

THYMELAEACEAE (Ding Hou, Leyden)

Shrubs, trees, or lianas, rarely undershrubs or herbs, with a very strongly developed and layered, fibrous, tough bast ("Seidenbast", silky fibres). *Leaves* opposite or decussate, spiral or alternate, very rarely some ternate, simple, entire, exstipulate, articulated at the base, glandular-punctate in *Gonystyloideae*. *Inflorescences* terminal, axillary or extra-axillary, or on internodes, sometimes on brachyblasts, simple or rarely branched, sessile or peduncled, racemose, umbelliform, spicate, capitate, or fascicled, obviously basically racemose; flowers rarely solitary, sometimes cauliflorous and condensed into glomerules, bracteate (bracts sometimes forming an involucre) or ebracteate. *Flowers* bisexual (rarely unisexual by abortion and polygamodioecious or dioecious in extra-Mal. *spp.*), homomorphic, rarely heteromorphic, regular, tubular, campanulate or infundibuliform, tube very short in *Gonystyloideae*, or with almost free sepals in extra-Mal. *spp.*, mostly caducous, some circumsciss in the lower part, or persistent (sometimes enveloping the ripe fruit in extra-Mal. *spp.*), sometimes slit lengthwise in fruit, 4-5(-6)-lobed, the lobes imbricate (rarely valvate in some extra-Mal. *spp.*), equal or rarely the interior 2 slightly smaller, erect or reflexed. *Corolla* absent or represented by free or united *petaloid appendages*, isomerous and alternating with the calyx lobes, or double in number and arranged in pairs opposite the calyx lobes, rarely more (*Gonystylus*), fleshy or membranous, filamentous or oblong, entire or lobed, rarely united into a ring, inserted at the throat of floral tube or slightly lower, sometimes behind the stamens, or absent. *Stamens* 2 only, or 4-∞, in Malaysia (except in some *Gonystyloideae*) mostly diplostemonous, in two or in one series, if in two series then at two different levels, the upper ones opposite the calyx lobes and the lower ones alternate with them, sessile or filamentous; filaments filiform or slightly flattened, entirely or partly adnate to the floral tube; anthers 2-celled, basi- or dorsifixed, obtuse or apiculate, introrse, hippocrepiform (*Gonystyloideae*), or extrorse (extra-Mal. *spp.*), dehiscent lengthwise, usually free, sometimes the lower $\frac{1}{3}$ - $\frac{1}{2}$ adnate to the tube (*Aquilaria cumingiana*). Disk hypogynous, membranous or subcarinose, annular, cupular, lobed, free and scale-like, or none. *Ovary* superior, 1-2-celled, 3-5(-8)-celled in *Gonystyloideae* and extra-Mal. *spp.*, sessile or shortly stalked; style filiform, caducous, sometimes very short or obscure, terminal or excentric, in *Gonystyloideae* sometimes accompanied by 'parastyles' at the base; stigma capitate, subglobose, oblong, subclavate or pyramidal, entire and smooth, or slightly emarginate, sometimes papillose. *Ovules* solitary in each cell, with axial or parietal placentation, pendulous from near the top, sometimes partly or entirely and laterally adnate to the placenta, the micropyle towards the top and outward. *Fruit* a drupe or drupaceous, a berry, or a capsule, either apically or laterally emerging from the floral tube, 1- or 2(-3)-seeded, or 3-5(-8)-seeded in *Gonystyloideae* and extra-Mal. *spp.*; pericarp membranous, pulpy, coriaceous, or fibrous. *Seeds* with a caruncle-like or tail-like appendage, usually with an aril in *Gonystyloideae*, the seed usually hanging out by one end on a thin, string-like funicle in *Aquilarioideae*; testa usually crustaceous, black, often with rather irregular ridges, glabrous or short-hairy in some *spp.* of *Aquilarioideae*; albuminous or exalbuminous. Embryo straight; cotyledons plano-convex; radicle short, superior.

Distribution. About 50 genera with about 500 species, chiefly developed in south and tropical Africa and Australia; it is almost cosmopolitan.

In addition to *subfam. Gonystyloideae* which contains 3 genera with 21 species and has been treated in this Flora (I, 4, 1953, 349–365) by AIRY SHAW, there are 9 genera with 46 species in Malaysia.

Aquilaria, *Gyrinops*, *Enkleia*, and *Linostoma* are confined to Malaysia and the southern part of tropical continental SE. Asia. *Wikstroemia* is widely distributed, from eastern Asia at about 37° N southward throughout Malaysia to northern and eastern Australia and the Pacific Islands (Bonin, Guam, Palau, Hawaii, Tahiti, Marquesas, Tonga, Samoa, Fiji, Norfolk I., and New Caledonia).

Daphne is distributed in Europe, northern Africa, through central Asia, eastward to China and Japan, and southward to Malaysia.

Phaleria is developed chiefly in Malaysia and Fiji, westward to Ceylon (*P. capitata*), southward to eastern Australia, and eastward as far as Palau, Samoa, and Tonga.

Drapetes shows the typical pattern of S. Pacific subantarctic distribution: South America (Fuegia and Falkland Is.), New Zealand, Tasmania, SE. Australia, and Malaysia (New Guinea and Borneo).

Pimelea is chiefly confined to Australia, with some outlying species in New Zealand, and two others extending northward to Malaysia (Timor, Sumba, New Guinea, and Luzon in the Philippines).

Ecology. Most Malaysian species are of small to moderate size, while a few species of *Aquilaria*, *Gyrinops*, and *Gonystyloideae* are trees up to 45 m tall. They usually occur scattered, but *Gonystylus bancanus* may occur gregarious, sometimes forming pure stands. They are chiefly constituents of primary and secondary rain-forests, while *Gonystylus bancanus* occurs predominantly in freshwater swamp and peat forest; recently J. A. R. ANDERSON found *Linostoma longiflorum* in peat swamp forest in Sarawak.

Most of the species occur at low and medium altitudes, some of them ascending into the montane zone (e.g. *Phaleria capitata* 0–1200 m and *Linostoma pauciflorum* 0–1300 m), or even confined to the montane zone (e.g. *Daphne composita* commonly recorded from 1200–2000 m, and *Aquilaria apiculata* from 1800 m). A few are restricted to the upper montane and subalpine rain-forest (e.g. *Daphne luzonica* 2000–2500 m, and *Wikstroemia brachyantha* 1400–2800 m). *Drapetes ericoides* is commonly reported from the subalpine to alpine zone from 3000–4450 m.

As to climate, most of the species are confined to everwet regions, some also extend to seasonal areas (e.g. *Phaleria capitata*, *Gyrinops versteegii*, and *Wikstroemia indica*), while *Wikstroemia androsaemifolia* and *Phaleria octandra* chiefly occur under seasonal climatic conditions.

Pollination. Insect-pollination is indicated by the brightly coloured, generally many-flowered inflorescences, the sweet scent, the occurrence of floral heteromorphism, and the usual presence of the hypogynous disk (*vide* RENDLE, *Classif. Fl. Pl.* 2, 1952, 371). I have no records of observations on Malaysian species.

Dispersal. Though no direct evidence has been recorded from Malaysia it can be indirectly inferred that the red or black coloured drupaceous fruits of *Wikstroemia*, *Phaleria*, and *Daphne* will be dispersed endozoically by birds or other animals. See RIDLEY, *Disp.* (1930) 401, 466, 472, and GUPPY, *Observ. Nat. Pac.* 2 (1906) 348. *Wikstroemia indica* has, probably through this agent spread from the Botanic Gardens at Bogor but its area is only slowly, though steadily, extending into a circle with Bogor in its focus; its radius of c. 60 km was reached only after several decades.

Another dispersal class is represented by species of *Linostoma* and *Enkleia*. In *Linostoma* the inflorescences consist of a few inconspicuous flowers subtended by a pair of thin, cream-coloured or rose-pink coloured leaf-like bracts. In anthesis they possibly act as a show apparatus attractive to pollinators. They become pale and papery when the fruit is ripe, and are detached, adhering to the fruit, so as to be blown away separately. In *Enkleia*, a lofty climber, the pair of bracts below the inflorescence is very inconspicuous during anthesis, but in fruit (one developing only) the peduncle below the small nut lengthens considerably and the bracts grow to large, stiff, coriaceous leaves (fig. 10e). When the fruit, on its peduncle, with the two bract leaves attached, separates from the plant, it rotates rapidly, drifting away in the wind, across the forest to some distance (RIDLEY, *l.c.* 92–93). Though the structure is most peculiar, its effect (for longer distances) must not be overrated as winds are scarce in the tropical rain-forest, the apparatus is rather heavy, and as soon as it descends in the canopy it will come down, gradually, in a vertical line.

A third, very interesting dispersal class is represented by the capsular fruits of *Aquilaria* and *Gyrinops*, in which the seeds dangle from the apex of the fruit valves on filiform funicles, the glossy seeds having typically contrasting dark colours and possessing tails or other aril-like structures, probably of a pale colour, as is also found in *Gonystyloideae* (fig. 1 and 22). This structure is doubtless a curious adaptation to zoochorous dispersal, but unfortunately no observations have as yet revealed more exact data on its functioning.

Galls. DOCTERS VAN LEEUWEN (*Zoocec. N.I.* 1926, 397, f.735) recorded a leaf-gall caused by a gall-midge in *Phaleria laurifolia* (= *P. octandra*). The leaves bear spherical galls, 2–3 mm in diam.

Heteromorphous flowers. The flowers are heteromorphous in *Phaleria macrocarpa*. Two kinds of flowers are commonly found on different plants of that species, *viz* possessing exerted stamens and a short style and short stamens and an exerted style.

There is a sheet in Leyden Herbarium identified as "*Phaleria neumanni* F. v. M." collected by W. DUNN *s.n.* (in Nov. 1909) at Acacia D'K, New South Wales, which has three separate branchlets with similar

vegetative parts and two forms of flowers just like the above-mentioned case. It is not clear whether they were collected from the same plant.

Wood-anatomy. DEN BERGER, Determinatietabel houtsoorten van Malesië, Veenman, Wageningen (1949) 20 (*Aquilaria*); DESCH, Mal. For. Rec. 15^a (1954) 607; LÉANDRI, Ann. Sc. Nat. Bot. X, 12 (1930) 125 (hand lens); METCALFE & CHALK, Anat. Dic. 2 (1950) 1169 & 1178; MOLL & JANSSONIUS, Mikr. Holzes 5 (1934) 413.—By JANSSONIUS *l.c.* *Gonystylus* is referred to the *Thymelaeaceae*, mainly because of the characteristics shown by the pit pairs; METCALFE & CHALK *l.c.*, although recognizing common features, are treating *Gonystylaceae* as a separate family.—C.A.R.—G.

Morphology. In order to avoid confusion, it is advisable to give a concise explanation of some terms which are used in the descriptions of this revision. These terms serve for convenience of descriptive purpose.

Floral tube.—The vascular bundles going to the ovary are clearly different from those of the tube above the pedicel; the tube contains the vascular bundles of the outer whorls, it is 'appendicular' and not 'axile' in origin. Therefore, the tube is not an invaginated receptacle (*vide* LÉANDRI, Ann. Sc. Nat. Bot. X, 12, 1930, 235). Miss HEINIG (Am. J. Bot. 38, 1951, 125) confirmed the 'appendicular' origin of the tube which is composed of the fused bases of the sepals and adherent filaments. In the following I have called the tubular part of the flower the 'floral tube' and its lobes 'calyx lobes'.

