{3}$  mm long, puberulous outside, glabrous inside. *Flowers* subsessile, pinkish. *Calyx* c.  $1\frac{1}{2}$  mm long, sparsely puberulous, sometimes almost glabrous, on both surfaces; lobes rounded, c.  $\frac{1}{3}$  mm long. *Petals* elliptic to elliptic-oblong, 3-4 by  $1\frac{1}{2}$  mm, glabrous. *Stamens* inserted at the outer margin of the disk,  $2\frac{1}{2}$ -3 mm; anthers ovoid, c. 1 mm long; sterile stamens in ♀ c. 2 mm. *Disk* flat and slightly 4-angular, 1-1 $\frac{3}{4}$  mm wide. *Ovary* ovoid, c.  $1\frac{1}{2}$  mm Ø; style c. 1 mm; stigmas capitate. *Drupe* (MERRILL) ovoid, c. 2 cm long, enlarged calyx sparsely puberulous or almost glabrous on both surfaces, reddish when young and brownish when ripe; tube c.  $1\frac{1}{2}$  cm long; lobes (or wings) narrowly oblong,  $5\frac{1}{2}$ -10 by  $\frac{3}{4}$ -1 $\frac{1}{2}$  cm. *Seed* not seen.

Distr. *Malesia*: Philippines (Luzon: Dingalan Bay, Bosoboso, Zambales, Tayabas; Ticao, Masbate, Cebu, Negros, Mindoro, Sibuyan, Romblon, Tablas, Sibutu).

Ecol. Forested slopes or rocky hills at low altitude, and on rocky cliffs near the seashore; common on Ticao I. (MERRILL). Fl. Febr.-March; fr. March.

Uses. The timber is not in general use; in Masbate, Philippines, it is recorded for making canoes (MERRILL).

Vern. *Bitkan*, Tag., *bulābog*, Sul., P.Bis., *kupang-kupang*, *malābog*, *malābol*, *mallbog*, *mulābu*, P.Bis., *mulābug*, C.Bis.



J.v. Os'76

Fig. 69. *Pistacia malayana* HENDERSON. *a*. Habit, nat. size, *b*. ♂ flower, *c*. ditto, 1 perianth lobe and 2 stamens removed, *d*. ♀ flower, all  $\times 15$ . — *P. chinensis* BUNGE. *e*. Leaflet,  $\times \frac{1}{2}$  (*a-c* SF 34398, *d* SF 23831, *e* STEWARD & CHEO 443).

## 22. PISTACIA

LINNÉ, Gen. Pl. ed. 5 (1754) 452; Sp. Pl. (1753) 1025; HOOK. *f.* in B. & H. Gen. Pl. 1 (1862) 419; MARCH. Rév. Anacard. (1869) 96 & 184; ENGL. in DC. Mon. Phan. 4 (1883) 284. — **Fig. 69.**

Trees or shrubs. *Leaves* spiral, imparipinnate, pseudo-paripinnate, or paripinnate, (rarely 3- or uni-foliolate in *extra-Mal. spp.*), petioled. *Leaflets* opposite, subopposite, or alternate, entire. *Inflorescences* axillary and/or terminal, racemose and/or paniculate. *Flowers* unisexual (plants dioecious). *Tepals* free, 2–5. *Stamens* 3–5 in ♂, 0 in ♀; filaments short, glabrous; anthers basifixed, ellipsoid or ovoid. *Disk* minute or 0. *Ovary* subglobose, 1-celled; style short; stigmas 3, capitate or spatulate, spreading. Sterile pistil in ♂ 0 or minute. *Drupe* 1-celled; stone bony, smooth. *Seed* with testa free from the endocarp; embryo straight, cotyledons free, plano-convex.

Distr. Species *c.* 9, disjunctly distributed in the Mediterranean region, Canary Is., W., S. & E. Asia, North America (Texas, U.S.A.), and Central America (Mexico); 2 *spp.* in *Malesia*: Malay Peninsula and Philippines.

