

LOGANIACEAE (P. W. Leenhouts, Leyden)

Trees, shrubs, woody climbers, or herbs. Hairs simple, stellate, or glandular-capitate; colleters often present in the axils of the leaves, stipules, and sepals (among Mal. genera absent in *Buddleja* only). *Leaves* nearly always opposite, entire or nearly so, penninerved, rarely 3–7-plinerved (*Strychnos*) or curvinerved (*Mitrasacme*); *stipules* interpetiolar (in many genera reduced to a stipular line) and in some genera moreover intrapetiolar. *Flowers* in cymose to thyriform (rarely racemose or spicate) inflorescences or solitary, 5-(rarely 4-, in *Anthocleista* up to 16-)merous, nearly always bisexual, actinomorphic (in some genera slightly zygomorphic). *Disk* sometimes present (not in Mal. spp.). *Sepals* united or free. *Corolla* gamopetalous, very rare with a corona. *Stamens* isomerous in Mal. spp. (in 2 extra-Mal. genera less), alternating, inserted on the corolla tube (with one exception in *Buddleja*), included or exerted; anthers basifixed or sometimes slightly dorsifixed (in the *Spigeliaceae*), slightly to deeply bifid at base, lengthwise dehiscent. *Ovary* superior (in *Polypremum*, *Cynoctonum*, and *Mitrasacme* p.p. semi-inferior), (1-)2(-4)-celled, placentas axile (parietal if 1-celled), often peltate; ovules 1-∞ per cell, amphitropous or anatropous; style usually one. *Fruit* always superior, capsular, baccate, or drupaceous. *Seeds* 1-∞, with copious endosperm; embryo minute, straight, cotyledons small.

Distribution. About 28 genera with some 600 spp., almost confined to the tropics of both eastern and western hemispheres, a few genera extending to the warm-temperate regions, mainly towards the south. In Malaysia 11 genera with 80 spp.

Ecology. The majority of the genera and species are confined to the everwet tropical lowland. A few are indifferent to climate (e.g. *Cynoctonum mitreola*, *Fagraea racemosa*, and *F. fragrans*); a few others are characteristic for areas subject to distinct periodical drought. e.g. *Strychnos lucida* (fig. 29), *Mitrasacme* (*M. elata*, fig. 41, and a few others). As to altitude almost all representatives occur below 2000 m. *Buddleja asiatica* and a few species of *Fagraea* and *Geniostoma* are ascending to the lower border of the subalpine zone, but none is found above 3000 m.

Almost all species occur in dryland sites; *Fagraea crenulata* is confined to temporarily or permanently inundated swamps (fig. 18), several *Neuburgias* occur in damp alluvial forest, *Fagraea racemosa* can also stand marshy conditions.

The role played by *Loganiaceae* in vegetation is small as none occurs gregariously. Only very few species are sizeable trees, notably old specimens of *Fagraea fragrans*, *F. elliptica*, *F. crenulata*, both *Norrisias*, and further a few *Neuburgias*. A temporary predominance in seral vegetation types is found with *Buddleja asiatica* which is a characteristic shrub of disturbed terrain and *Fagraea fragrans* which is rather fire-resistant (fig. 20).

Flowers are usually whitish and frequently fragrant, mainly attracting insects; some obviously nocturnal (certain *Fagraeas*); it has been suggested that some large-flowered *Fagraeas* are visited by birds, or even bats, but this matter is insufficiently investigated.

The seeds from species with capsular fruits are mostly very light and often winged (*Norrisia*, *Gelsemium*, *Buddleja*); they are dispersed by wind; the small to rather big baccate fruits of some genera are swallowed by birds and bats who will be responsible for the dispersal of the seeds. *Neuburgia* seems to possess buoyant fruits, possibly dispersed by water.

Wood-anatomy. DEN BERGER, Determinatietabel houtsoorten van Malesië, Veenman, Wageningen (1949) 20, 21, 27, 60; DESCH, Mal. For. Rec. 15¹ (1941) 302 (hand lens); CHALK & CHATTAWAY, Trop. Woods 50 (1937) 1; METCALFE & CHALK, Anat. Dic. 2 (1950) 928; MOLL & JANSSONIUS 4 (1926) 652; PEARSON & BROWN, Commercial timbers of India 2(1932) 738. According to CHALK (METCALFE & CHALK l.c.) the woods of the family suggest more than one distinct group, but according to them the material available for examination was insufficient to justify any more detailed conclusions. JANSSONIUS (MOLL & JANSSONIUS l.c.) studying *Geniostoma rupestre* FORST. (= *G. haemospermum* STEUD., *G. miqelianum* K. & V., *G. oblongifolium* K. & V.), *Buddleja asiatica* LOUR. and *Fagraea racemosa* JACK ex WALL. (= *F. morindaefolia* BL.) and *F. blumii* G. DON (= *F. obovata-javana* BL.) has claimed that they belong to two families, one including *Geniostoma* and *Buddleja*, the other *Fagraea*. It seems to me that the differences between the genera are not large enough to justify such a conclusion and that for the present, there is no evidence against LEENHOUTS' subdivision into tribes.—C.A.R.—G.

Phytochemistry. From this family the great pantropic genus *Strychnos* has attracted the attention of many phytochemists. It was known early that most species are toxic and contain alkaloids. Today many pure *Strychnos* alkaloids are known and all of them proved to be indol derivatives. Most South American species contain highly complex curarizing quaternary bases in the barks. The most recent reviews of these alkaloids are those of BERNAUER (Fortschr. Chemie Org. Naturstoffe 17, 1959, 183; *Planta Medica* 9, 1961, 340). On the other hand Asiatic and Australian *Strychnos* species contain convulsive alkaloids of the strychnine-type. Strychnine, brucine, and closely related bases were demonstrated to be present in many species from Asia, Malaysia, and Australia. The alkaloids of the African species of *Strychnos* have not yet been investigated thoroughly. Indole-alkaloids occur also in the African genus *Mostuea* and in the Chinese and North-American genus *Gelsemium*. In other genera alkaloids have been demonstrated to be present but their chemistry is unknown. Complex indole-alkaloids are restricted, as far as we know, among Angiosperms to the families of *Loganiaceae*, *Apocynaceae*, and *Rubiaceae*. This may well indicate that they are all phylogenetically closely related as suggested by HUTCHINSON.

Besides alkaloids some *Loganiaceae* accumulate pseudo-indicans, i.e. glycosides producing blue colours under certain conditions. Loganin and loganic acid were found in many species of *Strychnos* (A. DENOËL *et al.*, Contribution à l'étude chimique des *Strychnos* du Congo Belge, Bruxelles 1953; publ. par Ministère des Colonies, Direction de l'Agriculture). Loganin has also been isolated from *Meynantes trifoliata* (*Gentianaceae*). In the genus *Buddleja* loganin is replaced by the related glycoside aucubin, which is a characteristic compound of many families of *Tubiflorae* (CHASLOT, Thèse [Pharm.] Univ. Paris 1955). This may indicate rather clear relationships between *Buddlejeae* and some families of *Tubiflorae*. This assumption is strengthened by the fact that still other types of glycosides are common to *Buddlejeae* and different taxa of *Tubiflorae*. The flavonoid compound buddleo-flavonolioside is known to be identical with linarin from *Linaria* (*Scrophulariaceae*) and according to a recent suggestion of HARBORNE & CORNER (*Biochem. J.* 81, 1961, 242) the third heteroside (= buddleoside) known to occur in *Buddleja* is probably identical with orobanchoside from several species of *Orobanche* (*Orobanchaceae*). The recent elucidation of the structures of loganin, aucubin, and other pseudo-indicans (for instance asperuloside from *Rubiaceae*) and related compounds (gentiopicrin and gentianin from *Gentianaceae*) seems to be highly interesting for taxonomy (for structures compare R. THOMAS, *Tetrahedron Letters* 1961, 544-553). It is very probable that many constituents isolated from species belonging to families of the orders *Loganiales*, *Contortae*, *Tubiflorae*, and *Rubiales* are biochemically intimately related.

As a whole, the *Loganiaceae* have hitherto not been studied intensively by phytochemists. Most of the research has been concentrated on the alkaloid-bearing species of *Strychnos*. Chlorogenic acid, some triterpenes, rubber (fruit of *Fagraea*), bitter principles (*Fagraea*) and saponins were demonstrated to be present in some species. The distribution and chemistry of these compounds is not yet sufficiently well known to permit their use for chemotaxonomical speculations. On the other hand, as already mentioned, *Loganiaceae* are biochemically related to *Apocynaceae* and *Rubiaceae* by the glycosides and alkaloids of the subfamily of *Loganioideae* and to *Scrophulariaceae* and derived families by the different types of glycosides present in the subfamily of *Buddlejoideae*.—R. HEGNAUER.

Morphology. *Stipules*. The leaf-bases are probably all developed into *vaginae connatae*. They can be developed as a stipular line only, can form a sheathlike connection between the petioles (*vaginae interpetiolares*; fig. 23b), or can be moreover connected in the leaf-axils as an ocrea (fig. 10b). In the last case either the interpetiolar part may be strongest developed (interpetiolar stipules, fig. 31a) or the axillary part is predominant ('axillary scales' of *Fagraea*, fig. 3, 6, 20f). The stipules resemble those of the *Rubiaceae*; they are persistent except in *Mostuea* where the upper portion withers. Some species of *Fagraea* have auricles at the base of the petiole outside of (and sometimes hiding) the ocrea; they may be taken at first sight as stipules, but are of distinctly laminar origin (fig. 3c-d). Most genera of the *Buddlejeae* show a (sometimes faint) stipular line. In *Buddleja* the lamina is often decurrent along these stipular lines; in that case there may be a pair of auricles at the leaf-base, or these may be combined into an 'interpetiolar stipule' on either side of the node, or the leaves may be perfoliate. In some *Buddlejas* the interpetiolar stipules develop into a second pair of (slightly smaller) leaves decussate to and inserted between the normal leaf pair (analogous to those of *Galium* and *Asperula* in the *Rubiaceae*). Whether the stipular line of the *Buddlejeae* is comparable with the *vaginae connatae* of the other *Loganiaceae* deserves further study. It seems to me that there is a gradual series from the stipules of the *Loganiaceae* to those of the *Rubiaceae*, the latter usually being better developed organs. In the related *Apocynaceae* axillary scales similar to those found in *Fagraea* are also known, for example in *Conopharyngia*, but they also occur in other families, for instance *Guttiferae*. HASSELBERG (*Symb. Bot. Upsal.* 2, 3, 1937, 1-170) gave an extensive account of the morphology of the stipules in the *Loganiaceae*.

Aestivation of the corolla-lobes. The aestivation of the corolla-lobes can be valvate, imbricate, or contorted. This character seems to be of some systematical importance; in most of the tribes, and in all genera with only one exception, we find only one type of aestivation:

Potalieae: contorted.

Buddlejeae: mostly imbricate, valvate in *Peltanthera* and *Nuxia*.

Antonieae: valvate.

Gelsemieae: imbricate.

Strychneae: valvate.

Loganieae: *Logania* imbricate, *Geniostoma* imbricate or contorted, *Labordia* contorted.

Spigeliaceae: *Spigelia* and *Mitrasacme* valvate, *Cynoctonum* and *Polypremum* imbricate.

Delimitation and subdivision. *Loganiaceae* are considered to be a heterogenous family. Especially the position of *Buddleja* and related genera has given rise to controversial opinion. To gain a better insight in this matter I felt compelled to study all genera, from almost all of which herbarium material was available and has been analyzed; in few cases my work was supplemented by examining published descriptions and plates. Furthermore, I have used data derived from anatomy, cytology, palynology, embryology, and phytochemistry.

From these studies emanated the following subdivision into tribes, to which have been added the names of genera which I have accepted:

- A. Potalieae: (1) *Potalia*, (2) *Anthocleista*, (3) *Fagraea*.
- B. Buddlejeae: (4) *Peltanthera*, (5) *Sanango*, (6) *Nuxia*, (7) *Androya*, (8) *Gomphostigma*, (9) *Buddleja*, (10) *Emorya*, (11) *Adenoplosia*, (12) *Adenoplea*.
- C. Antonieae: (13) *Bonyunia*, (14) *Antonia*, (15) *Norrissia*, (16) *Usteria*.
- D. Gelsemieae: (17) *Gelsemium*, (18) *Mostuea*.
- E. Strychnaeae: (19) *Strychnos*, (20) *Gardneria*, (21) *Neuburgia*.
- F. Loganieae: (22) *Geniostoma*, (23) *Labordia*, (24) *Logania*.
- G. Spigeliaceae: (25) *Polypremum*, (26) *Cynoctonum*, (27) *Spigelia*, (28) *Mitrasacme*.

Genera dubia: *Retzia*, *Desfontainea*.

I agree with SOLEREDER (in E. & P. Nat. Pfl. Fam. 4, 2, 1892-95, 19-50) that the *Loganiaceae* represent a well-circumscribed family, and that at least some of the tribes show clear mutual relationships. From this follows that I disagree with HUTCHINSON (Fam. Fl. Pl. ed. 2, 1, 1959, 370-378) who raised nearly all tribes to family rank, keeping only the *Loganieae* and *Gelsemieae* in *Loganiaceae* in the restricted sense; he largely maintained the suprageneric taxa of BENTHAM & HOOKER. His delimitation of some of the tribes differs from that of SOLEREDER; therefore, his families are sometimes less homogeneous and less sharply defined than SOLEREDER's tribes. For the rest, the raising of tribes to the rank of families leads, it seems to me, not to scientific gain if these families are mutually kept in the same position within an order.

Critical remarks in more detail follow below; all generic names mentioned by either SOLEREDER or HUTCHINSON are included, as well as some more recently ascribed to the family.

- A. Potalieae. For a survey, see LEEUWENBERG, Act. Bot. Neerl. 10 (1961) 1-53.
- (1) *Potalia*. Monotypic; tropical South America. Shows distinct relationships to both other genera.
- (2) *Anthocleista*. 14 spp.; tropical Africa. For a revision see LEEUWENBERG, l.c. Closest allied to *Fagraea*.
- (3) *Fagraea*. c. 35 spp.; SE. Asia, Malaysia, tropical Australia, and the southwestern Pacific. Distinctly related to both other genera.

B. Buddlejeae. This is a group of mutually distinctly related genera, the systematic position of which is still a source of controversial opinion. In fact this all comes to the same thing: its position with either the *Scrophulariaceae* or the *Loganiaceae*, as a tribe or a subfamily, or as a family of its own. Up to and including EICHLER (Blüthendiagr. 1. 1875. 210) this generic assemblage was mostly treated as a tribe of the *Scrophulariaceae*. BENTHAM & HOOKER (Gen. Pl. 2, 1876, 787) were apparently the first who included it in the *Loganiaceae* (as a subtribe of the tribe *Euloganieae*), probably on account of the presence of stipules. SOLEREDER, l.c., raised it to the rank of a subfamily, and opposed it to the other *Loganiaceae*, mainly on anatomical grounds, remarking that, apart from the stipules, they could as well be included in the *Scrophulariaceae*. WILHELM (Die Samenpfl. 1910, 90) was apparently the first who raised this group to family rank. These *Buddlejeaceae* were usually placed near the *Loganiaceae*, but sometimes near the *Scrophulariaceae*. Recently HARTL (Oest. Bot. Z. 103, 1956, 185-242) included them again as a tribe in the *Scrophulariaceae*, in which he was followed by some German authors (WAGENITZ, TROLL). The main differences between the *Buddlejeae* and the other *Loganiaceae* mentioned are:

- (i) Intraxylary phloem. Absent in the *Buddlejeae* and *Polypremum*, present in all other *Loganiaceae*.
- (ii) Glandular-capitate hairs. Present in *Buddlejeae* except *Peltanthera*, in *Mostuea* (on the style), in *Logania* (on the ovary), and in *Mitrasacme* (on the calyx, sec. KLETT in Mez, Bot. Arch. 5, 1924, 327), absent in all other *Loganiaceae*.
- (iii) Stellate hairs. Present in the *Buddlejeae* (except *Peltanthera* and *Sanango*) and in *Spigelia*, absent in all other *Loganiaceae*.
- (iv) Unicellular or uniseriate hairs. Absent in most of the *Buddlejeae*, present in *Peltanthera* and *Sanango* of the *Buddlejeae* and in the other *Loganiaceae*.
- (v) Pericyclic cork in the *Buddlejeae* except *Peltanthera* and probably *Sanango*, superficial cork in the other *Loganiaceae*.
- (vi) Colleters. Absent in the *Buddlejeae* and *Polypremum*, present in the other *Loganiaceae*, at least in the leaf axils.

The genera usually included in the *Buddlejeae* (those cited in the survey above under B, plus *Polypremum*) are thus still marked off from the other *Loganiaceae* by the absence of intraxylary phloem and of colleters. Data derived from cytology, palynology, embryology, and phytochemistry sustain in general a relationship with the *Scrophulariaceae*. However, these data are very incomplete and comparisons often based on one or a few genera which are only distantly related (for example *Spigelia* and *Buddleja*). These assumptions may therefore lose significance if all genera are examined, as for example has already appear-

ed in palynology and chromosome numbers which have yielded a very varied pattern within the *Loganiaceae*. A comparison in these fields of *Peltanthera* with the *Antonieae* and of *Polypremum* with the *Spigeliaceae* would be highly desirable.

Two other facts are in favour of a closer relationship between the *Buddlejeae* and the *Loganiaceae*. The genus *Peltanthera* (and the closely related *Sanango*) is on the one side closely related to *Nuxia*, but shows on the other side a distinct alliance to the *Antonieae*, and was in fact included by HUTCHINSON in the *Antoniaceae*. *Polypremum* has been included mostly in the *Buddlejeae*, but HUTCHINSON included it in the *Loganiaceae sensu stricto*; in my opinion it should be included in the *Spigeliaceae* on account of the herbaceous habit, the membranous, sheath-like interpetiolar stipules, the partly inferior ovary, and the nearly basally inserted peltate placentas, all characters which are unusual in the *Buddlejeae*. Inclusion of *Polypremum* in the *Spigeliaceae* as accepted here entails the breakdown of the only two characters by which the *Buddlejeae* deviate from the other *Loganiaceae*.

Concluding, the affinity of the *Buddlejeae* is clearly with both the *Loganiaceae* and the *Scrophulariaceae*. But on account of the unsharp delimitation against the *Loganiaceae* and especially the distinct relationships with the *Antonieae* I prefer to include them in the *Loganiaceae*. In the *Scrophulariaceae* they would represent an isolated basal offshoot; within the *Loganiaceae* they are definitely less isolated than the *Potalieae* and the *Spigeliaceae*.

(4) *Peltanthera*. Monotypic; tropical Central and South America. Especially related to *Sanango* and to *Nuxia*, furthermore to the *Antonieae* (included by HUTCHINSON in the *Antoniaceae*).

(5) *Sanango*. Monotypic; tropical South America. Related to *Peltanthera*.

(6) *Nuxia* (syn. *Lachnopylis*). About 20 spp.; South Africa and Madagascar. Close to *Peltanthera* and to *Sanango*.

(7) *Androya*. Monotypic; Madagascar. Closely related to *Nuxia* but sufficiently different. Originally described in the *Oleaceae*.

(8) *Gomphostigma*. A few spp.; South Africa.

(9) *Buddleja* (syn. *Chilianthus* and *Nicodemia*). More than 100 spp.; in the tropics and subtropics, worldwide with the exception of the western half of Africa, Australia, and the Pacific. *Emorya*, *Adenoplusia*, and *Adenoplea* are closely related and should probably be united with it.

(10) *Emorya*. Monotypic; southwestern North America. Probably to be included in *Buddleja*.

(11) *Adenoplusia*. A few spp.; Madagascar and East Africa. Closely related to *Adenoplea*; both should possibly better be sunk in *Buddleja*.

(12) *Adenoplea*. A few spp.; Madagascar. Should probably be combined with *Adenoplusia*, and both possibly with *Buddleja*.

C. Antonieae.

(13) *Bonyunia*. About 2–5 spp.; tropical South America. Close to the next two genera.

(14) *Antonia*. Monotypic; tropical South America. Close to both *Bonyunia* and *Norrisia*.

(15) *Norrisia*. Two spp.; Malaysia. Close to the foregoing two genera.

(16) *Usteria*. Monotypic; tropical Africa. Somewhat isolated.

D. Gelsemieae.

(17) *Gelsemium*. Three spp.; southern North and northern Central America and SE. Asia (also in Malaysia). Shows also relationship to the *Antonieae*.

(18) *Mostuea* (syn. *Coinochlamys*). Eight spp.; tropical Africa and northern South America. Revision: LEEUWENBERG, Med. Landbouwhoges. Wageningen 61, 4 (1961) 1–31. Shows also relationship to the *Strychneae*.

E. Strychneae.

(19) *Strychnos* (syn. *Scyphostrychnos*; see LEEUWENBERG, Act. Bot. Neerl. 11, 1962, 47–50). About 150–200 spp.; worldwide in the tropics and subtropics.

(20) *Gardneria* (syn. *Pseudogardneria*). Five spp.; SE. and E. Asia, Malaysia. Revision: LEENHOUTS, Bull. Jard. Bot. Brux. 32 (1962) 431–439.

(21) *Neuburgia* (syn. *Couthovia* and *Crateriphytum*). About 10–12 spp.; Malaysia and the southwestern Pacific. Shows also affinities to the *Loganiaceae*.

F. Loganiaceae.

(22) *Geniostoma*. About 20–40 spp.; Malaysia and the Pacific. Close to *Labordia*.

(23) *Labordia*. About 20 spp.; Hawaii. Hardly generically different from *Geniostoma*.

(24) *Logania*. About 20–30 spp.; Australia (also Tasmania and New Zealand) and New Caledonia.

G. Spigeliaceae.

(25) *Polypremum*. Monotypic; subtropical North and South America. By SOLEREDER and most subsequent authors included in the *Buddlejeae*, by HUTCHINSON in the *Loganiaceae sensu stricto*. Distinctly related to *Mitrasacme* and *Cynoctonum*; compare also the notes to the *Buddlejeae*.

(26) *Cynoctonum* (syn. *Mitreola*). Six spp.; tropical and subtropical America, Madagascar, SE. Asia, Malaysia, and North Australia.

(27) *Spigelia* (syn. *Pseudospigelia*). About 50 spp.; tropical and subtropical America, 1 species naturalized in Africa and Malaysia.

(28) *Mitrasacme*. About 40 spp.; Australia (also Tasmania and New Zealand), SE. and E. Asia, Malaysia, the Carolines, and New Caledonia.

Mitrasacmopsis, a monotypic genus from Madagascar, described by JOVET in the *Loganiaceae-Spigelieae* and accepted as such by HUTCHINSON, should be excluded from this family. The leaves show abundant raphides, a character which is absent in the *Loganiaceae*, but characteristic of many *Rubiaceae*, as Dr C. E. B. BREMEKAMP informed me. It should be included in the *Rubiaceae-Hedyotideae* and seems to be especially close to the African genus *Diotocranus*.

Desfontainea. Monotypic; Andine South America. Included by HUTCHINSON in the *Potaliaceae*, also occasionally placed in or near the *Solanaceae*.

Retzia. Monotypic; South Africa. Relationships uncertain.

Systematic affinities. The relationships of the *Loganiaceae* are threefold:

Especially the *Potalieae* are distinctly related to the *Apocynaceae-Tabernaemontaninae*. The main characters in which they differ from the *Apocynaceae* are the absence of laticiferous vessels (but *Fagraea* has a laticiferous tissue under the epidermis of the fruits) and of the more complicated type of stigma characteristic of the latter family.

The *Spigelieae* show a distinct relationship to the *Rubiaceae-Hedyotideae*. As a whole, superior versus inferior ovary is a good distinguishing character between *Loganiaceae* and *Rubiaceae*. In this case the character is, however, not sharp: in the *Spigelieae* the ovary is superior or partly inferior, in the *Hedyotideae* it is often only halfway inferior or even less. The best distinguishing characters are the absence of raphides and the always superior fruit in the *Spigelieae*.

The *Buddlejeae* show an indubitable affinity to the *Scrophulariaceae*, as discussed above. The main difference with the latter family is the stipular line which is present in most genera.

Possibly there is some relationship with the *Oleaceae* which must then be found with the *Antonieae* and *Gelsemieae*.

The morphological relationships are mainly confirmed by the data provided by the auxiliary sciences.

I agree with HUTCHINSON in accommodating the *Loganiaceae* in an order *Loganiales*, from which the orders *Contortiae* (*Gentianales*), *Tubiflorae* (*Scrophulariales*), and *Rubiales* can be derived. The *Oleaceae* should possibly be included in the *Loganiales*, as proposed for example by SOLEREDER and by HUTCHINSON.

Uses. Some species are reputed for their alkaloids. Best known of these are strychnine and brucine in the seeds of several *Strychnos* spp., especially *S. ignatii* and *S. nux-vomica*; furthermore the very poisonous gelsemin from the roots of *Gelsemium*. Some species of *Fagraea* and the *Norrisias* are good timber-trees. A few species, mainly of *Fagraea* and *Buddleja*, are planted as ornamentals.

Notes. Many years ago Dr C. A. BACKER started a revision of this family but had to give up on account of failing eyesight; his MSS were put at my disposal. I have further cooperated with Dr A. J. M. LEEUWENBERG, Wageningen, who is revising the African *Loganiaceae*, by exchange of MSS.

KEY TO THE GENERA

1. Woody plants.
 2. Flowers 4-merous. At least underside of leaf always tomentose; hairs stellate or glandular-capitate 2. *Buddleja*
 2. Flowers 5-merous. Plants mostly ± glabrous; underside of leaf not tomentose; hairs neither stellate nor glandular-capitate.
 3. Leaves 3-5-plinerved. Tendrils often present 5. *Strychnos*
 3. Leaves penninerved. No tendrils.
 4. Inflorescences terminal, sometimes also lateral.
 5. Corolla-lobes valvate in bud.
 6. Corolla outside densely tomentose, without a hair-ring in the mouth. Capsule 2-valved, densely hairy. Seeds many, minute, spindle-shaped 3. *Norrisia*
 6. Corolla outside glabrous, inside with a hair-ring in the mouth. Fruit drupaceous, indehiscent, glabrous. Seeds 1-2, large, spindle-shaped, remaining in a stone 7. *Neuburgia*
 5. Corolla-lobes imbricate or contorted in bud.
 7. Corolla-lobes contorted. Trees, shrubs, or epiphytes. Fruit baccate, almost never dehiscent. Seeds many, angular, embedded in pulp 1. *Fagraea*
 7. Corolla-lobes imbricate. Liana or straggling shrub. Fruit a dry capsule, 2-valved. Seeds c. 8, elliptic to bean-shaped, winged all around 4. *Gelsemium*
 4. Inflorescences exclusively lateral.
 8. Fruits baccate, indehiscent.
 9. Corolla-lobes contorted in bud. Seeds small, angular 1. *Fagraea*
 9. Corolla-lobes valvate in bud. Seeds fairly large (1/2-1 cm), orbicular or elliptic. 6. *Gardneria*
 8. Fruits capsular, with 2 caducous valves. Seeds small, embedded in a red or orange placenta. 8. *Geniostoma*
1. Annual, rarely perennial herbs.
 10. Flowers 4-merous. Leaves 1-nerved or curvinerved. 11. *Mitrasacme*
 10. Flowers 5-merous. Leaves penninerved.
 11. Stem with some pairs of small leaves and at the base of the inflorescence a pseudowhorl of 4 larger leaves. Inflorescences unbranched 10. *Spigelia*
 11. No whorled larger leaves at the base of the inflorescence. Inflorescences dichasially branched. 9. *Cynoctonum*

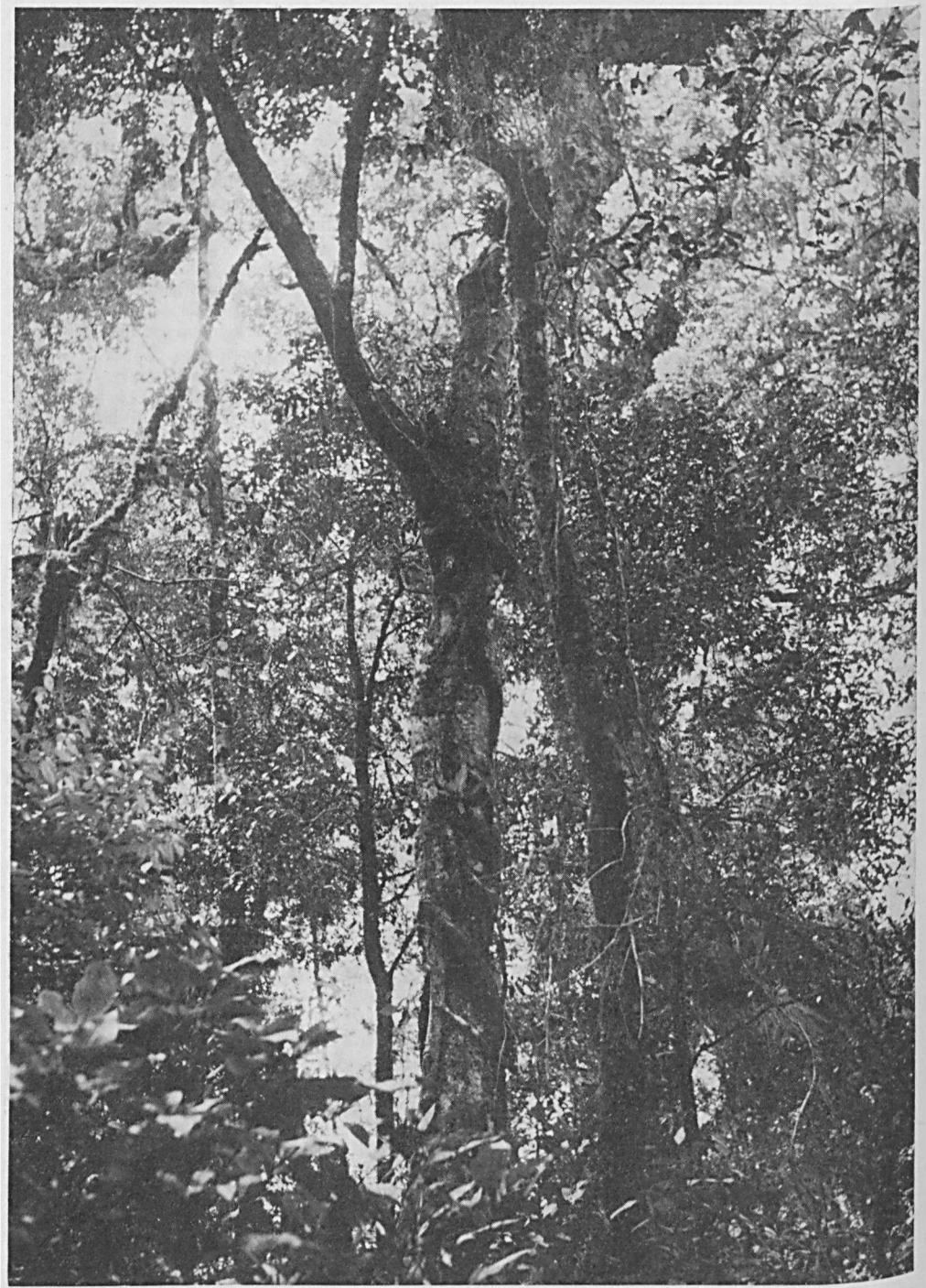


Fig. 1. A strangling *Fagraea* sp. at Pondok Patjet, Mt Singalang, Central Sumatra (W. MEYER, 1956).

1. FAGRAEA

THUNB. Vet. Acad. Handl. Stockh. 3 (1782) 132, t. 4; LEENH. Bull. Jard. Bot. Brux. 32 (1862) 418-431.—*Bertuchia* DENNST. Schluess. Hort. Malab. (1818) 30, *nom. inval.*—*Cyrtophyllum* REINW. [ex BL. Cat. (1823) 47; Isis 1 (1823) 313-314, *nom. nud.*] Syll. Pl. Ratisb. 2 (1826) 8.—*Kuhlia* REINW. [ex BL. Cat. (1823) 51, *nom. nud.*] Syll. Pl. Ratisb. 2 (1826) 6, *nom. illeg., non* H.B.K. (1825).—*Picrophloeus* BL. Bijdr. (1826) 1019.—*Utania* G. DON, Gard. Dict. 4 (1838) 663.—*Kentia* STEUD. Nomencl. ed. 2, 1 (1840) 845, *nom. illeg.*—*Flemingia* HUNTER in Ridl. J. Str. Br. R. As. Soc. n. 53 (1909) 83, *nom. inval., non* ROXB. ex AIT. (1812).—
Fig. 1-23.

Terrestrial, epiphytic, or hemi-epiphytic, often scrambling shrubs, woody climbers, or small to fairly large trees, glabrous in all parts. *Stipules* connate into an ocrea which usually early splits (interpetiolarly) into 2 axillary scales, these free or partly to entirely adnate to the base of the petiole; axillary colleters all around the node. *Leaves* petioled or sometimes sessile, coriaceous or more or less fleshy, nearly always entire (crenulate in *F. crenulata*), base usually decurrent and sometimes auriculate; penninerved, nerves often, veins nearly always inconspicuous to invisible. *Flowers* solitary, in twos, or in 3- to many-flowered cymose (rarely glomerulous, thyrsoid, or by reduction racemose or spicate) inflorescences, nearly always terminal, usually with a pair of strong basal branches in the upper leaf-axils; peduncle nearly always quadrangular in section, slightly compressed, sometimes terete, branches usually distinctly compressed. Bracts (except lower ones) small and scale-like. Bracteoles usually present, mostly similar to the bracts; but smaller, in some species large and enveloping the calyx, in that case often 2(-3) pairs present (fig. 21). *Calyx* thick-fleshy to coriaceous, in some species even almost woody, lobes imbricate, nearly always rounded, thick with a thin margin, inside with colleters at the base. *Corolla* fleshy, sometimes very thick, creamy-white (outside sometimes greenish or pinkish), the second day turning to yellow or orange, tube consisting of a tubular, thin(er)-walled basal part which may be very short and included in the calyx but can form the greater part of the tube, and a thicker-walled upper part which is either tubular and only slightly widened towards the mouth, or narrowly to widely funnel-shaped; lobes contorted, overlapping to the right, variable in length but always shorter than the tube, rounded. *Stamens* inserted in the throat (between the basal and the upper part of the tube), in some species on a thickened ring (fig. 23b); filaments broadened at and geniculate just above the base, strap-shaped, sometimes filiform; anthers basifixed, either deeply bifid at the base and blunt-ellipsoid, or shallowly bifid and acutelinear; cells dehiscing lengthwise, introrse. *Ovary* ellipsoid, tapering into a filiform to cylindrical (*in sicco* deeply lengthwise grooved) style about as long as the tube or distinctly exserted; stigma capitate, obconical, peltate, or 2-lobed; ovary either 1-celled with 2 parietal placentas, or 2-celled with axile placentas; placentas peltate, elliptic, with ∞ ovules. *Fruit*: berry, but in some large-fruited species 4-valved; usually globular to ellipsoid, crowned by the style-base, pale greyish-green or whitish or turning *via* yellow and orange to bright red; under the epidermis with a sticky white latex; calyx not or slightly enlarged (caducous in some forms of *F. blumei*). *Seeds* ∞ , irregularly angular, c. 1 mm long, minutely warty, brown.

Distr. About 35 *spp.*, from Ceylon and the Malabar coast through SE. continental Asia to South China, Hainan, and the southern peninsula of Formosa, throughout *Malaysia*, in the Northern Territory and NE. Queensland, and in the Pacific from the Marianas to the Marquesas and the Tubuai Is. and New Caledonia in the southwest; distinctly centered in *Malaysia*. LEENH. Pac. Pl. Areas 91. Fig. 3.

Ecol. Mostly heliophilous plants, along forest edges, on river-banks, in open places, also shrubs or trees in light forest and savannahs; from sea-level up to c. 3000 m. As epiphytic shrubs they are usually found on the trunk of large trees, clasping the stem with their roots; the latter may reach the soil whereby the plant becomes a hemi-epiphyte (fig. 13). Some collectors noted that the same species could be found as an epiphyte at lower altitudes, terrestrial at a higher altitude. *F. crenulata* is adapted to permanent or periodical swamp conditions. As to climate, most species grow under everwet conditions, a few only are tolerant to seasonal conditions (for example *F. fragrans*).

Flowers are mainly visited by insects (especially *Xylocopa spp.* and butterflies), some large-flowered species also by birds, possibly some species by bats (see DERX, Ann. Bog. 1, 1950, 50). The anthesis of an individual flower apparently lasts for two days, opening is after sunset; in *F. blumei*, *F. auriculata*, and possibly in all large-flowered species the free halves of the lobes are released within 5–10 minutes, standing out as the blades of a turbine after which the limb expands suddenly. The flowers are protandrous (see BURCK, Teysmannia 3, 1892, 201–203).

Dispersal is mainly effected by birds, not rarely by bats, apparently sometimes also by ants. At least some or several species are myrmecophilous: they possess extra-floral nectaries near the leaf-base, on the leaf-blades, and on the calyces; in a few species with large auricles at the petiole ants live in the shelter provided by these. For the possible protection, given by these ants, see BURCK, Ann. Jard. Bot. Btzg 10 (1891) 95–98, and Mrs NIEUWENHUIS-VON ÜXKÜLL-GÜLDENBANDT, *ibid.* 21 (1907) especially p. 252 and t. 27 f. 60 & 67.

Anat. See VON GUTTENBERG, Ann. Jard. Bot. Btzg 44 (1934) 35–41, f. 34–40; for the extrafloral nectaries see also ZIMMERMANN, Ann. Jard. Bot. Btzg 18 (1901) 1, f. 1–7.

Uses. A few species are good timber trees, notably *F. crenulata*, *F. elliptica*, and *F. fragrans*. The latex under the epidermis of the fruits is widely in use as a glue. Some of the species with large flowers are locally cultivated as ornamentals.

Morph. The *rebranching* is mainly sympodial (also in the two species with axillary inflorescences). The lower two or three internodes of the axillary shoots are in several species much longer than the further ones of the same shoot; this is especially conspicuous in the species of *sect. Cyrtophyllum*, in which a shoot of some strongly lengthened internodes abruptly ends in a number of densely crowded leaf-pairs (fig. 6).

The *stipules* are as well intra- as interpetiolarly connate and form an annulus around the twig. This annulus is nearly always highest in the leaf-axils and often shows a suture between the leaf-bases. With very few exceptions it soon splits into two 'median stipules', which I have called axillary scales (fig. 2a).

The *auricles* which are present in some species (fig. 2b–d) are no stipules but appendages of the base of the blade; they are always inserted outside the stipules. In petioled leaves the blade is often decurrent as a narrow wing along the petiole broadening at the base into the auricle, but in others the terete petiole bears no trace of such wings. See HASSELBERG, Symb. Bot. Upsal. 2, n. 3 (1937) 49–50.

The *ovary* can be 2-celled with axile placentation, or 1-celled with 2 parietal placentas. The latter may be the more primitive condition. The systematic value of this character cannot be thoroughly studied in the herbarium. I tried to get a rough impression by making sections of one or two ovaries of several species, of one ovary of several specimens of *F. gracilipes* (belonging to 'elata', 'muelleri', and 'cabbagei'), and of several ovaries of one specimen of *F. gracilipes*. I found that the ovary in one specimen is constant, 'elata' and 'cabbagei' both showed only 1-celled ovaries, but in 'muelleri' both types occurred. In some other species there was also a difference between my observations and descriptions or figures published. The tentative conclusion is that the inner structure of the ovary is variable and anyhow cannot serve for sectional or specific discrimination. During this investigation I found several ovaries which were solid, which may point to a tendency of dioecism, or dioecio-polygamism. This matter should be examined in more detail with plenty of fresh material.

Taxon. The genus has been subdivided here into three sections, *sect. Cyrtophyllum* with 3 *spp.*, *sect. Racemosae* with *F. racemosa* as only species, and *sect. Fagraea* with 27 *spp.*

A further subdivision of *sect. Fagraea* into sharply separated infrageneric taxa is not well possible. The flowers provide still the best characters, especially the form of the stigma, 2-lobed or not, seems to be important. There is a group of species characterized by a 2-lobed stigma associated with linear anthers and inside the corolla with a ring on which the stamens are inserted (fig. 23). Unfortunately *F. annulata* has the ring but not the other two characters and *F. gardenioides* has linear anthers but no ring and no 2-lobed stigma.

The remaining species have a globular, obconical, or truncate stigma, which is, however, sometimes grooved with a tendency to be slightly 2-lobed. There are two groups of species, one of which is characterized by auricles at the leaf-base, the other lacking this character. Though this character is constant for the species it cannot serve for further infrageneric subdivision as it occurs in various degree of development and seems to be of minor importance systematically.

As to other specific characters the shape of the stipules is fairly constant.

In general it has been found necessary to adopt a rather wide specific delimitation because it was often difficult to find reliable characters; especially the size of the corolla shows great but grading variation. *F. auriculata*, *F. berteriana*, *F. blumei*, *F. ceilanica*, and *F. gracilipes* are such species with wide circumscription.

Nomenclature. The name *Bertuchia* DENNST. is considered to be invalid as it is not fully in accordance with Art. 42 of the Montreal Code.

The name *Kuhlia* REINW. is illegitimate, being a later homonym of *Kuhlia* H. B. K.; *Utania* and *Kentia* were both published as substitutes, the latter superfluously.

Flemingia HUNTER is not validly published as RIDLEY's publication of the old MS of HUNTER's was only for historical reasons, and not to validate any name.

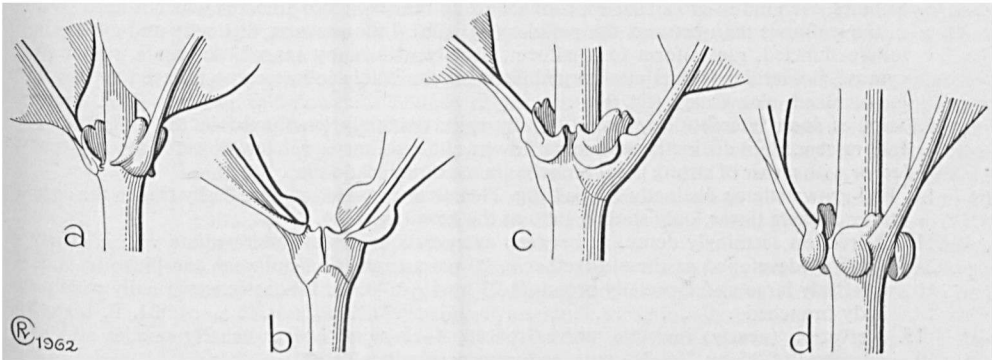


Fig. 2. Different kinds of stipules and auricles in *Fagraea*. a. Axillary scales and very faint auricles in *F. eymae* BACK. (BW. 8908), b. not-reflexed auricles in *F. fastigiata* BL. (KOORDERS 4329), c. small reflexed auricles in *F. tacapala* LEENH. (EYMA 2473), d. well developed auricles in *F. auriculata* JACK (SINCLAIR s.n.). All $\times \frac{3}{4}$.

KEY TO THE SPECIES

1. Leaves minutely crenulate. Stem and branches prickly. 12. *F. crenulata*
1. Leaves entire. Stem and branches unarmed.
2. Inflorescences exclusively axillary.
3. Inflorescences thyrsoïd, usually corymbose, mostly many-flowered; peduncle slender. Stamens and style far exserted 2. *F. fragrans*
3. Inflorescences condensed racemose, umbelliform, few-flowered; peduncle short and thick. Stamens and style hardly exserted. 3. *F. umbelliflora*
2. Inflorescences terminal (the lowest pair of strong branches often in the upper leaf-axils).
4. Flowers and fruits small (calyx 2-3 mm, corolla-tube 3½-8 mm, fruits 5-8 mm ø). Inflorescences many-flowered, corymbose 1. *F. elliptica*
4. Flowers and fruits distinctly larger. Inflorescences rarely corymbose.
5. Leaves with distinct auricles (reflexed or not) at or slightly above the base (fig. 2b-d).
6. Auricles reflexed. Young leaves not connate. Inflorescence without an involucre of reduced leaves.
7. Auricles on the petiole distinctly above the axillary scale (fig. 2b). Calyx 7 mm long, sepals connate for more than 2/3 of their length 11. *F. fastigiata*
7. Auricles at the very leaf-base, clasping the axillary scale (fig. 2c-d). Calyx (8-10 mm or more, sepals for their greater part (mostly nearly completely) free.
8. Flowers in many-flowered inflorescences. Bracteoles one pair, attached to the lower half of the pedicel. Corolla-tube 2-3 cm.
9. Leaves blunt to acute at the apex; nerves 8-10 pairs. Inflorescences about corymbose (branches erecto-patent and not of the same length). Bracteoles (½-)1-1½ cm. Calyx 1¼-2½ cm long, sepals nearly free. Corolla-tube widely funnel-shaped. 14. *F. tacapala*
9. Leaves rounded (apart from the acumen) at the apex; nerves 7-8 pairs. Inflorescences pyramidal (branches transverse to the rachis and of nearly the same length). Bracteoles 2½-3 mm. Calyx 8-10 mm, sepals connate for ¼-½. Corolla-tube slenderly funnel-shaped. 15. *F. woodiana*
8. Flowers solitary or inflorescences up to 5(-7)-flowered. Bracteoles 1-3 pairs, attached to the upper half of the pedicel. Corolla-tube 4½-15 cm.
10. Calyx enveloped by 2(-3) pairs of decussate bracteoles, the upper of which being at least half as long as the calyx (fig. 21). Flowers solitary.
11. Nerves hardly visible. Sepals rounded (fig. 18b) 19. *F. involucreta*

11. Nerves distinctly prominent on the lower side. Sepals long and acute (fig. 21e).
20. *F. macroscypha*
10. One or two pairs of small appressed bracteoles at the base of the calyx, much smaller than the latter. Inflorescences 1-3(-7)-flowered 18. *F. auriculata*
6. Auricles not reflexed. Leaves connate when young. Inflorescence with an involucre of reduced leaves.
12. Corolla-tube tubular, slender, c. 11 cm. Sepals nearly halfway up connate. 16. *F. longiflora*
12. Corolla-tube funnel-shaped, 3-3½ cm. Sepals connate for about ¼ of their length. 17. *F. carstensensis*
5. Leaves without distinct auricles (fig. 2a).
13. Stipules, even in full-grown leaves, connate around the twig into an ocrea which is hardly longer in the leaf-axils than between the petioles (fig. 10b). Inflorescences distinctly and mostly fairly long-peduncled, racemiform to spiciform, usually with many spaced, decussate, rather short, cymose glomerules (sometimes corymbiform or the whole inflorescence reduced to one fairly long-stalked glomerule) (fig. 9) 4. *F. racemosa*
13. Stipules soon interpetiolarly (nearly) fully split, distinctly lengthened in the axils (fig. 23f). Inflorescences not distinctly peduncled; flowers either solitary, or in few-flowered sessile glomerules, or with a pair of strong basal branches in the upper leaf-axils.
14. Full-grown stigma distinctly 2-lobed (fig. 23d). Stamens inserted on a fleshy ring in the corolla-tube; anthers linear, only slightly bifid at the base (fig. 23b).
15. Nervation seemingly dense, as between every two nerves an intermediate vein is nearly as strongly developed as these, together c. 20 pairs (nervation not very conspicuous). Leaves relatively large and especially broad (9-23 by 4½-14 cm). Inflorescences usually widely and laxly branched 31. *F. berteriana*
15. Nervation (nearly) invisible, nerves spaced, 4-12 pairs. Leaves usually smaller and often narrower (4-15 by 2½-7½ cm). Inflorescences rather dense.
16. Leaf-base subcordate to rounded, rarely broadly cuneate, distinctly set off from the petiole. Bracteoles, if present, apical, appressed to the calyx 28. *F. salticola*
16. Leaf-base acute, decurrent. Bracteoles attached about halfway the pedicel.
17. Corolla-tube tubular or narrowly funnel-shaped, 1½-4 cm. Axillary scale usually distinctly broader than the base of the petiole, 3-10 mm long. Leaf apex often shortly and broadly acuminate. Fruits broadly ellipsoid to subglobose, contracted into a strong conical beak. 29. *F. bodenii*
17. Corolla-tube long-tubular, 7-11 cm. Axillary scale inconspicuous, 3-5 mm long. Leaf-apex blunt to rounded, not acuminate. Fruits oblong-ellipsoid, acute 30. *F. gitingensis*
14. Full-grown stigma capitate, obconical, or peltate (in the latter case sometimes slightly 2-lobed). Stamens not inserted on a ring (*F. annulata* excepted); anthers oblong to elliptic, about halfway bifid (*F. gardenioides* excepted).
18. Corolla-tube 6-14 cm, cylindrical or almost so.
19. Calyx ½-1 cm long; anthers 4 mm. Flowers in sessile glomerules, rarely solitary. 8. *F. tubulosa*
19. Calyx 1½-5 cm; anthers 7 mm long or more. Flowers solitary or in up to about 5-flowered cymes. 21. *F. resinosa*
20. Calyx enveloped by an involucre consisting of two pairs of large bracteoles.
20. Calyx not enveloped by such an involucre.
21. Anthers linear, bifid at the very base only. Stipules conspicuous. 23. *F. gardenioides*
21. Anthers oblong to elliptic, bifid till about the middle. Stipules not very conspicuous.
22. Flowers in c. 5-flowered cymes. Bracteoles small, attached about halfway the pedicel, patent. Calyx 1½-1¾ cm high. Anthers 7 mm long. Fruits subglobose, 5 cm ø. Axillary scale truncate to slightly emarginate. The Ceylonese form 5. *F. ceilanica*
22. Flowers solitary or rarely in twos. Bracteoles ½-1 cm long, attached just below and appressed to the calyx. Calyx (1½-2)-2-5 cm high. Anthers 1-1¼ cm long. Fruits ellipsoid, 4-7 cm long. Axillary scale rounded 22. *F. carnosa*
18. Corolla-tube less than 6 cm, funnel-shaped.
23. Flowers sessile, in 3-7-flowered glomerules.
24. Calyx ¾-1¼ cm high. Axillary scale inconspicuous, rounded, appressed to the twig. Leaves 7-24 by 3¾-10 cm; midrib slender, rounded beneath, nerves invisible. 7. *F. acuminatissima*
24. Calyx 2½-3 cm high. Axillary scale conspicuous, 2-lobed, adnate to the petiole. Leaves 20-38 by 8-18 cm; midrib bold, keeled beneath, nerves conspicuous. 13. *F. truncata*
23. Flowers either solitary or distinctly pedicelled in few-flowered, or in widely branched and many-flowered inflorescences.
25. Inflorescences warty-lenticellate 10. *F. blumei*
25. Inflorescences not warty-lenticellate (at least during anthesis!).
26. Calyx partly enveloped by an involucre consisting of 1 or 2 pairs of large bracteoles.

- 27. Involucrum composed of one pair of confluent bracteoles (fig. 14c). 5. *F. ceilanica*
- 27. Involucrum composed of two pairs of free bracteoles 25. *F. calcarea*
- 26. Calyx without involucrum.
- 28. Nerves distinctly prominent beneath 9. *F. ridleyi*
- 28. Nerves either impressed, or inconspicuous to invisible.
- 29. Stamens inserted on a distinct thickened ring about halfway the corolla-tube. 6. *F. annulata*
- 29. Stamens not inserted on a distinct thickened ring.
- 30. Leaves sessile, rounded to subcordate at base, faintly auriculate (fig. 2a); nerves 5-6 pairs. Inflorescences usually 2-flowered 27. *F. eymae*
- 30. Leaves nearly always petioled, acute to decurrent at base; mostly more nerves (one form of *F. ceilanica* has a rounded to subcordate leaf-base, but is not auriculate and has 4-15-flowered inflorescences).
- 31. Axillary scale conspicuous, rounded, truncate, or emarginate at the apex. Inflorescences up to 5-flowered. Pedicels robust. Anthers 7½ mm long or more. Stigma peltate.
- 32. Leaves often slightly auriculate at the base; midrib keeled beneath; nerves inconspicuous, up to 20 pairs. Sepals connate for half their length or less. Fruits ellipsoid, 6-7 cm long, not distinctly beaked . . . 18. *F. auriculata* ssp. *parviflora*
- 32. Leaves never auriculate; midrib rounded beneath; nerves about invisible, up to 10 pairs. Sepals connate for half their length or more. Fruits subglobular, up to 5 cm long, with a long and slender beak 24. *F. curtisii*
- 31. Axillary scale inconspicuous, rounded, rarely truncate at the apex. Inflorescences mostly more than 5-flowered. Pedicels nearly always slender. Anthers up to 7½ mm long. Stigma capitate, obconical, or more exceptionally peltate.
- 33. Usually a shrub or climber. Midrib flat or prominulous above, nerves usually invisible. Calyx 1-2¾ (-4) cm long (in the form 'khasiana' 6-7½ mm). Anthers usually more than 5 mm long. Stigma obconical to peltate 5. *F. ceilanica*
- 33. Usually a tree. Midrib mostly grooved above, nerves delicately grooved on both sides. Calyx ¼-¾ (-1½) cm long. Anthers up to 5 mm long. Stigma capitate to subobconical 26. *F. gracilipes*

1. Section *Cyrtophyllum*

(REINW.) BL. *Rumphia* 2 (1838) 34.—*Cyrtophyllum* REINW. 1826.—*Picrophloeus* BL. 1826.—*Fagraea* subg. *Cyrtophyllum* MIQ. Fl. Ind. Bat. 2 (1857) 375.—*Fagraea* sect. *Parviflorae* BTH. J. Linn. Soc. Bot. 1 (1856) 100.—*Flemingia* HUNTER in Ridl. 1909, *nom. inval.*

Leaves not auriculate. Inflorescences corymbose, with many small flowers; corolla-tube always tubular; stamens and style far exserted (except in *F. umbelliflora*); fruits globular, small.

1. *Fagraea elliptica* ROXB. [Hort. Beng. (1814) 84, *nom. nud.*] Fl. Ind. ed. Wall. 2 (1824) 32; ed. Carey 1 (1832) 462; DC. Prod. 9 (1845) 30; MIQ. Fl. Ind. Bat. 2 (1857) 376; K. & V. Bijdr. 9 (1903) 84; Atlas 2 (1914) f. 330; KOORD. Fl. Tjib. 3 (1918) 48; CAMMERL. Bull. Jard. Bot. Botz III, 5 (1923) 316; HEYNE, Nutt. Pl. (1927) 1270; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 13.—*Picrophloeus javanensis* BL. Bijdr. (1826) 1020; DON, Gard. Dict. 4 (1837) 66; DC. Prod. 9 (1845) 32.—*Cyrtophyllum speciosum* BL. Bijdr. (1826) 1022; DC. Prod. 9 (1845) 31; RIDL. Fl. Mal. Pen. 5 (1925) 322, *incl. var. montanum*.—*Willughbeia elliptica* SPRENG. Syst. Veg. 4 (1827) Cur. Post. 71.—*F. speciosa* BL. *Rumphia* 2 (1838) 35, t. 81; Mus. Bot. 1 (1850) 172; *non* RIDL. J. Str. Br. R. As. Soc. n. 50 (1908) 122 (= *F. fragrans*); MERR. Philip. J. Sc. 11 (1917) Bot. 306.—*F. picrophloea* BL. *Rumphia* 2 (1838) 36, *nom. illeg.*; Mus. Bot. 1 (1850) 173; MIQ. Fl. Ind. Bat. 2 (1857) 377.—*F. kimangu* BL. Mus.

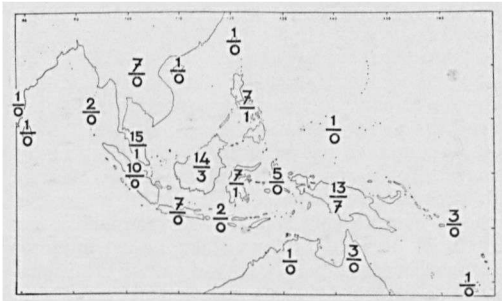


Fig. 3. Distribution of *Fagraea* in and around Malaysia. The number above the hyphen refers to the total number of species, that below the hyphen to the number of endemic species in each island or district.

Bot. 1 (1850) 173; Walp. Ann. 3 (1852) 76, *sphalm. kimangu*; MIQ. Fl. Ind. Bat. 2 (1857) 377.

—*F. valida* MIQ. Fl. Ind. Bat. 2 (1857) 376.—*F. sumatrana* MIQ. Fl. Ind. Bat. 2 (1857) 377; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 318.—*F. aurantiodora* S. MOORE, J. Bot. 66 (1928) 105.—*F. pseudoelliptica* KAN. & HATUS. Bot. Mag. Tokyo 56 (1942) 161, f. 5.—*F. javanensis* BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 12; Blumea 6 (1950) 382.—*F. pusilliflora* BAKH. f. [in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 13, Dutch descr.] Blumea 6 (1950) 383.—Fig. 4.

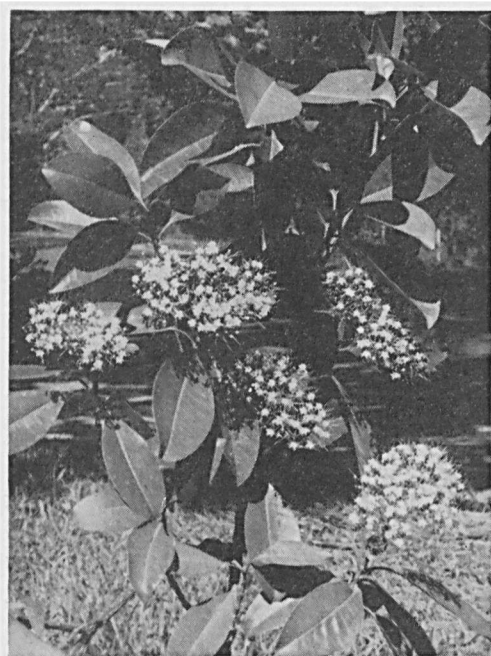


Fig. 4. *Fagraea elliptica* ROXB., Sandakan (North Borneo) (MEYER, 1960).

Tree up to 45 m by 0.15–1½ m ø, sometimes with buttresses up to 1 m high, or shrub, rarely a vine. Leaves usually lanceolate or oblong to obovate, sometimes broadly obovate, 7½–24(–32) by 1¾–15 cm, thinly to thickly coriaceous, base acute to slightly attenuate, apex mostly short- to long-acuminate, less often obtuse, rarely broadly rounded or subretuse; nerves 6–20 pairs, faintly to distinctly conspicuous, often slightly impressed above, beneath usually distinctly prominulous or (in thick leaves) hardly visible; petiole varying from rather thin to robust, 1–4 cm long. Stipules connate into a 1½–7½ mm long ocrea which may split into rounded axillary scales, partly adnate to the petiole. Inflorescences terminal and often also in the topmost leaf-axils, up to 30 cm wide, often much smaller, very many-flowered; peduncle 1–13 cm; pedicels during anthesis 1–4 mm (later up to 6 mm), often provided with 2 minute bracteoles inserted about halfway or somewhat lower down. Calyx campanulate, 2–3 mm

long, divided ± halfway. Corolla: tube narrow, cylindric, 3½–6(–8) mm. Stamens erect or later reflexed; anthers oblong, 1½ mm long, cells free in the basal half. Style (accrescent during anthesis?) varying from 1½ mm and included to 1¾ cm and far exserted; stigma small, capitate, very obscurely 2-lobed. Berry globose, ½–¾ cm ø, tipped by a minute circular style-rest, orange-coloured to brick-red.

Distr. *Malaysia*, except Central and East Java, the Lesser Sunda Is., and the Philippines.

Ecol. In very different sites, both on dry and on marshy or temporarily inundated soils, mostly on sand, often along rivers, in humid forests, open forests, shrubberies, heath forest, grass wastes, rocky strand forest, also as a shrub on open dry hill-tops, from sea-level up to 1800 m. Fl. (mainly April–June), fr. Jan.–Dec.

Uses. The brownish to pale yellow, medium to very hard, very durable wood is used for house-building, for bridges, and for padi pounders. Also used medicinally against stomach-ache.

Vern. *Kaju badjam*, *k. galumbang batu*, *k. kadjang*, *k. kisa*, *k. labih*, *k. rama-rama*, *k. sabo*, *k. si margalugur*, *k. si margapuk*, *randa tiung*, *ruku biruwang*, *sélura*, *sépuhan*, *sibatukon*, *simar tarasa*, *témbésu kétam*, *t. rawah*, *t. rawang*, *t. talang*. Sum., *rubi*, *ténggél dotan*, *tutun ténggél délok*, Simalur, *témbésu*, Nias & Billiton, *kaju bujuk*, *k. sabo* (or *sobo*), *témbésu samsu*, Banka, (*jénis*) *témbasu*, Mal. Pen., *ki mangle*, *ki mangul*, *ki minjak*, *ki tandu*, *ki térong badak*, *rangkot tandus* (or *tando*), Java S., *bintulu*, *brut-brut*, *témasu* (*kbini*), *témbaso bansang*, *témbusu*, Born., *tariwan*, Cel.; Moluccas: *bientaus*, Sula, *kau*, *wadil*, Buru, *atieso*, Ceram, *tonki tonki*, Ambon; *niperen*, New Guinea.

Note. *F. picrophloea* BL. is illegitimate, being based upon *Picrophloeus javanensis*; the epithet *javanensis* should, and could, have been used.

2. *Fagraea fragrans* ROXB. [Hort. Beng. (1814) 84, *nom. nud.*] Fl. Ind. ed. Wall. 2 (1824) 32; ed. Carey 1 (1832) 461; DON, Gard. Dict. 4 (1837) 68; BL. Mus. Bot. 1 (1850) 172; BTH. J. Linn. Soc. Bot. 1 (1857) 100; MIQ. Fl. Ind. Bat. 2 (1857) 375; SCHEFF. Nat. Tijd. N.I. 31 (1870) 22; KURZ, Fl. Burm. 2 (1877) 205; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 85; VIDAL, Sinops. (1883) t. 69 f. A; WATT, Dict. 3 (1890) 312; AHERN, Compil. Timber Tree P. I. (1901) 88, pl.; K. & V. Bijdr. 9 (1903) 86; KING, J. As. Soc. Beng. 74, ii (1908) 611; RIDL. J. Str. Br. R. As. Soc. n. 50 (1908) 121; ELM. Leaf. Philip. Bot. 2 (1909) 597; DOP, Fl. Gén. I.–C. 4 (1914) 177; K. & V. Atlas (1914) f. 332; ENDERT, Tectona 13 (1920) 132; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 318; FOXW. Mal. For. Rec. n. 3 (1927) 157; HEYNE, Nutt. Pl. (1927) 1270; HOLTUM, Gard. Bull. S. S. 9 (1935) 73; ESSENBERG, Tectona 28 (1935) 606, fig.; DE GRAAF, Tectona 28 (1935) 611; VAN DER VOORT, Trop. Natuur 28 (1939) 207, f. 9–10; CORNER, Ways. Trees (1940) 424, t. 122–123; KERR in Craib, Fl. Siam. En. 3 (1951) 55; BROWNE, For. Trees Sar. & Brun. (1955) 244, t. 32. —

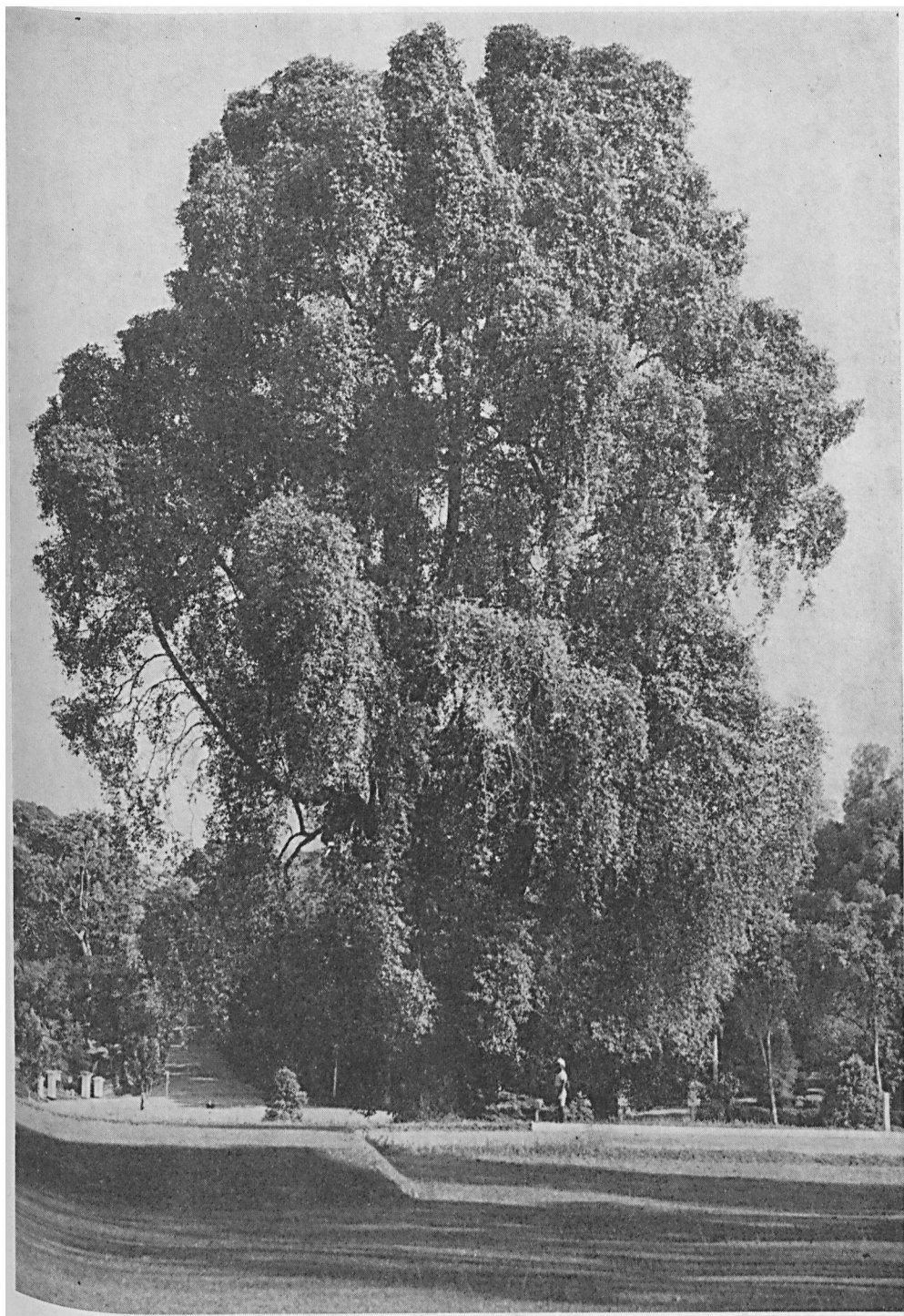


Fig. 5. *Fagraea fragrans* ROXB. at Tanglin Barracks, Singapore (CORNER).