Petaloid appendages.—In some genera there are petal-like structures, situated either at the throat or on the receptacle surrounding the ovary. In this treatment, they have been designated as 'petaloid appendages'. Miss HEINIG suggested (*l.c.* 127) them to represent special enations of the sepals.

Disk.—In some genera and species there is a cup-shaped or free, thin structure at the base of the ovary, which has here been designated as 'disk'. According to Miss HEINIG (*l.c.* 128) this structure is probably a part of the androecium.

Chalazal fold.—A mature seed-coat is formed by the outer integument and the inner integument; the latter is composed of a sclerenchymatous layer and a reticular layer (*cf.* GUÉRIN, Ann. Jard. Bot. Btzg 29, 1916, 29).

In all the seeds (at least in Malaysia) there is, at the basal part or chalazal end, either a caruncle-like thickening (in most of the genera) or a tail-like appendage (in some species of *Aquilarioideae*). The formation of the tail-like appendage has been interpreted in different ways. GILG (in E. & P. Pfl. Fam. III, 6a, 1894, 223) assumes it to be the downward elongation of the integument. LECOMTE (Bull. Soc. Bot. Fr. 61, 1914, 414–418) accepted it as the elongation of the lower part of the ovule. DOMKE (Bibl. Bot. 111, 1934, 37, t.V, f.43a–h) believed it to be formed by a more or less deeply transverse fold of the testa and designated it as "chalazal fold". However, the ontogeny of this appendage has not been well understood and further morphological and anatomical studies are needed.

Albumen.—Endosperm is found in most of the seeds although it is often a very thin layer, predominantly found on the dorsal surface of the cotyledons; it is very abundant in the seeds of *Pimelea* (*cf.* GUÉRIN, Ann. Jard. Bot. Btzg 29, 1916, 31–32, t.4). The absence of endosperm is rather rare (some *Phalerias*).

Cytology. As far as is known a basic number of chromosomes in the family seems to be $n = 9$, which is found in *Wikstroemia*, *Gnidia*, and *Daphne*; *Edgeworthia* has $n = 18$. In *Wikstroemia indica* FAGERLIND found also an apomictic triploid $2n = 27$ (Hereditas 26, 1940, 1–50).

Taxonomy. Subdivisions.—According to DOMKE (Bibl. Bot. 111, 1934, 103–104) the family is subdivided into 4 subfamilies, viz *Gonystyloideae*, *Aquilarioideae*, *Gilgiodaphnoideae*, and *Thymelaeoideae*. With the exception of *Gilgiodaphnoideae*, the other three subfamilies all have some representatives in Malaysia.

The 3 genera of trib. *Aquilarioideae-Microsemmatidae*, all endemic in New Caledonia, seem to be more closely related to subfam. *Gonystyloideae* than their arrangement in two distinct subfamilies would suggest; they lack the pellucid dots and the petaloid appendages of the latter. But *Solmsia* has the typical parallel nervation, venation, and leaf texture as in *Gonystylus*, and the nervation and texture of the leaves of *Microsemma* and *Deltaria* is resembling that of *Amyxa*. Furthermore, the macroscopical structure of the bast fibers in the three genera of *Microsemmatidae* resembles that of *Gonystyloideae* and is not so fine as in typical *Aquilarioideae*. Finally, the fruit in *Aquilarioideae* is 2-celled, against 3- or more-celled in both *Microsemmatidae* and *Gonystyloideae*.

1. *Subfam. Gonystyloideae* has been treated in this Flora (I, 4, 1953, 349–365) by AIRY SHAW. Leaves mostly pellucid-punctate. Flowers with a short or inconspicuous tube. *Petaloid appendages* 7–40, deltoid to linear-subulate, rarely joined into a low, entire annulus, inserted at the base of the floral tube. Disk 0. *Stamens* 8–80; filaments free. *Ovary* (2–)3–5(–8)-celled. *Fruit* a capsule. *Seeds* without chalazal fold, usually with aril. Endosperm 0. (*Gonystylus*, *Amyxa*, and *Aëtoxydon*.)

2. *Subfam. Aquilarioideae*. Leaves not pellucid-punctate. Flowers with a short to cylindrical tube or sepals free. *Petaloid appendages* scale-like, free or rarely united, inserted at the throat of the tube or slightly below it or none. *Stamens* (in the Mal. spp.) at most 10, diplostemonous or haplostemonous; filaments (in Mal. spp.) partly or entirely adnate to the tube. Disk 0, or ring-shaped. *Ovary* (in Mal. spp.) 2-celled. *Fruit* a capsule. *Seeds* usually with a conspicuous chalazal fold, and a thin funicle, without aril. Endosperm 0, or present. (*Aquilaria* and *Gyrinops*.)

3. *Subfam. Thymelaeoideae*. Leaves not pellucid-punctate. *Floral tube* funnel-shaped or cylindrical.

Petaloid appendages obscure and ridge-like or represented by scales. *Stamens* at most 10, usually diplostemonous, rarely haplostemonous or hemistemonous; filaments partly or entirely adnate to the tube. *Ovary* 1–2-celled. *Fruit* a drupe or drupaceous. *Seeds* mostly without or rarely with a small chalazal fold. Endosperm 0, or present. (*Linostoma*, *Enkleia*, *Phaleria*, *Wikstroemia*, *Daphne*, *Drapetes*, and *Pimelea*.)

Generic delimitation in Thymelaeaceae proves sometimes to be very difficult on account of the fact that though the majority of the species of one genus might be distinguished from those of another genus by two or even more good characters, there are frequently one or two species – or even different specimens of one species – which form an exception and are transitional in all but one character. Consequently such genera are then sharply separated by one character only, which is an unsatisfactory situation. For instance in *Phaleria* the petaloid appendages are rim-like, but they are distinct in *P. pentecostalis* LEANDRI. In *Aquilaria* the opposed case occurs, viz that they are distinct in all species except in *A. urdanetensis* where they are rim-like. In *Aquilaria* the anthers are always free from the tube except in *A. cumingiana* where they are partly adnate to the tube in part of the specimens! Also in *Aquilaria* the petaloid appendages are free except in part of the specimens of *A. cumingiana*; the same phenomenon is observed in *Gyrinops* where they are free, but in *G. moluccana* and *G. decipiens* they are usually united.

Dr B. PETERSON, Lund, who is working on the African *Thymelaeaceae*, told us of similar difficulties encountered in defining genera in that area. He wrote (May 1959): "I have devoted much time to generic delimitation in this family. As I have examined more and more African material (c. 15,000 sheets) I have found that the limits are in some cases so vague that it has appeared unavoidable to merge several genera. It is often rather easy to give a specific epithet but very difficult to come to a decision of the generic name. For example the only generic characters in *Gnidia*, *Lasiosiphon*, and *Arthrosolen*, and some smaller genera, are the number of calyx lobes and the presence or absence of petaloid appendages. And these are not at all enough to keep these genera separate. Sometimes these characters do not even hold for the type species. GILG and later STANER proposed that these genera should be united but other botanists have not followed their suggestions. In my monograph of *Gnidia* I will merge seven genera."

Aquilaria and *Gyrinops* seem to be very closely allied, the first being diplostemonous, the second haplostemonous, which is the only constant character. HALLIER *f.* found this difference not sufficient for generic distinction and united these genera. Dr PETERSON found in Africa a similar case, viz between *Gnidia* and *Struthiola* of which the first is diplostemonous, the second haplostemonous. He "never found any trace of staminodes in *Struthiola*. In some species of *Gnidia*, however, usually, but not always, the upper whorl of stamens is abortive. All species of *Struthiola* have a whorl of hair round each petaloid appendage. This arrangement is not found in *Gnidia* except for a single species as far as I have found. This will be placed in a separate section."

In Dr PETERSON's opinion *Struthiola* and *Gnidia*, though properly only distinguished 'absolutely' by one character, should not be united; if that were done, the consequence would be that still more genera had to be merged in the complex which would lead to an unsatisfactory situation. In this revision I have not followed HALLIER *f.* in uniting *Aquilaria* and *Gyrinops*.

The difference between *Wikstroemia* and *Daphne* seems, by being merely vegetative, still more feeble, the chief distinction being the opposite phyllotaxis in *Wikstroemia*, notwithstanding the note by STAPP (Bot. Mag. 156, 1933, *sub* t. 9313, p. 2). If it is realized that the phyllotaxis varies widely within the single genus *Pimelea*, it is tempting to merge *Wikstroemia* and *Daphne*.

The merging of *Aquilaria* and *Gyrinops* and of *Daphne* and *Wikstroemia* might give a better reflection of the natural affinities, as the single character separating the components of these pairs effects, in my opinion, not a natural segregation.

Specific delimitation in Thymelaeaceae is in many cases also extremely difficult, specially because it has appeared that characters not only vary within a single species, but also within the flowers of one single specimen, as for example the shape of the disk in *Wikstroemia aurantiaca* (*cf.* STAPP, *l.c.*). I have encountered several similar cases in other species and Dr PETERSON communicated to have a similar experience with African representatives which has led him to a severe reduction of accepted species.

Specific delimitation in Malaysia proved particularly difficult in *Wikstroemia* and *Phaleria*; for *W. indica* I have accepted much wider specific limits than my predecessors.

Affinities with other families.—For a detailed review and discussion of the relationship of *Thymelaeaceae* and other families, one should consult the works of DOMKE (Bibl. Bot. 111, 1934, 1–3, 16) and HEINIG (Am. J. Bot. 38, 1951, 113 & 131).

According to Miss HEINIG's studies on the floral morphology the polypetalous and polystemonous condition of the primitive members of the *Thymelaeaceae* and the modified parietal placentation suggest a derivation from some polymorous parietalean family such as, possibly, the *Flacourtiaceae*; there seems also a possible relationship with the *Tiliaceae*.

ERDTMAN (Pollen Morph. & Pl. Tax. 1952, 43) stated that there is a more or less close relationship between *Thymelaeaceae* and *Euphorbiaceae*, especially the crotonoid members of the latter.

Uses. The heartwood of some species of *Aquilaria* and *Gonystylus* contains aromatic substances and is used as incense (*cf.* BURK. Dict. 2, 1935, 197–205). The scented portions are only found in irregular small parts of the heartwood and are obviously caused by some abnormality (infection by fungi or insects?) and they occur not in all trees. SCHUITMAKER described the occurrence of scented thymelaeaceous wood in West Borneo and the ceremonials connected with the collecting of it (Tectona 26, 1933,

851-892, fig. 1-6). The strong barks of some species are used for weaving, walls of huts, paper-making, and tying purpose. Wood of *Gonystylus bancanus* is used for internal building construction; it is one of the most important timber exports of Sarawak and Brunei.

Note. Sterile material has a limited value and can sometimes hardly be identified even to the genus with certainty, viz in *Aquilaria-Gyrinops* and *Phaleria-Wikstroemia*. Flowering or fruiting material is essential for identification.

I am indebted to Dr J. LÉANDRI for putting his valuable manuscript notes at my disposal.