Notes. The perianth in this genus is unique in the family, consisting only of free, thin and narrow segments which could either be named tepals or calyx lobes. Some botanists suggested that they are of bracteal nature and that the flowers would properly be naked, *e.g.* H. F. COPELAND (Phytomorph. 5, 1955, 440). In the ♂ flowers they alternate with the stamens which rather defeats this idea.

Recently GRUNDWAG (Bot. J. Linn. Soc. 73, 1976, 355–370) published observations on embryology and fruit development in 4 *spp.*

## KEY TO THE SPECIES

1. Apex of leaflets retuse or slightly emarginate. Leaflets obovate, elliptic, or rarely ovate-oblong,  $2\frac{3}{4}$ – $3\frac{1}{2}$  by 1– $1\frac{1}{2}$  cm . . . . . **1. *P. malayana***  
 1. Apex of leaflets acuminate. Leaflets lanceolate, 4–8 by 1– $2\frac{1}{2}$  cm . . . . . **2. *P. chinensis***

**1. *Pistacia malayana*** HENDERSON, Gard. Bull. S. S. 7 (1933) 97, t. 19; J. Mal. Br. R. As. Soc. 17 (1939) 23, 42. — **Fig. 69a–d.**

Tree up to 6 m tall and 19 cm Ø. Bark white, scaly. *Leaves* with 7–8 pairs of leaflets (terminal leaflet very small or obscure), 9–11 cm long; rachis and petiole sparsely puberulous, glabrescent; petiole 1–2 cm. *Leaflets* sessile or subsessile, rarely alternate, chartaceous, obovate, elliptic, or rarely ovate-oblong,  $2\frac{3}{4}$ – $3\frac{1}{2}$  by 1– $1\frac{1}{2}$  cm, glabrous; base cuneate; apex retuse or slightly emarginate, with a minute mucro in the notch; nerves 7–9 pairs, faint, veins obscure. *Inflorescences* paniculate, up to 7 cm long, sparsely puberulous, glabrescent; bracts ovate,  $\frac{2}{3}$ –1 mm long; pedicels  $\frac{1}{2}$ – $1\frac{1}{2}$  mm. *Flowers* red. *Tepals* 4–5, ovate,  $\frac{1}{2}$ –1 mm long, short-fringed at the acute apex. *Stamens* 3–5; filaments very short; anthers ellipsoid, 1– $1\frac{1}{4}$  mm, slightly apiculate. *Disk* minute, flat in ♂, 0 in ♀. *Ovary* ellipsoid, *c.*  $\frac{2}{3}$  mm Ø; style  $\frac{1}{2}$  mm long; stigmas  $\frac{1}{2}$  mm long. Sterile pistil in ♂  $\frac{2}{3}$  mm long. *Drupe* obliquely subglobose, *c.*  $\frac{1}{2}$  cm Ø, slightly compressed.

Distr. *Malesia*: Malay Peninsula (Perak, Pahang, and Selangor).

Ecol. On limestone, 150–350 m. *Fl.* June, Nov.; *fr.* June.

**2. *Pistacia chinensis*** BUNGE, En. Pl. China Bor. (1833) 15; Mém. Ac. Imp. Sc. St. Pétersb. 2 (1835) 89; TURCZ. Bull. Soc. Nat. Mosc. 10 (1837) 150;

HANCE, J. Linn. Soc. 13 (1873) 77; ENGL. in DC. Mon. Phan. 4 (1883) 291; REHD. & WILS. in Sargent, Pl. Wils. 2 (1914) 173; MERR. En. Philip. 2 (1923) 472; REHD. J. Arn. Arb. 7 (1926) 194; KANEH. Form. Trees rev. ed. (1936) 362, f. 319; REHD. Man. Cult. Trees & Shrubs, ed. 2 (1947) 540; COPEL. Phytomorph. 5 (1955) 440; LIU, Ill. Pl. Taiwan 2 (1962) 936, f. 771; LI, Woody Fl. Taiwan (1963) 445, f. 173. — *P. formosana* MATSUM. Bot. Mag. Tokyo 15 (1901) 40; MATSUM. & HAYATA, J. Coll. Sc. Imp. Un. Tokyo 22 (1906) 99, t. 9. — *P. philippinensis* MERR. & ROLFE, Philip. J. Sc. 3 (1908) Bot. 107; MERR. & MERRITT, *ibid.* 5 (1910) Bot. 357. — **Fig. 69e.**

