

OLACACEAE (H. Sleumer, Leyden)

Trees or erect, rarely scandent shrubs, sometimes hemi-, rarely autoparasitic. *Leaves* spirally arranged, rarely distichous, simple, entire, often with parchment-like and/or finely tuberculate surfaces, mostly penni-, rarely pli-nerved, petioled, exstipulate, not rarely of a greyish-yellowish-olivaceous colour and dull, especially in the dry state. *Inflorescences* axillary, rarely on old wood, short racemes and panicles, or elongate spikes, often fascicles or glomerules, these rarely reduced to a solitary flower. *Flowers* generally bisexual, rarely unisexual (monoecious or andro-dioecious), generally actinomorphic, cyclic, 3–7-merous, rarely heterostylous. *Calyx* small in anthesis, often very shortly 3–7-lobed, -dentate, or -crenulate, the cup-like base free or adnate to the disk and/or ovary to various degrees, afterwards sometimes accrescent, and then either free from or connate with the fruit. *Petals* 3–7, free or connate below, valvate, caducous. *Disk* sometimes present, consisting of free glands, or cup-like, rarely accrescent and then covering the fruit almost to the apex. *Stamens* 1–3-seriate, hypogynous, 4–15 in number, epipetalous, or partly also episepalous, rarely in part staminodial; anthers basi- or medifixed, with 2 thecae, or rarely with 1 theca, dehiscing lengthwise. *Ovary* mostly superior, rarely semi-inferior when immersed in the disk, or inferior when connate with the cup-like flower-axis (*Schoepfia*), either 1-locular with 2–3 (–5, –7) ovules pendent from the apex of a central free placenta (sometimes projecting into the styler canal), or 3–5 (–7)-locular in the lower part only (rarely completely so), a single ovule hanging then from the inner angle into each of the cells; ovules generally anatropous, uni-, bi-, or ategmic; style, if any, conical, columnar or filiform, with a small, sometimes 3–5-partite or -lobed, subsessile stigma. *Fruit* a drupe with a thin and often fleshy, sometimes dehiscent or caducous exocarp, and a crustaceous to woody endocarp, or concrescent with the cup-shaped floral axis, or with an accrescent calyx or disk which then forms an external fleshy layer. *Seed* 1; testa (if any) thin; endosperm abundant, starchy and/or oily, bearing the embryo at its apex; cotyledons 2, 3, or 4.

Distribution. A pantropical family with about 27 genera and approximately 170 *spp.*, predominantly in the tropics, a few in the subtropics.

In Malesia 9 genera with a total of 14 *spp.* Of these only *Ochanostachys* is strictly limited to Malesia. *Erythralum*, *Harmandia* and *Scorodocarpus* are Indo-Malesian. Some have a wider Old World range, viz *Anacolosa* (1 *sp.* in Central Africa, 2 *spp.* in Madagascar and 3 *spp.* in the Pacific), *Olox* (also in Africa, Australia, and the Pacific), and *Strombosia* (also in Africa). *Schoepfia* is Indo-Malesian, with c. 20 *spp.* also in tropical America. *Ximenia* is pantropical. The genus *Malania* (limited to SW. China) is closely related to *Scorodocarpus*.

The Malesian representatives thus show a distinct alliance with those of SE. Asia, and a less marked one with Australia and the Pacific (*Anacolosa*, *Olox*, *Ximenia*). Alliances are strong with Africa in the genera *Anacolosa*, *Olox*, and *Strombosia*.

Ecology. Most Malesian *Olacaceae* occur in primary and secondary lowland (also littoral) rain-forest. *Olox* and *Ximenia* are found mainly in drier vegetation types as teak forest, brushwood or beach vegetation. *Ximenia* sheds its leaves in the dry season.

The size of Malesian *Olacaceae* is mostly moderate to small, and the majority belongs to the forest substage; they never become dominant.

Parasitism. Several *Olacaceae* are known for their non host-specific parasitism, as is a common feature in *Santalaceae* and *Loranthaceae*. Root haustoria have been found in *Olex* and *Ximения* in Asia, and also in *Ptychopetalum* and *Schoepfia*, both in America. The extent to which this parasitism occurs in these and possibly in other genera is not known. For Malesia proper no data on parasitism have been published but it can be expected for *Olex scandens*, *Ximения americana*, and maybe for *Schoepfia fragrans*. Cf. BARBER, Studies in root-parasitism. The haustoria of *Olex scandens*. Mem. Dept. Agr. India, Bot. ser. 2 (4) (1907) 1–47; KUIJT, The biology of parasitic flowering plants (1969) 65.

Dispersal. Little is known of the seed dispersal of *Olacaceae*; their fruits with fleshy pericarp and a big seed point to a possible dispersal by animals, mainly monkeys and birds eating the fruits. Fruits of the coastal *Ximения* are able to float for some time in seawater (RIDLEY, Disp., 1930, 195, 265, 346).

Morphology. The family has an interesting morphology in that, though small in size, it exhibits *pro ratio* a great pluriformity in important features as compared with many other families. The habit may be erect or scandent, plants may be armed with spines or thorns (*Ximения*, *Olex*) or unarmed; in *Erythralum* axillary tendrils occur (fig. 8), even rarely bifid. Of several genera it has been proved that they are hemiparasitic.

Also in the flowers variability occurs in merousness, and stamens, which are usually epipetalous, may also occur partly episepalous, rarely in part staminodial; stamens may be up to 3-seriate.

The ovary is superior, but may become through various ways of conrescence with disk and/or receptacle inferior or lead to an inferior fruit.

In *Erythralum* flowers are bisexual or andro-dioecious, in *Ximения* flowers are bisexual or rarely functionally unisexual, in *Olex scandens* and *Schoepfia* flowers are often heterostylous, in *Harmandia* flowers are monoecious, in many others they are normally bisexual.

The ovary is either one-celled with a central placenta or the lower part is more-celled with ovules pendent in these cells. Ovules may be bitegmic, unitegmic or even ategmic.

Phytochemically there is also variability: in *Ochanostachys* and *Harmandia* tissues contain cells with milky juice, *Scorodocarpus* reeks of garlic, while *Erythralum* has also a bad smell.

Leaf and wood anatomy and pollen morphology are also very diverse; see below.

This pluriformity is striking, because the family must be of ancient date, as can be derived from the fact that it does not only range over the tropics of all continents but even three genera are trans-Atlantic and one trans-Pacific.

Galls. Cf. DOCTERS VAN LEEUWEN, Zoocecid. Neth. Ind. (1926) 175 (galls of *Anacolosa frutescens*).

Embryology. Cf. AGARWAL, Phytomorphology 11 (1961) 269–272 (*Strombosia*); *ibid.* 13 (1963) 185–196 (*Olex*).

Phytochemistry. There is a more or less general tendency in *Olacaceae* to deposit oxalate of lime in various parts, and silicic acid in leaves (not in wood). Seeds tend to be rich in oil. Triglycerides with C-18 acetylenic acids such as santalbic (ximenynic), isanic and isanolic acid occur amply in seed oils (e.g. *Ximения americana*), but are also present in roots, stems and leaves (*Ximения americana*, *Olex stricta*), linking *Olacaceae* biochemically with *Santalaceae* and *Opiliaceae*.

The lack of knowledge about polyphenolic compounds in *Olacaceae* is astonishing. Tannins, probably of mixed origin (mainly flavonoid type, but sometimes accompanied by galloyl tannins) are abundantly present in the bark, roots or leaves of *Ximения americana*, *Anacolosa spp.*, *Olex spp.*, and others.

Prunasin-like (i.e. yielding HCN and benzaldehyde) cyanogenic glycosides are present in different parts of *Ximения spp.* and *Olex spp.* Saponins seem to occur rather widely in *Olacaceae*. Olacaceous saponins appear to be mainly triterpenoids; this character is shared with, among others, *Opiliaceae* and *Santalaceae*.

Alcaloids are possibly present in some species of the palaeotropical genera *Anacolosa*, *Olex*, and *Strombosia*.

Literature. R. HEGNAUER, Chemotaxonomie der Pflanzen 5 (1969) 227; in Sleumer, *Olacaceae*, Flora Neotropica, in press. — R. HEGNAUER.

Vegetative anatomy. For general accounts see SOLEREDER (1899, 1908), METCALFE & CHALK (1950), REED (1955) and BAAS *et al.* (1982, with full references to older literature). Leaf and wood anatomy of the *Olacaceae* are very diverse, but still support the concept of a natural family. Stomatal type, secretory cavities, laticifers, silicified cells, nodal, petiole and midrib vasculature, idioblastic sclereids, type of vessel perforations, parenchyma distribution, ray type, and fibre pitting all show distinct character states enabling a reconstruction of phylogenetic trends and relationship patterns within the family (see BAAS *et al.*, 1982; REED, 1955). Most Malesian genera have their closest relatives in Africa and/or the New World. *Ochanostachys* is anatomically more or less identical to *Coula* (Africa) and *Minquartia* (South America) and has both secretory cavities and laticifers. *Harmandia* strongly resembles *Aptandra* from Africa and South America and shares the occurrence of infrequent (reduced?) laticifers in the mesophyll. *Anacolosa* has its closest relative in the neotropical genus *Cathedra*. *Olox*, *Schoepfia*, and *Ximenia* belong to a larger, anatomically fairly homogeneous group including African and neotropical representatives. This group also shares many characters with *Anacolosa* and *Cathedra* on the one hand, and with *Santalaceae* and *Loranthaceae* on the other. *Strombosia* belongs to a well defined anatomical assemblage including *Strombosiopsis* and *Diogoia* from Africa and *Tetrastylidium* from South America. This group is unrelated to *Anacolosa*, with which it has been placed in the same tribe *Anacoloseae* in the past. *Scorodocarpus* shows remote affinities to *Strombosia*, but is closer anatomically to the neotropical *Brachynema*. *Erythralum* remains anatomically fairly isolated within the family, but differences are insufficient to advocate a separate family. The geographical distribution of the anatomical units (largely coinciding with the traditionally recognized tribes, with the exception of the *Anacoloseae*) is suggestive of considerable age and conservatism of the anatomical character complexes. For a key to the genera based on leaf anatomy, see BAAS *et al.* (1982). A detailed wood anatomical survey of the family is in preparation (L. VAN DEN OEVER, Blumea).

Literature: BAAS, VAN OOSTERHOUD & SCHOLTES, Allertonia 3 (1982) 155–210; METCALFE & CHALK, Anatomy of the Dicotyledons I, Oxford (1950); REED, Mem. Soc. Brot. 10 (1955) 29–79; SOLEREDER, Systematische Anatomie der Dicotyledonen & Ergänzungsband, Stuttgart (1899 & 1908). — P. BAAS.

Pollen morphology. *General description.* *Olacaceae* exhibit a variable pollen morphology. In *Olox* and *Ptychopetalum* both intra- and interspecific, geographically based variation occurs. In general Olacaceous pollen grains are single; size varies between 11 μm (*Heisteria micrantha*) and 48 μm (*Olox benthamiana*) and shape is basically subequiaxial, ranging from oblate to peroblate in *Anacolosa* and *Olox* to subprolate in *Diogoia* and *Tetrastylidium*. Mostly grains are isopolar, but subisopolar and heteropolar types occur also. This heteropolarity may be expressed in sculpturing (*Coula p.p.*, *Ochanostachys*), in apertures (*Heisteria p.p.*, *Strombosia p.p.*), or in shape and apertures (*Aptandra*, *Harmandia*, *Ongokea*, *Schoepfia*). In *Coula*, *Heisteria* and *Strombosia* both isopolar and heteropolar types occur.

According to apertures, *Olacaceae* can be divided into four main groups, A, tricolpate with an endoaperture which is not wider than the colpus or tricolporate with a rectangular or slightly elliptical endoaperture at the equator, B, 3- (4-, 5-) stephanoporate and C, 6-diploporate. In *Schoepfia* syncolpate ectoapertures are found at the proximal pole. The apertures are generally closed by a granular-verrucate membrane.

The sculpture of the tectum varies between psilate (*Erythralum*, *Minquartia*, *Schoepfia*), perforate (*Scorodocarpus*), reticulate (*Diogoia*, *Strombosiopsis*, *Ximenia p.p.*) and microechinulate (*Curupira*, *Octoknema*). The sculpture may be different between apo- and mesocolpia. *Chaunochiton* has unique sculptured ridges. Infratectal structure is mostly granular but transitions to a columellate structure are frequent. In *Anacolosa* and *Chaunochiton* distinct but always irregular columellae are developed.

The footlayer is generally present, visible in the mesocolpia in *Chaunochiton*. This layer is often

sculptured on the inner side of the apertural margin. The footlayer is especially thick when the endexine is missing (*Coula*, *Minquartia*, *Ochanostachys*, *Schoepfia p.p.*, *Ximenia*). The endexine is mostly confined to the apertural areas, except in *Anacolosia*, *Cathedra*, *Chaunochiton* and *Phanerodiscus* in which the endexine is thick and continuous, and in *Erythropalum*, *Heisteria*, *Schoepfia p.p.*, *Scorodocarpus* and *Strombosia* in which the endexine is very thin and continuous in the mesocolpia.

The tricolpate isopolar pollen types of Group A, found in *Coula*, *Curupira*, *Heisteria p.p.*, *Aptandropsis* and *Minquartia*, and the tricolporate pollen types of Group A, found in *Diogoia*, *Strombosiopsis* and *Tetrastylidium* are considered primitive.

Porate types in *Aptandra*, *Brachynema*, *Dulacia*, *Harmandia*, *Olox p.p.*, *Ongokea* and *Ptychopetalum p.p.* as well as 6-diploporate grains characterizing *Anacolosia*, *Cathedra*, *Phanerodiscus* and *Ptychopetalum p.p.* are probably derived.

The heteropolar-tetrahedral pollen grains of *Schoepfia* and the brevicolpate grains of *Chaunochiton* with its ectexinal ridges seem morphologically isolated and may also represent derived types.

Intergeneric relationships. *Couleae* and *Heisterieae p.p.* (*Heisteria*, *Aptandropsis*) are pollen morphologically related. The mutual affinities between *Heisteria* and *Chaunochiton* are weakly expressed in aperture characters and by the loss of the tectum in the intercolpium, and this last genus could be placed in a separate tribe of its own.

Anacolosae fall into two quite distinct generic groups, I, *Diogoia*, *Scorodocarpus*, *Strombosia*, *Strombosiopsis*, *Tetrastylidium* and II, *Anacolosia*, *Cathedra* and *Phanerodiscus*. *Brachynema* is isolated.

Within *Olaceae*, the pollen of *Ptychopetalum* is very distinct from that of *Olox* and *Dulacia*. It is distinct also from that of *Anacolosia*.

Pollen of *Aptandreae* (*Aptandra*, *Harmandia* and *Ongokea*) is uniform.

The morphology of *Schoepfieae* offers no clue to its affinities, but the ultrastructure of the exine draws them near to the *Couleae*.

Relationship of family. *Olaceae* pollen shows resemblance to *Opiliaceae* and *Santalaceae* pollen. Some similarity also exists between the pollen of the *Olaceae* and *Icacinaceae*.

Fossil occurrences. Pollen of the *Anacolosia* type is known from the Maestrichtian onwards, while *Olox* type pollen has been recorded from the lower Eocene. The pollen of *Ximenia* has been found in Quaternary sediment in East Africa.