KEY TO THE GENERA

Based on flowering and fruiting material¹

- 1. Leaves not pellucid-dotted. Stamens and petaloid appendages adnate to or inserted on the floral tube. Fruits 1-2-celled.
- 2. Ligneous, perennial. Inflorescences without involucre bracts, or (in *Phaleria* and *Daphne composita*) with free ones. Stamens 4 or more.
- 3. Stamens twice the number of the calyx lobes.
- 4. Fruit a loculicidal capsule. Petaloid appendages usually distinct and always densely pubescent or puberulous 1. *Aquilaria*
- 4. Fruit a drupe or drupaceous. Petaloid appendages if present always glabrous.
- 5. Ovary 2-celled (rarely one cell abortive in *Phaleria perrottetiana*). Fruits (1-)2-seeded. (Petaloid appendages none, or obscure and rim-like.) 2. *Phaleria*
- 5. Ovary always 1-celled. Fruits 1-seeded.
- 6. Usually climbing shrubs. Inflorescences usually provided with 2 leafy bracts on each branch. Petaloid appendages well developed. Ovary densely pubescent.
- 7. Stamens in two series. Style obscure or shorter than the ovary 3. *Enkleia*
- 7. Stamens in one series. Style several times as long as the ovary 4. *Linostoma*
- 6. Erect shrubs. Inflorescences without leafy bracts. Petaloid appendages none. Ovary glabrous or only hairy at the top.
- 8. Leaves opposite. Disk lobed, scale-like, lobes free or united in pairs 5. *Wikstroemia*
- 8. Leaves alternate. Disk ring-like or cup-shaped 6. *Daphne*
- 3. Stamens the same number as the calyx lobes.
- 9. Shrubs or trees. Leaves ovate-oblong to lanceolate, 1½-24 by (½-)-1-3 cm. Ovary densely hairy, 2-celled; style terminal. Fruit a loculicidal capsule, protruding either from the top or from the split side of the floral tube 7. *Gyrinops*
- 9. Dwarf-shrub. Leaves linear, 3-5 by 2/3 mm. Ovary hairy at the upper half or only at the top, 1-celled; style lateral. Fruit a drupe, developing inside the floral tube 8. *Drapetes*
- 2. Annual herbs. Inflorescences with 4, partly united involucre bracts. Stamens 2 9. *Pimelea*
- 1. Leaves pellucid-dotted. Stamens free. Petaloid appendages inserted on the receptacle. Fruits 3-5 (-8)-celled.
- 10. Leaves decussate, sometimes some subopposite; nervation lax and open. Flowers subumbellate. Calyx lobes valvate. Petaloid appendages fused in a ring. See vol. 4, p. 365 11. *Aëtoxyton*
- 10. Leaves spiral or alternate. Inflorescences thyrsoïd or racemose. Calyx lobes imbricate or subvalvate. Petaloid appendages 7-40.
- 11. Leaves with few, spaced nerves. Petaloid appendages 10, more or less in pairs. Parastyles subulate-corniform. Fruits long-beaked. See vol. 4, p. 363 and this vol. p. 47 10. *Amyxa*
- 11. Leaves with numerous parallel nerves, veins distinctly prominent. Petaloid appendages 7-40, not in approximate pairs. Parastyles if present very small and clavate. Fruits not beaked. See vol. 4, p. 350. 12. *Gonystylus*

KEY TO THE GENERA

Based on sterile material

- 1. Leaves not pellucid-dotted.
- 2. Ligneous, perennial plants.
- 3. Leaves at least 15 mm long, penninerved, not linear, at least 1 mm petioled. Lowland or montane shrubs or trees.
- 4. Lateral nerves and intermediate veins more or less parallel.
- 5. Leaves alternate or spiral. Erect shrubs or trees 1. *Aquilaria* & 7. *Gyrinops*
- 5. Leaves opposite, rarely also with some subopposite ones. Liana, very rarely erect shrubs or small trees 4. *Linostoma*
- 4. Lateral nerves curved, intermediate veins reticulate or cross-bar like (*Enkleia*).
- 6. Leaves strictly opposite or decussate 2. *Phaleria* & 5. *Wikstroemia*
- 6. Leaves alternate or spiral, or at least *not all strictly* opposite.

(1) In some genera the floral characters can usually easily be studied in the fruiting state as the floral parts are generally persistent.

7. Liana, often provided with hooks. Cross-bar veins subparallel 3. Enkleia
 7. Erect shrub or small tree. Venation reticulate 6. Daphne
 3. Leaves small (3-5 by $\frac{2}{3}$ mm), with 7-9 more or less parallel, longitudinal nerves, sessile, linear.
 Subalpine dwarf-shrub 8. Drapetes
 2. Annual herbs 9. Pimelea
 1. Leaves pellucid-dotted.
 8. Leaves opposite or subopposite. See vol. 4, p. 365 11. Aëtoxyton
 8. Leaves alternate or spiral.
 9. Leaves with few, spaced nerves, veins rather obscure. See vol. 4, p. 363 and this vol. p. 47
 10. Amyxa
 9. Leaves with numerous more or less parallel nerves, veins distinctly prominent. See vol. 4, p. 350.
 12. Gonystylus

1. AQUILARIA

LAMK, Encycl. 1 (1783) 49, *nom. gen. conserv.*; *ibid.* 2 (1786) 610; DOMKE, Bibl. Bot. 111 (1934) 118, map 2; QUIS. J. Arn. Arb. 27 (1946) 402.—*Agallochum* RUMPH. ex LAMK, Encycl. 1 (1783) 48, *nom. gen. rejic.*—*Ophispermum* LOUR. Fl. Coch. 1 (1790) 281.—*Gyrinopsis* DECNE, Ann. Sc. Nat. Bot. II, 19 (1843) 41; QUIS. J. Arn. Arb. 27 (1946) 404.—*Decaisnella* O.K. Rev. Gen. Pl. 2 (1891) 584.—*Aquilariella* VAN TIEGH. Ann. Sc. Nat. Bot. VII, 17 (1893) 216; Bull. Soc. Bot. Fr. 40 (1893) 77.—*Aquilaria* sect. *Agallochum* HALLIER f. Med. Rijksherb. n. 44 (1922) 15.—*Aquilaria* sect. *Gyrinopsis* HALLIER f. l.c. 16.—*Aquilaria* sect. *Amphinoman* HALLIER f. l.c. 18.—Fig. 1.

Shrubs, treelets or trees. Innovations always pubescent but usually glabrescent. *Leaves* on the lateral twigs alternate, penninerved; nerves distinct or obscure, simple or sometimes branched, usually slightly curved, ascending towards the margins and joining several intramarginal veins; veins and veinlets numerous, parallel or subparallel; margins wavy, slightly recurved and thickened. *Inflorescences* axillary or supra-axillary, sometimes on internodes, terminal, or rarely cauliflorous, sessile or short-peduncled, simple or rarely branched, umbelliform or paniculiform, usually without bracts, rarely with a few small ones. *Flowers* usually 5-merous, pedicelled, articulated at the base of the pedicel. Floral tube cupular to tubular, persistent, in fruit sometimes splitting on one side, outside puberulous or pubescent, inside puberulous with reflexed hairs arranged in lengthwise lines towards the upper part. Calyx lobes (4-)5(-6), reflexed or erect, usually shorter than or rarely as long as the tube. *Petaloid appendages* twice as many as the lobes, free, or united in a ring (*A. cumingiana*), inserted at the throat of the tube, lanceolate, ovate, semi-orbicular, or rim-like (*A. urdanetensis*), each pair opposite the calyx lobe, usually densely pubescent or puberulous. *Stamens* twice as many as calyx lobes, emerging from the tube at the same level as the appendages, rarely emerging slightly below them, sometimes behind them, sessile or filamentous, equal in length or sepalous ones longer than the others; filaments filiform, sometimes slightly swollen at the upper end; anthers linear-oblong, dorsifixed, free (but in *A. cumingiana* the lower $\frac{1}{3}$ - $\frac{1}{2}$ adnate to the tube); connective broad over the whole length of the anther. Disk none or rarely ring-like. Pistil included. *Ovary* sessile or stiped, ovoid, oblanceolate or ellipsoid, densely short-puberulous, 2-celled (or incompletely 2-celled in extra-Mal. *spp.*); style terminal, obscure or distinct, gradually dilated to the ovary, densely puberulous towards the base; stigma distinct, globose, capitate, pyramidal, or oblong, black. *Ovule* attached near the top of the septum and partly adnate to it. *Fruit* a loculicidal capsule, globose, obovoid, or oblanceolate, rugose or smooth,

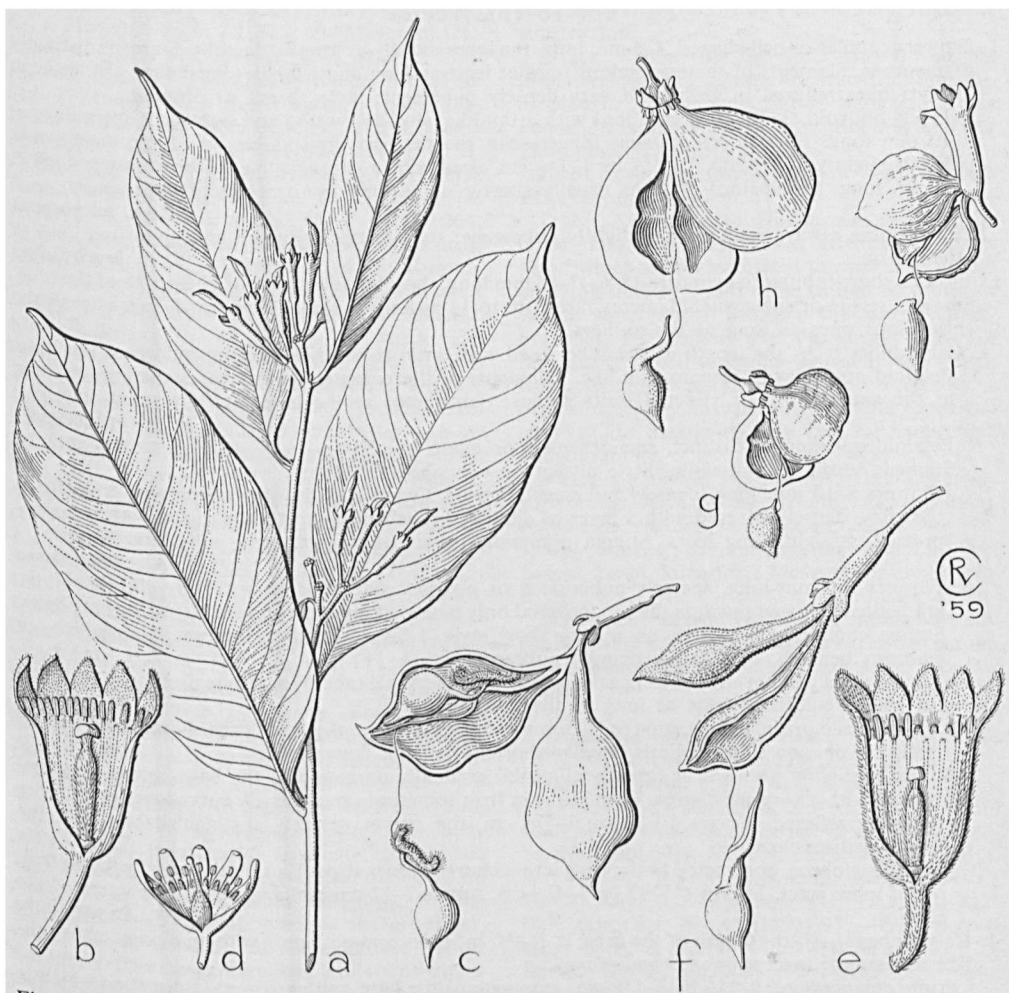


Fig. 1. *Aquilaria beccariana* VAN TIEGH. *a.* Habit, $\times \frac{2}{3}$, *b.* opened flower, two anthers removed, $\times 3$, *c.* dehiscent fruit emerging from top of floral tube with one seed dangling out, nat. size.—*A. brachyantha* (MERR.) HALL. *f. d.* Opened flower, $\times 3$.—*A. hirta* RIDL. *e.* Opened flower, $\times 3$, *f.* dehiscent fruit, nat. size.—*A. microcarpa* BAILL. *g.* Dehiscent fruit, nat. size.—*A. malaccensis* LAMK. *h.* Dehiscent fruit, nat. size.—*A. cumingiana* (DECNE) RIDL. *i.* Dehiscent fruit emerging from lateral slit of floral tube, one seed dangling out, nat. size (*a-b* SAN A 1726, *c* SF 29381, *d* FB 19562, *e* BÜNNEMEYER 7575, *f* CUMING 1617, *g* SAN 16965).

sometimes slightly compressed laterally, protruding either from the top or from the split side of the floral tube, distinctly stalked, densely puberulous to glabrous; pericarp coriaceous or woody. *Seeds* 2, or 1 by abortion, ovoid or ellipsoid; testa crustaceous, sometimes downy, bearing a caruncle-like or tail-shaped appendage at the base; usually the whole seed and sometimes a portion of the appendage is laterally adnate to the septum, with an obscure or a distinct funicle; in the latter case the seeds dangle out of the fruit on the end of the thin funicle in open capsules; albumen none or scant; cotyledons thick, plano-convex.