Tree up to 26 m tall and 1 m Ø, sometimes with buttresses. Bark light brownish, scaly. *Leaves* with (3–)5–6(–10) pairs of leaflets (terminal leaflet sometimes absent), up to 20 cm long; rachis and petiole puberulous, glabrescent; petiole up to 7 cm. *Leaflets* subsessile or sessile, chartaceous, lanceolate, 4–8 by 1– $2\frac{1}{2}$  cm, puberulous beneath, glabrescent; base cuneate; apex acuminate; nerves 10–14 pairs, distinct; veins reticulate. *Inflorescences* racemose in ♂, paniculate in ♀, up to 8 cm long, puberulous, glabrescent; bracts lanceolate, *c.* 1 mm long; pedicels 1–2 mm. *Tepals* 2–5, elliptic, 1– $1\frac{1}{2}$  mm long. *Stamens* 3–5,  $\frac{3}{4}$  mm; filaments very short; anthers ellipsoid or oblong, *c.* 1 mm, slightly apiculate. *Disk* 0. *Ovary* globose,  $\frac{2}{3}$  mm Ø; style  $\frac{1}{2}$  mm long; stigmas *c.*  $\frac{1}{2}$  mm long; sterile

pistil in  $\frac{1}{2}$  minute. *Drupe* globose,  $\frac{1}{3}$ - $\frac{1}{2}$  cm  $\varnothing$ , slightly compressed, red changing to greenish blue when ripe.

Distr. China, Formosa, and *Malesia*: Philippines (Luzon).

Ecol. Open slopes, from the lowland up to 1350 m. *Fl.* March, July; *fr.* May, July, Sept.

Uses. The wood is used locally in the Philippines for making tobacco pipes (MERRILL & MERRITT, *l.c.*).

Vern. *Agiao*, *Ilk.*, *sanguido*, *sanguilo*, *samido*, *Ig.*

Note. The fruits are often empty with only an undeveloped ovule. This is apparently due to the failure of pollination (COPELAND, *l.c.*).

#### Excluded

*Sorindeia glaberrima* HASSK. *Flora* 25 (1842) *Beibl.* ii: 45; *ibid.* 27 (1844) 617; *Cat. Hort. Bog.* (1844) 245 was described from a tree grown in Hort. Bog., which according to HASSKARL was certainly introduced; *cf.* also STEN. *Bull. Bot. Gard. Btzig* III, 17 (1948) 462. BLUME, *Mus. Bot.* 1 (1850) 205, reduced it to *Sorindeia madagascariensis* THOU. and said that it was introduced from Madagascar. BACKER, *Schoolfl.* (1911) 282 and BACKER & BAKH. *f. Fl. Java* 2 (1965) 152 referred it to its *var. paucijuga* ENGL. in DC. *Mon. Phan.* 4 (1883) 301, a variety not mentioned in the recent *Flore de Madagascar*.

Cultivated in Hort. Bog. *sub n.* VI-B-1 & 3.

# ADDENDA, CORRIGENDA ET EMENDANDA

C. G. G. J. VAN STEENIS, *c.s.*

As was done in the preceding volumes, it seemed useful to correct some errors which have crept into the text of volumes 4-8 as well as to add additional data, new records and references to new species which came to my knowledge and are worth recording. Also there are alternative opinions about generic and specific delimitation on most of which comments are given.

Printing errors have only been corrected if they might give rise to confusion.

Volume and page number are separated by a colon. Page numbers provided with either *a* or *b* denote the left and right columns of a page respectively.