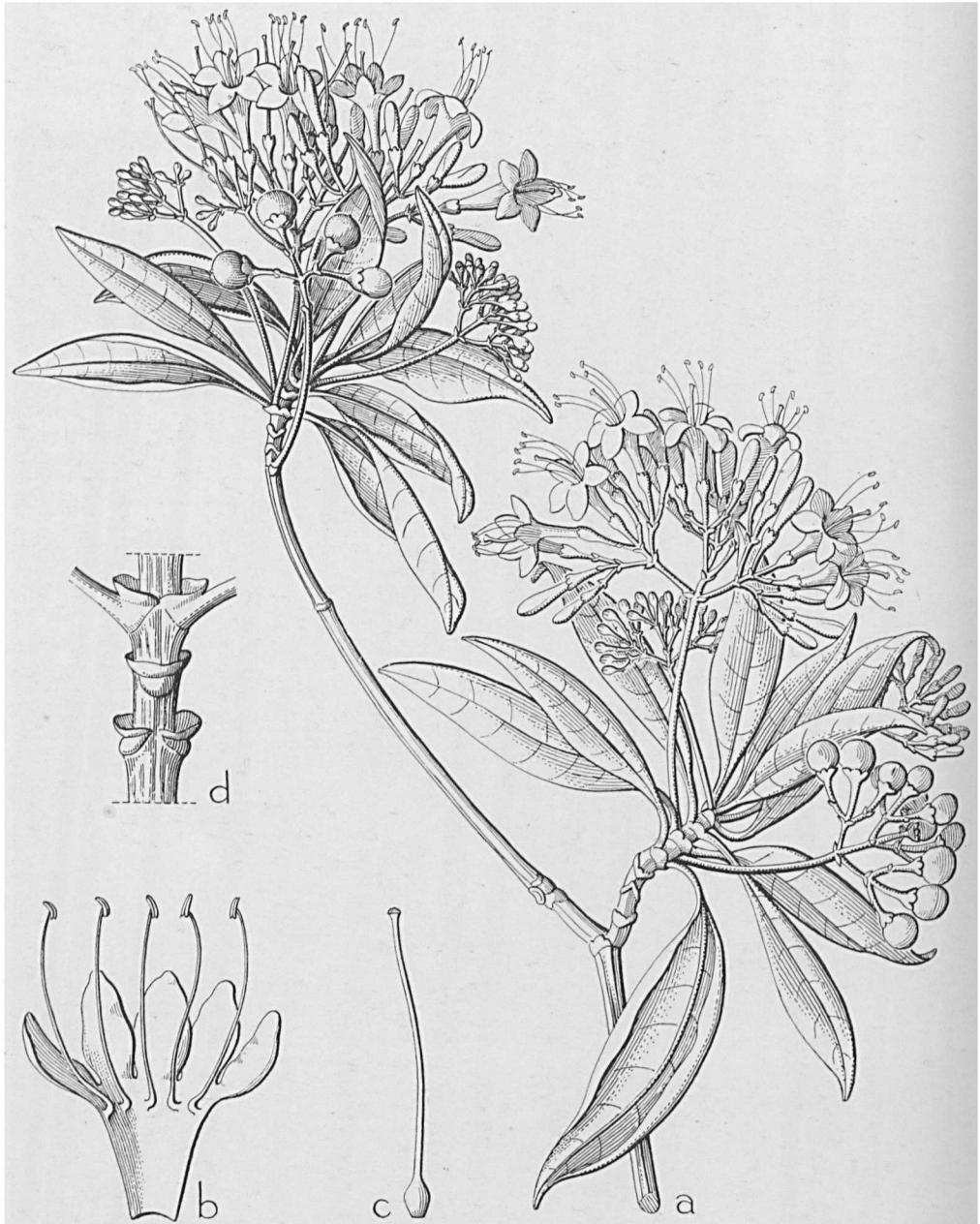


Fig. 6. *Fagraea fragrans* ROXB. a. Habit, with flowers and fruits, $\times \frac{2}{3}$, b. opened corolla with the long-exserted stamens, $\times 2$, c. pistil, $\times 2$, d. small part of twig, showing the axillary scales, $\times 2$ (a after Rumphia 2, t. 80, b-d BLUME in herb. L 908.127-224).

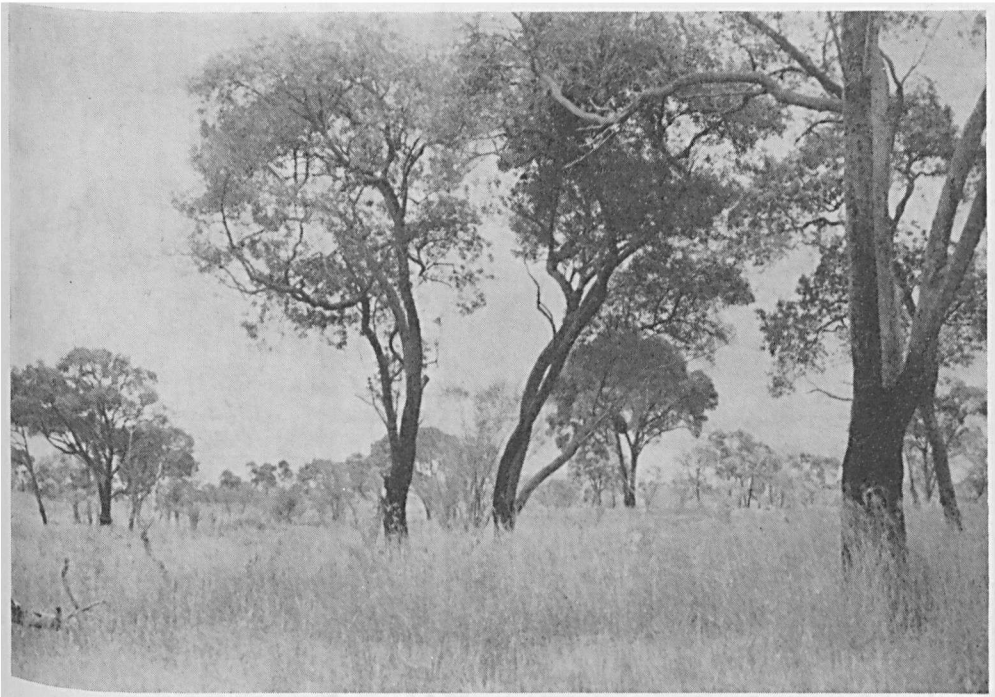


Fig. 7. Burned-over savannah with *Fagraea fragrans* ROXB., Padang Bolak, Sumatra East Coast Res. Corky bark charred by fire (VAN DER VOORT, 1939).

- Cyrtophyllum peregrinum* REINW. [ex BL. Cat. (1823) 47, *nom. nud.*; Isis 1 (1823) 313 & 314, *nom. nud.*] Syll. Pl. Ratisb. 2 (1826) 9; BL. Bijdr. (1826) 1022; DC. Prod. 9 (1845) 31; RIDL. Fl. Mal. Pen. 2 (1923) 421; HOLTUM, Gard. Bull. S.S. 5 (1931) 189.—*Willughbeia fragrans* SPRENG. Syst. Vcg. 4 (1827) Cur. Post. 71.—*F. peregrina* BL. Rumphia 2 (1838) 34, t. 80; Mus. Bot. 1 (1850) 172; SCHEFF. Nat. Tijds. N. I. 31 (1870) 22.—*Cyrtophyllum fragrans* DC. Prod. 9 (1845) 31; RIDL. Trans. Linn. Soc. Bot. 3 (1893) 323.—*Cyrtophyllum lanceolatum* DC. Prod. 9 (1845) 31; RIDL. Fl. Mal. Pen. 2 (1923) 421.—*F. lanceolata* WALL. [Cat. (1829) n. 1599, *nom. nud.*] SCHNIZL. Iconogr. 2 (1851) t. 131, fig. 1, *nom. illeg., non Bl.* 1826; MIQ. Fl. Ind. Bat. 2 (1857) 376; BURK. Dict. (1935) 995.—*F. wallichiana* BTH. J. Linn. Soc. Bot. 1 (1856) 98; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 85; KING, J. As. Soc. Beng. 74, ii (1908) 607; CORNER. Ways. Trees (1940) 426.—*F. speciosa* (non BL.) RIDL. J. Str. Br. R. As. Soc. n. 50 (1908) 122.—*Flemingia fragrans* HUNTER in Ridl. J. Str. Br. R. As. Soc. n. 53 (1909) 83, *nom. inval.*—*F. caudata* RIDL. J. Str. Br. R. As. Soc. n. 79 (1918) 97.—*F. gigantea* RIDL. l.c. 98; Foxw. Mal. For. Rec. n. 3 (1927) 157, pl.; BURK. Dict. (1935) 995; CORNER, Ways. Trees (1940) 425; BROWNE, For. Trees Sar. & Brun. (1955) 245.—*Cyrtophyllum caudatum* RIDL. J. Str. Br. R. As. Soc. n. 79 (1918) 98, *nom. altern., illeg.*—*Cyrtophyllum wallichii* RIDL. l.c., *nom. altern., illeg.*—*F. cochinchinensis* A. CHEV. Cat. Pl. J. Bot. Saigon (1919) 65, *pro specim., excl. basionym*; BROWN, Min. Prod. Philip. For. 3 (1921) 220; MERR. En. Philip. 3 (1923) 314; BURK. Dict. (1935) 994; BROWN, Useful Pl. Philip. 3 (1950) 223.—*Fagraea* sp. ENDERT, Tectona 13 (1920) 142.—*F. sororia* J. J. SMITH in Cammerl. Bull. Jard. Bot. Btzig III, 5 (1923) 319, f. 5; HEYNE, Nutt. Pl. (1927) 1270; STEUP, Tectona 24 (1931) 1132–1133; Trop. Natuur 22 (1933) 110.—*Cyrtophyllum giganteum* RIDL. [J. Str. Br. R. As. Soc. n. 79 (1918) 98, *nom. altern., inval.*] Fl. Mal. Pen. 2 (1923) 421.—*F. ridleyi* GANDOGER, Bull. Soc. Bot. Fr. 70 (1924) 921, *nom. illeg., non K. & G.* 1908.—Fig. 5–8.
- Tree (sometimes a shrub), 8–25(–55) m tall, up to 1.35(–2½) m ø, sometimes with buttresses up to 2½ m. Leaves petioled, oblong-lanceolate to lanceolate or obovate-oblong, 4–15 by 1½–6 cm, mostly thin, rarely firmly coriaceous, sometimes more or less bullate, the base acute or shortly attenuate, the apex rarely blunt to acute, usually short- to long-acuminate, sometimes to caudate, obtuse; nerves 4–9 pairs, rarely more or fewer, sunken above, slightly prominent or invisible beneath; petiole thin, 1–2½ cm; axillary scale rounded, c. 1–2 mm long, partly free from the petiole. Inflorescences in the higher leaf-axils, (1–)3- to ∞-flowered, often rather dense; peduncle thin, 1½–7½ cm; pedicels thin, ½–2½ cm, often with 2 minute bracteoles in or below the middle



Fig. 8. *Fagraea fragrans* ROXB., cult. in Botanic Gardens, Singapore (HENDERSON, 1949)

(in few-flowered inflorescences sometimes with a second pair near the base). *Calyx* campanulate, 2½–8 mm long, divided over ¼–¾ of its length. *Corolla*-tube narrowly funnel-shaped, ¾–2¼ cm. *Anthers* oblong-linear to oblong-elliptic, 1¾–3 mm long, cells free in the basal half. *Style* 1¼–6 cm long; stigma small, capitate or obconical, faintly 2-lobed. *Berry* broadly ellipsoid, tipped by the short but distinct style-rest, ¾–1 cm ø, red or orange.

Distr. Bengal (near Calcutta, wild?), Lower Burma (from Rangoon southward), the Andaman Is. (CLARKE, *l.c.*), Siam, South Indo-China (N. to Tourane, Central Annam), and *Malaysia*: Sumatra, Malay Peninsula, W. Java (naturalized), Bawean, Borneo, SW. Philippines (Balabac, Palawan, Busuanga, Culion, Mindoro), Celebes, and Japen I. near NW. New Guinea.

According to MIQUEL, *l.c.*, also in the Moluccas; I do not know on what collection this assertion was based. The statements "China" and "Japan" in older literature go back to ROXBURGH and BLUME, who gave this as the possible origin of cultivated specimens.

Ecol. Humid, often seasonally but not constantly swampy, light forest, secondary forests, lalang fields, in the Malay Peninsula also along the beach; it does very well in poorly aerated, compact or swampy soils, but also on poor sands or podsols; from sea-level up to c. 800 m. *Fl.* mainly April–June, *fr.* mainly July–Nov. Flowering (and consequently fruiting) is distinctly periodical: HOLTUM (Gard. Bull. S. S. 9, 1935, 73–78)

found in Singapore that "...general flowering is in progress about four months after the onset of the dry weather." and "...the time from the stimulus to flower-development to the ripening of fruit is about seven months and a half" (p. 75). RIDLEY (Trans. Linn. Soc. Bot. 3, 1893, 323) cited as flower-visitors, mainly in the evening, "innumerable butterflies, of the *Hesperidae* section, and humming-bird hawk-moths (*Macroglossa luteata* and *M. insipida*)." The fruits are mainly eaten by bats (*Pteropus edulis* and *Cynopterus spp.* according to RIDLEY, Disp. 1930, 348), furthermore by birds (*Otocompsa analis*, RIDL. *l.c.* 481), and possibly also by fruit-eating ants (*Polyrachis sp.*, RIDL. *l.c.* 526). A light-demanding tree, often a pioneer on burned-over areas (VAN DER VOORT, *l.c.*) (fig. 7).

Uses. This beautiful tree is often planted, especially along roads and as a shade tree, mainly in Siam, Sumatra, Singapore, and locally in Java. Furthermore it is commonly planted for reforestation, as the timber is highly valued, being hard and very durable – even in the soil or in water – though not very beautiful. A decoction of the bark is used as a febrifuge, *e.g.* for malaria, a decoction of the leaves and twigs is drunk in Kedah, Malaya, for passing blood in stools, such as happens in dysentery.

Vern. *Ironwood*, E. The common Malayan name is *těmběsu* (*lěměsu*, *sěměsu*, *tamasu*, *taměsu*, *těmasu(k)*, *těmběsi*, *těmbusu*, *těmě(n)su*, *těmusu*) in many combinations. *Kayu musuh-musuh*, *k. tammusuh padang-padang*, *k. těmbusu*, *pohon su-*

mĕjar, tĕmbĕsu bukit, t. kapur, t. langkanang, t. lĭlin, t. paya, t. pĕmatang, t. rawang, t. rĕnah, t. talang, Sum., kayu tĕmbusu, pako (or poko(k)) tĕmbusu, p. tummōsōh paya, rĕriang, riang-riang, tamsao, tĕmbĕsu bukit, t. hutan, t. kĕmpang (or kampong), t. luar, t. padang, t. talang, t. tĕmbaga, t. tikus, Mal. Pen., ki badak, Java S., (s)ambinaton (or binaton or tombiaton), loang, mahoei, marambungkam, pĕrĕpat, sĕranai, tambiaton, tĕmbĕsu butat, t. danau, t. hutan, t. laut, t. padang, t. pasir, t. rĕbong, t. rusa, t. tanduk, tibuan, Born.; Philip.: t. dĕlo, dĕlo, ũling, Tagb., susulin, Tag., tĕka, uring, ũrung, Kuy.; anrali, bitjoro, nosu, (pohon) kulahi (or kolahi), Cel., mana hurudu, manderi, Japen.

Notes. On the whole this species is fairly uniform. Only two of the synonyms were based upon clearly distinguishable forms, viz *F. wallichiana* (= *F. lanceolata* SCHNIZL. = *Cyrtophyllum lanceolatum* DC.) and *F. caudata*, the former comprising all the specimens known from P. Penang near the Malay Peninsula, the latter described from Borneo. Both are characterized by (1-)3-flowered inflorescences with relatively large flowers and by lanceolate leaves, tapering at both ends, distinctly caudate in the latter form.

Furthermore, foresters, especially in Malaya, distinguish between *F. fragrans*, being a fairly small tree of the secondary forest, and *F. gigantea*, a canopy tree of the high lowland forest; there are also differences in the bark, which is dark-brown and deeply irregularly fissured in the first mentioned form, brown or reddish brown with closer, narrower and more regularly longitudinal ridges and fissures in the second one; in the leaves, being flat and with c. 8 pairs of nerves in *F. fragrans*, having a wavy, undulating margin and 5-6 pairs of nerves in *F. gigantea*; the timber of *F. fragrans* is also more heavy than that of *F. gigantea*. *F. fragrans* is often mentioned to propagate freely, *F. gigantea* would not propagate or only exceptionally. In my opinion these are merely ecotypes, or even only specimens of different age: *F. fragrans* is a light-demander, thus a pioneer of open country, where it can maintain itself fairly well, being fire-resistant. The name *F. gigantea* is probably applied to the few old specimens left after the forest has restored itself, or - as there seems to be mostly a small group of specimens - which filled up a glade. And these old specimens stand in an ecological position in which propagation is impossible.

In old literature the inflorescences are often said to be axillary and terminal; the latter statement is apparently based upon inaccurate observation, and then copied again and again.

Sterile specimens can be distinguished from the related *F. elliptica* especially by the stipules: in *F. elliptica* they form together an annular ocrea closely appressed to the twig, in *F. fragrans*

they are mutually nearly free and form small cups in the leaf-axils (fig. 6d).

For the name *Flemingia fragrans* HUNTER see under the notes to the genus.

The basionym of *F. cochinchinensis* A. CHEV. is *Aidia cochinchinensis* LOUR. (type in BM). This was reduced by MERR. Comm. Lour. (1935) 365 to *Randia cochinchinensis* (LOUR.) MERR. (*Rubiaceae*).

3. *Fagraea umbelliflora* GILG & BENED. Bot. Jahrb. 54 (1916) 193, f. 12.

Treelet or shrub, 2-5 m tall. Leaves petioled, broadly ovate to obovate or lanceolate, 8-18 by 3-9 cm, thin- to stiff-coriaceous, base broadly to acutely cuneate, attenuate, apex broadly rounded, rather abruptly terminated by a short and slender acumen or acute and hardly acuminate; nerves 5-10 pairs, inconspicuous to invisible, sometimes prominulous beneath; petiole slender, 2½-5 cm; axillary scale for the greater part adnate, 3-5 mm long, cup-shaped, rounded at the apex. Inflorescences axillary, umbelliform, nearly sessile or with an up to c. 1 cm long, thick peduncle, c. 4-10 fairly long-pedicelled flowers, pedicels slender, without bracteoles, 1-1½ (in fruit -2) cm. Calyx campanulate, 4-6 mm long, divided somewhat less than halfway down. Corolla-tube nearly tubular, 2-2¼ cm, slightly widened towards the mouth. Anthers oblong-sagittate, 2-3 mm long, cells free in their basal half. Stigma small, narrowly cuneate, truncate. Fruits subglobular, c. 1 cm ø; pedicels hardly thickened, calyx appressed.

Distr. *Malaysia*: New Guinea (Japen I., Vogelkop Peninsula, Sepik region).

Ecol. In dense, very humid high-stemmed primary forest, 60-1200 m. Fl. July, Nov., fr. Nov.

Vern. *Niejap*.

Notes. The type is cited as LEDERMANN 9714; the only original specimen I did see, which is apparently an isotype (in L) bears the number 9614.

In principle the inflorescences seem to be umbelliform condensed racemes, terminal on short axillary shoots or knobs, but with the exception of some minute bracts these shoots are quite leafless. Therefore it comes very near to a really axillary inflorescence, as we find in this genus only in *F. fragrans*.

Though the affinity of *F. umbelliflora* is not fully clear I have tentatively included it in *sect. Cyrtophyllum*; it differs from the other species amongst other characters, by the stamens and style which are only very slightly exerted. Within *sect. Cyrtophyllum* it seems to be closest to *F. fragrans*. Outside the section it may have some affinity with *F. gracilipes*.

2. Section Racemosae

BTH. J. Linn. Soc. Bot. 1 (1856) 99 & 73.—*Kuhlia* REINW. 1826, non H.B.K. 1825.—*Utania* G. DON, 1838.—*Kentia* STEUD. 1840, *nom. illeg.*—*Fagraea sect.*

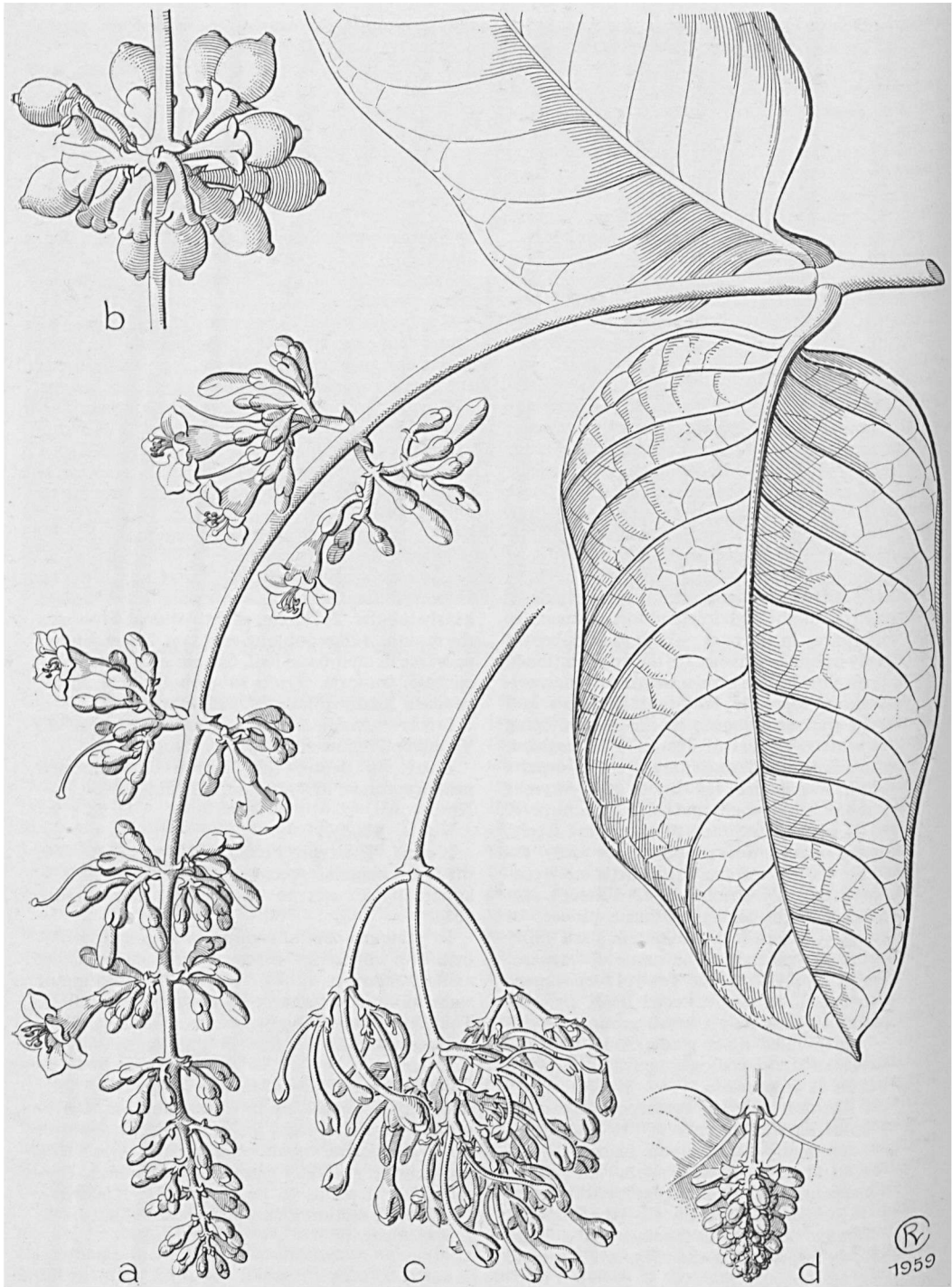


Fig. 9. *Fagraea racemosa* WALL. a. well-developed normal inflorescence, $\times \frac{1}{2}$, b. part of infructescence, $\times 1$, c. inflorescence of '*F. pendula*', $\times \frac{1}{2}$, d. inflorescence of '*F. spicata*', $\times \frac{1}{2}$ (a partly after Rumphia 2, t. 79, the leaves from WOMERSLEY NGF 3870, b WOMERSLEY NGF 3870, c CLEMENS 21546, d AGAMA BS 553).

Pseudoracemosae SOLER. in E. & P. Nat. Pfl. Fam. 4, 2 (1892) 43.

Leaves not auriculate; stipules connate in an ocrea. Inflorescences peduncled, racemiform, with a number of distant decussate pairs of small cymes (sometimes basal cymes long-stalked, sometimes all cymes sessile and close together, sometimes the whole inflorescence reduced to a long-stalked, few-flowered glomerule). Stamens and style not or only slightly exerted.

4. *Fagraea racemosa* JACK *ex* WALL. in Roxb. Fl. Ind. 2 (1824) 35; DC. Prod. 9 (1845) 29, *incl. var. grandis* [WALL. Cat. (1829) n. 1601-2, *nom. nud.*]; BENTH. J. Linn. Soc. Bot. 1 (1856) 99; MIQ. Ann. Mus. Bot. Lugd.-Bat. 2 (1866) 218, *incl. var. coarctata*; BENTH. Fl. Austr. 4 (1869) 501; KURZ, Fl. Burm. 2 (1877) 205; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 84; K. SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 109; F. M. BAIL. Queensl. Fl. 3 (1900) 1023; KING, J. As. Soc. Beng. 74, ii (1908) 608, *incl. var. pauciflora*; RIDL. J. Str. Br. R. As. Soc. n. 50 (1908) 118; DOP, Fl. Gén. I.-C. 4 (1914) 175; BURK. J. Str. Br. R. As. Soc. n. 73 (1916) 215, 226, 259; GILG & BENO. Bot. Jahrb. 54 (1916) 184; MERR. Sp. Blanc. (1918) 306; En. Philip. 3 (1923) 315; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 310; RIDL. Fl. Mal. Pen. 2 (1923) 418; BURK. & HENDERS. Gard. Bull. S. S. 3 (1925) 399; LANE-POOLE, For. Res. (1925) 134; BURK. Dict. (1935) 996; CORNER, Ways. Trees (1940) 425; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 10; F. S. WALKER, For. Br. Sol. Is. (1948) 137; BROWN, Useful Pl. Philip. 3 (1950) 224, f. 87; KERR in Craib, Fl. Siam. En. 3 (1951) 57; MERR. J. Arn. Arb. 33 (1952) 225; BROWNE, For. Trees Sar. & Brun. (1955) 246.—*F. volubilis* WALL. in Roxb. Fl. Ind. 2 (1824) 36; DON, Gard. Dict. 4 (1837) 68; DC. Prod. 9 (1845) 30; MIQ. Fl. Ind. Bat. 2 (1857) 367; VIDAL, Sinopsis (1883) t. 69 f. B.—*Kuhlia morindaefolia* REINW. [*ex* BL. Cat. (1823) 51, *nom. nud.*] Syll. Pl. Ratisb. 2 (1826) 7, *nom. illeg.*; BL. Bijdr. (1826) 777.—*F. malayana* MART. Nov. Gen. Sp. 2 (1826) 91; DON, Gard. Dict. 4 (1837) 68; DC. Prod. 9 (1845) 30.—*Willughbeia racemosa* SPRENG. Syst. Veg. 4 (1827) Cur. Post. 71.—*Willughbeia volubilis* SPRENG. l.c.—*F. morindaefolia* BL. Rumphia 2 (1838) 32, t. 73 f. 2, t. 79, *incl. var. robusta*; DC. Prod. 9 (1845) 29; BL. Mus. Bot. 1 (1850) 169; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 84; K. & V. Bijdr. 9 (1903) 74; ELM. Leaf. Philip. Bot. 2 (1909) 596; K. & V. Atlas (1914) f. 331, '*morindifolia*'.—*F. cordifolia* BL. Rumphia 2 (1838) 33; Mus. Bot. 1 (1850) 171; MIQ. Fl. Ind. Bat. 2 (1857) 368.—*F. coarctata* BL. Rumphia 2 (1838) 33; Mus. Bot. 1 (1850) 170; MIQ. Fl. Ind. Bat. 2 (1857) 368, *incl. var. ligustrina*; VAL. Bull. Dép. Agr. Ind. Néerl. 10 (1907) 45.—*F. ligustrina* BL. Rumphia 2 (1838) 33; Mus. Bot. 1 (1850) 171, *incl. var. disparifolia*; BENTH. J. Linn. Soc. Bot. 1 (1856) 100, *incl. var. brachystachya*; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 85; KING, J. As. Soc. Beng. 74, ii (1908) 609; RIDL. Fl. Mal. Pen. 2 (1923) 420.—*Utania morindaefolia* DON, Gard. Dict. 4 (1838) 663.—*Kentia morindaefolia* STEUD. Nomencl. ed. 2 (1840) 845, *nom. illeg.*—*F. scholaris* BLCO, Fl. Filip. ed. 2 (1845) 93; ed. 3, 1 (1877) 171.—*F. appendiculata* BL. Mus. Bot. 1 (1850) 169; Walp. Ann. 3 (1852) 76.—*F. cuspidata* BL. Mus. Bot. 1 (1850) 170; Walp. Ann. 3 (1852) 76; MIQ. Ann. Mus. Bot. Lugd.-Bat. 2 (1866) 218; MERR. J. Str. Br. R. As. Soc. n. 77 (1917) 237; En. Philip. 3 (1923) 314.—*F. robusta* BL. Mus. Bot. 1 (1850) 170; Walp. Ann. 3 (1852) 76.—*F. subreticulata* BL. Mus. Bot. 1 (1850) 171; Walp. Ann. 3 (1852) 76; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 10.—*F. crassipes* BTH. J. Linn. Soc. Bot. 1 (1856) 99; MIQ. Fl. Ind. Bat. 2 (1859) 1080; GIBBS, J. Linn. Soc. Bot. 42 (1914) 111.—*F. latifolia* MIQ. Fl. Ind. Bat. 2 (1857) 369.—*F. thwaitesii* F. v. M. Fragm. 2 (1861) 137.—*F. maingayi* CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 84; KING, J. As. Soc. Beng. 74, ii (1908) 608; RIDL. Fl. Mal. Pen. 2 (1923) 419; FOXW. Mal. For. Rec. n. 3 (1927) 159.—*F. spicata* BAKER, Kew Bull. (1896) 25; MERR. J. Str. Br. R. As. Soc. n. 77 (1917) 237.—*F. rodatzii* K. SCH. & LAUT. Fl. Schutzgeb. (1901) 499.—*F. congestiflora* ELM. Leaf. Philip. Bot. 8 (1915) 2741.—*F. grandifolia* MERR. J. Str. Br. R. As. Soc. n. 77 (1917) 231; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 338.—*F. cymosa* MERR. J. Str. Br. R. As. Soc. n. 77 (1917) 234; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 338.—*F. stenophylla* BECC. [For. Born. (1902) 524, f. 65(1), *nom. nud.*] *ex* MERR. J. Str. Br. R. As. Soc. n. 77 (1917) 236; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 337.—*F. pauciflora* RIDL. Fl. Mal. Pen. 2 (1923) 419, f. 110; BURK. & HENDERS. Gard. Bull. S. S. 3 (1925) 399; BURK. Dict. (1935) 996.—*F. eucalyptifolia* CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 312, f. 2.—*F. teysmannii* CAMMERL. l. c. 314, f. 3.—*F. gracilis* CAMMERL. l. c. 316, f. 4.—*F. pendula* MERR. Pl. Elm. Born. (1929) 251.—*F. minor* (non BL.) HEINE, Pfl. Clemens Kinabalu (1953) 91. — Fig. 9-12.
- Tree, 2-10(-16 or even -35?) m, up to c. 30 cm ø, shrub or sometimes a straggling climber. Leaves varying from broadly ovate via elliptic, obovate-oblong and oblong to oblong-lanceolate or rarely even linear, 5-50 by 1-23 cm, thinly to thickly coriaceous or almost fleshy, sometimes bullate between the nerves; base cuneate, obtuse, rounded or often slightly to distinctly cordate; apex acute, obtuse, rounded or very often shortly to rather long acuminate; nerves usually 4-12 pairs, sunken or less often flat to very slightly prominent above, distinctly prominent beneath; reticulations lax, more or less distinctly visible; petiole ¼-5 cm, thin to stout; stipules connate into an annular,

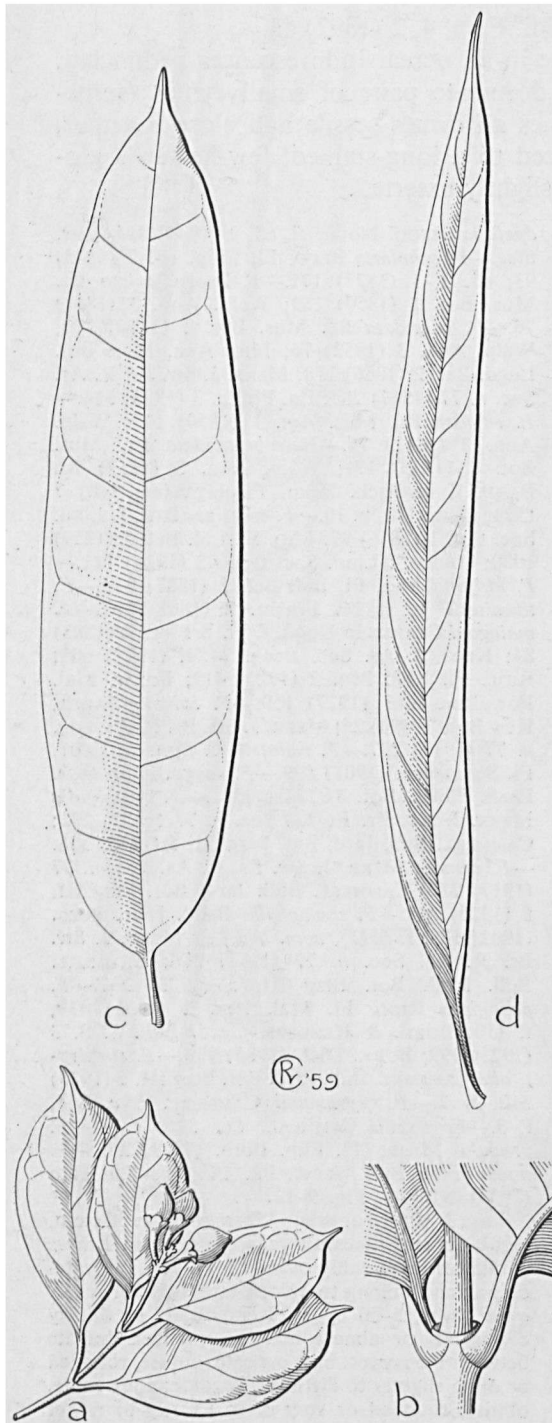


Fig. 10. *Fagraea racemosa* WALL. a. Fruiting twig of '*F. ligustrina*', $\times \frac{2}{3}$, b. ocrea, $\times \frac{1}{2}$, c. leaf of '*F. teysmannii*', $\times \frac{2}{3}$, d. leaf of '*F. eucalyptifolia*', $\times \frac{2}{3}$ (a KEP 15425, b WHITEHOUSE in herb. BRI 016414, c PURSEGLOVE 4500, d BROOKE 10668).

up to $\frac{3}{4}$ cm high ocrea which clasps the twig. Inflorescences erect, nodding, or very often drooping, 2–60 cm long (incl. the 1–30 cm long, slender to robust peduncle); usually thyrsoid with decussate, spaced, nearly sessile cymes of c. 7 (the higher ones less) long-stalked flowers; by reduction spiciform if the internodes are short combined with sessile cymes and short-stalked flowers, corymbose if all cymes or at least the lower ones are long-stalked, laxly branched, and many-flowered, racemiform if the cymes are sessile and few-flowered or in the apical part even 1-flowered, or glomerulous if the whole inflorescence is reduced to 5–7 flowers crowded on a long stalk; pedicels (0–) $\frac{3}{4}$ –3 cm, thin to stout, 2-bracteolate at the base. Calyx campanulate to subglobose, $\frac{1}{4}$ – $1\frac{1}{2}$ cm, divided about halfway down or slightly deeper. Corolla-tube 2–4 cm, funnel-shaped. Anthers rather thick oblong, c. $3\frac{1}{2}$ mm long, cells free in their basal half. Stigma (broadened) obconical, up to c. $1\frac{1}{2}$ –2 mm broad, subtruncate, faintly 2-lobed. Berry globose-ellipsoid-ovoid, tipped by the very short but distinct style-base, up to $2\frac{1}{2}$ cm long, said to be sky-blue (or red?) when ripe.

Distr. SW. Indo-China, Siam, South Burma, the Andamans and Nicobars, throughout *Malaysia* (except the eastern half of Java, Madura I., and the Lesser Sunda Is.), Solomon Is., and North Australia (Northern Territory: Victoria River, Providence Hill; Queensland: Cape York Peninsula).

Ecol. Light to rather dense, often secondary forests on swampy to dry soil, on muddy river-banks, podsolized sand, sometimes in savannahs and lalang fields, 0–2000 m. *Fl.* mainly April–Sept., *fr.* July–Nov.

The flowers have a smell of butter or butter-milk, as they produce diacetyl (see DERX, *Ann. Bot.* 1, 1950, 49–52), a substance which is characteristic of bat-visited flowers; there are, however, no observations that *Fagraea* flowers are visited by bats. According to RIDLEY (*Disp.* 1930, 421) the fruits are probably dispersed by bats. For galls see GIBBS, *J. Linn. Soc. Bot.* 42 (1914) 111, and DOCTERS VAN LEEUWEN, *Zoococcidia* (1926) 464, f. 887.

Uses. The soft to moderately hard timber is used for construction and as firewood. Decoctions of the leaves, bark, and roots play a role in Malayan medicine, mainly as tonics (see BURK, *Dict. l.c.*); in the Philippines the bark and the flowers are used as an antidote for snake bites.

Vern. *False Coffee-Tree*, E, *gluguh babi*, *kaju buliga*, *k. isop-isop dahojong*, *k. kapis*, *k. kopi-kopi*, *k. obi*, *k. rupun-rupun*, *k. si markopi-kopi*, *lengugu*, *rampisi*, *tuma taveuh pajo*, Sum., *tuma tajeu*, Simalur, *kayu naga*, Enggano, *coffee utan*, *dada kora* (or *kura*), *daun pepulit*, *d. puleh*, *glam tikus jantan*, *kahwa hutan*, (*kaju*) *lidah rusa(h)*, (*k.*) *rumpo-rumpo*, *k. skobang*, *katiduran puak*, *keia* (*payam*), *kemusang*, *kopi* (*h*)*utan*, *lambusa* (or *lumbusa*) (*pajah*), *membëra gading*, *mengkudu badak*, *m. hutan*, *mumpuleh*, (or *mempuleh*, or *mumpulih*), *pepulit*, (*pokô*) *pakan payâ*, *p. sâtûbal paya*, *p. suruas jantan*, (*p.*) *sêpuleh*, *riang-riang*

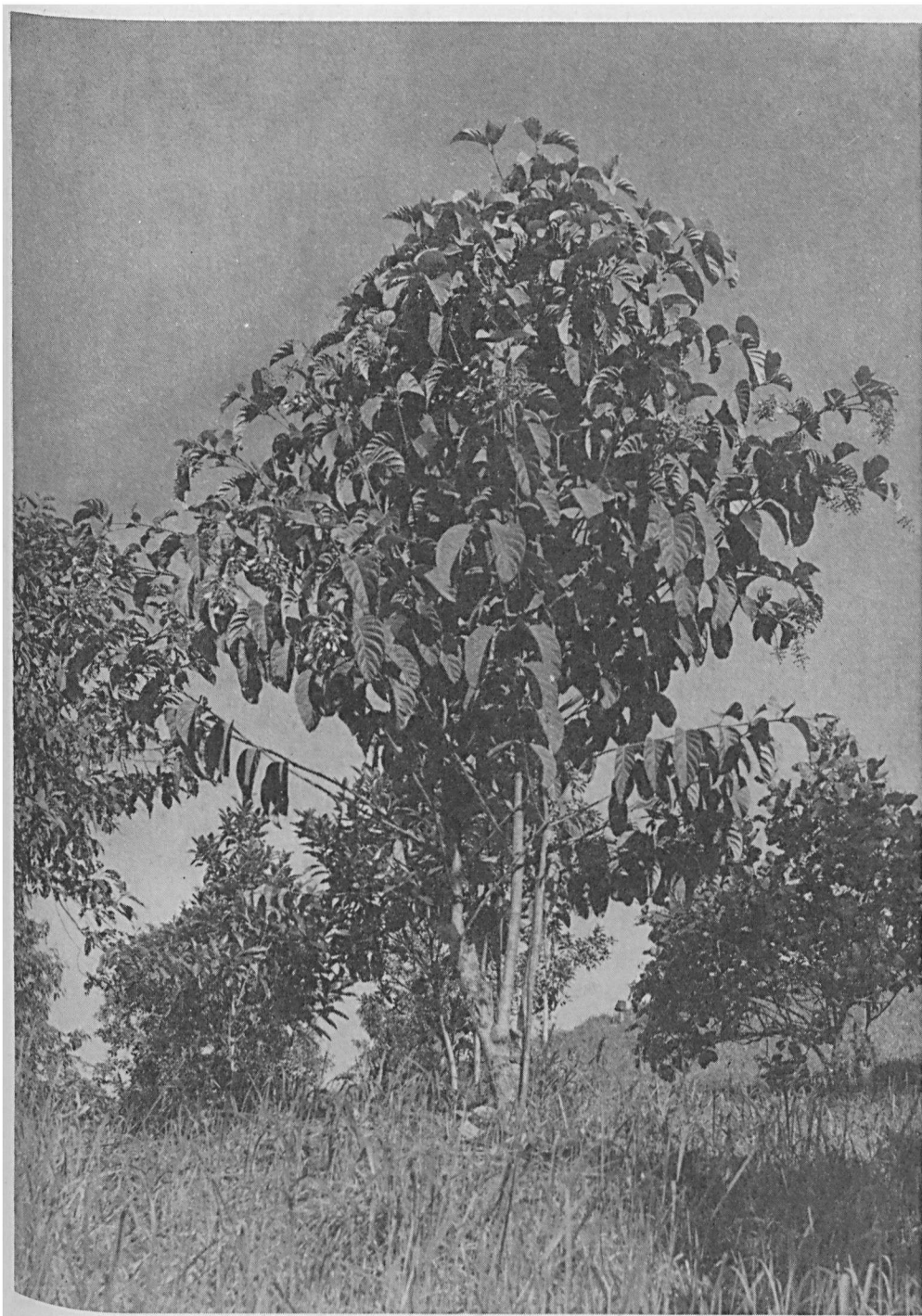


Fig. 11. *Fagraea racemosa* WALL. in secondary vegetation, Brunei (Borneo) (ASHTON, 1960).



Fig. 12. *Fagraea racemosa* WALL., close-up from the tree of fig. 11 (ASHTON, 1960).

gelugot, *sapooli*, *sěbėrotut*, *sėkobang*, *sėpulis*, *sėrawas*, *sėruas*, *sėtėbal*, *sătűbal*, *tahi musang*, *tėmbusu* (or *tumpusu*), *t. bukit*, *t. jantan*, *t. paya* (or *gajah*, or *kaya*), *wa nam*, Mal. Pen., *kendung badak*, *ki tjankuda*, *kopi mėtado*, *mangu leweng*, *tjangkudu* (or *tjangkuda*) *badak*, *t. gunung*, *t. lőwőng*, *t. utan*, *tjang-tjangkudian*, S, *baros*, *melingu*, J, *dawun sukung*, *engkudu hutan*, *gėmpar*, *kadampuhok*, *kafi hutan*, *kalam kubak*, *kasadapan*, *katiduran puak*, *kayu badal*, *k. ranau*, *kėlagikong*, *lankonis*, *legkau*, *lundus*, *mambunal*, *manggapuak*, *nva gohong*, *puak bulan*, *sankaniap*, *sukong* (or *sukung*), *tadapan puak*, *tapa labie*, *tėmhusu* (or *tėmasuk*) *gaja*, *tėnggilan* (or *tinggiran*) *puah* (or *puak*), (r)(o)dopon (or *dapan*) *puak*, *ukudu ayěr*, Born.; Philip.: *baėgu*, *Bag.*, *bagontapai*, *pońgabu*, Mbo., *bakau*, *balat-buaya*, *kabál*, *libákan*, *talob-đak*, Tag., *bogosalá*, S. L. Bis., *bulobuáya*, *hambuáia*, *himbubüya*, *lambuáya*, *malabuáya*, *salak*, P. Bis., *cudman*, *gatibuka*, *makatibuga*, *sin alas*, Sub., *kukodmón*, Bik., *kakáo-ita*, *magusayak*, Sul., *kibuđia*, Laguna, *malabago*, Cebu; *leraa*, Cel., *kore haru*, Halmahera, *barua*, *batteriengien*, *berean*, *bisip*, *bogabogoa*, *dabe*, *fokhipėh*, *galud*, *kankanis*, *kubugup*, *mahobaatje*, *makereko*, *malar*, *misal*, *omborupa*, *sibėh*, *simbe*, New Guinea, *swaret*, Aru Is.

Notes. Wide-spread, polymorphous species, described under a host of names. The extreme forms look so different that one might feel warranted to keep them wide apart, but on close examination of a sufficient number of specimens they prove to be connected by numerous intergrades which render a sharp delimitation impossible. Notwithstanding the differences all specimens have a certain habit in common so that the species can nearly always be recognized at first sight.

The most common form is fairly coarse, with thick twigs, relatively large, ovate, thick-coriaceous leaves, rounded to subcordate at the base,

long thyrsoid inflorescences, and medium-sized flowers (fig. 9a). An extremely coarse form, with larger and thicker leaves, nerves less conspicuous, and large flowers was described from the Malay Peninsula as '*F. maingayi*'. Another coarse form, characterized by corymbose inflorescences with short rachis and long lower branches, is the Bornean '*F. pendula*' (fig. 9c). '*F. spicata*' differs from the typical form only by its fairly short, contracted inflorescences with sessile cymes or flowers (Borneo) (fig. 9d). Other Bornean forms, characterized by narrow leaves, are '*F. teysmannii*' with lanceolate leaves (fig. 10c), and '*F. eucalyptifolia*' and '*F. stenophylla*' with linear leaves, tapering at both ends (fig. 10d); these narrow-leaved forms have moreover small few-flowered inflorescences with small flowers; they occupy a rheophytic habitat (gravelbeds of stream-banks). '*F. pauciflora*' (Mal. Pen.) differs from the normal form by being more slender in all parts, and especially in the inflorescence which has less and relatively small flowers. The most extreme form is represented by '*F. ligustrina*' (Mal. Pen. to Moluccas, not uniform), with slender twigs, small, elliptic leaves, tapering at base and apex, nervation not very conspicuous, glomerulous inflorescences, and flowers with a very small calyx and a slender corolla; in this form the fruit is also distinctly smaller (fig. 10a).

The names *Kuhlia morindaefolia* BL. and *Kentia morindaefolia* STEUD. are illegitimate as these generic names were illegitimate.

MARTIUS erroneously described *F. malayana*, of which I saw the type in the Brussels Herbarium, with a 6-merous corolla and 6 stamens and wrongly assumed it to be related to *F. elliptica*. BENTHAM J. Linn. Soc. Bot. 1 (1856) 100, who only knew the deficient description, took it for possibly synonymous with *Tabernaemontana corymbosa* ROXB. (*Apocynaceae*).

3. Section *Fagraea*

Sect. Fagraeae verae & *sect. Eufagraea* BL. Mus. Bot. 1 (1850) 163 & 169 resp.
—*Sect. Corymbosae* BTH. J. Linn. Soc. Bot. 1 (1856) 97.—*Subg. Eufagraea* MIQ. Fl. Ind. Bat. 2 (1857) 367.—*Sect. Pseudocorymbosae* SOLER. in E. & P. Nat. Pfl. Fam. 4, 2 (1892) 42.

Leaves auriculate or not. Inflorescences corymbose, dichasial, glomerulous, or flowers solitary; always terminal and usually with a pair of strong branches in the upper leaf-axils, therefore the inflorescence as a whole mostly sessile. Stamens and style hardly or not exerted.

S. Fagraea ceilanica THUNB. Vet. Acad. Handl. Stockh. 3 (1782) 132, t. 4; Nov. Gen. Pl. (1782) 35; BL. Rumphia 2 (1838) 29, t. 78 f. 2 ('*zeylanica*'); Hook. Bot. Mag. (1874) t. 6080; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 83, incl. var. *brevituba*; TRIMEN, Fl. Ceyl. 3 (1895) 170; GAMBLE, Fl. Madras 5 (1923) 865; LEENH. Bull. Jard. Bot. Brux. 32 (1962) 420.—*Modagam* RHEEDE, Hort. Mal. 4 (1673) 119, t. 58.—*F. obovata* WALL.

in Roxb. Fl. Ind. 2 (1824) 33, non BL. (1826), *quae est F. blumei*; DC. Prod. 9 (1845) 29; Hook. Bot. Mag. (1846) t. 4205; GRIFF. Notul. 4 (1854) 35; Ic. Pl. Ind. Or. 4 (1854) t. 382; non MIQ. Sum. (1861) 226 & 550, incl. var. *latifolia* (= *F. blumei*); KURZ, Fl. Burm. 2 (1877) 205; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 83, p.p., incl. var. *gardneri*; RIDL. Trans. Linn. Soc. Bot. 3 (1893) 323; TRIMEN, Fl. Ceyl. 3 (1895) 171; non F. M.

BAIL. Queensl. Agr. J. 3 (1898) 157, *incl. var. papuana* (= *F. berteriana*); KING, J. As. Soc. Beng. 74, ii (1908) 606, *p.p.*; ELM. Leaf. Philip. Bot. 2 (1909) 598; 3 (1910) 857; DOP, Fl. Gén. I.-C. 4 (1914) 174, *excl. syn. p.p.*; *non* CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 322 (= *F.*



Fig. 13. *Fagraea ceilanica* THUNB., a young specimen encircling the trunk of a tree with its roots. Bogor (Java) (JACOBS, 1958).

blumei); GAMBLE, Fl. Madras 5 (1923) 865; MERR. En. Philip. 3 (1923) 315, *p.p.*; RIDL. Fl. Mal. Pen. 2 (1923) 418, *p.p.*; SASAKI, Cat. Gov. Herb. Formosa (1930) 414; *non* MERR. Contr. Arn. Arb. 8 (1934) 138 (= *F. blumei*); BURK. Dict. 1

(1935) 996, *p. min. p.*; HENDERS. J. Mal. Br. R. As. Soc. 17 (1939) 58; KANJILAL & DAS, Fl. Assam 3 (1939) 318; *non* BAKH. *f.* in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 11, *nec* in Blumea 6 (1950) 382, *incl. var. brevicalyx* (both = *F. blumei*); KERR in Craib, Fl. Siam. En. 3 (1951) 56; *non* HEINE, Pfl. Clemens Kinabalu (1953) 91 (= *F. blumei*).—*F. littoralis* BL. Bijdr. (1826) 1021; Rumphia 2 (1838) 28, t. 74, *incl. var. amboinensis*; DC. Prod. 9 (1845) 30 ('*littoralis*') ; BL. Mus. Bot. 1 (1850) 166; MIQ. Fl. Ind. Bat. 2 (1857) 374; Ann. Mus. Bot. Lugd.-Bat. 2 (1866) 217, *incl. var. moluccana & forstenii*; RACIBORSKI, Ann. Jard. Bot. Btzg 17 (1900) 43, f. 23; K. & V. Bijdr. 9 (1903) 82; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 328; DOCT. VAN LEEUWEN, Zooecidia (1926) 463, f. 886; BAKH. *f.* in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 11.—*F. lanceolata* BL. Bijdr. (1826) 1021, *non* WALL. (1829), *nec* MIQ. (1857); Rumphia 2 (1838) 31, t. 77; DC. Prod. 9 (1845) 29; BL. Mus. Bot. 1 (1850) 167; MIQ. Ann. Mus. Bot. Lugd.-Bat. 2 (1866) 218; K. & V. Bijdr. 9 (1903) 81; K. & G. J. As. Soc. Beng. 74, ii (1908) 607; KOORD. Fl. Tjib. 3 (1918) 47; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 329; RIDL. Fl. Mal. Pen. 2 (1923) 420; *non* HENDERS. Gard. Bull. S.S. 4 (1927) 99 (= *F. carnosa*); BAKH. *f.* in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 12.—*F. minor* REINW. *ex* BL. [Cat. (1823) 47, *nom. nud.*] Bijdr. (1826) 1021; Rumphia 2 (1838) 27, t. 73 f. 1; DC. Prod. 9 (1845) 30; BL. Mus. Bot. 1 (1850) 166; MIQ. Fl. Ind. Bat. 2 (1857) 370; *non* HEINE, Pfl. Clemens Kinabalu (1953) 91 (= *F. racemosa*).—*F. malabarica* BL. Rumphia 2 (1838) 29.—*F. rostrata* BL. Rumphia 2 (1838) 31, t. 76 f. 2; DC. Prod. 9 (1845) 30; BL. Mus. Bot. 1 (1850) 168; MIQ. Fl. Ind. Bat. 2 (1857) 374; SCHEFF. Ann. Jard. Bot. Btzg 1 (1876) 38.—*F. crassifolia* BL. Rumphia 2 (1838) 31, t. 78 f. 1, *non* WALL. (1829) (= *F. ridleyi*); DC. Prod. 9 (1845) 30; BL. Mus. Bot. 1 (1850) 166; BTH. J. Linn. Soc. Bot. 1 (1856) 98; MIQ. Fl. Ind. Bat. 2 (1857) 373; Ann. Mus. Bot. Lugd.-Bat. 2 (1866) 217.—*F. coromandelina* WIGHT, Lc. 4 (1850) t. 1316.—*F. malabarica* WIGHT, Lc. t. 1317, *nom. illeg.*, *non* BL. (1838).—*F. amboinensis* BL. Mus. Bot. 1 (1850) 166; Walp. Ann. 3 (1852) 75; MERR. Int. Rumph. (1917) 424, *excl. syn. Rumph. (p.p. ?)*; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 329.—*F. forstenii* BL. Mus. Bot. 1 (1850) 166; Walp. Ann. 3 (1852) 75; *non* KOORD. Minah. (1898) 540 and KOORD.-SCHUM. Syst. Verz. 3 (1914) 105 (= *F. truncata*).—*F. celebica* BL. Mus. Bot. 1 (1850) 167; Walp. Ann. 3 (1852) 75.—*F. heterophylla* BL. Mus. Bot. 1 (1850) 168; Walp. Ann. 3 (1852) 75; MIQ. Fl. Ind. Bat. 2 (1857) 375.—*F. congesta* BL. Mus. Bot. 1 (1850) 168; Walp. Ann. 3 (1852) 75.—*F. fuscescens* BL. Mus. Bot. 1 (1850) 168; Walp. Ann. 3 (1852) 75.—*F. splendens* BL. Mus. Bot. 1 (1850) 168; Walp. Ann. 3 (1852) 75.—*F. khasiana* BTH. J. Linn. Soc. Bot. 1 (1856) 99; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 84; BRANDIS, Ind. Trees (1906) 476; KANJILAL & DAS, Fl. Assam 3 (1939) 319.—*F. oxyphylla* MIQ. Fl. Ind. Bat. 2 (1857)

371, *nom. illeg.*—*F. gardneri* THWAITES, En. (1860) 200; BEDDOME, Fl. Sylv. (1869) 164.—*F. ternatana* MIQ. Ann. Mus. Bot. Lugd.-Bat. 2 (1866) 217; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 333; *non* HOLTH. & LAM, Blumea 5 (1942) 230 (= *F. gitingensis*).—*F. oblonga* K. & G. J. As. Soc. Beng. 74, ii (1908) 612; RIDL. J. Str. Br. R. As. Soc. n. 50 (1908) 121; Fl. Mal. Pen. 2 (1923) 417; BURK. & HOLT. Gard. Bull. S.S. 3 (1923) 61; BURK. & HENDERS. Gard. Bull. S.S. 3 (1925) 399.—*F. sasakii* HAYATA, Ic. Pl. Formos. 3 (1913) 151, t. 29; KANEH. Formosan Trees, rev. ed. (1936) 623, f. 581.—*F. gardeniaeflora* WERNH. Trans. Linn. Soc. Bot. 9 (1916) 111.—*F. macrodendron* GILG & BENED. Bot. Jahrb. 54 (1916) 187.—*F. birmanica* GANDOGGER, Bull. Soc. Bot. Fr. 65 (1918) 58.—*F. prainii* GANDOGGER, l.c.—*F. lutea* CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 330, f. 8; *non* MERR. Contr. Arn. Arb. 8 (1934) 138 (= *F. blumei*).—*F. chinensis* MERR. Philip. J. Sc. 23 (1923) 261.—*F. loheri* MERR. *ibid.* 27 (1925) 49.—*F. pyriformis* S. MOORE, J. Bot. 63 (1925) Suppl. p. 70.—*F. sparei* HENDERS. Gard. Bull. S.S. 7 (1933) 114, t. 28 A.—*F. rahmatii* MERR. Pap. Mich. Ac. Sc. 23 (1938) 189.—*F. angiensis* KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 160, f. 3.—*F. archboldiana* MERR. & PERRY, J. Arn. Arb. 23 (1942) 412.— Fig. 13-15.

Epiphytic or (more rarely) terrestrial shrub, climber, or small tree, up to 15 m. *Leaves* very variable as to shape and size, varying from ovate to obovate (to spatulate in the Deccan and Ceylon) via oblong or oblong-obovate to narrowly lanceolate, $4\frac{1}{2}$ -35 by $1\frac{1}{2}$ -9 cm, fleshy or coriaceous, base attenuate and decurrent, cuneate, or rounded to subcordate, apex rounded to acute, usually (and mostly gradually) acuminate, acumen short to long and blunt to acute; nerves 4-8(-12) pairs, inconspicuous or mostly invisible (only in the typical form from Ceylon and S. Deccan slightly prominent beneath); petiole slender to robust, $\frac{1}{2}$ - $3\frac{1}{2}$ (-5) cm, exauriculate, the axillary scale appressed to the twig or (more rarely) partly or entirely adnate to the petiole, mostly inconspicuous, rarely somewhat broader than the petiole, $\frac{1}{4}$ - $\frac{3}{4}$ (-1) cm long, usually rounded, rarely truncate or emarginate, often slightly confluent between the leaves. *Inflorescences* dichasial, branched from the base, usually rather dense, sometimes laxly thyrsoid and up to 15 cm long, (1-)-3-17-flowered; pedicels slender (then usually thickened towards the calyx) to stout, $\frac{1}{4}$ - $3\frac{1}{2}$ cm long; bracteoles 2, inserted from about halfway the pedicel to just below the calyx, very small to c. 2½ cm long (usually the more apical the larger), sometimes confluent at the base and together encircling the calyx. *Calyx* campanulate to slightly urceolate, 1-2¾(-4) cm long (in Assam 6-7½ mm), connate for $\frac{1}{4}$ to more than $\frac{1}{2}$. *Corolla* widely to slenderly funnel-shaped, tube 2-5 cm (in the typical form from Ceylon and SW. Deccan 8½-10 cm). *Anthers* oblong to ovate, ($3\frac{1}{2}$ -) 5-7½(-12½) mm long, cells free at the base for $\frac{1}{3}$ -½. *Stigma* obconical, slightly cup-shaped to

peltate, 1-5 mm ø. *Fruits* ovoid or ellipsoid to subglobular, 3-5 cm long (specimens from Assam 1¾ cm), slightly to strongly beaked, glaucous-white (sometimes mentioned as being coffee-brown or black); calyx often warty-lenticellate, lobes appressed, spreading, or reflexed.

Distr. Ceylon, SW. Deccan, Assam, Burma, Siam, Indo-China, SW. China (SW. Yunnan), Hainan, Hongkong, Formosa (S. peninsula only), and throughout *Malaysia*.

Cited by SASAKI, l.c. (as *F. obovata*) from Ponape (Carolines); I saw no material from there; confusion with small-flowered *F. berteriana* seems probable.

Ecol. Occupying a wide range of habitats, in open localities and along forest edges but also in primary and secondary forests, both on dry and on marshy or periodically inundated soils, under everwet as well as under seasonal conditions, from sea-level up to 2500 m. *Fl.* mainly in the dry season, *fr.* in the rainy period.

Uses. Sometimes cultivated as an ornamental shrub.

Vern. *Kaju djottik*, Sum., *angilaän bilu, bani bani luam, olor arèlah*, Simalur, *ara burong*, Mal. Pen., *kikunteh, kiterong*, S, *kèmrungèn, kèpitu*, J, *rauai kajarok*, Sumba, *salang mapit*, Born.; Philip.: *bankalon*, Bag., *busalsal*, Sbl., *kotoñgogan*, Mbo., *malatúnog*, C. Bis., *mamagon*, Bik., *panagang*, Tagb., *pospusug, pukut*, Ig.; *papatjeda bangan, p. utan, pasi gunung*, Ternate, *tonki utan*, Ambon, *mèngando*, Moluccas (?), *kulaken* (or *kuleka*), N. G.

Notes. In the circumscription given here an extremely variable species. Both inside and outside *Malaysia* it comprises several local forms, some of which have very conspicuous characters; it is quite understandable that they were described as distinct species, sometimes not even thought to be closely related. After a careful study of a large number of specimens from all parts of the area I feel convinced that all these forms belong to one species. Most of the more extreme ones are in fact not sharply delimited but grade into other forms. In a few cases where there is a really sharp demarcation this depends on characters which are ephemeral and of no systematic importance in this species. Though it would not be impossible to subdivide this species into a (fairly large) number of forms and varieties I have refrained from doing so. I confine myself to an enumeration of the more important local forms in *Malaysia* with the synonyms belonging to them:

'*F. litoralis*' is the most common form to which most of the synonyms belong; it occurs throughout *Malaysia*: leaves medium-sized to small, elliptic, acute at the base, gradually acuminate at apex, nerves invisible; axillary scale appressed to the twig, small, rounded; inflorescence 3-5-flowered; bracteoles inserted about halfway the pedicel, small; calyx 1-1¾ cm, sepals free for at least half their length; anthers $\frac{1}{2}$ -¾ cm long; stigma up to 3½ mm ø, mostly about obconical; fruits subglobular, not strongly beaked, calyx spreading.

'Kinabalu-race' (Borneo: Mt Kinabalu): differs

from '*F. litoralis*' by lanceolate leaves, solitary flowers, and the calyx which is appressed to the fruit. It comes close to the type of '*F. sasakii*' from Formosa.

'*F. pyriformis*' (Sumatra): differs from '*F. litoralis*' mainly in its calyx, which is $1\frac{3}{4}$ – $2\frac{1}{2}$ cm long and slightly constricted in the mouth, the sepals being halfway connate.