Distr. About 15 spp., India (Bengal and Assam), Burma (Tenasserim), Indo-China (Cambodia, Annam, and CochinChina), China (Hongkong and Hainan), and widely distributed in *Malaysia*.

Ecol. In forests at low and medium altitudes, some species occurring from 1000–1700 m.

KEY TO THE SPECIES

1. Flowers cupular or bell-shaped, 4–6 mm long, the lobes usually as long as the tube. Stamens distinctly filamentous, filaments of the episepalous ones at least as long and usually longer than the anthers.
2. Calyx lobes reflexed in anthesis. Ovary densely pubescent; style absent or obscure.
3. Fruits obovoid, 3–4 by 2½ cm. Seed with a tail-like, slightly twisted and pubescent appendage c. 10 mm long. Episepalous stamens longer than the petaloid appendages 1. *A. malaccensis*
3. Fruits slightly obcordate, ¾–1½ by 1–1½ cm. Seed with a caruncle-like, glabrous appendage c. 2 mm long. Episepalous stamens usually shorter or as long as the petaloid appendages.
 2. *A. microcarpa*
2. Calyx lobes always erect. Ovary slightly pubescent; style distinct, filiform and almost as long as the ovary 3. *A. brachyantha*
1. Flowers short-tubular to cylindric, (5–6–)7–15 mm long, the lobes usually 1/5–1/8 the length of the tube. Stamens sessile or subsessile, filaments rarely up to ½ as long as the anthers, in *A. urdanetensis* the episepalous ones as long as the anthers.
4. Calyx lobes c. ½ the length of the tube. Seed with a short caruncle-like appendage at the base.
5. Petaloid appendages obscure, rim-like. Filaments of the episepalous stamens sometimes as long as the anthers. Style distinct. (Fruits globose, contracted at the base into a distinct stalk.)
 4. *A. urdanetensis*
5. Petaloid appendages distinct, semiorbicular or ovate to oblong, 1/3–1/2 as long as the anthers. Stamens sessile or subsessile. Style absent or very short.
6. Flowers 8–10 mm long, densely pubescent outside. Ovary slightly obovate-oblong, truncate at the apex, densely covered with a layer of densely set, reflexed, short hairs mixed with some appressed, straight, long hairs. Stigma pyramidal, sessile. Leaves densely pubescent beneath.
 5. *A. citrinaecarpa*
6. Flowers 5–6 mm long, sparsely puberulous or glabrous outside. Ovary slightly elliptic-oblong, gradually narrowed towards the top, covered only with densely set, appressed, straight long hairs. Stigma capitate or globose, on a very short style. Leaves slightly pubescent, glabrescent, or glabrous beneath, very rarely densely pubescent.
7. Fruit with a distinct stipe as long as or longer than the floral tube. Floral tube usually not splitting in fruit. Pedicels at least as long as the flowers. 6. *A. apiculata*
7. Fruit sessile or on a short stipe (c. 2–3 mm), not longer than the floral tube. Floral tube in fruit splitting on one side. Pedicels usually shorter than the flowers.
8. Fruits slightly obovoid or broadly ellipsoid, gradually narrowed to the base, sessile or sometimes with a very short stipe. Floral tube in fruit sometimes transversely curved and calyx lobes usually reflexed. Leaves 10–20 by 3–5½ cm, the nerves scarcely distinguishable from the intermediate veins 7. *A. filaria*
8. Fruits globose, contracted at the base into a short, slender stipe. Floral tube usually flat in fruit and lobes erect. Leaves 4½–15 by 1–4½ cm, nerves 7–12 pairs, distinct from the intermediate veins 8. *A. parvifolia*
4. Calyx lobes 1/5–1/8 the length of the tube, c. 2/5–1/8 in *A. beccariana*. Seeds with an elongated or tail-like appendage (except in *A. cumingiana*).
9. Fruits oblanceolate, 2–3½ by 1–1¾ cm, attenuate to the base and narrowed into a stipe which is usually longer than the floral tube. Seeds ovoid or ellipsoid-oblong, brownish hairy or puberulous, with a tail-like appendage. Petaloid appendages free and inserted at the same level as the stamens. Anthers free from the floral tube.
10. Undersurface of the leaves and the fruits densely pubescent. Leaves acute. Petaloid appendages deltoid, 1/3–1/2 the length of the anther, long-hairy, the hairs as long as the appendages or longer. Seeds cuneate to the base and attached to a glabrous, elongate appendage c. 10 mm long.
 9. *A. hirta*
10. Lower surface of the leaves and the fruits sparsely pubescent, glabrescent, or glabrous. Leaves acuminate.
11. Seeds narrowed to the base and elongated into a long (c. 15 mm), glabrous or subglabrous appendage. Petaloid appendages unknown 10. *A. rostrata*
11. Seeds narrowed to the base and separated from the tail-like, hairy appendage c. 10 mm long by a short, thin stipe-like constriction. Petaloid appendages oblong, almost as long as the stamens, shortly puberulous 11. *A. beccariana*
9. Fruits subglobose, globose, slightly obovoid or ellipsoid, 1¾ by 1½ cm, contracted at the base, sessile or with an obscure stipe. Seeds broadly ovoid, planoconvex, glabrous, c. 1 by ¾ cm, with a small caruncle-like appendage. Petaloid appendages short, usually united in a ring. Lower 1/3–1/2 of the anthers usually adnate to the floral tube 12. *A. cumingiana*

1. *Aquilaria malaccensis* LAMK, Encycl. 1 (1783) 49, t. 356; DC. Prod. 2 (1825) 59; MEISN. in DC. Prod. 14 (1857) 602, *excl. citat.* of BENTH.; MIQ. Fl. Ind. Bat. 1, 1 (1858) 883; KURZ, Nat. Tijds. N.I. 27 (1864) 171; For. Fl. Burm. 2 (1877) 236; RIDL. Trans. Linn. Soc. Lond. II, 3 Bot. (1893) 341; GILG, Bot. Jahrb. 18 (1894) 506, f. 8, B; *ibid.* 28 (1900) 145; BOERL. Handl. 3 (1900) 112; RIDL. J. Str. Br. R. As. Soc. n. 35 (1901) 73; GAMBLE, J. As. Soc. Beng. 75, ii (1912) 264; KOORD. Ekk. Fl. Java 2 (1912) 656 (erron. record); MERR. Philip. J. Sc. 10 (1915) Bot. 44; Int. Rumph. (1917) 381; BROWN, Minor Prod. Philip. Forests 1 (1920) 403; MERR. En. Born. (1921) 417; HALL. f. Med. Rijksherb. n. 44 (1922) 16; MERR. En. Philip. 3 (1923) 130; RIDL. Fl. Mal. Pen. 3 (1924) 147; BURK. & HENDERS. Gard. Bull. S.S. 3 (1925) 417; HEYNE, Nutt. Pl. ed. 2 (1927) 1149; HENDERS. Gard. Bull. S.S. 4 (1928) 314; METCALFE, Kew Bull. (1933) 5; CORNER, Ways. Trees (1940) 632; QUIS. J. Arn. Arb. 27 (1946) 403; MERR. J. Arn. Arb. 31 (1950) 270.—*Agallochum secundarium wainamense* & *A. malaccense* RUMPH. Herb. Amb. 2 (1741) 34–35, t. 10.—*A. ovata* CAV. Diss. (1789) 577, t. 224.—*A. secundaria* DC. Prod. 2 (1825) 59; MIQ. Fl. Ind. Bat. 1, 1 (1858) 883; BOERL. Handl. 3 (1900) 112.—*Agallochum malaccense* O.K. Rev. Gen. Pl. 2 (1891) 583.—*Aquilaria malaccensis* VAN TIEGH. Ann. Sc. Nat. Bot. VII, 17 (1893) 216; Bull. Soc. Bot. Fr. 40 (1893) 77.—Fig. 1h.

Tree up to 40 m by 60 cm. Bark smooth, whitish; branchlets slender, pale brown, pubescent, glabrescent. *Leaves* chartaceous, subcoriaceous, glabrous, sometimes pubescent beneath, glabrescent, shining on both surfaces, elliptic-oblong to oblong-lanceolate, $7\frac{1}{2}$ –12 by $2\frac{1}{2}$ – $5\frac{1}{2}$ cm; base acute, attenuate, or obtuse; apex acuminate, acumens up to 2 cm; nerves 12–16 pairs, rather irregular, often branched, curving upward, elevated beneath, plane or obscure above, veins distinct beneath, invisible above; petiole 4–6 mm. *Inflorescences* terminal, axillary or supra-axillary, sometimes on internodes, usually branched with 2 or 3 umbels and each with about 10 flowers, more rarely a simple umbel; peduncle or common peduncle 5–15 mm; pedicels slender, 3–6 mm. *Flowers* green or dirty-yellow, campanulate, 5–6 mm long, scattered puberulous outside. Floral tube nearly glabrous within, distinctly 10-ribbed. Calyx lobes ovate-oblong, 2–3 mm long, densely puberulous within, almost as long as the tube, reflexed. *Petaloid appendages* oblong or slightly ovate-oblong, c. 1 mm long, slightly incurved, densely pilose. *Stamens* $1\frac{1}{4}$ –2 mm long, the episepalous ones longer than the others; anthers linear, obtuse, as long as or shorter than the filaments. *Ovary* ovoid, 1– $1\frac{1}{2}$ mm long, densely pubescent; style obscure; stigma capitate. *Fruits* obovoid or obovoid-oblong, rounded at the apex, cuneate to the base, 3–4 by $2\frac{1}{2}$ cm, usually compressed, pubescent outside, glabrescent; pericarp woody, the suture face c. 6 mm wide. *Seed* proper ovoid, including the beak 10 by 6 mm, densely covered with red hairs, the beak c. 4 mm long, the appendage twisted and as long as the

seed, separated from it by a short, thin, stipe-like constriction.

Distr. India (Bengal and Assam), Burma (Tenasserim), and *Malaysia*: Sumatra (Simalur, Sibolangit, Palembang, and Banka), Malay Peninsula (common), N. & E. Borneo, and the Philippines (Luzon).

Ecol. Primary forests at low and medium altitudes up to 270 m.

Uses. According to HEYNE, *l.c.* and RIDLEY (1901, *l.c.*) the tree yields a celebrated incense wood which is obtained from the center of an old or dying tree. It is said to be caused by a disease which gains entry through the old decaying branches. Its greatest use has always been for fumigating and it is highly valued in the Orient for ceremonial purposes. It also furnishes a beautiful, silvery bast used for making ropes and clothes. The bast is highly prized for its strength and durability.