Literature: R. BONNEFILLE, D. LOBREAU-CALLEN & G. RIOLLET, J. Biogeogr. 9 (1982) 469–486; G. ERDTMAN, Pollen morphology and plant taxonomy, Angiosperms (1952) 295–297; S. FEUER, Pollen morphology and evolution in the *Santalales s. str.* Thesis Univ. Mass. (1977), Amer. J. Bot. 65 (1978) 759–763; D. LOBREAU-CALLEN, *Adansonia* sér. 2, 20 (1980) 29–89; Bot. Jahrb. 103 (1982) 371–412; Bull. Lab. Géol. Genève (1983) in press; J. MULLER, Bot. Rev. 47 (1981) 84; C. REED, Mem. Soc. Brot. 10 (1955) 29–79. — D. LOBREAU-CALLEN.

Chromosomes. Only in the allied *Santalaceae* species of a fair number of genera have been examined; this yielded $2n = 20, 24, 30, 38, 40,$ and 72 .

The two species of *Olaceae* examined, one in *Heisteria* and one in *Strombosia*, yielded $2n = 38$ and 40 respectively. The one species examined in *Opiliaceae*, viz. of *Opilia*, showed $2n = 20$. Although the evidence is small, it does support the affinity between the three families.

Literature: AN.A. FEDOROV (ed.), Chromosome numbers of flowering plants. Leningrad (1969).

Taxonomy. The family as a whole is characterized by a free basal central placenta from which a single ovule is pendent into each of the generally imperfect cells of the ovary, or in case of a 1-celled ovary, several ovules from the apex of such a free placenta. The ovules are bitegmic, or more often unitegmic, or have — mainly in parasitic species — no integument at all. The ovary is hypogynous in principle, but may become semi-hypogynous or even epigynous by concrescence with the calyx, disk or flower-axis. The fruit is drupaceous, not rarely \pm included by the accrescent calyx or disk.

Olacaceae are regarded by ENGLER (Syllabus, 1924) to represent the most primitive family of the *Santalales* with regard to the occurrence of hemiparasitism and the reduction in number of the integuments. ENGLER has divided the family in the first edition of ENGLER & PRANTL, Nat. Pfl. Fam. (III, 1, 1894; Nachtr. 1, 1897; Nachtr. 3, 1908) into 3 subfamilies with 6 tribes mainly on the base of the presence or absence of integuments and the position of the micropyle on the ovulum. These subdivisions have been maintained by the author in the second edition, 16b (1935). However, the characters used by ENGLER to distinguish subfamilies were based on too scanty observations to prove the constancy needed for such high taxonomic rank as that of a subfamily.

Characters may prove more variable than assumed; for example AGARWAL (Phytomorphology 13, 1963, 185) found that in *Olax* both unitegmic and ategmic species occur, which means that more observations in embryology are needed.

The tribes distinguished by ENGLER are mainly based on the presence or absence of starch and/or fatty constituents in the endosperm, and on the amount of fusion between the stamens. These tribes are not well established as the mentioned chemical constituents are not fully known yet in all members of the genera concerned. At the moment a subdivision of *Olacaceae* into natural subfamilies and tribes is still open.

Uses. *Scorodocarpus borneensis* provides a deep red timber (*kulim*). The timber of other genera (*Anacolosia*, *Strombosia*) is less important, usually of small size, and only locally used. *Ximenia americana* has a hard yellowish wood similar to Sandal wood, and is used locally. Young leaves of *Strombosia javanica* are eaten. Edible fruits are known of *Scorodocarpus borneensis* and *Ochanostachys amentacea*. The kernel of *Ximenia americana* contains a strong purgative.

Note. The most important paper on Malesian *Olacaceae* has been written by VALETON (Crit. Overzicht *Olacineae*; Inaug. Diss., Groningen, 1886). In a precursor I have given an account of the genera and species of Asia, Malesia and adjacent areas (Blumea 26, 1980, 145-168). All genera of this part of the world occur also in Malesia, with the exception of the monotypic genus *Malania* which is endemic in SW. China.

KEY TO THE GENERA
based on flowering material

1. Leaves 3-5-plinerved, at base subpeltate. Climbing shrub; axillary tendrils often present
 2. Stamens and staminodes present
 3. Stamens fully fused into a tube. Flowers unisexual, plant monoecious
 3. Stamens not fused (sometimes partly adnate to the petals). Flowers generally bisexual
 4. Stamens 8 or 10, half of them epipetalous, the other half episepalous. Leaves usually mucronulate at apex. Spines and/or thorns generally present
 4. Stamens all epipetalous. Leaves not mucronulate at apex. Spines and/or thorns absent
 5. Flowers interruptedly arranged in elongate spikes
 5. Flowers arranged in short racemes, panicles, or mostly in fascicles
 6. Stamens 8 or 10, arranged in pairs before each petal
 6. Stamens 4-7, solitary before each petal
 7. Petals entirely free
 7. Petals fused in the lower half
 8. Calyx cupular, \pm truncate to very shortly 6-dentate. Petals thick-fleshy. Anthers apically penicillate
 8. Calyx indistinct, merely a rim with minute teeth. Flower supported by an epicalyx consisting of 3 concrescent bracts. Petals thin. Anthers not penicillate at apex
6. *Erythralium*
1. *Olax*
2. *Harmandia*
3. *Ximenia*
4. *Ochanostachys*
5. *Scorodocarpus*
7. *Strombosia*
8. *Anacolosia*
9. *Schoepfia*

KEY TO THE GENERA
based on fruiting material

1. Leaves 3–5-plinerved, often subpeltate. Climber, often with axillary tendrils. Fruit long-stipitate narrowed to the base. Pericarp dehiscent, inside red. Seed blue **6. Erythralium**
1. Leaves penninerved (if \pm triplinerved a tree). Fruit at most very short-stipitate, usually rounded or obtuse at base. Seed whitish.
 2. Calyx indistinct, merely with a rim. Fruit inferior, supported by a persistent epicalyx consisting of 3 accrescent bracts **9. Schoepfia**
 2. Calyx distinct. No epicalyx.
 3. Calyx much enlarged in fruit.
 4. Enlarged calyx connate with the fruit only in its lower part, for the rest frill-like expanded, very large **2. Harmandia**
 4. Enlarged calyx enveloping the fruit for its entire or almost entire length **1. Olax**
 3. Calyx not accrescent in fruit.
 5. Disk much accrescent, adnate to and almost entirely covering the fruit (which bears the persistent calyx at its base!) **8. Anacolosa**
 5. Disk, if present, not accrescent.
 6. Petiole very distinctly swollen distally **5. Scorodocarpus**
 6. Petiole slightly or not thickened distally.
 7. Leaves usually mucronulate at apex. Axillary spines and ramal thorns may be present **3. Ximenia**
 7. Leaves not mucronulate at apex. Spines or thorns absent **4. Ochanostachys**

KEY TO THE GENERA
based on sterile material

1. Leaves usually mucronulate at apex, deciduous in the dry season. Branchlets usually with axillary spines and/or brachyblasts ending in thorns **3. Ximenia**
1. Leaves not mucronulate at apex, persistent. Branchlets usually without, in 1. *Olax pr. p.* sometimes with ramal thorns.
 2. Climbing shrubs
 3. Leaves subpeltate, 3–5-plinerved. Branches often with spring-like lignescent tendrils **6. Erythralium**
 3. Leaves not subpeltate, exclusively pinninerved. Tendrils absent **1. Olax pr. p.**
 2. Erect shrubs or trees.
 4. Leaves markedly distichous.
 5. Spines or thorns sometimes present **1. Olax pr. p.**
 5. Spines or thorns absent **2. Harmandia**
 4. Leaves indistinctly or not distichous.
 6. Petiole conspicuously thickened distally **5. Scorodocarpus**
 6. Petiole hardly or not thickened distally.
 7. Leaves usually showing scattered blackish points on both faces; nerves slightly impressed above **4. Ochanostachys**
 7. Leaves without such blackish points; nerves not properly impressed above.
 8. Leaves usually with numerous fine pellucid points visible against strong light **7. Strombosia**
 8. Anacolosa
 8. Leaves not pellucid-punctate **9. Schoepfia**

1. OLAX

LINNÉ, Sp. Pl. (1753) 34; ENGL. in E. & P. Nat. Pfl. Fam. 3, 1 (1889) 231; SLEUM. in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 24; Blumea 26 (1980) 154. — *Drebbelia* ZOLL. Nat. Tijd. N. I. 14 (1857) 160; ENGL. in E. & P. Nat. Pfl. Fam., Nachtr. 2 (1900) 18. — **Fig. 1.**

Trees, shrubs or subshrubs, sometimes climbing, occasionally armed with ra-

mal thorns. *Leaves* spiral, sometimes (sub)distichous, penninerved. *Flowers* in racemes, panicles or spikes, rarely solitary. *Calyx* cup-shaped, truncate or obscurely dentate, small in anthesis, much accrescent in fruit. *Petals* 3, entire, or all or in part bipartite and thus seemingly 6 (rarely 5), inserted on a conical disk, free or connate in pairs. *Stamens* 8 (Mal.), partly adnate to the petals below, 3 of them fertile, and 5 staminodial (often bifid or bilobed, void of pollen); filaments flat; anthers oblong. *Ovary* superior, 1-celled, or 3-celled in the lower part only, with 3 anatropous uni- or ategmic ovules pending from the apex of a free central short placenta; style short or elongate; stigma capitellate, 3-lobed. *Drupe* oblongoid or ovoid to subglobular, included halfway or to almost the top by the accrescent firmly membranous calyx, though not strictly connate with it; pericarp parenchymatose; endocarp stony. *Seed* mostly 1; albumen copious, containing oily substances.

Distr. About 40 (or less) *spp.* in the Old World tropics, subdivided by ENGLER into 4 African sections, and a fifth *sect. Triandrae* ENGL. which comprises both African *spp.* and all those found in Asia, *Malesia* (2 *spp.*), Australia, and the Pacific.

Ecol. Most species occur in drier vegetation types; a few are climbers; root-parasitism seems to be frequent.

Morphology. Cf. FAGERLIND, Beobachtungen über die Kletterorgane bei *Olox*; Svensk Bot. Tidskr. 34 (1940) 26–34.

KEY TO THE SPECIES

1. Branchlets with a fine patent pubescence, usually armed with strong ramal thorns. Petals 7–9 mm, white, not or hardly changing colour in the dry state. Drupe c. 1.5 cm long 1. *O. scandens*
1. Branchlets more or less glabrous, unarmed. Petals 10–12 mm, becoming dark to blackish in the dry state. Drupe 1.7–2.5 cm long 2. *O. imbricata*

1. *Olox scandens* ROXB. Pl. Corom. 2 (1798) 2, t. 102; MIQ. Fl. Ind. Bat. 1, 1 (1856) 785; MAST. Fl. Br. Ind. 1 (1875) 575; VALET. Crit. Overz. Olacin. (1886) 114; RIDL. Trans. Linn. Soc. London II, 3 (1893) 286; BACK. Fl. Bat. 1 (1907) 290; Voort. (1908) 54; Schoolfl. Java (1911) 222; RIDL. J. Str. Br. R. As. Soc. 59 (1911) 84; KOORD. Exk. Fl. Java 2 (1912) 172; KOORD.-SCHUM. Syst. Verz. 1 (1912) 2; BEUMÉE, Flor.-anal. Onderz. Djatiboschen (1922) 113; RIDL. Fl. Mal. Pen. 1 (1922) 421; HEYNE, Nutt. Pl. (1927) 592; BURK. Dict. (1935) 1578; BACK. & BAKH. f. Fl. Java 2 (1965) 64; SLEUM. Blumea 26 (1980) 157. — *O. obtusa* BL. Bijdr. (1825) 131; MIQ. Fl. Ind. Bat. 1, 1 (1856) 785. — *Drebbelia subarborescens* ZOLL. Nat. Tijd. N. I. 14 (1857) 160. — Fig. 1.

Shrub with pendent branches, or generally scandent, 2–20 m; stem 1–15 cm \varnothing ; bark rather smooth, grey; old branches with strong obtuse ramal straight or slightly curved thorns. Branchlets often horizontally spreading, patently puberulous or pubescent at younger parts, glabrescent below, striate-wrinkled longitudinally in dry specimens (not transversely ridged!). *Leaves* almost distichous, ovate-elliptic-oblong, apex broadly attenuate to rounded, base slight-

ly inequilateral, attenuate to obtuse, not rarely rounded and plicate, thin-coriaceous, dark to yellowish green, somewhat shining and glabrous above, initially short-pubescent at midrib beneath, glabrescent, 2–8 (–9.5) by (0.3–) 0.8–3.5 cm; nerves 5–8 pairs, unequal-spreading, rather inconspicuous on both faces as are the reticulations; petiole short-pubescent, 5–7 (–10) mm. *Racemes* 1–3 per axil, simple or branched, obliquely ascending, many-flowered, densely short-hairy, bracteate at base, 0.5–3.5 cm; bracteoles distichous, obtuse, keeled, pubescent, c. 2 mm, caducous; pedicels thickened at the very base, glabrous, 1–1.5 mm. *Calyx* cup-shaped, truncate, ciliolate, 0.5–1 mm high, c. 1.5 mm \varnothing , much accrescent in fruit. *Petals* 3, of which 2 (rarely all) are split about halfway, thus 5(–6) petals seemingly present, linear-oblong, apex acute and incurved, glabrous, white, scented, 7–9 by c. 1.5 mm. *Stamens* 3, in the long-styled form reaching to the base of the sinus of the petals, in the short-styled form reaching 2–2.5 mm beyond it; filaments free for a short part; anthers oblong, c. 1.5 mm. *Staminodes* with very narrow void, deeply bifid cells. *Ovary* ovoid, glabrous; style either long (5–6 mm) or short (1.5–2.5 mm); stigma



Fig. 1. *Olax scandens* Roxb. In teak forest near Djombang, East Java (DE VOOGD 893).

obscurely 3-lobed. *Drupe* broadly ovoid to subglobose, covered for the lower 2/3 or more by the accrescent firmly membranous calyx, apiculate, orange to yellow (0.8–) 1.5 by (0.6–) 1 cm.

Distr. Widely distributed from Ceylon and tropical W. Himalayas through India, Burma, Indochina, Thailand; in *Malesia*: Malay Peninsula, Java incl. Kangean Is., Madura, Lesser Sunda Is. (Bali).

Ecol. Mostly in dry deciduous forest or scrub, also in teak forest, not rarely on rocky ground, often close to the sea (beach forest, dunes), rarely in light rain-forest, up to c. 300 m.

Vern. *Ganpi*, *M* (Antjol), *wangon*, *J*, *wuru wuru*, *Md*.

2. *Olax imbricata* Roxb. [Hort. Beng. (1814) 5, *nom. nud.*] Fl. Ind. 1 (1820) 169; ed. Carey 1 (1832) 164; DECNE, *Nouv. Ann. Mus. Paris* 3 (1834) 438; Herb. Timor. Descr. (1835) 110; ZOLL. & MOR. Syst. Verz.