## Aceraceae

- 4: 3, *Acer laurinum* HASSK.  
592ab; Add to Ecol.: A characteristic hill tree,  
6: 915a; also found in Sarawak and W. Borneo  
7: 820a also in the lowland, as well as in S. Malaya  
(Johore); in the latter place twice found in  
peat-swamp forest, a remarkable change in  
ecological conditions (*cf.* WHITMORE,  
Tree Fl. Malaya 2, 1973, 2). It could be  
that the locality at Simpang (W. Kaliman-  
tan) is also in peat-swamp forest.

## Amaranthaceae

- 4: 83b *Cyathula prostrata* (L.) Bl. var. *stenophylla*  
(MERR.) KANIS, Kew Bull. 31 (1976) 340.  
— *C. prostrata* var. *lanatifolia* (MERR.)  
BACK. Fl. Males. I, 4 (1949) 83, *comb.*  
*illeg.*  
4: 91, *Alternanthera pungens* H.B.K. Nov. Gen.  
594b; Sp. 2 (1818) 206; MELVILLE, Kew Bull. 13  
5: 554b, (1958) 174. — *A. repens* (L.) LINK, En.  
555a Berol. 1 (1821) 154, non GMEL. 1791.  
4: 94b, *Alternanthera brasiliiana* (TORNER) O.K.;  
594b; STEEN. Blumea 22 (1975) 171.  
5: 555a Add to Distr.: East New Guinea, Tami-  
loa, cultivated in garden and intruding  
garden beds.

## Balanophoraceae (B. HANSEN)

- 7: 784 Replace in line 15 from bottom 'acetate'  
by 'palmitate'.

## Campanulaceae

- 6: 111b *Peracarpa carnosus* (WALL. in ROXB.)  
HOOK. f. & TH.; STEEN. Blumea 22  
(1975) 171.  
Add to Distr.: East New Guinea, 3150 m.

## Chenopodiaceae

- 4: 101a *Chenopodium ambrosioides* L.; KANIS,  
Contr. Herb. Austr. 20 (1976) 3.  
Add to Distr.: East New Guinea.

## Connaraceae (LEENHOUTS)

- 5: 533b *Connarus paniculatus* ROXB.  
As finally flowering Malayan material  
became available (KEP FRI 2948), the  
following can be added to or replace the  
description: Sometimes a shrub. *Leaflets*

up to 24 by 8 cm; nerves up to *c.* 12 pairs.  
*Inflorescences* up to 80 cm long. *Sepals*  
elliptic, acute, 3 by 1 mm, keeled, outside  
densely ferruginous-pubescent, inside  
subglabrous. *Petals* linear-lanceolate, *c.*  
7 mm long, acute, outside densely puberul-  
ous, inside tomentose. *Stamens* shortly  
connate, epipetalous ones much shorter  
than episepalous ones and possibly  
sterile; filaments glabrous. *Fruit* 3-3<sup>1</sup>/<sub>2</sub>  
by 1<sup>3</sup>/<sub>4</sub>-2 cm, stipe 3-4 mm long, pericarp  
inside sparsely to rather densely short-  
hairy.

- 5: 535b *Connarus semidecandrus* JACK.  
Notes. The form mentioned by me as *δ*  
was named var. *gaudichaudii* (DC.) FOSB.  
in FOSBERG & SACHET, Micronesica 11  
(1975) 82. They did not mention any other  
infraspecific taxon.

## Ericaceae

- 6: 746 *Vaccinium whitmorei* NG, Gard. Bull.  
Sing. 28 (1976) 231, pl. on p. 232.  
A new species described from Malaya,  
without indication of its affinity and where  
it should be inserted in SLEUMER's key.  
6: 753 *Vaccinium pseudodialypetalum* NG, Gard.  
Bull. Sing. 28 (1976) 231, pl. on p. 233.  
A new species described from Malaya,  
said to be allied to *V. dialypetalum* J.J.S.,  
differing by: calyx lobes 1 mm, filaments  
glabrous, dorsal spurs on stamens short,  
and pedicel slender, 1 cm long.