Vern. *Calambac*, *ching karas*, *gaharu*, *galoop*, *garu*, *karas*, *kayu gaharu*, *kēkaras*, *kēpang*, *laroo*, *mēngkaras*, *tabak*, *taras gharu*, *tēngkaras*, *M*, *sigsigi*, Borneo; Sumatra: *alim*, *Batak*, *halim*, *Lamp.*, *karèh*, *Minangk.*; *Malayan eaglewood tree*, *E*.

Note. The vegetative parts of this species are similar to those of *A. microcarpa* in the herbarium, and I cannot find any good character to separate them.

2. *Aquilaria microcarpa* BAILL. *Adansonia* 11 (1875) 304; GILG, Bot. Jahrb. 28 (1900) 145; MERR. En. Born. (1921) 417; DOMKE, Bibl. Bot. 111 (1934) t. 4 f. 43f; QUIS. J. Arn. Arb. 27 (1946) 403.—*Aquilaria microcarpa* VAN TIEGH. Ann. Sc. Nat. Bot. VII, 17 (1893) 216; Bull. Soc. Bot. Fr. 40 (1893) 77.—*Aquilaria borneensis* VAN TIEGH. Ann. Sc. Nat. Bot. VII, 17 (1893) 217; Bull. Soc. Bot. Fr. 40 (1893) 77.—*A. borneensis* GILG in E. & P. Pfl. Fam. III, 6a (1894) 224; BOERL. Handl. 3 (1900) 112; MERR. En. Born. (1921) 417.—Fig. 1g.

Tree up to 40 m by 80 cm. Bark grey, superficially fissured; branchlets light brown, puberulous, glabrescent. *Leaves* subcoriaceous, shining and glabrous above, rather dull, glabrous or sometimes scattered hairy beneath, elliptic-oblong to obovate-oblong or oblanceolate, $4\frac{1}{2}$ –10 by $1\frac{1}{2}$ – $4\frac{1}{2}$ cm; base cuneate to attenuate; apex acute to acuminate, the acumens up to 1 cm; nerves 12–19 pairs, sometimes branched, slightly curved and ascending to the thickened margin, prominent beneath, visible above; veins and veinlets rather irregular, subparallel, distinct beneath, obscure above; petiole 3–5 mm, pubescent. *Inflorescences* axillary or supra-axillary, terminal, or on short lateral branchlets, usually branched, rarely simple, peduncle short or up to 1 cm, 6–11-flowered. *Flowers* white, light-yellow or yellow, 5 mm long; pedicels c. 5 mm, puberulous. Floral tube puberulous outside, sparsely puberulous inside. Calyx lobes ovate or oblong, obtuse, densely puberulous on both surfaces. *Petaloid appendages* almost as long as the stamens or

sometimes slightly longer, ovate or oblong, densely hairy. *Stamens* 1–1½ mm, alternately long and short; anther *c.* ½ mm, usually shorter than the filament, rarely as long or longer. Pistil ovoid, 1½–2 mm long. *Ovary* densely pubescent; style obscure or rarely very short; stigma capitate. *Fruits* subcordate, slightly compressed, 8–12(–16) by 10–12(–15) mm, 1–(2)–seeded; persistent floral tube sometimes splitting on one side. *Seed* ovoid, 6 by 4 mm, densely brownish pubescent; caruncle-like appendage 2 mm long.

Distr. *Malaysia*: Malay Peninsula (Singapore), Sumatra (Sidjungjung, Palembang, and Lampongs), Billiton, Banka, and throughout Borneo.

Ecol. Lowland forests up to 200 m.

Vern. Sumatra: *tengkaras*, M, *hepang*, Banka; Borneo: *engkaras*, Dayak, *karas* or *sigi-sigi*, Bugis, *kumbil*, *garu*, *tulang*, M.

3. *Aquilaria brachyantha* (MERR.) HALL. *f. Med. Rijksherb. n. 44* (1922) 16; QUIS. *J. Arn. Arb. 27* (1946) 403.—*Gyrinopsis brachyantha* MERR. *Philip. J. Sc. 7* (1912) Bot. 313; ELM. *Leaf. Philip. Bot. 5* (1913) 1629; MERR. *En. Philip. 3* (1923) 130; DOMKE, *Bibl. Bot. 111* (1934) t. 2, f. 8; t. 5, f. 43e.—Fig. 1d.

Small tree or shrub up to 2 m. Branchlets glabrous, yellowish brown to brownish when dry, the tips usually pubescent. *Leaves* chartaceous to subcoriaceous, shining on both surfaces, oblong, elliptic-oblong, or lanceolate, 8–16 by 2–4½ cm; base acute or obtuse; apex acuminate; nerves and veins numerous, homogeneous, slightly elevated beneath, obscure or invisible above; petiole *c.* 5 mm. *Flowers* greenish, small, axillary, 1 to several in a fascicle on a very short peduncle; pedicels 1–3 mm, pubescent. Floral tube campanulate, 3–4 mm long, pubescent or puberulous on both surfaces, usually glabrescent outside. Calyx lobes 5, slightly oblong or ovate-oblong, as long as the tube or sometimes slightly longer. *Petaloid appendages* linear or oblong, *c.* 1 mm long, densely pubescent. *Stamens* 1–1¼ mm long, filamentous, the episepalous ones slightly longer than the others. *Ovary* ovoid, *c.* 1½ mm long, slightly pubescent; style distinct, filiform, *c.* 1 mm; stigma capitate. *Fruits* narrowly obovoid, compressed, 1¼–1½ by ¾–1 cm. Seed including the caruncle-like appendage *c.* 1 cm long, pubescent, persistent floral tube splitting on one side.

Distr. *Malaysia*: Philippines (Luzon: Cagayan Prov.), twice collected.

Ecol. In primary forests at low altitudes.

4. *Aquilaria urdanetensis* (ELMER) HALL. *f. Med. Rijksherb. n. 44* (1922) 16.—*Gyrinopsis urdanetensis* ELMER, *Leaf. Philip. Bot. 5* (1913) 1630; MERR. *En. Philip. 3* (1923) 131; QUIS. *J. Arn. Arb. 27* (1946) 405.

Slender shrub, up to 7 m. Bark dull grey and smooth. Young branchlets whitish pubescent, glabrescent. *Leaves* chartaceous, shining on both surfaces, young leaves pubescent beneath especially on the nerves and veins, glabrescent,

elliptic-oblong to broadly lanceolate, 4–9 by 1½–3¼ cm; base cuneate to attenuate; margins slightly thickened and shining on both surfaces; apex acuminate, the acumen up to 1 cm, pointed or obtuse at the tip; nerves and veins undistinguishable, numerous, divaricate, subparallel, some of them branched, distinct beneath, obsolete above; petiole 3–4 mm. *Inflorescences* axillary, sessile or very short peduncled, usually with a few, very small, caducous bracts, 2- or 3-flowered; pedicels *c.* 3½ mm, sparsely pubescent. *Flowers* short-tubular, 5–6 mm long, yellowish. Floral tube 3½–4 mm long, sparsely pubescent outside, pubescent towards the base and at the mouth inside. Calyx lobes 5(–6), ovate and obtuse, sparsely pubescent outside, densely puberulous inside, 1½–2 mm long. *Petaloid appendages* obscure, rim-like. *Stamens* free from the tube slightly below the petaloid appendages, ¾–1½ mm, episepalous ones with a filament shorter than the anther or as long as it, the others sessile. Pistil *c.* 2 mm long. *Ovary* ellipsoid, densely puberulous, narrowed into a short style *c.* 1 mm; stigma nipple-like. *Fruits* globose or slightly obovate, glabrous when mature, *c.* 8 mm diam., with a slender stipe 3–6 mm; persistent floral tube splitting on one side. *Seed* ovoid, plano-convex, black, *c.* 1 cm long, with a short caruncle-like appendage.

Distr. *Malaysia*: Philippines (Mindanao: Mt Urdaneta), twice collected.

Ecol. In the mossy forest on exposed ridges, *c.* 1700 m (*cf.* MERR. *l.c.*).

Vern. *Mañgod*, *makolan*, Mbo.

Note. Known only from the authentic collections, ELMER 14195 (lectotype) and 13742 (paratype).

5. *Aquilaria citrinaecarpa* (ELMER) HALL. *f. Med. Rijksherb. n. 44* (1922) 18.—*Gyrinopsis citrinaecarpa* ELMER, *Leaf. Philip. Bot. 5* (1913) 1631; MERR. *En. Philip. 3* (1923) 130; QUIS. *J. Arn. Arb. 27* (1946) 405.

Small tree up to 8 m. Young branches densely olivaceous tomentose, glabrescent. *Leaves* subcoriaceous, dull, olivaceous, and densely pubescent beneath, shining, reddish-brown, and glabrous above, elliptic-oblong, or slightly obovate-oblong, 6–10(–12) by 2½–4(–5½) cm; base cuneate; apex acute; margins slightly recurved; nerves 15–20 pairs, on the lower surface obscure, rarely distinct, slightly ascending towards the margin; veins and veinlets obscure or visible beneath, obscure above; petiole *c.* 3 mm. *Inflorescences* terminal and axillary, sessile or with a very short peduncle, densely hairy, usually with a few small bracts, 3–6-flowered; pedicels 2–4 mm, pubescent. *Flowers* 8–10 mm long, greenish. Floral tube cylindric, densely pubescent outside and towards the base inside. Calyx lobes oblong or ovate, 3–3½ mm long, densely puberulous on both surfaces. *Petaloid appendages* oblong or ovate, about ½ the length of the anthers, densely villose. *Stamens* sessile, 1½ mm long. *Ovary* slightly obovate-oblong, densely puberulous, *c.* 3 mm

long, style none; stigma pyramidal, black. *Capsules* 1¾ by 1¼ cm, bright yellow or citrine, obtuse to subtruncate at the apex, attenuate to the base, sometimes slightly compressed, persistent floral tube splitting on one side. *Seeds* deltoid, 8 by 7 mm, plano-convex, acute to the apex, almost truncate at the base, with a very short caruncle-like appendage at the base.

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

Ecol. On moist, compact soil of forested ridges, c. 1300 m.

Vern. *Agododan*, Mbo.

6. *Aquilaria apiculata* MERR. Philip. J. Sc. 20 (1922) 411; En. Philip. 3 (1923) 130; QUIS. J. Arn. Arb. 27 (1946) 403.

Shrub or small tree up to 3 m. Branchlets reddish brown, pubescent, glabrescent. *Leaves* papery, glabrous above, sparsely or scattered pubescent beneath, elliptic-lanceolate, 8–14 by 2½–4 cm; base cuneate to attenuate; apex acuminate, the acumen up to 2 cm, tip obtuse; nerves 8–16 pairs, curved and ascending to the margin, prominent beneath, visible above; veins distinct, sometimes visible beneath, obscure above; petiole 3–5 mm. *Inflorescences* axillary, sessile or short-peduncled, usually with a few small bracts, 3–6-flowered; pedicels 6–7 mm, puberulous. *Flowers* 5–6 mm long. Floral tube short-tubular, 4–5 mm long, puberulous outside and inside, glabrescent. Calyx lobes ovate to oblong, 1½–2 mm long, densely puberulous on both surfaces. *Petaloid appendages* semi-orbicular to ovate, ½–½ the length of the stamens, hairy. *Stamens* c. 1 mm long, sessile or the episepalous ones on short filaments. *Ovary* slightly obovate, 3 mm long, densely pubescent, slightly attenuate towards the base, acute and narrowed towards the apex; style very short; stigma capitate. *Fruits* yellowish orange, ellipsoid, slightly compressed, developing on top of a slender ½–1 cm long stipe, protruding from the floral tube, 1½ by 1 cm; persistent floral tube entire or sometimes splitting at one side. *Seeds* ovoid, 8–9 by 6 mm, dark-brown, with a caruncle-like appendage c. 2 mm long.