(1846) 25; A. GRAY, U.S. Expl. Exp. Bot. (1854) 305; MIQ. Fl. Ind. Bat. 1, 1 (1856) 785; MAST. Fl. Br. India 1 (1875) 575; F.-VILL. Nov. App. (1880) 45; VIDAL, Sin. Atlas (1883) 20, t. 30, f. A; Phan. Cuming. Philip. (1885) 102; Rev. Pl. Vasc. Filip. (1886) 85; VALET. Crit. Overz. Olacin. (1886) 115; CERON, Cat. Manila (1892) 45; KING, J. As. Soc. Beng. 64, ii (1895) 99, *p.p.*; HOCHR. Bull. Inst. Bot. Btzg 11 (1904) 38; MERR. Govt. Lab. Publ. Philip. 27 (1905) 32; Philip. J. Sc. 1 (1906) Suppl. 51; BACK. Fl. Bat. 1 (1907) 292; Voorl. (1908) 54; MERR. Philip. J. Sc. 3 (1908) Bot. 80; BACK. Schoolfl. Java (1911) 222; MERR. Fl. Manila (1912) 185; KOORD. Exk. Fl. Java 2 (1912) 171; MERR. Sp. Blanc. (1918) 134; En. Born. (1921) 242; RIDL. Fl. Mal. Pen. 1 (1922) 421; MERR. En. Philip. 2 (1923) 116; SCHELLENB. Bot. Jahrb. 58 (1923) 158; BAKH. Bull. Jard. Bot. Btzg III, 15 (1936) 49; BACK. & BAKH. f. Fl. Java 2 (1965) 64; SLEUM. Blumea 26 (1980) 156. — *O. multiflora* A. RICH. ex

BAILL. *Adansonia* 3 (1862) 121. — *Pseudaleia imbricata* (ROXB.) HASSK. ex VALET. Crit. Overz. Olacin. (1886) 115, *pr. syn.* — *Pseudaleia longistylis* HASSK. ex VALET. *l.c.*, *pr. syn.* — *O. semiinfera* VALET. *l.c.* 116; MERR. En. Born. (1921) 242. — *O. laxiflora* RIDL. Kew Bull. (1931) 34. — *O. multiflora* RIDL. *l.c.* — *O. rosea* RIDL. *l.c.*, 33; SINCLAIR, Gard. Bull. Sing. 14 (1953) 31.

Shrub, usually climbing; branchlets unarmed, striate, somewhat pubescent initially, practically glabrous, dark red-brown when dry; lenticels pale. *Leaves* ovate- to elliptic-oblong, apex subacuminate, acute or blunt, base cuneate or rounded, (sub)coriaceous, shining above, glabrous on both faces, 4–15 (–18) by 2–7.5 cm, nerves 6–9 pairs, rather irregularly curved-ascending, sometimes less in number and more steeply ascending, slightly raised beneath; petiole wrinkled, 5–10 mm. *Racemes* branched from the base, many-flowered, 1–3 (–5) cm; floral bracts ovate, concave, imbricate in 2 rows when young, caducous, 2–3 mm. *Calyx* very small. *Petals* 3, linear-oblong, white or pinkish, 10–12 mm. *Stamens* 3; staminodia 5 or 6, bifid. *Drupe* subglobose, rarely

oblongoid or obovoid, almost completely covered by the thin accrescent orange calyx, 1.7–2.5 cm. Otherwise as in *O. scandens*.

Distr. India, Ceylon, Burma, Andaman & Nicobar Is., Thailand, S. China (Hainan); in *Malesia*: Sumatra, Malay Peninsula, Java incl. Madura, Borneo, Celebes (incl. Kabaena & Buton Is.), Philippines (incl. Sulu Arch.), Lesser Sunda Is. (Flores, Sumbawa, Alor, Timor), Moluccas (Tanimbar & Kei Is.), New Guinea; also known from Formosa (Botel Tobago), Micronesia (Palau), and the Solomon Is.

Ecol. In primary, also often in secondary forest, dry brushwood, on coral limestone, but also occasionally in mangrove or peat swamp, at low elevations, rarely up to 900 m.

Vern. Philippines: *balagon*, *labnót*, P. Bis., *bitón*, *malabágio*, *malabútong*, Tag., *ubet-úbet*, Ilk.; Lesser Sunda Is.: *leténg*, Flores.

Excluded

Olax sumatrana MIQ. Fl. Ind. Bat. Suppl. (1860) 342 = *Cansjera scandens* ROXB. (*Opiliaceae*).

2. HARMANDIA

PIERRE ex BAILL. Bull. Soc. Linn. Paris 2 (1889) 770; BAILL. Hist. Pl. 11 (1892) 452; SLEUM. in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 30; Blumea 26 (1980) 153. — **Fig. 2.**

Monoecious tree. *Leaves* distichous, penninerved, with infrequent laticifers. *Racemes* corymbiform, short. *Calyx* in anthesis small, patelliform, shortly 4-dented, much accrescent afterwards to form a frill which includes the fruit below. *Petals* 4 in the ♂, 6–8 in the ♀, connate to an urceolate tube for the lower 3/4, free above in form of 4 lobes. *Disk* extra-staminal, annular, crenulate, thin, finally disappearing. — ♂ *Flowers*: *Stamens* 4, epipetalous; filaments fused to a tube which bears the free anthers on top; connective thick. *Ovary* rudimentary. — ♀ *Flowers*: *Staminodial* tube without anthers. *Ovary* pyramidal, 1-celled, with 2 (unitegmic or naked?) ovules pendent from the short basal placenta; style short-conical; stigmas 3, sessile. *Fruit* drupaceous, concrescent with the much enlarged calyx below; pericarp fleshy; endocarp thin-woody. *Seed* 1, containing exclusively oil; embryo excentrically at apex of endosperm.

Distr. Monotypic. Indochina; in *Malesia*: Sumatra, Malay Peninsula, and Borneo. **Fig. 3.**
Ecol. Lowland forest.

1. *Harmandia mekongensis* PIERRE ex BAILL. Bull. Soc. Linn. Paris 2 (1889) 770; PIERRE, Fl. For. Coch. (1892) t. 264; GAGN. Fl. Gén. I.-C. 1 (1911) 818, f. 95; Suppl. (1948) 739. — *H. kunstleri* KING, J. As. Soc. Beng. 64, ii (1895) 100; RIDL. Fl. Mal. Pen. 1 (1922) 421; HENDERS. Gard. Bull. S. S. 4 (1928) 238;

HEYNE, Nutt. Pl. (1927) 674 ('*Hernandia*') (cf. KOSTERM. Reinwardtia 2, 1953, 360); DESCH, Mal. For. Rec. 15, 2 (1954) 414; BALAN MENON, Mal. For. 24 (1961) 292 (wood); WHITMORE, Tree Fl. Malaya 2 (1973) 301, f. 1; SLEUM. Blumea 26 (1980) 153. — **Fig. 2.**

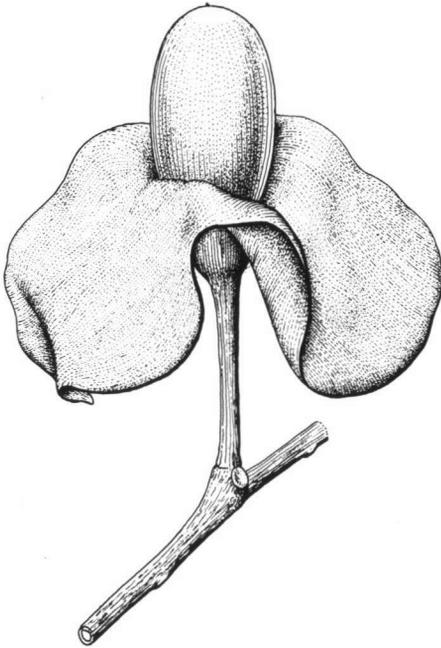


Fig. 2. *Harmandia mekongensis* PIERRE. Mature fruit with accrescent calyx, $\times 2/3$ (VAN BALGOOY 2559).

Glabrous monoecious tree (6-)10-22(-40) m, fluted towards the base; bark pale fawn, greenish or whitish, flaky and corky; slash of inner bark whitish to pale yellow, granular; wood pale yellow. Branchlets slender, striate, zig-zag, older parts with linear lenticels. *Leaves* distichous, oblong or elliptic, sometimes lanceolate, short-acuminate, base cuneate to obtuse or rounded, (sub)coriaceous or parchment-like, shagreened from minute warts especially beneath, dull and brittle in the dry state, 5-7 (-9) by 2.5-4 cm, nerves (5-) 6-8 (-10) pairs, rather inconspicuous on both faces; petiole 3-4 mm. *Inflorescences* racemose-corymbiform, c. 5-flowered, 1-1.5 cm; bracts scaly, minute. *Flowers* small, green. *Calyx* cupular and low initially, hardly sinuate-dented,

very much accrescent in fruit. *Petals* connate below, forming a thickish urceolate corolla, 2 mm. — σ *Flowers*: Stamens 4; filaments connate to a fleshy tube, 1.5 mm; anthers cordate, 0.5 mm. Rudiment of ovary generally present. — q *Flowers*: Staminodial tube without anthers. Ovary conical, tapering to a short style; stigmas 3, sessile. *Drupe* ovoid-ellipsoid, orange below, glaucous-green above, purple-black with a waxy bloom when dry, 2.5 (-3) by 1.3 (-2) cm, connate for c. 1 cm at the base with the enlarged persisting calyx which is free and collar-like spreading above, green turning yellow or pink-orange at maturity, 5-8 (-11) cm across, (1-) 2-3 (-4) cm high. *Seed* 1; pericarp fleshy, 0.5 mm; endocarp ligneous, 0.5 mm.

Distr. Indochina (Laos, Annam); in *Malesia*: Sumatra (Atjeh: G. Leuser Nat. Res.; Palembang: Rawas), Malay Peninsula (Perak, Pahang, Trengganu, Selangor, Negri Sembilan, Malacca), and Borneo (Sabah: Keningau Distr.). Fig. 3.



Fig. 3. Range of *Harmandia* PIERRE ex BAILL.

Ecol. In primary lowland forest, hilly country, up to 300 m, apparently rare. The fruits are eaten by animals.

Vern. *Mempudu tanah*, M, *kayu tadji*, Palembang.

3. XIMENIA

LINNÉ, Sp. Pl. ed. 1 (1753) 1193; SLEUM. in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 22; Blumea 26 (1980) 166. — Fig. 4.

Shrubs or low trees; branches usually armed with axillary spines; brachyblasts often ending in thorns. *Leaves* spiral, sometimes fascicled on brachyblasts, pen-

ninerved. *Inflorescences* axillary or at the end of brachyblasts, arranged in rather few-flowered peduncled, sometimes umbel-like cymes, or in fascicles, rarely solitary; bracts small. *Flowers* usually bisexual, rarely functionally unisexual. *Calyx* small, cupular-expanded, 4 (-5)-dentate, persistent, hardly or not accrescent in fruit. *Petals* 4 (rarely 5), free, linear-oblong, finally revolute about half-way, with a brush of hairs on the inner surface. *Stamens* 8 (rarely 10), free, hypogynous, alternately epipetalous and episepalous; filaments filiform; anthers linear-oblong to subovate, basifixed, dehiscent lengthwise; connective thick. Disk 0. *Ovary* sessile, superior, (3-) 4-locular; style slenderly columnar, as long as ovary; stigma small, capitate; ovules anatropous, bitegmic, solitary in each cell, pendulous from a free basal placenta. *Fruit* superior, drupaceous, with a rather thin pulpy pericarp, and a crustaceous to woody endocarp. *Seed* 1; endosperm copious, containing oily substances; embryo very small.

Distr. 8 *spp.* in the (sub)tropics, rather closely allied to each other, one of them (*X. americana*) pantropical and -subtropical.

Ecol. In thickets along the sea-shore, or in dry forests, mainly at low elevations.

1. *Ximenia americana* LINNÉ, Sp. Pl. (1735) 1193; DECNE, Herb. Timor. Descr. (1835) 111; BL. Mus. Bot. Lugd.-Bat. 1 (1850) 247; MIQ. Fl. Ind. Bat. 1, 1 (1856) 786; Suppl. (1860) 136; MAST. Fl. Br. India 1 (1875) 574; BECC. Nuov. Giorn. Bot. Ital. 9 (1877) 278, t. 11, f. 1-11; F.-VILL. Nov. App. (1880) 45; BISCHOP GREVELINK, Pl. Ned. Ind. (1883) 221; HEMSL. Rep. Challenger Bot. 1, 3 (1884) 132; VALET. Crit. Overz. Olacin. (1886) 74, t. 2, 20-22; WARB. Bot. Jahrb. 13 (1891) 299; SCHIMP. Ind. Mal. Strandpfl. (1891) 176; KING, J. As. Soc. Beng. 64, ii (1895) 107; VALET. in Koord. Minah. (1898) 391; RIDL. J. Str. Br. R. As. Soc. 32 (1900) 61; K. & V. Bijdr. Booms. Java 5 (1900) 280; K.SCH. & LAUT. Fl. Schutzgeb. (1901) 301; MERR. Philip. J. Sc. 1 (1906) Suppl. 190; VALET. Pl. Pap. (1907) 8; BACK. Fl. Bat. 1 (1907) 288; Voorl. (1908) 53; FOXW. Philip. J. Sc. 4 (1909) Bot. 450; BACK. Schoolfl. Java (1911) 222; GAGN. Fl. Gén. I.-C. 1 (1911) 814; KOORD. Exk. Fl. Java 2 (1912) 172; RECHINGER, Bot. Ergebn. Wiss. Reise Salomon Ins. (1913) 107; MERR. Int. Rumph. (1917) 209; BROWN, Minor Prod. Philip. For. 2 (1921) 274, f. 23; RIDL. Fl. Mal. Pen. 1 (1922) 424; MERR. En. Philip. 2 (1923) 117; SCHELLENB. Bot. Jahrb. 58 (1923) 158; CRAIB, Fl. Siam. En. 1 (1926) 269; HEYNE, Nutt. Pl. (1927) 592; WHITE, J. Arn. Arb. 10 (1929) 211; RIDL. Kew Bull. (1931) 33; BOOBERG, Bot. Jahrb. 66 (1933) 13; SLEUM. in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 23, f. 11; CORNER, Wayside Trees (1940) 728; HOLTH. & LAM, Blumea 5 (1942) 178; QUIS. Medic. Pl. Philip. (1951) 253; BACK. & BAKH. f. Fl. Java 2 (1965) 64; SLEUM. Blumea 26 (1980) 166. — *Vidara littorea* RUMPH. Herb. Amboin. 2 (1741) 119, t. 37. — *X. loranthifolia* SPAN. Linnaea 15 (1841) 177; Ic. Ined. t. 44. — *Zizyphus lit-*

torea TEYSM. ex HASSK. Abh. Naturf. Ges. Halle 9 (1866) 176, *nom. nud.* — Fig. 4.

var. americana: DEFILIPPIS, Bot. Soc. Broter. II, 43 (1969) 195.

Glabrous sprawling or low-branching shrub or tree, up to 10 m; bark greyish brownish. Branchlets usually spiny, covered with red cork and roundish lenticels. *Leaves* often closely arranged on short lateral twigs, deciduous in the dry season, variable in shape, size and texture, narrowly to broadly lanceolate, ovate, elliptic, obovate or sometimes suborbicular, generally obtuse on both ends, though apex generally minutely apiculate or mucronulate, and sometimes emarginate, (sub)coriaceous, yellowish green, turning brownish blackish and becoming brittle in drying, (2-) 2.5-5 (-8, -10) by (1-) 2-3 (-4, -6) cm; nerves 3-5 (-7) pairs, rather faint; petiole 3-7 (-10) mm. *Inflorescences* axillary or near the ends of short lateral branchlets (brachyblasts) in form of subumbellate racemes or cymes, peduncled up to 1.5 cm, 3-9-flowered, up to 2.5 cm, pedicels ebracteolate, 3-7 (-12) mm. *Flowers* usually bisexual, white to greenish, fragrant. *Calyx* cupular, subacutely 4(-5)-toothed, ciliate, 0.5-1.5 mm. *Petals* 4 (5), linear-oblong, acute to rather obtuse, finally recurved for about half their length, white-barbate inside, (5-) 8-10 (-12) by 1.5-2 mm. *Stamens* 8 (10); filaments 2.5-4 mm, sigmoid near apex; anthers 2-4 mm; connective apiculate. *Ovary* ovoid-conical; style filiform, up to 5 mm. *Drupe* plum-like, subglobose to ellipsoid, rarely ovoid, apiculate, yellow to orange or scarlet, (1.7-) 2.5 (-3.5) by 1.5-3 cm; pericarp pulpy, green; endocarp bony. *Seed* 1, 1.5-2.5 by 1.2-2 cm.