'*F. oblonga*' (Sumatra, Malay Peninsula): a very characteristic form which differs from '*F. litoralis*' by long and narrow leaves (11–35 by 2–9 cm), when dried greyish green, beneath lighter or brownish, apex usually long and slender acuminate; nerves 10–12 pairs, visible though inconspicuous; petiole long and slender (2–5 cm); axillary scale slightly broader and truncate; inflorescence relatively many-flowered; calyx $1\frac{1}{2}$ cm long, slightly constricted at the mouth.

'*F. sparei*' (Sumatra, Malay Peninsula): a characteristic form which differs from '*F. litoralis*' by small (7–10 by $3\frac{1}{4}$ –5 cm) stiff leaves with a blunt to slightly acuminate apex; inflorescences 1–9-flowered; calyx large ($2\frac{1}{4}$ – $2\frac{3}{4}$ cm); bracteoles inserted just below and appressed to the calyx, c. $\frac{3}{4}$ cm long, lanceolate.

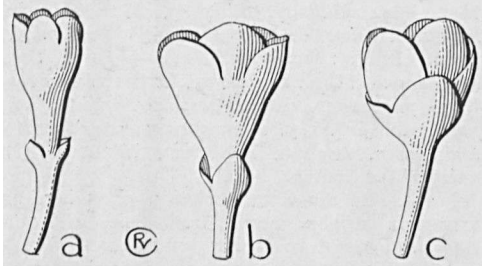


Fig. 14. *Fagraea ceilanica* THUNB., calyces and bracteoles of Philippine specimens. a. Bracteoles small and attached about halfway the pedicel, b. bracteoles slightly larger, attached just below the calyx, c. bracteoles connate, forming a cupule around the calyx, all $\times \frac{2}{3}$ (a WILLIAMS 1316, b BS 45700, c WENZEL 936).

'Philippine-race' (Philippines: Mindoro, Luzon, Catanduanes, Leyte, Negros, Mindanao) mainly differs from '*F. litoralis*' by a large calyx ($2\frac{1}{2}$ cm) which at its base is enveloped by a cupule composed of the confluent, $1\frac{1}{2}$ cm long bracteoles. '*F. loheri*' is intermediate between this form and '*F. litoralis*': it has a long calyx and high-inserted bracteoles, but these are smaller, patent, and not confluent at the base (Luzon) (fig. 14).

'*F. ternatana*' (Luzon, Moluccas, New Guinea) differs from '*F. litoralis*' by somewhat broader leaves, a blunt to rounded, slightly acuminate apex; axillary scale adnate to the petiole, slightly larger, truncate to emarginate; calyx large ($2\frac{1}{4}$ – $2\frac{1}{2}$ cm), slightly constricted at the mouth; anthers long and narrow (1 cm); stigma broadly peltate (5 mm ϕ); fruit distinctly beaked. '*F. angiensis*' from New Guinea differs only from '*F. ternatana*' by its leaves, which are more similar to those of '*F. litoralis*' but slightly obovate (fig. 15).

'*F. gardeniaeflora*' (incl. *F. archboldiana*; New

Guinea) differs from the closely related '*F. ternatana*' and '*F. angiensis*' by a $2\frac{3}{4}$ –4 cm long calyx, enveloped by a cupule composed of the strongly enlarged ($1\frac{3}{4}$ – $2\frac{1}{2}$ cm long) partly connate bracteoles; anthers 1– $1\frac{1}{4}$ cm long.

'*F. minor*' (best developed in Borneo) differs mainly from '*F. litoralis*' by the ovate leaves which are rounded to subcordate at the base.

'*F. forstenii*' and '*F. celebica*' (Celebes) differ mainly from '*F. litoralis*' by the spindle-shaped fruits, the latter furthermore by the broad, almost deltoid axillary scale.

The affinity of *F. ceilanica* is especially with 6. *F. annulata* and 10. *F. blumei* (see under these species for differences and further remarks).

The pseudo-axillary inflorescences, as mentioned by CAMMERLOHER in a note to his description of *F. lutea*, are apparently only the normal, axillary lower branches of a furthermore broken terminal inflorescence.

According to MERRILL's description, in *F. loheri* the tube of the corolla would be 11 mm long, the lobes 16 mm; in fact, the measurements are exactly the reverse.

The leaves are always exauriculate, but in *F. gardeniaeflora* on both sides of the broadened petiolar base a distinct wart (probably a gland) can be found, which may look like a rudimentary auricle.

Funis toaccae RUMPHIUS, Herb. Amb. 5 (1747) 481, t. 179 has been referred by MERRILL, Int. Rumph. (1917) 424 to *F. amboinensis* BL. but as he rightly remarked, the fruits doubtless belong to an *Apocynaceae*; the latex mentioned to occur in the twigs points to the same family. See also HEYNE, Nutt. Pl. (1927) 1292, under *Apocynaceae*. On the other hand the large flowers (according to the figure they must be about 10 cm) with 5 free stamens may represent some *Fagraea* (though not the present species)

F. oxyphylla MIQ. was published as a new more appropriate name after combination of three earlier species and is therefore illegitimate.

6. *Fagraea annulata* HIERN, Nova Guinea 8 (1909) 202; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 333, f. 10.

Tree, 6–8 m tall. *Leaves* petioled, (oblong-)ovate to (oblong-)obovate, 5–14 by $2\frac{1}{4}$ – $5\frac{1}{2}$ cm, firmly herbaceous or thinly coriaceous, base acute, often subcontracted and decurrent, apex very shortly acute-acuminate; nerves c. 10 pairs, very thin and hardly visible above, invisible beneath, veins inconspicuous except sometimes some intermediate ones; petiole slender, $\frac{3}{4}$ – $2\frac{1}{2}$ cm; exauriculate; axillary scale adnate to the petiole, $\frac{1}{4}$ – $\frac{1}{2}$ cm long, fairly broad (much broader than the base of the petiole), truncate to faintly 2-lobed. *Inflorescences* cymose, 2–15-flowered, dense; pedicels thick, $\frac{1}{2}$ –12 mm long, often 2-bracteolate above the middle and then thickened above the bracteoles. *Calyx* campanulate, often with recurved lobes, $\frac{3}{4}$ –1 cm long, divided about halfway. *Corolla*-tube funnel-shaped, $2\frac{3}{4}$ – $3\frac{1}{2}$ cm, inside about halfway with a distinct horizontal rim bear-

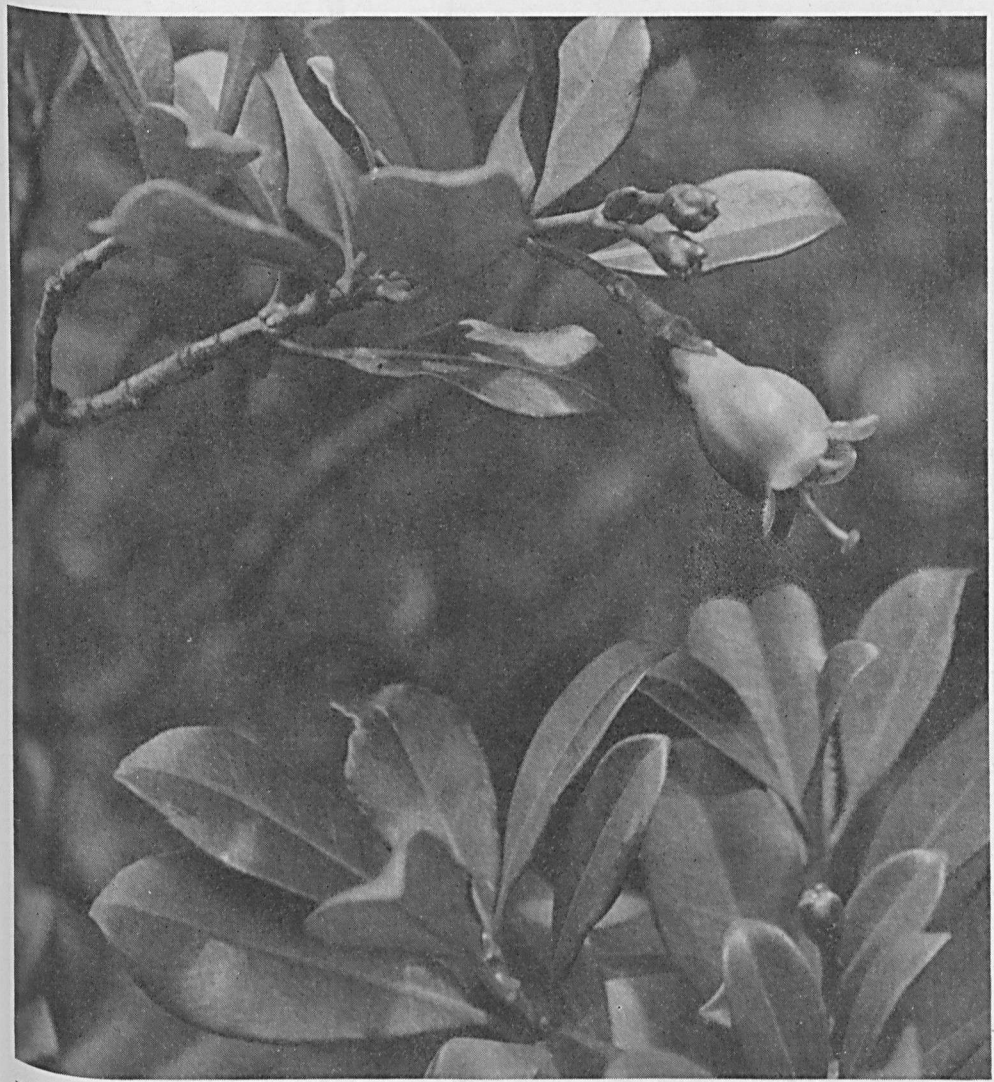


Fig. 15. *Fagraea ceilanica* THUNB., a flowering specimen of '*F. angiensis*', Mt Gwamongga at 2450 m (W. New Guinea) (SLEUMER, 1962).

ing the stamens. *Anthers* oblong, c. $\frac{3}{4}$ cm long, to about halfway bifid. *Stigma* subpeltate, c. $2\frac{1}{2}$ mm. *Fruits* (unripe) ellipsoid-oblong, c. $1\frac{1}{4}$ by $\frac{3}{4}$ cm.

Distr. Malaysia: SW. New Guinea (Noord River), once collected.

Ecol. On river-bank at low altitude. *Fl.* June.

Note. Doubtless very close to *F. ceilanica*; in fact the only difference with that species is the thickened annulus in the corolla-tube bearing the stamens. This character it has in common with the small group of species with a 2-lobed stigma (*F. berteriana* and allies). As only one specimen is known it is not impossible that it is of hybrid origin, the more so as in New Guinean specimens of *F. ceilanica* there seems to be a slight introgression

of *berteriana*-characters, especially concerning the leaves.

7. *Fagraea acuminatissima* MERR. J. Str. Br. R. As. Soc. n. 77 (1917) 232; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 330, f. 9.—*F. obovata* (non WALL.) KING, J. As. Soc. Beng. 74, ii (1908) 606, p.p.; RIDL. Fl. Mal. Pen. 2 (1923) 418; BURK. Dict. (1935) 996.—*F. longicuspis* GANDOGER, Bull. Soc. Bot. Fr. 65 (1918) 58.

Usually a shrub or small tree, sometimes a climber. *Leaves* petioled (suborbicular to) oblong to lanceolate or subobovate, 7–24 by $3\frac{3}{4}$ –10 cm, thickly coriaceous (fleshy when fresh); base acute and decurrent, apex obtuse or rounded, abruptly contracted into a narrowly triangular, acute,

$\frac{3}{4}$ –(2) cm long acumen; nerves invisible; petiole robust, $1\frac{1}{4}$ –5 cm long, exauriculate; axillary scale appressed to the twig, inconspicuous, rounded. *Inflorescences* subsessile, subglomerulous, 3–5-flowered; pedicels thick, $\frac{1}{2}$ – $\frac{3}{4}$ cm long, about halfway with a pair of small, appressed to patent bracteoles. *Calyx* campanulate, $\frac{3}{4}$ – $1\frac{1}{4}$ cm long, deeply divided (about $\frac{2}{3}$ – $\frac{3}{4}$ of its length). *Corolla*-tube funnel-shaped, $2\frac{1}{2}$ – $4\frac{1}{2}$ cm long. *Anthers* oblong, thick, $\frac{2}{5}$ – $\frac{3}{4}$ cm long, cells free in their basal half. *Stigma* broadly obconical to peltate, c. $1\frac{1}{2}$ mm ϕ . *Fruits* ellipsoid to globular, c. $1\frac{1}{2}$ –2 cm ϕ ; calyx appressed.

Distr. *Malaysia*: Sumatra (also Banka and Riouw Is.), Malay Peninsula, W. and N. Borneo.

Ecol. Mainly in peat-swamp forests, sometimes also in bamboo forests, up to 750 m. *Fl.* Febr.–Nov., *fr.* Febr., July, Sept.

Vern. *Malikoh*, Banka, *akar tunkoo beavak*, *tmbusu*, Mal. Pen., *baruas babi*, *dawi-dawi*, *nyatu*, Born.

Notes. This species belongs to the wider relationship of *F. ceilanica* (in the Malay Peninsula it has always been identified with *F. obovata*). Its most distinctive characters are the often blackish, round twigs, the dull- to olive-brown upper and smooth red-brown lower side of the very stiff dried leaves, and the small, \pm sessile, glomerulous inflorescences, with the small calyces. Apart from the flowers which are very long and slenderly tubular in *F. tubulosa* there is a great resemblance with that species; a good difference is found in the midrib, which is rounded beneath in the present species, strongly keeled in *F. tubulosa*.

8. *Fagraea tubulosa* BL. Mus. Bot. 1 (1850) 167; Walp. Ann. 3 (1852) 75; MIQ. Fl. Ind. Bat. 2 (1857) 373; KING, J. As. Soc. Beng. 74, ii (1908) 604; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 326; RIDL. Fl. Mal. Pen. 2 (1923) 415.

Straggling climbing shrub. *Leaves* petioled, ovate-oblong, oblong, or oblong-lanceolate, 10–22 $\frac{1}{2}$ by 5–10 cm, thinly coriaceous, base broadly cuneate or obtuse, narrowly decurrent, apex abruptly short- to long-subcaudate; nerves 5–7 pairs, invisible or almost so above, faintly visible or quite inconspicuous beneath; petiole $1\frac{1}{2}$ –3 cm long; exauriculate; the axillary scale inconspicuous, adnate to the petiole, blunt, 3 mm long. *Flowers* 1–6 in sessile glomerules; pedicels very short with 1–2 pairs of small bracteoles. *Calyx* campanulate, $\frac{1}{2}$ –1 cm long, divided somewhat less than halfway down. *Corolla*-tube tubular, very slender, 8–9 cm. *Anthers* elliptic, c. 4 mm long, cells in their basal half free. *Stigma* peltate, 2 mm ϕ . *Fruit* unknown.

Distr. *Malaysia*: Sumatra, Malay Peninsula (Perak).

Ecol. In forests, c. 900 m. *Fl.* June.

Note. A very distinct species, well characterized by its glomerulous, long and slender, fragile flowers. Apart from this character much alike (and possibly related to) *F. acuminatissima*, which has the midrib rounded beneath, not keeled as it is here.

9. *Fagraea ridleyi* K. & G. J. As. Soc. Beng. 74, ii (1908) 612, non GANDOGGER (1924); RIDL. J. Str. Br. R. As. Soc. n. 50 (1908) 118; Fl. Mal. Pen. 2 (1923) 417.—*F. crassifolia* WALL. Cat. (1829) n. 1602, nom. nud., non BL. (1838) (= *F. ceilanica*).—Fig. 16.

Liana or big straggling shrub. *Leaves* petioled, obovate to suborbicular, 13–24 by 9–18 cm, thick-coriaceous, base acute, somewhat decurrent, apex rounded, with or without an abrupt short and blunt acumen; nerves 4–10 pairs, flattish or slightly impressed above, prominent beneath; petiole 2–4 cm, robust, exauriculate; stipules connate in a 4 mm high ocrea which in older leaves is split between the petioles. *Inflorescences* cymose, 3–9 flowered; pedicels $\frac{1}{2}$ –2 cm, thick, tapering into the calyx, usually with a pair of small patent bracteoles somewhat above the middle. *Calyx* campanulate, 2–2 $\frac{1}{2}$ cm high, tube woody, lobes $1\frac{1}{4}$ – $1\frac{3}{4}$ cm, thick-coriaceous. *Corolla*-tube funnel-shaped, $3\frac{1}{2}$ –4 cm. *Anthers* bifid to halfway, oblong, $\frac{3}{4}$ cm long. *Stigma* subpeltate, $2\frac{1}{2}$ mm ϕ . *Fruits* inversely pear-shaped to globular and conically beaked, c. 5 by $3\frac{1}{4}$ cm; calyx loosely appressed.

Distr. *Malaysia*: Malay Peninsula, Lingga Arch., and Borneo (Sarawak, Brunei).

Ecol. In the Malay Peninsula on rocky sea-cliffs and along rivers, in Borneo in primary forests on sandstone hills, 0–300 m. *Fl.* May, Aug., *fr.* April, May, and Sept.

Vern. *Buah telan kényalang*, Born. (this means: the fruit which is swallowed by the hornbills).

Notes. Specimens from Borneo differ slightly from those of the Malay Peninsula; the main difference is in the fruits, which are globular with a strong conical beak in Borneo, inversely pear-shaped in the Malay Peninsula.

The relationship of *F. ridleyi* is doubtless with *F. blumei* (which differs by warty-lenticellate inflorescences and conspicuous axillary scales) and with *F. ceilanica* (which differs by invisible nerves).

As lectotype I have designated RIDLEY 5845 (SING; dupl. BM, K).

10. *Fagraea blumei* G. DON, Gard. Dict. 4 (1837) 69 ('*blumii*'); STEUD. Nomencl. ed. 2, 1 (1840) 624; DC. Prod. 9 (1845) 30.—*F. obovata* BL. Bijdr. (1826) 1021, nom. illeg., non WALL. (1824).—*F. obovato-javana* BL. Rumphia 2 (1838) 29, t. 75, nom. superfl., incl. var. *bebeak*; Mus. Bot. 1 (1850) 164; MIQ. Ann. Mus. Bot. Lugd.-Bat. 2 (1856) 217, incl. var. *latifolia*; K. & V. Bijdr. 9 (1903) 78; KOORD. Exk. Fl. Java 3 (1912) 59; Fl. Tjib. 3 (1918) 47; HOCHR. Candollea 6 (1936) 473.—*F. leschenaultii* BL. Rumphia 2 (1838) 30; Mus. Bot. 1 (1850) 164; MIQ. Fl. Ind. Bat. 2 (1857) 370.—*F. plumeriaeflora* DC. Prod. 9 (1845) 29; BENTH. J. Linn. Soc. Bot. 1 (1856) 98 ('*plumeriaefolia*'); MIQ. Fl. Ind. Bat. 2 (1857) 375; ELM. Leaf. Philip. Bot. 2 (1909) 598; *ibid.* 3 (1910) 857; MERR. En. Philip. (1923) 315, excl. spec. *Celeb.*; non KOORD. Minah. (1898) 540, nec KOORD.—SCHUM. Syst. Verz. 3 (1914) 105 (both are *F. truncata*).—*F. obovata*



Fig. 16. *Fagraea ridleyi* K. & G. a. Habit (note the glands on the lower side of the leaf), b. opened corolla, c. style and stigma, d. fruit, all $\times \frac{2}{3}$ (RIDLEY 5845).

(non WALL.) MIQ. Fl. Ind. Bat. 2 (1857) 369; Sum. (1861) 226, incl. var. *latifolia*; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 83, p.p.; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 322; MERR.

En. Philip. 3 (1923) 315, p.p.; DOCT. VAN LEEUWEN, Zoocecidia (1926) 463; MERR. Contr. Arn. Arb. 8 (1934) 138; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 11; Blumea 6 (1950)



Fig. 17. *Fagraea blumei* G. DON. a. Habit, $\times \frac{2}{3}$, b. opened corolla, $\times 1$, c. stigma, $\times 5$, d. anther, $\times 2$ (a-d BÜNNEMEYER 4950).

382, incl. var. *brevicalyx*.—*F. vaginata* K. & G. J. As. Soc. Beng. 74, ii (1908) 610; RIDL. Fl. Mal. Pen. 2 (1923) 418; S. MOORE, J. Bot. 63 (1925) Suppl. 69; BURK. Dict. 1 (1935) 997.—*F. negrosensis* ELM. Leaf. Philip. Bot. 2 (1909) 599; MERR. En. Philip. 3 (1923) 315.—*F. cuernosensis* ELM. Leaf. Philip. Bot. 2 (1909) 600; MERR. En. Philip. 3 (1923) 314.—*F. intermedia* RIDL. J. Fed. Mal. St. Mus. 8, n. 4 (1917) 63.—*F. spatiosa* S. MOORE, J. Bot. 63 (1925) Suppl. 69.—*F. lutea* (non CAMMERL.) MERR. Contr. Arn. Arb. n. 8 (1934) 138.—Fig. 17.

Tree up to 26 m, scandent or erect, epiphytic or terrestrial shrub, or climber. *Leaves* mostly ovate, sometimes elliptic to oblong, rarely lanceolate, 7–60 by 2–30 cm, thin to stiff-coriaceous, base acute, mostly long-attenuate, apex rounded to cuneate, nearly always acuminate, acumen tapering to abrupt, short and broad to fairly long and

slender; nerves 3–15 pairs, usually slightly though distinctly prominent on both surfaces, rarely inconspicuous to invisible; petiole $\frac{1}{2}$ –4 cm, mostly robust, often narrowly winged, exauriculate; axillary scale for the greater part adnate to the petiole but distinctly broader, 4 mm–1½ cm long, usually 2-lobed to truncate, rarely rounded. *Inflorescences* terminal with 2 strong branches in the upper leaf-axils, cymose to corymbose, lax to rather dense, (1–)7–c.50-flowered, sparsely to densely warty-lenticellate (still more conspicuously so in fruit); pedicels usually stout, $\frac{1}{4}$ –2½ cm, 2-bracteolate in the lower two-thirds. *Calyx* cupular to campanulate, very slender to rather broad, 4–20 mm long, sepals connate for $\frac{1}{3}$ – $\frac{2}{3}$. *Corolla*-tube narrowly to widely funnel-shaped, 1½–4 cm, lobes varying from about $\frac{1}{3}$ to nearly as long as the tube. *Anthers* thickly ovate-oblong to lanceolate, 4–10 mm, to halfway bifid. *Stigma* capitate

to peltate, 1-5 mm ø. Fruits either subglobular (sometimes beaked) and 3-4 cm ø, or spindle-shaped and 5-7 by 1¾-2½ cm, said to be black (Sumatra) or yellow (Philippines); calyx with loosely appressed to spreading or caducous lobes.

Distr. *Malaysia*: Sumatra, Malay Peninsula (Perak, Pahang, Selangor), Java, Borneo, and the Philippines; a few dubious specimens from Celebes.

This species comprises two subspecies, as follows:

ssp. blumei.—*F. blumei* G. DON.—*F. obovata* BL.—*F. obovato-javana* BL., *incl. var.*—*F. leschenaultii* BL.—*F. obovata* (non WALL.) AUCT., *incl. var.*—*F. vaginata* K. & G.—*F. negrosensis* ELM.—*F. intermedia* RIDL.—*F. spatiosa* S. MOORE.—*F. lutea* (non CAMMERL.) MERR.

Axillary scale ± flat, dark-brown. Leaves obovate, up to 27 by 13 cm, thick- and stiff-coriaceous, dark-brown when dry, base long-attenuate, apex rounded with a minute, broadly triangular acumen; nerves 3-6 pairs, distinctly forked towards the margin, conspicuous beneath. Pedicels up to 1 cm, with a pair of bracteoles about halfway. Calyx up to 1½ cm. Corolla-tube up to 2½ cm. Anthers up to 7 mm. Stigma usually 1-2½ mm ø. Fruits (sub)globular, calyx persistent.

Distr. Sumatra, Malay Peninsula, Java, rare in Borneo and the Philippines (Negros).

Ecol. Preferably on a fertile wet soil and in light shade, in and especially along primary and secondary forests, on river-banks, etc.; usually under everwet, in East Java also under seasonal conditions. Rarely under 500 m (except in the Malay Peninsula), usually 1200-1800(-2200) m. Fl. fr. Jan.-Dec.

Uses. The rubbed leaves are used as a medicine against fever and headache; latex from the fruits used to make lime-twigs for catching birds. The fruits are said to be poisonous.

Vern. *Akar konjal, kaju djottik, kama lojang, Sum., akar t̄erong kusan̄g, ar̄eng kidjamudju, bebeak, kalang mangga, ki minjak, kit̄erong areui, S, djeruk utan, (̄n)dog-(̄n)dogan, k̄empl̄ek, ki hurip (or horip), ki k̄endal, ki t̄erong, salisor, wuru, J, njam plongolos, Md, dirung, Born.; Philip.: buton, aolis, Bag., magan̄nok, Sub.*

ssp. plumeriaeflora (DC.) LEENH. *nov. stat.*—*F. plumeriaeflora* DC.

Axillary scale concave, greenish. Leaves elliptic, 17-60 by 6-30 cm, thin-coriaceous, greyish green when dried, base not long-attenuate, apex blunt, abruptly terminated by a slender acumen; nerves 9-15 pairs, looped and joined near the margin, visible on both sides. Pedicels 1½-2½ cm, bracteoles at the base. Calyx 1¾-2 cm. Corolla-tube 3½-4 cm. Anthers 6-10 mm. Stigma c. 4 mm ø. Fruits spindle-shaped, calyx caducous.

Distr. Philippines (Luzon, Catanduanes, Samar, Leyte, Panay, Mindanao).

Ecol. Humid primary forests, 500-2000 m. Fl. fr. Jan.-Dec. The very fragrant flowers are visited by butterflies.

Vern. *Butoon ta-usá, Bag., kalaynig, Buk.*

Notes. This species is related to *F. ceilanica*, *F. fastigiata*, and *F. tacapala*. The conspicuous stipules, the distinctly prominent nerves, and the warty lenticellate inflorescences are good characters to distinguish it from *F. ceilanica*; only some forms from the Philippines and from Sumatra have about the same leaves as the latter species. *F. fastigiata* is doubtless very close to *ssp. blumei*, but differs by the auricles inserted slightly above the leaf-base; it could be conspecific. *F. tacapala* comes near *ssp. plumeriaeflora*, is also different by the presence of auricles.

Typical specimens of the two subspecies are so different that one would prefer to distinguish them as good species. There are, however, two series of intermediate specimens; the type of *F. cuernosensis* and several other specimens I have not referred to a subspecies.

The first series is formed by the specimens from Negros (among which the types of *F. negrosensis* and *F. cuernosensis*), several specimens from Mindanao, and one from Luzon (FB 8996). The Negros specimens come close to *ssp. blumei* and differ mainly by their *ceilanica* ('*litoralis*')-like leaves; most of the Mindanao specimens have the same kind of leaves, but the inflorescences and flowers look more like those of *ssp. plumeriaeflora*, with which they have also the spindle-shaped fruits in common; the calyx is not caducous, however. The latter character is the main difference between the remaining specimens and *ssp. plumeriaeflora*.

The second series goes via Borneo. Among the Bornean specimens one (BECCARI PB 3032) comes close to *ssp. blumei*, from which it differs only by the greater number of nerves. All other Bornean specimens combine the leaves of *ssp. plumeriaeflora* with the inflorescences, flowers, and fruits of *ssp. blumei*.

Especially *ssp. blumei* shows a wide range of variability; this mainly concerns the inflorescences and the flowers (many- to few-flowered inflorescences, small to big calyces and corollas, the former cupular to campanulate and with short to long lobes, the latter slender to wide). This variability is gradual, and in Java nearly the full range of specimens is found. Some local races with deviating characters are restricted to Central Sumatran volcanoes. The specimens from Mt. Merapi are mainly aberrant by the caducous calyx under a globular fruit. Those of Mt. Kerintji differ only from typical *blumei* in the large, many-flowered inflorescence and the small flowers (calyx cupular, 4 mm high, less than halfway connate, corolla-tube 1½ cm long). The specimens from Mt. Singalang have oblong, acute leaves, the nerves of which are invisible, a very lax, few-flowered inflorescence and the smallest flowers (calyx tubular, 4 mm long, more than halfway up connate, corolla-tube c. 5 mm). On account of the leaf-shape, the inflorescences, and the small flowers, the latter race is sometimes confused with *F. fragrans* (which has, however, lateral inflores-

cences). Specimens from Mt. Sibajak are mainly characterized by elliptic, acute leaves, the nerves of which are nearly invisible, by short-stalked and densely crowded inflorescences of 3–9 flowers, with big (6 by 10 mm) bracteoles clasping the calyx, and by sepals connate for only $\frac{1}{4}$.

The nomenclature of *F. blumei* is somewhat confused. BLUME, who was the first to recognize and publish it in 1826, named it *F. obovata*, apparently unaware of the fact that WALLICH had used the same epithet already two years earlier for another species. Later on G. DON, BLUME himself, and STEUDEL corrected this error, using the epithets *blumii*, *obovato-javana*, and *blumei* respectively. All these names were clearly based upon *F. obovata* BL.

11. *Fagraea fastigiata* BL. Rumphia 2 (1838) 30, t. 76 f. 1; DC. Prod. 9 (1845) 30; BL. Mus. Bot. 1 (1850) 164; MIQ. Fl. Ind. Bat. 2 (1845) 369; K. & V. Bijdr. 9 (1903) 80; KOORD. Exk. Fl. Java 3 (1912) 59; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 322, *pro spec. Jav., fr. excl.*; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 11, *p.p.*; *non* RIDL. J. Str. Br. R. As. Soc. n. 30 (1897) 167, *nec* ENDERT, Tectona 13 (1920) 117 (= *F. crenulata*).—Fig. 2b.

Liana, epiphytic shrub, or small tree, up to 13 m by c. 10 cm \varnothing . *Leaves* sessile, oblong-obovate, 13–27 by 6–12 cm, thin-coriaceous, base narrowly cuneate, long-decurrent, again somewhat broadened and subauriculate slightly above the twig, completely hiding the axillary scale which is adnate to the midrib, $\pm \frac{3}{4}$ cm long and rather narrow; apex blunt to faintly blunt-acuminate; nerves 5–7 pairs, inconspicuous above, prominent to prominent beneath. *Inflorescences* corymbose, laxly branched, with c. 15–20 subsessile flowers; bracteoles small, appressed, just below the calyx. *Calyx* slender-campanulate, c. 7 mm, less than $\frac{1}{2}$ divided. *Corolla*-tube widely funnel-shaped, 3 cm. *Anthers* ovate-lanceolate, 7 mm, cells in their basal half free. *Stigma* unknown. *Fruits* globular, 2 cm \varnothing ; pedicels slender, calyx-lobes reflexed.

Distr. *Malaysia*: Malay Peninsula (Perak: Ijok F. R.) and West and Central Java.

Ecol. Forests, c. 600–1000 m. *Fr.* June. For a gall see DOCTERS VAN LEEUWEN, Zooecidia (1926) 463, f. 885.

Vern. *Lanupa*, S.

Note. This species is closely related to *F. blumei* ssp. *blumei*; it is even possible that it will finally appear to be conspecific with that species, from which it mainly differs by its auriculate leaf-base. By this character it seems to link up *F. blumei* with the group of species (*n.* 14–20) with well-developed auricles.

12. *Fagraea crenulata* MAINGAY ex CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 83; KING, J. As. Soc. Beng. 74, ii (1908) 610; DOP, Fl. Gén. I.—C. 4 (1914) 176; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 321; RIDL. Fl. Mal. Pen. 2 (1923) 420; FOXW. Mal. For. Rec. n. 3 (1927) 160, plates;

HEYNE, Nutt. Pl. (1927) 1269; DE VOOGD, Trop. Natuur 21 (1932) 60, f. 1; BURK. Dict. 1 (1935) 994; CORNER, Ways. Trees (1940) 423, t. 121.—*F. fastigiata* (*non* BL.) RIDL. J. Str. Br. R. As. Soc. n. 30 (1897) 167; ENDERT, Tectona 13 (1920) 117.—Fig. 18.

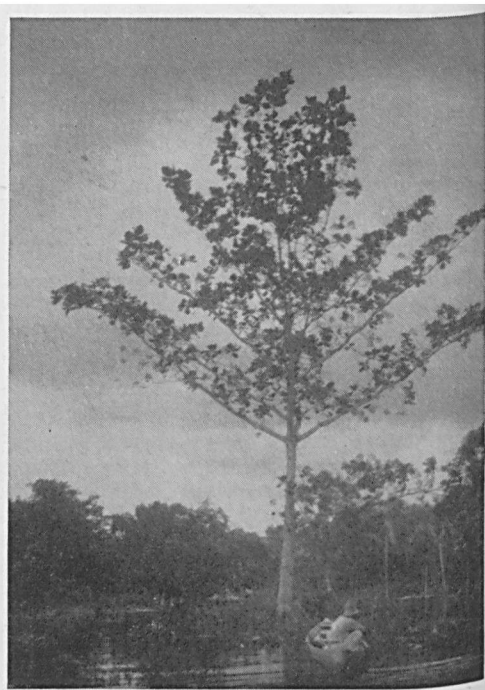


Fig. 18. *Fagraea crenulata* CLARKE in marshes near Palembang (Sumatra) (DE VOOGD).

Tree, up to 23 m by 50 cm \varnothing , trunk and branches with simple or divided prickles. *Leaves* sessile or subsessile, broadly obovate, 18–45 by 14–25 cm, thin-coriaceous to stiff-herbaceous, base narrowed, then widened again into a pair of amplexicaulous or recurved auricles, margin finely crenulate, apex very broadly rounded to nearly truncate; nerves 5–7 pairs, clearly visible above, prominent beneath; axillary scale fully adnate to the petiole or midrib, fairly narrow, acute, $1\frac{1}{2}$ –2 cm, completely enveloped by the leaf-base. *Inflorescences* corymbose, widely branched and many-flowered, up to 25 cm; pedicels 1–2 cm, gradually thickened towards the apex; bracteoles appressed, not very large, usually about halfway the pedicel. *Calyx* 1 cm long, divided to quite near the base. *Corolla*-tube funnel-shaped, $1\frac{3}{4}$ –2 cm. *Anthers* oblong, 6 mm, cells free in their basal third. *Stigma* peltate, $1\frac{1}{2}$ –2 mm \varnothing , faintly 2-lobed. *Fruits* ellipsoid, $2\frac{1}{2}$ cm or longer; calyx more or less spreading.

Distr. South Indo-China and *Malaysia*: along the east coast of Sumatra, the west coast of the Malay Peninsula, and the southwest and south coast of Borneo.

Ecol. Permanent or periodical swamps behind

the mangrove belt, along rivers, up to 10 m. *Fl.* fr. Jan.-Dec.

Uses. Furnishes a good, though cross-grained, timber; wood very valuable for piling, resists *teredo* borers when used with the bark on; furthermore used as firewood. In Bengkalis (Sum.) planted on yards.

Vern. *Cabbage tree*, E, *bēbira*, *bira bira*, *bubira*, *malabira*, *mēlabira*, Sum., *bērah*, *bira(h)*, *malabēra*, *mal(a)bira*, Mal. Pen., *kayu bulan*, Born.

Notes. The tree reminds in habit of *Terminalia catappa* L.

Young trees have densely spiny trunks (LÖRZING in Herb. Bo). These sharp conical prickles form part of the bark and are apparently corky in nature.

This is the only species of which the leaves are not entire. Its affinity seems to be with *F. blumei*.

13. *Fagraea truncata* BL. Mus. Bot. 1 (1850) 165; Walp. Ann. 3 (1852) 75; Miq. Fl. Ind. Bat. 2 (1857) 372; Ann. Mus. Bot. Lugd.-Bat. 2 (1866) 216; non KOORD. Minah. (1898) 540, KOORD.-SCHUM. Syst. Verz. 3 (1914) 105 (= *F. nov. sp. aff. longiflora*).—*F. plumeriaeflora* (non DC.) KOORD. Minah. (1898) 540, *sphalm. plumeriaefolia*; KOORD.-SCHUM. Syst. Verz. 3 (1914) 105.—*F. forstenii* (non BL.) KOORD. Minah. (1898) 540; KOORD.-SCHUM. Syst. Verz. 3 (1914) 105.

Liana, shrub, or tree, up to 12 m high. *Leaves* oblong, oblong-obovate or oblanceolate, 20-38 by 8-18 cm, coriaceous, base broadly to narrowly cuneate, apex broadly cuneate to rounded, abruptly, up to 1½ cm long, blunt- or acute-acuminate; nerves 7-10 pairs, slightly impressed above, prominulous beneath; petiole 2-3 cm, narrowly winged over the whole length, exauriculate; axillary scale adnate, c. 1 cm long, broadened towards the apex, 2-lobed. *Inflorescences* glomerulous, 3-7-flowered; pedicels ½-1½ cm, with a pair of 1-2 cm long, lanceolate bracteoles. *Calyx* widely campanulate, 2½-3 cm long, slightly less than halfway connate. *Corolla*-tube widely funnel-shaped, 4 cm. *Anthers* oblong, 1 cm, split halfway. *Stigma* obconical-peltate, c. 3 mm ø. *Fruits* ellipsoid, ± 3½ by 2½ cm, orange; calyx loosely appressed.

Distr. *Malaysia*: Celebes (Minahasa).

Ecol. Primary forests, 700-1250 m. *Fl.* July, fr. Jan., April.

Vern. *Matenga*, *simbēlan*, *sumering*.

Notes. Doubtless related to *F. fastigiata* of Java and to *F. blumei ssp. plumeriaeflora* from the Philippines.

The leaves are exauriculate, but sometimes there is a pair of gland-like structures on both sides of the leaf-base.

14. *Fagraea tacapala* LEENH. Bull. Jard. Bot. Brux. 32 (1962) 430—*F. fastigiata* (non BL.) CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 322, *pro specim. Celeb.*—Fig. 2c.

Treelike (up to 3 m high), tall epiphytic or terrestrial shrub, or woody climber. *Leaves* (sub)

sessile or distinctly petioled, (oblong-)obovate, rarely elliptic, 20-35 by 7-17 cm, thin-coriaceous, base (narrowly) cuneate or attenuate, usually decurrent, auriculate, apex blunt to broadly cuneate or shortly acuminate; nerves 8-10 pairs, prominulous on both sides; petiole (0-)2-5 cm, axillary scale adnate to the petiole, large (nearly 1-1½ cm), much broader than the petiole, distinctly bilobed. *Inflorescences* broadly corymbose, laxly branched, with up to c. 30 flowers; pedicels ½-2 cm, at the base to somewhat less than half-way provided with a pair of ovate to lanceolate, (½-)1-1½ cm long bracteoles. *Calyx* campanulate, 1¼-2½ cm long, confluent at base. *Corolla*-tube funnel-shaped, 2½ cm. *Anthers* oblong, ½-1 cm long, cells free in their basal half. *Stigma* peltate, funnel-shaped or discoid, 2½-4 mm ø. *Fruits* subglobular to spindle-shaped, up to 7 cm long; calyx more or less spreading.

Distr. *Malaysia*: Celebes, Moluccas (Ceram).

Notes. This species, with its three subspecies, is more or less intermediate between *F. blumei ssp. plumeriaeflora* on one side and *F. woodiana* on the other. Especially *ssp. gracilis* comes in its leaves very close to *F. blumei ssp. plumeriaeflora*; a constant difference between these two species is the presence of (mostly small) auricles in *F. tacapala*, their absence in *F. blumei*.

The three subspecies, in the sequence *gracilis-ceramensis-tacapala* form together a series from slender to very coarse.

KEY TO THE SUBSPECIES

1. Leaves distinctly petioled. Calyx 1¼ cm, slender *ssp. gracilis*
1. Leaves sessile. Calyx 1¼-2½ cm, fairly wide to wide.
 2. Calyx 2½ cm long, strongly warty-lenticellate. *ssp. tacapala*
 2. Calyx 1¼-1½ cm long, smooth or with few lenticels *ssp. ceramensis*

ssp. tacapala.—*F. fastigiata* BL. *sensu* CAMMERL. *p.p.*

Leaves sessile; axillary scale 1½ cm long, much broader than the petiole, deeply 2-lobed. *Inflorescence* very coarse, densely warty-lenticellate; pedicels 1 cm, thick; bracteoles lanceolate to ovate, 1-1½ cm, usually inserted about halfway the pedicel, sometimes both or one of them nearly apical. Calyx 2½ cm long, strongly warty-lenticellate, very broad; anthers 7½-10 mm; stigma discoid-peltate.

Distr. SW. Celebes.

Ecol. In primary and secondary forests, along forest-edges and waysides; on volcanic tuff, at 1000-2000 m alt. *Fl.* Jan., June.

Vern. *Ta'kapala*.

ssp. gracilis LEENH. Bull. Jard. Bot. Brux. 32 (1962) 431.

Leaves distinctly petioled; axillary scale somewhat less than 1 cm long, relatively narrow. *Inflorescence* not very coarse, not warty-lenticellate;

pedicels slender, 1–2 cm; bracteoles oblong, c. $\frac{3}{4}$ –1 cm. Calyx slender, $1\frac{1}{4}$ cm; anthers 5 mm; stigma funnel-shaped.

Distr. Celebes.

Ecol. Rain-forests, along streams or on marshy soil, 500–1200 m. *Fl.* June–July.

Vern. *Pulularé*.

ssp. ceramensis LEENH. Bull. Jard. Bot. Brux. 32 (1962) 430.

Leaves sessile; axillary scale nearly $1\frac{1}{2}$ cm long, broadly cup-shaped, faintly 2-lobed. Inflorescence large, fairly coarse, smooth or sparsely warty-lenticellate; pedicels moderately slender, $\frac{1}{2}$ –1 cm; bracteoles ovate, c. $\frac{3}{4}$ –1 cm. Calyx fairly broad, $1\frac{1}{4}$ – $1\frac{1}{2}$ cm long; anthers 6 mm; stigma disk-shaped.

Distr. Moluccas (Ceram).

Ecol. In forests, 500–800 m. *Fl.* Jan., May.

15. *Fagraea woodiana* F. v. M. Austr. J. Pharm. (Sept. 1886) 323; Bot. Centralbl. 29 (1887) 241; S. MOORE, J. Bot. 61 (1923) Suppl. 35.—*F. anthocleistifolia* GILG & BENED. Bot. Jahrb. 54 (1916) 192.

Tree, up to 20 m by 41 cm ϕ , shrub, or liana. Leaves subsessile, oblong-obovate, 25–50 by 10–20 cm, thin-coriaceous, base attenuate and decurrent, ending in a pair of auricles c. $\frac{1}{2}$ – $1\frac{1}{2}$ cm ϕ , apex broadly rounded and emarginate to slightly acuminate; nerves 7–8 pairs, prominulous on both sides, mainly underneath; axillary scale for the greater part or entirely adnate to the petiole, c. $1\frac{1}{2}$ cm long, very broad and deeply 2-lobed to truncate. Inflorescences pyramidal-thyrsoid with c. 3 pairs of horizontal branches, these up to 3 cm long, rebranched or not, at the end with a more or less dense 5–7-flowered cyme, the total inflorescence about 20 cm long; pedicels $\frac{1}{2}$ –1 cm, bracteoles inserted at their base or up to halfway, small and thin. Calyx campanulate, 1 cm, divided for c. $\frac{2}{3}$. Corolla-tube funnel-shaped, c. 2–3 cm. Anthers bifid to about halfway, sagittate, 6– $7\frac{1}{2}$ mm. Stigma peltate, faintly 2-lobed, $2\frac{1}{2}$ –3 mm ϕ . Fruits ovoid, c. 2–3 cm long, yellow; pedicel warty-lenticellate, calyx more or less spreading.

Distr. Malaysia: New Guinea.

Ecol. In primary and secondary forests, either temporarily inundated or not, from sea-level up to 1600 m. *Fl.* Aug., Oct., Dec., *fr.* Aug., Oct. The flowers are fragrant like those of jasmine.

Vern. *Amiundam*, *subekwa*, *wuribèding*.

Notes. Apparently related to *F. tacapala*.

The type is wrongly cited as FORBES 741, this must be 744.

16. *Fagraea longiflora* MERR. Philip. J. Sc. 3 (1908) Bot. 260; ELM. Leaflet. Philip. Bot. 2 (1909) 597; MERR. En. Philip. 3 (1923) 315.—*F. macgregorii* MERR. Philip. J. Sc. 13 (1918) Bot. 51.

Epiphytic shrub. Leaves sessile, broadly to narrowly obovate, 35–70(–100) by 10–32 cm, thin-coriaceous, narrowed towards the base, at the base widened into a pair of rounded, sometimes more or less reflexed wings at both sides of

the axillary scale, apex more or less rounded with a distinct, small (up to 2 cm long) and narrow, acute acumen; nerves 9–12 pairs, prominulous on both sides; axillary scale adnate to the midrib, $1\frac{1}{2}$ cm long, acute at the apex, completely hidden by the leaf-base. Inflorescences glomerulous, with 4–c. 15 subsessile flowers, enveloped by an involucre of reduced leaves. Calyx campanulate, $2\frac{1}{2}$ cm (–6 cm in fruit), slightly more than half-way divided. Corolla-tube tubular, slender, c. 11 cm. Anthers narrowly ovate, 7 mm long, cells free to slightly above the middle. Stigma peltate, $\frac{1}{2}$ – $\frac{3}{4}$ cm ϕ . Fruits subglobular, ovate, or ellipsoid, $3\frac{1}{2}$ – $4\frac{1}{2}$ by $2\frac{3}{4}$ cm; calyx accrescent, the fruits moreover enveloped by the long bracts.

Distr. Malaysia: Philippines (Luzon, Cantauanes); a dubious specimen from Mindanao (BS 38650).

Ecol. In forests, 100–1400 m. *Fl.* April, Oct.–Dec., *fr.* May.

Vern. *Sapiag*, Klg.

Notes. Probably near to *F. blumei ssp. plumeriaeflora*: distinguishable, however, at first sight by the glomerulous inflorescences and the long corolla-tube. Possibly also related to *F. carstensensis* from New Guinea.

As lectotype I have designated FB 8026 (PNH, †; dupl. K), the only syntype I have seen.

MERRILL erroneously cited the type number of *F. macgregorii* as BS 17938, this should be BS 19738.

17. *Fagraea carstensensis* WERNH. Trans. Linn. Soc. Bot. 9 (1916) 111.—Fig. 19.

Small tree (c. 3 m). Leaves sessile, broadly obovate to obovate-oblong, 17–35 by 5–17 cm, coriaceous, base subcordate by a broadly rounded, probably flat wing (apparently not auriculate), connate when young, apex rounded, shortly acute-acuminate; nerves 5–12 pairs, conspicuous though flat above, prominent beneath; axillary scale fully adnate to the midrib, $1\frac{1}{2}$ – $1\frac{3}{4}$ by c. $1\frac{1}{2}$ cm, quadrangular; the reduced leaves at the base of the inflorescence are connate and much broadened at the base, \pm perfoliate. Inflorescences sessile and glomerulous, c. 15-flowered; bracts and (one pair of) bracteoles relatively large ($1\frac{1}{2}$ and 1 cm long resp.), enclaspings the calyx. Calyx c. campanulate, 2 cm long, fairly slender, sepals free for c. $\frac{3}{4}$ of their length. Corolla-tube funnel-shaped, c. $3\frac{1}{4}$ cm long. Anthers elliptic, c. $6\frac{1}{2}$ mm long, thecae free in their basal third. Stigma obconical-peltate, 3 mm ϕ . Fruit unknown.

Distr. Malaysia: W. New Guinea (Mt Tamrau and Mt Carstensz), twice collected.

Ecol. Forests, 200–860 m.

Note. Probably nearest related to *F. longiflora* and *F. woodiana*.

18. *Fagraea auriculata* JACK, Mal. Misc. 2, n. 7 (1822) 82; WALL. in Roxb. Fl. Ind. 2 (1824) 34 & 573; BL. Bijdr. (1826) 1020; WALL. Pl. As. Rar. 3 (1832) 16, t. 229; JACK in Hook. Comp. Bot. Mag. 1 (1836) 254; BL. Rumphia 2 (1838) 26, t. 72, *excl. syn.* *Valli-Modagam* RHEEDE; DC.

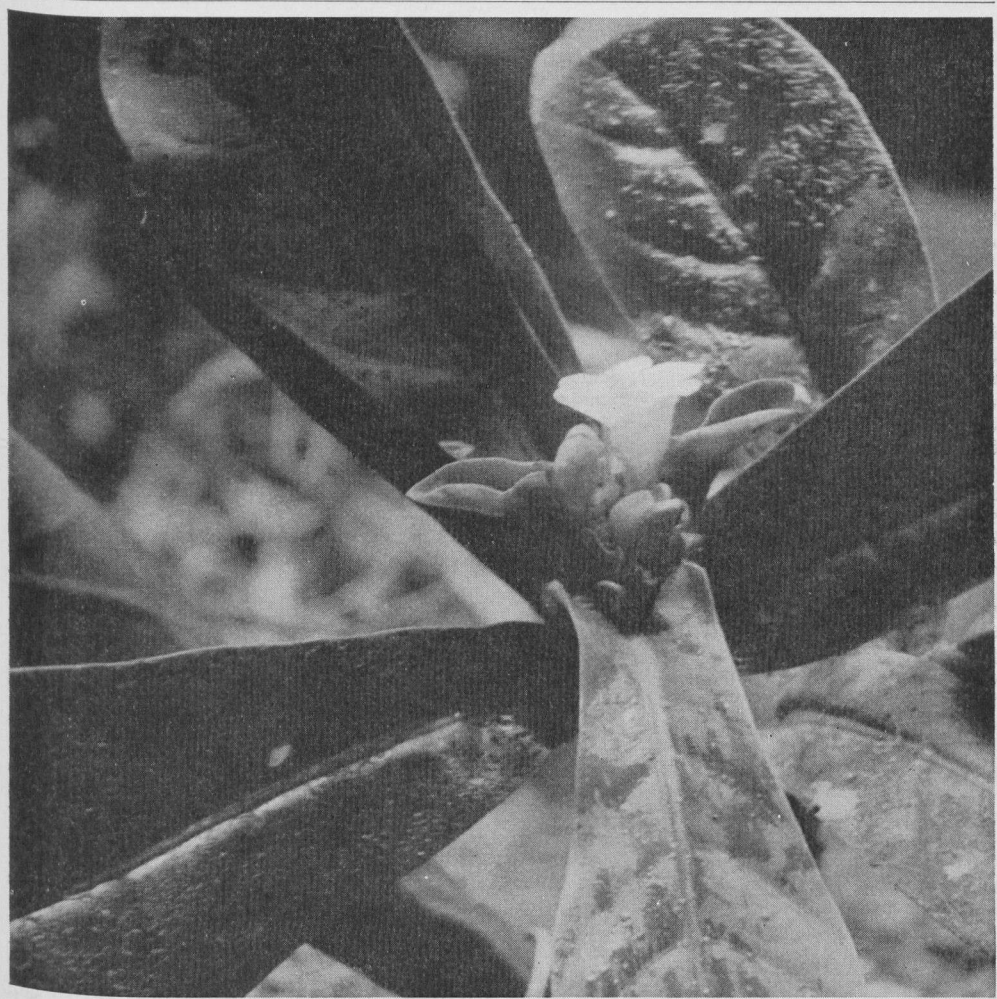


Fig. 19. *Fagraea carstensensis* WERNH., Tamrau Mts, Vogelkop Peninsula, W. New Guinea (VAN ROYEN & SLEUMER 7755) (VAN ROYEN, 1961).

- Prod. 9 (1845) 29; HASSK. Flora 28 (1845) 246; BL. Mus. Bot. 1 (1850) 165; MIQ. Fl. Ind. Bat. 2 (1857) 371; KURZ, For. Fl. Burma 2 (1877) 204 ('auricularia'); CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 83; SOLER. in E. & P. Nat. Pfl. Fam. 4, 2 (1892) 42, f. 23; RIDL. Trans. Linn. Soc. Bot. 3 (1893) 322; K. & V. Bijdr. 9 (1903) 76; KING, J. As. Soc. Beng. 74, ii (1908) 605; RIDL. J. Str. Br. R. As. Soc. n. 50 (1908) 119; ELM. Leaf. Philip. Bot. 2 (1909) 599; KOORD. Exk. Fl. Java 3 (1912) 59; DOP, Fl. Gén. I.-C. 4 (1914) 173, f. 21 (5-7); BURK. J. Str. Br. R. As. Soc. n. 73 (1916) 258; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 326; MERR. En. Philip. 3 (1923) 314; RIDL. Fl. Mal. Pen. 2 (1923) 416; BEUMÉE, Trop. Natuur 15 (1926) 208, cum fig.; HEYNE, Nutt. Pl. (1927) 1269; RIDL. Disp. (1930) 420; STEEN. & RUTTNER, Arch. Hydrobiol. Suppl. 11 (1932) 319, f. 16, 20, 21; BURK. Dict. 1 (1935) 993; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 10; KERR in Craib, Fl. Siam. En. 3 (1951) 54; MERR. J. Arn. Arb. 33 (1952) 224.—*F. javanica* REINW. ex BL. Cat. (1823) 47, nom. nud.—*Willughbeia auriculata* SPRENG. Syst. 4 (1827) Cur. Post. 71.—*F. imperialis* MIQ. Fl. Ind. Bat. 2 (1857) 372; Ann. Mus. Bot. Lugd.-Bat. 2 (1866) 216, t. 5 & 6; BURCK, Ann. Jard. Bot. Btzg 10 (1891) t. 8 f. 1-2; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 327.—*F. euneura* SCHEFF. in Hassk. Flora 52 (1869) 308; Nat. Tijd. N.I. 31 (1869?) 20; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 328.—*F. borneensis* SCHEFF. in Hassk. Flora 52 (1869) 309; Nat. Tijd. N.I. 31 (1869?) 21; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 326.—*F. nonok* ELM. Leaf. Philip. Bot. 3 (1910) 858; MERR. En. Philip. 3 (1923) 315.—*F. epiphytica* ELM. Leaf. Philip. Bot. 8 (1915) 2743.—*F. jackii* ELM. l.c. 2744.—*F. curranii* MERR. Philip. J. Sc. 13 (1918)

Bot. 50; En. Philip. 3 (1923) 314.—*F. fastigiata* (non BL.) CAMMERL. Bull. Jard. Bot. Btzig III, 5 (1923) 322, *pro specim. Simalur*.—*F. bracteosa* CAMMERL. l.c. 323, f. 6–7.—Fig. 2d, 20.

Epiphytic, more rarely terrestrial, shrub or climber, with age sometimes becoming a small to medium-sized tree (up to 20 m by c. 25 cm \varnothing). Twigs often sharply 4-angled, each ridge crowned by a small acute spine (which in large specimens may be developed into a small extra auricle). Leaves mostly distinctly petioled, varying from narrowly oblanceolate to oblong or obovate, 9–40(–60) by 4–25 cm, usually thickly coriaceous, base broadly cuneate to narrowly acute, more or less decurrent, apex rounded to acute, mostly terminated by a narrowly triangular, acute acumen; nerves 5–20 pairs, often inconspicuous to invisible; petiole robust, often about quadrangular in cross-section, 2–4(–8) cm, at the base (faintly to) distinctly auriculate, auricles about orbicular, somewhat convex, appressed to the twig; axillary scale for the greater part adnate to the petiole, loosely appressed to the twig, $\frac{1}{2}$ – $\frac{3}{4}$ cm long, fairly broad, rounded to slightly 2-lobed at the apex. Flowers solitary or in 2–7-flowered cymes; pedicels robust, 1–5 cm, quite near the top or somewhat lower down with 1 or 2 pairs of appressed, small to fairly large bracteoles. Calyx campanulate, 2–7 $\frac{1}{2}$ cm long, mostly divided to near the base, sometimes only slightly more than halfway down. Corolla thin to very thickly fleshy-leathery (in the herbarium sometimes nearly woody), tube widely to narrowly funnel-shaped, 4 $\frac{1}{2}$ –15 cm, limb wide-spreading (in the fresh state the whole corolla may be up to nearly 30 cm long and more than 30 cm across). Anthers bifid to about the middle or somewhat lower down, elliptic to oblong, $\frac{3}{4}$ –2 cm, thick. Stigma peltate, flat or slightly hollowed, 4–8 mm \varnothing (*in vivo* up to 2 cm). Fruits oblong-ellipsoid to ovoid, crowned by the persistent style-base, 6–15 cm long, greyish-white when ripe, dehiscent with 4 lobes; seeds embedded in an orange to red pulpa (which is derived from the placentas); calyx somewhat accrescent, mostly more or less spreading.

Distr. Lower Burma (Sandoway, Tenasserim), Siam, South Indo-China, and *Malaysia*: Sumatra, Malay Peninsula, Java, Bali, Borneo, Philippines, and Moluccas (Halmahera and surrounding islands). In older literature also often cited for India (Malabar), but this is based upon a wrong interpretation of RHEEDE's *Valli-Modagam*.

Ecol. In primary and secondary rain-forests, often along clearings, river-banks, paths, etc., sometimes in mangrove swamps on tidal waterways, on coastal rocks, in alang-alang fields and scrub, from sea-level up to 1500(–1900) m. Fl. fr. Jan.–Dec. The flower biology of this magnificent and gigantic flower is relatively well known: it is protandrous, and visited by insects and birds (see RIDL. J. Str. Br. R. As. Soc. n. 50, 1908, 119, and BURCK, Ann. Jard. Btzig 10, 1891, 97). The seeds are dispersed by birds and ants (see RIDL. l.c. and Disp. 1930, 421).

Uses. The sticky fluid under the epidermis of

the fruit is used in Sumatra as a glue, especially as a bird-lime. Forms with large flowers are cultivated as ornamentals.

Vern. *Bira-bira*, *kayu tulang*, *kĕnang* (or *kĕmang*) *hutan*, *puleh*, *sikaso udieng*, *simbu badak*, *tĕrĕntang langit*, *tĕrong tĕrong*, Sum., *pĕlir musang*, *sagam*, Mal. Pen.; *ki nangka*, *ki tĕrong* (*badak*), *kontrol buta*, *mangando badak*, Java S.; Philip.: *nato*, *tumakos*, Mbo., *nonok*, P. Bis., *piakang*, Buk.

Notes. *F. auriculata* is nearest related to *F. involucreta* and *F. macroscypha*, both especially characterized by the involucre of large bracteoles around the calyx, moreover by the slender, terete petiole.

The auricles are usually described as being green, once, however, they were mentioned to be orange. They provide shelter to ants (see BURCK, Ann. Jard. Bot. Btzig 10, 1891, 95).

SCHIEFFER's names were apparently published for the first time in a review by HASSKARL, dated June 9th, 1869, and published July 1st, 1869, in *Flora*. Though SCHIEFFER's paper was dated July 1868, it was not yet published at August 21st, 1869, as appears from the annual report of the 'Koninklijke Natuurkundige Vereeniging in Nederlandsch Indië'. So probably HASSKARL had received either a proof or a pre-issued reprint.

KEY TO THE SUBSPECIES

1. Corolla widely funnel-shaped.
2. Flowers large; calyx 3 $\frac{1}{2}$ –7 $\frac{1}{2}$ cm, corolla-tube 5–15 cm. Auricles at the leaf-base well developed *ssp. auriculata*
2. Flowers small; calyx 2–3 $\frac{1}{2}$ cm, corolla-tube c. 5 cm. Auricles at the leaf-base small or almost absent *ssp. parviflora*
1. Corolla slenderly funnel-shaped. *ssp. borneensis*

ssp. auriculata.—*F. auriculata* JACK.—*F. javanica* BL.—*Willughbeia auriculata* SPRENG.—*F. imperialis* MIQ.—*F. epiphytica* ELM.

Auricles well developed, up to 2 by 2 $\frac{1}{2}$ cm; leaves shortly petioled to subsessile. Inflorescences 1–3(–6)-flowered. Calyx 3 $\frac{1}{2}$ –7 $\frac{1}{2}$ cm. Corolla-tube 5–15 cm long, widely funnel-shaped. Fruits 8–15 cm long; calyx-lobes often appressed.

Distr. Burma, Siam, South Indo-China, and *Malaysia*: Sumatra, Malay Peninsula, Java, Bali, Borneo, and SE. Philippines (Panay, Mindanao).

ssp. borneensis (SCHEFF.) LEENH., *nov. stat.*—*F. borneensis* SCHEFF.—*F. nonok* ELM.—*F. jackii* ELM.—*F. bracteosa* CAMMERL.

Auricles usually well developed, though not very large ($\frac{3}{4}$ –1 $\frac{1}{2}$ cm \varnothing); leaves mostly distinctly petioled. Inflorescences 3–7-flowered. Calyx 2 $\frac{1}{2}$ –3 $\frac{1}{2}$ cm. Corolla-tube 8–9 cm long, narrowly funnel-shaped (basal half narrowly tubular). Fruits 6–7 cm long; calyx-lobes spreading.

Distr. *Malaysia*: Northern half of Borneo and W. Philippines (Palawan, Mindoro, Sibuyan).

ssp. parviflora LEENH., *nov. ssp.*—*F. euneura* SCHEFF.—*F. curranii* MERR.



Fig. 20. *Fagraea auriculata* JACK; the giant flower of 'F. imperialis', cult. Hort. Bog. (Hj. JENSEN).

Auricles small or almost absent (up to $\frac{3}{4}$ cm ϕ); leaves mostly distinctly petioled. Inflorescences (1-)3-5-flowered. Calyx 2-3 $\frac{1}{2}$ cm. Corolla-tube 4 $\frac{1}{2}$ -5 $\frac{1}{2}$ cm long, widely funnel-shaped. Fruits 6-7 cm long; calyx-lobes spreading.

Distr. *Malaysia*: Philippines (Luzon) and Moluccas (Halmaheira and adjacent islands).

Note. *Ssp. parviflora* has been based upon *F. curranii* MERR.

19. *Fagraea involucrata* MERR. J. Str. Br. R. As. Soc. n. 77 (1917) 233; non var. *longipetiolata* MERR. Pl. Elm. Born. (1929) 251 (= *F. macroscypha*).—*F. macroscypha* (non BAKER) HEINE, Pfl. Clemens Kinabalu (1953) 91.—*F. uniflora* (non MERR.) Heine, l.c. 92.—Fig. 21a-d, 22.

Epiphytic shrub or liana which later can become a fairly slender tree. Leaves petioled, oblong to lanceolate, (9-)12-25 by 4-8 cm, thickly coriaceous, base cuneate or slightly contracted, acute, apex rather abruptly and shortly acute acuminate; nerves c. 15 pairs, on either side nearly always inconspicuous to invisible, or slightly prominent on the lower surface; petiole 1 $\frac{1}{2}$ -4 $\frac{1}{2}$ cm, mostly terete, auriculate; axillary scale largely free from

the petiole, $\frac{1}{2}$ -1 cm long, rounded. Flowers solitary; pedicel very robust, $\frac{3}{4}$ -2 $\frac{1}{2}$ cm, thickened upwards, bearing in its upper part (2-)3 closely approximate, decussate pairs of appressed, coriaceous, ovate, 2-6 cm long bracteoles which enclose the lower part of the calyx (inner bracteoles distinctly larger than outer ones). Calyx 7-9 cm long, divided to quite near its base, segments oblong, rounded, leathery, very concave. Corolla inside green with 5 broad cream streaks, tube at base tubular, abruptly widened in its upper third part, 14-15 cm, the upper part inside rather densely tomentose. Anthers oblong, very thick, 1 $\frac{1}{2}$ -1 $\frac{3}{4}$ cm, cells free to distinctly below their middle. Stigma peltate-cupshaped, $\frac{3}{4}$ cm ϕ . Fruits ovoid, about 4 $\frac{1}{2}$ by 4 cm; calyx spreading.

Distr. *Malaysia*: Borneo.

Ecol. In forests, on river-banks and along paths up to 1800 m. Fl. fr. probably Jan.-Dec.

Vern. *Kaju ara jangkit*.

Note. Closely related to *F. macroscypha* (see there) and to *F. auriculata*, especially its *ssp. borneensis*, different from the latter by the solitary flowers with much larger calyx, by the greater number of exceptionally large bracteoles, and by the abruptly widened corolla-tube.