## Erythroxylaceae

- 5: 548b *Erythroxylon kochummenii* NG, Gard.  
Bull. Sing. 28 (1976) 235, f. 1.  
A new species described from Malaya  
(3 coll.), said to differ from *E. cuneatum*  
(Miq.) KURZ as follows:  
1. Fruit oblong-ellipsoid, up to 1 by  
1/2 cm; loculi occupying 3 angles of a  
triangle; fertile loculi nearly the same  
size as the sterile ones. Styles basally  
united . . . . . *E. cuneatum*  
1. Fruit broadly obovoid, 2-2<sup>1</sup>/<sub>4</sub> by  
1<sup>1</sup>/<sub>2</sub>-2 cm; the loculi lying 3 in a row;  
fertile loculi much narrower than the  
sterile ones . . . . . *E. kochummenii*

## Fagaceae

- 7: 290 *Nothofagus crenata* STEEN. var. *sapeli*  
STEEN. Blumea 22 (1975) 171.

Leaves entire. ♂ Flowers in sessile triads; pedicels 2 mm; perianth 2 mm.

Distr. East New Guinea: S. Highlands, southeastern end of Lake Kutubu, on limestone ridge, 950 m, R. H. HYNES K.F. 27.

Note. The new material exactly matches the type and only (♀) specimen known, except for the entire leaves.

7: 400 *Trigonobalanus verticillatus* FORMAN; cf. JACOBS, Fl. Mal. Bull. 30 (1977) 2767.

Add to Distr.: N. Sumatra, South Losir Nature Reserve, Gajolands, c. 500 m (M. BORNER coll.). Collected in sterile state, obviously from suckers, as rhino food, but identity indubitably correct.

#### Rhizophoraceae (DING HOU)

5: 429; *Rhizophoraceae*.

6: 965 Replace the number of genera by 18.

Add to footnote (2): The South American genus *Polygonanthus* DUCKE and the recently described African *Comiphyton* J. J. FLORET have been added to this family (cf. VAN VLIET, Leiden Bot. Ser. 3, 1976, 71).

5: 431 Add to footnote (2): The main works on the Malesian mangrove; PERCIVAL, M. & J. S. WOMERSLEY: Floristics and ecology of the mangrove vegetation of Papua New Guinea. Bot. Bull. Lae 8 (1975) 1-96.

5: 445 Add to literature of Wood Anatomy: GEH & KENG, Gard. Bull. Sing. 27 (1974) 190-194; VAN VLIET, Leiden Bot. Ser. 3 (1976) 20-75.

5: 445 Add to Taxonomy: GEH & KENG (Gard. Bull. Sing. 27, 1974, 183-220) made morphological studies of some Malayan members of the inland genera of *Rhizophoraceae* and suggested that the most appropriate place of the Malesian genera of this family is in the three tribes published by HOOKER (in B. & H. Gen. Pl. 1, 1865, 678) and revised by MELCHIOR (in ENGL. Syllabus Pfl. Fam. ed. 12, 2, 1964, 357): *Rhizophoreae* (the four mangrove genera), *Gynotrocheae* (*Carallia*, *Gynotroches*, and *Pellacalyx*) and *Anisophylleae* (*Anisophyllea* and *Combretocarpus*).

VAN VLIET (Leiden Bot. Ser. 3, 1976, 20-75) in his comprehensive study of the wood anatomy of many representatives of all 18 genera so far known for this family concluded that these genera, based on wood anatomical characters, can be arranged in four groups or tribes following the names used by MELCHIOR (*l.c.*). Three of them with their respective Malesian representatives are similar to those just recorded above; the fourth one, *Macaristeae*, consists only of extra-Malesian genera.

5: 447 In the KEY TO THE GENERA (mainly based on vegetative characters), replace the first line of lead 3 by the following:

3. Branchlets usually solid, sometimes hollow at the apical part of a young shoot. Pedicel without articulation.

5: 448 *Rhizophora* L.

Replace the number of stamens in the description by: 8-16(-22).

5: 450 In the KEY TO THE SPECIES replace lead 1 by the following:

1. Inflorescences 2(-4)-flowered; peduncle usually shorter than the petiole. Flowers sessile or subsessile. Bracteoles at the base of the flower completely connate, short-cupular. Petals glabrous or loosely hairy usually on the margins. Stamens (8-)12-16(-22).