Fig. 4. *Ximenia americana* L. var. *americana*. South coast of New Guinea (photogr. C. KALKMAN).

Distr. Pantropical and -subtropical.

Ecol. In thickets immediately back of the beach along sea-shore (*Barringtonia* formation), also in dry savannah or forest, sometimes even in light rain-forest, scattered, on stony or sandy ground; facultative root-parasite and auto-parasite.

Dispersal. The succulent pericarp is eaten by birds. The kernel is light enough to float, and there is, in addition, a layer of air-bearing tissue beneath the shell which allows the fruit to be water-borne for months (GUPPY, Plant seeds and currents W. Indies, 1917,

252; DEFILIPPS, *Webbia* 30, 1976, 180).

Taxon. *Ximenia americana* comprises numerous local forms of doubtful taxonomic significance.

Uses. Wood hard, close-grained, used as a substitute for white Sandal wood, because of its yellowish brownish colour. The sour pulp of the fruit is eaten. The kernels are purgative, a fact already stated by RUMPHIUS.

Vern. *Bédara laut*, *bidari*, *pidaroh*, M; Philippines: *bo-o*, Samar I., *pangungán*, Yak., *paniungán*, Sul., *sulo-sulo*, Bag.

4. OCHANOSTACHYS

MAST. Fl. Br. India 1 (1875) 576; ENGL. in E. & P. Nat. Pfl. Fam. Nachtr. 3 (1908) 99; SLEUM. in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 12; *Blumea* 26 (1980) 153. — *Petalinia* BECC. *Malesia* 1 (1883) 257. — **Fig. 5.**

Tree. *Leaves* spiral, penninerved; hairs, if any, of a dendritic type. *Spikes* simple or sometimes 1- or 2-branched, elongate, slender, the bisexual flowers interruptedly solitary or arranged in groups of 2–4. *Calyx* small, cup-shaped,

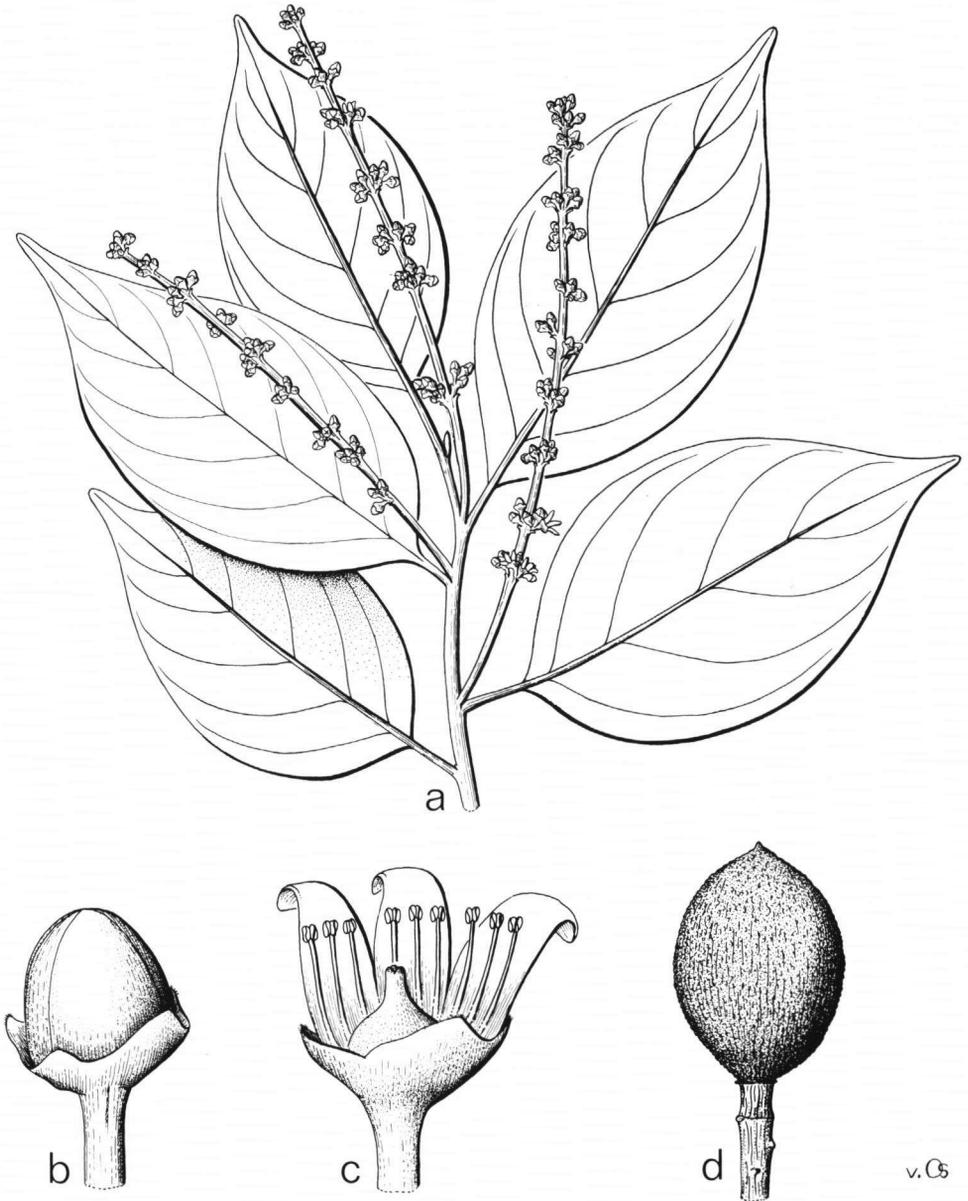


Fig. 5. *Ochanostachys amentacea* MAST. a. Habit, $\times 3/5$, b. flowerbud, c. flower, two petals removed, both $\times 8$, d. fruit, $\times 1 1/5$ (a-c VAN BALGOOY 2524, d FRI 13320).

4–5-toothed, not accrescent. *Petals* (3–) 4 (–5), free to almost the base. *Stamens* generally 2, rarely 1 or 3 before each petal and adherent to its base; filaments linear-subulate; anthers subglobular-didymous. *Staminodes* 0. *Disk* hypogynous, fleshy, shallow, rather inconspicuous. *Ovary* superior, incompletely (2–) 3 (–4)-celled below, 1-celled above; ovules bitegmic, each one pendent from the top of a free basal placenta into the cell; style short, cylindrical; stigma minute, 3-lobed. *Drupe* subglobose; pericarp thin; endocarp woody. *Seed* 1, mainly containing starch, and very little fatty substances in the form of oil-droplets; embryo very small in the apex of the endosperm.

Distr. Monotypic, endemic in *Malesia*: Sumatra, Banka, Malay Peninsula, and Borneo. Fig. 6.
Ecol. In lowland rain-forest.

1. *Ochanostachys amentacea* MAST. Fl. Br. India 1 (1875) 577; VALET. Crit. Overz. Olacin. (1886) 104; BOERL. Handl. 1 (1890) 207; KING, J. As. Soc. Beng. 64, ii (1895) 100; RIDL. J. Str. Br. R. As. Soc. 33 (1900) 60; HOOK. Ic. Pl. 27 (1901) t. 2689; HOCHR. Bull. Inst. Bot. Btzg 22 (1905) 44; FOXW. Philip J. Sc. 4 (1909) Bot. 449 (wood); WINKL. Bot. Jahrb. 49 (1913) 365; MERR. En. Born. (1921) 242; RIDL. Fl. Mal. Pen. 1 (1922) 422, f. 42; S. MOORE, J. Bot. 62 (1924) Suppl. 21; HEYNE, Nutt. Pl. (1927) 593; FOXW. Mal. For. Rec. 3 (1927) 119, with plate; HENDERS. Gard. Bull. S. S. 4 (1928) 238; MERR. Pl. Elm. Born. (1929) 58; RIDL. Kew Bull. (1931) 35, *incl. var. rufa* STAFF *ex* RIDL.; DESCH, Mal. For. Rec. 15, 2 (1954) 415, pl. 86, f. 1 (wood); BROWNE, For. Trees Sarawak & Brunei (1955) 281; STAUFF. Vierteljahrschr. Nat. Ges. Zürich 106 (1961) 414; WYATT-SMITH & KOCHUM. Mal. For. Rec. 17 (1965) 309; SMYTHIES, Common Sarawak Trees (1965) 113; BURGESS, Timbers of Sabah, Sabah For. Rec. 6 (1966) 420 (wood); WHITMORE, Tree Fl. Malaya 2 (1973) 302, f. 2; MEIJER, Field Guide Trees W. Males. (1974) 222, f. 57; SLEUM. Blumea 26 (1980) 153. — *Petalinia bancana* BECC. Malesia 1 (1883) 258. — *O. bancana* (BECC.) VALET. Crit. Overz. Olacin. (1886) 104. — Fig. 5.

Tree, (5–) 10–30 (rarely –50) m high; bole straight, maybe fluted at base or shortly buttressed, 15–40 (rarely –80) cm ø; bark grey-brown to brown-red, shedding in thin irregular flakes to expose lighter coloured patches so that the whole trunk is characteristically mottled; slash of inner bark finely fibrous, yellow-brownish, interspaced with blackish fibres and discrete droplets of white latex. Branchlets glabrous or puberulous, rarely rufous-tomentellous-scurfy at tips. *Leaves* ovate to elliptic or elliptic-oblong, sometimes slightly inequilateral, apex short-acuminate, tip blunt, base broadly cuneate to rounded, subcoriaceous to coriaceous, usually glabrous, rarely rufous-tomentellous on the nerves beneath (Borneo), green and shining above, yellowish

green beneath when fresh, rather dull olivaceous-brownish when dry, usually sparsely shallowly tubercled on both faces, the tubercles (or slightly impressed dots) in part blackish, (5–) 6–13 by (2.5–) 3–7 cm; nerves (4–) 5 (–6, –8) pairs, curved-ascending, the upper ones inarching before the edge, slightly though distinctly impressed above, much raised beneath in dry specimens, transverse veins and reticulation of veinlets rather inconspicuous; petiole (1–) 1.5–2 (–3) cm, not or hardly thickened distally. *Spikes* erect-ascending, (2–) 3–6 (–12) cm. *Flowers* arranged interruptedly, either solitary or mostly 2 or 3 together in opposite clusters, all over subglabrous or puberulous, rarely scurfy rufous-tomentellous (Borneo); bracts minute, ovate, acute. Flowers green to whitish-yellowish, subsessile, or pedicelled up to 1 mm. *Calyx* 4–5-toothed, 1 mm. *Petals* (3–) 4 (–5), ovate to ovate-oblong, with a few coarse hairs inside, 2.5 by 1.5 mm. *Filaments* white-greenish; anthers light brown. *Ovary* depressed-ovoid, lengthwise striate, glabrous; style short-cylindrical. *Drupe* supe-

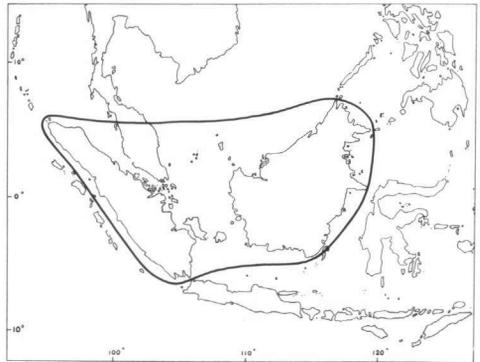


Fig. 6. Range of the genera *Ochanostachys* MAST and *Scorodocarpus* BECC.

rior, subglobose, green turning yellow when fully ripe, pendulous, (1.5–) 2–2.5 (–3) cm \varnothing , on a slender peduncle 2–3 mm; pericarp thin, exuding a milky gum, often tubercled outside, getting loose finally; endocarp woody, hardly 1 mm. *Seed* 1, subglobular.

Distr. *Malesia*: Sumatra, Banka, Malay Peninsula, Borneo. Fig. 6.

Ecol. Understorey tree in primary, also secondary lowland rain-forest, often in mixed Dipterocarp forest, undulating country, hillsides and ridges, up to

950 m, on loamy or sandy, rarely periodically inundated ground, scattered, or locally frequent.

Uses. The hard and durable yellowish to purple-brown wood is used for house constructions. The fruit is said to be edible.

Vern. Sumatra: *gaé, gai, goi, Karo, nahum, pè-taling, pètikal, pimpin bulan, pitatar*, Minangk.; *kè-map*, Banka; Malaya: *kètikal, kuning, mahun, mentatai*, Kedah, *pètaling*, the common Malay name; Borneo: *èmpilang, ènticol, èntikan, guru, pitotar, santikal*, Iban, *tanggal*, Dusan, *kadasan*, M.

5. SCORODOCARPUS

BECC. Nuov. Giorn. Bot. Ital. 9 (1877) 274, t. 11, f. 12–17; SLEUM. in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 20; Blumea 26 (1980) 160. — Fig. 7.

Trees. *Leaves* spiral, penninerved. *Flowers* bisexual, in short racemes. *Calyx* small, cupular, 4–5-crenate or -dentate, not enlarged in fruit. *Petals* 4 or 5, hypogynous, narrow, coherent by their edges until full anthesis, brush-like woolly inside. *Stamens* 8 or 10, adnate to the lower half of each petal in pairs, the uppermost part of the filaments remaining free as are the linear-elongate anthers. *Ovary* superior, imperfectly 3–4-celled, with 1 (uni- or bitegmic?) ovule pendent from the top of the almost free placenta into each cell; style elongate-conical; stigma minutely 3–4-lobed. *Drupe* medium-sized, subglobular, with a thin fleshy pericarp and a much thicker woody endocarp. *Seed* 1; albumen fleshy, containing starch and tannin.

Distr. Monotypic. Peninsular Thailand; in *Malesia*: Sumatra, Lingga Is., Malay Peninsula, and Borneo Fig. 6.

Ecol. Lowland forest.