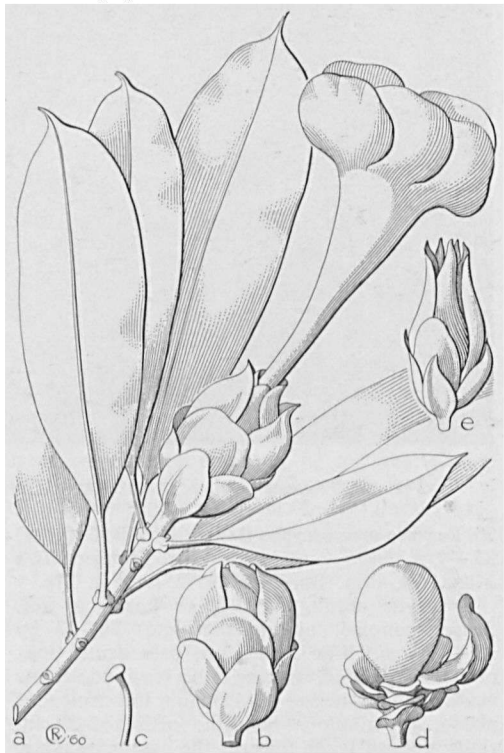


Fig. 21. *Fagraea involucrata* MERR. a. Habit, $\times \frac{1}{3}$. b. flower-bud, $\times \frac{1}{3}$. c. apical part of style and stigma, $\times \frac{1}{3}$. d. young fruit, calyx partly removed, $\times \frac{1}{3}$.—*F. macroscypha* BAKER. e. Calyx with involucre, $\times \frac{1}{3}$. (a SF 26733, b ENDERT 4613, c CLEMENS 30072, d SAN 16380, e CREAGH s.n.).



Fig. 22. *Fagraea involocrata* MERR., Bundu Tukan, North Borneo (W. MEYER, 1960).

20. *Fagraea macroscypha* BAKER, Kew Bull. (1896) 25.—? *F. involocrata* MERR. var. *longipetiolata* MERR. Pl. Elm. Born. (1929) 251.—Fig. 21e.

Epiphytic shrub, climber, or finally a tree. *Leaves* petioled, oblong-lanceolate, $7\frac{1}{2}$ –27 by $3\frac{1}{2}$ – $6\frac{1}{2}$ cm, thick coriaceous, base acute, apex obtuse or rounded, tapering into a long and narrow acute acumen; nerves 10–15 pairs, inconspicuous above, prominulous beneath; petiole 2–3 cm, rather robust, terete towards the base, auriculate; axillary scale nearly free, loosely appressed to the twig, 3 mm high, rounded. *Flowers* solitary, pedicel very thick, $\frac{3}{4}$ –1 cm, at the apex with 2 decussate pairs of large ($2\frac{1}{2}$ –3 cm), appressed bracteoles, these together embracing the base of the calyx. *Calyx* campanulate, $6\frac{1}{2}$ –9 cm long, divided to near the base, lobes ovate-lanceolate, tapering

into a long and slender acumen. *Corolla* white to cream with a broad green medium stripe, tube 12–14 cm, tubular, slightly widened upwards. *Anthers* divided to below the middle. *Stigma* peltate, slightly hollowed, 5 mm or more \emptyset . *Fruits* reversed pear-shaped or acutely obovoid, c. 7 by 4 cm.

Distr. *Malaysia*: Borneo.

Ecol. In logged area, up to 200 m. *Fl.* March, Sept.

Vern. *Kayu ara jangkit*.

Notes. Closely related to *F. involocrata*, mainly different by the long and acute sepals and by the nerves which are prominent on the lower surface of the leaves.

As far as I can judge from sterile specimens, *F. involocrata* var. *longipetiolata* comes closer

to this species than to any other one. MERRILL, in describing this variety, already had some doubt about its identity.

21. *Fagraea resinosa* LEENH. Bull. Jard. Bot. Brux. 32 (1962) 429.

Leaves distinctly petioled, oblong to lanceolate, 10–16 by 4–7 cm, stiffly coriaceous, base acute, apex blunt, abruptly terminated by a short, narrow, and acute point; nerves c. 15–20 pairs, inconspicuous above, invisible beneath; petiole 2½–4 cm, terete or slightly flattened above, exauriculate, axillary scale partly adnate to the petiole, 4–5 mm, rounded. Flowers solitary, known only in bud, pedicel relatively slender, ½–1½ cm, at the apex with 2 pairs of bracteoles, all broadly rounded and embracing the basal part of the calyx, the upper 2½ cm, the lower 1½ cm long. Calyx campanulate, 3½ cm, deeply divided, lobes broadly rounded. Anthers broadly oblong, 6 mm long, slightly bifid at the base only. Stigma dish-shaped, 2½ mm ø (or more?). Fruits ovoid, 4½ by 3 cm; calyx appressed.

Distr. Malaysia: Borneo (Brunei: Bt Belalong; W. Borneo: Mt Amai Ambit).

Ecol. Forests, c. 700 m. Fr. April.

Notes. Related to, but distinctly different from, *F. macroscypha* and *F. involucrata*.

In its vegetative parts resembling *F. carnosa* which differs by its smaller, slender calyx not enveloped by large bracteoles, and by the smaller number of nerves (c. 6 pairs).

22. *Fagraea carnosa* JACK, Malay. Misc. 2, n. 7 (1822) 81; in Hook. Comp. Bot. Mag. 1 (1836) 254; DC. Prod. 9 (1845) 30; MIQ. Fl. Ind. Bat. 2 (1857) 374; KURZ, Fl. Burm. 2 (1877) 204; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 82; KING, J. As. Soc. Beng. 74, ii (1908) 604; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 323; RIDL. Fl. Mal. Pen. 2 (1923) 416; HENDERS. J. Mal. Br. R. As. Soc. 17 (1939) 58.—*F. monantha* MIQ. Fl. Ind. Bat. 2 (1857) 373; Ann. Mus. Bot. Lugd.-Bat. 2 (1866) 218; SCHEFF. Nat. Tijd. N.I. 31 (1870) 21.—*F. rotundifolia* RIDL. J. Str. Br. R. As. Soc. n. 50 (1908) 117; Fl. Mal. Pen. 2 (1923) 416.—*F. uniflora* MERR. J. Str. Br. R. As. Soc. n. 77 (1917) 235; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 337.—*F. flavidula* RIDL. Fl. Mal. Pen. 5 (1925) 322.—*F. lanceolata* (non BL.) HENDERS. Gard. Bull. S.S. 4 (1927) 99.

Epiphytic (rarely terrestrial) shrub or climber. Leaves petioled, (suborbicular to) elliptic to lanceolate or oblong-obovate, 7½–16 by 3½–8½ cm, thickly and rigidly coriaceous, base cuneate, sometimes shortly contracted, apex acute to rounded or even slightly emarginate, and in both latter cases shortly acutely acuminate; nerves 6–7 pairs, at both surfaces inconspicuous or almost so, sometimes slightly sunken above; petiole ¾–3 cm, exauriculate; axillary scale halfway up to nearly completely adnate to the petiole, ½–¾ cm long, obtuse or rounded, not very conspicuous. Flowers 1(–2), pedicel very thick, ½–2 cm, bracteoles 1 or 2 pairs, apical, appressed, ½–1 cm long. Calyx

slender, (1½–)2–5 cm long, divided ± halfway down or slightly less. Corolla-tube rather slender, tubular, 7–14 cm. Anthers oblong, 1–1¾ cm, cells free to somewhat below the middle. Stigma capitate to peltate-cupular, 4–5 mm ø. Fruits (oblong) ellipsoid, 4–7 cm, greyish blue; calyx appressed.

Distr. Lower Burma (Moulmein) and Malaysia: Sumatra, Malay Peninsula, and Borneo.

Ecol. Forests on limestone, also along the beach, from sea-level up to 2000 m. Fl. mainly Jan., fr. Jan., Aug., Nov.

Vern. *Andor hapal*, Sum., *num pang*, Born.

Notes. *F. uniflora* was apparently based upon an anomalous specimen, with 6 calyx-lobes and 8–9 corolla-lobes; I have not seen the type specimen.

This species is best characterized by the slender though rather large, spindle-shaped calyx, furthermore by the very stiff, usually minutely pointed leaves and the smooth, greyish-yellow twigs.

JACK's type specimen is apparently lost. Among the few Sumatran specimens at my disposal none fits his original description very well, and there is no later collection from the type-locality, cited as Bencoolen, S. Sumatra. The only specimen which is well in accordance with the original diagnosis is ROSTADO s.n. from Tringgandu, Bundi, Malaya, collected Febr. 1904 (K), the type of *F. rotundifolia* RIDL.

23. *Fagraea gardenioides* RIDL. J. Fed. Mal. Str. Mus. 5 (1914) 42; Fl. Mal. Pen. 2 (1923) 416.

Epiphytic shrub or possibly sometimes a treelet. Leaves petioled, (oblong or elliptic to) obovate, 6½–13 by 4–6½ cm, coriaceous (*in vivo* probably thick fleshy), base cuneate, attenuate, apex rounded or blunt, without or with a short acumens; nerves c. 7–8 pairs, mostly invisible, sometimes minutely grooved beneath; petiole 1–2 cm, exauriculate; axillary scale partly adnate to the petiole, ¼–¾ cm long, about square, truncate to 2-lobed, distinctly broader than the petiolar base. Inflorescences terminal; flowers 1–5 in a sessile cyme; pedicel ½–2 cm; bracteoles appressed to the calyx, ovate to roundish, ½–¾ cm long. Calyx campanulate, 1½–3 cm long, connate for ½–¾. Corolla-tube tubular, 6–7 cm. Anthers linear (-lanceolate), 9 mm, up to c. ½ bifid at the base. Stigma subpeltate, sometimes slightly 2-lobed, 3–5 mm ø. Fruits (young) ovoid to ellipsoid, 4 cm or more long, tapering into a conical beak; calyx loosely appressed.

Distr. Malaysia: Malay Peninsula, Borneo.

Note. On the one side closely related to *F. curtisii*, which differs by the short corolla-tube and the longer and relatively narrower, acute leaves. On the other side especially *ssp. borneensis* shows some relationship to *F. berteriana* and allies.

ssp. gardenioides.

Rather coarse. Petioles narrowly winged; axillary scale ¾ cm long; blade up to 13 by 7½ cm, not acuminate. Flowers up to 3; pedicel up to 2 cm,

thick. Calyx 2½–3 cm, less than halfway up connate. Corolla-tube relatively wide. Stigma obconical with a membranous margin, c. 5 mm ø.

Distr. Malay Peninsula.

Ecol. On hills, c. 1400–1900 m. *Fl.* Jan., April, July, Aug.

ssp. borneensis LEENH. Bull. Jard. Bot. Brux. 32 (1962) 425.

Rather slender. Petioles not winged; axillary scale ¼–½ cm long; blade 7–10 by 4–6½ cm, fairly abruptly, shortly and broadly acute-acuminate. Flowers up to 5; pedicel up to ¾ cm, rather slender. Calyx 1½ cm, connate for ⅔. Corolla-tube slender. Stigma cupular-peltate, slightly 2-lobed, c. 3 mm ø.

Distr. Borneo (Sarawak: near Kuching).

Ecol. *Fl.* Dec.

24. *Fagraea curtisii* K. & G. J. As. Soc. Beng. 74, ii (1908) 605; RIDL. Fl. Mal. Pen. 2 (1923) 417; KERR in Craib, Fl. Siam. En. 3 (1951) 55.

Low spreading tree or (sometimes epiphytic) shrub. *Leaves* petioled, elliptic, ovate-elliptic, or oblong-obovate, 10–21 by 5–8½ cm, firmly coriaceous, base cuneate or contracted, apex shortly and often abruptly triangular-acuminate; nerves 7–10 pairs, invisible on both surfaces; petiole 1–1½ cm, robust; exauriculate; axillary scale for the greater part adnate to the petiole, ½–¾ cm long, narrowed towards the truncate to slightly 2-lobed apex. *Flowers* in (1–)2–4-florous cymes; pedicels stout, 1¼–2½ cm; 1–2 pairs of bracteoles near the apex, appressed, broadly ovate, ½–1 cm long, caducous. *Calyx* campanulate, 1¾–3½ cm long, divided ± ⅓ to nearly halfway down. *Corolla*-tube funnel-shaped, c. 4½ cm. *Anthers* oblong, thick, ± 8 mm, bifid to about the middle. *Stigma* peltate, c. 2½ mm ø. *Fruits* subglobose or broadly (ob)ovoid, 3¼–5 cm long; calyx funnel-shaped, loosely appressed.

Distr. North Burma (Kachin State) and *Malaysia*: Malay Peninsula (Puket, Kedah, Kelantan, Langkawi I.).

Ecol. From sea-level up to 1300 m (in Burma), on limestone. *Fl.* Aug.–Sept., *fr.* Febr.

Note. On the one side closely related to *F. gardenioides*, on the other to *F. calcarea*. The former differs by its long tubular corolla, the other by its large bracteoles.

25. *Fagraea calcarea* HENDERS. Gard. Bull. S.S. 7 (1933) 113, t. 28 B.

Climbing shrub. *Leaves* petioled, elliptic to broadly ovate or obovate, 12–17½ by 6–9 cm, thinly coriaceous, base cuneate, somewhat decurrent, apex rounded, without or with an abrupt very short, triangular acumen; nerves 8–10 pairs, very faint on both surfaces; petiole 1½–3 cm, fairly slender, exauriculate; axillary scale adnate to the petiole, ¾–1 cm long, truncate, not very conspicuous. *Flowers* 1(–3); pedicels stout, ¼–1½ cm; bracteoles 2 pairs, the outer ovate or ovate-lanceolate, acute, up to 3 cm long, the inner ovate, rounded, 2 cm long, all embracing the basal

part of the calyx. *Calyx* ovoid, 3½–4 cm long, divided for about ⅓. *Corolla*-tube funnel-shaped, c. 5 cm. *Anthers* oblong, c. 1 cm. *Stigma* broadly funnel-shaped. *Fruits* unknown.

Distr. *Malaysia*: Malay Peninsula (Pahang: B. Chintamani near Bentong), once collected.

Ecol. Climbing on a limestone rock face, at low altitude. *Fl.* Oct.

Note. Evidently allied to *F. curtisii* but differing in the thinner, wider and more rounded leaves, the flowers of the single specimen known being mostly solitary (in a few inflorescences in threes), and somewhat larger, and in the much larger and more deeply cut calyx. Possibly also related to *F. involucrata*.

26. *Fagraea gracilipes* A. GRAY, Proc. Am. Ac. Arts Sc. 4 (1859) 323; SEEMANN, Fl. Vit. (1866) 165; A. C. SMITH, J. Arn. Arb. 33 (1952) 113; LEENH. Bull. Jard. Bot. Brux. 32 (1962) 426.—*Gardneria fagraeacea* F. v. M. Fragm. 6 (1868) 130.—*F. muelleri* BTH. Fl. Austr. 4 (1869) 368, *nom. illeg.*; F. M. BAIL. Queensl. Fl. 3 (1900) 1023.—*F. dolichopoda* GILG & BENEDE. Bot. Jahrb. 54 (1916) 196.—*F. fagraeacea* DRUCE, Rep. Exch. Cl. Brit. Is. 1916 (1917) 623.—*F. amabilis* S. MOORE, J. Bot. 61 (1923) Suppl. 36.—*F. cambagei* DOMIN, Bibl. Bot. 89 (1929) 1071; MERR. & PERRY, J. Arn. Arb. 23 (1942) 413.—*F. elata* MERR. & PERRY, *l.c.*—*F. obtusifolia* MERR. & PERRY, *l.c.* 415; F. S. WALKER, For. Br. Solomon Is. (1948) 137.—*Fagraea sp.* KAN. & HATUS. Bot. Mag. Tokyo 56 (1942) 163.

Small to medium tree, usually up to 15 m, rarely up to 40 m by 45 cm ø; sometimes a scrambling shrub. *Leaves* petioled, broadly elliptic or elliptic obovate to oblong, (6–)9–17(–23) by (2½–)4½–8½(–10) cm, coriaceous, base narrowly acute to broadly cuneate, nearly always attenuate, apex blunt, usually terminated by a short, broad, and blunt acumen; midrib grooved above, towards the base sometimes flattish; nerves 5–8(–9) pairs, minutely grooved above, grooved to prominent beneath, usually inconspicuous or sometimes invisible; petiole 1–4 cm, mostly slender, exauriculate; axillary scale more than halfway up to nearly completely adnate to the petiole, but appressed to the twig, not conspicuous, 2½–5 mm long, blunt to rounded. *Inflorescences* cymose, few- to many-flowered, dense to lax, always relatively small, the branches often more or less drooping, pedicels sometimes very slender, ½–3 cm, with 1(–3) pairs of small bracteoles, inserted from about halfway to just below the calyx. *Calyx* campanulate, c. 6–7 mm(–1½ cm), divided about halfway or somewhat more. *Corolla*-tube funnel-shaped (basal half mostly tubular), slender, 2¼–5 cm long. *Anthers* bifid to c. ½–½ from the base, oblong (to elliptic), 3–5 mm. *Stigma* small, subobconical, slightly 2-lobed or entire. *Fruits* broadly ellipsoid-obovoid to -ovoid, abruptly terminated by a strong long-conical beak, the whole fruit 3–4 cm long, orange or red; pedicels apparently somewhat lengthened, calyx appressed, slightly crescent.

Distr. Fiji, Santa Cruz Is., Solomon Is. (Santa Isabel, New Georgia), Australia (NE. Queensland) in *Malaysia*: New Guinea (also Aru Is.). Cf. LEENHOUTS, Pac. Pl. Areas map 91.

Ecol. In and along the edges of rain-forests, as well on a dry as on a swampy or temporarily inundated soil, furthermore in secondary forests, in palm-swamps and in mossy oak forests, 0-1530 (-2000) m. *Fl.* Jan.-Dec., *fr.* April, June-Nov.

Uses. A hard, heavy timber, very durable, esteemed by the natives, who use it for making combs, houseposts, canoes, etc., also suitable for survey-marks, heavy construction, and turnery. In Fiji tea made from the bark and leaves is used medicinally. The fruits are sometimes pickled and eaten.

Vern. *Mulgrave plum*, E, *besron*, *boggong*, *ibelaka*, *iedəwəb*, *i(eg)bərakka*, *mofruka*, *nasam*, *ngorarien*, *nietsamber*, *numae*, New Guinea.

Notes. A variable species; the Papuan specimens are rather uniform and well characterized by the brown to blackish twigs and the thick, fleshy-coriaceous, broadly elliptic to obovate leaves, which are distinctly attenuate at the base and obtuse or rounded, but always shortly and bluntly acuminate at the apex, and with the nerves delicately grooved on both surfaces. Some small-leaved and small-flowered specimens remind of the Australian form known as *F. muelleri*; a few specimens, with large oblong leaves, come close to the other Australian form which was described under the name of *F. cambagei*.

The relationships are not fully clear to me. On the one side it reminds of *F. berteriana*, on the other hand it has several characters in common with *F. umbelliflora*.

The name *F. muelleri* is illegitimate, as it had been based upon *Gardneria fagraeacea* F. v. M., and the epithet of the latter should have been used.

27. *Fagraea eymae* BACKER in Leenh. Bull. Jard. Bot. Brux. 32 (1962) 425.—Fig. 2a.

Shrub. *Leaves* subsessile to shortly petioled, oblong to elliptic, c. 9-10 by 4½-5½ cm, firmly coriaceous, base rounded or subcordate, faintly auriculate, margin recurved, apex obtuse or minutely obtusely pointed; nerves 5-6 pairs, on the upper surface faintly visible, beneath inconspicuous or almost so; axillary scale for the greater part adnate to the petiole, ½-¾ cm long, about quadrangular to slightly bilobed, boat-shaped, nearly completely hidden by the leaf-base. *Inflorescences* usually 2-flowered, pedicels thick, 1-2 cm long; bracteoles near the apex, ovate to oblong, ¾-1½ cm long. *Calyx* campanulate, 2-2½ cm long, divided somewhat over halfway down. *Corolla*-tube distinctly funnel-shaped, 4½ cm, lobes exceptionally short, rounded. *Anthers* oblong, thick, 8-11 mm long, cells free in their basal half. *Stigma* ± cupular-peltate, 2½ mm ø. *Fruits* globular, 2½-3 cm ø; calyx appressed.

Distr. *Malaysia*: West New Guinea (Wissel Lake area).

Ecol. In permanently inundated, secondary

forest on peat at c. 1750 m. *Fl.* Jan.

Vern. *Ipu* or *iepo*.

Note. Apparently related to *F. salticola* and to *F. monticola*.

28. *Fagraea salticola* LEENH. Bull. Jard. Bot. Brux. 32 (1962) 429.—Fig. 23.

Tree, up to c. 25 m high by 35 cm ø. *Leaves* shortly petioled, elliptic to slightly obovate, 4-11 by 2½-7 cm, somewhat convex, very thickly and stiffly coriaceous (fleshy when fresh), the base slightly cordate to rounded, rarely broadly cuneate, apex rounded to blunt; nerves c. 5 pairs, nearly invisible, sometimes slightly sunken above; petiole ½-1 cm, thick, exauriculate; axillary scale adnate to the petiole, distinctly broader than this and convex, 4-7 mm long, widened towards the 2-lobed apex. *Inflorescences* cymose, rather dense, with 3-10 flowers; pedicels ½ cm long, thick, tapering towards the calyx, either without or with a pair of bracteoles appressed to the calyx. *Calyx* ellipsoid-campanulate, 1¼-1½ cm long, divided about halfway up. *Corolla*-tube funnel-shaped, 2½ cm long. *Stamens* inserted on a thickened ring in the inside of the corolla; anthers attached just above the base, lanceolate, c. 7 mm. *Stigma* bilobed, 3-4 mm ø. *Fruits* ellipsoid, acute, 3½ by 1½ cm, orange; calyx appressed.

Distr. *Malaysia*: East New Guinea (Western and Eastern Highlands).

Ecol. In mossy and *Podocarpus-Libocedrus* forests at 2500-2850 m. *Fl. fr.* July-Aug.

Uses. Wood previously used by natives for making spears.

Vern. *Banda*, *mama*, *mband*, *tihl*.

Notes. A very characteristic species, which only shows a distinct resemblance to *F. eymae* as to the vegetative parts. Apart from *F. annulata*, *F. salticola*, *F. bodenii*, and *F. berteriana* - with which it is connected by the annulus inside the corolla and as to the latter three also by the only very slightly bifid anthers and the bilobed stigma - it may be related to *F. monticola* GILG & BENED. (1916), and it would even be possible that it is identical with *F. melanochlora* GILG & BENED. (1916), from which, however, it differs in some points.

29. *Fagraea bodenii* WERNH. Trans. Linn. Soc. Bot. 9 (July 1916) 111; MERR. & PERRY, J. Arn. Arb. 23 (1942) 414.—*F. jasminodora* GILG & BENED. Bot. Jahrb. 54 (Oct. 1916) 190.—*F. ampla* S. MOORE, J. Bot. 61 (1923) Suppl. 35.—*F. suaveolens* CAMMERL. Nova Guinea 14 (1924) 117, t. 13.—*F. papuana* MERR. & PERRY, J. Arn. Arb. 23 (1942) 414.

Tree, up to 30 m by 50 cm, or erect shrub, sometimes epiphytic. *Leaves* petioled, elliptic to oblong-obovate to oblong, 5-15 by 2½-7½ cm, rigidly coriaceous, base acute or shortly contracted, apex obtuse or rounded, often terminated by a short and broad, obtuse and often recurved point; nerves c. 6-10 pairs, not or hardly visible on the upper surface, very faintly visible or obsolete beneath; petiole firm to slender, ¾-3 cm long,

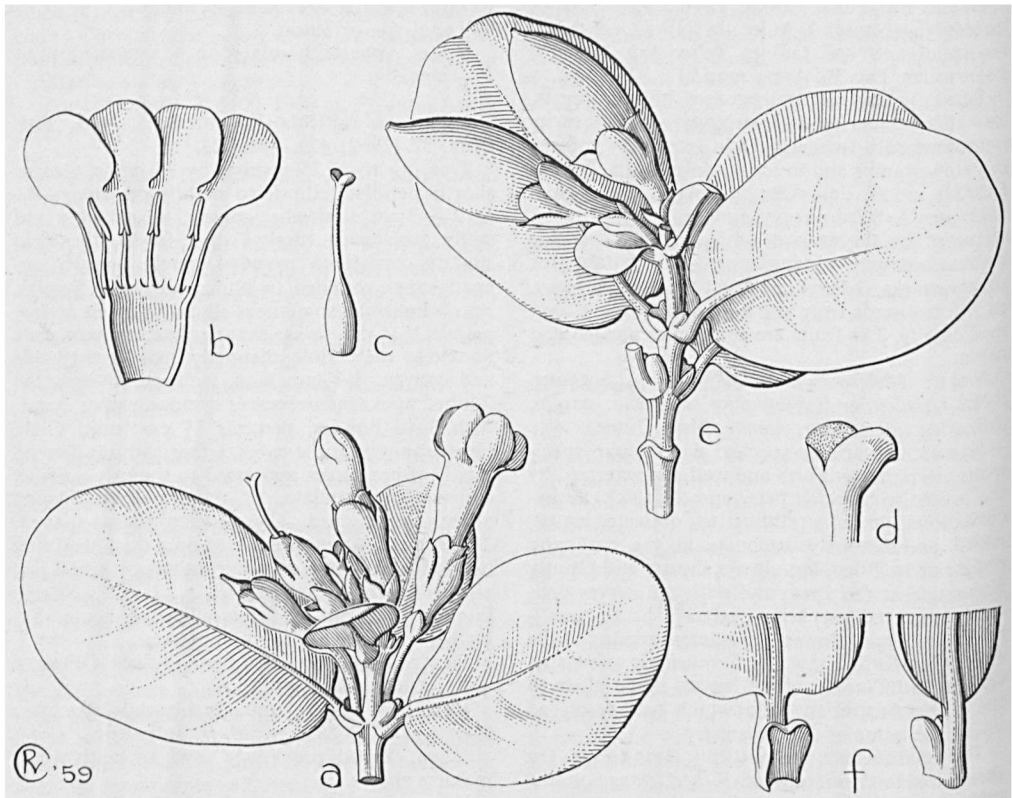


Fig. 23. *Fagraea salticola* LEENH. a. Habit with flowers, $\times \frac{2}{3}$, b. opened corolla, $\times 1$, c. pistil, $\times 1$, d. stigma, $\times 3$, e. twig with fruits, $\times \frac{2}{3}$, f. leaf-bases, showing the axillary scale, $\times 1$ (a-f HOOGLAND & PULLEN 5623).

exauriculate; axillary scale adnate to the petiole, usually distinctly broader than this, $\frac{1}{3}$ –1 cm long, rounded or obtuse. *Inflorescences* cymose, mostly short and dense, 2–15-flowered; pedicels thick, $\frac{3}{4}$ – $3\frac{1}{2}$ cm; bracteoles halfway. *Calyx* narrowly campanulate, $\frac{3}{4}$ – $1\frac{1}{4}$ cm long, divided slightly less to somewhat more than halfway down. *Corolla* deep-olive outside, cream-coloured to white inside, tube tubular or narrowly obconical, $1\frac{1}{2}$ –4 cm. *Stamens* inserted on a thickened ring in the tube, anthers linear-lanceolate, $\frac{3}{4}$ – $1\frac{1}{4}$ cm, slightly bifid at base. *Stigma* distinctly 2-lobed, 2–3 mm ϕ . *Fruits* broadly ellipsoid-subglobose, contracted into a long conical, robust beak, c. 4 by $2\frac{1}{4}$ cm, orange; calyx appressed.

Distr. *Malaysia*: New Guinea.

Ecol. Forests and shrubberies on slopes, on limestone hills, etc., 80–2840 m. *Fl.* Oct.–Febr., May, Aug., *fr.* Oct.–Febr.

Notes. Distinctly related to *F. gitingensis* and in less degree to *F. annulata*.

Specially characterized by the conspicuous, boat-shaped stipules and the strongly beaked fruit on a short, stiff pedicel. *F. gracilipes* has also beaked fruits, but its pedicels are usually

distinctly longer and more slender, even drooping; *F. salticola* has the same kind of stipules, but they are less conspicuous.

30. *Fagraea gitingensis* ELM. Leaf. Philip. Bot. 3 (1910) 859; MERR. En. Philip. 3 (1923) 315.—*F. ternatana* (non MIQ.) HOLTH. & LAM, Blumea 5 (1942) 230.

Gnarled tree or subarborescent shrub, 3–10 m, trunk up to 25 cm ϕ . *Leaves* petioled, (obovate-) oblong to (obovate-) lanceolate, $7\frac{1}{2}$ –12 by $2\frac{1}{2}$ –4 cm, thickly coriaceous, base tapering, decurrent, apex very obtuse or rounded; nerves 5–12 pairs, faintly visible above, subinconspicuous beneath; petiole $1\frac{1}{2}$ –3 cm, rather slender, narrowly winged towards the lamina; exauriculate; axillary scale adnate to the petiole, $\frac{1}{3}$ – $\frac{1}{2}$ cm long, truncate or slightly emarginate. *Inflorescences* 3–9-flowered cymes, pedicels not very thick, $\frac{1}{2}$ – $1\frac{1}{2}$ cm; bracteoles about halfway. *Calyx* narrowly campanulate, 1–2 cm long, divided \pm halfway down. *Corolla*-tube long-cylindric, narrow, slightly widened in the upper part, 7–11 cm. *Anthers* narrowly linear-lanceolate with a narrowed apex, c. 1 cm, slightly bifid at base. *Stigma* 2-lobed with oblong

lobes, 4-5 mm ø. *Fruits* oblong-ellipsoid, acute, 3½-4 by 1¼ cm, shining orange-red; calyx appressed.

Distr. *Malaysia*: Philippines (Sibuyan: Mt Giting-Giting) and N. Moluccas (Talaud I.: G. Piapi), twice collected.

Ecol. Woods on very sandy, gravelly soil, open sunny slopes, 300-400 m. *Fl.* April, *fr.* May. Vern. *Tènggeh*, Talaud.

Note. Distinctly related to *F. bodenii* and *F. salticola*, both from New Guinea.

31. *Fagraea berteriana* A. GRAY ex BTH. J. Linn. Soc. Bot. 1 (1856) 98; SEEM. Fl. Vit. (1866) 164; F. B. H. BROWN, Bull. Bish. Mus. 130 (1935) 228, f. 34; YUNCKER, Bull. Bish. Mus. 220 (1959) 217; LEENH. Bull. Jard. Bot. Brux. 32 (1962) 419.—*Carissa grandis* BERT. ex GUILLEMIN, Ann. Sc. Nat. Bot. II. 7 (1837) 248. *nom. nud.*—*F. grandis* PANCH. & SÉBERT in Sébert, Not. Bois Nouv. Cal. (1874) 184, *nom. superfl.*—*F. obovata* WALL. var. *papuana* F. M. BAIL. Queensl. Agr. J. 3 (1898) 157.—*F. peekelii* GILG & BENED. Bot. Jahrb. 54 (1916) 185, f. 10.—*F. pachypoda* GILG & BENED. l.c. 186.—*F. calophylloides* GILG & BENED. l.c. 188, f. 11.—*F. schlechteri* GILG & BENED. *ibid.* 56 (1921) 550, *nom. superfl.*; SARLIN, Bois et Forêts de la Nouv. Calé. (1954) 264, t. 127.—*F. ksid* GILG & BENED. Bot. Jahrb. 56 (1921) 552; KANEH. Fl. Micron. (1933) 317, f. 161.—*F. salomonensis* GILG & BENED. Bot. Jahrb. 56 (1921) 554.—*F. samoensis* GILG & BENED. l.c. 551.—*F. vitiensis* GILG & BENED. l.c. 553, *non* SEEM. (1861), *nom. nud.*—*F. galilai* GILG & BENED. l.c. 555; KANEH. Fl. Micron. (1933) 316, f. 160.—*F. sair* GILG & BENED. Bot. Jahrb. 56 (1921) 555, f. 3; KANEH. Fl. Micron. (1933) 318, f. 162.—*F. affinis* S. MOORE, J. Bot. 61 (1923) Suppl. 36.—*F. novae-guineae* CAMMERL. Nova Guinea 14 (1924) 117, t. 14.—*F. pluvialis* S. MOORE, J. Bot. 67 (1929) 49.—*F. kusaiana* HOSOKAWA, Trans. Nat. Hist. Soc. Form. 24 (1934) 202.—*F. rosenstromii* C. T. WHITE, Proc. R. Soc. Queensl. 47 (1936) 71.

Usually a small, often shrub-like tree, up to 15 (-30) m by 50 cm ø, sometimes an epiphytic or terrestrial, erect or scrambling shrub. *Leaves* petioled, elliptic or oblong, sometimes slightly ovate or obovate, 9-16 by 4½-12 cm, fleshy-coriaceous, base acute, attenuate, apex rounded; nerves c. 10 pairs (and between every pair an intermediate vein which is slightly less conspicuous), faintly visible on the upper surface, almost or quite invisible beneath; petiole 1½-4 cm, usually slender, exauriculate; axillary scale partly adnate to the petiole, 8-9 mm long, boat-shaped, 2-lobed at the apex. *Inflorescences* cymose, often widely branched, few- to rather many-flowered, pedicels ½-1½ cm, thick, especially towards the calyx, bracteolate. *Calyx* rather narrowly campanulate, 1¼-2½ cm long, usually divided for c. ½, rarely up to halfway down. *Corolla*-tube tubular, 3-8 cm long when dry (up to 15 cm when alive). *Stamens* inserted on a thickened ring in the tube, anthers narrowly linear with an attenuate apex,

1-1½ cm, slightly bifid at their base. *Stigma* distinctly 2-lobed (the halves in bud, however, folded upwards and appressed), lobes oblong, c. ¾-1 cm ø. *Fruits* ellipsoid to globular, orange to red when ripe, 3-5½ by 2½-4½ cm; calyx-lobes spreading.

Distr. SE. Polynesia (Marquesas: Nukuhiva, Hiva Oa; Tubuai Is.: Tubuai, Rapa; Society Is.: Tahiti, Tahaa; Cook Is.: Rarotonga), SW. Polynesia (Tonga Is.: Niue, Tonga; Samoa), Melanesia (Fiji, New Caledonia, Loyalty Is.; New Hebrides: Vanikoro, Oba, Aneytum; Solomon Is.), Australia (NE. Queensland: Mossman R.), Micronesia (Carolines: Palau Is., Truk, Ponape, Kusaie; Marianas: Guam, Rota), and *Malaysia*: New Guinea (also in the Bismarcks and Louisiades). Cf. LEENHOUTS, Pac. Pl. Areas map 91.

Ecol. In open to dense, wet to dry, primary and sometimes secondary forests, preferably along the edges, along river-banks, creeks, etc., also in open country, on rocks, even along the beach, also in the mangrove; from sea-level up to 500 (-1600) m. *Fl.* Jan.-Dec., mainly July-Febr., *fr.* mainly Aug. The fruits are eaten by birds, mainly pigeons (cf. BROWN, l.c.); for possible occasional dispersal by water see RIDLEY, Disp. (1930) 219.

Uses. The timber is hard, and locally used for house posts, other constructions, and for tools. The very fragrant flowers are in many Pacific islands highly appreciated for decoration (crowns, leis) and for making perfumes. In New Caledonia the boiled leaves are used as a medicine against rash and skin irritation. The natives of the Solomon Is. use the fruit as a flytrap by first removing the epicarp to expose the sticky interior.

Vern. *Argook*, *kaunomori*, New Britain.

Note. This species belongs to the group with a 2-lobed stigma, linear anthers, and a thickened ring inside the corolla-tube on which the stamens are inserted; through these characters it is related to *F. gitingensis*, *F. bodenii*, *F. salticola*, and in a less degree to *F. annulata*.

Doubtful

Fagraea alteniana F. v. M. Vict. Nat. 6 (1889) 45, *nom. nud.*

I saw no specimen bearing a label with this name.

Fagraea dasyantha GILG & BENED. Bot. Jahrb. 54 (1916) 195.

Possibly related to or conspecific with *F. gracilipes*. None of the syntypes seen, probably all lost at Berlin.

Fagraea ledermannii GILG & BENED. Bot. Jahrb. 54 (1916) 191.

The description of the vegetative parts fits very well with *F. salticola*, but the flowers are much smaller in all parts and remind more of *F. gracilipes* or *F. bodenii*.

Fagraea melanochlora GILG & BENED. Bot. Jahrb. 54 (1916) 192.

Possibly identical with *F. salticola* or with *F. bodenii*.

Fagraea monticola GILG & BENED. Bot. Jahrb. 54 (1916) 189.

Apparently related to *F. salticola* or *F. bodenii*.

Excluded

Fagraea cardinalicarpa ELM. Leaf. Philip. Bot. 10 (1939) 3759, *nom. illeg.*—Based upon ELMER 15492, a duplicate of which is preserved in the Herbarium of the Arnold Arboretum. This was distributed under the manuscript name of *Ternstroemia megacarpa* ELM. According to Dr VAN STEENIS it probably represents some *Rubiaceae*, possibly *Cephaelis*. It is doubtful whether the fruit and the twig belong together. The name is illegitimate as the description was in English only.

Fagraea dubia WALL. Cat. (1831) n. 4456,

nom. nud.—This was the base of *Ternstroemia ? penangiana* CHOISY, Mém. Soc. Phys. Hist. Nat. Genève 14 (1855) 108 (*Guttiferae*).

Fagraea pachyclados K. SCH. in Sch. & Laut. Nachtr. (1905) 349.—This is the basionym of *Mastixiodendron pachyclados* (K. SCH.) MELCH. Bot. Jahrb. 60 (1925) 167 (*Rubiaceae*).

Fagraea tetragona SPAN. Linnaea 15 (1841) 326.—MIQUEL (Fl. Ind. Bat. 2, 1857, 409) based hereon his *Alyxia spanogheana* (*non Alyxia tetragona* R. BR. 1810) (*Apocynaceae*).

Fagraea vitiensis SEEM. Bonplandia 9 (1861) 257, *nom. nud.*; *ibid.* 10 (1862) 37, *nom. nud.* = *Linociera vitiensis* A. C. SMITH, Bull. Torr. Bot. Cl. 70 (1943) 549 (*Oleaceae*). See A. C. SMITH, J. Arn. Arb. 33 (1952) 112.

2. BUDDLEJA

HOUST. *ex* LINNÉ, Gen. Pl. ed. 5 (1754) 51; Sp. Pl. 1 (1753) 112; GAGNEPAIN, Not. Syst. 2 (1912) 182; MARQUAND, Kew Bull. (1930) 177. Spelled *Buddleja* by most authors.—*Nicodemia* TENORE, Cat. Orto Bot. Napoli (1845) 88.—Fig. 24–25.

Shrubs, rarely trees or suffrutescent herbs; twigs, leaves (especially underneath) and inflorescences usually covered with a dense tomentum of stellate hairs (sometimes and in some parts intermingled with capitate-glandular hairs); colleters absent. *Branches* terete or quadrangular, in the latter case sometimes narrowly winged. *Leaves* opposite or nearly so (in some non-Mal. *spp.* alternate), either auriculate at the base or connected by a stipular line, or by leafy 'interpetiolar stipules', in a few species perfoliate, entire, serrate-dentate, or rarely lobed. *Inflorescences* terminal and/or axillary, thyrsoïd, racemose, clustered-cymose, or pseudo-verticillate, especially the terminal panicles often long and many-flowered. Bracts linear. *Flowers* 4-merous. *Calyx* gamosepalous, outside usually densely tomentose, inside glabrous. *Corolla* salver-shaped, sometimes campanulate, outside tomentose or glabrous, inside usually sparsely hairy; tube straight or curved, lobes imbricate in bud. *Stamens* adnate to the corolla-tube (the only exception being *B. gynandra*, in which they are described as attached to the ovary); anthers subsessile, cleft at base, introrse, mostly included. *Ovary* 2-celled, placentas thickened, with ∞ ovules; stigma conical or club-shaped. *Fruit* a septicidal 2-valved capsule (*subg.* *Buddleja*) or a 'berry' (*subg.* *Nicodemia*). *Seeds* ∞, small, often winged; endosperm fleshy.

Distr. About 100–120 *spp.* in the tropics and subtropics of America, Africa, and Asia; in *Malaysia* one species native, a few others naturalized or cultivated.

Ecol. Heliophilous shrubs of open terrain, shrubby vegetation, and forest borders, often invading disturbed places, from the lowland to high up in the mountains (especially some andine species). Many species have fragrant flowers and are frequented by many insects; the widely cultivated *B. davidii* is well known to attract many butterflies. The seeds of the species with capsular fruits are wind-dispersed; those from the species bearing berries may be dispersed by birds or other animals.

Uses. The leaves of some species are used as a wash on account of the presence of saponin; for the same reason some species are used as a fish-poison. Moreover, some are used in medicine. A few species are commonly planted as ornamentals.

Morph. The flowers are normally 4-merous; in *B. officinalis* MAXIM., however, I found in the same inflorescence between many 4-merous flowers some 5-merous ones and some with only the calyx 5-merous; Hook. f. (Bot. Mag. t. 6323) mentions also 5-merous flowers for *B. asiatica*.

GAGNEPAIN and MARQUAND attached much value to the place of insertion of the stamens. In many species, e.g. *B. asiatica*, this character seems to be very constant indeed. In some cases, however, it seems to represent the only differentiating character between a pair of sympatric closely related species. A possible example is *B. curviflora* H. & A. and *B. japonica* LINDEN; furthermore, I found many specimens which fully agreed with *B. lindleyana* with the exception of the stamens which were inserted about halfway the corolla-tube instead of at its base; according to the key given by MARQUAND these specimens should represent *B. venenifera* MAKINO; a third case may be the pair *B. paniculata* WALL. and *B. crispa* BTH. Whether these could be examples of heterostyly should be examined in the field.

The fruits in *Buddleja* and related genera are principally capsular; they are 2-, or (in *Adenoplea*) 4-celled, with many seeds, the cavities neither completely filled up by the seeds, nor by a pulp. In the African genera *Adenoplea* and *Adenoplusia*, and in *Buddleja* subg. *Nicodemia* they are indehiscent, in the other genera involved and in *Buddleja* subg. *Buddleja* they are septicial with 2 valves. The fruits of *Adenoplea* and of *Buddleja* subg. *Nicodemia* have thin fleshy walls; in *Adenoplusia* the walls are also thin-fleshy, but the endocarp is chartaceous; in the genera with dehiscent fruits the walls are dry and chartaceous or leathery. A typical character is the occurrence of large spherical glands on the inner side of the pericarp in *Adenoplea* and *Adenoplusia*, in the first named genus all over the surface, in the last named one only in the axils of the dissepiment. I agree with BRUCE & LEWIS (Fl. Trop. E. Afr. Logan. 1960, 40, footnote) that it is misleading to describe the fruits of *Adenoplea* and of *Buddleja* subg. *Nicodemia* as 'berries', as is usually done, or even those of *Adenoplusia* as 'drupes'; 'a non-dehiscent fleshy capsule' would be a better description, in the latter case with the addition 'with chartaceous endocarp'.

Taxon. I have recombined the genus *Nicodemia* with *Buddleja*, as was tentatively proposed by some authors, for instance by BRUCE & LEWIS, l.c. 35, 41; they only differ in the fruit characters cited above. The merging of these two genera is supported by the karyological data published by R. J. MOORE (Am. J. Bot. 34, 1947, 527-538): the diploid number of chromosomes of *Nicodemia* is 38 which is also the basic number of *Buddleja*, and morphologically the chromosomes are indistinguishable. The few phytochemical data known also point to a close relationship; anatomically there seems to be no clear difference; palynological and embryological data on *Nicodemia* are still unknown.

KEY TO THE SPECIES

1. Ovary and style glabrous. Fruit a dehiscent capsule.
2. Tube of the corolla 2½-4½ mm long, about as long as or slightly longer than the calyx; corolla outside densely stellate-hairy 1. *B. asiatica*
2. Tube of the corolla 9-12 mm long, 3-4 times as long as the calyx; corolla outside either glabrous or glandular-pubescent.
3. Corolla straight, outside glabrous. Interpetiolar stipules distinct, leafy, often divided into 2 auricles. Inflorescences paniculate 2. *B. davidii*
3. Corolla slightly curved, outside densely glandular-pubescent. Stipules represented by an inconspicuous rim. Inflorescences slender, spike-like. A native from China and Japan, in *Malaysia* sometimes cultivated *B. lindleyana* FORTUNE
1. Ovary and style pubescent. Fruit fleshy, indehiscent 3. *B. madagascariensis*

1. Subgenus *Buddleja*

Fruit a dry capsule, dehiscent.

Distr. The area of the genus, apparently with the exception of Madagascar and the Mascarenes.

1. *Buddleja asiatica* LOUR. Fl. Coch. (1790) 72; ed. Willd. (1793) 90; BTH. in DC. Prod. 10 (1846) 446; MIQ. Fl. Ind. Bat. 2 (1857) 363; BTH. Fl. Hongk. (1862) 231; BEDDOME, Flor. Sylv. 3 (1872) 163, t. 21 (IV); BRANDIS, For. Fl. (1874) 318; KURZ, Fl. Burm. 2 (1877) 250; HOOK. f. Bot. Mag. (1877) t. 6323; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 82; K. & V. Bijdr. 9 (1903) 89, incl. var. *densiflora*, *salicina*, & *sundaica*; BRANDIS, Ind. Trees (1906) 475; KING, J. As. Soc. Beng. 74, ii (1908) 600; TALBOT, For. Fl. Bombay 2 (1911) 262; GAGNEP. Not. Syst. 2 (1912) 189; KOORD. Exk. Fl. Java 3 (1912) 60; DOP, Fl. Gén. l.-C. 4 (1912) 160, f. 20 (5-9); KOORD. Atlas (1914) f. 325-326, incl. var. *brevispica*; MERR. Sp. Bianc. (1918) 306; En. Philip. 3 (1923) 316; RIDL. Fl. Mal. Pen. 2 (1923) 414; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 334; BOYNTON, Addisonia 13 (1928) 5, t. 419; MARQUAND, Kew Bull. (1930) 195; REHDER, J. Agr. Arb. 15 (1934) 309; MERR. Comm. Lour. (1935) 310; KANEHIRA, Formosan Trees, rev. ed. (1936) 622, f. 580; KANJILAL & DAS, Fl. Assam 3 (1939) 312; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 14; KERR in Craib, Fl. Siam. En. 3 (1951) 53.—*B. salicina* LAMK, Ill. 1 (1792) 291; POIRET, Encycl. Suppl. 1 (1810) 744; BL. Bijdr. (1826) 742.—*B. neemda* BUCH. HAM. ex ROXB. Fl. Ind. 1 (1820) 411; REICH. Ic. Bot. Exot. (1824) t. 21; CHAM. & SCHLECHT. Linnaea 2 (1827) 598, incl. var. *philippensis*; ROXB. Fl. Ind. ed. Carey 1 (1832) 396; BTH. in DC. Prod. 10 (1846) 446; MIQ. Fl. Ind. Bat. 2 (1857) 363; HANCE, J. Linn. Soc. Bot. 13 (1873) 112; F.-VILL. Nov. App. (1880) 136; VIDAL, Sinopsis Atlas (1883) t. 69 C; MARQUAND, Kew Bull. (1930) 195.—*B. acuminata*



Fig. 24. *Buddleja asiatica* LOUR. a. Habit, $\times \frac{1}{2}$, b. connate leaf-sheaths, $\times 2$, c. flower, $\times 5$, d. opened corolla, $\times 10$, e. pistil, $\times 10$, f. fruit, $\times 5$, g. seeds, $\times 10$ (a RAHMAT 11423, b HOLSTVOOGD 571, c-e HOOGLAND & PULLEN 5355, f-g KOORDERS 4343).

tissima BL. Bijdr. (1826) 743.—*B. densiflora* BL. Bijdr. (1826) 743; BTH. in DC. Prod. 10 (1846) 447; MIQ. Fl. Ind. Bat. 2 (1857) 364.—*B. sundaica* BL. Bijdr. (1826) 743; BTH. in DC. Prod. 10 (1846) 446.—*B. virgata* (non L. f.) BLCO, Fl. Filip. (1837) 57; ed. 2 (1845) 38; ed. 3. 1 (1877) 70.—*B. amentacea* KRÄNZL. Bull. Jard. Imp. Bot. St. Pétersb. 13 (1913) 89 & 92; MARQUAND, Kew Bull. (1930) 184.—*B. arfakensis* KAN. & HAT. Bot. Mag. Tokyo 56 (1942) 157, f. 1.—Fig. 24-25.

Evergreen shrub, suffrutex, or sometimes small tree, 1-7 m high. Branches terete or subterete, when young densely appressed- or woolly-, white-, grey-, or fulvous-hairy. *Leaves* opposite, those in the inflorescence often more or less alternate; connected by an, often inconspicuous, stipular line, narrowly to oblong- or ovate-lanceolate, 4-30 by $\frac{3}{4}$ -7 cm, herbaceous, glabrous to rather densely hairy above, underneath densely short to rather long woolly-hairy; base acute, margin remotely serrate-dentate to subentire, apex long-acuminate, acute, nerves and veins often impressed above; petioles $\frac{3}{4}$ -1 cm, tomentose. *Inflorescences* terminal and/or axillary, thyrsoïd, spiciform, up to 25 by $\frac{3}{4}$ -2 cm, densely tomentose; flowers in crowded or more or less remote, (sub) sessile, 1-3-(rarely more-)flowered cymes, each cyme in the axil of a linear bract. Pedicels $\frac{1}{4}$ -2 mm. *Flowers* 4-merous, a few occasionally 5-merous. *Calyx* campanulate, 2-4½ mm long, cleft to $\frac{1}{3}$ -½, outside more or less densely tomentose, lobes triangular-oblong, acute. *Corolla* white, sometimes light-violet or greenish, outside stellate-hairy, inside from halfway the tube to the basal part of the lobes woolly; tube 2½-4½ mm, lobes oblong-ovate, 1-1½ mm long, rounded or obtuse. *Stamens* inserted near the throat, anthers $\frac{3}{4}$ mm long, deeply 2-lobed at the base. *Ovary* and style glabrous, style 1 mm, including the club-shaped stigma. *Capsule* ovate or oblong, flattened, 3-5 by 2½-3 mm, glabrous, brown. *Seeds* ellipsoid, laxly enveloped by the testa which is at both ends prolonged into a short wing; the endosperm c. 1 mm long.

Distr. SE. Asia from W. Pakistan and the Deccan to South China and Formosa, the Marianas (Guam, Saipan), and throughout *Malaysia*. Sometimes cultivated and naturalized in tropical and subtropical regions.

Ecol. In open, often disturbed or secondary vegetation, apparently more or less a pioneer of secondary growth, in pyrogenous grassland, in gravel-beds, on lavastreams, and landslides, from the lowland up to about 3000 m, locally often gregarious. *Fl. fr.* Jan.-Dec.

Uses. Probably mainly on account of its saponin-content sometimes used as fish-poison and in native medicine for several purposes (see BURKILL, Dict. 1935, 379; QUIS. Med. Pl. Philip. 1951, 710). In Assam the flowers are eaten "cooked with rats' meat" (KANJILAL & DAS, l.c.); in the Philippines used in making rice-wine. Sometimes used for fuel. Cultivated as an ornamental in many tropical and subtropical to even temperate regions.

Vern. *White butterfly bush*, E, *kaju saladang*,

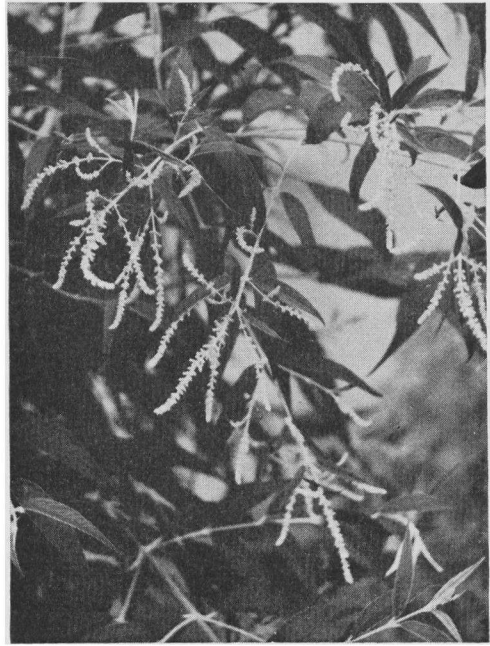


Fig. 25. *Buddleja asiatica* LOUR., Leson Creek, Markham River (E. New Guinea) (P. VAN ROYEN, 1961).

tjëmara angin, Sum., (*djugul*, *ki hirisan*, (*ki monjènjen*, *kipirit*, *ki urug*, *sumbung luna*, Java S., (*daun*)putihan, *godijan*, *gutèhan*, *sanggal putung*, J, *barakadjër*, Sumba, *hu touis*, Timor, *lälawäl*, *lawähmas*, *tubilit*, Alor, *bandau*, *päti-ata*, Born.; Philip.: *alatin*, Bag., *lagündi-salasä*, Bis., *maligus*, Bon., *duñgalau*, Ibn., *anaioip*, *dumdumani*, If., *amuging*, Ig., *lagien-ti-subisub*, *tugnanng*, Ilk., *ilentud ulangan*, *mengayan*, Sub., *malasambüng*, *salibug*, *samböngkala*, *taliknòno* (*talianono*). Tag., *doknam*, Ting.; *kukuru-in-talun*, *malelema*, Cel., *deraidauti*, *hagaiahas*, *hifaita*, *jamp*, *mukorrere*, *taggaras*, *tunun*, *uganga*, *wihadzaha*, *wold*, New Guinea.

Notes. A variable species, especially in Java. It is not possible, however, to subdivide it into well circumscribed varieties.

Buddleja amentacea KRÄNZL. was based upon the apical part of a flowering shoot with alternate leaves as occurs in many species. This is one of the fairly exceptional cases in which the leaves in the inflorescence are strongly developed and conspicuous. The two leaves under the inflorescence, however, are opposite in the type specimen; MARQUAND, l.c., erroneously included this species in his *sect. Alternifoliae*. There is further no reason to doubt Java as its provenance; in fact, among the Javanese material of *B. asiatica* I found some specimens which match the type of *B. amentacea* quite well.

2. *Buddleja davidii* FRANCH. Nouv. Arch. Mus. Hist. Nat. Paris II, 10 (1887) 65; GAGNEP. Not. Syst. 2 (1912) 188; BOYNTON, Addisonia 2 (1917) 9, t. 45; MARQUAND, Kew Bull. (1930) 196; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 14.

Large bush up to 2½ m. Branches subquadrate, when young densely grey to white tomentose. *Leaves* oblong-elliptic or -ovate, 8–10 by 3–4 cm, herbaceous, glabrous above except on the base of the midrib, densely tomentose beneath; base cuneate, attenuate, margin minutely serrate-dentate, apex acute-acuminate; petiole c. ½ cm long, densely tomentose, glabrescent, at the base with auriculate, usually not connate, often relatively large stipules. *Inflorescences* terminal, sometimes moreover lateral, thyrsoid, composed of mostly short-stalked, lax, many-flowered cymes, c. 12–20 by 3½ cm, sparsely pubescent. Bracts linear, up to c. ½ cm. Flowers subsessile, very fragrant. *Calyx* slender-campanu-

late, 3 mm long, outside sparsely pubescent, lobes c. ⅓–¼ the total length of the calyx, acute. *Corolla* lilac, the mouth orange-yellow, outside glabrous, inside sparsely hairy above the insertion of the stamens, tube slender, 9 mm, slightly swollen halfway, lobes semiorbicular, 2–2½ mm long, their margin crisped. *Stamens* inserted halfway the tube, anthers 1 mm long, 2-parted at base, apiculate. *Pistil* glabrous, style 2 mm including the club-shaped stigma. *Capsule* lanceolate-ellipsoid, 8 by 1½–2 mm, glabrous. *Seeds* thread-like, 4 mm, in the centre only slightly thickened.

Distr. Tibet and Central China (Szechuan, Hupeh); in *Malaysia* and elsewhere commonly cultivated as an ornamental, naturalized in the Malay Peninsula (Cameroon Highlands, above Pavit Falls).

Ecol. In a clearing in jungle. *Fl. fr.* Jan.–Dec. Vern. *Summer lilac, orange eye butterfly bush, E, Japanese sering, Dutch.*

2. Subgenus *Nicodemia*, nov. stat.

Nicodemia TENORE, Cat. Orto Bot. Napoli (1845) 88.

Fruit indehiscent, with a thin fleshy pericarp.

Distr. Apparently restricted to Madagascar and the Mascarenes.

3. *Buddleja madagascariensis* LAMK, Encycl. 1 (1785) 513; Hook. Bot. Mag. (1828) t. 2824; BTH. in DC. Prod. 10 (1846) 447; KING, J. As. Soc. Beng. 74, ii. (1908) 601.—*Nicodemia madagascariensis* R. N. PARKER, For. Fl. Punjab, ed. 2 (1924) 357.—*Adenoplea madagascariensis* EASTW. Leaf. West. Bot. 1 (1936) 197.

Shrub, 2–3 m. Branches terete, densely silvery-white (in the herb. rusty-)tomentose, as are the petioles, the undersurface of the leaves, and the inflorescences. *Leaves* connected by an inconspicuous stipular line, ovate-oblong to ovate-lanceolate, 9–11 by 3–4½ cm, more or less coriaceous, somewhat bullate, glabrous above, densely tomentose beneath; base rounded to acute, margin entire, apex tapering, acute; petiole c. 1½ cm. *Inflorescences* terminal, thyrsoid with some rather long thyrsoid basal branches, c. 20 cm long, with relatively long-stalked (c. 1 cm), rather dense, c. 7-flowered, patent lateral cymes. Bracts linear, up to c. 1½ cm. *Flowers* subsessile, sweet-scented. *Calyx* campanulate, 3 mm long, outside densely tomentose, lobes c. ½ mm, broadly triangular. *Corolla* orange, outside densely tomentose, inside glabrous, tube slender, c. 6 mm, lobes 2 mm long, rounded. *Stamens* inserted slightly below the mouth; anthers 1¼ mm long, shortly split at the base. *Ovary* (except at base) and style densely hairy, style slender, 4½ mm including the club-shaped stigma. *Fruit* globular, c. 2½ mm, pubes-

cent, at first white, when ripe purple-blue. *Seeds* ellipsoid, c. 1 mm long, smooth, brown.

Distr. A native of Madagascar, cultivated and naturalized in tropical and subtropical regions; in *Malaysia* naturalized in the Malay Peninsula (Penang, Perak).

Ecol. Open jungle, 700–800 m. *Fl.* Oct.–Febr.; I saw no fruiting specimens from *Malaysia*.

Uses. According to STANDLEY (Contr. U.S. Nat. Herb. 23, 1924, 1143) in Madagascar "the leaves were formerly employed ... as a soap substitute and the plant is used as a remedy for asthma, coughs, and bronchitis."

Excluded

Buddleja indica LAMK, Encycl. 1 (1785) 513.—*B. diversifolia* VAHL, Symb. 3 (1794) 15, *nom. illeg.*; BTH. in DC. Prod. 10 (1846) 445.—*Nicodemia diversifolia* TENORE, Cat. Orto Bot. Napoli (1845) 88, *nom. illeg.*

A native from the Mascarenes and Madagascar, twice wrongly described from Java, as already mentioned by BENTHAM, *l.c.* The name *B. diversifolia* was illegitimate as *B. indica* LAMK was cited as a synonym.

Buddleja otophylla HASSK. Versl. Med. Kon. Ak. Wet. Afd. Nat. 5 (1857) 97 = *B. brasiliensis* JACQ. f.

Apparently based on a specimen cultivated in the Botanical Garden, Bogor.

3. NORRISIA

GARDN. in Hook. J. Bot. Kew Misc. 1 (1849) 326.—Fig. 26.

Trees. Twigs gradually thickening from the nodes upwards, rusty pubescent when young. *Leaves* petioled; connected by very broadly triangular, about 1 mm high, blunt stipules. *Inflorescences* terminal and axillary, dichasially branched to thyrsoïd, dense and many-flowered, densely rusty tomentose; bracts narrowly triangular. *Flowers* 5-merous, subsessile, with two pairs of decussate, minute bracteoles. *Calyx* cupular, $\frac{3}{4}$ (-1) mm high, tube very short, lobes broadly rounded, densely tomentose outside, inside glabrous, without colleters. *Corolla* salver-shaped, thin-fleshy, outside densely tomentose, creamy to yellowish; lobes valvate in bud. *Stamens* inserted between the corolla-lobes, glabrous, exerted filaments filiform, c. 6 mm; anthers latrorse, cells free in the lower half. *Ovary* obovoid, for the greater part densely and shortly erect-hairy; 2-celled, with elliptic peltate placentas; ovules ∞; style terete, slender, glabrous, caducous, stigma faintly capitate and slightly bilobed. *Capsule* septicidal, 2-valved, valves outside densely fulvous-tomentose except the margins. *Seeds* few to many, small, slenderly spindle-shaped, smooth and glabrous; endosperm fleshy.

Distr. Two closely related species, restricted to *Malaysia*: Sumatra, Malay Peninsula, Borneo, and the Philippines.

Ecol. Small to medium trees of lowland forests. Insect-pollination seems probable; the tiny seeds are in all probability wind-dispersed.

KEY TO THE SPECIES

1. Anthers oblong, $\frac{4}{5}$ mm long. Mouth of the corolla glabrous or with a few long hairs only. Most of the nerves distinctly looped and joined at some distance from the margin. Twigs usually conspicuously lenticellate 1. *N. malaccensis*
1. Anthers orbicular, $\frac{1}{2}$ mm ϕ . Mouth of the corolla densely tomentose. Nervation for the greater part open, only the upper two or three pairs of nerves looped and joined close to the margin. Twigs rarely distinctly lenticellate 2. *N. maior*

1. *Norrisia malaccensis* GARDN. in Hook. J. Bot. Kew Misc. 1 (1849) 327; MIQ. Fl. Ind. Bat. 2 (1857) 359; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 85; KING, J. As. Soc. Beng. 74, ii (1908) 602, incl. var. *pubescens*; RIDL. Fl. Mal. Pen. 2 (1923) 414, var. *malaccense* only; BURK. Dict. (1935) 1561, p.p.—*Antonia griffithii* WIGHT, Ill. Ind. Bot. 2 (1850) 172, t. 156 b.—*N. philippinensis* ELM. Leaf. Philip. Bot. 4 (1912) 1482; MERR. En. Philip. 3 (1923) 311.—Fig. 26g, l.

Tree 10–30 m by 32–40 cm ϕ . Twigs terete, nearly always densely set with minute, warty, white lenticels. *Leaves* faintly pubescent to glabrous, elliptic to oblong, $6\frac{1}{2}$ –10 by $2\frac{3}{4}$ –4 cm, thin-coriaceous, base cuneate, attenuate, apex usually shortly acute-acuminate, rarely blunt; midrib prominent and keeled beneath, nerves 6–8 pairs, usually distinctly ascending, fairly strongly curved, usually distinctly looped and joined at some distance from the margin, flat above, prominulous beneath; petiole $\frac{1}{2}$ –1 cm, slender. *Inflorescences* terminal, often thyrsoïd, $4\frac{1}{2}$ –8 $\frac{1}{2}$ cm long incl. the $2\frac{1}{2}$ –4 $\frac{1}{2}$ cm long peduncle. Largest bracts $1\frac{1}{2}$ –2 mm long. Tube of the corolla $4\frac{1}{2}$ mm, inside sparsely hairy, the base excepted. *Anthers* oblong, c. $\frac{4}{5}$ mm. *Ovary* 1 mm; style 6–7 $\frac{1}{2}$ mm. *Fruits* apparently scarce, 2–3 $\frac{1}{2}$

by $1\frac{3}{4}$ mm. *Seeds* few, c. 2 mm long, very delicate.

Distr. *Malaysia*: Sumatra (West Coast Res.), Malay Peninsula (southern half only), and the Philippines (Sibuyan, Mindanao).

Ecol. In and along primary forests, up to 920 m. Fl. March–Nov., fr. Nov.

Vern. *Balang, bareh bareh, Sum., kayu karas, kèlat, sèrapoh bukit*, Mal. Pen.

Notes. Specimens from the Philippines differ slightly from those of the Malay Peninsula and Sumatra in the following points: petioles 5–6 mm versus 7–10 mm, nerves 7–8 pairs, more or less spreading versus 6–7 pairs and distinctly ascending.

Antonia griffithii WIGHT was based upon material collected by GRIFFITH in Malacca. This was probably GRIFFITH K.D. 3731. The specimens, distributed under this number belong, however, to both species of *Norrisia*. I did not see any specimen clearly bearing the name in WIGHT's handwriting; the figure can refer to both species; the same holds for the description, the only point in favour of *N. malaccensis* being "leaves . . . glabrous on both sides".

2. *Norrisia maior* SOLER. in E. & P. Nat. Pfl. Fam. 4, 2 (1892) 37; KING, J. As. Soc. Beng. 74, ii (1908) 602.—*N. malaccensis* (non GARDN.) MERR.



Fig. 26. *Norrisia maior* SOLER. a. Habit, $\times \frac{2}{3}$, b. connate leaf-sheaths, $\times 2$, c. flower, $\times 4$, d. detail of opened corolla, showing the bearded mouth, $\times 8$, e. pistil, $\times 4$, f. stigma, $\times 20$, h. anther, $\times 8$, i. fruit, $\times 4$, j. placenta with seeds, $\times 4$, k. seed, $\times 6$.—*N. malaccensis* GARDN. g. Anther, $\times 8$, l. leaf, $\times \frac{2}{3}$ (a-f, h RIDLEY 6828, g, l SF. 40586, i-k KEP 15224).