Distr. *Malaysia*: Philippines (Mindanao: Bukidnon Prov.).

Ecol. In dry and mossy forests, 1100–1800 m.

7. *Aquilaria filaria* (OKEN) MERR. J. Arn. Arb. 31 (1950) 283, excl. syn. *Gyrinopsis brachyantha* MERR.—*Cortex filarius* RUMPH. Herb. Amb. 7 (1755) 13.—*Pittosporum ferrugineum* var. *β filarium* DC. Prod. 1 (1824) 347, excl. RUMPH. t. 7 cit.; DON, Gen. Hist. 1 (1831) 374.—*Pittosporum filarium* OKEN, Allg. Naturgesch. 3^a (1841) 299.—*A. tomentosa* GILG, Bot. Jahrb. 28 (1900) 145.—*Gyrinopsis brachyantha* (non MERR. 1912) MERR. Int. Rumph. (1917) 380, *quoad specim.*—*Gyrinopsis acuminata* MERR. Philip. J. Sc. 17 (1920) 294; En. Philip. 3 (1923) 130.—*A. acuminata* QUIS. J. Arn. Arb. 27 (1946) 403.

Shrub or tree up to 17 m by 50 cm. Young branchlets light-brown, pubescent and glabres-

cent. *Leaves* subcoriaceous, glabrous or scattered hairy rarely pubescent beneath, oblong, elliptic-oblong to lanceolate, rarely oblanceolate-oblong, 10–20 by 3–5½ cm; base obtuse to cuneate; apex shortly acuminate; nerves and veins usually homogeneous, slightly elevated beneath, obscure above; petiole 3–5 mm. *Inflorescences* axillary and extra-axillary, umbelliform or condensed paniculiform, rarely cauliflorous, very short-peduncled, (1–)3–7 (∞)-flowered; pedicels 2–5 mm, pubescent. *Flowers* yellowish-green or white, infundibular, 5–6½ mm long. Floral tube sparsely pubescent outside, glabrescent. Calyx lobes oblong to slightly ovate, c. 2 mm long, densely puberulous on the upper part and the margins outside, and the whole surface inside. *Petaloid appendages* oblong or deltoid, c. 1 mm long, densely villous. *Stamens* c. 1 mm long, the episepalous ones with short, fleshy filaments, the others sessile or subsessile. *Ovary* obovoid, c. 3¼ mm long, densely villous; style very short or obscure; stigma capitate. *Fruits* ellipsoid to obovoid or subglobose, slightly compressed, rugose, 1¼–1½ by 1¼ cm, sparsely hairy, glabrescent, narrowed to the base, sometimes on a very short stipe, yellow. *Seeds* deltoid, including the appendage c. ¾ by ¾ cm, plano-convex, black, with a very short caruncle-like appendage.

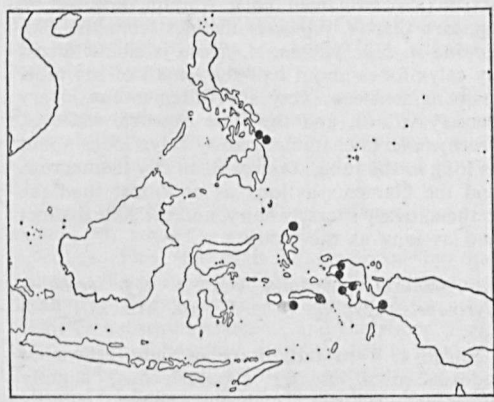


Fig. 2. Localities of *Aquilaria filaria* (OKEN) MERR.

Distr. *Malaysia*: Philippines (Dinagat I. and Bucas Grande I.), Moluccas (Morotai, Ceram, and Ambon), and New Guinea (Sorong, Babo, and Kapor). Fig. 2.

Ecol. In lowland forests, once collected in open swamp forest (Sorong: PLEYTE 393), up to 130 m.

Vern. *Agé*, Sorong, *bòkuin*, Morotai, *lason*, Ceram, *kasjik*, Tehid lang., *malowassi*, Uliassers.

Notes. In the description of *Cortex filarius* RUMPH. (Herb. Amb. 7, 1755, 13) RUMPHIUS recorded the bark with strong bast and the leaves with more or less parallel veins which agree with the characters of *Aquilaria*. He described the fruit as 2-celled; one of the cells being empty and filled with pulp, the other having two seeds. However, in *Aquilaria* the ovary is 2-celled and each has only one ovule. Based on the description, the

common name 'Malowassi' and the usage, HEYNE (Nutt. Pl. 1927, p. 1151) identified it as a *Gyrinopsis* sp. (= *Aquilaria*).

MERRILL (Int. Rumph. 1917, 380) in interpreting RUMPHIUS' *Cortex filarius*, with the representing specimen (ROBINSON'S Pl. Rumph. Amb. n. 274), referred it to *Gyrinopsis brachyantha* MERR. (= *Aquilaria brachyantha*). The leaves of these two species are very similar to each other. See also BAKKER (Fl. Mal. I, 5, 1957, 359-360).

J. SMITH initiated the error to combine the plate of *Cortex foetidus* RUMPH. (t. 7) with the description of *Cortex filarius* RUMPH. referring them both to *Pittosporum ferrugineum* (in REES, Cycl. 27 art. Pittosporum, 1814), although he remarked already that the "thready bark" ascribed to it by RUMPHIUS does not occur in *Pittosporum*. This error was continued by DE CANDOLLE, *l.c.*

In reviewing OKEN'S work in 1950, MERRILL (J. Arn. Arb. 31, 1950, 283) pointed out that the description of *Pittosporum filarium* OKEN was wholly taken from RUMPHIUS' *Cortex filarius* and concluded that *Gyrinopsis brachyantha* MERR. should be added to the synonymy of *Aquilaria filaria* (OKEN) MERR.

On examining ROBINSON'S specimen indicated above and another specimen collected by TEYSMANN (*s.n.*, Bo) from Soja, Ambon, however, it appears that *A. filaria* is distinct from the Philippine *A. brachyantha*. *A. filaria* is characterized by calyx lobes about half the length of the tube, stamens sessile or very short-filamentous, ovary densely villous, and the style obscure, while *A. brachyantha* is characterized by calyx lobes about as long as the tube, stamens distinctly filamentous and the filaments as long as or longer than the anthers, ovary sparsely hairy, and the style distinct and as long as the ovary.

8. *Aquilaria parvifolia* (QUIS.) nov. comb.—*Gyrinopsis parvifolia* QUIS. J. Arn. Arb. 27 (1946) 405.

Shrub c. 1 m tall, branches light brown or reddish-brown. *Leaves* subcoriaceous, slightly pubescent beneath, glabrous above, elliptic-oblong, ovate-oblong, or lanceolate, 4½-15 by 1-4½ cm; base acute to cuneate; apex narrowly acute to acuminate; nerves 7-12 pairs, slightly curving upward, distinctly elevated beneath, slightly elevated above; veins distinct beneath, invisible above; petiole c. 5 mm, sparsely pubescent, glabrescent. *Infructescences* axillary, terminal, sometimes extra-axillary, umbelliform, short-peduncled, sometimes almost sessile, each with 1 to 4 fruits; pedicel c. 3 mm, puberulous. Persistent *flower* short-tubular, 5-6 mm long. Floral tube sparsely puberulous on both surfaces. Calyx lobes ovate or ovate-oblong, 1½-2 mm long, densely puberulous inside and on the margins and tips outside. *Petaloid appendages* orbicular or deltoid, c. ½-½ the length of the stamens, villous, the hairs slightly longer than the appendage. *Stamens* sessile, c. 1 mm long. *Fruits* slightly obovoid or globose, 1-1½ by 1-1¼ cm, yellowish, rugose when dry, constricted at the base into c. 2 mm long stipe. *Seeds* broadly ovoid,

8-9 by 6½-7 mm, dark-brown, smooth, shining, with an obscure caruncle-like appendage at the base.

Distr. *Malaysia*: Philippines (Luzon: B.S. 26876, 41562, 76441—type (A), WENZEL 1201).

Ecol. On forested slopes, 1000 m.

Note. Very closely related to *A. filaria*, but easily separated from the latter by the persistent floral tube with erect calyx lobes and the smaller leaves with distinct lateral nerves.

9. *Aquilaria hirta* RIDL. J. Str. Br. R. As. Soc. n. 35 (1901) 78; GAMBLE, J. As. Soc. Beng. 75, ii (1912) 265; RIDL. Fl. Mal. Pen. 3 (1924) 148; DOMKE, Bibl. Bot. 111 (1934) t. 5 f. 43g.—*A. moszkowskii* GILG, Notizbl. Berl.-Dahl. 5 (1908) 84; QUIS. J. Arn. Arb. 27 (1946) 403.—Fig. 1e-f.

Tree up to 14 m with whitish and rather smooth bark. Young branchlets light brown, covered with silky hairs, glabrescent. *Leaves* subcoriaceous, dull and pubescent beneath especially on the midrib, nerves and veins, sometimes glabrescent, shining on the upper surface, elliptic-oblong, ovate-oblong, 6½-14 by 2½-5½ cm; base cuneate to obtuse or rounded; apex acuminate, the acumen up to 1½ cm, mucronate, pointed at the tip; nerves 16-30 pairs, irregular, sometimes branched, elevated beneath, visible to obsolete above, slightly curved upward and towards the margin; veins distinct or visible beneath, obscure or not visible above; petiole 5-7 mm, thickened, curved, pubescent. *Inflorescences* sessile or up to 10 mm peduncled, pubescent, 5-14-flowered; bracts small. *Flowers* white (*vide* Kep. 71521) or light yellow (*vide* BÜNNEMEIJER 7575), up to 2 cm pedicelled, pubescent. Floral tube cylindric 6-8 mm long, densely pubescent outside and towards the base inside, ribbed and sparsely villose within at the upper part. Calyx lobes ovate and obtuse, 2-3 mm long, densely pubescent outside and densely puberulous inside. *Petaloid appendages* inserted slightly behind the stamens, ovate or semi-orbicular, densely villous, almost as long as the stamens, sometimes even slightly longer. *Stamens* sessile, c. 1 mm long, oblong, connective dark-brown. Pistil clavate, 5 mm long; *ovary* densely puberulous; style absent; stigma capitate. *Fruits* protruding from the floral tube, oblanceolate, abruptly acute at the apex, attenuate to the base, including the stipe 3½-5 by 1 cm, densely golden puberulous; pericarp coriaceous. *Seeds* ovoid, 10 by 6 mm, puberulous, glabrescent, shortly beaked at the apex, cuneate at the base, black and shining, with a long glabrous appendage c. 10 mm long.

Distr. *Malaysia*: Malay Peninsula (Trengganu, Pahang, Johore, and Singapore; lectotype: MURTON 2, SING; paratypes: RIDLEY 3837, SING and RIDLEY 11020, K, SING), E. Sumatra (Senamunik), Riouu, and Lingga.

Ecol. Hill slopes, from the lowland up to 300 m.

Vern. *Chamdan, changang, kayu chandan, sahare*, M; Sumatra: *karas*.