1. *Scorodocarpus borneensis* (BAILL.) BECC. Nuov. Giorn. Bot. Ital. 9 (1877) 274, t. 11, f. 12–17; VALET. Crit. Overz. Olacin. (1886) 89; BOERL. Handl. 1 (1890) 205; KING, J. As. Soc. Beng. 64, ii (1895) 108; RIDL. J. Str. Br. R. As. Soc. 33 (1900) 60; HOCHR. Bull. Inst. Bot. Btzg 22 (1905) 42; FOXW. Philip. J. Sc. 4 (1909) Bot. 449, pl. 22, f. 11 (wood); MERR. En. Born. (1921) 242; RIDL. Fl. Mal. Pen. 1 (1922) 424; BURK. & HENDERS. Gard. Bull. S. S. 3 (1925) 358; FOXW. Mal. For. Rec. 3 (1927) 121 & plates; HEYNE, Nutt. Pl. (1927) 593; DESCH. Mal. For. Rec. 15, 2 (1954) 418, f. 2 (wood); BROWNE, For. Trees Sarawak & Brunei (1955) 280; SMYTHIES, Common Sarawak Trees (1965) 113; WYATT-SMITH & KOCHUM. Mal. For. Rec. 17 (1965) 347; BURGESS, Sabah For. Rec. 6 (1966) 422 (wood); WHITMORE, Tree Fl. Malaya 2 (1973) 303, f. 3; MEIJER, Field Guide Trees W. Males. (1974) 224, f. 58; RAO, Mal. For. 38 (1975) 184, f. 1–5 (leaf anat.); SLEUM. Blumea 26 (1980) 160. — *Ximenia borneensis* BAILL. Adansonia 11 (1874) 271. — Fig. 7.

A large tree, 10–40 (rarely –60) m, 20–60 (–80, or more) cm \varnothing , all parts reeking of garlic or onion especially after rain and from cut or bruised parts; crown dense; bole usually straight, notched, sometimes with small buttresses; bark grey to dark brown, fissured and thinly rectangularly flaky, inwards dark red with coarse orange flecks; wood hard, slash generally yellow to orange-brown, rarely whitish. Branchlets smooth and glabrous at tips, older parts dark coloured with elongate lenticels. *Leaves* generally elliptic-, rarely lanceolate-oblong, apex rather abruptly acuminate for 1–2 cm, base cuneate to rounded, entire, subcoriaceous to coriaceous, shining green above, paler beneath when fresh, dull olive-green when dry, glabrous, often densely minutely tubercled mainly on upper surface by spicular cells or sclereids which show remarkably in dry leaves, 7–15 (–22, –32) by 3–5 (–7, –12) cm; nerves 4–5 (–7) pairs, distant, curved-ascending (one marginal rather inconspicuous), flat above, much raised beneath as are the midrib and the transverse veins, reticulations

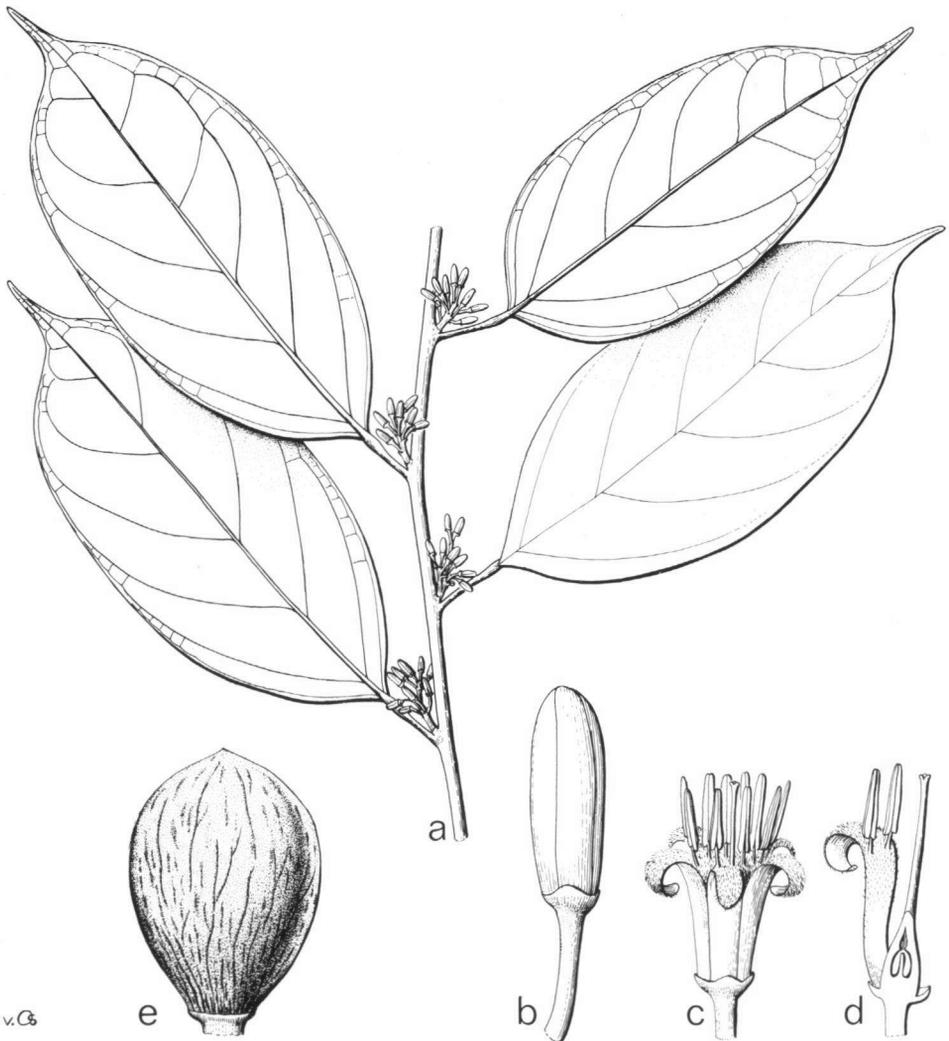


Fig. 7. *Scorodocarpus borneensis* BECC. a. Habit, $\times \frac{1}{2}$, b. flowerbud, c. flower, d. ditto, petals save one removed, all $\times 3\frac{1}{2}$, e. fruit, $\times \frac{1}{2}$ (a-d FRI 4784, e FRI 17777).

rather faint; petiole swollen distally, 1–1.5 (–2) cm. *Racemes* rusty- to greyish-puberulous; rachis 2 (–4) cm; flowers along rachis either solitary or 2 or 3 in a group; pedicels 1.5–2 mm. *Calyx* small with wavy edge. *Petals* narrow-oblong, yellowish, pink or usually creamy white, 8–10 (–15) by 2 mm, brushed-woolly inside, finally reflexed. *Anthers* yellow, 3–4 mm. *Ovary* yellowish green, tapering to the thickish white style. *Drupe* superior globose to rather pear-shaped, with numerous vertical stripes or faint ribs in the dry state, glabrous, green, (3–) 4–5 (–7.5) cm

\emptyset , on peduncle 1 by 0.5 cm; pericarp thin, fleshy; endocarp woody, 2–2.5 mm thick, wrinkled by an outer layer of numerous vertical fibre-like stony strands, and an inner one of compact stone cells. *Seed* 1, subglobular.

Distr. Peninsular Thailand and *Malesia*: Sumatra, Lingga Is., Malay Peninsula, and Borneo. Fig. 6.

Ecol. In primary, or often disturbed or secondary lowland forest, on flat (sometimes seasonally flooded) country or undulating hillsides, up to 600 (rarely –900) m, on sandy or clayey, rarely blackish

soil, scattered, but locally frequent.

Uses. A medium hardwood timber; wood of rather fine texture and fairly durable, purple-brown, used for constructions. The seeds are reported to be edible; they have a taste of onion.

Vern. Generally known as *kulim*, M; locally called *bawang hutan*, *maju bawang*, *kisindah*, *mar-sindu*, *sagad berau*, Murut, *sédau*, Kutei, *sinoh*, Iban *téradu*, *ungsunah*, M.

6. ERYTHROPALUM

BL. Bijdr. (1826) 921; Fl. Jav. (1828) praefatio VII (*'Erythroropalum'*); HASSK. Cat. Hort. Bog. (1844) 191 (*'Erythropalla'*); SLEUM. in E. & P. Nat. Pfl. Fam. ed. 2, 20b (1940) 401, f. 121; Blumea 26 (1980) 151. — *Monaria* KORTH. ex VALET. Crit. Overz. Olacin. (1886) 130, in syn. — Fig. 8.

Slender scandent shrub or liana, with axillary tendrils usually present. *Leaves* spiral or subdistichous, slightly peltate, 3–5-plinerved, long-petioled. *Flowers* very small, bisexual, or andro-dioecious, borne in loose, slender, peduncled and repeatedly dichotomous many-flowered cymes; bracts minute. *Calyx* cupular, with 4 or 5 short, broad, subimbricate teeth, the basal part accrescent and covering the fruit. *Petals* 5, ovate-triangular, coherent by their bases, recurved. *Stamens* 5, inserted at the base of the petals, each provided there with 2 lateral scales (or staminodes?); filaments very short; anthers ovate, introrse; connective thickish. *Disk* cup-shaped, 5-crenate. *Ovary* (rudimentary in the ♂) inferior, tapering to a short conical style with a minutely 3-lobed stigma, (2–) 3-celled below, 1-celled above; placenta central, free, with 2 or 3 unitegmic ovules pendent from its apex. *Fruit* drupaceous, crowned by the persistent calyx lobes and remains of the disk, ellipsoid, stipitate-contracted downwards; pericarp thin-fleshy; endocarp crustaceous to woody, splitting into 3–6 segments. *Seed* 1; embryo minute near the apex of the large albumen which contains oily substances.

Distr. Monotypic. Widely spread in S. India, and from the E. Himalaya to Assam, Bengal, Burma and the Andaman Is., in Indochina, Thailand, SW. China (incl. Hainan); in *Malesia*: Sumatra, Malay Peninsula, Borneo, Java, Lesser Sunda Is. (Flores), N. Celebes (Minahasa), Philippines, Talaud Is.

Ecol. In forest or forest borders at low and medium altitudes.

1. *Erythropalum scandens* BL. Bijdr. (1826) 922; HASSK. Pl. Jav. Rar. (1848) 193; MIQ. Fl. Ind. Bat. 1, 1 (1856) 704; MAST. Fl. Br. India 1 (1875) 578; VALET. Crit. Overz. Olacin. (1886) 130; BOERL. Handl. 1 (1890) 208; O.K. Rev. Gen. Pl. 1 (1891) 111; PIERRE, Fl. For. Coch. (1892) t. 269 f. A; KING, J. As Soc. Beng. 64, ii (1895) 130; RIDL. J. Str. Br. R. As. Soc. 33 (1900) 61; HOCHR. Bull. Inst. Bot. Btzg 19 (1904) 39; *ibid.* 22 (1905) 102; Ann. Jard. Bot. Btzg Suppl. 3, 2 (1910) 854, incl. var. *abbreviatum* HOCHR.; BACK. Schoolfl. Java (1911) 223; GAGN. Fl. Gén. I.-C. 1 (1911) 822, f. 96; KOORD. Exk. Fl. Java 2 (1912) 172; MERR. Philip. J. Sc. 14 (1919) 242; RIDL. Fl. Mal. Pen. 1 (1922) 436; MERR. En. Philip. 2 (1923) 118; BURK. & HENDERS. Gard. Bull. S. S. 3

(1925) 358; CRAIB, Fl. Siam. En. 1 (1926) 271; BARTLETT, Pap. Mich. Ac. Sc. 6 (1929) 49; MERR. Pl. Elm. Born. (1929) 58; BURK. Dict. (1935) 949; HOLTH. & LAM, Blumea 5 (1942) 78; GAGN. Fl. Gén. I.-C. Suppl. (1948) 741; BACK. & BAKH. f. Fl. Java 2 (1965) 65; HATUS. Fl. Batan I. (1966) 27; STEEN. Blumea 15 (1967) 153; SLEUM. Blumea 26 (1980) 151. — *Modeccopsis vaga* GRIFF. Notulae 4 (1854) 633. — *E. vagum* (GRIFF.) MAST. Fl. Br. India 1 (1875) 578; VIDAL, Phan. Cuming. Philip. (1885) 85; CERON, Cat. Pl. Herb. Manila (1892) 45. — *E. grandifolium* ELMER, Leaf. Philip. Bot. 8 (1915) 2788. — Fig. 8.

Scandent shrub or liana, glabrous, 3–10 m; stem flexible; tendrils often lignescence-thickened distally, simple, or rarely bifid. Branches slender, elongate,

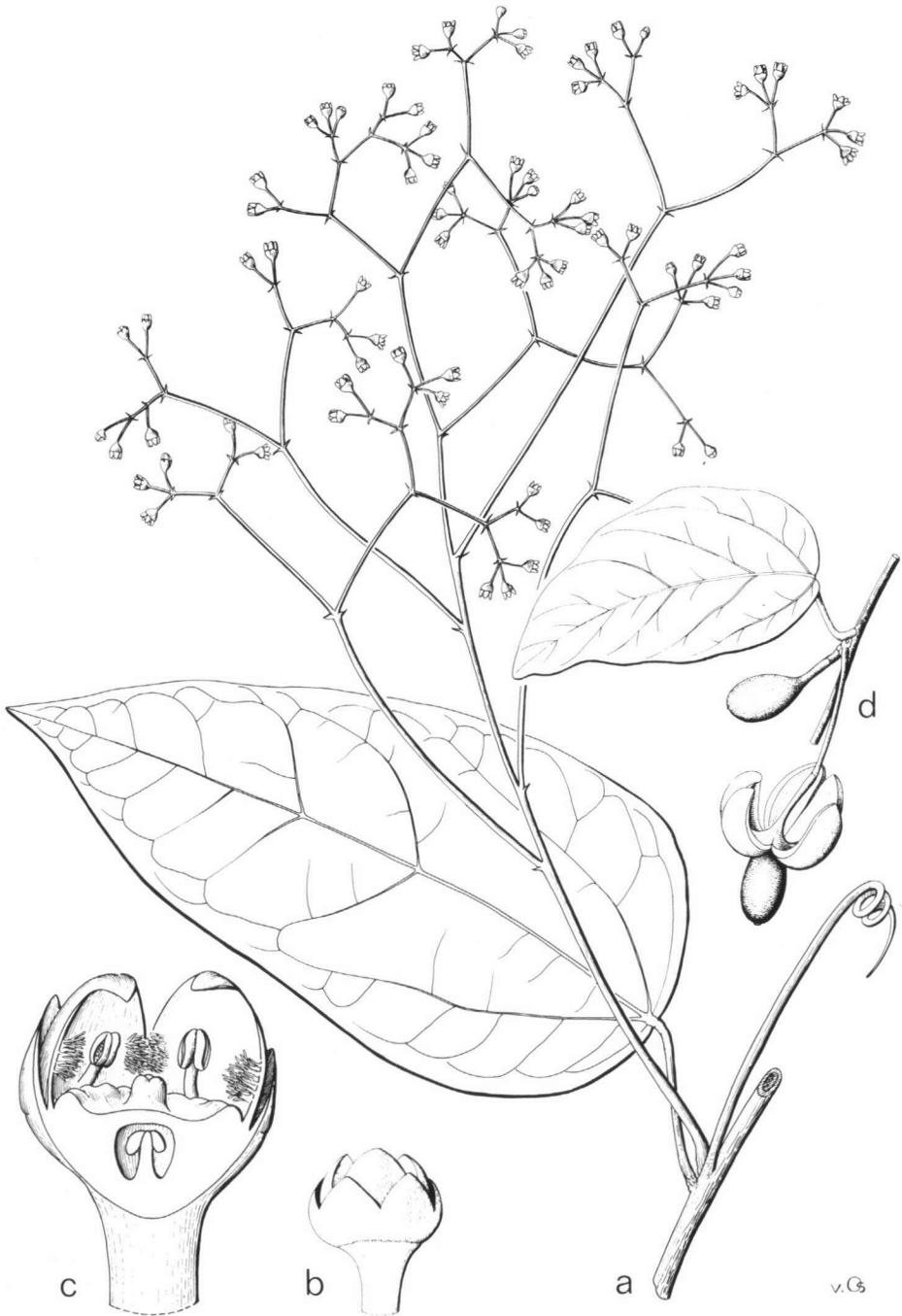


Fig. 8. *Erythralum scandens* BL. *a.* Habit, $\times \frac{1}{2}$, *b.* flowerbud, $\times 5$, *c.* flower, in section, $\times 14$, *d.* fruits, one dehiscent, $\times \frac{1}{2}$ (*a-c* KERR 20888, *d* VAN STEENIS 12722).