En. Born. (1921) 490; CAMMERL. Bull. Jard. Bot. Btz III, 5 (1923) 302; HEYNE, Nutt. Pl. (1927) 1267; BURK. Dict. (1935) 1561, p.p.—*N. malaccensis* var. *major* RIDL. Fl. Mal. Pen. 2 (1923) 414.—Fig. 26a-f, h-k.

Tree 10–45 m by 10–75 cm ϕ , heavily buttressed up to 4 m high; twigs terete, lenticels inconspicuous to nearly invisible. Leaves elliptic, 5½–10 by 2½–5 cm, thin-coriaceous, usually minutely tomentose on the midrib above, sparsely hairy on midrib, nerves, and sometimes veins beneath; base cuneate, attenuate, apex blunt or rounded to fairly abruptly to tapering acuminate, acumen short and broad, blunt to acute; midrib prominent

and rounded beneath, nerves 6–10 pairs, spreading faintly curved, not looped and joined with the exception of the upper 2 or 3 pairs, petiole (4–) 6 mm. Inflorescences terminal and usually in the axils of the upper pair of reduced leaves, usually compoundly cymose, 3–6½ cm long, including the peduncle, which is up to 3¼ cm; bracts up to 2½ mm. Corolla-tube 5–6 mm long, inside about the mouth densely tomentose, further glabrous. Anthers suborbicular, c. ½ mm ϕ . Ovary 1½ mm; style 7–8 mm. Fruits always many, 4–10 by 2–4 mm. Seeds c. 5–20 per cell, 4 mm long, delicate.

Distr. Malaysia: Sumatra (Palembang), Banka, Riouw, Malay Peninsula (southern half only), and

Borneo.

Ecol. Primary and secondary forests, apparently often along river-banks, in swamp forests or in temporarily inundated places, up to 450 m. Fl. Jan., July–Oct., fr. Febr.–April, Aug., Oct.–Nov.

Uses. In the Malay Peninsula the timber is locally used in house building. In Sumatra the

light and soft wood is used for floors of houses and indoor constructions, but even then it lasts for only 3–4 years; from the buttresses, handles of tools and oars are made.

Vern. (B) *ēngkaras*, *mērkaras*, Sum., *kayu tankat*, *lēmak hutam* (or *kētam* ?), *otak hudang*, *sērapak paya*, Mal. Pen., *bandung*, *kēlait*, *masilan putih*, *simpopoit*, *tabak*, Born.

4. GELSEMIUM

JUSSIEU, Gen. Pl. (1789) 150.—*Medicia* GARDN. & CHAMP. in Hook. J. Bot. Kew Misc. 1 (1849) 324.—*Leptopteris* BL. Mus. Bot. 1 (1850) 240.—Fig. 27.

Straggling shrubs. Twigs slender, terete. *Leaves* petioled; stipules reduced to an interpetiolar line. *Inflorescences* terminal and axillary, thyrsoid to 1-flowered. *Flowers* 5-merous (in *G. sempervirens* heterostylous). *Calyx*: sepals free, glabrous or ciliate. *Corolla* funnel-shaped, lobes imbricate. *Stamens* glabrous, exerted; filaments strap-shaped; anthers sagittate, cells free, latrose. *Pistil* glabrous; ovary 2-celled, ovules several per cell; style filiform, stigma twice forked. *Capsule* septicidal, 2-valved. *Seeds* several, winged.

Distr. Three species, one in SE. Asia, the others in SE. North America, Mexico, and Guatemala. Cf. LEENH. Pac. Pl. Areas map 30.

Ecol. Shrubby vegetation at low to medium altitudes.

Gelsemium elegans (GARDN. & CHAMP.) BTH. J. Linn. Soc. Bot. 1 (1856) 90; MIQ. Fl. Ind. Bat. 2 (1857) 359; BTH. Fl. Hongk. (1861) 229; KURZ, Fl. Burma 2 (1877) 249; FORB. & HEMSL. J. Linn. Soc. Bot. 26 (1889) 117; BRANDIS, Ind. Trees (1906) 476; DOP, Fl. Gén. I.–C. 4 (1914) 162, f. 21¹⁻⁴; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 295; HU & CHUN, Ic. Pl. Sinic. (1929) t. 97; MERR. & CHUN, Sunyatsenia 2 (1935) 305; KANJILAL & DAS, Fl. Assam 3 (1939) 314; HERKLOTS, Hongk. Natur. 10 (1940) 28, f. 1–2.—*Medicia elegans* GARDN. & CHAMP. in Hook. J. Bot. Kew Misc. 1 (1849) 324; BTH. in *ibid.* 5 (1853) 56.—*Leptopteris sumatrana* BL. Mus. Bot. 1 (1850) 240, f. 34.—*G. sumatrana* BOERL. Handl. 2 (1899) 448, 457; GIBBS, J. Linn. Soc. Bot. 42 (1914) 111.—Fig. 27.

Usually a straggling half-shrub, sometimes a large, woody climber; twigs glabrous. *Leaves* ovate-lanceolate (to ovate), (7–)10–12 by 2–5½ cm, thin-chartaceous to pergamentaceous, base rounded to cuneate, apex long and slenderly acute-acuminate; midrib sunken above; nerves c. 5–8 pairs; petioles ¾–1 cm. *Inflorescences* terminal and in the upper leaf-axils, together making a pyramidal leafy panicle; lower axillary branches up to 6 cm, the terminal inflorescence c. 3 cm, all sparsely pubescent. Bracts acutely triangular to subulate, up to 4 mm long, ciliate and pubescent on the prominent midrib beneath.

Pedicels c. ¾ cm, bibracteolate. *Sepals* oblong-ovate, 2½–3½ by 1¼–1¾ mm, acute, erect, outside glabrous or slightly pubescent on the thickened to keeled midrib, inside glabrous; no colleters. *Corolla* 1–1½ cm long, bright yellow to orange, the tube outside brownish, mouth spotted with red, the tube 7–9 mm, thin, fully glabrous, lobes blunt to acute. *Stamens* inserted about the middle of the tube, filaments 3½–4 mm long, anthers oblong-ovate to lanceolate, 1½–2 mm long, acute. *Ovary* oblong to obovoid-lanceolate, 2–2½ mm; style 8–12½ mm. *Fruits* ellipsoid, 4–10 by 3–4 mm, smooth and glabrous, papyraceous, the valves split at the top. *Seeds* c. 8 per cell, elliptic to bean-shaped, 3½ mm ø, warty, the central part hairy, winged all around.

Distr. Assam, N. Burma, N. Siam, Indo-China, S. and SE. China, Hainan, and *Malaysia*: Sumatra, Borneo.

Ecol. In scrubby forests and thickets, 250–2000 m. Fl. June–Aug., Nov., Dec., fr. June–July, Nov.

Uses. Reputed to be very poisonous, especially the leaves and roots; mentioned to be used for murder and suicide. The poisonous element is the alkaloid gelsemidin.

Vern. *Liman*, Borneo.

Note. In specimens from N. Burma the fruits are usually slightly larger (12 by 6 mm).

5. STRYCHNOS

LINNÉ, Gen. Pl. ed. 5 (1754) 86; Sp. Pl. 1 (1753) 189; A. W. HILL, Kew Bull. (1917) 121.—Fig. 28, 30–32.

Usually lianas, sometimes shrubs or treelets; usually provided with axillary,

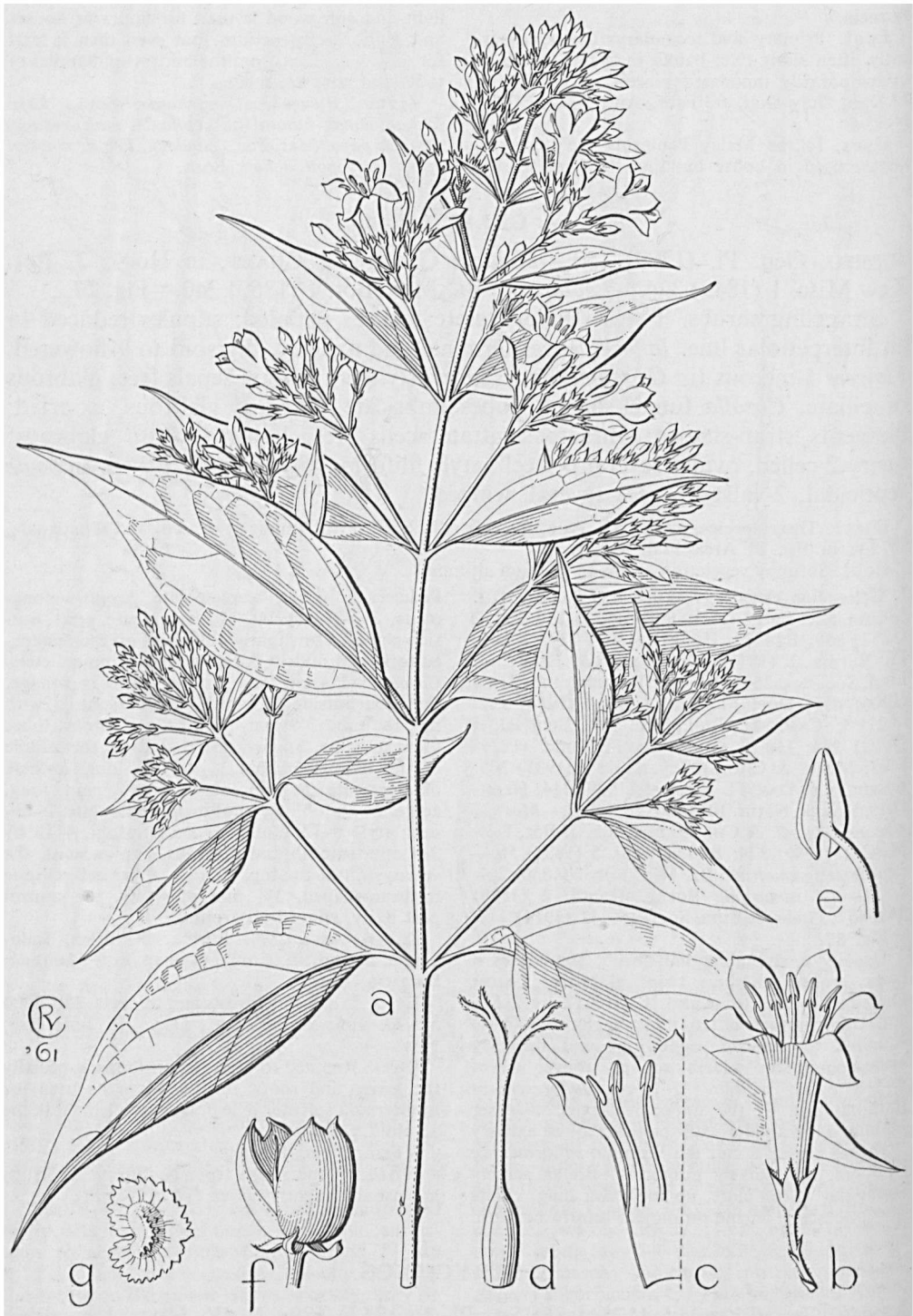


Fig. 27. *Gelsemium elegans* (GARDN. & CHAMP.) BTH. a. Habit, $\times \frac{2}{3}$, b. flower, $\times 2$, c. opened corolla, $\times 2$, d. pistil, $\times 4$, e. anther, $\times 6$, f. fruit, $\times 2$, g. seed, $\times 4$ (a-e BALANSA 1041, f-g BECCARI herb. 6642).

simple or double tendrils and sometimes with axillary thorns; stems and older branches in some species spiny. *Stipules* reduced to a mostly ciliate and straight rim connecting the leaf-bases. *Leaves* mostly inserted upon distinct leaf-cushions, 3-5(-7)-plinerved, *i.e.* apart from the midrib nearly always provided with one or a few pairs of nearly equally strongly developed basal nerves which do not fully reach the leaf apex; penninerved in a few African species. Some pairs of scale-like *cataphylls* are present at the base of new shoots, of inflorescences, and of the branches of the latter. *Inflorescences* terminal or axillary, thyrsoid. Bracts scale-like. *Flowers* (4-)5-merous. *Calyx* nearly completely divided, lobes in Mal. *spp.* always broad, scale-like, and brown (in African and American *spp.* sometimes lanceolate and green), outside usually very sparsely hairy, ciliate along the margin, inside at the base provided with colleters. *Corolla* rotate to salver-shaped, white to yellowish or greenish, thin-fleshy, always more or less thickened towards the lobes, the basal part included by the calyx much thinner, outside usually distinctly densely papillose, mostly glabrous, inside variously hairy except the thin basal part; lobes valvate in bud, spreading to reflexed when open. *Stamens* exerted; anthers mostly slightly bifid at the base, introrse. *Ovary* 2-(in some African *spp.* 1-)celled, with many ovules; style cylindric, stigma faintly 2-lobed. *Berry* usually globose or ellipsoid, the thin to thick shell in Mal. *spp.* always hard, outside smooth or minutely warty, glabrous, orange to red when ripe; pulp fleshy, usually orange. *Seeds* ∞, or 2-1, either lenticular, orbicular to elliptic and usually convex on one and concave on the other side with a silky or felty testa (fig. 28g, k), or irregular castorbean-shaped and glabrous (fig. 28j); endosperm bony.

Distr. About 150-200 *spp.* in the tropics and subtropics.

Ecol. Large lianas in the forests or scrambling or erect shrubs or treelets in more open vegetations.

The dispersal of the seeds is still incompletely known; in all probability this is largely due to animals, both mammals and birds which digest the fruit pulp; according to KRUKOFF (*Brittonia* 4, 1942, 258) toucans may be mainly responsible for it in America.

Uses. Many species are poisonous as they contain a sometimes high amount of alkaloids in their seeds, roots, bark, and leaves. Most important among these alkaloids are strychnine and brucine (in American *spp.* these are replaced by curare), which are used in medicine; the main source of these alkaloids are the seeds of *S. nux-vomica*, and locally those of *S. ignatii*. The natives, especially those in Borneo and the Malay Peninsula, make use of the poison from roots and bark in composing arrow-poison. The lianas are used as ropes. For further details see BURKILL, *Dict.* (1935) 2091-2100.

Taxon. It is not yet possible to give a satisfactory subdivision of the whole genus. Best known and still in use is that by PROGEL (*in Mart. Fl. Bras.* 6, 1, 1868, 271), modified and made suitable for the whole genus by SOLEREDER (*in E. & P. Nat. Pfl. Fam.* 4, 2, 1892, 37). They distinguished 3 sections, *vi*

Sect. Longiflorae: corolla-tube distinctly longer than the lobes.

Sect. Intermediae: corolla-tube about as long as the lobes.

Sect. Breviflorae: corolla-tube distinctly shorter than the lobes.

This division is obviously rather artificial because lines of alliance based on a complex of other characters sometimes go across it.

In his revision of the Asiatic species HILL, *l.c.*, accepted SOLEREDER's classification but divided *sect. intermediae* into two sections by using as an additional character the kind of indument on the inner side of the corolla. In this way he came to the following subdivision:

Sect. Brevitubae: identical with SOLEREDER's *Breviflorae* (fig. 30b-c).

Sect. Lanigerae: *Intermediae sensu* SOLEREDER in part, with long woolly hairs at the mouth (fig. 32).

Sect. Penicillatae: *Intermediae sensu* SOLEREDER in part, with a line of erect bristle-like hairs either across the base or across the middle of the inner face of the corolla lobes (fig. 30g).

Sect. Tubiflorae: identical with SOLEREDER's *Longiflorae* (fig. 28).

As far as the Asiatic species are concerned this subdivision is more satisfactory. Especially the *Penicillatae* and the *Tubiflorae* (the latter section with the exception of *S. angustiflora* BTH.) seem to be natural taxa. Among the *Lanigerae* a few species are somewhat anomalous (*S. polytrichantha*, *S. curtisii*, and *S. lanata*), the Asiatic *Brevitubae* showing the greatest diversity.

Though this is a fairly good subdivision of the Indo-Malayan species, it proved to be of very little use for the African ones. In Africa the genus shows its greatest development, and any subdivision of the genus

as a whole will primarily have to be framed on the African species. DUVIGNEAUD (Bull. Soc. R. Bot. Belg. 85, 1952, 9) attempted this and distinguished 17 sections and some subsections, based upon as many characters as possible. I feel incapable of judging the full merits of his system; in trying to fit the Asiatic species into it I got the impression that the number of subdivisions may be somewhat too large.

In the present account I have refrained from giving a sectional subdivision, confining myself to the mentioning of six groups of distinctly related species:

- (i) *S. ignatii*, *S. nux-vomica*, and *S. lucida* (*Tubiflorae* HILL; nearest to DUVIGNEAUD's *Floribundae*).
- (ii) *S. maingayi*, *S. ovata*, and *S. villosa* (*Brevitubae* HILL, close to DUVIGNEAUD's *sect. Sambae*).
- (iii) *S. curtisii*, *S. polytrichantha*, *S. oleifolia*, and *S. lanata* (different from HILL's *Lanigerae* by the relatively short tube; according to the description almost identical with DUVIGNEAUD's *sect. Ligustroides*).
- (iv) *S. colubrina*, *S. quadrangularis*, *S. borneensis*, *S. ledermannii*, *S. lanceolaris*, and *S. flavescens* (*Lanigerae* HILL, about identical with DUVIGNEAUD's *Booneae* according to the description).
- (v) *S. luzoniensis* (close to the next group, but with a short corolla-tube).
- (vi) *S. axillaris* and *S. ridleyi* (*Penicillatae* HILL).

Nomenclaturally the sectional and subsectional names must be typified and corrected, starting with those of PROGEL.

Notes. A fairly complete account of the morphology and of the variability of many characters, based upon extensive field-studies, was given by KRUKOFF & MONACHINO, *Brittonia* 4 (1942) 253-259.

Though after some experience it may be possible to recognize the leaves of many species, flowers are absolutely necessary to come to a trustworthy identification. In many cases the fruits are possibly also of value for specific distinction, but up till now the available material of undamaged fruits is insufficient as they were usually dried and pressed, instead of preserved in liquor. According to DUCKE, *Bol. Tecn. Inst. Agr. Norte n. 30* (1955) the seeds show also distinct specific characters but they should also be preserved in liquor: seeds prepared out of dried fruits are nearly worthless, as the typical testa-characters usually have been lost by then.

KEY TO THE SPECIES

1. Tube of the corolla distinctly longer than the limb.
 2. Inflorescences axillary. Leaves distinctly slender-(to caudate-)acuminate. Fruits 4-12 cm ø, many-seeded 1. *S. ignatii*
 2. Inflorescences terminal, eventually on axillary twigs with at least one pair of leaves. Leaves either not acuminate, or with a short and broad, triangular acumen. Fruits 2-4(-6) cm ø, 2-4-seeded.
 3. Petiole 6-11 mm. Branchlets smooth. Leaves large, 4½-15 by 3½-11 cm, apex blunt to shortly and broadly triangular-acuminate, mucronulate. Inflorescences many-flowered. Style sparsely woolly hairy. Seeds c. 2 cm ø, sericeous 2. *S. nux-vomica*
 3. Petiole 2-4 mm. Branchlets scabrous by many small warty lenticels. Leaves small, 2½-10 by 1½-6 cm, apex blunt to emarginate, not mucronulate. Inflorescences few-flowered. Style glabrous. Seeds c. 1-1½ cm ø, tomentose 3. *S. lucida*
1. Tube of the corolla about as long as or shorter than the limb.
 4. Corolla inside partly or nearly completely woolly, very rarely fully glabrous, never with a whorl of erect, bristle-like hairs (fig. 30c, 31c, 32c).
 5. Tube of the corolla distinctly shorter than the limb.
 6. Corolla 2-4 mm long.
 7. Calyx inside thinly pubescent. Inflorescences terminal and in the upper leaf-axils, 5-20 cm long, lax, long-peduncled 6. *S. villosa*
 7. Calyx inside glabrous. Inflorescences axillary and terminal, up to 7 cm long, dense, short-peduncled.
 8. Corolla outside glabrous. Filaments 1½-2 mm; anthers oblong to lanceolate. 4. *S. maingayi*
 8. Corolla outside sparsely hairy. Filaments short, up to 1¾ mm; anthers ovate. 5. *S. ovata*
 6. Corolla 5½-10 mm long.
 9. Corolla 5½-7 mm long.
 10. Anthers 1 mm long, glabrous; filaments 2 mm. Indument of the pistil appressed and short. Inflorescences dense, 2-4½ cm 7. *S. curtisii*
 10. Anthers 1¼-2 mm long, bearded; filaments 1-1½ mm. Indument of the pistil woolly. Inflorescences lax, 6-8 cm 10. *S. lanata*
 9. Corolla 8-10 mm long.
 11. Corolla outside glabrous, inside woolly with the exception of the basal part of the tube. Filaments 2½-4 mm; anthers lanceolate. Pistil 9 mm. Nerves strongly prominent beneath, nearly unbroken till near the apex; venation very conspicuous on both sides. 8. *S. polytrichantha*
 11. Corolla outside with some scattered hairs about the mouth and along the sutures, inside woolly

- from slightly above the base till about halfway the lobes. Filaments 2 mm; anthers elliptic. Pistil 6 mm. Nerves moderately prominent, broken into arches and feeble towards the apex; venation not very conspicuous 9. *S. oleifolia*
5. Tube of the corolla about as long as the limb.
12. Corolla about 9 mm long 13. *S. borneensis*
12. Corolla up to 6½ mm long.
13. Corolla inside only with a few woolly hairs near the apex of the lobes 15. *S. lanceolaris*
13. Corolla inside woolly especially in the mouth, sometimes fully glabrous.
14. Ovary pubescent. Filaments 1–1½ mm long, anthers often 1 mm or more. 11. *S. colubrina*
14. Ovary glabrous, style often with some hairs. Anthers sessile, c. ¾ mm long (compare also 12. *S. quadrangularis*, the flowers of which are still unknown).
15. Corolla glabrous outside. Leaves 5–7-plinerved 14. *S. ledermannii*
15. Corolla pubescent outside. Leaves 3-plinerved 16. *S. flavescens*
4. Corolla on the inner surface provided with a whorl of erect, stiff, bristle-like hairs, either at the base of the lobes or up to about halfway on these, very rarely moreover pubescent (fig. 30g).
16. Calyx inside pubescent. Corolla-lobes inside fairly densely patently short-hairy above the bristles. 19. *S. ridleyi*
16. Calyx inside glabrous. Apart from the bristles corolla-lobes inside glabrous.
17. Corolla 2½ mm long, tube shorter than the limb. Pistil pubescent 17. *S. luzonensis*
17. Corolla 3–4 mm long, tube about as long as the limb. Pistil glabrous 18. *S. axillarlis*
1. *Strychnos ignatii* BERG. Mat. Med. 1 (1778) 146; FLUCKIGER & MEYER, Pharm. J. III, 12 (1881) 1–6, *cum fig.*; VIDAL, Rev. Pl. Vasc. Filip. (1886) 449, *p.p.*, t. 2; BAILL. Hist. Pl. 9 (1888) f. 387–388; OLIVER in Hook. Ic. (1892) t. 2212; HILL, Kew Bull. (1911) 290, t. opp. 281; *ibid.* (1917) 200; MERR. Sp. Blanc. (1918) 306; BROWN, Min. Prod. Philip. For. 3 (1921) 70 & 221; MERR. En. Philip. 3 (1923) 312; BURK. Dict. (1935) 2095; BROWN, Usef. Pl. Philip. 3 (1950) 225, f. 88.—*Ignatia amara* L. f. Suppl. (1781) 149, *pro fr.*; see OLIVER in Hook. Ic. (1892) t. 2212.—*Ignatiana philippinica* LOUR. Fl. Coch. (1790) 126, *pro fr.*, *nom. illeg.*; see MERR. Comm. Lour. (1935) 309.—*S. tieute* LESCH. Ann. Mus. Hist. Nat. Paris 16 (1810) 479 & 480, t. 23; BL. Bijdr. (1826) 1019; Rumphia 1 (1836) 66, t. 24; MIQ. Fl. Ind. Bat. 2 (1857) 380; HILL, Kew Bull. (1911) 292; KOORD. Exk. Fl. Java 3 (1912) 58; HILL, Kew Bull. (1917) 200; HEYNE, Nutt. Pl. (1927) 1268; *non v.* MALM in Fedde, Rep. 34 (1934) 285, *quae est Ervatamia sphaerocarpa* (BL.) BURK. (*Apoc.*); BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 8.—*S. ovalifolia* WALL. [Cat. (1829) n. 1592, *nomen*] ex G. DON, Gard. Dict. 4 (1837) 65; BTH. J. Linn. Soc. Bot. 1 (1856) 103; GAMBLE, J. As. Soc. Beng. 74, ii (1908) 616, *fr. excl.*; HILL, Kew Bull. (1917) 201; RIDL. Fl. Mal. Pen. 2 (1923) 425; BURK. Dict. (1935) 2097.—*S. philippinensis* BLCO, Fl. Filip. ed. 2 (1845) 61; ed. 3, 1 (1877) 116; F.-VILL. Nov. App. (1880) 136.—*S. maingayi* CLARKE var. *fructuosa* CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 88.—*S. beccarii* GILG, Notizbl. Berl.-Dahl. 1 (1897) 267; HILL, Kew Bull. (1911) 291.—*S. cuspidata* HILL, Kew Bull. (1909) 359; *ibid.* (1911) 288; *ibid.* (1917) 199.—*S. pseudotieute* HILL, *ibid.* (1911) 287.—*S. balansae* HILL, *ibid.* (1917) 200.—*S. krabiensis* HILL, *ibid.* (1940) 199; in Craib, Fl. Siam. En. 3 (1951) 58.—Fig. 28a–j.
- Large liana (in Borneo sometimes a shrub or treelet); twigs glabrous; branches greyish brown, more or less scabrous. Leaves ovate or elliptic to lanceolate, 4–18(–22) by 2¼–9(–12) cm, thin-
- to coriaceous-chartaceous, glabrous, acute to rounded at the base, always slightly attenuate, apex distinctly acuminate, acumens up to 1¼ cm long, slender and blunt or acute; triplinerved at or above the base; petiole ½–1 cm. *Inflorescences* axillary, mostly in the axils of already fallen leaves, laxly branched, 2–4(–7) cm long, with some 10–20 flowers, minutely pubescent. *Calyx* 1–1½ mm high, sepals ovate, acute, outside densely minutely tomentose, inside glabrous. *Corolla* salver-shaped, 7–17 mm long, tube 5–12 mm, inside in the lower half with some long woolly hairs. *Stamens* inserted in the mouth, filaments short, anthers deeply cleft, oblong, 1¼–2 mm long, apiculate, glabrous. *Ovary* globular, c. 1 mm ø, glabrous; style c. 5–12 mm, glabrous or rarely with a few long woolly hairs about the middle; stigma truncate. *Fruits* few on strongly thickened branches, (ellipsoid to) globular, 4–12 cm ø, pericarp up to 5 mm thick, hard and woody, smooth and glabrous. *Seeds* usually several, either lenticular, elliptic to orbicular, c. 20–35 by 16–20 by 8–9 mm, and silky to felty (fig. 28g), or irregular castorbean-shaped, c. 2 by 1 by 1 cm, rough but glabrous (fig. 28j).
- Distr. Tonkin and *Malaysia*: Malay Peninsula, Borneo, Java, and the SE. Philippines (Biliran, Samar, Leyte, Mindanao).
- Ecol. Apparently often in Dipterocarp forests on a sandy soil, furthermore in mixed rain-forests, and sometimes along river-banks, from the lowland up to c. 1500 m. *Fl.* Jan.–Sept., *fr.* Jan.–Dec. According to RIDLEY, Disp. (1930) 342 & 352, the fruits are eaten by monkeys and civet-cats.
- Uses. The seeds are the *Saint Ignatius beans* of commerce, one of the sources of strychnine. The bark and the seeds are used as a febrifuge in the Philippines. In the Malay Peninsula, Java, and Borneo the roots are used for poisoning arrows; moreover, in the Malay Peninsula a fish-poison is made from it.
- Vern. *Saint Ignatius bean*, E, *pepita de San Ignacio*, Sp, *akar ipoh (pěrah)*, a. *tontong, belai*

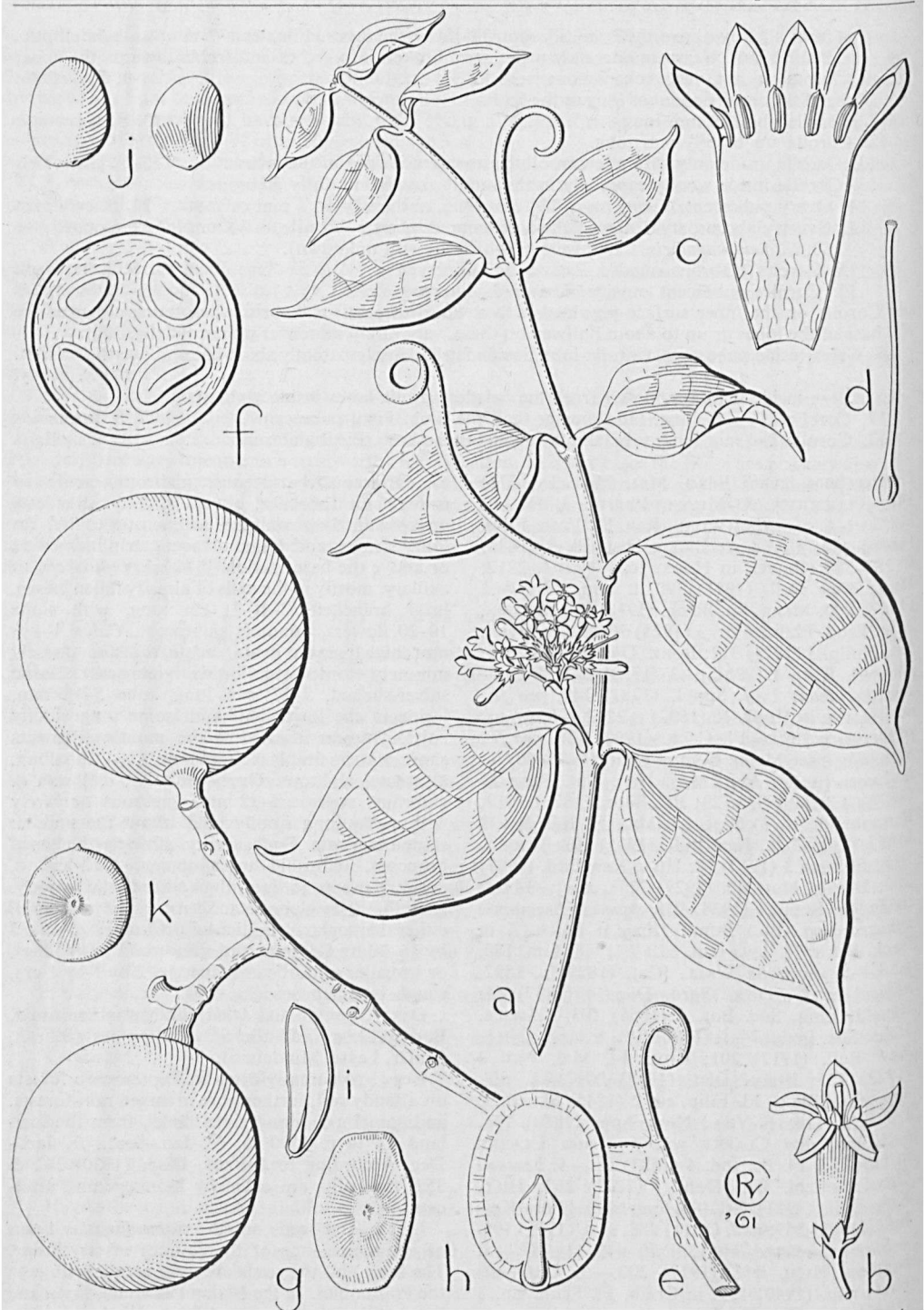


Fig. 28. *Strychnos ignatii* BERG. a. Habit, $\times \frac{2}{3}$, b. flower, $\times 2$, c. opened corolla, $\times 4$, d. pistil, $\times 4$, e. twig with fruits, $\times \frac{2}{3}$, f. cross-section of fruit, the seeds embedded in the pulpa, $\times \frac{2}{3}$, g. lenticular-shaped seed, $\times \frac{2}{3}$, h. ditto in length-section, showing the embryo, $\times \frac{2}{3}$, i. ditto, showing the endosperm which is split for the greater part, $\times \frac{2}{3}$, j. irregular shaped seeds ('St Ignatius Beans'), $\times \frac{2}{3}$.—*S. nuxvomica* L. k. Seed, $\times \frac{2}{3}$ (a after Rumphia I, t. 24, b-d Hort. Bogor X-G-46a, e & g RIDLEY s. n., j. Hort. Bot. Bogor X-G-46, h-i KL 1929A, j herb. L Carpol. 1194, k herb. L Carpol. 1202).

hitam, ipoh akar (bĕsar), i.a. buah kĕchul, pokok ipoh, ya mu lek, Mal. Pen., pokru, S, tjĕtĕk, J. bahan-lak, bina(h), b. kalikis, b. sangang, ipu kajo, sireh-sireh, talinga basing, Born.; Philip.: aguason, dankagi, kanlĕra, katalĕnga, mananĕog, pangaguason, pepita-sa-katbalĕgan, Bis., (i)gasud, S. L. Bis., C. Bis., (pepita-sa-)katbalĕnga(n), Tag., Pamp., yangi-ilagan, Mbo.

Notes. A fairly variable species comprising three forms. The specimens from the Philippines (*S. ignatii* sens. str.), part of those from Borneo (*S. cuspidata*), '*S. krabiensis*' from the Malay Peninsula, and '*S. balansae*' from Tonkin are characterized by large, relatively thin leaves which are dark-green when dried; the nerves are distinctly looping in the upper part, as some of the veins are fairly strongly developed. Furthermore, these specimens have the largest flowers. A second group is formed by the commonest form from the Malay Peninsula (*S. ovalifolia*) and the other part of the Bornean ones (*S. beccarii*): these have small leaves with a less conspicuous nervation, especially those of the Bornean ones are slightly more coriaceous and are brown when dry, while the flowers are smaller; the leaves are distinctly acuminate like in the large-leaved group. The third form, '*S. tieute*' from Java, is more or less intermediate; it has small thin leaves, which show a fairly coarse nervation, they are not conspicuously acuminate, and greyish green when dried; the flowers are small.

As to the seeds, from the Philippines I saw only irregular-shaped ones, from Borneo and Java only lenticular ones, and from the Malay Peninsula I had both types of seeds from plants which otherwise showed no difference. Therefore I conclude that this character cannot be used for specific distinction; KRUKOFF & MONACHINO (Brittonia 4, 1942, 258) reached the same conclusion for the American species. The value, formerly laid upon this character, will have been caused by the pharmaceutical use of the lenticular-shaped seeds of *S. nux-vomica* and the irregular shaped ones of *S. ignatii* from the Philippines.

The type of *S. krabiensis* is KERR 18582 (in K), not 18532 as cited in the original publication.

S. spireana DOR (Bull. Soc. Bot. Fr. 57, Mém. n. 19, 1910, 19), described from Laos, is either closely related to or conspecific with *S. ignatii*; as already remarked by HILL (Kew Bull. 1917, 199) the corolla-lobes were erroneously described as being hairy inside.

Ignatia amara L. f. was apparently based upon flowering material of the American *Rubiacea Posoqueria longiflora* AUBL. and a fruit of *S. ignatii*. *Ignatiana philippinica* LOUR. was no more than a superfluous new name, fully based upon the diagnosis of LINNÉ f. BLANCO originally (Fl. Filip. ed. 1, 1837, 82) also adopted the name *Ignatia amara* and copied the original diagnosis, in the later editions he changed the name into *S. philippinensis*, and gave a new description of flowering material of the true *S. ignatii*, correctly including only the fruit from the original mixtum. In doing thus he restricted the name *Ignatia amara*

to the flowering, Rubiaceae part.

2. *Strychnos nux-vomica* LINNÉ, Sp. Pl. 1 (1753) 189; MIQ. Fl. Ind. Bat. 2 (1857) 378, excl. specim. Mal. et f. depauperata quoad est *S. lucida*; non F. v. M. Fragm. 4 (1863) 44 (= *S. lucida*); CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 90; SOLER. in E. & P. Nat. Pfl. Fam. 4, 2 (1892) 37, f. 20 E-J; TRIMEN, Fl. Ceyl. 3 (1895) 175; non BOERL. Handl. 2 (1899) 460 (= *S. lucida*); HILL, Kew Bull. (1917) 183, cum fig., 341; J. M. HILLIER, Kew Bull. (1919) 238; GAMBLE, Fl. Madras 5 (1923) 868; BURK. Dict. (1935) 2096; KANJILAL & DAS, Fl. Assam 3 (1939) 315; QUIS. Philip. J. Sc. 77 (1947) 141; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 8; HILL in Craib, Fl. Siam. En. 3 (1951) 59.—Fig. 28k.

Liana or tree up to 20 m high. Twigs slightly pubescent, glabrescent; branches yellowish grey, not rough, sometimes with axillary thorns. Leaves broadly ovate to elliptic, (4½–)7½–15 by (3½–)6½–11 cm, pergamentaceous to chartaceous, glabrous, faintly cordate to rounded at the base, apex blunt or gradually acuminate, in the latter case with a broadly triangular acumen, often mucronulate; 3–5-plinerved, the inner pair diverging slightly above the base, the outer pair mostly faint, midrib often with two additional stronger nerves in the upper leaf-half; petioles 6–11 mm. Inflorescences terminal on short axillary branchlets with usually one pair of normal leaves, mostly laxly pyramidal and fairly many-flowered, 4–4½ cm long, thinly tomentose. Calyx 1–1¼ mm high, sepals ovate, blunt to acute, outside fairly densely pubescent, inside glabrous. Corolla salver-shaped, 10–12 mm long, tube 6½–9 mm, inside in the lower half sparsely woolly, margins of the lobes thickened and minutely tomentose. Stamens inserted in the mouth, anthers subsessile, cleft to slightly below the middle, elliptic, 1¾ mm, blunt, glabrous. Ovary ovoid, 1 mm, glabrous; gradually narrowed into the style, the latter 10 mm, sparsely woolly hairy about the middle; stigma orbicular. Fruits few on strongly thickened branches, globular, c. 3–4(–6) cm ø, somewhat scabrous. Seeds c. 4, lenticular, orbicular to elliptic, 2–2¼ by 1¾–2 cm by c. 4 mm, densely sericeous.

Distr. Ceylon, India, Siam, Indo-China, and Malaysia: N. Malay Peninsula (Puket, cf. HILL), naturalized in the Philippines (Mindoro, Oriental Prov., on the shore of the Puerto Galera Bay).

Ecol. In forests and along the shore, at low altitudes.

Uses. Cultivated for its seeds, which are used in pharmacy as the main source of strychnine.

Note. *S. nux-blanda* HILL, distributed in Burma, Siam, and Indo-China, differs only slightly from *S. nux-vomica*, mostly by its larger, more-nerved and more distinctly acuminate leaves and its c. 2 mm long, mostly narrower and more acute sepals. Furthermore by the sweet seeds which contain no or only a very small percentage of strychnine. Probably this is only a variety or form of *S. nux-vomica*.

3. *Strychnos lucida* R. BR. Prod. (1810) 469; BTH. Fl. Austr. 4 (1869) 369; BAILEY, Queensl. Fl. 3 (1900) 1024; HILL, Kew Bull. (1911) 287; *ibid.* (1917) 194.—*Lignum colubrinum timorense* RUMPH. Herb. Amb. 2 (1741) 121, t. 38.—*S. colubrina* L.: WILLD. Sp. Pl. 1, 2 (1797) 1052, *et auct. div. p.p., typ. excl.*—*S. muricata* KOST. Allg. Med.-Pharm. Fl. 3 (1834) 1072; MIQ. Fl. Ind. Bat. 2 (1857) 380; MERR. Int. Rumph. (1917) 423; MEYER DREES, Comm. For. Res. Inst. n. 33 (1951) 74.—*S. ligustrina* BL. Rumphia 1 (1836) 68, t. 25; HILL, Kew Bull. (1911) 286; KOORD. Exk. Fl. Java 3 (1912) 58; HILL, Kew Bull. (1917) 193; HEYNE, Nutt. Pl. (1927) 1267; BURK. Dict. (1935) 2095; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 8.—*S. nux-vomica* L.: BTH. J. Linn. Soc. Bot. 1 (1856) 103, p.p.; MIQ. Fl. Ind. Bat. 2 (1857) 378, *pro spec. Mal., incl. f. depauperata*; F. v. M. Fragm. 4 (1863) 44; BOERL. Handl. 2 (1899) 460; K. & V. Bijdr. 9 (1903) 66.—*S. roborans* HILL, Kew Bull. (1925) 424; in Craib, Fl. Siam. En. 3 (1951) 60.

Small, often crooked tree or shrub, up to 12 m by 24 cm \emptyset , spiny when young. Twigs sparsely pubescent, soon glabrescent (Australian specimens glabrous from the beginning); branches greyish, rough by many small lenticels. *Leaves* ovate or elliptic to suborbicular, 2½–10 by 1½–6 cm, thin-chartaceous, glabrous, below granular and dull (somewhat glaucous), base cuneate to faintly cordate, usually attenuate, apex blunt to rounded, sometimes slightly emarginate, rarely tapering and acute; mostly 3-plinerved at the base (to 5-plinerved); petiole 2–4 mm. *Inflorescences* terminal, sometimes with a pair of strong basal branches in the upper leaf-axils, 2½–3 cm long, with c. 9 flowers, fairly densely, minutely pubescent. *Calyx* 1–1¼ mm long, sepals broadly cordate, acute, outside short-tomentose, inside glabrous. *Corolla* salver-shaped, 1–1½ cm long, tube 7–12 mm, inside sometimes with a few woolly hairs. *Stamens* inserted in the mouth, glabrous, filament short, anther cleft to about or slightly below the middle, oblong, 1½–1¾ mm. *Ovary* globular, c. 1 mm \emptyset , conically narrowed into the c. 1¼ cm long style, both glabrous; stigma truncate. *Fruits* few, globular, 2–2½ cm \emptyset , smooth, glabrous. *Seeds* 2–3, nearly disk-shaped, 12–15 by 10–12 by 2½–5 mm, densely short pubescent.

Distr. Siam (Nakawn Sawan, Rachasima, Ayuthia, Rachaburi) to Australia (W. Australia: Prince Regent River; Northern Territory: Arnhem Land; N. Queensland: Cook Peninsula); in Malaysia: E. Java (also Madura and Kangean), Lesser Sunda Is. (Bali to Timor), S. Moluccas (Tanimbar Is.). Fig. 29.

Ecol. A characteristic plant of land subject to a dry monsoon, in S. Malaysia and Siam in teak and other dryland forests, in secondary forest, shrubberies, and savannahs, in Siam also on limestone rocks, in Australia mainly in open to dense savannah woodland, open places in monsoon forests, scrubby forest, *etc.*, up to c. 200(–400) m. *Fl.* May, Sept.–Dec., *fr.* June–Dec. (for both only very few exact dates are available).

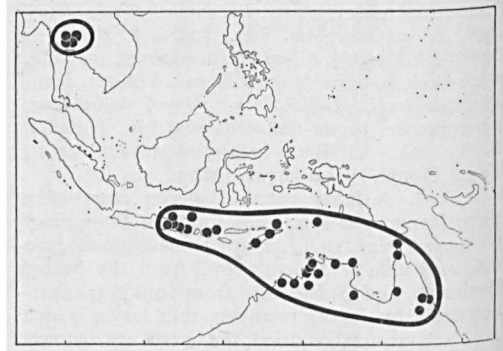


Fig. 29. Distribution of *Strychnos lucida* R. BR., a species of drier regions.

Uses. The bark, the bitter wood, and the root are medicinally used.

Vern. *Doro laut, kaju-bidara-pait, widoro gunung, J, bidara patis, Md, dergunung, Kangean, kaju bidara laut, Bali, songga, Sumbawa, ai baku moruk, bidara laut, kaju-nassi, (daon) kaju ular, maba muti (or putih), Timor, botniawe, Tanimbar Is.*

Notes. The leaves are deciduous, they turn yellow before falling.

HILL (Kew Bull. 1917, 193) already stressed the close affinity of *S. lucida* and *S. ligustrina*; in fact he distinguished them only upon one character: the first-named would be a shrub, the second one a tree, but he already was in doubt as to the reliability as well as the value of this character. From the large range of Australian specimens in the herbaria at Brisbane and Melbourne it is quite clear that this only 'difference' does not exist. The species is very homogeneous in spite of the large area from Siam to N. Australia and the considerable gap in the everwet parts of Malaysia.

4. *Strychnos maingayi* CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 88, *excl. var. fructuosa* (= *S. ignatii*); GAMBLE, J. As. Soc. Beng. 74, ii (1908) 614, *p. maj. p.*; HILL, Kew Bull. (1917) 141, *cum fig.*; RIDL. Fl. Mal. Pen. 2 (1923) 423.—*S. laurina* DC.: CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 88, *pro fr.*

Liana. Twigs glabrous; branches purplish-brown with many orbicular, small, light yellow lenticels. *Leaves* elliptic to oblong (to lanceolate), 5–10 by 2½–5½ cm, chartaceous to thin-chartaceous, glabrous, base broadly cuneate to rounded, apex tapering acute-acuminate; 3-plinerved at the base, nerves near the margin; petiole 5–7 mm. *Inflorescences* axillary and terminal or pseudo-terminal, axillary ones usually on a quadrangular 1–1½ cm long peduncle, and often with a pair of strong basal branches, thyse oblong, (2–)5–6 cm long, laxly branched and fairly many-flowered, densely and shortly tomentose-pubescent. *Calyx* 0.9 mm, sepals broad-ovate, blunt to rounded, outside subglabrous, inside glabrous. *Corolla* rotate, 3–4 mm long, glabrous outside, inside

in the mouth long woolly hairy, tube $\frac{1}{2}$ –1 mm, lobes linear, acute. *Stamens* inserted in the mouth, filaments $1\frac{1}{2}$ –2 mm long, glabrous, anthers bifid at the base, oblong to lanceolate, 1 mm long, slightly acuminate, densely barbate to long-ciliate all around. *Ovary* ellipsoid, $\frac{1}{2}$ mm, for the greater part sparsely shaggy hairy, grading into the style, the latter 2– $2\frac{1}{2}$ mm long and fairly thick, hairy in the basal part; stigma semi-globular. *Fruits* fairly many, globular, c. $2\frac{1}{2}$ cm ϕ . *Seeds* 1–2.

Distr. Malaysia: Malay Peninsula (Perak and Singapore); a specimen from Borneo (ENDERT 4838, W. Kutai) with only very young flower-buds may also belong to this species.

Ecol. Dense jungle at low altitude. *Fr.* July.

Notes. The leaves look like those of *S. curtisii* and of *S. ignatii* ('*ovalifolia*'); the former has usually the nerves more distinctly diverging above the base, and the latter differs by the coarser venation, the more abruptly acuminate leaf apex, and the green colour of the dried leaves (in *S. maingayi* the dried leaves are reddish brown). The flowers of these three species cannot be confused, as they belong to different sections.

The relationship of *S. maingayi* is mainly with *S. andamanensis* HILL (Andamans) and *S. ovata*, but they are both sufficiently different.

5. *Strychnos ovata* HILL, Kew Bull. (1909) 360; *ibid.* (1917) 143; MERR. En. Philip. 3 (1923) 313; non Pl. Elm. Born. (1929) 252 (= *S. axillaris*).—*S. panayensis* HILL, Kew Bull. (1917) 148, *cum fig.*; MERR. En. Philip. 3 (1923) 313.—*Strychnos* sp. 1, HILL, Kew Bull. (1917) 206.—*Fig.* 30a–f.

Climber or shrub. Twigs glabrous; branches yellowish-brown to yellowish-grey. *Leaves* ovate to elliptic or oblong, 6–10 by 3–6 cm, chartaceous, glabrous, base broadly cuneate to rounded, mostly attenuate, apex blunt, acute, or tapering acute-acuminate; 3–5-plinerved, the nerves nearer to the margin than to the midrib; petiole 4–10 mm. *Inflorescences* axillary and pseudoterminal or terminal, $2\frac{1}{2}$ –7 cm long, laxly to densely branched, fairly many-flowered, sparsely pubescent. *Calyx* 1– $1\frac{1}{4}$ mm, sepals ovate, blunt, outside slightly tomentose, inside glabrous. *Corolla* rotate, 3– $4\frac{1}{2}$ mm long, thin to fairly thick-fleshy, especially the lobes, outside sparsely appressed-pubescent, mainly towards the tip of the lobes, rarely glabrous, inside in the mouth and on the bases of the lobes (sometimes very sparsely) woolly, tube 1– $1\frac{3}{4}$ mm long, lobes oblong-ovate to linear. *Stamens* inserted in the mouth, filament short ($\frac{3}{4}$ – $1\frac{3}{4}$ mm), glabrous or pubescent, anthers broadly ovate to elliptic, $\frac{3}{4}$ –1 mm long, bearded. *Ovary* globular to ovoid, 1– $1\frac{1}{4}$ mm high, glabrous or shaggy hairy in the upper part, style 1– $2\frac{1}{2}$ mm, in the basal half likewise hairy; stigma truncate to semi-globular, somewhat broadened. *Fruits* few, ellipsoid to globular, 1– $2\frac{1}{2}$ cm, smooth, thin-walled, with 1–2 seeds. *Seeds* orbicular, flat, 1 cm ϕ , felty.

Distr. Malaysia: Borneo, Philippines (Palawan, Calamianes, Mindoro, Babuyan Is., Luzon, Ticao, Panay), and N. Celebes (Gorontalo); possibly

also on P. Penang near the Malay Peninsula.

Ecol. In thickets and forests, along river-banks, from sea-level up to c. 250 m. *Fl.* May–June, *fr.* Febr., May.

Vern. Philip.: *Igasud*, Bis.

Notes. In the original diagnosis the length of the petiole is given as 0.5 mm; this should be 0.5 cm.

The Bornean specimens are slightly different from those of the Philippines by less conspicuous, parallel (instead of reticulate) veins, distinctly acuminate leaves, oblong-ovate (instead of linear) corolla-lobes, and smaller and broader anthers.

KERR *s.n.* (coll. 26–10–1926) collected on P. Penang (herb. E) comes very close to the Bornean specimens; it mainly differs in some minute flower-characters (pubescence inside of the corolla mainly towards the tips of the lobes; anthers sometimes, ovary and style fully glabrous).

The relationships of *S. ovata* are with *S. maingayi* (Malaya and ? Borneo) and *S. confertiflora* MERR. & CHUN (Hainan). The latter differs by its shorter and more dense inflorescences and by some flower details.

Apart from the flowers, *S. ovata* looks much alike *S. axillaris* ('*impressinervis*'), but differs by the usually more ovate and dull greyish green (instead of shining brown) leaves, in fruit moreover by the larger and more lax infructescences with larger fruits.

6. *Strychnos villosa* HILL, Kew Bull. (1911) 296; KOORD. Exk. Fl. Java 3 (1912) 58; HILL, Kew Bull. (1917) 143; BAKH. *f.* in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 7.—*S. laurina* (non DC.) K. & V. Bijdr. 9 (1903) 68.—*S. horsfieldiana* (non MIQ.) KOORD.-SCHUM. Syst. Verz. 1 (1913) fam. 245, 164.—*Strychnos* sp. A & B, KOORD.-SCHUM. *l.c.* 165 & 166 *resp.*—*S. hirsutiflora* HILL, Kew Bull. (1917) 144, *cum fig.*, RIDL. Fl. Mal. Pen. 2 (1923) 423.

Liana. Twigs thinly tomentose, glabrescent. *Leaves* ovate or elliptic to oblong, 7–17 by 3–8 cm, chartaceous, glabrous to pubescent on the nerves beneath, base broadly cuneate to subcordate, attenuate, apex tapering to abruptly acuminate, acumen short, deltoid, acute; 5-plinerved, inner nerves diverging at $\frac{1}{2}$ – $1\frac{1}{4}$ cm above the base; petiole $\frac{1}{2}$ –1 cm. *Inflorescences* terminal and in the upper leaf-axils, 5–20(–30) cm long, laxly branched, many-flowered, thinly tomentose, peduncle up to 10 cm long. *Calyx* $\frac{3}{4}$ –1 mm, sepals elliptic or ovate, acute to blunt, outside pubescent to glabrous, inside thinly pubescent. *Corolla* 2(–4) mm, less than halfway connate, outside fairly densely hirsute to subglabrous, inside partly or nearly completely (the base always excepted) woolly or hirsute. *Stamens* inserted in the mouth, filaments up to $\frac{3}{4}$ mm, glabrous or sparsely pubescent, anthers ovate, $\frac{1}{2}$ – $\frac{3}{4}$ mm, apiculate and slightly bearded. *Pistil* $1\frac{1}{2}$ –4 mm, glabrous to hirsute. *Fruits* several, ellipsoid to globular, $1\frac{3}{4}$ – $2\frac{1}{4}$ cm, the wall thin and hard. *Seeds* 1–4, elliptic, 15 by $12\frac{1}{2}$ by $3\frac{1}{2}$ mm, woolly-tomentose.

Distr. Malaysia: Malay Peninsula (Perak,

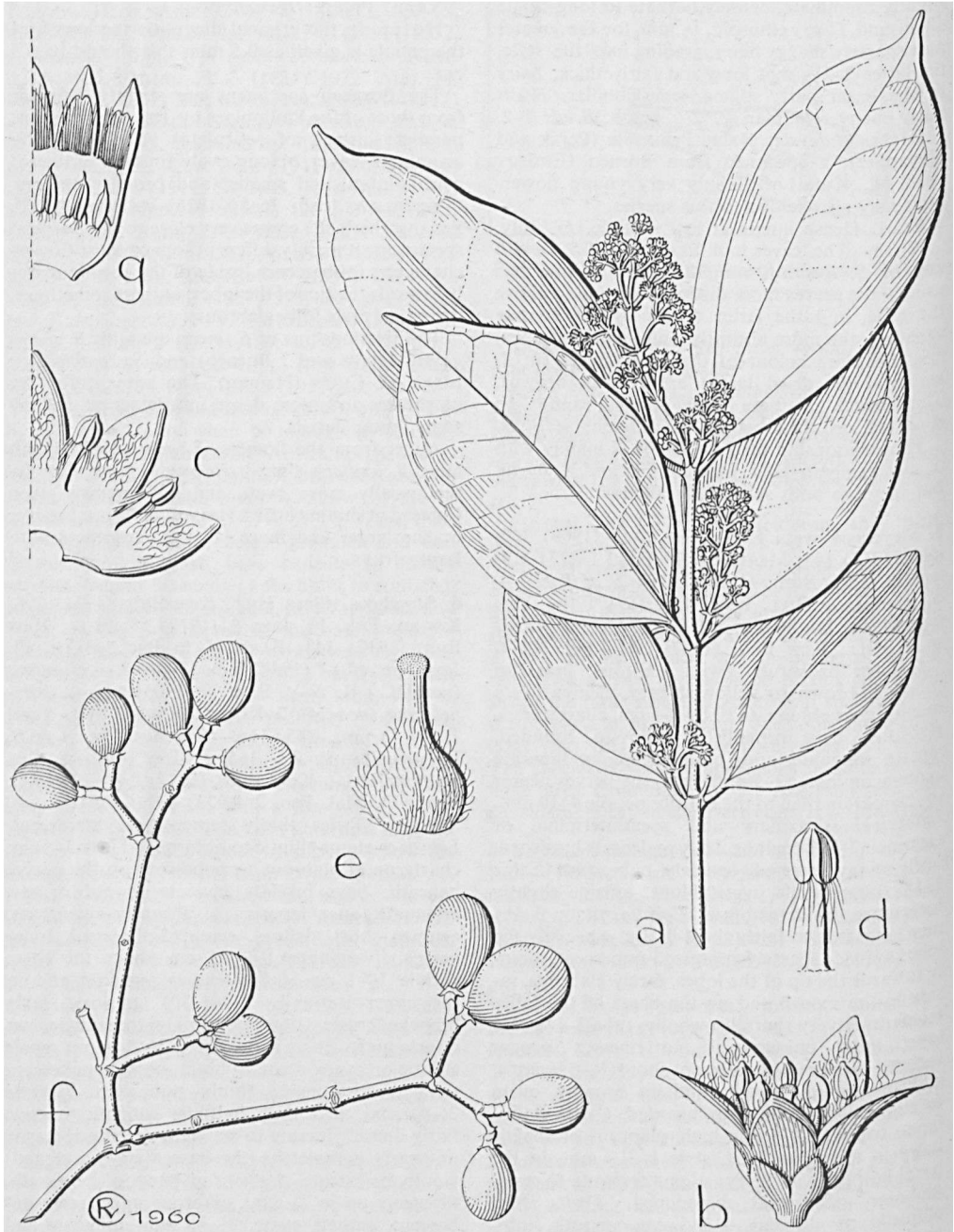


Fig. 30. *Strychnos ovata* HILL. a. Habit, $\times \frac{2}{3}$. b. flower, $\times 8$. c. opened corolla, $\times 8$. d. stamen, $\times 16$. e. pistil, $\times 16$. f. infructescence, $\times \frac{2}{3}$.—*S. axillaris* COLEBR. g. Opened corolla to show the type of hairiness of the *Penicillatae* (a-e SAN 15268, f KOSTERMANS 4946, g CURTIS 3494).

Johore), Simalur (off NW. Sumatra), N. Borneo, Java, and Lesser Sunda Is. (Bali, Sumbawa).

Ecol. Apparently indifferent to climatic seasons, in and along rain-, beach-, and teak-forests; up to 600 m. *Fl.* Jan., June–July, *fr.* Aug., Nov.

Vern. *Akar tandu dotan*, Simalur.

Notes. Well characterized by the large and lax terminal inflorescences with small and mostly hairy flowers.

This species shows, apart from the small and short-tubed flowers, a distinct resemblance to *S. colubrina*.

7. *Strychnos curtisii* K. & G. J. As. Soc. Beng. 74, ii (1908) 614, *excl. specim.* KING's coll. 10281 & 10438 (= *S. colubrina*); HILL, Kew Bull. (1917) 164, *cum fig., fr. excl.* (= *S. colubrina*); RIDL. Fl. Mal. Pen. 2 (1923) 424, *fr. excl.*

Climber. Twigs glabrous, yellowish brown, later on slightly scabrous by scattered lenticels. *Leaves* elliptic, 8–9 by 3¼–5 cm, subcoriaceous, glabrous, base rounded and slightly attenuate, apex rounded, more or less abruptly, shortly and bluntly acuminate; (sub)5-plinerved, the inner nerves diverging at c. ½ cm above the base; petioles 7 mm. *Inflorescences* axillary and (pseudo?)terminal, 2–4½ cm long, rather dense and many-flowered, minutely tomentose. *Calyx* 1½ mm, sepals broad, rounded, glabrous on both surfaces. *Corolla* rotate, 6 mm long, outside glabrous, inside the lower half of the linear-lanceolate lobes densely woolly, tube 2 mm long. *Stamens* inserted in the mouth, filaments 2 mm, glabrous, anthers oblong-lanceolate, 1 mm long, apiculate, glabrous. *Pistil* 4¾ mm, densely appressed-short-pubescent on the upper half of the ovary and the greater part of the style. *Fruit* unknown.

Distr. *Malaysia*: Malay Peninsula.

Ecol. Evergreen forest, 200–650 m. *Fl.* April–June.

Vern. *Sēmijo akar*.

Notes. Very close to *S. polytrichantha* and *S. oleifolia*. The differences between these three species are mainly in such characters as larger or smaller flowers, inside completely or only partly woolly, and in the shape and nervation of the leaves. Possibly they only represent a Malayan, Bornean, and Philippine subspecies of one species, but for the moment I prefer to keep them separate.

As a lectotype I have designated CURTIS 2973, from which I saw two duplicates from SING.

8. *Strychnos polytrichantha* GILG, Notizbl. Berl.-Dahl. 1 (1897) 267; HILL, Kew Bull. (1911) 298, *cum fig.; ibid.* (1917) 156.

Climber. Twigs glabrous, branchlets yellowish brown, fairly scabrous by scattered small lenticels. *Leaves* ovate or elliptic to lanceolate, 6½–14 by 2–7½ cm, chartaceous to subcoriaceous, glabrous, base rounded to acute, attenuate, apex broadly rounded, more or less abruptly acuminate, acumen short and blunt; 5-plinerved, inner nerves diverging slightly above the base, nearly as strong as the midrib, veins mainly transverse, minute and dense, prominulous on both sides; petiole 6–7 mm.

Inflorescences axillary and terminal, 2–8 cm long, laxly branched to fairly compact, few- to many-flowered, minutely tomentose, glabrescent. *Calyx* 1–2 mm, sepals ovate, blunt, inside glabrous. *Corolla* 8–10 mm, tube 3 mm, inside densely woolly the basal part of the tube excepted. *Stamens* inserted in the mouth, filaments 2½–4 mm, glabrous, anthers lanceolate, 1¼ mm, minutely apiculate, barbate or not. *Pistil* 9 mm long, ovary and at least the basal half of the style shaggy hairy. *Fruits* few, globular, 5 cm ø, scabrous. *Seeds* probably many.

Distr. *Malaysia*: Borneo.

Ecol. Up to 1800 m. *Fl.* April–July, Dec.

Notes. Closely related to *S. curtisii* (Mal. Pen.) and to *S. oleifolia* (Philipp.); see under the first-named species. Among these three species *S. polytrichantha* is the one best characterized by its large, woolly flowers and its very typical nervation and venation.

9. *Strychnos oleifolia* HILL, Kew Bull. (1917) 156; MERR. En. Philip. 3 (1923) 313.

Liana. Twigs glabrous, branchlets yellowish brown, more or less scabrous by many small lenticels. *Leaves* ovate-oblong to -lanceolate, c. 11–12 by 4 cm, chartaceous, glabrous, base broadly cuneate, slightly attenuate, apex gradually acuminate; 3–5-plinerved, the inner nerves diverging at c. 2 mm above the base; petiole 6–10 mm. *Inflorescences* terminal, 7–8 cm long, fairly laxly branched and many-flowered, thinly short-hairy. *Calyx* 1¼ mm, sepals ovate, blunt, sparsely hairy outside, inside glabrous. *Corolla* 8 mm, outside with some scattered short hairs about the mouth and along the sutures, inside woolly from slightly above the base of the tube to about halfway the lobes; tube 3½ mm long. *Stamens* inserted in the mouth, filaments 2 mm, glabrous, anthers elliptic, 1½ mm long, glabrous. *Pistil* 6 mm, thinly shaggy hairy on the upper half of the ovary and all along the style. *Fruit* unknown.

Distr. *Malaysia*: Philippines (Palawan, possibly also in Luzon).

Ecol. In forests at low altitudes. *Fl.* May.

Notes. A specimen from Luzon (RAMOS 1388), which might also belong to this species, shows a large infructescence with branches which are only slightly thickened and with several small, 2-seeded fruits. Vegetatively this specimen is about identical with the type from Palawan, but as flowers are absent nothing can be said with certainty. These fruits however, are one reason more to keep this species apart from *S. polytrichantha*, with which it is distinctly related. Other reasons are the differences in the leaves and in some flower characters.

On the other side the whole group of three species (*S. curtisii*, *S. polytrichantha*, and *S. oleifolia*) is distinctly related to *S. colubrina*, the main difference being the relatively very short tube of the corolla. *S. oleifolia* especially, is quite close to some Philippine forms of *S. colubrina*.