Note. *A. moszkowskii* GILG was described on a

sterile specimen collected by MOSZKOWSKI (12, B) at Senamanik, eastern Sumatra. I have not seen the type, but the locality and GILG's detailed description agree very well with the present species, especially the silky hairs occurring on the underside of the leaf which is peculiar to this species.

10. *Aquilaria rostrata* RIDL. Fl. Mal. Pen. 3 (1924) 148.

Tree. Branchlets pubescent, glabrescent. *Leaves* subcoriaceous, glabrous, rather shining on both surfaces, lanceolate, rarely ovate-oblong, $6\frac{1}{2}$ –10 by $2\frac{1}{2}$ – $4\frac{1}{2}$ cm; base obtuse, cuneate to attenuate; apex acuminate, the acumens up to $1\frac{1}{2}$ cm; nerves 16–many pairs, simple or rarely branched, spreading or slightly curved and ascending, elevated beneath and visible above; veins visible beneath and obscure above; petiole $3\frac{1}{2}$ –7 mm. Pedicels c. 3 mm, brownish hairy. *Floral tube* cylindrical, 6 mm long, splitting on one side, glabrous outside, sparsely puberulous inside. Calyx lobes slightly oblong, c. $1\frac{1}{2}$ mm long, puberulous on both surfaces. *Petaloid appendages* unknown. *Stamens* sessile. *Fruits* (young) obovate-oblong or oblanceolate, including the stipe 3 by $\frac{3}{4}$ – $1\frac{1}{2}$ cm, brownish hairy outside, long-narrowed towards the base, apex beaked. *Seeds* slightly ellipsoid-oblong, 10 by 4 mm (*excl.* the appendage), brownish, puberulous, acuminate, base attenuate and elongate into a slender appendage, glabrous.

Distr. *Malaysia*: Malay Peninsula (Pahang, Wray's Camp, Gunung Tahan, RIDLEY 16264, type, K, SING).

Note. As mentioned by RIDLEY the specimens are poor. No material has been collected since the type. I have seen two sheets of the type number and one other sterile unnumbered sheet. Only young fruits are available, with the persistent floral tube. Unfortunately, the petaloid appendages and stamens of them were eaten by insects except the basal parts of two sessile stamens in one flower. From the available material, it is impossible to verify the number and shape of the petaloid appendages and the number of stamens.

This species, as pointed out by RIDLEY, is characterized by the long-beaked fruits. In addition, the floral tube is longer than the lobes, and the stamens are sessile.

11. *Aquilaria beccariana* VAN TIEGH. Ann. Sc. Nat. Bot. VII, 17 (1893) 217; Bull. Soc. Bot. Fr. 40 (1893) 77; GILG, Bot. Jahrb. 28 (1900) 145; BOERL. Handl. 3 (1900) 112; BECC. Nelle Foreste (1902) 592; MERR. En. Born. (1921) 416.—*A. grandifolia* DOMKE, Notizbl. Berl.-Dahl. 11 (1932) 348.—*A. cumingiana* var. *parviflora* AIRY SHAW, Kew Bull. (1940) 261.—*Gyrinopsis grandifolia* QUIS. J. Arn. Arb. 27 (1946) 406.—Fig. 1a–c.

Tree up to 20 m tall and 36 cm diam. with grey and smooth bark. Young branchlets pubescent. *Leaves* papery to subcoriaceous, glabrous on both surfaces, sometimes scattered pubescent beneath, oblong, oblong-lanceolate, or elliptic-oblong, rarely elliptic, (7–)11–27 by (3–)6– $8\frac{1}{2}$ cm; base cuneate to attenuate; apex acute to acuminate;

nerves (10–)15–25 pairs, curving and ascending towards the margin, elevated and prominent beneath, distinct above; veins loosely reticulate; petiole 5–7 mm. *Inflorescences* axillary or extra-axillary, branched and up to $1\frac{1}{2}$ cm peduncled, short-paniculiform, pubescent; pedicels 3–7 mm, pubescent. *Flowers* 7–12 mm long, yellowish, greenish or yellowish-white. Floral tube cylindrical, 10-costate, sparsely hairy outside. Calyx lobes slightly ovate, puberulous inside, 2–3 mm long, densely puberulous on both surfaces, sometimes glabrescent on the outside. *Petaloid appendages* oblong, c. 1 mm long, densely short-hairy. *Stamens* usually sessile, rarely with very short filaments, almost as long as the petaloid appendages. Disk ring-like to cupular, densely puberulous. Pistil c. 5 mm long, with a distinct stipe c. 2 mm long, the stipe accrescent and elongated. *Ovary* ellipsoid, attenuate to the base, gradually narrowed at the apex; stigma capitate. *Fruit* protruding from the top of the floral tube, ellipsoid or obovoid, 2– $3\frac{1}{2}$ by $1\frac{3}{4}$ cm, slightly puberulous and glabrescent, narrowed to the base into an elongate stipe up to $1\frac{1}{2}$ cm, acuminate to the apex, usually slightly contracted in the middle; floral tube entire, very rarely splitting on one side (KADIR A 3601). *Seeds* black; ovoid, 10 by 5 mm, sparsely puberulous, acuminate to the apex, with an elongate tail c. 5 mm long, attached at the center of the appendage, the appendage slender, c. 1 cm long, densely reddish-brown pubescent.

Distr. *Malaysia*: Sumatra (Palembang), Malay Peninsula (Johore), and common in Borneo.

Ecol. Primary forests, rarely in swampy forest (Johore: S.F. 29008, K), from the lowland up to 825 m.

Vern. *Merkaras puti*, Sum., *gaharu*, *gumbil*, *njabak*, M, *tanduk* = *garu*, Born.

Notes. This species is characterized by the cylindrical floral tube, the oblong and puberulous petaloid appendages which are almost as long as the sessile or subsessile stamens, and the stiped pistil with a short, puberulous, ring-like disk at its base.

The type specimen of the present species was collected by BECCARI (PB 2339, F1) from Sarawak. It has rather small leaves ($8\frac{1}{2}$ – $13\frac{1}{2}$ by $\frac{1}{2}$ –4 cm) and young flowers. The type of *A. grandifolia* (GRASHOFF 693, Bo) collected in the swamp forest, Palembang, S. Sumatra, has larger leaves (17–27 by 6– $8\frac{1}{2}$ cm) and young flowers. Many specimens collected in the Malay Peninsula (e.g. S.F. 29008, 29195, 29381, 29470) and Borneo (e.g. bb 34916, ENDERT 3319, 4035, C.F. 34453, PURSEGLOVE P 4752, RUTTEN 68, PATRICK PING San A 1726, and WOOD San 15218) have flowers and fruits in different stages of development and their leaves show a variable size. From this additional material we can clearly infer that only one species is represented.

Aquilaria cumingiana var. *parviflora* was based on HAVILAND 3092 (type) and several other collections from western Borneo. All the specimens cited in the original description agree with the present species and are quite different from *A. cumingiana*.

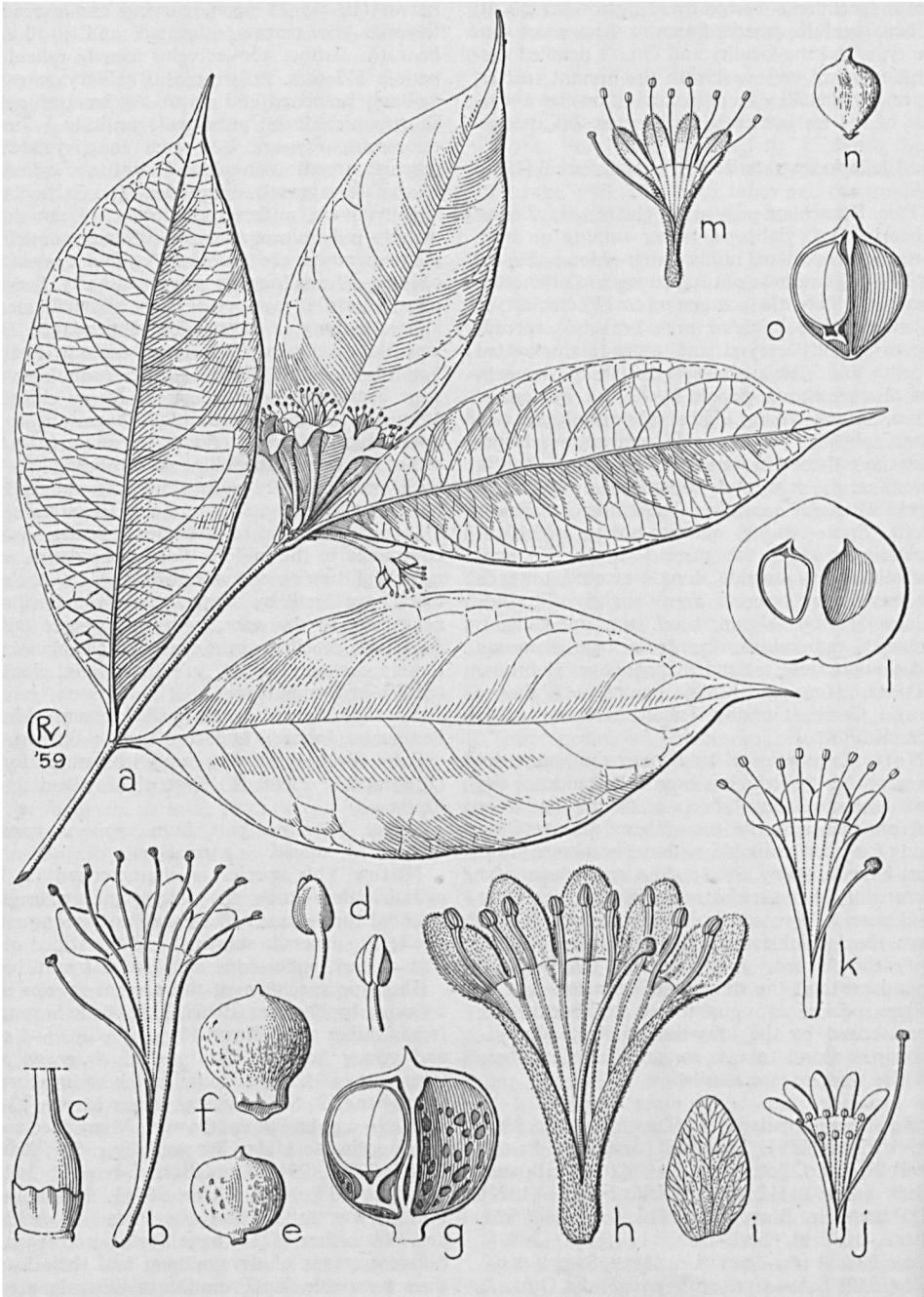


Fig. 3. *Phaleria capitata* JACK. *a*. Habit, $\times \frac{2}{3}$, *b*. opened flower, $\times \frac{1}{3}$, *c*. ovary with disk, $\times 7$, *d*. stamens, $\times 7$, *e*. fruit, nat. size, *f*. seed, $\times 2$, *g*. longitudinal section of fruit, one seed removed to show meshes of endocarp, $\times 2$.—*P. elegans* L. M. PERRY, *h*. Opened flower, $\times \frac{1}{3}$, *i*. punctate bract, $\times \frac{2}{3}$.—*P. macrocarpa* (SCHEFF.) BOERL. *j*–*k*. Opened flowers, dimorphous, $\times \frac{1}{3}$, *l*. longitudinal section of fruit, one seed removed, $\times \frac{2}{3}$.—*P. octandra* (L.) BAILL. *m*. Opened flower, $\times \frac{1}{3}$, *n*. fruit, nat. size, *o*. longitudinal section of fruit, one seed removed, $\times 2$ (*a* BAKHUIZEN VAN DEN BRINK 2294, *b*–*d* C.H.B. XI-B-III-8, *e*–*g* C.H.B. XI-B-XVII-43, *h* BRASS 24484, *i* BRASS 24483, *j* ATASRIP 139, *k*–*l* C.H.B. VIII-G-93, *m*–*p* WALSH 36).