sparingly rebranched, the free ends dropping; bark yellowish brownish, dotted with pale lenticels. *Leaves* variable in shape and size, triangularly ovate to ovate- or lanceolate-oblong, apex acuminate, tip acute, base broadly attenuate-truncate, rarely subcordate, mostly a little peltate, membranaceous to firmly chartaceous, rarely coriaceous, deep green above, glaucescent beneath when fresh, yellowish greenish in the dry state, fetid when bruised, (5-) 6-16 (-20, -25) by 6-12 (-15) cm; basal nerves 1 or 2 pairs, widely divergent and ascendent, 3-6 upper pairs spreading, prominent beneath, reticulations usually inconspicuous; petiole slightly thickened and wrinkled on both ends, (2-) 3-5 (-10) cm. *Inflorescences* peduncled, lax, very slender, repeatedly dichotomous and many-flowered cymes, up to 15 cm long, these sometimes reduced to subsessile rather few-flowered cymes or fascicles; pedicels filiform, 4-5 mm; bracts triangular-ovate, hardly 1 mm. *Calyx* cupular, 5-toothed, 1 (-1.5) mm. *Petals* 5, ovate-triangular, glabrous, 1.5-2 mm. *Stamens* with a tuft of hairs on either side; filaments very short; anthers ovate-cordate, c. 0.3 mm; connective thick. *Disk* pentagonous, rather flat, fleshy, crenulate, 1.5 mm \varnothing , elevated in the centre to form the short conical style with 3 small stigmas. *Drupe* pendulous, subglo-

bose to ellipsoid or obovoid-pyriform, stipitate-attenuate towards the base for 2-3 cm, crowned by the persistent calyx lobes and the remains of the disk, 1.5-2 (-2.5) by 1.5-2.5 cm; pericarp thin-fleshy, yellow to red, rarely whitish; endocarp crustaceous; finally stellately splitting from top downwards into 3-6 reflexed segments, inside red. *Seed* indigo blue, evil smelling.

Distr. S. India, E. Himalaya to Assam, Bengal, Burma, the Andaman Is., Indochina, Thailand, SW. China (incl. Hainan); in *Malesia*: Sumatra, Malay Peninsula, Borneo, Java, Lesser Sunda Is. (Flores), NE. Celebes (Minahasa), Philippines (incl. Sulu Arch.), Talaud Is.

Mentioned to occur in the Kei Is. (S. Moluccas) by WARBURG (Bot. Jahrb. 13, 1891, 299) possibly due to an erroneous identification. Sterile material can be (and has been) confused with *Cardiopteris moluccana* and with *Menispermaceae* (e.g. *Tinospora*).

Ecol. Scattered in the substage of lowland and submontane primary and secondary rain-forest or forest borders, in mixed Dipterocarp forest, rarely up to 2135 m.

Vern. *Kulim akar*, M, *aroy uat bankong*, S; Philippines: *balingayo*, *saynat*, Tag., *barak-barak*, Mbo., *pulipis*, Sub.

7. STROMBOSIA

BL. Bijdr. (1826) 1154; SLEUM. in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 21; Blumea 26 (1980) 163. — *Lavallea* BAILL. *Adansonia* 2 (1862) 361. — Fig. 9.

Shrubs or trees; young twigs distinctly zig-zag. *Leaves* spiral, sometimes almost distichous, penninerved. *Flowers* bisexual, small, in shortly peduncled cymes or in sessile fascicles. *Calyx* a shallow cup, 5-lobed to various depth, showing a reddish brown prominent dot on tip of each lobe, subperigynous or perigynous, finally epigynous, accrescent, adnate to the pericarp almost to the top of the mature fruit. *Petals* (4-) 5, free, often reflexed at anthesis, hairy within. *Stamens* 5 (sometimes 4), epipetalous; filaments flat, adnate to the petals except for their uppermost part, and bearing numerous unicellular hairs; anthers didymous, dorsifixed. *Disk* hypogynous, prominent, (3-) 5-lobed. *Ovary* initially superior, finally partly inferior, i.e. partly sunken into the receptacle, almost entirely covered by the fleshy disk, 3-5 (-6)-celled below, 1-celled above; placenta free, central, from which 3-5 (-6) anatropous unitegmic ovula are pendent; style short to filiform-elongate; stigma subglobular, rather obscurely 3-5 (-6)-lobed. *Drupe* crowned by the persistent calyx and style base; pericarp (the outer part of which is formed by the accrescent calyx) thin-fleshy; mesocarp crustaceous or woody. *Seed* 1, with a small embryo in the apex of the fleshy albumen which contains oily substances and amorphous polysaccharides.



Fig. 9. *Strombosia ceylanica* GARDN. *a*. Habit, $\times \frac{1}{2}$, *b*. flower, $\times 5$, *c*. fruit, $\times \frac{1}{2}$. — *S. javanica* BL. *d*. Inflorescence, $\times 1$, *e*. fruit, $\times \frac{1}{2}$ (*a*–*b* Cult. Hort. Bog. III-G-122a, *c* DE WILDE c.s. 16551, *d* KOSTERMANS 10593, *e* KOSTERMANS 9570).

Distr. About 12 *spp.*, c. 9 of which in tropical Africa, the rest in India (W. Peninsula) and Ceylon to Burma and Thailand; in *Malesia*: Sumatra, Malay Peninsula, Java, Borneo, the Philippines, and the N. Moluccas (Morotai).

Ecol. Lowland forest.

KEY TO THE SPECIES

1. Cymes peduncled for 0.5–1 cm. Bracts and bracteoles caducous in early anthesis. Petals (6–) 8–10 mm. Drupe obovoid-subturbinata, apex truncate, apiculate by the remaining hard style base. Leaves smooth on upper surface, not pellucid-punctulate 1. *S. javanica*
1. Cymes or fascicles sessile. Bracts and bracteoles persisting into anthesis. Petals 2–5 mm. Drupe pyriform when young, subglobose at full maturity, apex obtuse-rounded; remains of calyx and style base inconspicuous
 2. Leaves hardly or not pellucid-punctulate, their surfaces smooth. Petals 2 mm 2. *S. philippinensis*
 2. Leaves generally distinctly pellucid-punctulate, their surfaces markedly parchment-like (shagreened) from tiny surface wrinkles or bumps, often glaucous-green and dull in dry specimens. Petals (2.5–) 3–4 (–5) mm 3. *S. ceylanica*

1. *Strombosia javanica* Bl. Bijdr. (1826) 1155; HASSK. Cat. Hort. Bog. (1844) 232; Pl. Jav. Rar. (1848) 238; Bl. Mus. Bot. Lugd.-Bat. 1 (1850) 251, f. 47; MIQ. Fl. Ind. Bat. 1, 1 (1856) 787; MAST. Fl. Br. India 1 (1875) 579; VALET. Crit. Overz. Olacin. (1886) 86, pl. 1, 16 a–n, incl. var. *sumatrana* VALET.; KING, J. As. Soc. Beng. 64, ii (1895) 590; K. & V. Bijdr. Booms. Java 5 (1900) 282; HOCHR. Bull. Inst. Bot. Btzg 22 (1905) 43; K. & V. Atlas Booms. Java 1 (1913) t. 124; MERR. En. Born. (1921) 242; RIDL. Fl. Mal. Pen. 1 (1922) 425; BURK. & HENDERS. Gard. Bull. S. S. 3 (1925) 358; HEYNE, Nutt. Pl. (1927) 594; FOXW. Mal. For. Rec. 3 (1927) 125, 2 pl.; HENDERS. Gard. Bull. S. S. 4 (1928) 238; DESCH, Mal. For. Rec. 15, 2 (1954) 422, t. 87, f. 1 (wood); BROWNE, For. Trees Sarawak & Brunei (1955) 282; BACK. & BAKH. f. Fl. Java 2 (1965) 65; WYATT-SMITH & KOCHUM. Mal. For. Rec. 17 (1965) 353; WHITMORE, Tree Fl. Malaya 2 (1973) 306, f. 4; SLEUM. Blumea 26 (1980) 164; DE VOGEL, Seed Dicot. (1980) 378, f. 141 (seedling). — Fig. 9d–e.

Tree 10–25 (–40) m; trunk straight, often with knobs, up to 70 (rarely –100) cm ϕ ; crown dense; bark grey to yellowish, shallowly irregularly fissured or cracked; slash outer bark pink, fibrous, turning pale brown. Branches slender. *Leaves* oblong to elliptic- or ovate-oblong, apex shortly subacutely acuminate, base obtuse to rounded, thick-membranaceous to subcoriaceous, deep to pale green when fresh, grey to yellowish olivaceous or brownish in dry specimens, smooth and shining above, practically without pellucid points, (10–) 12–18 (–24) by 4–8 cm; nerves 5–7 pairs (the lowest pair close to the base), curved-ascending, flat above, raised beneath, veins transverse, slightly prominent beneath; petiole slightly swollen distally, 1.5–2 (–2.5) cm. *Cymes* solitary or fascicled, 3–7-flowered, on puberulous peduncle 5–10 mm, which bears a few basal very small caducous bracts; pedicels glabrous, 3–5 mm,

ebracteate and ebracteolate already at anthesis. *Calyx* patelliform, tube rather inconspicuous, 4–5-angular, teeth obscure, c. 3 mm ϕ . *Petals* ovate-lanceolate, papillose-ciliate, glabrous outside, densely hairy inside, greenish white, reflexed at apex, (6–) 8–10 by 2–3 mm. *Filaments* ciliate at the free top; anthers ovate-oblong, 0.5 mm. *Ovary* deeply 5-furrowed lengthwise; style thick-columnar, as long as ovary; stigma obscurely 5-lobed. *Drupe* obovoid-oblong to almost turbinate, apex truncate and a little impressed, crowned by the remains of calyx, disk and style, the latter forming a hard beak, green, 2–4 by 1.5–2.2 cm; pericarp thin, fleshy; endocarp woody, 0.5 mm.

Distr. Tenasserim to S. Thailand, in *Malesia*: Sumatra (incl. Nias I.), Malay Peninsula, W. Java, Borneo (incl. Natuna Is.). Fig. 10.

Ecol. Lowland rain-forest, also secondary forest, mixed Dipterocarp forest, undulating country, up to c. 600 m, scattered though locally common.



Fig. 10. Range of *Strombosia javanica* Bl.

Uses. Young leaves are edible and have the taste of katjang, *i.e.* various *Leguminosae*. Wood moderately durable, hard and heavy, light yellowish brown, locally used for house constructions and cabinet work.

Vern. *Ki katjang, ki kojop, S, bayam badak, bê-lian landak, dèdali, èntelung, madang kalawar, sanam sanam, M, leke-leke, Nias.*

2. *Strombosia philippinensis* (BAILL.) ROLFE, J. Bot. 23 (1885) 211; VIDAL, Phan. Cuming. (1885) 23, 102; Rev. Pl. Vasc. Filip. (1886) 86; VALET. Crit. Overz. Olacin. (1886) 87; CERON, Cat. Manila (1892) 45; FOXW. Philip J. Sc. 2 (1907) Bot. 393 (wood); *ibid.* 4 (1909) Bot. 449, t. 22, f. 12 (wood); MERR. En. Philip. 2 (1923) 117; SLEUM. Blumea 26 (1980) 164. — *Lavallea philippinensis* BAILL. Adansonia 2 (1862) 361. — *S. dubia* VIDAL, Sin. Atl. (1883) 20, t. 30, f. D; MERR. Govt. Lab. Publ. Philip. 17 (1904) 15. — *S. minor* ELMER *ex* MERR. En. Philip. 2 (1923) 117, *in obs. pr. syn.*; ELMER, Leaflet. Philip. Bot. 10 (1939) 3770, *descr. angl.* — *S. elmeri* SALVOSA, Lexic. Philip. Trees, Bull. For. Prod. Res. Inst. Coll. Laguna 1 (1963) 125.

Tree 5–28 m; trunk up to 30 cm ø. Branchlets slender, glabrous. *Leaves* subdistichous, ovate-oblong to oblong, rarely lanceolate, apex shortly subacutely acuminate, base cuneate to the petiole, thin-chartaceous, smooth above, finely wrinkled above, green to brownish and rather dull in dry specimens, glabrous, hardly or not pellucid-punctulate, (6–) 8–12 (–16) by (3–) 4–6 (–7.5) cm; nerves 4–5 (–6) pairs curved-ascending, slightly prominent beneath, reticulations obscure; petiole slender, hardly thickened distally, (1–) 1.5–2 cm. *Flowers* on axillary very short multibracteolate subglobular axes, 5–8 per cluster; pedicels glabrous, c. 1 mm, with 1 or 2 persistent minute scaly bracteoles. *Calyx* cupular, deeply 5-lobed, glabrous, lobes ovate, ciliate, 0.5 mm. *Petals* 5, linear-oblong, greenish-white, glabrous outside, hairy at apex inside, 2 by 0.5 mm. *Stamens* 5; filaments fully adnate to the petals; anthers ovate-oblong, 0.5 mm. *Ovary* superior, subglobose; style filiform, 1–2 mm. *Drupe* subglobular, substipitate-attenuate at base for 1–2 mm, apex obtuse, the persistent style base short, c. 1 cm ø; pericarp thin-fleshy, finely tubercled in the dry state as in *S. ceylanica*; endocarp thin-woody.

Distr. *Malesia*: Philippines (Basilan, Catanduanes, Leyte, Luzon, Mindanao, Mindoro, Sibuyan), N. Moluccas (Morotai, Halmahera).

Ecol. Forests at low and medium altitudes, locally common.

Uses. Timber heavy, dull yellowish to pinkish, used for house building.

Vern. *Kamauyán, Tag., kamayúán, Tag., S.L.Bis., larág, Ilk., larák, Ibn., samayónan, Bik.,*

sumayuán, Tag., tamahuyán, Bik., S.L.Bis., tamaoyán, Neg., Tag., tamaúán, Tag., tamauyán, Ibn., Neg., Tag., tamayuán, tamayuéon, Bik., Tag.