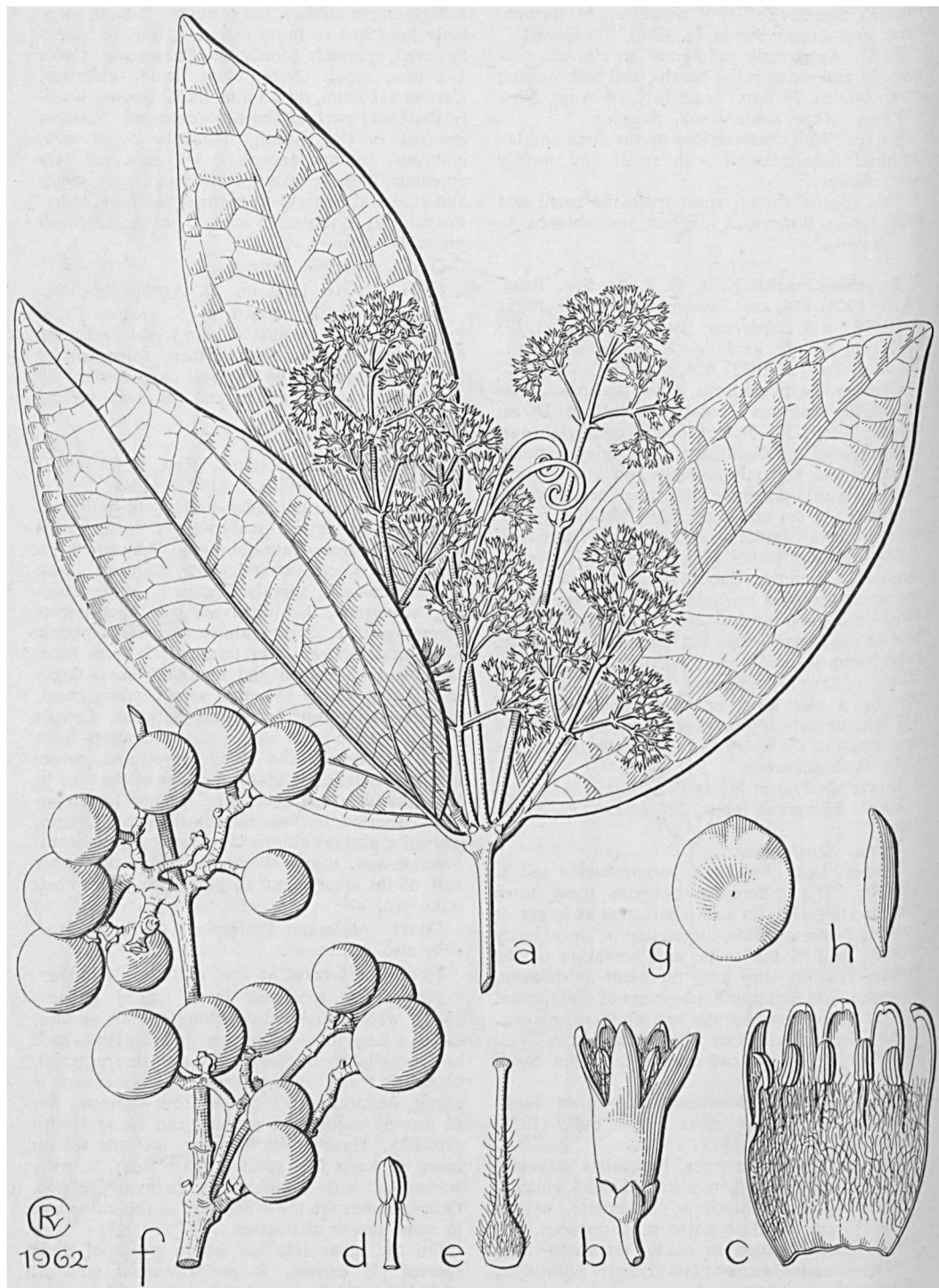


Fig. 31. *Strychnos colubrina* L. a. Habit of '*S. forbesii*', $\times \frac{2}{3}$, b. flower, $\times 4$, c. opened corolla, $\times \frac{5}{3}$, d. stamen, $\times 6$, e. pistil, $\times 6$, f. twig with infructescences, $\times \frac{2}{3}$, g. and h. frontal and lateral view of seed, $\times 1$ (a BRASS 5890, b-e RAHMAT 652, f VAN ROYEN 4272, g-h ELMER 8960).

10. *Strychnos lanata* HILL, Kew Bull. (1911) 299, *cum fig.*; *ibid.* (1917) 165; MERR. En. Philip. 3 (1923) 312.

Liana. Twigs glabrous; branchlets brown, with many minute lenticels. *Leaves* oblong(-ovate), 6½–18 by 3½–9 cm, chartaceous, glabrous, base cuneate to rounded, sometimes slightly attenuate, apex blunt or gradually blunt- to acute-acuminate; 5-plinerved; petioles ½–1 cm long. *Inflorescences* axillary, 6–8 cm long, laxly branched, many-flowered, tomentose. *Calyx* 1¼–2 mm, sepals ovate, blunt to acute, glabrous. *Corolla* 5½–7 mm, inside from about halfway the tube to at least halfway the lobes woolly; tube 2–2¼ mm. *Stamens* inserted in the mouth, filaments 1–1½ mm, glabrous, anthers oblong to ovate-lanceolate, 1¼–2 mm, apiculate, barbate. *Pistil* 5–6 mm, ovary woolly, style in the lower half with a few long woolly hairs. *Fruit* unknown.

Distr. *Malaysia*: Philippines (Mindanao).

Ecol. Rain-forest along river, at 350–700 m. Fl. Sept.

Vern. *Bebekang-ulongen*, Sub., *tolanan*, Bo.

Note. This species is about intermediate between *S. oleifolia* and *S. colubrina*; from the former differing in some flower details, from the latter mainly by the short corolla-tube.

11. *Strychnos colubrina* LINNÉ, Sp. Pl. 1 (1753) 189; non SPAN, in Hook. Comp. Bot. Mag. 1 (1835) 347, *nec* Linnaea 15 (1841) 325 (= *S. lucida*); HILL, Kew Bull. (1917) 157; GAMBLE, Fl. Madras 5 (1923) 868; BURK. Dict. (1935) 2095.—*Sirioides* & *Sirioides alter* RUMPH. Herb. Amb. 5 (1747) 49, t. 29 f. 1.—*Camotain* BLCO, Fl. Filip. (1837) 85; ed. 2 (1845) 62; ed. 3, 1 (1877) 116.—*S. laurina* WALL. [Cat. (1829) n. 1591, *nom. nud.*; G. DON, Gard. Dict. 4 (1837) 65, *in syn.*] *ex DC.* Prod. 9 (1845) 13; non K. & V. Bijdr. 9 (1903) 68 (= *S. villosa*); HILL, Kew Bull. (1911) 297; *ibid.* (1917) 150, *cum fig.*, *incl. var. thorelii*; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 7; non HEINE, Pfl. Samml. Clemens Kinabalu (1953) 90 (= *S. borneensis*).—*S. acuminata* WALL. [Cat. (1829) n. 1593, *p.p.*, *nom. nud.*] *ex DC.* Prod. 9 (1845) 14; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 86; HILL, Kew Bull. (1911) 302.—*S. multiflora* BTH. J. Linn. Soc. Bot. 1 (1856) 102; F.-VILL. Nov. App. (1880) 136; OLIVER in Hook. f. (1892) t. 2213; HILL, Kew Bull. (1911) 300, t. opp. p. 301; *ibid.* (1917) 162; BROWN, Min. Prod. Philip. For. 1 (1920) 406; *ibid.* 3 (1921) 221; MERR. En. Philip. 3 (1923) 312; BROWN, Usef. Pl. Philip. 3 (1950) 227.—*S. potatorum* (non L. f.) F.-VILL. Nov. App. (1880) 136; VIDAL, Sinopsis (1883) 33, t. 69 f. D, *pro var. multiflora* VIDAL.—*S. hypogyna* CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 86, *pro specim. Born.*, *typo excl.*; cf. HILL, Kew Bull. (1917) 146.—*S. septemnervis* CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 88; GAMBLE, J. As. Soc. Beng. 74, ii (1908) 619; HILL, Kew Bull. (1917) 149, *cum fig.*, *incl. var. imberbis*; RIDL. Fl. Mal. Pen. 2 (1923) 423.—*S. ignatii* (non BERG.) VIDAL, Rev. Pl. Vasc. Filip. (1886) t. 1.—*S. bancroftiana* F. M. BAIL.

Rep. Exp. Bellenden-Ker (1889) 49; Syn. Queensl. Fl. Suppl. 3 (1890) 47; Queensl. Fl. 3 (1900) 1025, t. 43; Compr. Cat. Queensl. Pl. (1913) 340; HILL, Kew Bull. (1911) 301; *ibid.* (1917) 208.—*S. celebica* KOORD. Med. Lands Pl. Tuin 19 (1898) 540 & 631.—*S. minahassae* KOORD. ex BOERL. Handl. 2 (1899) 460, *nom. nud.*—*S. kerstingii* GILG & K. SCH. in K. Sch. & Laut. Fl. Schutzgeb. (1901) 498; GILG & BENED. Bot. Jahrb. 54 (1916) 164.—*S. luzonensis* ELM. Leaf. Philip. Bot. 1 (1908) 332, *p.p.*, *typo excl.*—*S. barbata* HILL, Kew Bull. (1909) 359, *non* CHIOV. (1932); *ibid.* (1911) 297; *ibid.* (1917) 153; MERR. Int. Rumph. (1917) 423.—*S. forbesii* HILL, Kew Bull. (1909) 360; *ibid.* (1911) 295; *ibid.* (1917) 150, *fr. excl.*—? *S. merrillii* HILL, Kew Bull. (1911) 297; *ibid.* (1917) 161; MERR. En. Philip. 3 (1923) 312.—*S. dubia* HILL, Kew Bull. (1911) 298, *cum fig.*; *ibid.* (1917) 156; MERR. En. Philip. 3 (1923) 312.—*S. similis* HILL, Kew Bull. (1912) 38; *ibid.* (1917) 153; MERR. En. Philip. 3 (1923) 313.—*S. pycnoneura* GILG & BENED. Bot. Jahrb. 54 (1916) 164, f. 4; HILL, Kew Bull. (1917) 162.—*S. cinnamophylla* GILG & BENED. Bot. Jahrb. 54 (1916) 166; HILL, Kew Bull. (1917) 148.—*S. myriantha* GILG & BENED. Bot. Jahrb. 54 (1916) 167, f. 5; HILL, Kew Bull. (1917) 162; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 303.—*S. leuconeura* GILG & BENED. Bot. Jahrb. 54 (1916) 169.—*S. curtisii* K. & G.: HILL, Kew Bull. (1917) 164, *pro fr.*; RIDL. Fl. Mal. Pen. 2 (1923) 424, *pro fr.*—*S. silvicola* HILL, Kew Bull. (1930) 156; in Craib, Fl. Siam. En. 3 (1951) 61.—*S. polytoma* (non GILG & BENED.) KAN. & HAT. Bot. Mag. Tokyo 53 (1939) 11.—Fig. 31.

Liana, sometimes a tree (?). Twigs glabrous, branchlets greyish and fairly smooth. *Leaves* ovate or suborbicular to lanceolate, 8–25 by 3–12 cm, chartaceous to stiff-coriaceous, glabrous, base subcordate to broadly cuneate, apex blunt to rounded and rather abruptly shortly blunt-acuminate to gradually acute-acuminate, sometimes even caudate; 3–5(–7)-plinerved, inner nerves usually diverging fairly high above the base (up to c. 2 cm) and in the eastern races usually at a different height, venation often coarse-scalariform; petiole 3–15 mm. *Inflorescences* axillary and/or terminal, usually large (up to c. 15 cm long), widely branched and many-flowered (in some western races only a few cm long and with some flowers), partly or completely thinly tomentose or subglabrous. *Calyx* 1–3 mm, outside (glabrous to) sparsely to densely short-tomentose, inside glabrous, sepals broad-ovate to suborbicular, blunt to rounded, rarely acute. *Corolla* 3–6½ mm long, about halfway connate, outside glabrous (except sometimes in young buds) inside at least about the mouth, at most from about halfway the tube to the mouth, rarely also on the lobes, (mostly densely) woolly, lobes slightly thickened only. *Stamens* inserted in the mouth, filament up to 1½ mm, glabrous, anther ovate to ovate-lanceolate or elliptic to oblong, ¾–1½ mm long, blunt or minutely apiculate, glabrous or barbate. *Pistil* 2–6 mm, ovary completely or for the greater part hairy, style

often glabrous, sometimes in the basal half, rarely completely hairy, indument sparse to fairly dense, shaggy to woolly. *Fruits* many, globular, 2½–3 cm ø, sometimes ellipsoid and 3½ cm long, thin-walled, glabrous and smooth to minutely warty. *Seeds* 1–8, often 2, lenticular, 12–15 by 10–12 by 2–4 mm, minutely densely tomentose.

Distr. From Ceylon, India, Cochin-China, through *Malaysia*: Malay Peninsula, Simalur I. off NW. Sumatra, Borneo, Philippines, Celebes, Moluccas, New Guinea, and New Britain, to the Solomon Is. and Australia (NE. Queensland, mainly the coastal region between Cairns and Innisfail).

Ecol. Primary and secondary forests, in New Guinea also in mixed *Araucaria* forests, from sea-level up to 1850 m. *Fl.* mainly July–Nov., fr. Jan.–Dec.

Uses. The wood, bark, and roots are medicinally used (*snake-wood*). A decoction of these parts is used as a poison for arrows, the vine for tying purposes.

Vern. *Snake-wood*, E, *tali siri* (*kětjil*), M, *olor sikasa ilir dotan*, Simalur, *lěngkoyan*, *sēmijo akar*, Mal. Pen., *tao kwang du tuk*, Mal. Pen. Surat, *ipu ako*, *i. tanah*, Born.; Philip.: *abukobukó*, *bukian*, Ibn., *batlag*, Pint., Sbl., *batul*, *pamulaklak*, *tibanglân*, Tag., *bugahin*, Bis., *bukúan*, Neg., *daŋgilian Bag.*, *fantandok*, Ill., *malaitmoma-balaein*, Dun.; *ranosandang*, Cel., *akar pamali*, *aywãa umali*, *hutuu*, *wale ammelaum*, *wari ammo*, Moluccas.

Notes. Very variable species, comprising a great number of local races. Many of these races were treated by HILL as separate species, and some more he either did not have available or could not identify. The differences between these races are mostly very small and mainly concern the following characters: larger or smaller flowers, corolla more or less pubescent, anthers barbate or glabrous, style either glabrous or partly or entirely hairy, furthermore differences in shape, size, nervation of the leaves, and larger or smaller inflorescences. Many of these characters proved to be variable in one or some of the races and are therefore useless for specific distinction. Even only very few races can clearly be characterized: best recognizable are '*S. bancroftiana*' and '*S. forbesii*' from Australia and New Guinea, with oblique, oblong to lanceolate leaves, the inner nerves of which distinctly diverge at a different height, and '*S. multiflora*' from the Philippines with large and many-flowered inflorescences, large flowers, and large, ovate, coarsely reticulate leaves. Towards the west the leaves, inflorescences, and flowers are smaller; moreover, the leaves of the continental Asiatic forms are usually narrow and long-acuminate.

Though I did not see good specimens of *S. merrillii*, I scarcely doubt its conspecificity with the present species; the only difference, according to HILL's description, is apparently the pubescence of twigs, leaves, and the outside of the corolla.

The nearest relative of *S. colubrina* is apparently *S. quadrangularis*, different by the glabrous pistil and seed.

12. *Strychnos quadrangularis* HILL, Kew Bull. (1917) 205; RIDL. Fl. Mal. Pen. 2 (1923) 426; BURK. Dict. (1935) 2099.

Climbing shrub or liana. Twigs slender, mostly sharply quadrangular, glabrous; branches rounded quadrangular. *Leaves* (ovate-)oblong to elliptic, 13–20 by 5½–11 cm, thin-chartaceous to papyraceous, glabrous, beneath copper-coloured to yellowish brown or green when dried, base cuneate to rounded, apex (caudate-)acuminate; 3–5-plinerved; petiole 4–5 mm. *Inflorescences* axillary, 4–6 cm long, laxly branched, fairly many-flowered, minutely pubescent. *Sepals* broadly ovate, acute, glabrous on either side. *Corolla* small; *stamens* unknown. *Pistil* glabrous. *Fruits* globular, c. 2 cm ø, said to be white. *Seed* 1, semiglobular, c. 1 cm ø and 8 mm thick, glabrous.

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

Ecol. Dense jungle, from the lowland to above 1000 m. *Fr.* Sept.

Uses. The bark of the roots is used for arrow-poison. See BURKILL, l.c.

Vern. *Akar ipoh chelak*, *a.i. padi*, *a.i. siat gunong*, *a.i. tontong*, *ipoh aker*.

Note. Inadequately known, doubtless closely related to *S. colubrina*, mainly different by the glabrous pistil and seed, both characters being usually constant.

13. *Strychnos borneensis* LEENH. Bull. Jard. Bot. Brux. 32 (1962) 458.—*S. laurina* (non DC.) HEINE, Pfl. Samml. Clemens Kinabalu (1953) 90.—Fig. 32.

Liana. Twigs glabrous; branchlets (yellowish) brown, smooth or scabrous by many small lenticeles. *Leaves* oblong or elliptic-oblong, 7½–9½ by 3–4 cm, chartaceous, glabrous, base cuneate, slightly attenuate, apex gradually to caudate acute-acuminate, acumen up to 1½ cm; 3–5-plinerved, nerves diverging at or slightly above the base, distinct, not far from the margin, venation dense, transverse; petiole 6–7 mm. *Inflorescences* axillary, 2–7 cm long, larger ones long-peduncled and with a pair of strong branches at the base, laxly branched, relatively few-flowered, at least the terminal parts fairly densely rusty tomentose. *Calyx* 1½–1¾ mm, inside sometimes at the base with a line of erect hairs, sepals ovate, rounded to nearly truncate. *Corolla* c. 9 mm long, halfway connate, very thin, outside glabrous, inside densely woolly from slightly above the base to about halfway the lobes, most densely so in the mouth. *Stamens* inserted in the mouth, filament 1¼–2½ mm long, glabrous, anthers elliptic to lanceolate, 1¼–1¾ mm long, minutely apiculate, glabrous or with a few hairs at the base of the cells. *Pistil* 8–9 mm, fairly densely shaggy short-hairy from about halfway the ovary upwards. *Fruit* (possibly not quite normal and galled!) on a strongly thickened branch, globular, c. 2 cm ø, slightly scabrous. *Seeds* unknown.

Distr. *Malaysia*: North Borneo.

Ecol. Forests, from sea-level to c. 1600 m. *Fl.* Nov.–Jan.

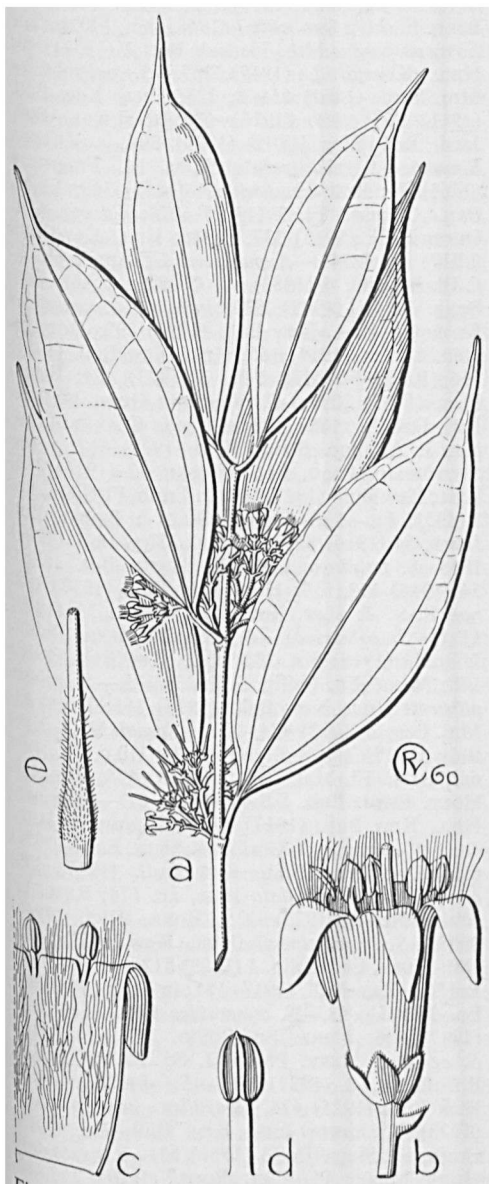


Fig. 32. *Strychnos borneensis* LEENH. a. Habit, $\times \frac{2}{3}$, b. flower, $\times 4$, c. opened corolla, $\times 4$, d. stamen, $\times 8$, e. pistil, $\times 4$ (all from PUASA 4190).

Vern. *Bina, kabuh*.

Note. A characteristic species, possibly related to *S. polytrichantha*, but differing by the corolla of which the tube is about half the total length. The leaves are very similar to those of *S. vanprukii* CRAIB (Siam).

14. *Strychnos ledermannii* GILG & BENED. Bot. Jahrb. 54 (1916) 169; HILL, Kew Bull. (1917) 179.

Liana. Twigs subglabrous; branchlets grey, smooth. *Leaves* ovate to oblong-elliptic, 7–13 by 3–5½ cm, coriaceous to chartaceous, glabrous, base cuneate to broadly rounded, apex gradually acute-acuminate; 5–7-plinerved above the base, nerves irregular, venation coarse; petiole 5–7 mm. *Inflorescences* axillary and terminal, laxly branched, up to c. 5 cm long, few-flowered, subglabrous. *Flowers* seen in bud only. *Calyx* 1 mm, sepals elliptic to broadly ovate, blunt, glabrous on both surfaces. *Corolla* 3 mm, halfway up connate, outside glabrous, inside woolly about the mouth. *Stamens* inserted in or slightly below the mouth, anthers sessile, elliptic, ¾–1 mm, glabrous. *Pistil* 2¼ mm, with some patent long hairs on the style. *Fruit* unknown.

Distr. *Malaysia*: New Guinea (NE. New Guinea, Etappenberg).

Ecol. Dense forest, 850 m. *Fl.* Oct.

Notes. HILL, who did not see any specimen, placed this incorrectly in his section *Penicillatae*.

The only one of the syntypes apparently still preserved, LEDERMANN 9435 (dupl. in K, L), I have indicated as lectotype.

15. *Strychnos lanceolaris* MIQ. Sum. (1861) 551 & 227; HILL, Kew Bull. (1911) 295.

Probably a liana. Twigs glabrous; branchlets yellowish, scabrous. *Leaves* lanceolate, 6½–9 by 2–2½ cm, coriaceous, glabrous, base acute, apex caudate-acuminate, acute; 3-plinerved above the base, nerves usually not far from the margin, veins transverse, minute, and dense; petiole 4–6 mm. *Inflorescences* axillary, lax, c. 2½ cm long, narrow and with few flowers, thinly tomentose. *Calyx* 1½ mm, outside sparsely pubescent, inside glabrous. *Corolla* 3 mm, halfway up connate, outside very sparsely pubescent, inside with some short woolly hairs near the apex. *Stamens* inserted in the mouth, filaments short, glabrous, anthers broad-ovate, ½ mm long, apiculate, slightly barbate. *Pistil* 2 mm, sparsely pubescent. *Infructescences* with strongly thickened branches, torus 1 cm thick. *Fruits* probably large and many-seeded.

Distr. *Malaysia*: Sumatra.

Vern. *Tēmēras akar*.

Note. A species of unclear relationships.

16. *Strychnos flavescens* K. & G. J. As. Soc. Beng. 74, ii (1908) 617; HILL, Kew Bull. (1917) 155; RIDL. Fl. Mal. Pen. 2 (1923) 423.

Liana. Twigs usually glabrous, sometimes sparsely minutely pubescent; branchlets whitish yellow-brown, fairly smooth. *Leaves* elliptic-lanceolate to ovate-oblong, 5–12 by 3–6½ cm, thin-chartaceous to coriaceous, glabrous, very glossy light yellow-green when dried, base cuneate to subcordate, slightly attenuate, apex gradually acuminate, more or less caudate, acute; 3-plinerved at the base, nerves near the margin, distinctly more faint than the midrib; petiole ½–1 cm. *Inflorescences* terminal and axillary, up to 10 cm long, laxly branched, many-flowered, sparsely minutely pubescent. *Flowers* (4–)5-merous. *Calyx* 1 mm, outside with some scattered hairs, inside

glabrous, sepals ovate, blunt. *Corolla* 2–3 mm, halfway connate or somewhat less, outside thinly tomentose, inside about the mouth woolly or fully glabrous; lobes often strongly thickened. *Stamens* inserted in the mouth, anthers subsessile, ovate, $\frac{1}{2}$ – $\frac{2}{3}$ mm, minutely apiculate, glabrous or barbate. *Pistil* $1\frac{1}{2}$ –2 mm, glabrous or the style slightly hairy. *Fruits* many, subglobose, c. $1\frac{1}{2}$ –2 cm \emptyset , smooth or slightly warty. *Seeds* 1 or 2, lenticular, 14–16 by $11\frac{1}{2}$ mm, thin.

Distr. *Malaysia*: Malay Peninsula, Banka.

Ecol. Swampy forests, along streams, at low altitudes. *Fl.* April–May, Nov.

Vern. *Akar kalikut, kĕlikuh*, Banka.

17. *Strychnos luzonensis* ELM. Leaf. Philip. Bot. 1 (1908) 332, p.p.; em. HILL, Kew Bull. (1911) 297; *ibid.* (1917) 180, cum fig.; MERR. En. Philip. 3 (1923) 312, p.p.

Scandent shrub. Twigs thinly, minutely pubescent. *Leaves* oblong-ovate, $7\frac{1}{2}$ –10 by $3\frac{1}{2}$ –4 cm, thin-chartaceous, midrib on both sides slightly pubescent near the base or glabrous beneath; base rounded, attenuate, apex tapering acute-acuminate; 3–5-plinerved; petiole $7\frac{1}{2}$ mm. *Inflorescences* terminal, with a pair of strong branches in the upper leaf-axils, c. 5–7 cm long, lax, many-flowered, thinly short-pubescent. *Calyx* 1 mm, outside subglabrous, inside glabrous, sepals ovate, blunt to acute. *Corolla* $2\frac{1}{2}$ mm, tube 1 mm, lobes thickened towards the apex, inside with a line of erect, bristle-like hairs about halfway the free lobes (these hairs sometimes missing in older flowers!). *Stamens* inserted in the mouth, filaments $\frac{1}{2}$ mm, glabrous, anther broad-ovate (subquadrangular), $\frac{1}{2}$ mm, apiculate, slightly barbate. *Pistil* $1\frac{1}{2}$ mm, thinly pubescent. *Fruit* unknown.

Distr. *Malaysia*: Philippines (Luzon), once collected.

Ecol. Humid forest, 500 m. *Fl.* May.

Notes. The combination of a short corolla-tube and a line of erect bristle-hairs is unique among the Malaysian species.

As mentioned already by HILL, ELMER included in his original description two different elements; the above description has been based exclusively upon ELMER 8251, in accordance with HILL's emendation. The other specimen, ELMER 7885, is here referred to *S. colubrina*.

Vegetatively, *S. luzonensis* closely resembles *S. ovata*; the latter species is *inter alia* different by the glabrous twigs and the often blunt leaves with the nerves closer to the margin.

18. *Strychnos axillaris* COLEBR. Trans. Linn. Soc. 12 (1819) 356, t. 15; WALL. in Roxb. Fl. Ind. 2 (1824) 266; BL. Bijdr. (1826) 1019; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 89; HILL, Kew Bull. (1917) 169.—*S. malaccensis* BTH. J. Linn. Soc. Bot. 1 (1856) 101; GAMBLE, J. As. Soc. Beng. 74, ii (1908) 618; HILL, Kew Bull. (1917) 177; RIDL. Fl. Mal. Pen. 2 (1923) 425.—*S. horsfieldiana* MIQ. Fl. Ind. Bat. 2 (1857) 379; HILL, Kew Bull. (1911)

294, cum fig.; *ibid.* (1917) 179; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 7.—*S. monosperma* MIQ. Fl. Ind. Bat. 2 (1857) 381; HILL, Kew Bull. (1917) 207.—*S. palembanica* MIQ. Sum. (1861) 551 & 227; HILL, Kew Bull. (1911) 293; *ibid.* (1917) 179; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 304, excl. spec. Simalur.—*S. psilosperma* F. v. M. Fragm. 4 (1863) 44; BTH. Fl. Austr. 4 (1869) 369; F. M. BAIL. Queensl. Fl. 3 (1900) 1024; Compr. Cat. Queensl. Pl. (1913) 337, f. 316; HILL, Kew Bull. (1917) 171 & 341.—*S. pubescens* CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 89; GAMBLE, J. As. Soc. Beng. 74, ii (1908) 620, incl. var. *scortechinii* K. & G.; HILL, Kew Bull. (1911) 292; DOP, Fl. Gén. I.–C. 4 (1914) 165; HILL, Kew Bull. (1917) 166; RIDL. Fl. Mal. Pen. 2 (1923) 424; BURK. Dict. (1935) 2098.—*S. pilgeriana* GILG, Notizbl. Berl.-Dahl. 1 (1897) 268.—*S. rufa* CLARKE; GAMBLE, J. As. Soc. Beng. 74, ii (1908) 617, p.p.—*S. schmidtii* GILG, Bot. Tidsskr. 32 (1915) 312; HILL, Kew Bull. (1917) 170; in Craib, Fl. Siam. En. 3 (1951) 61.—? *S. oophylla* GILG & BENED. Bot. Jahrb. 54 (1916) 170, f. 6; HILL, Kew Bull. (1917) 181.—*S. polytoma* GILG & BENED. Bot. Jahrb. 54 (1916) 173, f. 7; HILL, Kew Bull. (1917) 182; non KAN. & HAT. Bot. Mag. Tokyo 53 (1939) 11 (= *S. colubrina*).—*S. wenzelii* MERR. Philip. J. Sc. 11 (1916) Bot. 202; HILL, Kew Bull. (1917) 178; MERR. En. Philip. 3 (1923) 313.—*S. quintuplinervis* HILL, Kew Bull. (1917) 166; RIDL. Fl. Mal. Pen. 2 (1923) 424.—*S. robinsonii* HILL, Kew Bull. (1917) 168.—*S. scortechinii* HILL, l.c., cum fig.; RIDL. Fl. Mal. Pen. 2 (1923) 425; BURK. & HOLT. Gard. Bull. S.S. 3 (1923) 61.—*S. armata* HILL, Kew Bull. (1917) 170.—*S. plumosa* HILL, l.c. 171, cum fig.; in Craib, Fl. Siam. En. 3 (1951) 60.—*S. arborea* HILL, Kew Bull. (1917) 172, cum fig.—*S. penicillata* HILL, l.c. 178; RIDL. Fl. Mal. Pen. 2 (1923) 425; BURK. Dict. (1935) 2098.—*S. impressinervis* HILL, Kew Bull. (1917) 180; MERR. En. Philip. 3 (1923) 312.—*S. mucronata* HILL, Kew Bull. (1917) 181; in Craib, Fl. Siam. En. 3 (1951) 58.—*S. tesseroidea* HILL, Kew Bull. (1917) 206; MERR. En. Philip. 3 (1923) 313.—*S. cenabrei* MERR. Philip. J. Sc. 20 (1922) 433; En. Philip. 3 (1923) 312.—*S. viridiflora* HILL, Kew Bull. (1925) 424, nom. illeg., non DE WILD. (1923).—*S. kawbet* HILL, Kew Bull. l.c. 425; in Craib, Fl. Siam. En. 3 (1951) 58.—*S. ovata* (non HILL) MERR. Pl. Elm. Born. (1929) 252.—*S. chloropetalata* HILL, Kew Bull. (1930) 175; HENDERS. J. Mal. Br. R. As. Soc. 17 (1939) 58; HILL in Craib, Fl. Siam. En. 3 (1951) 57.—*Strychnos* sp. HILL in Craib, Fl. Siam. En. 3 (1951) 62.—Fig. 30g.

Usually a liana, sometimes a shrub or small tree. Twigs densely to sparsely minutely pubescent and glabrescent or glabrous; axillary spines sometimes present. *Leaves* rhomboid to suborbicular and elliptic to lanceolate, $1\frac{3}{4}$ –18 by 1–9 cm, chartaceous (rarely \pm herbaceous) to coriaceous, smooth to densely minutely warty on the lower surface, above glabrous to tomentose on the midrib and the bases of the nerves, beneath mainly on mid-

rib, nerves, and veins, sometimes sparsely all over the leaf; base cuneate to subcordate, often attenuate (in Australian specimens sometimes decurrent to the base of the petiole), apex tapering acute-acuminate to slightly emarginate, occasionally mucronate; 3-5-plinerved at the base; petiole $1\frac{1}{2}$ - $7\frac{1}{2}$ mm. *Inflorescences* axillary and/or terminal, 1-5 cm long, sessile or distinctly peduncled, dense to lax, always fairly many-flowered, densely minutely tomentose to glabrous. *Calyx* 1-2 mm, sepals ovate to suborbicular, acute to rounded, outside glabrous to densely tomentose, inside glabrous. *Corolla* 3-4 mm long, about halfway connate, lobes strongly thickened in their upper part, outside glabrous or very rarely sparsely tomentose, inside with a row of erect bristle-like hairs at the base of or up to halfway on the lobes. *Stamens* inserted at *c.* $\frac{1}{4}$ the length of the corolla below the hair ring, filaments short, glabrous, anthers (broadly) ovate, $\frac{2}{3}$ -1 mm long, usually minutely apiculate, barbate, rarely moreover ciliate all around. *Pistil* $1\frac{1}{4}$ -2 mm, glabrous. *Fruits* some to many, either oblique-ovoid, $1\frac{1}{2}$ -2 by $\frac{3}{4}$ - $1\frac{1}{4}$ cm, and slightly scabrous, or globular, $\frac{3}{4}$ - $1\frac{1}{2}$ cm \varnothing and smooth, pericarp thin, corneous. *Seeds* 1-2, either elliptic, $7\frac{1}{2}$ -15 by 6-10 by 3-5 mm, or orbicular, 6- $7\frac{1}{2}$ mm \varnothing .

Distr. Continental SE. Asia from Assam through Siam to Cochin-China, throughout Malaysia (except the Lesser Sunda Is.) to Australia (E. Queensland from about Innisfail to the MacPherson Range just over the NSW frontier).

Ecol. In and along primary and secondary forests, in dry as well as in swampy localities, sometimes on coastal rocks, up to 2000 m. *Fl.* mainly March-Aug., *fr.* Jan.-Dec.

Uses. In the Malay Peninsula apparently sometimes used for the composition of an arrow-poison.

Vern. *Akar kuling*, Sum., *akar bidara utan*, *a. ipoh*, *a. lada lada*, *bédara utara*, *bélai bésar*, *ipoh batang*, *i. burong*, *kio ngu*, *lep rawk*, *opoh batang*, Mal. Pen., *tjantèlan*, *J. tangang*, Born.; Philip.: *malaigasud*, S. L. Bis., (*mara*) *igasud*; *apu'u laáwan*, Talaud, *kebrai pakrik*, New Guinea.

Notes. This is the most variable species of the genus in Indo-Malaysia; it comprises a fairly large number of local races, most of them distinguished by HILL (1917 and later) as different, though related, species. In my opinion they can be treated only as local races as most of the differences between these forms are either gradual or concern vegetative characters only; the flowers are surprisingly uniform. Only the fruits - and accordingly the seeds - show two distinctly different forms which are geographically almost replacing one another: the oblique-ellipsoid, large fruits with large elliptic seeds are found in Asia and West Malaysia, reaching as far east as the Philippines ('*S. tesseroidea*') in the north and the Tanimbar Is. ('*S. horsfieldiana*') in the south; the smaller globular fruits with orbicular seeds are known from the Philippines, East Malaysia, and Australia. I do not set much value on these

fruit and seed characters as they do not correlate with others; besides from many forms no ripe and undamaged fruits are available.

The races can be arranged into four groups which possibly deserve the status of subspecies; part of the races may be subordinated as varieties; in the present state of our knowledge I prefer not to go too far into details.

These four groups are:

Group A. Spines often present. Leaves usually oblong to lanceolate, about rhomboid with the greatest width near the base, mostly thinly chartaceous, black when dried, smooth and usually glabrous; base broadly cuneate, apex acute; mostly 3-plinerved, veins inconspicuous or invisible. *Inflorescences* axillary, rarely more over terminal. Fruits oblique-ellipsoid. Seeds elliptic. Throughout Siam and Cochin-China, the Malay Peninsula, and Sumatra.

Especially the species distinguished by HILL in this group can only be separated either with great difficulty, or by characters which in my opinion are of very slight importance. '*S. armata*' is characterized by the spines which are more often present and more numerous than in the other forms; '*S. plumosa*' is the form with twigs which are most densely tomentose, but only '*S. schmidtii*' is fully glabrous. '*S. kawbet*' and '*S. chloropetala*' are nearly indistinguishable from '*S. plumosa*'.

Two forms deserve some more attention as they are the links with two other groups. They are the only representatives of group A in Malaysia. The first is '*S. scortechinii*' from Malaya, which is aberrant in this group by the pubescent leaves with the nerves diverging distinctly above the base, and which apart from the colour of the dried leaves could as well be included in group B. The second is '*S. quintuplinervis*' from Malaya and Sumatra, with larger and firmer leaves, more nerves, and coarser veins; it is intermediate between groups A and C.

Group B. Spineless. Greatest width of the leaf usually slightly below or about the middle, either rounded and attenuate, or very broadly cuneate towards the base, apex usually more or less distinctly acute-acuminate; mostly coriaceous and fairly stiff, the dried leaf olive- or yellowish-brown, apparently in most forms full of cystoliths, as the lower surface is often densely minutely warty; usually pubescent on the nerves beneath, often thinly pubescent all over the lower surface; 3-5-plinerved at some distance above the base, venation visible beneath, but minute and not conspicuous. *Inflorescences* axillary and/or terminal. Fruits oblique-ellipsoid, seeds elliptic. Assam, Malay Peninsula, Borneo, Palawan, Sumatra, Java, and Tanimbar Is. The main races distinguishable are:

S. axillaris sens. str. (incl. also *S. palembanica* and *S. horsfieldiana*), best characterized by the rarely absent pubescence in the axils of the nerves beneath; occurs in Assam, Malay Peninsula, Sumatra, Java, and the Tanimbar Is.; it is nearly indistinguishable from '*S. impressinervis*' from Palawan.

'*S. penicillata*', characterized by the distinctly densely and minutely warty lower surface of the leaves, with scattered appressed hairs, and by nearly exclusively terminal inflorescences, is restricted to the Malay Peninsula (apparently confined to Perak and P. Penang).

'*S. pubescens*' mainly differs from the preceding form in the lower surface of the leaves which is less rough, but with all the hairs inserted upon a larger and distinct wart; inflorescences are in Malayan specimens always axillary, in Bornean ones usually moreover terminal; it occurs in SW. Malay Peninsula (Singapore to Selangor) and Borneo.

'*S. malaccensis*', differing from '*S. penicillata*' mainly by the smooth and glabrous leaves which are thick and shining (those of '*S. penicillata*' are usually dull) occurs in the Malay Peninsula (Malacca and Singapore).

Group C. Spineless. Leaves on the average distinctly larger than in the preceding two groups, greatest width in or slightly below the middle, towards the base either slightly attenuate, or very broadly cuneate to rounded, apex acute or slightly acute-acuminate; firmly chartaceous, dried leaves usually shining brown to purplish-brown beneath, grey to purple-black above, smooth and glabrous; 3-5-plinerved, nerves diverging only slightly above the base, main veins transverse, strong, conspicuous beneath. Inflorescences axillary. Fruits globular and seeds orbicular as far as known. Borneo, Philippines, and Moluccas (Halmahera).

This group can be considered to represent one race; in HILL's classification it corresponds to '*S. wenzelii*'.

One specimen, PNH 12436, is aberrant by a row of hairs at the base inside the calyx.

Group D. Spines in Australian specimens sometimes present, in Malaysian ones absent. Leaves variable in shape, size, nervation, and colour, always coriaceous; base and apex very variable. Inflorescences variable, but often relatively large and lax. Fruits globular, seeds orbicular. East Malaysia and Australia.

This eastern group is morphologically less clearly defined than the other ones, yet it is not well possible to subdivide it into well defined races, like the first two groups.

Two specimens from Celebes represent the most western and morphologically also the most deviating form. They are characterized by large ovate leaves, with a subcordate base and a blunt apex, and by axillary, laxly branched inflorescences c. 5 cm long, with a peduncle of about 2 cm. These specimens show also some relationship to '*S. wenzelii*' (group C).

'*S. robinsonii*' (Celebes and Ambon) and '*S. polytoma*' (New Guinea) are more or less intermediate between these specimens from Celebes and the Australian races.

The Australian races '*S. psilosperma*' and '*S. arborea*' are both characterized by the (apparent) absence of tendrils, the occasional presence of spines, and furthermore by the fairly small, mucronate leaves. '*S. psilosperma*' is the

more variable race and is distributed all over the area in Australia (moreover, part of the New Guinean specimens are nearly identical); its leaves are usually greenish when dried, they are mostly 5-plinerved and thus relatively broad; its inflorescences are mainly terminal, large, and lax. '*S. arborea*' is restricted to the vicinity of Brisbane; the dried leaves are dark-brown, and usually 3-plinerved, the base is cuneate and decurrent to near the base of the petiole; the inflorescences are mainly axillary, small, and dense.

It is surprising that these Australian races, occupying the southeastern part of the specific range, are, apart from the fruits (those are, however, unknown from most Asiatic forms), nearly indistinguishable from the continental Asiatic forms which occupy the northwestern part of the vast area of this species.

I am not quite certain about the identity of *S. oophylla*. The type is apparently lost; I saw two specimens, which I think represent *S. oophylla* (BECCARI sheet n. 6659, Fr; NGF 11008, L), but these two specimens are different from '*S. polytoma*', the common New Guinean race of *S. axillaris* to which I have referred them with some doubt. According to the original diagnosis the corolla of *S. oophylla* would be only 1½ mm long, but from the figure it is clear that the flowers were in bud.

19. *Strychnos ridleyi* K. & G. J. As. Soc. Beng-74, ii (1908) 621; *non* DOP, Bull. Soc. Bot. Fr. 57, Mém. n. 19 (1910) 16 and Fl. Gén. I.-C. 4 (1914) 165 (p.p. = *S. axillaris*); HILL, Kew Bull. (1917) 167; RIDL. Fl. Mal. Pen. 2 (1923) 424.

A climbing shrub. Twigs thinly pubescent. Leaves oblong, rarely ovate-oblong, 8-10 by 4-4½ cm, thin-chartaceous, glabrous except for small tufts in the nerve-axils beneath, base broadly cuneate to rounded, apex gradually acuminate, acumen short, broad, and acute; 3-plinerved from the base, veins obliquely transverse; petiole 6-11 mm. Inflorescences axillary, 1½-2 cm long (peduncle ¾-1 cm), few-flowered, peduncle fairly densely, the other parts thinly pubescent. Calyx 1 mm, sepals suborbicular, acute, outside glabrous, inside fairly densely appressed short-hairy. Corolla 4 mm, up to 2½ mm connate, inside with a whorl of erect, bristle-like hairs at the base of the lobes and fairly densely, shortly, patently hairy above this whorl. Stamens inserted halfway the corolla-tube, anthers subsessile, broadly ovate, c. 0.8 mm long, bearded. Pistil 1½ mm, glabrous. Fruit unknown.

Distr. *Malaysia*: Malay Peninsula (Singapore only).

Ecol. Fl. May.

Note. Doubtless related to *S. axillaris*, but distinctly different by the calyx and the corolla-lobes which are pubescent inside.

Insufficiently known

Probably good species, but flowers unknown.

20. *Strychnos rufa* CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 89; GAMBLE, J. As. Soc. Beng. 74, ii (1908) 617, p.p.; HILL, Kew Bull. (1917) 203; RIDL, Fl. Mal. Pen. 2 (1923) 426.

Large liana. Twigs patently rufous-hairy. *Leaves* ovate to oblong, 9–16½ by 4–6½ cm, papyraceous to chartaceous, above minutely pubescent mainly on the midrib and the basal half of the nerves, beneath sparsely patently pubescent all over the surface, more densely so on nerves and veins, moreover fairly densely minutely warty; base rounded to faintly cordate, apex gradually acute-acuminate; 3- to faintly 5-plinerved at the base; petiole 3–4 mm. *Flowers* unknown, according to the collector small and yellow. *Infructescences* axillary, c. 2 cm long, with thick branches and strongly broadened torus, pubescent like the twigs; 1 or few fruits. *Fruits* globular, c. 3½–4 cm ø, red. *Seeds* many, elliptic, flattened, 19 by 12½ mm.

Distr. *Malaysia*: Malay Peninsula (Selangor, Malacca).

Ecol. Mountain forest.

Uses. Dart-poison.

Vern. *Akar ipoh tanah*.

Note. The pubescence and the warty lower surface of the leaf remind of *S. axillaris* ('*penicillata*'), but the shape and size of the leaves, and above all the large and many-seeded fruits are quite different. The latter might point to alliance with *S. ignatii*.

21. *Strychnos thorelii* PIERRE ex DOP, Bull. Soc. Bot. Fr. 57, Mém. n. 19 (1910) 20; Fl. Gén. I.–C. 4 (1914) 171, t. 3 f. 11–13; HILL, Kew Bull. (1917) 207; in Craib, Fl. Siam. En. 3 (1951) 62.

Liana. Twigs thinly patently pubescent, glabrescent. *Leaves* oblong-ovate to lanceolate,

4½–10 by 2–4 cm, chartaceous to coriaceous, shining above, sometimes sparsely patently hairy on the midrib beneath, otherwise glabrous; base broadly cuneate to subcordate, slightly attenuate, apex gradually acute-acuminate; 3–5-plinerved above the base; petiole ½–1 cm, pubescent. *Infructescences* axillary and terminal, up to c. 10 cm long, lax, minutely pubescent, with some fruits only, branches slender, torus somewhat broadened. *Fruits* ovoid to oblong-ellipsoid, 2½ by 1½ cm, thin-shelled. *Seed* 1, elliptic-lenticular, 2 by 1¼ cm.

Distr. Cochín-China, Siam, and Burma, in *Malaysia*: northern part of the Malay Peninsula.

Ecol. In and along evergreen and bamboo forests, up to c. 200 m. *Fr.* March–April.

Note. I have designated as a lectotype PIERRE 1703 (P) (erroneously cited as 1702 by DOP).

Dubious

No material seen, description insufficient.

Strychnos melanocarpa GILG & BENED. Bot. Jahrb. 54 (1916) 172; HILL, Kew Bull. (1917) 181.

Distr. NE. New Guinea (Sepik, Malu).

From the description it is not clear whether the indument in the mouth consists of one row of bristle-like hairs or is woolly. In the first-named case this species would be closely related to *S. axillaris* (different, however, by the hairy ovary), otherwise it might be identical with *S. colubrina*.

Excluded

Strychnos grandis WALL. Cat. (1831) n. 4454, *nom. nud.* = *Anisophyllea grandis* (BTH.) BURK. (*Rhizophoraceae*).

6. GARDNERIA

WALL. in Roxb. Fl. Ind. 1 (1820) 400; LEENH. Bull. Jard. Bot. Brux. 32 (1962) 431.—Fig. 33.

Mostly climbing or creeping, glabrous shrubs. Twigs terete, sometimes with 4 faint ridges. *Leaves* petioled, connected by interpetiolar stipular rims; at the base of the new shoots a number of persistent, acute-triangular bud-scales. *Infructescences* axillary, dichasial, usually few-flowered or flowers solitary, sometimes lax and many-flowered; bracts narrowly triangular, 1–2 mm long. *Flowers* long-pedicelled, 4–5-merous. *Calyx* small, deeply lobed, lobes rounded, sometimes acuminate, shortly ciliate, for the rest glabrous, inside with colleters at the base. *Corolla* rotate, thin-fleshy, creamy to yellow, lobes valvate in bud. *Stamens* exserted, filaments very short, flat; anthers bifid at the base, introrse, 4- or 2-celled (if 4-celled the outer cells much bigger than the central ones). *Pistil* glabrous; ovary small, 2-celled, with 1–4 ovules per cell; style mostly long and slender; stigma capitate to 2-parted. *Berry* globular, red. *Seeds* 1 or more, elliptic to orbicular, concave on the hilar side, convex on the other; testa thin, endosperm thick, cartilaginous.

Distr. Five species in SE. and E. Asia, from India to Central Japan and Java; in *Malaysia* 1 species.

Note. The relationship of this genus is clearly with *Strychnos*.

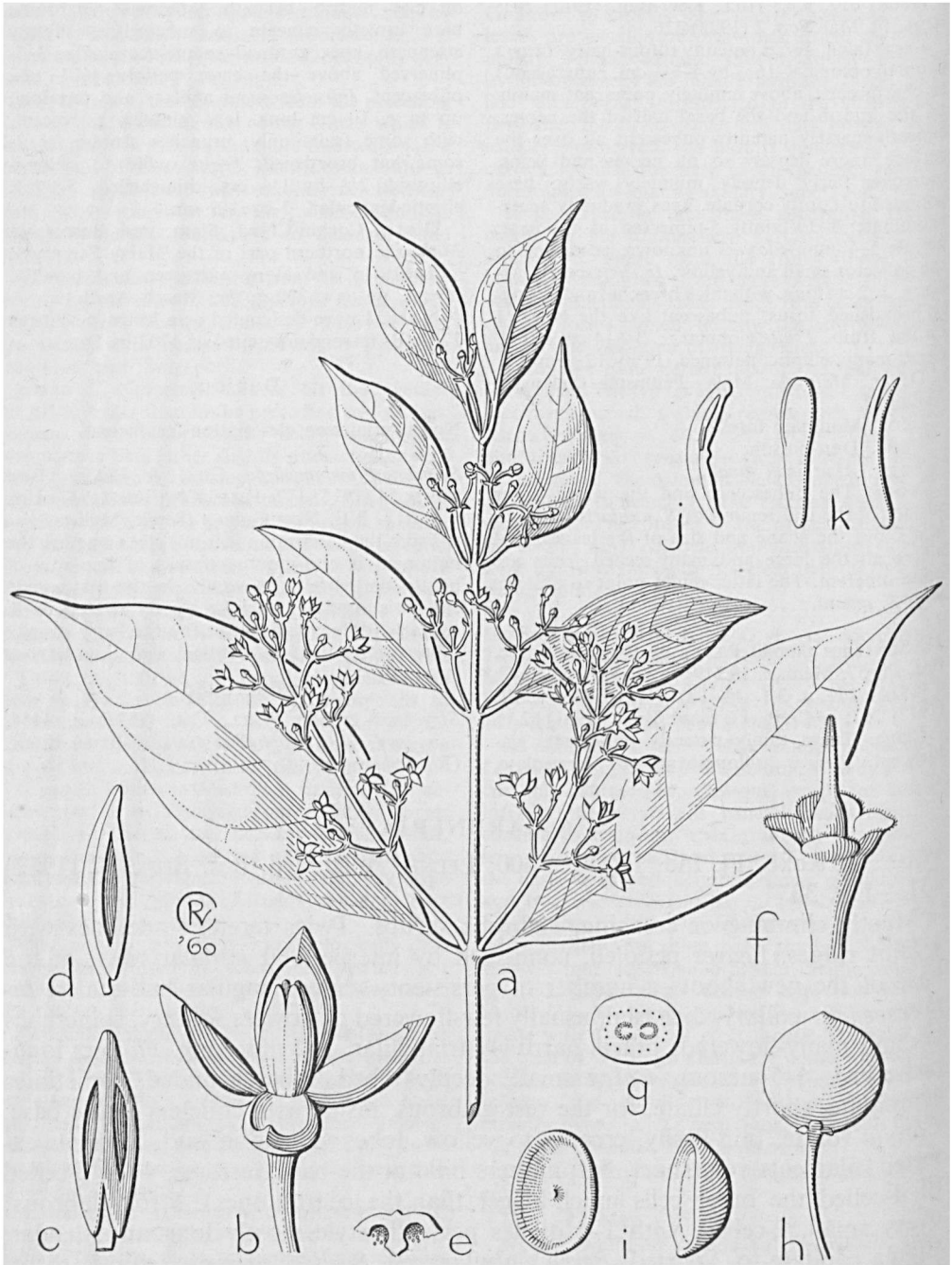


Fig. 33. *Gardneria ovata* WALL. *a.* Habit, $\times \frac{2}{3}$, *b.* flower (note the cohering anthers), $\times 3\frac{1}{2}$, *c.* anther, 2-celled, $\times 6$, *d.* ditto, lateral view, $\times 6$, *e.* ditto, cross-section, $\times 6$, *f.* calyx with pistil, $\times 8$, *g.* ovary in cross-section, showing the two ovules, $\times 16$, *h.* fruit, $\times 1\frac{1}{2}$, *i.* seeds, $\times 2$, *j.* ditto in length-section showing the small embryo embedded in the endosperm, $\times 2$, *k.* embryo, frontal and lateral view, $\times 4$ (*a* herb. L 908.127-599, *b-g* sine coll., *s.n.* in herb. E, *h-k* HENRY 10906).

1. *Gardneria ovata* WALL. in Roxb. Fl. Ind. 1 (1820) 400; Pl. As. Rar. 3 (1832) 17, t. 231; BUREAU, Fam. Logan. (1856) f. 32-34; Bth. J. Linn. Soc. Bot. 1 (1856) 109; KURZ, Fl. Burm. 2 (1877) 227; RACIBORSKI, Rozpr. Wydz. Mat.-Przyrod. Ak. Umiej. Krak. 32 (1896) 315, f. 1-5; Bull. Int. Ac. Sc. Cracovie (1896) 206; GAMBLE, Fl. Madras 5 (1923) 869; KANJILAL & DAS, Fl. Assam 3 (1939) 320; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 9; KERR in Craib, Fl. Siam. En. 3 (1951) 63; LEENH. Bull. Jard. Bot. Brux. 32 (1962) 437.—*G. wallichii* WIGHT ex WALL. Pl. As. Rar. 3 (1832) 49, t. 281.—Fig. 33.

Vine or shrub. *Leaves* (ovate or) oblong to lanceolate, 6-13(-16) by 2¼-5½(-8) cm, chartaceous to thin-coriaceous, acute and slightly decurrent at the base, gradually acute-acuminate to caudate and sometimes mucronulate; nerves 4-10 pairs. *Inflorescences* erect to pendulous, 4-8 cm long, 1-3-flowered to laxly thyrsoid and more-

flowered, sometimes with a serial solitary flower in the same axil; peduncle ¾-2 cm, pedicels ½-2 cm, bibracteolate. *Flowers* 4-merous. *Sepals* ¾-1½ by 1½-2 mm. *Corolla* yellow to orange, waxy, tube ½-1½ mm long, lobes ovate to elliptic, acute, inside papillose-pubescent, 3-4½ mm. *Stamens* inserted just above the base of the corolla-tube (rarely halfway), anthers cohering mutually, erect, broadly ovate or elliptic to ovate-lanceolate, 1½-4 mm long, truncate, 2-celled. *Ovary* ½-1½ mm, tapering into the ½-2 mm long style, stigma faintly 2-4-lobed to 2-parted. *Ovules* 1 per cell. *Berry* ¾ cm ø, 1- or 2-seeded. *Seeds* orbicular, ½ cm ø, smooth, dull grey.

Distr. NE. and SE. India, Ceylon, Yunnan, Siam, and *Malaysia*: N. Sumatra (Tapanuli) and W. Java (Preanger: Tjadas Malang), twice collected.

Ecol. Along forest edges and climbing over limestone rocks, at 50-2250 m. *Fl.* March-June, *fr.* May-Nov.

7. NEUBURGIA

BLUME, Mus. Bot. 1 (1850) 156; MARKGRAF, Bot. Jahrb. 61 (1927) 222.—*Couthovia* A. GRAY, Proc. Am. Ac. Arts Sc. 4 (1859) 324.—*Crateriphytum* SCHEFF. ex KOORD. [Nat. Tijd. N.I. 55 (1896) 345, *nom. nud.*] Med. Lands Pl. Tuin 19 (1898) 540.—Fig. 34-35.

Trees or shrubs; branches glabrous. Lateral branches mostly up to c. 1 cm high coalescent with the main branch (fig. 34i). *Stipules* interpetiolar, adnate to the petioles, obdeltoid, in older leaves often split along a distinct suture. *Leaves* petioled to sessile; midrib often forked towards the apex, venation obscure. *Inflorescences* terminal, thyrsoid, the ends cincinnate; bracts semi-amplexicaulous, scale- to ridge-like, minute, ciliate. *Flowers* sessile, 5-merous. *Sepals* confluent at base, suborbicular, mostly ciliate, inside at the base often with hairs and/or ciliolers. *Corolla* rotate to salver-shaped, white, tube thin-fleshy, the valvate lobes thicker; with a hair ring in the mouth, inner surface of the tube either glabrous or hairy. *Stamens* inserted on the upper half of the corolla-tube, usually just below the mouth, included; filaments strap-shaped, usually very short, glabrous; anthers introrse, 2-celled, cells up to about halfway free, the apices mostly, the bases sometimes ending in a short sterile tip, the latter often, the former rarely bearded. *Pistil* mostly glabrous; ovary 2-celled with ∞ ovules on a strongly thickened placenta; style early caducous; stigma always about reaching the mouth, mostly ± ellipsoid, ½-¾ mm high, faintly grooved, hollow (in *N. sarcantha* broadly truncate). *Fruits* drupaceous, mesocarp dry, rather hard and very fibrous, these fibres originating from the woody, rugose stone; cells slenderly spindle-shaped, slightly curved. *Seed* one per cell (and usually only one per fruit), slenderly spindle-shaped.

Distr. About 10-12 *spp.*, in *East Malaysia* (from the Philippines and Celebes to New Guinea), Carolines, Solomons, New Hebrides, New Caledonia, and the Fiji Is. Cf. LEENH. Pac. Pl. Areas 38.

Ecol. Shrubs or small to medium-sized trees in the undergrowth or substage of primary, rarely secondary forests, rarely canopy trees, often in marshy or temporarily drained localities, largely confined to everwet lowland. The clustered, small, white, scented flowers probably attract insects. Once it has been stated that the fruits were eagerly eaten by pigeons, but the rather dry, thick, corky mesocarp and the hard pyrene make the impression that they are normally dispersed by water.

Notes. *Neuburgia* was assigned by BLUME to the *Apocynaceae*; he mentioned two species, *N. tuber-*

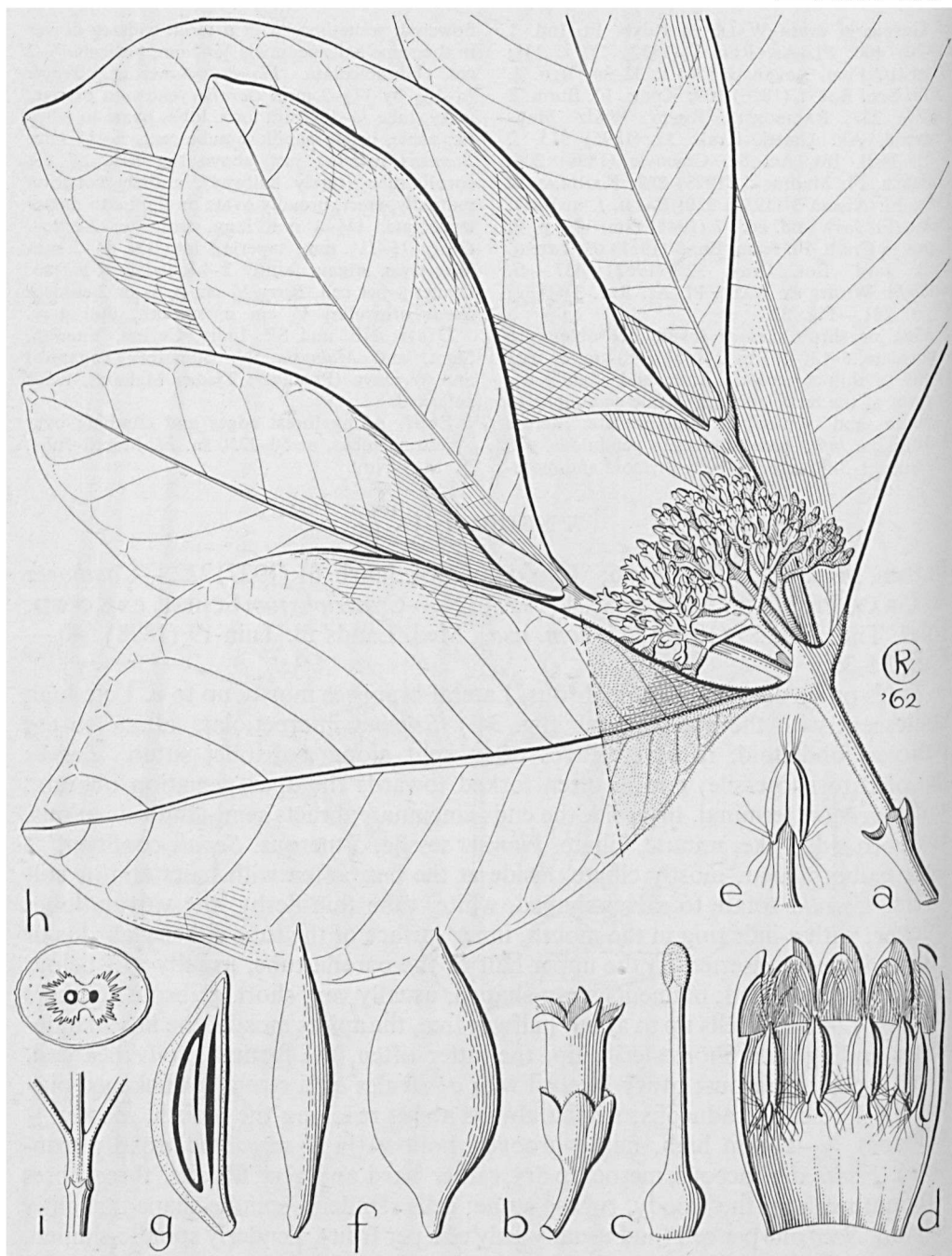


Fig. 34. *Neuburgia rumphiana* LEENH. a. Habit (part of leaf showing the indumentum on the lower side), $\times \frac{2}{3}$, b. flower, $\times 2$, c. pistil, $\times 6$, d. opened corolla, $\times 6$, e. stamen, $\times 6$, f. lateral and frontal view of fruit, $\times 1$.—*N. moluccana* (BOERL.) LEENH. g. Longitudinal section of fruit, showing the one-seeded fertile cell and the sterile one, $\times 1$.—*N. celebica* (KOORD.) LEENH. h. Cross-section of fruit (note the corkmesocarp, the woody putamen, the two cells, one of which is fertile, and the soft tissue in the centre), $\times 1$.—*N. corynocarpa* (A. GRAY) LEENH. i. Detail of branching, showing the coalescence between the lateral branches and the main branch, $\times \frac{2}{3}$ (a–e LAM 7787, f BW 7526, g Hort. Bot. Bog. IV-E-92, h FRI Cel III-40, i SAUNDERS 195).

culata and *N. tubiflora*. MARKGRAF, *l.c.*, transferred the genus to the *Loganiaceae*; he already suggested the identity with *Crateriphytum*. MERRILL (J. Arn. Arb. 23, 1942, 416) typified the genus by *N. tubiflora*.

KOORDERS already realized the close relationship between the monotypic *Crateriphytum* (= *N. moluccana*) and *Couthovia*. Of the two main generic differences he mentioned, the long corolla-tube provided with a rim in the mouth, shared also by *N. tubiflora*, is still a conspicuous character, but I cannot attach generic value to it; the rim is much less conspicuous than depicted by him.

CAMMERLOHER (Bull. Jard. Bot. Btzg III, 5, 1923, 306) laid special stress on a supposed third difference, the 2-lobed stigma which is also clearly depicted by KOORDERS. However, this appears to be an artefact sometimes caused by the pressing of herbarium specimens; the stigma is slightly grooved and hollow when mature, it ruptures fairly easily when pressed, and the papillae are of course found on the outside of the 'lobes'; in many young fruits I found an undamaged unlobed stigma!

KEY TO THE SPECIES

1. Corolla-tube c. 1½ cm long.
2. Corolla-tube inside glabrous. Leaves broadly elliptic to obovate, 17½–30 by 11–22 cm. Nerves 6–8 pairs 6. *N. moluccana*
2. Corolla-tube inside hairy except at the base. Leaves oblong-obovate, 16–20 by 8–10 cm. Nerves 4–6 pairs 7. *N. tubiflora*
1. Corolla-tube less than 1 cm long.
3. Style 4½–6 mm. Calyx 2¾–4 mm high. Corolla 8–10 mm.
4. Leaves about orbicular. Corolla-tube inside laxly hairy from the insertion of the stamens to the mouth. Anthers glabrous. Stigma broadly truncate 2. *N. sarcantha*
4. Leaves lanceolate to elliptic. Corolla-tube inside glabrous. Anthers bearded. Stigma club-shaped to ovoid 4. *N. rumphiana*
3. Style up to 1½ mm. Calyx up to 2½ mm high. Corolla up to 6 mm.
5. Leaves thick and stiff, coriaceous when dry 1. *N. corynocarpa*
5. Leaves thin, papyraceous to thin-pergamentaceous when dry.
6. Leaves elliptic to lanceolate, tapering at both ends, midrib reaching the apex. Fruit 5–6 cm long, acute 3. *N. kochii*
6. Leaves broad-elliptic to broad-obovate, blunt at the apex, midrib forked near the apex. Fruit 3½–4 cm long, blunt 5. *N. celebica*

1. *Neuburgia corynocarpa* (A. GRAY) LEENH. *nov. comb.*—*Couthovia corynocarpa* A. GRAY, Proc. Am. Ac. Arts Sc. 4 (1859) 324; SEEMANN, Fl. Vit. (1866) 165, t. 32; GILLESPIE, Bull. Bish. Mus. n. 83 (1931) 28, f. 35; A. C. SMITH, Sargentia 1 (1942) 102.—*Couthovia seemanni* A. GRAY, Proc. Am. Ac. Arts Sc. 5 (1862) 320; GILLESPIE, Bull. Bish. Mus. n. 83 (1931) 29, f. 36.—*Couthovia densiflora* K. SCH. Bot. Jahrb. 9 (1887) 215; GILG & BENED. *ibid.* 54 (1916) 178.—*Couthovia rhynchocarpa* GILG & BENED. *l.c.* 176.—*Couthovia terminalioides* GILG & BENED. *l.c.* 177.—*Couthovia pachypoda* GILG & BENED. *l.c.* 178, f. 8.—*Couthovia brachyura* GILG & BENED. *l.c.* 179; LANE-POOLE, For. Res. (1925) 134.—*Couthovia nymanii* GILG & BENED. Bot. Jahrb. 54 (1916) 180.—*Couthovia astyla* GILG & BENED. *l.c.* 183.—*Couthovia brassii* S. MOORE, J. Bot. 67 (1929) 50.—*Couthovia novobritannica* KAN. & HAT. Bot. Mag. Tokyo 53 (1939) 9, f. 4; MERR. & PERRY, J. Arn. Arb. 23 (1942) 410.—*Couthovia collina* A. C. SMITH, Sargentia 1 (July 1942) 101.—*Couthovia leucocarpa* MERR. & PERRY, J. Arn. Arb. 23 (Oct. 1942) 412.—*Couthovia yunzaingensis* MERR. & PERRY, *ibid.* 29 (1948) 163.—Fig. 34i.