2a. Inflorescences bearing mature flowers always in the axils of leaf-scars. Petals glabrous. Stamens 12

#### 1. *R. apiculata*

2a. Inflorescences bearing mature flowers usually in the axils of leaves. Petals hairy. Stamens (8-)14-16 (-22), sometimes some of them very small, staminode-like or filamentous

#### 1a. *R. lamareckii*

1. Inflorescences usually more than 4-flowered; peduncle usually longer than the petiole. Flowers distinctly pedicelled. Bracteoles at the base of the flower only connate at their bases. Petals densely villose on the margins. Stamens 8.

5: 453b Add the following species:

1a. *Rhizophora lamareckii* MONTROUZIER, Mém. Ac. Sc. Lyon 10 (1860) 201; SALVOZA, Nat. Appl. Sc. Bull. Un. Philip. 5 (1936) 229, t. 9; DING HOU, Blumea 10 (1960) 629; PERCIVAL & WOMERSL. Bot. Bull. Lae 8 (1975) 82; WOMERSL. in Toml. & Womersl. Contr. Herb. Austr. 19 (1976) 7, f. 4. — *R. pachypoda* BAILLON, Adansonia 11 (1875) 309. — *R. conjugata* var. *lamareckii* GUILLAUM. Not. Syst. 3 (1914) 56.

Sprawling interlocked tree, up to 8 m. Leaves elliptic or broadly elliptic, rarely ovate, 10-15 by 5-9 cm; base cuneate or acute; apex mucronate, sometimes apiculate; petiole 2-3½ cm. Stipules 4-5½ cm long. Inflorescences 2(-4)-flowered, usually in the leaf axils, sometimes in the axils of leaf-scars; peduncle 1-1¾ cm. Flowers sessile or subsessile; mature buds ellipsoid or ovoid, 12-15 mm long; bracteoles at the base of the flower completely connate, short-cupular, irregularly lacerate or dentate on the margin. Calyx lobes ovate, 10-15 by 5-7 mm, acute. Petals lanceolate, 10-13 by c. 3½ mm, membranous, sometimes slightly thicker and with involute margins; loosely hairy usually on the margins, sometimes also on the inner surface. Stamens (8-)12-16(-22), sometimes some of them very small, staminode-like or even filamentous, 7-10 mm long, subsessile. Superior part of ovary obscure; style 2-3 mm, 2-lobed at the apex. Fruits conical, 2 by 1½ cm, with exerted hypocotyl (cf. SALVOZA, *l.c.*).

Distr. Rather rare, scattered in New Caledonia, Bismarck Archipelago (New Ireland), Solomon Is. (Big Nggela), NE.

Australia (Queensland: Hinchinbrook I.), Ceylon (Eastern Prov.), and Malesia: New Guinea (Central Distr.: Port Moresby), Lesser Sunda Is. (Flores).

Ecol. Recorded as occurring in swampy mangrove forest or in closed mangrove swamp on two field notes. Further field observations and ecological data are needed.

Notes. Until recently *R. lamarckii* has been known only from New Caledonia. TOMLINSON & WOMERSLEY (*l.c.*) reported its occurrence in Papua New Guinea, the Bismarck Archipelago, Solomon Is., and Queensland; they have described its morphological characters and their observations in relation to other species of this genus in eastern Malesia, and have also discussed the evidence for its possible hybrid origin.

Since then, I found that one specimen from Flores (SCHMUTZ 286, L) and another from Ceylon (BALAKRISHNAN 372, PDA) can also be possibly included here.

As yet no seedlings of this species have been observed outside New Caledonia. According to TOMLINSON & WOMERSLEY (*l.c.*) the population in the vicinity of Buruni village, Port Moresby harbour, forms a pure stand of several acres and preliminary observations did not show pollen sterility.

It is interesting that this species is in some characters intermediate between *R. apiculata* and *R. stylosa* or *R. mucronata*, but at the same time it possesses a very distinctive feature of its own in this genus, *viz* the very variable and usually rather high stamen number, (8-)12-16 (-22).