3. *Strombosia ceylanica* GARDN. Calc. J. Nat. Hist. 6 (1845) 350; MIQ. Fl. Ind. Bat. 1, 1 (1856) 787; MAST. Fl. Br. India 1 (1875) 579; VALET. Crit. Overz. Olacin. (1886) 87; K. & V. Bijdr. Booms. Java 5 (1900) 284; HOCHR. Bull. Inst. Bot. Btzg 22 (1905) 43, *incl. var. lucida* (T. & B. *ex* VALET.) HOCHR., *var. membranacea* (BL.) HOCHR. *ex var. sessilis* HOCHR.; Ann. Jard. Bot. Btzg Suppl. 3, 2 (1910) 854; BACK. Schoolfl. Java (1911) 223; KOORD. Exk. Fl. Java 2 (1912) 172; K. & V. Atlas Booms. Java 1 (1913) t. 125; BACK. & BAKH. f. Fl. Java 2 (1965) 64; SLEUM. Blumea 26 (1980) 165. — *Stemonurus? membranaceus* BL. Mus. Bot. Lugd. Bat. 1 (1850) 250. — *S. javanica auct., non BL.*: THWAITES, En. Pl. Ceyl. (1858) 42. — *Sphaerocarya leprosa* DALZ. in Hook. Kew J. Bot. 3 (1851) 34; DALZ. & GIBS. Bombay Fl. (1861) 223. — *Lavallea ceylanica* (GARDN.) BAILL. Adansonia 2 (1862) 361. — *Anacolosa maingayi* MAST. Fl. Br. India 1 (1875) 580; VALET. Crit. Overz. Olacin. (1886) 93. — *S. lucida* T. & B. Cat. Hort. Bog. (1866) 207, *nom. nud.*; *ex* VALET. Crit. Overz. Olacin. (1886) 86, pl. 2, f. 18; K. & V. Bijdr. Booms. Java 5 (1900) 286. — *S. membranacea* (BL.) VALET. Crit. Overz. Olacin. (1886) 87; K. & V. Bijdr. Booms. Java 5 (1900) 284. — *S. multiflora* KING, J. As. Soc. Beng. 64, ii (1895) 102; RIDL. Fl. Mal. Pen. 1 (1922) 425; WHITMORE, Gard. Bull. Sing. 26 (1973) 285; Tree Fl. Malaya 2 (1973) 306. — *S. rotundifolia* KING, J. As. Soc. Beng. 64, ii (1895) 103; RIDL. J. Str. Br. R. As. Soc. 33 (1900) 60; Fl. Mal. Pen. 1 (1922) 425; BURK. & HENDERS. Gard. Bull. S. S. 3 (1925) 358; FOXW. Mal. For. Rec. 3 (1927) 123, fig.; HENDERS. Gard. Bull. S. S. 4 (1928) 239; DESCH. Mal. For. Rec. 15, 2 (1954) 423, pl. 87, f. 2 (wood); WYATT-SMITH & KOCHUM. Mal. For. Rec. 17 (1965) 352. — *S. latifolia* STAPE, Kew Bull. (1906) 71; MERR. En. Born. (1921) 242. — *S. rapaneoides* S. MOORE, J. Bot. 62 (1924) Suppl. 22. — *S. maingayi* (MAST.) WHITMORE, Gard. Bull. Sing. 26 (1973) 285; Tree Fl. Malaya 2 (1973) 306; CORNER, Gard. Bull. Sing., Suppl. 1 (1978) 207. — Fig. 9a–c.

Shrub or generally tree, 10–20 (–36) m; crown compact; trunk straight, closely branched, occasionally up to 1.2 m ø at base, sometimes buttressed; bark grey to brown, peeling off in scroll-shaped patches. Branches pendulous. Branchlets smooth, glabrous. *Leaves* elliptic to ovate-oblong, sometimes ovate or suborbicular, apex shortly acuminate, tip acute or bluntish, rarely obtuse-rounded, base cuneate to obtuse or rounded, slightly inequilateral, firmly membranaceous when young, usually subcoriaceous, rarely coriaceous in later stages, glabrous, somewhat shining above when fresh, drying usually dull, green-

ish brown or glaucous-green, conspicuously parchment-like (shagreened) from close wrinkled surface and minutely pustular, \pm distinctly and densely pelucid-punctulate, considerably varying in size even in the same specimen, 8–15 (–25) by 3–7 (–8.5, –11) cm; nerves (4–) 5–8 (rarely –12) pairs, curved-ascendent, obsolete above, not much raised beneath, transverse veins and reticulations rather inconspicuous; petiole a little swollen distally, 4–10 (–17) mm. *Flowers* from small woody warts, (1–) 3–6 (–15) per fascicle; pedicels 1–2 mm; bracts and bracteoles several, rounded, scale-like, reddish, minute. *Calyx* 5-lobed, lobes ovate, obtuse, ciliate. *Petals* 5, oblong or elongately so, greenish white, glabrous outside, hairy except the base inside, tips finally recurved about halfway. *Anthers* ovate. *Ovary* semi-inferior in a conical faintly 5-lobed disk; style filiform, (1–) 2–4 mm. *Drupe* subsessile, pyriform when young, ellipsoid to subglobose with shortly attenuate base when fully developed, apex with the remains of the calyx obtuse-rounded, style base tiny, inconspicuous, 1.6–2 (–2.5) cm; pericarp thin-fleshy, pink to purple, rugose or tuberculate; endocarp thin-woody. *Seed* 1, c. 1.2 cm.

Distr. Ceylon and SW. India (Western Ghats from Kanara southwards); in *Malesia*: Sumatra, Malay Peninsula, Anambas Is., West & Central Java, Borneo. Fig. 11.

Ecol. In lowland forest and brushwood, mixed Dipterocarp and even secondary forest, often close

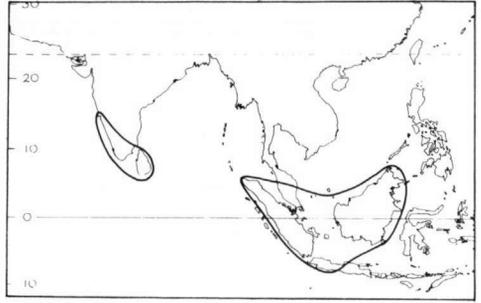


Fig. 11. Range of *Strombosia ceylanica* GARDN.

to the sea, scattered though locally common, on well-drained flat land or lower slopes of ridges, up to c. 800 m.

Uses. Wood yellowish brown, hard, heavy, quite durable, used for constructions.

Vern. *Pétaling ayer*, M; Borneo: *bélian landak*, Iban, *bungil*, Sampit, *kambau*, Dusun Kinabatangan; Sumatra: *damondjan*, Eastcoast, *médang huat*, Benkulen.

Note. *Strombosia ceylanica* is conceived here in a broad sense including *S. latifolia*, a variant with coriaceous leaves and up to 12 pairs of nerves, which in flower and fruit characters hardly differs from *S. ceylanica s. str.*

8. ANACOLOSA

BL. Mus. Bot. Lugd. Bat. 1 (1850) 250, t. 46; SLEUM. in E. & P. Nat. Pfl. Fam. ed. 2, 16 b (1935) 20; Blumea 26 (1980) 146. — Fig. 12–13.

Trees or erect shrubs (none scandent in Mal.). *Leaves* spiral, sometimes subdistichous, penninerved. *Flowers* in sessile (very rarely peduncled) cymes or fascicles, often from bracteolate woody warts or short axes, rarely from trunk or stem, bisexual. *Calyx* cupular, very shortly (5–) 6 (–7)-dentate, or subtruncate, not enlarged after anthesis, subsistent at base of the mature fruit. *Petals* (5–) 6 (–7) inserted on the margin of the cupular disk, fused in the lower part, fleshy, concave below and including the stamens there, with a bearded keel above the cavity. *Stamens* (5–) 6 (–7); filaments short, flat; anthers broad-ovoid, the cells distant and immersed in the thickened connective, the latter generally with a long-hairy top. *Disk* hypogynous, adnate to the ovary, much accrescent in fruit, 6-denticulate or -furrowed. *Ovary* with its base or for a greater part immersed in the disk, incompletely 2 (–3)-celled below, 1-celled above, with a central basal placenta bearing 2 (–3) unitegmic ovules pendent from its apex; style short, with a thickened or conical base; stigma very shortly lobed. *Drupe* included by the enlarged disk almost to the top, and tipped by the remains of the style at the

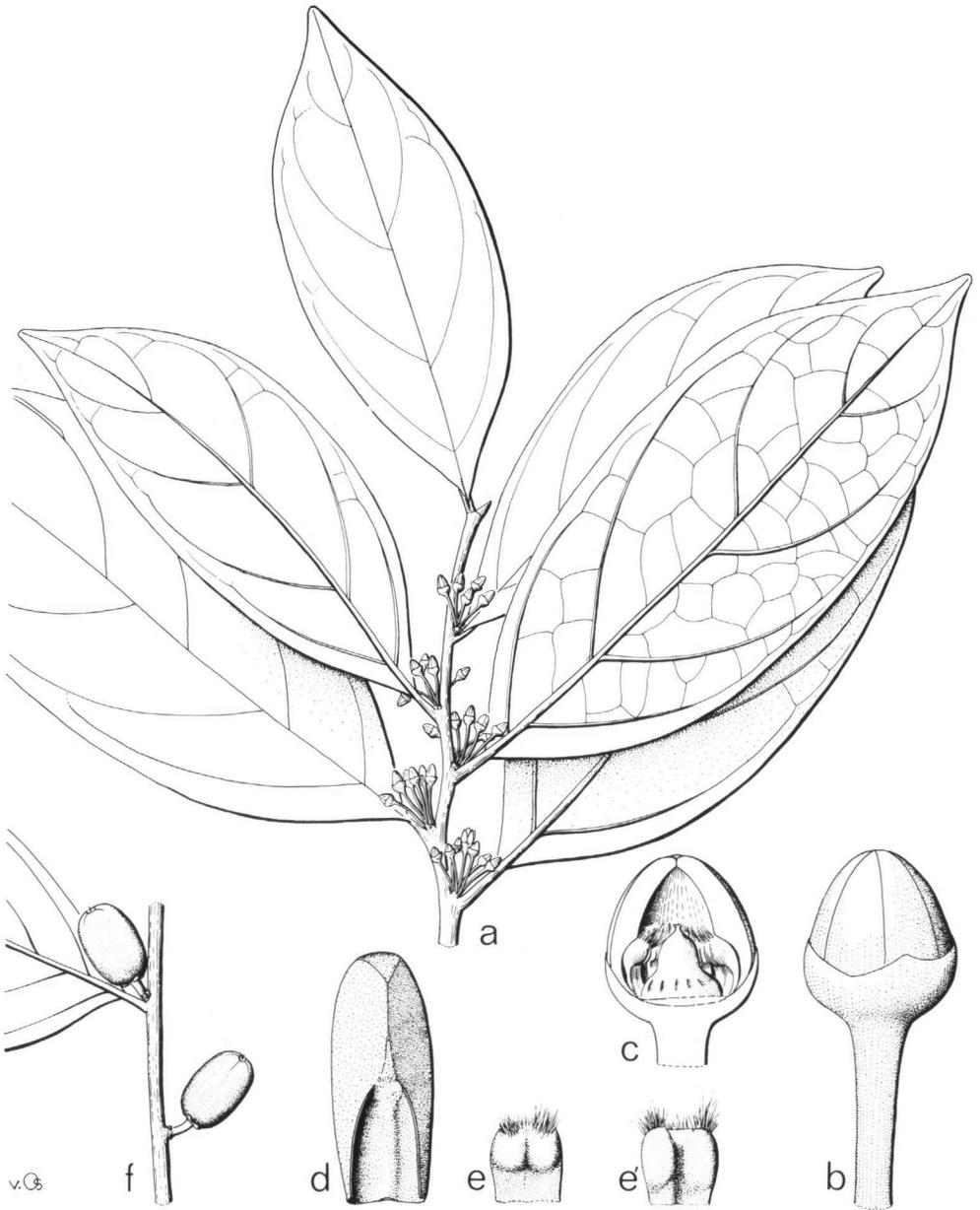


Fig. 12. *Anacolosa frutescens* (Bl.) Bl. *a.* Habit, $\times 1$, *b.* flowerbud, *c.* flower, front part of calyx and some petals removed, both $\times 7$, *d.* petal inside, *e.* anther, front side, *e'* same from the back, all $\times 14$, *f.* fruits, $\times \frac{1}{2}$ (*a-e* BACKER 22521, *f* SAN 70962).

base subtended by the persistent calyx; pericarp thin-fleshy; endocarp thin-crustaceous. *Seed* 1; embryo minute, at the apex of the fleshy albumen which contains starch and oil.

Distr. About 15 *sp.* in the Old World tropics, of which 1 *sp.* in Central Africa, 2 in Madagascar, the rest in S. India (not in Ceylon) to Assam, Burma, Andaman & Nicobar Is., Indochina, Thailand, Malesia and the Pacific; in *Malesia* 3 *sp.*, one of which also in SE. Asia.

Ecol. Usually in lowland forest, rarely in montane rain-forest.

KEY TO THE SPECIES

1. Flowers from the stem 1. *A. cauliflora*
 1. Flowers from foliate or defoliate axils of branchlets.
 2. Flowers pedicelled for at least 2 mm. Fruit smooth in the dry state, finally yellow to orange 2. *A. frutescens*
 2. Flowers subsessile (pedicels 0.5–1, rarely up to 2 mm). Fruit smooth or usually markedly tubercled in the dry state, finally cherry red 3. *A. papuana*

1. *Anacolosa cauliflora* SLEUM. *Blumea* 26 (1980) 148.

Treelet 3 m. branchlets glabrous. *Leaves* lanceolate, apex gradually long-attenuate, base cuneate to almost rounded, glabrous, dull, brown and subdensely tubercled on both faces when dry, 20–26 by 4–5.5 cm, midrib impressed above, much prominent beneath, nerves 4–5 pairs, curved-ascending and looping before the edge, obscure above, raised beneath, reticulations obscure; petiole transversely fissured, 5–7 by c. 2 mm. *Inflorescences* from the stem, glomerulate, each with numerous flowers on multi-bracteolate axes 5–10 by 2–3 mm. *Flowers* white, known only in bud. *Calyx* cupular, attenuate towards the base to a kind of stipe, glabrous. *Petals* 6, thickish, glabrous outside, barbate above the anthers inside. *Stamens* 6; anthers barbate apically.

Distr. *Malesia*: NW. New Guinea (once found in the Rouffaer R. area).

Ecol. In forest, at 250 m.

2. *Anacolosa frutescens* (BL.) BL. *Mus. Bot. Lugd. Bat.* 1 (1850) 251, f. 46; *Miq. Fl. Ind. Bat.* 1, 1 (1856) 787; *BAILL. Adansonia* 3 (1862) 118; *VALET. Crit. Overz. Olacin.* (1886) 92; *O.K. Rev. Gen. Pl.* 1 (1891) 111; *K. & V. Bijdr. Booms. Java* 5 (1900) 291; *Ic. Bog.* 2 (1904) t. 136; *BACK. Schoolfl. Java* (1911) 224; *KOORD. Exk. Fl. Java* 2 (1912) 172; *K. & V. Atlas Booms. Java* 1 (1913) t. 123; *RIDL. Kew Bull.* (1931) 34; *ANDERSON, Gard. Bull. Sing.* 20 (1963) 166; *BACK. & BAKH. f. Fl. Java* 2 (1965) 65; *SLEUM. Blumea* 26 (1980) 150. — *Stemonurus frutescens* BL. *Bijdr.* (1826) 649. — *A. zollingeri* *BAILL. Adansonia* 3 (1862) 118, cf. *Olacina ignota*, *Z. & M. Syst. Verz.* (1846) 25. — *A. heptandra* *MAING. ex MAST. Fl. Br. India* 1 (1875) 581; *VALET. Crit. Overz. Olacin.* (1886) 93; *KING, J. As. Soc. Beng.* 64, ii (1895) 110; *RIDL. Fl. Mal. Pen.* 1 (1922) 425; *WHITMORE, Tree*

Fl. Malaya 2 (1973) 300. — *A. arborea* *K. & V. Bull. Inst. Bot. Btzg* 2 (1899) 9; *Bijdr. Booms. Java* 5 (1900) 288; *KOORD. Nat. Tijd. N. I.* 60 (1901) 388; *BACK. Schoolfl. Java* (1911) 224; *KOORD. Exk. Fl. Java* 2 (1912) 172; *K. & V. Atlas Booms. Java* 1 (1913) t. 122. — *A. luzoniensis* *MERR. Philip. J. Sc.* 4 (1909) Bot. 253; *Foxw. l.c.* 449 (wood); *BROWN, Minor Prod. Philip. For.* 1 (1921) 270; *WESTER, Philip. Agr. Rev.* 14 (1921) t. 35a; *Bull. Agr. Philip. Is.* 39 (1921) 272; *MERR. En. Philip.* 2 (1923) 117. — *A. celebica* *VALET. in Koord. Minah.* (1898) 391; *KOORD.-SCHUM. Syst. Verz.* 2, 3 (1914) 38. — *Salacia bartlettii* *RIDL. Kew Bull.* (1938) 239, cf. *DING HOU, Fl. Mal. I.* 6 (1964) 420. — *Fig.* 12–13.