Tree, 4–40 m by up to 75 cm ø, sometimes with buttresses. Leaves oblong to broad-obovate or orbicular, 6½–17 by 3–12 cm, thin- to thick-coriaceous, glabrous; base cuneate to subcordate, decurrent; apex blunt to rounded, rarely short-acuminate; midrib distinctly forked or

not, nerves (4–)7–9(–11) pairs; petiole ¼–1¾ cm. Inflorescences 4–10 cm long, widely branched and many-flowered, glabrous, the terminal parts sometimes sparsely tomentose, flowers often crowded. Calyx 1–2½ mm, outside mostly glabrous, rarely minutely pubescent, inside with or without colleters and/or hairs at the base. Corolla outside glabrous, 4–6 mm long, tube inside usually laxly woolly at the insertion of the stamens, lobes 1½–2½ mm long. Anther-cells free for c. ⅓–½, hastate, 1½–2 mm long, corniculate at apex, glabrous to bearded at base. Style 1–1½ mm, stigma club-shaped, c. ½ mm. Fruits clavate, blunt to acute, straight to curved, 1¾–4 by ¾–1½ cm, white.

Distr. Melanesia (Solomon Is., Fiji) and Malaysia: New Guinea (also Kei and Aru Is., Los Negros, Admiralty Is., and New Britain).

Ecol. Primary (and sometimes old secondary) rain- and swamp-forests, also on temporarily flooded (freshwater) localities, from sea-level up to c. 2000 m. According to SEEMANN the fruits are much eaten by pigeons in Fiji. Fl. mainly Jan.–June, fr. Febr., July–Sept.

Uses. In the Solomon Is. the macerated bark is applied to skin diseases.

Vern. *Metan*, Aru Is, *masosen*, Schouten I., *kuma*, *rantiepi*, Japen, *aifim*, Numfoor, *badjagi*, *belik*, *bokon*, *eliew*, *falaka*, *fenam*, *gramgusun*, *inkwam*, *katadi*, *konote*, *kumo*, *maduwi*, *mafu*, *mailong*, *male*, *mingo*, *namooi*, *niesebuk*, *pao*, *pegamba*,

seruahika, situahiga, somuk, tamu, tani, teguk, teitakka or *tétaka, ufi, waffer waffer, yako(m)*, New Guinea.

Notes. *N. corynocarpa* is a widespread species and consists of a reticulate relationship of local races, both in New Guinea and in the Pacific. In the Papuan area (from the Aru Is. to the Solomons) there is a fairly distinct clinal variation as to the hairiness of the flower: the corolla-tube is inside glabrous in the Aru Is., pubescent in New Guinea and the Solomons, the anthers are bearded in the Aru Is. and New Guinea, glabrous in part of the material from E. New Guinea and in the Solomons. The variation in Fiji is mainly altitudinal, '*Couthovia collina*' being a small-leaved form of mainly higher altitudes, *N. corynocarpa sensu stricto* with larger leaves is mainly restricted to the lowlands; these two forms are grading. As to the other species described from the Pacific (from which I had not enough material at hand to come to a definite conclusion) *Couthovia alata* A. C. SMITH (Sargentina 1, 1942, 104; Fiji) and *Couthovia novocaledonica* GILG & BENED. (Bot. Jahrb. 56, 1921, 547; New Caledonia) should probably, *Couthovia macroloba* A. C. SMITH (l.c.; Fiji) and *Couthovia neo-ebudica* GUILLAUMIN (J. Arn. Arb. 13, 1932, 23; New Hebrides: Aneityum) possibly be combined with *N. corynocarpa*; *Couthovia macrocarpa* A. C. SMITH (l.c. 105; Fiji) and *Couthovia pachyantha* A. C. SMITH (l.c. 106; Fiji) may represent 2 (or only 1?) separate, though related species. Furthermore *N. corynocarpa* shows relationship with *N. sarcantha*.

The type of *Couthovia rhynchocarpa* has wrongly been described as lacking the hairs in the corolla-tube.

Throughout the genus the style is rather early caducous after fertilization, leaving a usually somewhat broadened, flat scar; in one case GILG & BENEDICT mistook this for a sessile stigma, and based their *Couthovia astyla* on that character.

Large-leaved specimens can vegetatively be distinguished from *N. celebica* not only by the thicker leaves, but also by the more spaced, and thus less numerous nerves.

2. *Neuburgia sarcantha* (GILG & BENED.) LEENH. nov. comb.—*Couthovia sarcantha* GILG & BENED. Bot. Jahrb. 54 (1916) 181, f. 9; non CAMMERL. Nova Guinea 14 (1924) 116, *quae est N. celebica*.

Tree, 15–23 m by c. 30 cm ø; branches glabrous. Leaves broadly obovate to nearly orbicular, 10–25 by 8–25 cm, coriaceous, glabrous; base cuneate to cordate, decurrent; apex rounded; midrib forked, nerves 6–7 pairs; petiole $\frac{3}{4}$ –2½ cm. Inflorescences 5–7 cm long, widely branched, fairly many-flowered, glabrous. Calyx 2¾ mm, sepals thick-fleshy, glabrous, inside with hairs and colleters at the base. Corolla 8 mm long, outside glabrous, inside laxly woolly between the mouth and the insertion of the stamens, lobes 4 mm long. Anthers oblong, 2 mm long, the cells free for c. ¼, corniculate at apex, rounded at base, glabrous. Style thick-cylindrical, 4½ mm, stigma broadly truncate, ½

mm thick, 1¼ mm ø. Fruits ovoid, constricted at base, 4 by 2½ cm, blunt, white.

Distr. Malaysia: New Guinea (Upper Digul River, Western Highlands, and Sepik River, 'Fels Spitze' of the LEDERMANN-expedition, probably not far from Malu).

Ecol. In forests and *Pandanus* swamps, 400–1900 m. Fl. Sept., fr. Aug.

Vern. *Bandih, mehmin*.

Notes. GILG & BENEDICT had only material in bud; for that reason the description given here differs in several points from the original diagnosis. When analyzing flower-buds of new material I found some of the characters specially stressed by them: a thick-fleshy corolla of which the tube is glabrous inside.

As apparently both syntypes (LEDERMANN 13005 and 13056) are lost, I propose as a neotype HOOGLAND & PULLEN 6207 (L, dupl. in BRI, CANB, and MEL), an excellent flowering specimen which has mainly served for the description given here.

N. sarcantha is best characterized by large flowers and a truncate stigma. It seems to be nearest related to *N. corynocarpa*.

3. *Neuburgia kochii* (VAL.) LEENH. nov. comb.—*Couthovia kochii* VAL. Bull. Dép. Agr. Ind. Néerl. 10 (1907) 46.—*Couthovia urophylla* GILG & BENED. Bot. Jahrb. 54 (1916) 176.—*Couthovia undulatifolia* KAN. & HAT. Bot. Mag. Tokyo 56 (1942) 158, f. 2.

Shrub or treelet, 2–4(–6) m; branches glabrous. Leaves elliptic to lanceolate (sometimes oblanceolate or slightly ovate), tapering at both ends, 13–17½ by 5–7½ cm, thin-papyraceous, above slightly scabrous (as are the stipules), beneath glabrous or rarely sparsely, shortly appressed-pubescent; base cuneate, decurrent; margin usually slightly undulate; apex tapering acuminate, slender, blunt to acute; midrib not forked; nerves (4–) 7–8(–9) pairs; petiole ½–1½ cm. Inflorescences 1½–5 cm long, densely to laxly branched, minutely pubescent. Calyx 1½–2 mm high, outside glabrous, inside at the base usually with colleters, sometimes with hairs. Corolla 4½–6 mm long, inside usually glabrous or nearly so, lobes 1½–3 mm long, outside glabrous or rarely slightly pubescent. Anthers hastate, 1¼–2 mm long, cells free for $\frac{1}{3}$ – $\frac{2}{5}$, corniculate at apex, not or only slightly bearded at base. Style c. 1–1½ mm, stigma slenderly club-shaped, $\frac{3}{4}$ –1 mm. Fruits curved, lanceolate to ovoid, flattened, tapering towards the acute apex, 5–6 by 2–2¼ by 1 cm, red or white.

Distr. Malaysia: New Guinea.

Ecol. Primary and secondary forests, from sea-level up to 1100 m. Fl. March, May, Aug., Sept., fr. March, May, July.

Vern. *Arora, osiwai*.

Notes. Young long shoots are characterized by 4 ribs, decurrent from the leaf-bases.

The roughness of the stipules and the upper side of the leaves is caused by numerous minute, yellow warts, probably from cystoliths.

Ripe fruits seem to be red in Western New

Guinea, white in the eastern half; this character is not distinctly correlated with any other.

4. *Neuburgia rumphiana* LEENH. Bull. Jard. Bot. Brux. 32 (1962) 457.—Fig. 34a-f.

Shrub or treelet, 3–6 m high; branches glabrous. *Leaves* elliptic to lanceolate, sometimes slightly asymmetric, 16–25 by 4¼–14 cm, chartaceous to thin-coriaceous, glabrous above, mainly on midrib and nerves beneath sparsely and shortly appressed-pubescent, or glabrous; base acute, attenuate; margin slightly undulate; apex shortly acuminate, blunt or acute; midrib not forked, nerves 9–15 pairs; petiole ¾–3 cm. *Inflorescences* c. 5 cm long, fairly dense, rather many-flowered, densely shortly ferruginous-pubescent, sometimes glabrescent. *Calyx* 3½–4 mm high, outside glabrous, inside at the base with hairs and colleters. *Corolla* 8–10 mm long, glabrous except the mouth, lobes 2½–3 mm long. *Anthers* linear, 2–2½ mm, cells free for ¼–½, corniculate and sometimes with a few bristles at the apex, bearded at the base. *Style* slender. 4½–6 mm, stigma club-shaped to ovoid, ¾ mm. *Fruits* flattened-ellipsoid, acute, 4½–5 by 1¾–2¼ cm, orange(-brown).

Distr. *Malaysia*: West New Guinea (around Hollandia and on Japen I.).

Ecol. Primary and secondary, sometimes swampy forests below 100 m. *Fl.* July, Oct., Febr., fr. July.

5. *Neuburgia celebica* (KOORD.) LEENH. nov. *comb.*—*Couthovia celebica* KOORD. Med. Lands Pl. Tuin 19 (1898) 537; Suppl. Minah. 1 (1918) 7, t. 2; MERR. En. Philid. 3 (1923) 313.—*Couthovia calophylla* GILG & BENED. Bot. Jahrb. 56 (1921) 548, f. 2; KANEH. Fl. Micron. (1933) 313, f. 158; J. Dep. Agr. Kyushu Imp. Univ. 4 (1935) 390.—*Couthovia sarcantha* (non GILG & BENED.) CAMMERL. Nova Guinea 14 (1924) 116.—*Couthovia toua* KAN. Bot. Mag. Tokyo 46 (1932) 490; Fl. Micron. (1933) 313, f. 159; J. Dep. Agr. Kyushu Imp. Univ. 4 (1935) 390.—*Couthovia macrophylla* MERR. & PERRY, J. Arn. Arb. 23 (1942) 411.—Fig. 34h.

Tree or large shrub, 7–30 m by 35–80 cm ø, often with small buttresses; branches glabrous, rarely densely tomentose. *Leaves* (mostly broad-)elliptic to broad-obovate, 13–30 by 9–25 cm, herbaceous to papyraceous, rarely chartaceous, glabrous or sometimes partly or entirely densely short-tomentose beneath; base subcordate to cuneate, decurrent; margin slightly undulate; apex rounded; midrib forked, nerves (7–)9–14 (–16) pairs; petiole 1–3½ cm. *Inflorescences* 15–25 cm long, glabrous but for the minutely tomentose ultimate branches, widely branched, many-flowered. *Calyx* 1–2 mm high, mostly glabrous, rarely outside more or less densely minutely tomentose. *Corolla* 4–4½ mm long, outside glabrous to sparsely pubescent, tube inside pubescent near the insertion of the stamens, lobes 1½–2 mm long. *Anthers* narrowly hastate, 1¼–1½ mm, cells up to halfway free, distinctly corniculate, glabrous. *Style* ½–1 mm, stigma capitate to club-shaped, ½ mm. *Fruits* ellipsoid, usually stipitate, blunt or rarely

acute, 3½–4 by 1¼–1¾ by 1½ cm, orange to red.

Distr. Micronesia (Carolines: Palau Is.) and *Malaysia*: Philippines (Mindoro, Mindanao), Celebes, Moluccas, and S. New Guinea.

Ecol. Dryland and swampy rain-forests, often along river-banks, sometimes in *Phragmites* swamps, in some localities periodically flooded by fresh or salt water, from sea-level up to c. 400 m. *Fl.* mainly Jan.–May, fr. Jan., March, July.

Uses. Timber sometimes used, mainly for indoor-constructions.

Vern. Philip.: *bali-bali*, C. Bis., *pagi-pagi*, Mbo., *salinuok*, P. Bis., *tanalak*, Bag.; *achera lika*, *dongkina puté*, *ēwē*, *léa léa*, *rondo rondo*, Cel., *a'sili*, Talaud I., *tampel putih*, Batjan, *gérépiw*, *porojijt*, New Guinea.

Notes. *Couthovia celebica* was based by KOORDERS upon two collections, viz KOORDERS 18628 and 18741 (cf. KOORD.-SCHUM. Syst. Verz. 3, 1914, 105). I have chosen as a lectotype KOORDERS 18741 (Bo; dupl. in L).

The specimens from the Carolines, described as *Couthovia toua*, differ partly by slightly larger dimensions of the flowers and fruits, and by more coriaceous leaves. These characters, however, are grading and some of the collections agree entirely with Malaysian material.

6. *Neuburgia moluccana* (BOERL.) LEENH. nov. *comb.*—? *Fructus musculiformis* RUMPH. Herb. Amb. 2 (1741) 184, t. 60, *pro fruct.*—? *Cerbera musculiformis* LAMK, Enc. 1 (1783) 62, *pro fruct.*—non *Banksia musculiformis* GAERTN. Fruct. 1 (1788) 221.—? *N. tuberculata* BL. Mus. Bot. 1 (1850) 157, *nom. illeg.*—? *N. musculiformis* MIO. Fl. Ind. Bat. 2 (1856) 403, *pro typo, excl. syn. N. tubiflora*; MERR. Int. Rumph. (1917) 425.—*Crateriphytum moluccanum* SCHEFF. ex BOERL. Handl. 2 (1899) 456, 460; KOORD. Bull. Inst. Bot. Btzg 16 (1903) 10; Abb. Besch. Crateriphytum moluccanum (1919) 3, t. 1; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 306.—Fig. 34g–35.

Shrub or treelet, 8–10 m high, rarely tree, up to 30 m by 45 cm ø, with buttresses; branches glabrous. *Leaves* broad-elliptic (sometimes nearly orbicular) to obovate, 12½–30 by 8–22 cm, thin-coriaceous, glabrous; base cuneate to cordate, decurrent; margin slightly undulate; apex rounded; midrib forked just below the apex, nerves 6–8 pairs; petiole 1–4 cm. *Inflorescences* 5–11 cm long, widely branched, few- to many-flowered, glabrous. *Calyx* 3–4 mm high, outside glabrous, inside at the base with or without colleters. *Corolla* 2 (when fresh 2.4) cm long, slender, glabrous apart from the hair-ring in the mouth which is inserted on a thickened, lobed rim; lobes ½ cm long, very thick-fleshy. *Stamens* inserted c. 4–7 mm below the mouth; anthers linear, 3½ mm, cells free for ¼–½, faintly corniculate at apex and with an acute membranous base, glabrous. *Style* slender, c. 1¼ cm, stigma ellipsoid, ½–¾ mm. *Fruits* ovoid, more or less flattened, slightly curved, tapering



Fig. 35. *Neuburgia moluccana* (BOERL.) LEENH.; note the long-tubed flowers and the stipules, especially between the leaf pair at the left. Cult. Hort. Bot. Bogor II-I-18 (from Ambon) (JACOBS, 1958).

towards the acute apex, $4\frac{1}{2}$ –7 by 2 – $2\frac{3}{4}$ (when fresh –4) by $1\frac{1}{4}$ – $1\frac{3}{4}$ cm, orange.

Distr. *Malaysia*: Moluccas (Halmahera, Batjan, Ceram, Ambon).

Ecol. Rain-forests, on river-banks, from sea-level up to c. 600 m. *Fl. fr.* Jan.–Dec.

Vern. *Dodalaim, pèpèkè ma tuhu*, Halmahera, *banàtau*, Ceram.

Notes. *N. celebica*, the only sympatric species which has moreover also rather large leaves, can vegetatively easily be distinguished, as the leaves are much thinner and the number of nerves is larger.

RUMPHIUS's *Fructus musculiformis* was originally based on fruit-kernels washed ashore on the island of Ceram. I am almost certain that they belong to a *Neuburgia* and, in view of the dimensions mentioned, probably to the present species. In an appendix to his description, and on his plate, he associated these fruits with a tree found on the shore of Ceram, apparently some *Apocynaceae*, probably *Cerbera* or a related genus. LAMARCK based his *Cerbera musculiformis* exclusively upon RUMPHIUS's description and plate which are discordant elements. Moreover it will hardly be possible to assign RUMPHIUS's fruits with certainty to a species. LAMARCK's name can therefore not be used as the oldest basionym.

N. tuberculata BL. is again fully based on RUMPHIUS's description and plate, but the epithet is illegitimate. BLUME was the first who apparently

correctly interpreted RUMPHIUS's plant by including it in his new genus *Neuburgia*. MIQUEL made the legitimate combination *N. musculiformis*; moreover he combined the two species distinguished by BLUME, with which I do not agree.

GAERTNER's *Banksia musculiformis* was based upon material of an Australian species of *Banksia* (*Proteaceae*); he cited RUMPHIUS's name in synonymy with a question-mark, obviously taking the specific epithet from it.

The name *Crateriphytum moluccanum* was originally based upon material from three plants in the Bogor Botanic Garden, viz II-I-1, IV-E-92, and IV-E-92a. As a lectotype I have chosen IV-E-92 (= KOORDERS 42708) (Bo, dupl. in L, WAG).

7. *Neuburgia tubiflora* BL. Mus. Bot. 1 (1850) 156; MARKGRAF, Bot. Jahrb. 61 (1927) 203, 222; MERR. & PERRY, J. Arn. Arb. 23 (1942) 416.—*N. musculiformis* MIQ. Fl. Ind. Bat. 2 (1856) 403, *typo excl.*

Treelet; branches glabrous. *Leaves* obovate, 16–20 by 8–10 cm, herbaceous to thin-coriaceous, glabrous; base cuneate; apex blunt to slightly blunt-acuminate; midrib forked just below the apex, nerves 4–6 pairs; petioles $1\frac{1}{2}$ –5 cm. *In-florescences* c. 6 cm long, laxly branched, few-flowered, glabrous. *Calyx* 3 mm high, outside glabrous, inside at the base with collectors. *Corolla* c. 2 cm long, slender, outside glabrous, the hair-

ring in the mouth inserted on a thickened, lobed rim, tube inside shortly patent-hairy from the mouth to c. 1–2 mm from the base, mainly on the main nerves; lobes c. ½ cm long. *Stamens* inserted at c. 5½ mm above the base of the tube; anthers lanceolate, 3 mm long, cells free for c. ⅓, corniculate at apex, membranous and acute at base, glabrous. *Style* c. 1 cm, stigma ellipsoid, ½–¾ mm. *Fruit* curved spindle-shaped, acute, 5½ by 1¾ cm (if 2-seeded broad-ovoid, shortly stipitate, 4 by 2 by 1¼ cm).

Distr. Malaysia: W. New Guinea, twice col-

lected; according to BLUME also in the Moluccas, but probably erroneous.

Ecol. Lowland forest, c. 50 m. *Fl.* May.

Note. The thickened rim in the throat is stronger developed than in *N. moluccana* which is distinctly the nearest related species.

As a lectotype I have chosen ZIPPELIUS 147a (L).

Excluded

Neuburgia ? sumatrana (MIQ.) BOERL. *Handl.* 2 (1899) 392 based on *Orchipeda sumatrana* MIQ. *Sum.* (1861) 553 = *Voacanga sp.* (*Apocynaceae*).

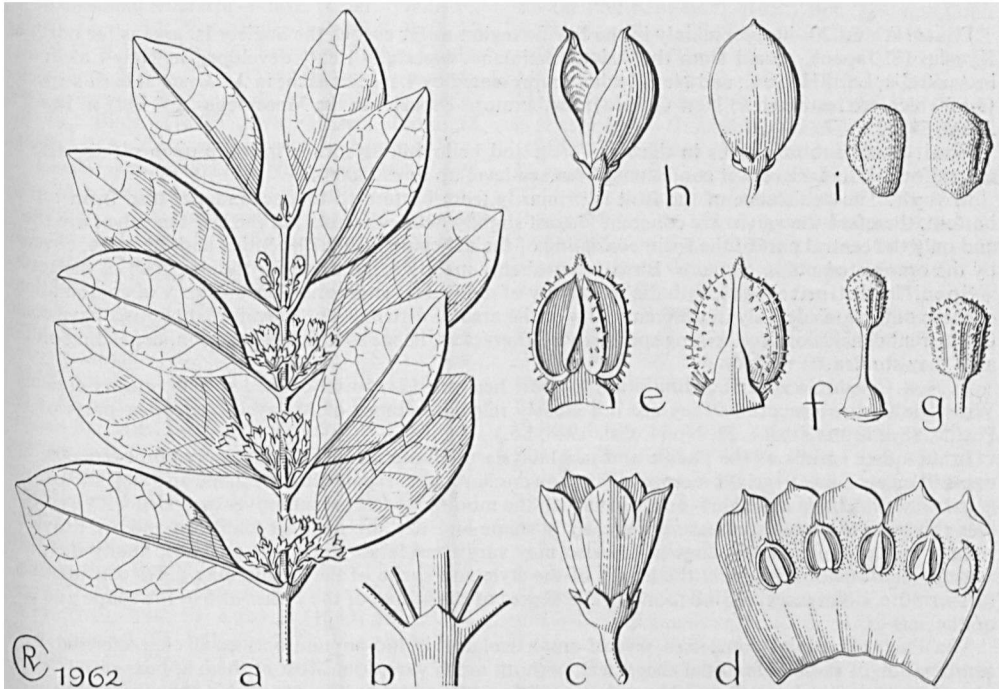


Fig. 36. *Geniostoma randianum* MERR. & PERRY. a. Habit, $\times \frac{2}{3}$, b. stipules, $\times 3$, c. flower, $\times 3$, d. opened corolla, $\times 4$, e. stamen from in- and outside, $\times 8$, f. pistil, $\times 4$, g. stigma, $\times 8$, h. fruit, $\times 1$.—*G. rupestre* FORST. i. Seeds, $\times 8$ (a–b BRASS 22598, c–g BRASS 4522, h BRASS 4995, i JUNGHUHN s.n.).

8. GENIOSTOMA

FORST. *Char. Gen. Pl.* (1776) 12, t. 12; VALETON, *Bull. Inst. Bot. Btzig* 12 (1902) 1–28.—*Anasser* JUSS. *Gen.* (1789) 150.—*Haemospermum* REINW. *Syll. Pl. Ratisb.* 2 (1826) 9.—Fig. 36.

Shrubs or small trees. Indument consisting of simple hairs. Twigs terete or quadrangular, sometimes 4-winged. *Leaves* petioled or rarely sessile, at the base with a short ocrea. *Inflorescences* axillary or sometimes (partly) ramiflorous, cymose, often pseudo-umbellate or glomerulous, sometimes uniflorous. Bracteoles present, mostly minute. *Flowers* 5-merous (exceptionally in some flowers 4-merous), gynodioecious. *Sepals* usually only confluent at the very base, inside usually with colleters at the base, thick, thinned out towards the almost always ciliate margin. *Corolla* campanulate to rotate, (greenish-)white, tube thin-fleshy, lobes thicker, imbricate or contorted in bud, outside glabrous or short-pubescent, inside glabrous

or densely woolly pubescent, especially in the mouth, sometimes also near the base. *Stamens* inserted in the mouth, exerted, recurved beyond anthesis; filaments usually short; anthers 2-celled, often with a distinct appendage (especially distinct in ♀ flowers). *Ovary* 2-celled, with ∞ ovules; style often very short; stigma club-shaped or ellipsoid to globular, about as large as the ovary. *Capsules* 2-valved, septicidal or septifragal, black or possibly in some species green when ripe. *Seeds* ∞, ellipsoid to subglobular, intruded on the hilar side, minutely warty, brown to black, embedded in a juicy yellow to red pulp; endosperm thick, chartaceous.

Distr. About 20–40 *spp.*, mainly in the Pacific region as far east as the Society Is. and as far north as Kyushu (S. Japan), absent from the Asiatic mainland, especially richly developed in New Caledonia; in Australia, Lord Howe I., and New Zealand represented by 1 species each; in *Malaysia* at least 4 species (3 of which are restricted to New Guinea); furthermore 2 species in the Mascarenes. *Cf.* LEENH. *Pac. Pl. Areas* 39.

Ecol. Small substage trees in the rain-forest and heliophilous shrubs in more open places, also in mossy forests, under everwet conditions, from sea-level up to c. 2800 m.

Morph. The dehiscence of the fruit is primarily from bottom to top, secondarily also from top to bottom, therefore the valves are coherent longest slightly below the apex; in the end the valves are shed, and only the central part of the fruit, consisting of the dissepiment, the placenta, and the seeds, covered by the orange-red pulpa, remains. Birds are probably mainly responsible for the dispersal of the seeds.

Specific delimitation. Both the variability of many characters and the constancy of combinations of these differ considerably in different parts of the area of distribution. Therefore, botanists have come to different conclusions concerning specificity of characters, hence specific delimitation, depending on the area they studied.

In New Caledonia specific delimitation is clear: here are 12–14 well defined species, mostly endemic. With one or two exceptions they are not closely related to those of Malaysia and other parts of the Pacific. (See GUILLAUMIN, *Fl. Nouv. Cal.* 1948, 85.)

In the other islands of the Pacific and in Malaysia the material is distinctly more homogeneous, but one still meets a great variation especially in flower-characters: sepals differ in shape and size, the corolla is sparsely or densely and short- or long-hairy in the mouth, sometimes moreover provided with a second hair-ring near the base, stamens vary greatly in shape and size, are hairy or glabrous, and are provided with or lack an apical appendage which also may vary considerably in shape and size, finally the pistil may be glabrous or hairy, and the length of the style and shape of the stigma may differ considerably; furthermore, differences may be found in the degree of branching of the cymes and in the shape and size of the leaves.

The Pacific material comprises several small isolated island-populations, each characterized by a combination of these differential characters, without much variation. Most of them appear closely allied and of clearly reticulate affinity. Nevertheless, here one could gain the impression that these characters and their combinations carry sufficient weight for specific delimitation. (See A.C. SMITH & B. STONE, *Contr. U. S. Nat. Herb.* 37, 1962, 1–41, pl. 1–3.)

Application of the same standard in Malaysia (which in fact has been done by VALETON, *Bull. Inst. Bot. Btzg* 12, 1902, 1–28, pl. 1) led me to the distinction of about 35 local populations which are also mutually distinctly and reticulately allied, similarly as in the Pacific. However, they are mostly far less clearly delimited and are often connected by transitional forms. What is worse, the characters cited above do not appear to be constant: they show variation not only within one form, but also in otherwise almost identical specimens from the same locality, and even between the flowers of one specimen; the sepals and stamens may even vary within one flower. Obviously, this break-down of the constancy of characters is primarily due to the fact that the much larger Malaysian islands offer larger continua of land through which the effect of isolation, hence homogeneity of local populations as occurs in the Pacific, is prevented; a second cause is probably some degree of dioecism especially in the Javanese populations.

As a result of the detail examination of a large amount of Malaysian material I have come to the conclusion that the above-mentioned characters can not be trusted for specific delimitation in the *G. rupestre* affinity. Those which seem to me useful and constant are the size of the corolla, the presence *c.q.* absence of hairs on its inner surface, and the size (and possibly the shape) of the fruit. A further character may be found in the presence or absence of a light-coloured membranous margin along the valves of the latter, depending on the mode of dehiscence of the fruit, septicidally or septifragally respectively.

Note. The relationship is especially with the Hawaiian genus *Labordia* GAUDICH., which differs by terminal inflorescences and a corolla-tube which is distinctly longer than the lobes.

KEY TO THE SPECIES

1. Corolla hairy inside, at least in the mouth.
2. Fruits up to 1¼ cm long. Corolla 2-4½ mm long 1. *G. rupestre*
2. Fruits 2 by ¾-1¼ cm. Corolla 6-7 mm long 2. *G. randianum*
1. Corolla inside glabrous.
3. Corolla 5½ mm long. Flowers long-stalked, in pseudo-umbels. Fruits c. 10 by 7½ mm. Leaves usually 10-19 by 5-9 cm, thin 3. *G. weinlandii*
3. Corolla 2-4 mm long. Flowers short-stalked, in fascicles or cymes. Fruits 3-5 mm ø. Leaves rarely more than 5 by 2 cm, stiff 4. *G. arfakense*

1. *Geniostoma rupestre* FORST. Char. Gen. Pl. (1776) 12, t. 12; VAL. Bull. Inst. Bot. Btzig 12 (1902) 12 & 17, f. 1; A. C. SMITH & STONE, Contr. U. S. Nat. Herb. 37, 1 (1962) 34.—*Haemospermum arboreum* REINW. Syll. Pl. Ratisb. 2 (1826) 10; BL. Bijdr. (1827) 1018; HASSK. Flora 28 (1845) 246 (*Haematosperma arborescens*).—*G. haemospermum* STEUD. Nomencl. (1840) 669, *nom. illeg.*; BL. Mus. Bot. 1 (1850) 238, *incl. var. angustifolia, elongata, erosa, laevigata, et rugulosa*; MIQ. Fl. Ind. Bat. 2 (1857) 365; VAL. Bull. Inst. Bot. Btzig 12 (1902) 21, f. 9, 10, 15 & 18; K. & V. Bijdr. 9 (1903) 56; KOORD. Atlas 2 (1914) f. 328; FL. Tjib. 3 (1918) 45.—*G. micranthum* DC. Prod. 9 (1845) 27; F.-VILL. Nov. App. (1880) 135.—*G. montanum* Z. & M. in Mor. Syst. Verz. (1846) 58; BTH. J. Linn. Soc. Bot. 1 (1856) 97; MIQ. Fl. Ind. Bat. 2 (1857) 366, t. 33.—*G. lasiostemon* BL. Mus. Bot. 1 (1850) 239, f. 35, *incl. var. moluccanum*; MIQ. Fl. Ind. Bat. 2 (1857) 365.—*G. reticulata* BL. Mus. Bot. 1 (1850) 239.—*G. lanceolatum* Z. & M. ex MIQ. Fl. Ind. Bat. 2 (1856) t. 33, *nom. illeg.*, *non BOJER ex DC.* 1845; HOCHR. Candollea 6 (1936) 471.—*G. cumingianum* BTH. J. Linn. Soc. Bot. 1 (1856) 97; MERR. En. Philip. 3 (1923) 310.—*G. australianum* F. v. M. Fragm. 5 (1865) 19; BTH. Fl. Austr. 4 (1869) 367; F. M. BAIL. Queensl. Fl. 3 (1900) 1022; VAL. Bull. Inst. Bot. Btzig 12 (1902) 17, f. 2.—*G. arboreum* O.K. Rev. Gen. Pl. (1891) 425, *incl. var. laevigatum*; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 3.—? *G. avene* VAL. Bull. Inst. Bot. Btzig 12 (1902) 23 & 16.—*G. celebicum* VAL. l.c. 19 & 15, f. 7 & 13.—*G. miquelianum* K. & V. ex VAL. l.c. 22 & 14, f. 11, 12 & 16; K. & V. Bijdr. 9 (1903) 58; KOORD. Exk. Fl. Java 3 (1912) 56 & 57; Atlas 2 (1914) t. 327; CAMMERL. Bull. Jard. Bot. Btzig III, 5 (1923) 297; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 3.—*G. moluccanum* VAL. Bull. Inst. Bot. Btzig 12 (1902) 19 & 15, f. 4; l.c. Bog. 2 (1904) 143, t. 130; CAMMERL. Bull. Jard. Bot. Btzig III, 5 (1923) 297.—*G. oblongifolium* K. & V. ex VAL. Bull. Inst. Bot. Btzig 12 (1902) 20 & 15, f. 5, 6 & 14; K. & V. Bijdr. 9 (1903) 60; KOORD. Atlas 2 (1914) f. 329; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 3; MEYER DREES, Comm. For. Res. Inst. n. 33 (1951) 74.—*G. caulocarpum* K. SCH. in K. Sch. & Laut. Nachtr. (1905) 348; GILG & BENED. Bot. Jahrb. 54 (1916) 161.—*G. Philippinense* MERR. Philip. J. Sc. 3 (1908) Bot. 259.—*G. batanense* MERR. *ibid.* 3 (1909) Bot. 27; En. Philip. 3 (1923) 309.—*G. stenophyllum*

MERR. Philip. J. Sc. 7 (1912) Bot. 329, *non* GILG & BENED. 1916; En. Philip. 3 (1923) 310.—? *G. pulgarensis* ELM. Leaf. Philip. Bot. 5 (1913) 1808; MERR. En. Philip. 3 (1923) 310.—*G. brevipes* MERR. Philip. J. Sc. 9 (1914) Bot. 384; En. Philip. 3 (1923) 309.—*G. laxa* ELM. Leaf. Philip. Bot. 8 (1915) 2746; MERR. En. Philip. 3 (1923) 310.—*G. mindanaense* ELM. Leaf. Philip. Bot. 8 (1915) 2747.—*G. acuminatissimum* GILG & BENED. Bot. Jahrb. 54 (1916) 159, f. 3, *non* MERR. 1922.—*G. antherotrichum* GILG & BENED. l.c. 158, f. 2.—*G. psychotrioides* GILG & BENED. l.c. 160.—*G. dasyneuron* GILG & BENED. l.c. 161.—*G. schlechteri* GILG & BENED. l.c. 162.—*G. longipes* MERR. Philip. J. Sc. 12 (1917) Bot. 296; En. Philip. 3 (1923) 310.—*G. nigrescens* (BLCO) MERR. Sp. Blanc. (1918) 305, *pro specim.*, *typo excl.*; En. Philip. 3 (1923) 310.—*G. pachyphyllum* MERR. Philip. J. Sc. 14 (1919) 448; En. Philip. 3 (1923) 310.—*G. lancilimum* MERR. Philip. J. Sc. 17 (1921) 304; En. Philip. 3 (1923) 310.—*G. ramosii* MERR. Philip. J. Sc. 17 (1921) 304; En. Philip. 3 (1923) 310.—*G. pullei* CAMMERL. Nova Guinea 14 (1924) 115, t. 12.—*G. fasciculata* QUIS. & MERR. Philip. J. Sc. 37 (1928) 190.—*G. aff. rupestris* FORST.: CHRISTOPHERSEN, Bull. Bish. Mus. n. 128 (1935) 176.—*G. dallmannense* KAN. & HAT. Bot. Mag. Tokyo 56 (1942) 164, f. 8.—Fig. 36f.

Shrub or treelet, up to 6(-10) m high. Branches mostly terete, rarely quadrangular, glabrous or the young twigs shortly brown- to fulvous-tomentose. Leaves ovate to lanceolate, 1½-17 by ½-6½ cm, herbaceous to chartaceous, rarely coriaceous, glabrous or (mainly on the midrib beneath) shortly tomentose; base rounded to acute, rarely emarginate; margin entire or rarely faintly crenulate; apex blunt or acute to long-acuminate, aristulate or not; nerves (3-)6-10(-11) pairs; petiole ¼-1(-1¾) cm. *Inflorescences* mostly axillary, sometimes partly ramiflorous, often glomerulous, not rarely laxly paniculate, sometimes umbelliform, with (1-)several flowers, ½-1½ (-4½) cm, sparsely (to densely) shortly appressed-hairy, sometimes glabrous. Pedicels 1-5 mm. *Calyx* (¾-)-1-2(-2¼) mm high, sepals elliptic or ovate to broad-triangular, blunt to acute, outside glabrous to densely short-tomentose. *Corolla* (1½-)-2½-4½ mm long, outside glabrous or rarely fairly densely papillose-hairy, inside the throat densely to sparsely hairy, sometimes a second ring of hairs near the base of the tube; lobes (¾-)-1-2½ mm long, usually blunt, rarely acute. *Stamens* variable, especially as to hairiness;

filaments ($\frac{1}{8}$ - $\frac{1}{2}$ - $\frac{3}{4}$ (-1) mm, glabrous to rather densely hairy; anthers $\frac{3}{4}$ -1 $\frac{1}{4}$ mm long, glabrous or hairy, appendage of the connective absent to as long as the cells, in the latter case (mainly in ♀ flowers) triangular above the adnate cells. *Ovary* glabrous to densely shortly tomentose; style usually very short (less than $\frac{1}{8}$ mm), in some forms (mainly in Sumatra, W. Java, and the Philippines) about 1(-2) mm, glabrous or rarely slightly pubescent. *Fruits* mostly slightly flattened-globose, rarely ellipsoid, ovoid, or obovoid, 4-7 $\frac{1}{2}$ (-12) by 4-6(-9) mm, black when ripe (*sec.* MERRILL whitish in *G. philippinense*, red in *G. stenophyllum*), septifragal (but see note).

Distr. Widely distributed, throughout *Malaysia* (except in the Malay Peninsula), E. Queensland (around Innisfail, Ravenshoe, and Rockingham Bay), and the West Pacific (at least as far north as the Marianas and east as far as Samoa).

Ecol. Very variable, in the substage of the rain-forest, but apparently preferring more open places, often in exposed sites, along forest edges and river-banks, in young secondary forests and shrubberies, on steep slopes and in grass fields, under everwet conditions, in regions subject to a dry season only, in the montane rain-forest, for example in the Lesser Sunda Is. only between 700-2200 m; from sea-level up to 2800 m.

Wood anat. JUTTE, Nova Guinea n.s. 9 (1958) 360, f. 8 (*sub Geniostoma sp.*).

Vern. *Itit biru, kaju tain, kitelong, S, maniran* (or *meniran-idju* (or *-idjo*), *tumon telong, J*; Philip.: *bitig-bitig*, Neg., *gagadang, Iv., saig-guadan, Mbo., tagobinlod, C. Bis., umum, Ig., bochogan, kaju-im-bulut, kaju-tai, kopopojoan-wewene, mawotai, Cel., gandarusa-utan, Ambon.*

Notes. As has been alluded to under the genus, *G. rupestre* is extremely variable, both in vegetative and in floral characters; fruit characters are less variable. There are a number of geographically more or less restricted races. Part of these are very local and often known from a few specimens only; others are locally sometimes sharply delimited but in other regions connected by intermediates. I deem it premature to venture on a subdivision of this species and it is doubtful that this will ever be possible on more than a local scale.

Some of these local forms, and some single specimens, have only with some doubt been included in *G. rupestre*. *G. pulgarensis* is known only from the type-collection (ELMER 13197, Mt Pulgar, Palawan, Philippines; fruiting specimen), and deviates from the mountain form described from Luzon as '*G. cumingianum*'; it seems to be more closely related to the form of Mt Kinabalu, Borneo. The type specimen of *G. avene* (TEYSMANN s.n., P. Gebeh, E. Moluccas; fruiting specimen) also comes close to *G. pulgarensis*, with the exception only of the fruits which are septicidal with light-coloured, membranous margins.

Two specimens from New Guinea (DOCTERS VAN LEEUWEN 10345 & 10415) are characterized by small, narrowly lanceolate leaves (2 $\frac{1}{2}$ -5 by $\frac{1}{2}$ -1 $\frac{1}{2}$ cm) and small flowers (calyx 0.8 mm, corolla 2 mm); these specimens were collected

near the Rouffaer River, on the river-bank between stones, at 250-300 m.

Among the Celebes specimens, KJELLBERG 2775 from Matano (at 400 m) is mainly aberrant by the relatively large (11-12 by 7 mm), ellipsoid to ovoid fruits. KJELLBERG 2681 (Central Celebes at 1200 m) and EYMA 470 & 2051 (both from Ceram, at 1550-2600 m) are deviating by very small flowers (calyx $\frac{3}{4}$ - $\frac{4}{8}$ mm, corolla 1 $\frac{1}{2}$ -2 mm, anthers subsessile, 0.4 mm long).

Nomencl. The name *G. haemospermum* STEUD. is illegitimate as it had been based upon *Haemospermum arboreum* REINW., and the epitheton *arboreum* should have been used.

The name *G. lanceolatum* Z. & M. *ex* MIQ. is illegitimate primarily as being a later homonym of *G. lanceolatum* BOJER *ex* DC. (1845), and secondarily as this name, apparently erroneously printed under the plate, was corrected in the text by MIQUEL to *montanum*, hence not accepted by him.

2. *Geniostoma randianum* MERR. & PERRY, J. Arn. Arb. 23 (1942) 409.—*G. obtusum* MERR. & PERRY, *l.c.* 410.—Fig. 36a-h.

Shrub or treelet, 2-6 m high, glabrous. *Leaves* often inserted on distinct leaf-cushions, obovate or elliptic to lanceolate, 3 $\frac{1}{2}$ -4 $\frac{3}{4}$ by 1 $\frac{1}{2}$ -2 $\frac{1}{2}$ cm, stiff-coriaceous; base cuneate; apex blunt or acute to shortly, broadly, and acutely acuminate, aristulate; nerves 5-7 pairs; petiole 6-8 mm. *Inflorescences* axillary, 1-5-flowered, dichasial, 1-2 cm. Pedicels c. $\frac{1}{2}$ cm. *Calyx* 1 $\frac{1}{3}$ -3 mm high, up to about halfway connate, glabrous, lobes acute. *Corolla* 6-7 mm long, outside glabrous, inside more or less densely hairy in and sometimes above the mouth; lobes acute, 2 $\frac{1}{2}$ -4 mm. *Filaments* 2 $\frac{1}{2}$ - $\frac{3}{2}$ mm, glabrous; anthers 1 $\frac{1}{4}$ -1 $\frac{1}{2}$ mm long, entirely or partly lax-hairy, appendage of the connective c. 0.1- $\frac{1}{4}$ mm. *Pistil* glabrous; style $\frac{1}{2}$ -3 mm. *Fruits* usually 1 per axil, flattened-ovoid to obovoid, 2 by $\frac{3}{4}$ -1 $\frac{1}{2}$ cm, septifragal.

Distr. *Malaysia*: New Guinea (Central Div.; Milne Bay Distr.).

Ecol. On forest fringes in mossy forest and shrubberies, 2230-2840 m.

Notes. In describing *G. obtusum*, MERRILL and PERRY observed already that it is closely related to *G. randianum*, and though there are some differences in fruit, flowers, and leaves, I think they should be combined.

Well characterized by the large-sized flowers and fruit.

3. *Geniostoma weinlandii* K. SCH. in K. Sch. & Laut. Nachtr. (1905) 349; GILG & BENED. Bot. Jahrb. 54 (1916) 157, f. 1.—*G. acutifolium* HIERN, Nova Guinea 8 (1909) 201.

Shrub or treelet, 2-5 m, glabrous or the young twigs sometimes thinly tomentose. *Leaves* ovate to oblong (to lanceolate), (6 $\frac{1}{2}$ -)10-21 by (3 $\frac{1}{2}$ -)5-9 cm, tough-papyraceous to thin-chartaceous, base rounded to cuneate, apex tapering to rather abruptly acuminate, acumen short and triangular to long and slender, acute; nerves 5-8(-10) pairs;

petiole $\frac{1}{3}$ - $1\frac{1}{2}$ cm. *Inflorescences* axillary and partly ramiflorous, umbelliform, short-stalked, 3-5(-±15)-flowered, 1-2 cm long. Pedicels slender, (0.6-)0.8-1.3 cm. *Calyx* 2- $2\frac{1}{2}$ mm high, outside rather densely shortly tomentose, lobes semi-orbicular. *Corolla* $5\frac{1}{2}$ mm long, glabrous on both sides, lobes $3\frac{1}{4}$ mm, slightly acuminate, broadly imbricate in bud. *Stamens* glabrous, filaments up to 1 mm, anthers 1- $1\frac{1}{2}$ mm long, the appendage of the connective small. *Pistil* glabrous, style $1\frac{1}{2}$ - $1\frac{3}{4}$ mm. *Fruits* obovoid to ellipsoid, c. 1 by $\frac{3}{4}$ cm, sutures distinct.

Distr. *Malaysia*: New Guinea and ? Moluccas (Aru Is.).

Ecol. Mainly along forested river-banks, also on *Saccharum*-covered shoals in river-beds, 50-1750 m. *Fl. fr.* probably Jan.-Dec.

Vern. *Djangdjangalie*, Aru Is., *marau*, New Guinea.

Notes. The species had been based upon two specimens, SCHLECHTER 14495 (still represented in BM, BRSL, K) and WEINLAND *s.n.* (BO, BRI, BRSL, SING), both from Kaiser Wilhelmsland, "am mittleren Bumifluss". As the WEINLAND specimen bears both flowers and fruits (especially the Wroclaw-sheet is a good one) I choose this as lectotype; the holotype is lost in Berlin.

A sterile specimen from the Aru Is. (bb. 25404) probably belongs to this species, though it is not quite impossible that it represents *G. rupestre* which is vegetatively not well distinguishable.

4. *Geniostoma arfakense* KAN. & HAT. Bot. Mag. Tokyo 56 (Apr. 20, 1942) 163, f. 7.—*G. archboldianum* MERR. & PERRY, J. Arn. Arb. 23 (Oct. 1942) 408.

Shrub or small tree, up to 10(-13?) m high. Branches glabrous or the young parts sometimes sparsely pubescent. *Leaves* glabrous or rarely ciliate when very young, (ovate-)elliptic to lanceolate, ($\frac{3}{4}$ -) $1\frac{1}{2}$ -5(-10) by ($\frac{1}{2}$ -)1-2(- $4\frac{1}{2}$) cm, chartaceous to coriaceous, base broadly to narrowly cuneate, sometimes slightly rounded, apex blunt to gradually long and slender acute-acuminate, sometimes aristulate; nerves 4-8 pairs; petiole ($1\frac{1}{2}$ -) $2\frac{1}{2}$ -5(-7) mm. *Inflorescences* axillary, glomerulous to laxly cymose, $\frac{3}{4}$ -2 cm long, up to c. 10-flowered; pedicels slender, $1\frac{1}{2}$ -6 mm. *Sepals* mostly acute, 1- $1\frac{1}{2}$ mm long, outside glabrous or minutely pubescent. *Corolla* 2-4 mm long, lobes blunt to acute, $1\frac{1}{2}$ - $2\frac{1}{4}$ mm, glabrous (rarely outside papillose-tomentose). *Stamens* mostly shortly patent-hairy, filaments very short to $\frac{3}{4}$ mm, anthers $\frac{3}{4}$ - $1\frac{1}{2}$ mm, appendage of the connective up to about half as long. *Ovary* glabrous or sometimes hairy around the style base; style almost absent or up to c. $\frac{1}{2}$ mm, glabrous or pubescent. *Fruits* globular to slightly ellipsoid, 3-5 mm ϕ , septifragal; suture inconspicuous.

Distr. *Malaysia*: New Guinea.

Ecol. In and mainly along primary, rarely secondary forests, along river-banks, on grassy deforested slopes, and in low regrowth on peaty soil, mainly 1700-2600 m. *Fl.* (March, April) June-Dec., *fr.* June-Nov.

Vern. *Kegopa*, *kiaugupa*, *mongemandimand*, *raurau*, *tuoparimoh*, *tuwupalimo*.

Notes. There is some variation in details, mainly in the shape and size of the leaves and the number of flowers per inflorescence.

The alliance is with *G. oleifolium* S. MOORE from New Caledonia, but it comes also very close to some E. Malaysian forms of *G. rupestre* ('*G. pullei*' and '*G. pulgarensis*' especially) from which it only differs by the glabrous mouth of the corolla.

Dubious

Anassera rumphii SPANOGHE, Linnaea 15 (1841) 325, *nom. nud.*

Neither the specimen, nor the drawing ("Icon. n. 27") could be localized.

Geniostoma gilgii MERR. & PERRY, J. Arn. Arb. 23 (1942) 409.—*G. stenophyllum* GILG & BENED. Bot. Jahrb. 54 (1916) 162, *nom. illeg., non* MERR. 1912.

Described from New Guinea. Possibly a synonym of *G. rupestre*, but the description shows some discrepancies with that species and authentic material could not be localized.

Excluded

Anasser moluccana LAMK, Illustr. 2 (1793) 40, is according to BAKKER, Fl. Mal. I, 5 (1957) 356-359 = *Pittosporum moluccanum* (LAMK) MIQ. (*Pittosporaceae*).

Anasser laniti BLCO, Fl. Filip. (1837) 112, is according to MERRILL, Sp. Blanc. (1918) 313 = *Wrightia laniti* (BLCO) MERR. (*Apocynaceae*).

Geniostoma acuminatissima MERR. Philip. J. Sc. 20 (1922) 432, *nom. illeg., non* GILG & BENED. 1916, is according to BREMEKAMP, Candollea 16 (1957) 93 = *Lasianthus furcatus* (MIQ.) BREMEK. (*Rubiaceae*).

Geniostoma acuminatum WALL. in Roxb. Fl. Ind. 2 (1824) 316, is according to BENTHAM, J. Linn. Soc. Bot. 1 (1856) 69 = *Urophyllum streptopodium* WALL. (*Rubiaceae*).

Geniostoma crassifolium BTH. J. Linn. Soc. Bot. 1 (1856) 96. A species described from the Isle of Pines near New Caledonia, in Index Kewensis erroneously cited as from the Philippines.

Geniostoma nigrescens (BLCO) MERR. Sp. Blanc. (1918) 305.—*Tayotum nigrescens* BLCO, Fl. Filip. (1837) 105; ed. 2 (1845) 76; ed. 3, 1 (1877) 141. MERRILL wrongly referred BLANCO's description to *G. philippinense*; the 'illustrative specimen' distributed by him (MERRILL, Sp. Blanc. 878) I reckon to belong to *G. rupestre*. FERN.-VILLAR (Nov. App. 1880, 136) was also mistaken by reducing BLANCO's species to *Norrissia malaccensis* GARDN. In fact BLANCO's monotypic genus cannot represent any *Loganiaceae*; the fruit which is said to be enveloped by the calyx, excludes it from that family.

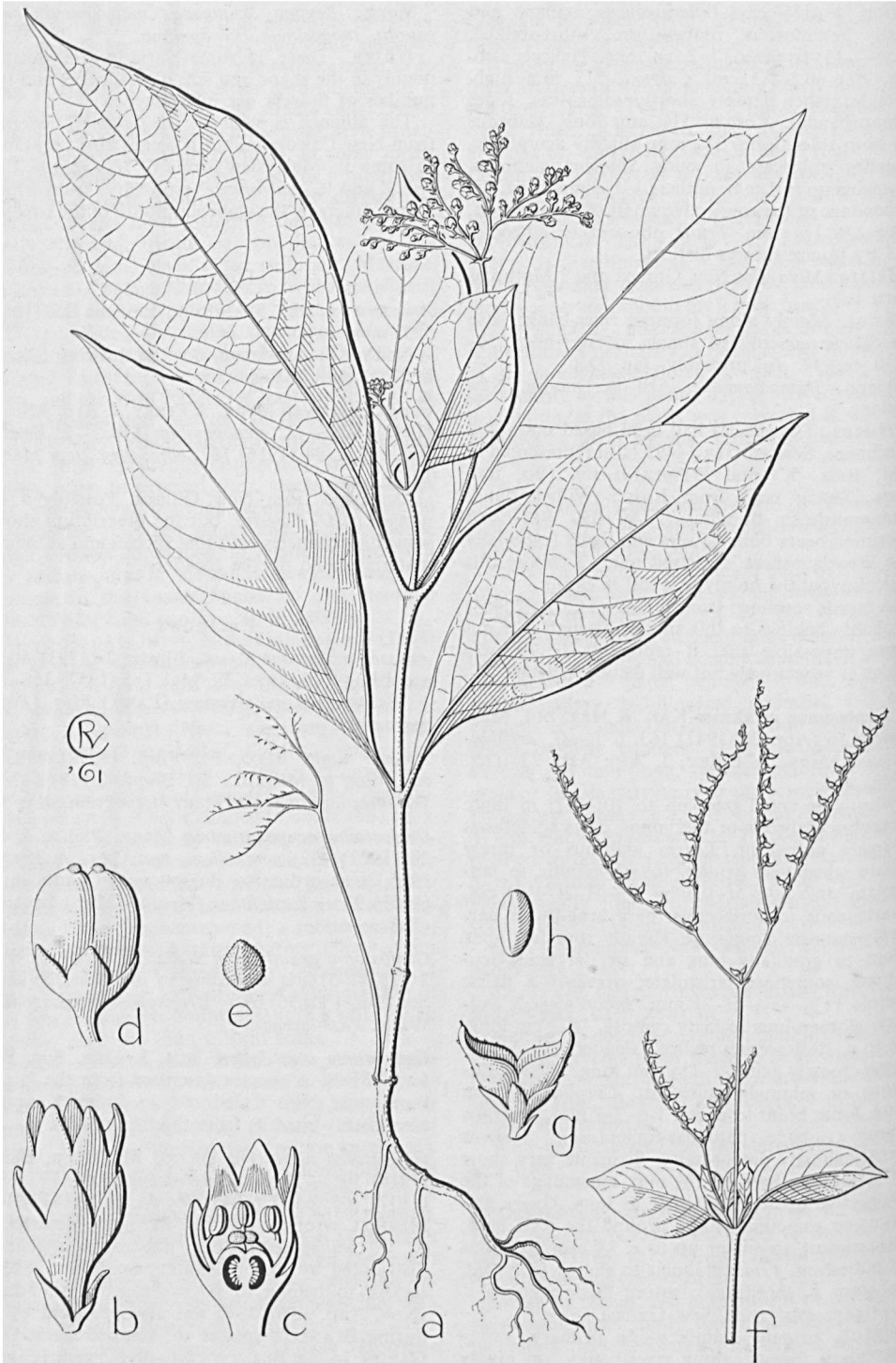


Fig. 37. *Cynoctonum sphaerocarpum* LEENH. a. Habit, $\times \frac{2}{3}$, b. flower, $\times 8$, c. ditto, longitudinal section, $\times 8$, d. fruit, $\times 4$, e. seed, $\times 20$.—*C. mitreola* (L.) BRITT. f. Habit, $\times \frac{2}{3}$, g. fruit, $\times 4$, h. seed, $\times 20$ (a combined from CLEMENS 29469 and JAHERI 286, b–e CLEMENS 29469, f–h HOOGLAND 4365).

9. CYNOCOTONUM

GMEL. Syst. (1791) 443.—*Mitreola* LINNÉ, Gen. Pl. ed. 1 (1737) 377.—*Ophiorhiza* LINNÉ, *ibid.* ed. 5 (1754) 74, *p.p.*—*Mitreola* BOEHMER in Ludwig, Def. Gen. Pl. (1760) 31, *nom. illeg.*, *p.p.*—*Mitreola* SCHAEFF. Bot. Exped. (1760) 11, *nom. illeg.*—*Selenocera* ZIPP. ex SPAN. Linnaea 15 (1841) 316.—*Parophiorrhiza* CLARKE in Hook. f. Fl. Br. Ind. 3 (1880) 85.—Fig. 37.

Herbs, annual and erect or perennial and creeping at the base. *Leaves* petioled or sessile; interpetiolar stipules well developed or reduced to a transverse ridge. *Inflorescences* terminal and/or axillary, usually long-peduncled, dichasial with long cincinnate branches. *Flowers* on short pedicels to subsessile, 5-merous. *Calyx* almost parted to the base. *Corolla* urceolate, lobes short, imbricate in bud, mouth closed by a dense ring of hairs. *Stamens* short, included; anthers introrse, cells free. *Pistil* semi-inferior; ovary 2-celled, each cell with many, small, anatropous ovules; styles 2, short, sometimes absent; stigmas more or less adnate to each other. *Capsules* 2-horned, rarely globular, almost free from the calyx, both carpels dehiscent along the ventral suture. *Seeds* ∞, small, with fleshy endosperm.

Distr. Six *spp.* in tropical and subtropical America (1 endemic), Madagascar (2 endemic), SE. Asia (1 endemic), Malaysia (1 endemic), and North Australia (Arnhem Land). Cf. LEENH. Pac. Pl. Areas 33. Ecol. Preferably on wet spots under seasonal conditions, on heavy clay soils or limestone, not or slightly shaded.

Notes. In defining the genus *Ophiorhiza*, LINNAEUS included two species, viz *O. mungos* and *O. mitreola* (Sp. Pl. 1753, 150). The former species is an *Ophiorhiza* (*Rubiaceae*) in the current sense, and the type of the genus; the latter was based upon *Mitreola* L. 1737, which is the present *Cynoctonum mitreola*. LUDWIG based his genus *Mitreola* upon LINNAEUS Gen. Pl. 1737; as he cited, however, *Ophiorhiza* L. as a synonym, his name is superfluous, hence illegitimate.

In the same year as LUDWIG, SCHAEFFER described his (new) genus *Mitreola*, without a reference to LINNÉ, but clearly distinguishing it from *Ophiorhiza* L. The preface of SCHAEFFER's publication is dated October 1760; though the month of LUDWIG's publication is unknown, it is at least probable that it appeared earlier in the year and antedated SCHAEFFER's name.

The genus is especially closely related to *Mitrasacme*, the main differences being the 5-merous flowers and the semi-inferior ovary.

KEY TO THE SPECIES

1. Annual erect herb. Pistil with two distinct styles. Fruits 2-horned 1. *C. mitreola*
 1. Perennial herb, creeping in the basal part and rooting at the nodes. Pistil with sessile stigmas. Fruits globular, only slightly bilobed at the top 2. *C. sphaerocarpum*

1. *Cynoctonum mitreola* (L.) BRITT. Mem. Torr. Bot. Cl. 5 (1894) 258; HOCHR. Bull. N.Y. Bot. Gard. 6 (1910) 284, *incl. var. orthocarpa*; MERR. & PERRY, J. Arn. Arb. 29 (1948) 163; BAKH. f. in B. ck. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 4, *incl. var. lilacina*; Blumea 6 (1950) 382; GLEASON in Britton & Brown, Ill. Fl. U.S. ed. 2, 3 (1952) 54, fig. p. 55.—*Ophiorhiza mitreola* LINNÉ, Sp. Pl. (1753) 150.—*C. petiolatum* GMEL. Syst. Sp. Pl. (1791) 443.—*Mitreola paniculata* WALL. ex G. DON, Gard. Dict. 4 (1837) 171; DC. Prod. 9 (1845) 9; WIGHT, Ic. 4 (1850) 14, t. 1600; Illustr. 2 (1850) t. 156 b fig. 1 (15–21); HOOK. Ic. Pl. (1852) t. 828; MIQ. Fl. Ind. Bat. 2 (1857) 361; PROGEL in Mart. Fl. Bras. 6, 1 (1865) 266, t. 71; KOORD. Exk. Fl. Java 3 (1912) 57; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 298, *incl. var. lilacina* BACK.: BACK. Onkr. Suiker. (1931) 485.—*Mitreola oldenlandioides* G. DON, Gard. Dict. 4 (1837) 172, *nom. illeg.*; DC. Prod. 9 (1845) 9; HOOK. Ic. Pl. (1852) t. 827; BTH. J. Linn. Soc. Bot. 1 (1856) 91; MIQ. Fl. Ind. Bat. 2 (1857) 360;

BTH. Fl. Austr. 4 (1869) 349; CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 79; BOERL. Handl. 2 (1899) 449 & 458; KING, J. As. Soc. Beng. 74, ii (1908) 598; DOP, Fl. Gén. I.–C. 4 (1912) 155, f. 20 (1–2); GILG & BENED. Bot. Jahrb. 54 (1916) 163; *ibid.* 56 (1921) 547; RIDL. Fl. Mal. Pen. 2 (1923) 413; GAMBLE, Fl. Madras 5 (1923) 863; KANJILAL & DAS, Fl. Assam 3 (1939) 310; HENDERS. Mal. Nat. J. 6 (1950) 303, f. 287; KERR in Craib, Fl. Siam. En. 3 (1951) 52.—*Selenocera secundiflora* ZIPP. ex SPAN. Linnaea 15 (1841) 316.—*Mitreola petiolata* TORR. & GRAY, Fl. N. Am. 2 (1841) 45; DC. Prod. 9 (1845) 8; BTH. J. Linn. Soc. Bot. 1 (1856) 91; PROGEL in Mart. Fl. Bras. 6, 1 (1865) 266, t. 82 (1); MERR. Philip. J. Sc. 11 (1917) Bot. 307; SPECHT, Rec. Am. Austr. Exp. Arnhem Land 3 (1958) 468.—*Mitreola inconspicua* Z. & M. in Mor. Syst. Verz. (1846) 55.—*C. paniculatum* B. L. ROB. Proc. Am. Ac. Arts Sc. 45 (1917) 396; MERR. Pap. Mich. Ac. Sc. 23 (1938) 188.—Fig. 37f–h.