It may be possible that *R. lamarckii* is of hybrid origin between *R. apiculata* and *R. mucronata* or *R. stylosa* and that its position resembles that of *R. harrisonii* LEECHM. in the Atlantic and America's Pacific areas (BRETHER, *Acta Bot. Neerl.* 18, 1969, 434-439; *ibid.* 26, 1977, 225-230). Further field and morphological studies on its status and distribution are needed.

5: 471b *Ceriops decandra* (GRIFF.) DING HOU.  
Add to Distr.: Lesser Sunda Is. (Flores, Sumba) and NE. Australia (Queensland: Cook Distr., L. S. SMITH 11617, L).

5: 473a *Kandelia candel* (L.) DRUCE.  
Add to Distr.: Ceylon.

5: 474 *Anisophyllea* R. BR. *ex* SABINE.  
Add to the Note: According to the morphological study of fresh seeds of *A. disticha* made by GEH & KENG (*Gard. Bull. Sing.* 27, 1974, 185-186, f. 2, C1-5), the entire, undifferentiated embryo is embedded in endospermous tissue and is quite naturally separable from it.

5: 477b *Anisophyllea ferruginea* DING HOU.  
Add to Distr.: N. Borneo (Sabah: Mempakul).

5: 477b *Anisophyllea grandis* (BENTH.) BURKILL.  
Add to Distr.: W. Borneo (Sarawak: ANDERSON 4576, L).

5: 480 *Combretocarpus* HOOK. *f.*  
Add the following Note: According to the morphological study of the flowers and seeds of *C. rotundatus* made by GEH & KENG (*Gard. Bull. Sing.* 27, 1974, 185 & 196, f. 12), the syncarpous ovary is unilocular at the upper one-third indicating the parietal condition while the lower two-third is typically plurilocular with axile placentation, and the seed has a clear demarcation between the embryo and its surrounding tissue.

5: 484a *Carallia eugenioidea* KING.  
Add to Distr.: E. & N. Sumatra (Pajakumbuh & Atjeh).

5: 488 *Gynotroches* BL.  
Add the following Note: According to GEH & KENG (*Gard. Bull. Sing.* 27, 1974, 196, f. 13), the structure of the ovary of *G. axillaris* is similar to that of *Combretocarpus rotundatus*. It is unilocular in the uppermost part with parietal placentation, but is plurilocular and showing axile condition in the lower part.

6: 967a *Carallia longipes* DING HOU.  
Add to Distr.: East New Guinea (Western Distr.: LAE 51872, L).

#### Ulmaceae

8: 32, 43 It was omitted to mention that rootlets of species of at least some *Parasponia* spp. (possibly also of some *Trema* spp.) mostly possess nodules which are caused by *Rhizobium* infections, similarly as in *Leguminosae*.

The capacity for aerial nitrogen fixation makes them extra suitable, useful and desirable for pioneering on waste and eroded lands (A. D. L. AKKERMANS, *in litt.*).

#### Printing error

Pages 160 and 161 of this volume have been interchanged.



# INDEX TO SCIENTIFIC PLANT NAMES

compiled by

M. J. VAN STEENIS-KRUSEMAN

*Families and higher taxa have been entered under their name.*

Names of families which have been revised in volumes 4-8 have been entered and are printed in **bold type**, so that as far as this is concerned this index is complete for all preceding volumes as well.

*Suprageneric epithets* have been entered under the family name to which they belong preceded by the indication of their rank (subfamilies, tribes, etc.).

*Infrageneric epithets* have been entered immediately under the generic name to which they belong preceded by the indication of their rank (subgenera, sections, series, etc.).

*Infraspecific epithets* have been entered under the specific name to which they belong preceded by the indication of their rank (subspecies, variety, forma, etc.).

*Epithets of 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.

Some minor printing errors in plant names have been corrected.

Of synonyms with a double authority, the latter has not always been cited in full. The full authority can easily be derived from the text.

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