Erect shrub or tree, 5–25 (–30) m; trunk occasionally up to 1.4 m ø; outer bark smooth, flaking in large thin pieces, grey to brown, inner one reddish. Branchlets glabrous, grey-corticate below. *Leaves* variable in shape and size, elliptic or elliptic-oblong to lanceolate, apex broadly to narrowly acuminate, tip blunt, base cuneate, slightly inequilateral, chartaceous to coriaceous, shining above when fresh, brownish and rather dull in the dry state, then usually with numerous tiny warts or tubercles on both faces, or mainly so beneath, with numerous fine pellucid points visible against strong light, (6.6–) 7–15 (–22) by (3–) 4–6.5 (–9, –12) cm; nerves (4–) 5–6 pairs, curved-ascending, the lowest pair close to the base, raised beneath, reticulation of transverse veins and veinlets lax, rather inconspicuous; petiole stoutish, 5–7 (–10) mm. *Flowers* on short warts or tubercles (these rarely elongate to short scaly axes), (2–) 5–15 per fascicle; bracts and bracteoles 0; pedicels glabrous or puberulous, 3–5 (–6) mm. *Calyx* cup-shaped, shortly 5–7-lobed or subentire, glabrous or pale rusty-puberulous, c. 3 mm diameter. *Petals* (5–) 6 (–7), ovate-lanceolate, connate about halfway, thickish, glabrous or rarely puberulous outside, bar-

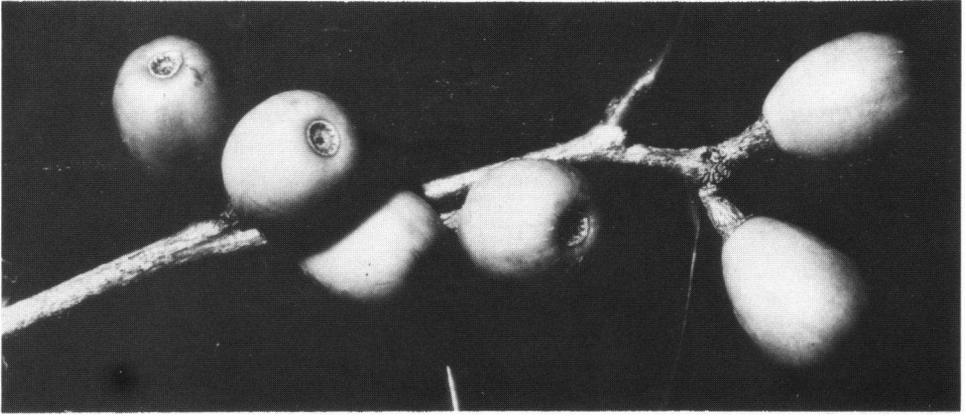


Fig. 13. *Anacolosa frutescens* (BL.) BL. Twig with fruits, \pm nat. size; Sarawak (Photogr. DING HOU 380).

bate in the upper free cristate and finally recurved part inside, green-white, 2–3 (rarely –4) by 1–1.5 mm. *Stamens* 5–7; filaments flat; anthers barbate apically. *Ovary* surrounded by the slightly 12-grooved disk; style short-conical; stigma minute, shortly lobed. *Drupe* obovoid-ellipsoid to oblong-ova, seata on the persistent non-acrescent calyx, apex truncate and slightly 6-sulcate, the persistent style base very short, at maturity yellow to orange, (1.5–) 1.8–2 (–2.5) by (1.2–) 1.5–2 cm, on stout pedicel 6–8 by 1.5 mm; pericarp thin-fleshy; endocarp thin-crustaceous. *Seed* 1; albumen copious.

Distr. Burma, Andaman & Nicobar Is., E. Thailand; in *Malesia*: Sumatra (Eastcoast, Palembang), Malay Peninsula, West & Central Java, Borneo, NE. Celebes (Minahasa), Moluccas (Sula Is.: Taliabu), Philippines (Luzon, Mindoro, Panay, Masbate,

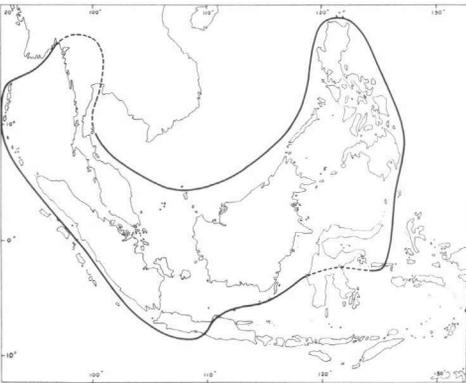


Fig. 14. Range of *Anacolosa frutescens* (BL.) BL.

Mindanao). Fig. 14.

Ecol. In lowland and submontane forest, mixed Dipterocarp forest, along stream in kerangas forest, sometimes in peat swamp forest (Borneo), also in secondary forest, occasionally on limestone, scattered though locally frequent, from sea-level up to 700 (rarely –1400) m.

Uses. Wood pale reddish brown, hard and heavy, used for house posts, but said to be not durable.

Vern. W. Java: *kopi gunung, tangki leuweung*, S; Borneo: *bèlian landak*, Iban; Philippines: *aluloi, gálo*, Tag., *mataboto*, S.L.Bis., *yu-pa*, Gad.

3. *Anacolosa papuana* SCHELLENB. Bot. Jahrb. 58 (1923) 157; SLEUM. Blumea 26 (1980) 148.

Small tree, occasionally up to 15 m; trunk up to 10 cm \varnothing ; bark smooth, light brown, with shallow longitudinal fissures. Branchlets glabrous, minutely lenticellate. *Leaves* oblong to oblong-elliptic, apex shortly acuminate, tip acute or bluntish, base cuneate, firmly membranaceous to subcoriaceous, dark green above, lighter below when fresh, becoming dull and brown in the dry state, glabrous, more or less densely and finely tubercled and wrinkled on both faces though mainly beneath in dry specimens, pellucid-punctulate against strong light, variable in size even in the same specimen, (8–) 10–26 by (3–) 4–7 (–10) cm; nerves 5–6 pairs, curved-ascending, raised beneath only, reticulations obscure; petiole 0.5–1 (–1.3) cm. *Flowers* 2–8 per sessile cluster, the latter on small woody scaly warts or tubercles, or on top of cylindrical woody axes (2–3, rarely –6 mm); pedicels 0.5–1 (rarely –2) mm. *Calyx* cupular to almost patelliform, entire, c. 3 mm \varnothing , attenuate at base towards to pedicel. *Petals* (5–) 6 (–7), lanceolate,

acute, fused in the lower part, thickish, white or cream, bearded at base of free part, glabrous below, 2-3 (rarely -4) by c. 1 mm. *Stamens* 5-7; filaments flat, glabrous; anthers bearded distally. *Disk* cupular, flattish. *Ovary* ovoid, glabrous; style very short. *Drupe* subglobular to slightly obovoid, the apex obtuse-rounded, rarely subtruncate, the remains of the style very short, smooth or usually shallowly tubercled in the dry state, yellowish to orange initially, finally deep cherry-red, (1.5-) 1.8-2.5 (sometimes

-3.5) by 1.3-2 (-2.5) cm, on stoutish peduncle up to 5 mm; pericarp thin-fleshy; endocarp woody, smooth or warted, 0.5-1 mm. *Seed* 1.

Distr. Malesia: New Guinea, Solomon Is. (Bougainville to San Cristobal).

Ecol. Understorey tree in lowland to mid-mountain rain-forest, also advanced secondary forest, rarely in flood plain or swamp forest, from sea-level up to c. 1675 m, locally common.

9. SCHOEPFIA

SCHREB. Gen. (1789) 129; ENGL. in E. & P. Nat. Pfl. Fam. 3, 1 (1894) 233; Nachtr. 1 (1897) 145; SLEUM. in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 30; STEEN. Reinwardtia 1 (1952) 467; SLEUM. Blumea 26 (1980) 161. — *Schoepfiopsis* MIERS, J. Linn. Soc. Bot. 17 (1878) 75. — **Fig. 15.**

Trees or shrubs, often root-parasites. *Leaves* spiral, penninerved. *Flowers* bisexual, fragrant, white or yellow, often heterostyled, in short racemes or corymbs; base of rachis with small imbricate scaly perulae (Mal.). Bract and bracteoles united at apex of pedicel into a small, acutely 3-lobed, persistent epicalyx. *Calyx* inconspicuous, *i.e.* connate with the cup-shaped truncate flower-axis. *Petals* 4-5 (-6), inserted on the edge of the flower axis, connate in the lower 1/2-2/3 to a tubular-campanulate corolla, free and revolute above, with a tuft of hairs inside the tube behind each anther. *Stamens* 4-5 (-6), epipetalous, the slender filaments adnate to the corolla tube for almost their full length, free at apex; anthers free, 2-celled, attached below the middle. *Disk* epigynous, annular, fleshy. Upper half of the *ovary* superior, included by the disk, lower half within the flower axis, 3-celled below, 1-celled above; style slender; stigma 3-lobed; placenta central, with 3 ategmic ovules pending from its apex. *Fruit* drupaceous, subtended at base by the persistent epicalyx, crowned by the remains of calyx, disk and corolla; epicarp (which originates from the somewhat accrescent flower-axis) thin, fleshy; endocarp crustaceous to pergamaceous, striate lengthwise. *Seed* 1; embryo very small at the apex of the fleshy albumen which contains oily substances.

Distr. About 24 *spp.*, of which c. 20 in (sub)tropical America, and c. 4 in SE. Asia, one of which in *Malesia* (N. Sumatra).

Ecol. In lowland to montane, even mossy forest.

1. *Schoepfia fragrans* WALL. in ROXB. Fl. Ind. ed. Wall. & Carey 2 (1824) 188; MAST. Fl. Br. India 1 (1875) 581, excl. GRIFFITH t. 629; STEEN. Reinwardtia 1 (1952) 470, f. 1; SLEUM. Blumea 26 (1980) 162. — *Schoepfiopsis fragrans* (WALL. in ROXB.) MIERS, J. Linn. Soc. Bot. 17 (1878) 76. — **Fig. 15.**

Glabrous shrub or small tree, (1-) 3-5 (-12) m; bark thick, corky, whitish grey or pale brown, with fine horizontal fissures. Branchlets angular. *Leaves*

elliptic-oblong to lanceolate, apex acuminate, base acute, subinequilateral, chartaceous to subcoriaceous (rarely coriaceous at higher altitudes), dark green above, paler beneath when fresh, often tubercled, 5-9 (-12) by (1.2-) 3-5 (-6) cm; nerves 5-7 (-9) pairs, inarching, inconspicuous above, a little raised beneath; petiole slender, 4-6 (-7) mm. *Racemes* solitary, 3-7 (-10)-flowered, 2.5-3 (-4) cm; peduncle provided at base with several persistent small



Fig. 15. *Schoepfia fragrans* WALL. *a.* Habit, $\times 1$, *b.* flower, opened, supported by the 3 bracts at base, $\times 2$ (VAN STEENIS 9719).

perular bracts; pedicels slender, (5-) 8-10 (-12) mm, distally with a cupule formed by 1 bract and 2 bracteoles, 0.5 mm. *Calyx* obconical, edge truncate, adherent to the ovary and accrescent in fruit. *Corolla* tubular, fleshy, whitish or pinkish to yellowish, or even sulphur-yellow, with a scent of jasmine, tube 0.8-1 cm long, 4-5 mm \varnothing , grooved at base where it is agglutinated (or connate) around the ovary; lobes oblong, subacute, 4-5 mm, with a tuft of hairs at their inner base above the insertion of the anthers.

Stamens (4) 5; filaments cohering to corolla tube; anthers ovate, subbilobed, free in the throat. Disk epigynous, pulvinate. *Ovary* half-superior, turbinata, 5-6 mm long; style as long as or shorter than the corolla tube; stigma generally 3-lobed. *Drupe* ellipsoid-oblongoid, whitish or cream to yellow, (0.7-) 1-1.2 cm long, 0.7-0.8 mm \varnothing , crowned by the disk; pericarp succulent when ripe, 1-2 mm thick; endocarp thin-crustaceous, striate lengthwise. *Seed* 1, white, conforming with the endocarp.

Distr. Nepal, Bhutan, E. Bengal, Assam, Burma, SW. China, Thailand, Indochina; in *Malesia*: N. Sumatra (Atjeh: Gajo Lands). Ecol. In primary montane forest or forest borders, also in mossy forest, (600–) 1400–2500 (–3000) m.

Excluded

Several genera formerly accommodated in a larger family concept '*Olacineae*' are excluded and treated under *Icacinaceae* (see Fl. Males. I, 7, 1971, 1–87) or *Opiliaceae* (this volume, pp. 31–52). The present list is restricted to those genera and some species which have in the past been ascribed to *Olacineae* but which belong to different families.

Braceea KING, J. As. Soc. Beng. 64, ii (1898) 101 is according to STAFF & KING, Ic. Pl. 7 (1901) t. 2690 = *Sarcosperma* (*Sarcospermataceae*).

Ctenolophon OLIV. Trans. Linn. Soc. 28 (1873) 516, t. 43 belongs according to WINKLER in E. & P. Nat. Pfl. Fam. ed. 2, 19a (1931) 122 to *Linaceae*.

Erythropolium triandrum QUIS. & MERR. Philip. J. Sc. 37 (1928) 143 = *Alsomitra macrocarpa* (BL.) ROEM. (*Cucurbitaceae*), *vide* Kew.

Fissipetalum MERR. J. Str. Br. R. As. Soc. 85 (1922) 168 is according to AIRY SHAW, Kew Bull. (1947) 22 = *Ericybe* ROXB. (*Convolvulaceae*).

Pteleocarpa OLIV. Trans. Linn. Soc. 28 (1873) 515 has, with some doubt, been accommodated in *Boraginaceae*.

Strombosia? philippinensis [non (BAILL.) ROLFE] LAM & HOLTHUIS, Blumea 5 (1942) 178, based on LAM 3175 from Talaud Is., is identified by BAKHUIZEN f. & VAN STEENIS as *Celtis paniculata* (ENDL.) PLANCH. (*Ulmaceae*).

Worcesterianthus MERR. Philip. J. Sc. 9 (1914) Bot. 288; *ibid.* 10 (1915) Bot. 270 is according to VAN STEENIS, Acta Bot. Neerl. 4 (1955) 478 = *Microdesmis* HOOK. f. (*Euphorbiaceae* or *Pandaceae* respectively).