Erect, annual herb, simple or branched from

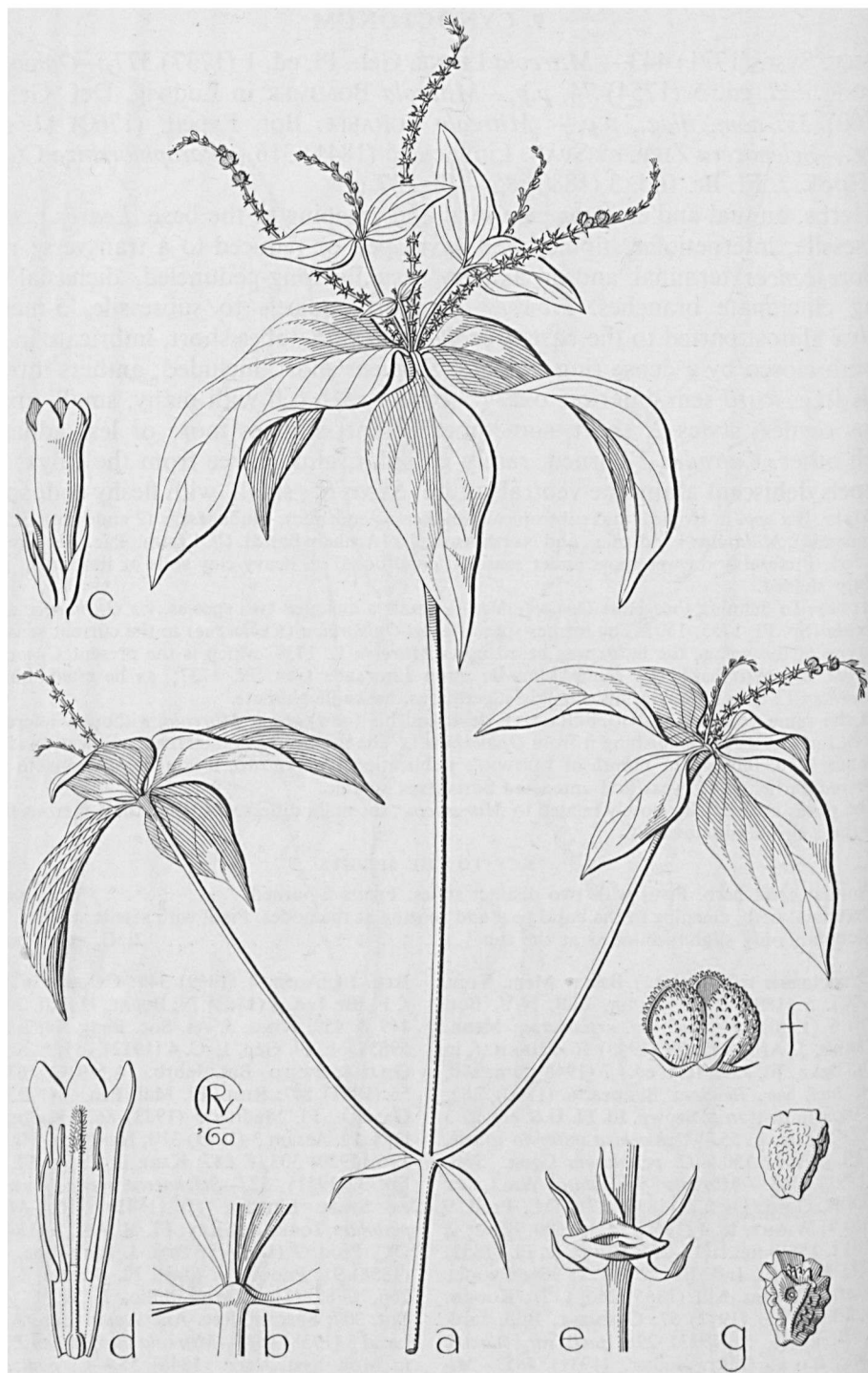


Fig. 38. *Spigelia anthelmia* L. a. Habit, $\times \frac{1}{2}$, b. stipules, $\times 3$, c. flower, $\times 3$, d. longitudinal section of corolla with pistil, $\times 4\frac{1}{2}$, e. calyx with persistent basal part of fruit, $\times 4\frac{1}{2}$, f. fruit, $\times 3$, g. seeds, $\times 6$ (a-b, e COERT 624, c-d HOLSTVOOGD 78, f-g RAHMAT 8401).

the base, 5–80 cm high. Stem quadrangular to narrowly 4-winged, glabrous. *Leaves* with broadly deltoid, 1–1½ mm high, interpetiolar stipules, ovate to ovate-oblong, 1½–7 by 1–3½ cm, herbaceous, very sparsely appressed-pubescent or glabrous apart from the appressed-ciliate entire margin, base obtuse or acute, usually decurrent, apex obtuse to acute; nerves 4–10 pairs, ascending; petiole grooved, ½–3 cm long. *Inflorescences* partly terminating the stem and few-leaved branches, partly in the highest leaf-axils, widely branched, the ultimate branches 2–15 cm, slender, glabrous or shortly ciliate under the nodes. Bracts narrowly deltoid, 1½–2 mm long. *Flowers* shortly pedicelled to sessile. *Calyx* obconical, ¼ mm, sepals ovate, acute, with broad, membranous margins, glabrous. *Corolla* 1–2 mm, halfway connate, lobes oblong-ovate, acute; corolla outside and lobes inside papillose. *Stamens* inserted just above the base of the corolla-tube, glabrous; filaments ¼–½ mm. *Pistil* glabrous, with 2 free styles ¼–½ mm long; stigmas globular, connate or not. *Capsules* 2-horned, 2–3½ mm long, ciliate on midrib and along the margins or fully appressed-pubescent, the horns either straight and divaricating or curved inwards. *Seeds* ellipsoid, ½–¾ mm long, concave on one side, smooth.

Distr. SE. United States, Central and tropical South America, SE. Asia from Bombay to Tonkin, in *Malaysia*: Malay Peninsula (peninsular Siam and Langkawi Is.), N. Sumatra, Java (especially common in the teak-forests of the eastern half), Bawean, Kangean, Bali, Timor, Tanimbar Is., S. Celebes (also Buton I.), Philippines (Luzon, Mindoro, Bohol), New Guinea, and N. Australia (Arnhem Land). Introduced in the Carolines (Yap and Palau).

Ecol. Forest edges, along roads, on grassy plains, sometimes as a weed on fields, on sawah-dikes etc.; on slightly shaded, badly drained, preferably marly soils, up to 600 m alt.; in Java especially along fire brakes in teak-forest, on Langkawi I. on limestone rocks near the sea; obviously bound to areas subject to a dry season. *Fl.* at the end of the rainy season.

Vern. *Ki fatu*, Timor; Philip.: *tagarinuk magtindug*, Mang.

Notes. The flowers are usually white. BACKER described a *var. lilacina* based upon specimens from Central Java which were characterized by violet flowers and straight fruit lobes; the specimens from Langkawi I. are also said to have pale

mauve flowers, and here the fruit lobes are also straight. HOCHREUTNER distinguished three varieties based upon the shape of the fruit. As his varieties are neither sharply delimited (*var. intermedia* comprises all specimens which do not show one of the extreme fruit forms) nor geographically restricted (only the frequency may be different) they seem to have no taxonomic value.

JOVET (Bull. Mus. Nat. Hist. Nat. II, 6, 1934, 291–301) described two species from Madagascar: *Mitreola perrieri* and *Mitreola turgida*, which are closely related to the present species; both are especially different in the shape and size of the fruit.

The name *Mitreola oldenlandioides* WALL. was not validly published by G. DON, as it was not accepted by him as a species.

2. *Cynoctonum sphaerocarpum* LEENH. Bull. Jard. Bot. Brux. 32 (1962) 417.—Fig. 37a–e.

Perennial herb, in the basal part creeping and rooting at the nodes. Stem terete to faintly quadrangular, at the top with two narrow wings most distinct below the nodes; glabrous. *Leaves* glabrous, with narrowly triangular, 1½ mm long, acute, soon shrivelling interpetiolar stipules, (elliptic-)oblong, 6–14 by 3–6 cm, thin-papyraceous, base cuneate and decurrent, apex tapering acute-acuminate; nerves c. 8 pairs; petiole flat above, 1–1½ cm. *Inflorescences* terminal and axillary, glabrous, rather dense, 2–3 cm long, 7–8 cm peduncled, ultimate branches short. Bracts narrowly deltoid, up to 1½ mm. Pedicels slender, 1–1½ mm. *Calyx* obconical, 1–1¼ mm long, sepals oblong-ovate, acute, with broad membranous margins, glabrous. *Corolla* 2 mm long, white, lobes c. ⅔ mm, elliptic, rounded, papillose inside. *Stamens* inserted about halfway the corolla-tube, glabrous, filaments ¼–½ mm, anthers elliptic-ovate, ½ mm long. *Pistil* glabrous, stigmas sessile, connate. *Fruits* broad-ovoid, bilobed, not or only very slightly split at the apex, c. 3 mm ø. *Seeds* about hemispherical to tetrahedral, c. ¾ mm, minutely warty.

Distr. *Malaysia*: Borneo (twice collected: Mt Kinabalu, at about 1800 m, *fl. fr.* May; Bt Liangbatu).

Note. Apparently closely related to *C. pedicellatum* (BTH.) B. L. ROV., a species described from the Sikkim and also cited from S. China (Yunnan, Kweichow); it differs from the Bornean one mainly by distinct styles and mitre-shaped fruits.

10. SPIGELIA

LINNÉ, Gen. Pl. ed. 5 (1754) 74; Sp. Pl. 1 (1753) 149; L. B. SMITH, *Wrightia* 2 (1960) 90 (Am. *spp.*).—Fig. 38.

Annual or perennial herbs or undershrubs. *Leaves* often partly in (pseudo) whorls at the base of the inflorescence, short-petioled or sessile, the bases connected by interpetiolar stipules or sheaths. *Inflorescences* terminal and/or in the upper leaf-axils, cincinnous, sometimes reduced to a few flowers. *Flowers* sessile or almost so, 5-merous. *Calyx*: sepals free or connate at the base, inside at the base

with some colleters. *Corolla*: tube tubular, lobes valvate in bud, shorter than the tube. *Stamens* included, anthers dorsifixed, introrse, lanceolate or ovate, 2-celled. *Ovary* superior, 2-celled, with many ovules. *Capsule* 2-lobed, 2-celled, 4-valved, valves caducous with the exception of a cupular basal part (fig. 38e). *Seeds* some per cell, globose to angular, verrucose; endosperm fleshy or cartilaginous.

Distr. About 50 spp. in tropical and subtropical America, one naturalized in W. Africa and in *Malaysia*.

1. *Spigelia anthelmia* LINNÉ, Sp. Pl. 1 (1753) 149; SIMS, Bot. Mag. (1822) t. 2359; DC. Prod. 9 (1845) 7; BISSCHOP GREV. Pl. N.I. (1883) 611; BACK. Trop Natuur 1 (1913) 65, f. 1-4; HEYNE, Nutt. Pl. (1927) 1267; BACK. Onkr. Suiker. (1931) 484; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 4; L. B. SMITH, *Wrightia* 2 (1960) 98; LEEUWENB. Acta Bot. Neerl. 10 (1961) 460, f. 1, map 1.—Fig. 38.

Annual herb, 2-25(-70) cm high, unbranched or with some pairs of strong branches near the base; stems erect, terete, glabrous, with a few remote pairs of rather small leaves and an apical pseudo-whorl of 4 larger ones. *Leaves* connected by interpetiolar, broadly triangular, blunt, glabrous stipules, ovate-oblong to ovate-lanceolate, 3-10 by ¾-5 cm, herbaceous, scabrous above, glabrous beneath, cuneate and often decurrent at the base, attenuate at the apex; nerves 4-5 pairs, strongly ascending; petiole 0-1 cm. *Inflorescences* terminal and usually in the axils of the whorled upper leaves, up to 15 cm long, peduncle very short, glabrous or nearly so; bracts lanceolate, 2-3 mm long. *Flowers* spaced, (sub)sessile. *Sepals* free, quincuncial in bud, somewhat unequal in length, ovate-linear-lanceolate, 2-3½ mm, acute, glabrous or outside sparsely puberulous, pale green. *Corolla* salver-shaped, glabrous, white to red or purplish;

tube 6½-15 mm, lobes exduplicative-valvate in bud, triangular, 2-2½ mm long. *Stamens* glabrous, inserted slightly below the middle of the tube, filaments filiform, ± 1 mm, anthers attached slightly above the base, lanceolate, 1¼-1¾ mm, obtuse. *Ovary* glabrous, subglobose, ½-¾ mm ø, style cylindrical, ¾ mm; stigma ovate-lanceolate, 2 mm, pubescent near the tip, caducous. *Capsule* 4-5 by 5-6 mm, squamulate-tuberculate mainly in the upper half. *Seeds* obliquely ellipsoid or ovoid, 2-3 by 1½-2 mm, dull brown, tuberculate.

Distr. Native in America from Mexico and Florida to Peru and Brazil, naturalized in tropical West Africa and in *Malaysia*: Sumatra, Java (mainly West and Central), and Lesser Sunda Is. (Sumba).

Ecol. A weed of sandy seashores, river-banks, fields, gardens, roadsides, waste places, from the beach up to 600 m; locally often common, but on the whole rather rare. A self-pollinating plant; the flowers are open from 2-5 in the afternoon. *Fl. fr.* Jan.-Dec.

Uses. A decoction of the roots is well known to be a very effective vermifuge.

Vern. *Wormgrass*, E, *sammondjo*, Sum., *djukut puntir*, *taih manuk*, S, *platikan*, J.

Note. Reported to be very poisonous.

11. MITRASACME

LABILL. Nov. Holl. Pl. Spec. 1 (1804) 35, t. 49; LEENH. Bull. Jard. Bot. Brux. 32 (1962) 440.—Fig. 39-47.

Annual or perennial herbs. *Leaves* in pairs along the stem or rosulate, (sub)sessile, connected at base by a membrane, stipules not separately distinguishable; one- or curvi-nerved. *Flowers* either solitary in the leaf-axils, rarely terminal, or in terminal and/or axillary cymose inflorescences, 4-merous. *Calyx* 4-, rarely 2-lobed, sepals about halfway connate; colleters few or absent. *Corolla* urceolate, campanulate, or salver-shaped, membranous to thin-fleshy, often bearded in the mouth; lobes exduplicate-valvate in bud. *Stamens* inserted on the lower half of the corolla-tube, mostly included, filaments usually filiform; anthers 2-celled, introrse, extrorse, or rarely latrorse. *Pistil* superior or slightly inferior, glabrous, ovary 2-celled with many ovules per cell; styles 2, usually free in their basal and connate in the upper part, rarely entirely connate or completely free; stigma truncate to 2-lobed; anthers and stigma always at about the same height. *Capsule* opening by apical loculicidal slits, 2-horned, the horns terminated by the styles, which may be torn loose (e.g. fig. 39l) or remain partly connate (e.g. fig. 42f). *Seeds* ∞, minute, ellipsoid or angular; testa thin, endosperm fleshy.

Distr. About 40 *spp.*, mainly Australian, furthermore in Tasmania, New Zealand, New Caledonia, Malaysia, the Carolines, and in Asia from the Deccan and Ceylon to Central Japan and Korea.

Ecol. Heliophilous plants from dry to wet open places, locally often gregarious, from sea-level to above 3000 m.

Notes. This largely Australian genus is in urgent need of revision. In the past the habit of the plant played a great part in specific delimitation. For that reason some species, for example *M. polymorpha* R. BR. and *M. alsinoides* R. BR., were supposed to have an extensive area of distribution, reaching from New South Wales (both were originally described from Sydney) to continental Asia and Japan. During the revision of the Malaysian species I found very useful and constant characters in the flower morphology and the seed-coat, coinciding with sometimes small but constant characters in the stem, leaves, inflorescences, and pubescence, but not with habit. In my opinion *M. polymorpha* and *M. alsinoides* are restricted to subtropical eastern Australia. What, in Malaysian literature, was called "*M. polymorpha*" is the lowland form of *M. pygmaea*, though the habit is quite different from that of Australian specimens. The Indo-Malaysian material formerly included in "*M. alsinoides*" comprises at least 4 well defined species which possess nearly the same habit.

It fell outside the scope of this work to verify the subdivision of the genus as proposed by R. BROWN and later authors, the more so because for distinction I have used a number of characters formerly neglected.

Many species look very much alike some of the smaller species of *Hedyotis* (*Rubiaceae*). *Mitrasacme* is easily distinguished by the superior fruit (in *Hedyotis* distinctly adnate to the calyx for the greater part) which is typically mitre-shaped, the superior ovary, and the short corolla-lobes (in *Hedyotis* about as long as the tube) and included stamens; furthermore by the absence of raphides in the leaves (in *Hedyotis* and related genera these are very conspicuous).

Morph. CLARKE (in Hook. f. Fl. Br. Ind. 4, 1883, 80) mentioned of *M. 'polymorpha'*: "stems . . . glandular hairy below". KLETT (in Mez, Bot. Arch. 5, 1924, 327) mentioned the presence of capitate-glandular hairs in *M. tenuiflora* BTH. Neither in these nor in any other species could I find them.

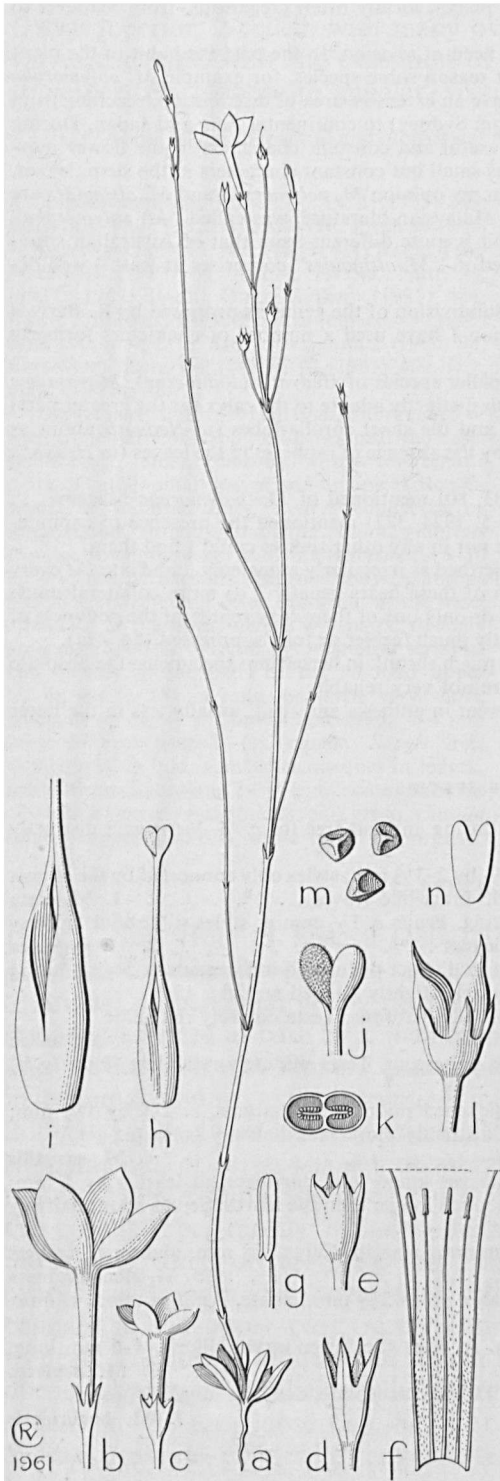
The inflorescence, if many-flowered, can be best described as irregularly repeatedly umbellate. At every node of the rachis there are 2 lateral branches; each of these bears usually 1 or more collateral much feebler or often uniflorous ones. Both these branches or only one of them may represent the peduncle of the next umbel; the continuation of the rachis is mostly much feebler or fully suppressed (fig. 42a).

The corolla is very thin in most species and usually much shrunk in herbarium specimens; the absolute dimensions (especially the lower values) are therefore not very reliable.

The degree to which the styles are connate is different in anthesis and fruit, usually less in the latter state.

KEY TO THE SPECIES

1. Flowers in distinct terminal inflorescences. Styles during anthesis free for c. $\frac{1}{4}$ – $\frac{1}{3}$; stigma distinctly 2-lobed (fig. 39j, 42e).
2. Corolla salver-shaped, 1–1 $\frac{3}{4}$ cm long. Fruits 5–7 $\frac{1}{2}$ by 2–3 $\frac{1}{2}$ mm; styles only connected by the stigma or free. Peduncle with some pairs of appressed, bract-like leaves 1. *M. elata*
2. Corolla urceolate to campanulate, up to $\frac{1}{2}$ cm long. Fruits c. 1 $\frac{1}{2}$ mm \varnothing ; styles still about halfway connate. Peduncle without appressed, bract-like leaves 2. *M. pygmaea*
1. Flowers solitary, axillary, sometimes terminal, not in distinct peduncled inflorescences. Styles during anthesis at least halfway free; stigma truncate or rarely slightly 2-lobed (e.g. fig. 45e).
3. Stem distinctly 4-ribbed to narrowly 4-winged, usually glabrous. Testa coarsely reticulate. 3. *M. indica*
3. Stem terete to somewhat flattened, nearly always pubescent. Testa minutely reticulate (fig. 47g–h) or more often densely warty (fig. 46g).
4. Leaves on the lower surface with distinctly thickened midrib and margins, c. 2 $\frac{1}{2}$ by 1 $\frac{1}{2}$ mm; internodes about as long as the leaves. Sepals distinctly more than halfway connate. 4. *M. saxatilis*
4. Midrib and margins not distinctly thickened, leaves longer and narrower, at least 4 by 1 mm; internodes at least in the upper part of the plant much longer than the leaves. Sepals about halfway connate.
5. Leaves and sepals with a narrow white membranous margin. Calyx 3 $\frac{1}{2}$ mm, glabrous. Anthers sagittate, 1 mm long, introrsely dehiscent 5. *M. albomarginata*
5. Leaves and sepals without a white margin. Calyx up to 2 $\frac{1}{2}$ mm, ciliate. Anthers about elliptic, up to $\frac{1}{2}$ mm long, extrorsely dehiscent.
6. Flowers terminal and in the upper leaf-axils. At least the lower leaves elliptic, 4–6 mm long, squamulate-ciliate along the margin 6. *M. neglecta*
6. Flowers exclusively in the upper leaf-axils. All leaves lanceolate, 5–9 mm long, glabrous. 7. *M. bogoriensis*



1. *Mitrasacme elata* R. BR. Prod. (1810) 453; DC. Prod. 9 (1845) 11; F. v. M. Fragm. 1 (1859) 132; BTH. Fl. Austr. 4 (1869) 354; F. M. BAIL. Queensl. Fl. 3 (1900) 1018; Compr. Cat. Queensl. Pl. (1913) f. 313; EWART & DAVIES, Fl. North. Terr. (1917) 219.—*M. nudicaulis* REINW. ex BL. Bijdr. (1826) 849; DC. Prod. 9 (1845) 12; MIQ. Fl. Ind. Bat. 2 (1857) 361; BOERL. Handl. 2 (1899) 458; non BTH. in Hook. J. Bot. Kew Misc. 5 (1853) 56, et AUCT. DIV. (= mostly *M. pygmaea* var. *pygmaea*, sometimes var. *malaccensis*, or *M. erophila* LEENH.).—*M. trinervis* SPAN. Linnaea 15 (1841) 335; DC. Prod. 9 (1845) 560; MIQ. Fl. Ind. Bat. 2 (1857) 361.—*M. longiflora* F. v. M. ex BTH. Fl. Austr. 4 (1869) 354; F. M. BAIL. Queensl. Fl. 3 (1900) 1018; EWART & DAVIES, Fl. North. Terr. (1917) 219.—Fig. 39-40.

Erect annual, 35-85 cm. *Leaves* radical, rosulate (often already withering during anthesis), sessile; oblong to lanceolate, $\frac{1}{2}$ - $4\frac{1}{2}$ by $\frac{1}{4}$ - $1\frac{1}{2}$ cm, fleshy, glabrous, narrowed at the base, apex blunt, 3(-5)-nerved. *Inflorescences* terminal and sometimes axillary, laxly paniculate with up to 4 lateral branches per node (usually irregular and few-flowered); peduncle long, c. $1\frac{1}{2}$ mm ϕ , terete, smooth to minutely fluted, glabrous to minutely tomentose especially near the base, with some distant pairs of appressed bract-like leaves, acute-lanceolate, c. 5 mm long, connate at the base, minutely ciliate. Bracts similar but smaller and patent. Pedicels 2- $3\frac{1}{2}$ cm. *Calyx* campanulate, 3-8 mm long, for $\frac{1}{2}$ - $\frac{3}{4}$ connate, glabrous, tube membranous, lobes oblong and acute or semi-orbicular and apiculate, thickened. *Corolla* salver-shaped, inside sparsely pubescent in the lower half of the tube, and with a thickened fimbriate rim in the mouth, outside (creamy or) salmon-pink to brownish, inside creamy to white; tube slender, 1- $1\frac{3}{4}$ cm, lobes elliptic to oblong, (2-) 4-12 mm, shortly acuminate. *Filaments* c. 6 mm long, anthers basifixed, ovate-lanceolate to linear or sagittate, 1-2 mm, blunt, latero-introrse. *Ovary* 1-2 mm, tapering into the styles, which are connate for the far greater part, 5-9 mm long, slender; stigma 2-lobed, 1 mm long. *Capsule* for the greater part enveloped by the persistent calyx, slender- to globular-mitre-shaped, 5- $7\frac{1}{2}$ by 2- $3\frac{1}{2}$ mm, styles either torn loose or only connected by the stigma when mature. *Seeds* angular, minutely warty.

Distr. Tropical Australia and SE. *Malaysia*: Lesser Sunda Is. (Sumba, Solor, Timor), and New Guinea. Fig. 41.

Ecol. Savannahs and parklands, up to 2000 m.

Fig. 39. *Mitrasacme elata* R. BR. var. *elata*. a. Habit, $\times \frac{1}{4}$, b. flower, $\times 1$, d. calyx, $\times 2$, f. opened corolla-tube, $\times 2$, g. anther, $\times 7$, h. pistil, $\times 3\frac{1}{2}$, i. ovary, $\times 7$, j. stigma, $\times 7$, k. cross-section of ovary, $\times 7$, l. fruit, $\times 2$, m. seeds, $\times 4$, n. embryo, $\times 48$.—var. *brevicalyx* LEENH. c. flower, $\times 1$, e. calyx, $\times 2$ (a-b, d, f-m VAN ROYEN 5027, c and e SPANOGHE in herb. L 908.127-526).

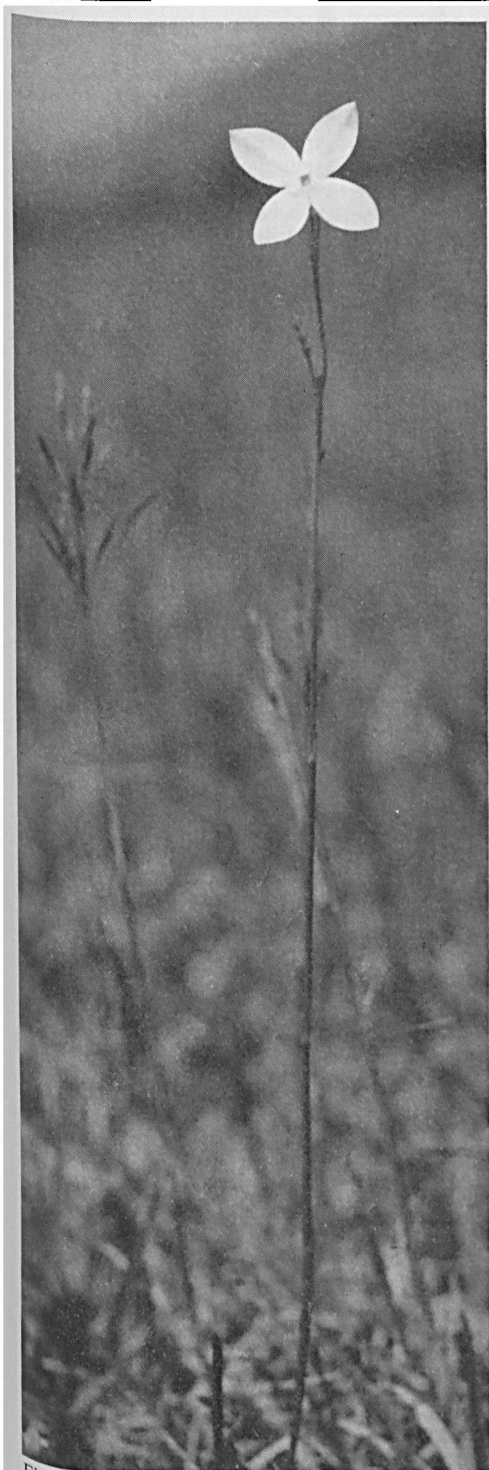


Fig. 40. *Mitrasacme elata* R. BR., Andjai, Kebar Valley, W. New Guinea (VAN ROYEN & SLEUMER 6756) (SLEUMER, 1961).

var. elata.—*M. elata* R. BR.

Calyx 4–8 mm long, connate for $\frac{1}{2}$ – $\frac{2}{3}$, lobes oblong, acute (fig. 39d). Fruit oblong, 6–7 $\frac{1}{2}$ mm long.

Distr. Australia (Arnhem Land) and *Malaysia*: New Guinea (also in Fergusson I.).

Ecol. Dry savannahs and parklands, from sea-level up to 2000 m. *Fl. fr.* Jan.–Dec.

var. brevicalyx LEENH. Bull. Jard. Bot. Brux. 32 (1962) 446.—*M. nudicaulis* REINW. ex BL.—*M. trinervis* SPAN.—*M. longiflora* F. v. M. ex BTH.

Calyx c. 3 mm long, connate for $\frac{2}{3}$ – $\frac{3}{4}$, lobes mostly semi-orbicular and apiculate (fig. 39e). Fruits subglobular, c. 5 mm ϕ .

This *var. brevicalyx* is primarily based upon, and thus typified by *M. trinervis* SPAN. (holotype SPANOGHE *s.n.* in L).

Distr. Australia (Northern Territory and Queensland), in *Malaysia*: Lesser Sunda Is. (Sumba, Solor, Timor), and some dubious specimens from E. New Guinea.

Ecol. Grassland and bare slopes, at 450–1000 m. *Fl. fr.* March–June.

Notes. '*M. elata*' and '*M. longiflora*' are clearly distinguishable in Australia, as there, apart from the varietal characters cited above, the former is a distinctly more robust plant with much larger flowers. The differences fade away in New Guinea, however, where many of the specimens are very slender and have small flowers as '*M. longiflora*', but share the long calyx and oblong fruit with typical *M. elata*. These proved to be the only "either . . . or . . ." characters.

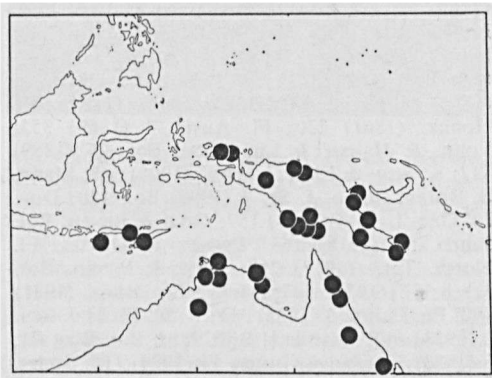


Fig. 41. Distribution of *Mitrasacme elata* R. BR., representative for those species restricted to tropical Australia and adjacent parts of *Malaysia*.

The structure of the inflorescence is somewhat complicated. In a well developed specimen the lower one or two nodes have four lateral branches, two collateral ones in every axil. In many specimens the central axis is less well developed or completely suppressed, the number of lateral branches may be less, and their size may differ considerably.

The nearest related species is *M. connata* R. BR. from tropical Australia which differs by the following characters: leaves not rosulate but some

pairs close to each other at the base, linear-lanceolate, cauline leaves $\frac{3}{4}$ –1 cm long, inflorescence more-flowered, styles fully connate, stigma truncate.

Another closely allied species is the Australian *M. exserta* F. v. M., which is at first sight different by its dense, umbellate inflorescences.

2. *Mitrasacme pygmaea* R. BR. Prod. (1810) 453; DC. Prod. 9 (1845) 11; BTH. J. Linn. Soc. Bot. 1 (1856) 92; Fl. Austr. 4 (1869) 357; F. M. BAIL. Queensl. Fl. 3 (1900) 1019; BARKS & SOL. Bot. Cook's Voy. 2 (1901) t. 208; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 6; HARA, J. Jap. Bot. 30 (1955) 23, incl. var. *malaccensis*, excl. syn. *M. nudicaulis* et *trinervis*; LEENH. Bull. Jard. Bot. Brux. 32 (1962) 452.—*M. polymorpha* (non R. BR.) CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 80, incl. var. *parishii*, excl. syn. *M. trinervis*; FORBES & HEMSL. J. Linn. Soc. Bot. 26 (1889) 118, incl. var. *grandiflora*; BOERL. Handl. 2 (1899) 450 & 458; KING, J. As. Soc. Beng. 74, ii (1908) 599; DOP, Bull. Soc. Bot. Fr. 57, Mém. n. 19 (1910) 5; Fl. Gén. I.—C. 4 (1914) 158, f. 20 (3–4); GAMBLE, Fl. Madras 5 (1923) 864; MERR. En. Philip. 3 (1923) 311; RIDL. Fl. Mal. Pen. 2 (1923) 413; MERR. & CHUN, Sunyatsenia 5 (1940) 171; GUILLAUMIN, Fl. Nouv. Cal. (1948) 285; HENDERS. Mal. Nat. J. 6 (1950) 304, f. 288; KERR in Craib, Fl. Siam. En. 3 (1951) 53; MAKINO, Ill. Fl. Japan, rev. ed. (1954) 217, f. 650.—*M. capillaris* WALL. in Roxb. Fl. Ind. 1 (1820) 420; D. DON, Prod. Nepal. (1825) 129; DC. Prod. 9 (1845) 11; BTH. J. Linn. Soc. Bot. 1 (1856) 92, excl. syn. *M. trinervis*; MIQ. Fl. Ind. Bat. 2 (1857) 362; BTH. Fl. Hongk. (1861) 230; NAKAI, Fl. Korea 2 (1911) 96.—*M. nudicaulis* (non BL.) BTH. in Hook. J. Bot. Kew Misc. 5 (1853) 56, p.p., excl. syn. *M. chinensis* GRISEB.; Fl. Hongk. (1861) 230; Fl. Austr. 4 (1869) 355; FORB. & HEMSL. J. Linn. Soc. Bot. 26 (1889) 117; K. SCH. & LAUT. Nachtr. (1905) 348; MERR. & ROLFE, Philip. J. Sc. 3 (1908) Bot. 120; DOP, Fl. Gén. I.—C. 4 (1914) 157; GILG & BENED. Bot. Jahrb. 54 (1916) 163; EWART & DAVIES, Fl. North. Terr. (1917) 219; GILG & BENED. Bot. Jahrb. 56 (1921) 547; MERR. En. Born. (1921) 490; En. Philip. 3 (1923) 311; RIDL. Fl. Mal. Pen. 2 (1923) 413; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 301; Nova Guinea 14 (1924) 116; STEEN. Trop. Natuur 25 (1936) 41–42, 159 f. 3; HARA, J. Jap. Bot. 16 (1940) 155; En. Sperm. Jap. 1 (1948) 130; GUILLAUMIN, Fl. Nouv. Cal. (1948) 285; KERR in Craib, Fl. Siam. En. 3 (1951) 52.—*M. malaccensis* WIGHT, Ic. 4, 4 (1850) 15, t. 1601.—*M. alsinoides* (non R. BR.) MERR. Philip. J. Sc. 1 (1906) Suppl. 116.—*Androsace tonkinensis* BONATI, Bull. Soc. Bot. Genève II, 5 (1914) 298.—*M. micrantha* DOMIN, Bibl. Bot. 89 (1929) 1071.—*M. setosa* (non HANCE) MASAMUNE, J. Geobot. 10 (1961) 1, f. 43.—Fig. 42–43.

Erect, annual herb, up to c. 35 cm, branched mainly at the base. Stem terete, slightly fluted, fairly densely white hirsute in the lower part, sometimes glabrescent or subglabrous. Leaf pairs

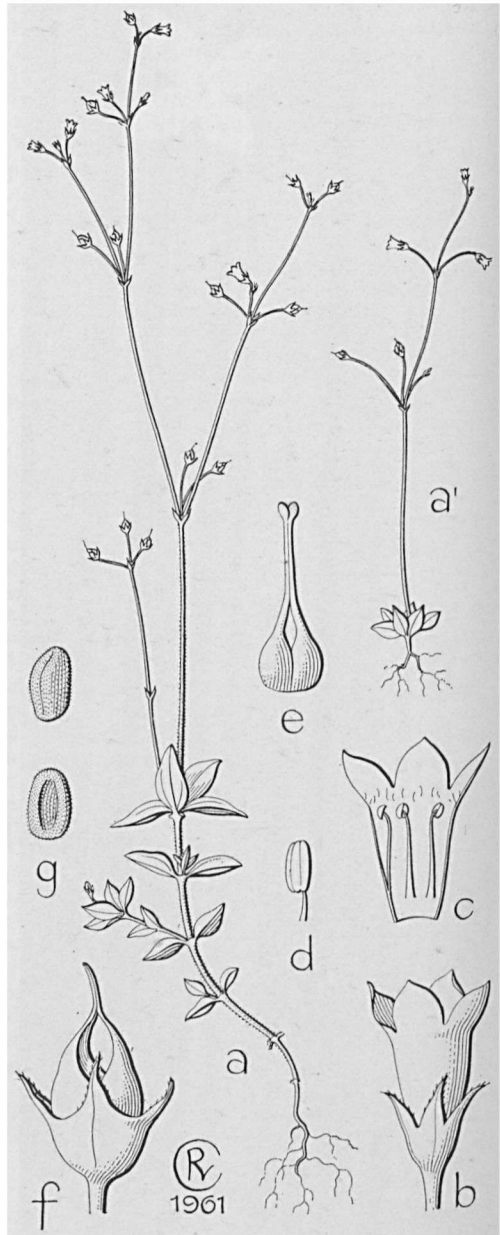


Fig. 42. *Mitrasacme pygmaea* R. BR. var. *pygmaea*. Habit, $\times \frac{3}{4}$, f. fruit, $\times 7$.—var. *malaccensis* (WIGHT) HARA. a. Habit, $\times \frac{3}{4}$, b. flower, $\times 7$, c. opened corolla (note the extrorse anthers), $\times 7$, d. anther, $\times 22\frac{1}{2}$, e. pistil, $\times 12$, g. seeds, $\times 22\frac{1}{2}$ (a MERRILL 3093, a' RAHMAT 6059, b–e BS 19208, f VAN STEENIS 6006, g FORBES 3884).

spaced, the upper 2 pairs sometimes rosulate at the base of the inflorescence, in small specimens (nearly) all the leaves radical rosulate; ovate or elliptic to linear-lanceolate, $2\frac{1}{2}$ –19 by 1–6 mm, herbaceous, subglabrous to rather densely hirsute above, hirsute along the margin and beneath on the midrib and sometimes on the nerves, base cuneate, apex blunt to acute, 1–3-nerved. *Inflorescences* terminal, umbellate-paniculate, up to c. 25 cm, long-peduncled, lax, \sim 1-flowered, usually glabrous; peduncle terete to distinctly grooved. Bracts oblong-ovate to lanceolate, up to 3 mm long, ciliate along the margin and sometimes along the midrib beneath. Pedicels slender, angular, up to $\frac{1}{2}$ cm (in fruit up to $1\frac{1}{4}$ cm). *Calyx* conical to conical-campanulate, $1\frac{1}{2}$ – $2\frac{1}{2}$ mm, about halfway connate or somewhat less, glabrous except some bristles along the margin or at the top of the acute-triangular lobes. *Corolla* urceolate to campanulate, 3–5 mm long, inside often with a few scattered hairs in the mouth, yellow, outside white to pink with brownish or pale orange dots or streaks, lobes $\frac{3}{4}$ – $1\frac{1}{2}$ mm, rounded. *Filaments* $1\frac{1}{2}$ –3 mm, anthers basifixed, extrorse, oblong-ovate to sagittate, c. $\frac{1}{2}$ mm long, acute. *Pistil* 2– $4\frac{1}{2}$ mm, ovary $\frac{3}{4}$ –1 mm, styles free in their basal $\frac{1}{4}$ – $\frac{1}{3}$ part, stigma 2-lobed. *Capsule* globular-mitre-shaped, c. $1\frac{1}{2}$ mm \varnothing , the styles remaining connate for the greater part. *Seeds* angular-ellipsoid, densely minutely warty.

Distr. Tropical Australia, New Caledonia, through *Malaysia* to the Carolines (Jap, Palau), and SE. Asia from Nepal to Korea and Japan.

var. *pygmaea*.—*M. pygmaea* R. BR.—*M. nudicaulis* AUCT.

Up to 12(–20) cm. Leaves radical rosulate, up to 8 by 3 mm, 1-nerved (fig. 42a').

Distr. NW. India (Garkhwāl, Kumaon), Siam (Rachasima, Prachinburi), Cambodia, South China (Yunnan), Formosa, Korea, Japan (Honshu to Ryukyus), Caroline Is. (Jap), Australia (Northern Territory, E. Queensland), New Caledonia, in *Malaysia*: Malay Peninsula (Malacca: Bukit Sialang near Sampang Ampat), North and Central Sumatra, Java (Preanger, Mt Merapi, Mt Idjen), Lesser Sunda Is. (Bali, Lombok, Alor, Timor), Philippines (Luzon), S. Moluccas (Aru Is.), and New Guinea (also Goodenough I.).

Ecol. On rocks, in grasslands, open spots in savannahs, in Eucalypt forest, along roadsides, near solfataras and fumaroles, at (0–)1000–1800 (–3150) m. *Fl. fr.* Jan.–Dec., mainly May–July. The abnormal high altitude of 3150 m is near the fumaroles on summit of Mt Agung, Bali; VAN STEENIS (1936) discussed this peculiar habitat and considers the seed to have been dispersed epizooically to this spot by the pilgrimage of man, or by monkeys, deer or other animals. See fig. 43.

Vern. *Kánaquila*, *lassak*, *watakiki*, Alor Is.

var. *malaccensis* (WIGHT) HARA (1955).—*M. polymorpha* AUCT.—*M. capillaris* WALL.—*M. malaccensis* WIGHT.—*Androsace tonkinensis* BONATI.—*M. micrantha* DOMIN.

Up to 35 cm. Leaves not rosulate (or only the

upper 2 pairs), usually 8–19 by 2–6 mm, often 3-nerved (fig. 42a).

Distr. Nepal, Burma, Siam, Indo-China, S. China, Hainan, Formosa, Japan (Okinawa, Kyushu, Honshu), Caroline Is. (Palau), to Australia (Northern Territory, Queensland), in *Malaysia*: Malay Peninsula, Sumatra (also Riouw Arch. and Billiton), E. Java (Besuki: Situbondo), Lesser Sunda Is. (Bali, Alor, Timor), Borneo (also Anambas Is.), Philippines (Luzon), SE. Celebes, Moluccas (Sula Is., Ambon, Tanimbar Is.), and New Guinea (also Sudest I.).

Ecol. In rocky localities, on bare soil, open spots in savannahs, along fields, lawns, roadsides, *Melaleuca* forest, both in very dry spots and in marshy places, from sea-level to 1000(–2000) m. The flowers are only open in the middle of the day. *Fl. fr.* Jan.–Dec., mainly Sept.–April.

Vern. *Bingbis-lupa*, Philip. Tag., *gomme gomme*, *gommoh gumiseh*, New Guinea.

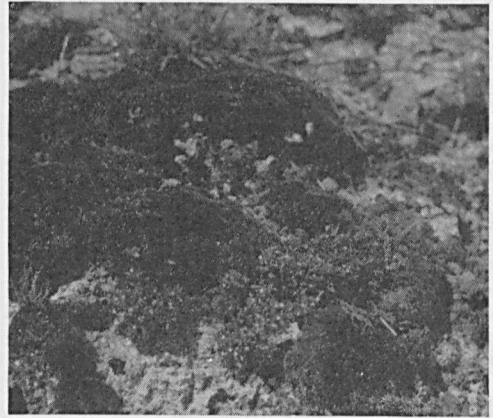


Fig. 43. *Mitrasacme pygmaea* R. BR. var. *pygmaea* between mosses near fumaroles at 3150 m, Mt Agung, Bali (VAN STEENIS, 1936).

Notes. Apart from the two varieties cited above, there are two more: var. *parishii* (CLARKE) LEENH. from Burma and var. *grandiflora* (HEMSL.) LEENH. from SE. China and Tonkin. Both are characterized by distinctly larger flowers; the former is connected with var. *malaccensis* by intergrades, mainly in Indo-China.

As the varieties *pygmaea* and *malaccensis* are mainly altitudinal vicariants, not every specimen can be included in one of them. Moreover, especially towards the north (Japan) the differences become vague also in the lowland specimens.

The only difference I found between the Australian specimens of var. *pygmaea* and the Malaysian ones is that the former have a sparsely hirsute inflorescence.

The synonymy cited above clearly shows that there has been considerable confusion about the correct name of this species. This was mainly caused by BENTHAM's misinterpretation of *M. nudicaulis* (and of *M. trinervis* which he put into

the synonymy of *M. capillaris*) and by CLARKE's concept of the Australian *M. polymorpha* in which he included with some doubt the Nepalese *M. capillaris*. The interpretations of these prominent botanists were commonly followed. Only recently HARA (1955), in his careful studies on the typification of Japanese plants, showed the correct application of these names.

Indeed, *var. malaccensis* is in habit closely alike *M. polymorpha* R. BR., a species restricted to subtropical E. Australia. The latter species differs mainly from *M. pygmaea var. malaccensis* in the following characters: pedicels long (2–3 cm in flower, up to 3½ cm in fruit), calyx long (5 mm), corolla large (7 mm, the lobes 3 mm), connective ending in a liguliform incurved appendix, stigma truncate, fruit exceeded by the calyx, larger (c. 2½ mm ø), and with free styles, seeds ellipsoid, rounded at both ends, rather large (0.6 mm instead of 0.35–0.4 mm), shining black instead of brown, sparsely warty.

Var. pygmaea is since BENTHAM (1853) confused with an overlooked species from Assam, *M. erophila* LEENH. This species differs from *var. pygmaea* by the following characters: the presence of sterile bracts along the peduncle (these are very exceptional in *var. pygmaea*), the slightly zygomorphic corolla with relatively long lobes and a more densely pubescent mouth, stamens which are inserted above the middle of the corolla-tube (in *M. pygmaea* distinctly below the middle), short styles which are nearly fully connate during anthesis, but free in fruit, and the fairly coarsely reticulated seeds.

In his description of *M. micrantha*, DOMIN mentioned by error a 5-lobed calyx; in all three type-specimens it is 4-merous.

In herbaria, *Mollugo nudicaulis* LAMK (*Aizoaceae*) is sometimes mixed up with this species on account of a superficial resemblance.

3. *Mitrasacme indica* WIGHT, Ic. 4, 4 (May 1850) 15, t. 1601; Illustr. Ind. Bot. 2 (1850) t. 156 f. 1–13; BTH. in Hook. J. Bot. Kew Misc. 5 (1853) 56; J. Linn. Soc. Bot. 1 (1856) 92; Fl. Austr. 4 (1869) 356; F. M. BAIL. Queensl. Fl. 3 (1900) 1019; EWART & DAVIES, Fl. North. Terr. (1917) 219.—*M. pusilla* DALZ. in Hook. J. Bot. Kew Misc. 2 (May 1850) 136.—*M. crystallina* GRIFF. Not. 4 (1854) 87; Icon. (1854) t. 383 f. 2.—*M. alsinoides* (non R. BR.) CLARKE in Hook. f. Fl. Br. Ind. 4 (1883) 80; FORB. & HEMSL. J. Linn. Soc. Bot. 26 (1889) 117; TRIMEN, Fl. Ceyl. 3 (1895) 170; BOERL. Handl. 2 (1899) 450 & 458; DOP, Bull. Soc. Bot. Fr. 57, Mém. n. 19 (1910) 4; Fl. Gén. I.–C. 4 (1912) 157; CAMMERL. Bull. Jard. Bot. Btzg III, 5 (1923) 300; GAMBLE, Fl. Madras 5 (1923) 864; MERR. En. Philip. 3 (1923) 311; RIDL. Fl. Mal. Pen. 2 (1923) 413; BACKER, Onkr. Suiker. (1931) 487; MERR. & PERRY, J. Arn. Arb. 23 (1942) 410; BAKH. f. in Back. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 170, p. 5; MASAMUNE & SYOZI, Act. Phytotax. Geobot. 12 (1950) 202; KERR in Craib, Fl. Siam. En. 3 (1951) 52; MAKINO, Ill. Fl. Japan, rev. ed. (1954) 217, f. 649; HARA,

J. Jap. Bot. 30 (1955) 24, incl. *var. indica*.—*Oldenlandia brachyphylla* MERR. Fl. Manila (1912) 448.

Annual, up to 15 cm. Stems usually branched, slender, distinctly 4-ribbed to narrowly 4-winged, often slightly compressed, glabrous or nearly so; internodes 2–4 times as long as the leaves. *Leaves* lanceolate to ovate, 4–7 by 1½–2½ mm, herbaceous, glabrous, apex acute, 1-nerved. *Flowers* solitary in the upper leaf-axils. Pedicels 3–7 (in fruit 5–25) mm, glabrous to scabrous. *Calyx* conical, 1¾–2 mm long, glabrous, about halfway connate, lobes lanceolate, acute. *Corolla* about campanulate, 3–4 mm long, shortly and thinly bearded in the mouth, white, lobes 1–1½ mm long, rounded. *Filaments* 1 mm; anthers basifixed, introrse, elliptic, rarely sagittate, c. ⅔ mm long, sometimes with an apical appendix. *Pistil* 1½ mm, ovary nearly ½ mm, styles far apart at the base, connate in the upper half, stigma broadly truncate (to 2-lobed). *Capsules* subglobular, c. 2 mm ø, styles connate only at the apex. *Seeds* angular-ovoid, 0.2 mm, brown, coarsely reticulate.

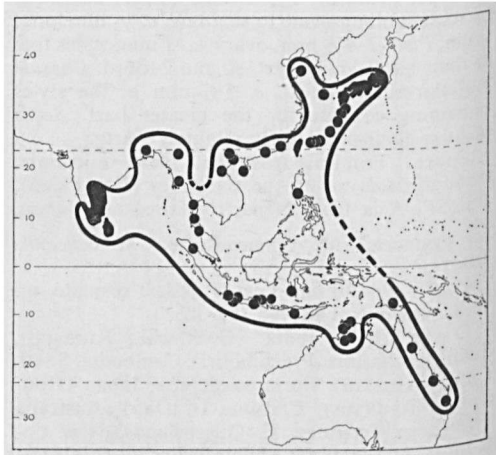


Fig. 44. Distribution of *Mitrasacme indica* WIGHT, as an example of a wide-spread species.

Distr. Ceylon, Deccan Peninsula, Upper Burma, Indo-China (Tonkin), coastal regions of China as far north as Shantung (Chefoo Mts), Korea (Chemulpo), Japan (Honshu to Ryukyus), Formosa, Hainan, Australia (Northern Territory, Queensland), in *Malaysia*: Sumatra (West Coast), Malay Peninsula (Surat, Puket, Kelantan), Java (also Madura and Kangean Is.), Lesser Sunda Is. (Sumba), SW. Celebes (Malino), Philippines (Luzon), and Southern New Guinea. All citations from Borneo seem to go back to CLARKE (1883, l.c.); I did not see any specimen from that island. Fig. 44.

Ecol. Open places of all kinds, on poor to heavy soils, dry to marshy, sandy or on limestone, from sea-level to c. 500 m. *Fl. fr.* Jan.–Dec., mainly March–June.

Notes. One of the species usually referred to as *M. alsinoides* R. BR. Well distinguishable by its

glabrous, ribbed to winged stems and its coarsely reticulated seeds.

The names *M. indica* WIGHT and *M. pusilla* DALZ. were apparently both published in May 1850. BENTHAM (1853, *l.c.*) was the first who reduced *M. pusilla* to *M. indica*. DALZIELL & GIBSON (Bombay Fl. 1861, 155) stated under *M. pusilla*: "This was afterwards named *M. indica* by Wight Ic. 1601." This remark does not necessarily refer to the dates of actual publication.

4. *Mitrasacme saxatilis* BACK. in Cammerl. Bull. Jard. Bot. Btzg III, 5 (1923) 301, f. 1; Onkr. Suiker. (1931) 487.

Erect, annual (or perennial?) herb, up to 12 cm, branched at the base. Stems terete, canaliculate, scabrous, internodes about as long as the leaves. *Leaves* sessile, ovate, $2\frac{1}{2}$ by $1\frac{1}{2}$ mm, stiff, glabrous, broadly cuneate at base, apex acute to aristulate, margin revolute, distinctly thickened as is the midrib on the lower surface. *Flowers* solitary in the upper leaf-axils. Pedicels $1\frac{1}{2}$ - $2\frac{1}{2}$ mm, slender, scabrous. *Calyx* campanulate, $1\frac{1}{2}$ mm long, glabrous, connate for $\frac{2}{3}$, lobes triangular, acute, midrib strongly thickened as are the margins near the apex. *Corolla* 2 mm long, bearded in the mouth, white, lobes $\frac{2}{3}$ mm long, nearly acute. *Anthers* subsessile, introrse, $\frac{1}{4}$ - $\frac{1}{3}$ mm long. *Pistil* small, styles $\frac{1}{3}$ mm long, far apart at the base, connate in the upper half. *Capsules* broadly mitre-shaped, c. $1\frac{1}{3}$ mm high, styles torn loose. *Seeds* ellipsoid, brown, minutely warty.

Distr. *Malaysia*: E. Java (near Banjuwangi) and Madura I.

Ecol. In open vegetation, on cliffs and dry limestone hills, locally gregarious; from sea-level up to 400 m. *Fl. fr.* May-July.

Note. A very characteristic species: stiff and erect, dense, with sessile, small, ovate leaves which have conspicuously thickened margins and midrib, calyx with relatively short lobes which also have strongly thickened margins and midrib, fruit nearly completely enveloped by the calyx and with very short styles.

5. *Mitrasacme albomarginata* LEENH. Bull. Jard. Bot. Brux. 32 (1962) 442.—Fig. 45.

Annual herb, up to c. 10-15 cm. Stems flattened (also *in vivo*?), minutely appressed-pubescent, internodes up to about twice as long as the leaves. *Leaves* lanceolate (rarely ovate-lanceolate) 5-6 by $1\frac{1}{2}$ mm, herbaceous with a narrow, white, membranous margin, glabrous, contracted at base, aristulate at apex, 1-nerved. *Flowers* solitary in the upper leaf-axils. Pedicel $\frac{1}{2}$ -1 cm, minutely pubescent. *Calyx* conical-campanulate, $3\frac{1}{2}$ mm long, glabrous, about halfway connate, lobes acute-triangular, with a narrow white membranous margin and aristulate like the leaves. *Corolla* white, campanulate, $4\frac{1}{2}$ mm, inside with long bristles in the mouth and some short hairs at the apex of the lobes; lobes elliptic, acute, 2 mm long. *Stamens* short, filaments 1.2 mm, strap-shaped; anthers basifixed, introrse, sagittate, 1 mm long, acute and with some short bristles at the

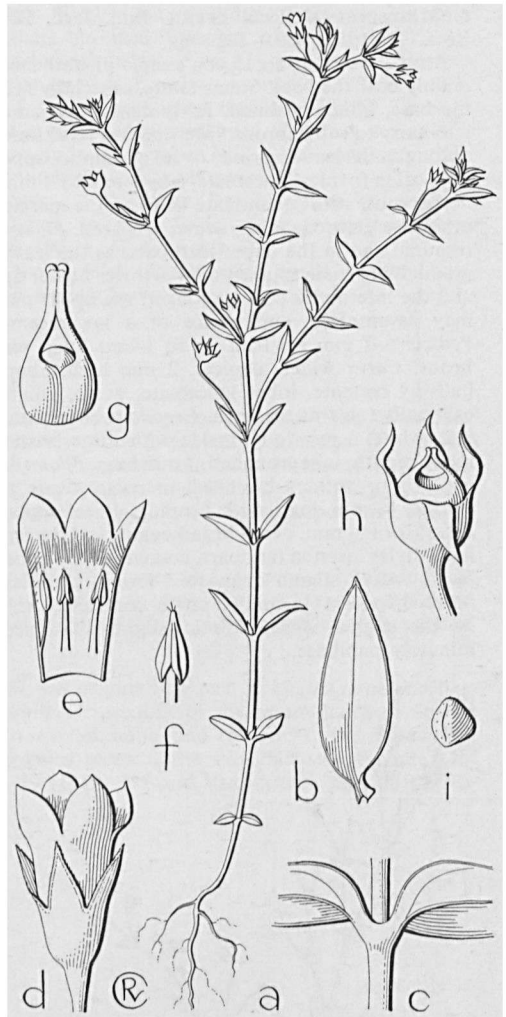


Fig. 45. *Mitrasacme albomarginata* LEENH. a. Habit, $\times 1$, b. leaf (note the membranous margin), $\times 5$, c. connate leaf-sheaths, $\times 5$, d. flower, $\times 5$, e. opened corolla, $\times 5$, f. anther, $\times 10$, g. pistil, $\times 10$, h. fruit, $\times 5$, i. seed, $\times 20$ (all from VAN ROYEN 4847).

apex. *Pistil* 2 mm, ovary globular, $\frac{3}{4}$ mm, styles inserted far apart, connate in their upper half, stigma truncate. *Fruits* globular, $1\frac{1}{4}$ mm ϕ , completely enveloped by the calyx-tube, styles soon separating from each other. *Seeds* angular, 0.2 mm, minutely warty.

Distr. SW. New Guinea, once collected.

Ecol. In grasslands, open places with very low vegetation, c. 8 m alt., locally common. *Fl. fr.* Sept.

Note. Similar to the East Australian *M. paludosa* R. BR. which is distinctly different in several floral characters, amongst others a fleshy corolla and extrorse anthers with a robust apical hook.

6. *Mitrasacme neglecta* LEENH. Bull. Jard. Bot. Brux. 32 (1962) 449.—Fig. 46.

Annual herb, up to 15 cm, simple or branched, mainly near the base. Stems terete, especially near the base, minutely fluted, fairly densely squamulate-hairy to subglabrous, internodes several times as long as the leaves. *Leaves* ovate or elliptic, upper ones often (ovate-)lanceolate, 6 by 3 to 4 by 1 mm, herbaceous, with squamulate hairs on the margin, otherwise glabrous, apex acute; 1-nerved. *Flowers* terminal and in the upper leaf-axils; as the leaves gradually become smaller and narrower higher up, and the internodes become longer, the upper part may assume the appearance of a lax raceme. Pedicel 6–7 mm (in fruit up to 1 cm) long, scabrous. *Calyx* widely conical, 2 mm high, about halfway connate, lobes lanceolate, acute, ciliate, especially towards the apex. *Corolla* subcampanulate, white, 3 mm long, inside with some bristles in the mouth, lobes rounded, 1 mm long. *Filaments* c. $\frac{2}{3}$ mm; anthers basifixed, extrorse, ovate to elliptic, $\frac{1}{2}$ mm long, with a minute apical appendix. *Pistil* $1\frac{1}{2}$ mm, ovary broad-cylindrical, $\frac{1}{2}$ mm high, styles inserted far apart, connate in the upper $\frac{1}{2}$ – $\frac{1}{4}$ part, stigma truncate. *Fruits* globular-mitre-shaped, $1\frac{1}{2}$ mm \varnothing , styles connected only by the stigma. *Seeds* elliptic, slightly flattened, minutely papillose.

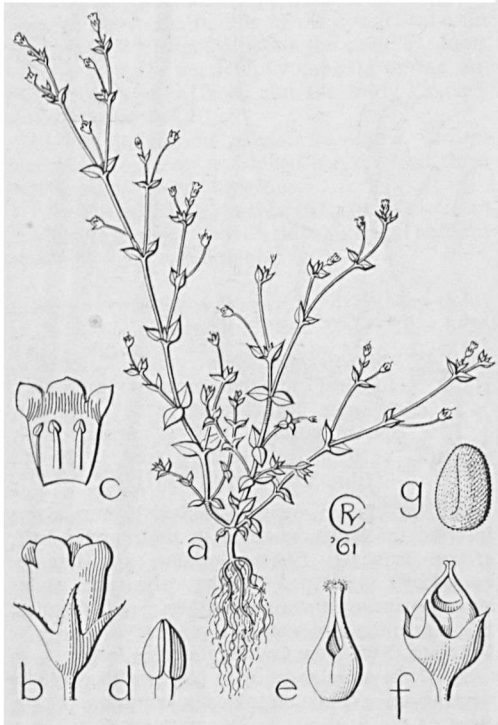


Fig. 46. *Mitrasacme neglecta* LEENH. a. Habit, $\times \frac{2}{3}$, b. flower, $\times 4$, c. opened corolla (note the extrorse anthers), $\times 4$, d. anther, $\times 16$, e. pistil, $\times 8$, f. fruit, $\times 4$, g. seed, $\times 30$ (a–e sine coll., s.n. in herb. L 909.67–695, f–g COERT 917).

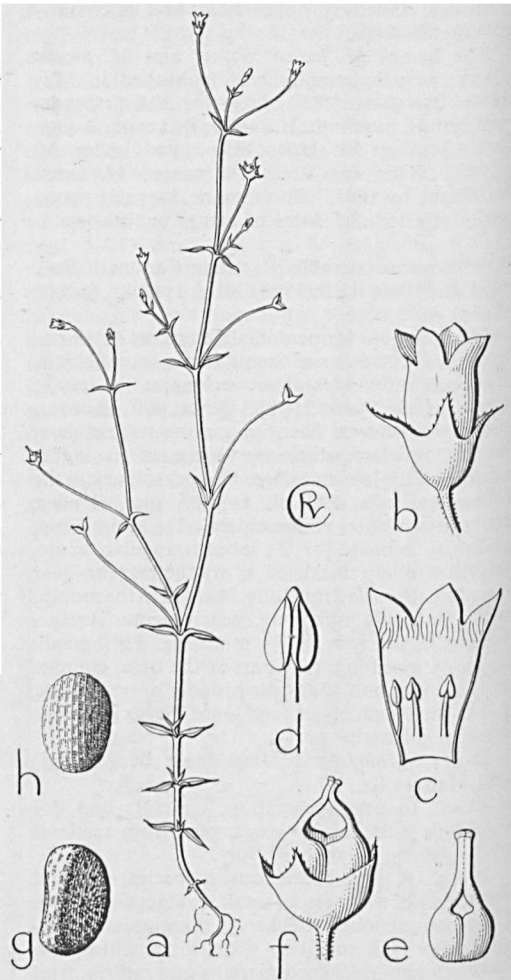


Fig. 47. *Mitrasacme bogoriensis* LEENH. a. Habit, $\times \frac{2}{3}$, b. flower, $\times 4$, c. opened corolla, $\times 4$, d. anther, $\times 16$, e. pistil, $\times 8$, f. fruit, $\times 4$, g. and h. seeds, $\times 42$ (all from BACKER 6218).

Distr. Australia (Arnhem Land) and *Malesia*: E. Java, Madura, Lesser Sunda Is. (Bali, Sumba, Timor), and SW. Celebes (Bt Parangpeda near Banto Parang).

Ecol. On beach walls, in fields, in rocky localities, on limestone hills, on bare rocks, between grass and low scrub; from sea-level up to 925 m. *Fl. fr.* March–April (July).

Note. From the closely related *M. indica* immediately distinguished by the terete, pubescent stem and the slight though distinct differentiation between the non-flowering and the flower-bearing part of the plant.

7. *Mitrasacme bogoriensis* LEENH. Bull. Jard. Bot. Brux. 32 (1962) 444.—Fig. 47.

Erect annual herb up to c. 18 cm, simple or branched in the upper half. Stems terete, rather

densely squamulate-hairy, internodes about as long as the leaves, the upper ones much longer. *Leaves* (ovate-)lanceolate, decreasing in size upwards, 5-9 by 1-1½(-2¼) mm, herbaceous, glabrous, margin revolute, apex acute, aristulate; 1-nerved. *Flowers* solitary in the upper leaf-axils, by the long internodes, small leaves, and long spreading pedicels seemingly forming a lax raceme. *Pedicel* c. ¾-2½ cm long, pubescent. *Calyx* conical-campanulate, 1½-2½ mm, about halfway connate, lobes acute-triangular, sparsely ciliate along the margin and on the prominent midrib towards the apex. *Corolla* white, urceolate-campanulate, 3-4½ mm long, bearded in the mouth,

lobes ¾-1½ mm, rounded. *Filaments* ⅔ mm; anthers basifixed, extrorse, oblong-ovoid, 0.3-½ mm long, truncate. *Pistil* 1½ mm, ovary 0.4 mm, styles inserted far apart, connate in their upper half, stigma broadened truncate, slightly 2-lobed. *Fruits* globular-mitre-shaped, 2 mm ø, styles still connate in their upper half. *Seeds* angular, rather minutely reticulate, brown.

Distr. W. Java (Bogor), three collections.

Ecol. In grass fields, along grassy roadsides, 100-400 m. *Fl. fr.* April, Dec.

Note. Well characterized by its slender habit and narrow leaves.

Excluded

Cleisocratera KORTH. Kruidk. (1844) 256 was originally as a monotypic genus assigned to the *Rubiaceae*, but MIQUEL (Fl. Ind. Bat. 2, 1857, 384) included it tentatively in the *Loganiaceae*. MERRILL (En. Born. 1921, 576) remarked that it had been referred incidentally to *Psychotria* but believed this to be wrong. KORTHALS himself already remarked its close proximity to *Saprosma* and VALETON (Ic. Bog. 3, 1909, 209) reduced it to the latter genus, an opinion which, after examination of the type specimen, is also shared by Dr BAKHUIZEN VAN DEN BRINK *f.* and Dr VAN STEENIS (*Rubiaceae*).

Dolianthus C. H. WRIGHT, Kew Bull. (1899) 106 was originally assigned to *Loganiaceae*, but according to BREMEKAMP (Kew Bull. 1936, 103) it is *Rubiaceous* and is allied to *Amaracarpus*. MERRILL & PERRY (J. Arn. Arb. 27, 1946, 221) accept it as belonging to a set of Papuan, high altitude species of that genus (*kubiaceae*).

Gaertnera LAMK, Tabl. Enc. Bot. III. 2 (1791) 273, t. 167 was originally placed in *Loganiaceae* and has up to the present often been treated as belonging to this family. On account of the resemblance in flower structure (apart from the more or less superior ovary), in stipules, habit, and anatomy to the *Rubiaceae-Psychotrieae*, with which it also shares the presence of raphides, recent authors on *Rubiaceae* include it in that family and tribe. See PETIT, Bull. Jard. Bot. Brux. 29 (1959) 377 and VERDCOURT, *ibid.* 28 (1958) 238 (*Rubiaceae*).