12. *Aquilaria cumingiana* (DECNE) RIDL. J. Str. B. R. As. Soc. n. 35 (1901) 80; HALL. f. Med. Rijks-herb. n. 44 (1922) 17.—*Gyrinopsis cumingiana* DECNE, Ann. Sc. Nat. Bot. II, 19 (1843) 41, t. 1 f. B, 13–21; MEISN. in DC. Prod. 14 (1857) 603; MIQ. Fl. Ind. Bat. 1, 1 (1858) 883; F.—VILL. Nov. App. (1880) 183; VIDAL, Phan. Cuming. (1885) 140; Rev. Pl. Vasc. Filip. (1886) 230; MERR. Bull. Bur. For. Philip. 1 (1903) 41; ELM. Leaf. Philip. Bot. 5 (1913) 1629; En. Philip. 3 (1923) 131; HOLTHUIS & LAM, Blumea 5 (1942) 216; QUIS. J. Arn. Arb. 27 (1946) 405; Med. Pl. Philip. (1951) 636.—*Decaisnella cumingiana* O.K. Rev. Gen. Pl. 2 (1891) 584.—*Gyrinopsis cumingiana* var. *pubescens* ELM. Leaf. Philip. Bot. 5 (1913) 1629; MERR. En. Philip. 3 (1923) 131.—*Gyrinopsis decemcostata* HALL. f. Med. Rijks-herb. n. 44 (1922) 17; DOMKE, Bibl. Bot. 111 (1934) t. 2 f. 9; t. 4 f. 36p.—*Gyrinopsis pubifolia* QUIS. J. Arn. Arb. 27 (1946) 406.—Fig. 11.

Shrub or small tree up to 5 m. Bark ashy grey, mottled and smooth. Young branchlets densely pubescent, glabrescent. Leaves chartaceous to subcoriaceous, glabrous on both surfaces or sometimes pubescent on the lower surface; oblong-lanceolate, elliptic-oblong, or ovate-oblong, rarely obovate-oblong, 14–18 by 5½–8½ cm; base cuneate, rarely rounded; apex acute to acuminate, acumened up to 1½ cm; nerves 12–18 pairs, slightly curved and ascending to the margin, elevated and distinct beneath, slightly elevated above; veins and veinlets numerous, irregularly forked; petiole 4–6 mm. Inflorescences simple or sometimes branched, few- to many-flowered; peduncle short, c. 5 mm long, rarely subsessile; pedicels 3 mm, setose. Flowers whitish, 13–16 mm long. Floral tube cylindrical, puberulous outside, glabrescent, densely or sparsely pubescent inside, the retrorse hairs appressed, sometimes distinctly 10-costate inside, usually with irregular, sulphureous, wart-like excretions. Calyx lobes ovate or oblong, obtuse, 2–3 mm long, densely puberulous on both surfaces, sometimes glabrescent. Petaloid appendages short, usually united in a ring, rarely free or united at the base, about half as long as the stamens, densely hairy, the hairs longer than or as long as the appendages. Stamens sessile, 1–2 mm long, free from the tube, slightly below the appendages or at the same level with them, the lower ⅓–½ of the anther usually adnate to the tube. Pistil c. 7 mm long,

short-stiped, densely hairy. Ovary obovate, attenuate to the base; style continuous with the ovary, obscure or distinct; stigma capitate. Fruits globose, slightly obovoid, or ellipsoid, rugose, protruding laterally from the split floral tube, 1¼ by 1½ cm. Seeds broad-ovoid, plano-convex, 1 by ¾ cm with a short caruncle-like appendage.

Distr. Malaysia: S. Borneo (Sampit region), Philippines (common), and Moluccas (Morotai and Halmahera).

Ecol. In primary forests at low and medium altitudes.

Uses. According to QUISUMBING, *l.c.*, the bark and roots are used to stop bleeding from wounds. The bark, wood, and fruit are used as a substitute for quinine.

Vern. Alahan, maga-an, pallsan, Tag., bago, Mbo., binukat, Ak. Bis., butlo, Neg., dalakit, S.L. Bis., magwalem, Sub., pamaluian, Bag.; giba kolano, Halmahera.

Note. The type specimen of *Gyrinopsis pubifolia* QUIS. is B.S. 75314 (A). According to QUISUMBING (*l.c.*) it was collected at Mt Abucay, Catanduanes, at c. 1600 m, September 11, 1928 (the field data on the label of this specimen are simply indicated as "Catanduanes, M. RAMOS & G. EDANO, July-Sept. 1928"); it has rather young flowers with the lower part of the anthers united with the floral tube. There is another specimen (B.S. 75516, SING) which is similar to the above one and bears the same field data; it has both young and mature flowers and has been distributed as *Gyrinopsis cumingiana* DECNE (= *A. cumingiana*) with which I agree. In comparing these two specimens, it appears that *Gyrinopsis pubifolia* is conspecific with *A. cumingiana*.

Excluded

Aquilaria? bancana MIQ. Sum. (1861) 355 is according to AIRY SHAW (Fl. Mal. I, 4, 1953, 361) = *Gonystylus bancanus* (MIQ.) KURZ (*Thymelaeac.*).

Aquilaria? macrophylla MIQ. Sum. (1861) 356 is according to AIRY SHAW (Fl. Mal. I, 4, 1953, 354) = *Gonystylus macrophylla* (MIQ.) AIRY SHAW (*Thymelaeac.*).

Aquilaria pentandra BLANCO, Fl. Filip. ed. 1 (1837) is according to BAKKER (Fl. Mal. I, 5, 1957, 355) = *Pittosporum pentandrum* (BLCO) MERR. (*Pittosporac.*).

2. PHALERIA

JACK, Mal. Misc. 2 (1822) 59; reimdr. HOOK. Comp. Bot. Mag. 1 (1835) 156; DOMKE, Bibl. Bot. 111 (1934) 123, t. 4 f. 36h, map 6; MERR. J. Arn. Arb. 33 (1952) 239.—*Drimyspermum* KEINW. Syll. Pl. Ratisb. 2 (1825) 15; RCHB. Nom. Bot. Hort. 2 (1841) 65, as *Drymispermum*.—*Pseudais* DECNE, Ann. Sc. Nat. Bot. II, 19 (1843) 10.—*Leucosmia* BENTH. in Hook. Lond. J. Bot. 2 (1843) 231.—*Dais* (non LINNÉ) auct.—Fig. 3–9.

Shrubs or trees. Leaves decussate or opposite. Inflorescences terminal or axillary, sometimes cauliflorous, capitate, fascicled or umbelliform, peduncled,

rarely sessile, peduncles usually with decussate, persistent, reddish-brown, glabrous bracteoles towards the base and gradually increasing in size and more spaced towards the upper parts, sometimes 4 or more involucre bracts at the uppermost part of the peduncle surrounding the flowers. *Flowers* monomorphic rarely heteromorphic, white, sessile, articulated at the base. Floral tube infundibuliform or cylindrical, glabrous or puberulous on both surfaces. Calyx lobes 5, rarely 4 or 6, slightly unequal. *Petaloid appendages* obscure and rim-like, or none, rarely distinct (*P. pentecostalis* LÉANDRI, an extra-Mal. sp.). *Stamens* in two series, usually filamentous and exerted, sometimes included, rarely sessile; anthers oblong, dorsifixed. Disk cupular, submembranous. *Ovary* ovoid or ellipsoid, glabrous or hairy at the apex, 2-celled or rarely 1-celled by abortion, once found 3-celled in *P. octandra*; style terminal, filiform, sometimes exerted; stigma capitate, papillose. *Fruits* drupaceous, 2- or 1-seeded, exocarp and mesocarp fibrous and fleshy (sometimes hard in the herbarium), endocarp coriaceous and hard. *Seeds* exalbuminous; cotyledons thick and hemispherical.

Distr. About 20 spp., distributed in Ceylon (*P. capitata*), SE. Asia, through Malaysia to Australia, Micronesia (*P. nisidai*), and the Pacific (as far as Samoa and Tonga).

Ecol. In rain-forests, rarely in seasonal forests, from the lowland up to 1400 m.

Note. The generic name *Drimyspermum* has in literature frequently been mis-spelled as *Drymyspermum*. No attempt has been made to indicate this erroneous etymology, except where new species or combinations have been proposed.

KEY TO THE SPECIES

1. Inflorescences terminal and/or in the leaf axils of the terminal node, sometimes also occurring in the upper two nodes, rarely in several nodes in *P. octandra*, sometimes cauliflorous in *P. capitata* and *P. coccinea*. Only one peduncle in each axil, bearing (6-)8-many flowers. Flowers homomorphic. Fruits usually small, less than 3½ by 2 cm; pericarp thin, less than ½ cm thick.
2. Floral tube pubescent outside, very rarely glabrescent. Fruits ellipsoid and apiculate at both ends, often spindle-shaped.
3. Involucre bracts 8 or more, large, 2½-3½ by 1-2 cm. Floral tube wide, 12-15 mm diam. at the throat 1. *P. elegans*
3. Involucre bracts usually 4 or 5, smaller, ¾-1½ by ½-1 cm. Floral tube narrow, 2-6 mm diam. at the throat.
4. Inflorescences 8-10(-15)-flowered, very rarely many-flowered. Flowers 1½-2(-2¼) cm long; calyx lobes ½(-⅓) the length of the tube. Ovary glabrous. Leaves elliptic-oblong, elliptic-lanceolate, or obovate, (4-)13-26 by (1½-)3-8 cm; nerves 9-11 pairs 2. *P. octandra*
4. Inflorescences 20-many-flowered. Flowers 3-4½ cm long; calyx lobes ¼-⅓ the length of the tube. Ovary usually hairy at the top, rarely glabrescent. Leaves oblong-lanceolate, oblanceolate or rarely ovate-oblong, 11½-33 by 3½-14 cm; nerves (8-)13-22 pairs 3. *P. perrottetiana*
2. Floral tube glabrous outside. Fruits subglobose, ovoid, or ellipsoid, usually rounded or obtuse at both ends, sometimes apiculate at the apex (acute or acuminate towards both ends in *P. sogerensis*).
5. Stamens and style always included. Stamens sessile or short-filamentous. Style usually not longer than the tube 4. *P. nisidai*
5. Stamens and style exerted. Stamens long filamentous.
6. Flowers 2½-4½ cm long. Calyx lobes ⅓-¼ the length of the tube. Ovary glabrous or hairy at the top.
7. Inflorescences usually 8-flowered, sometimes cauliflorous and many-flowered. Ovary glabrous. Fruits subglobose, 1-1½ cm in diam.; endocarp *perforated* (fibrous strands interlaced, leaving distinct meshes) 5. *P. capitata*
7. Inflorescences 20-many-flowered, rarely cauliflorous. Ovary usually hairy or puberulous at the top. Fruits ellipsoid, 1½-2 by 1 cm, usually blunt at both ends, sometimes apiculate at the apex; endocarp not perforated (fibres uniformly arranged, not leaving open spaces) 6. *P. coccinea*
6. Flowers 1½-2 cm long. Calyx lobes usually ½(-⅓) the length of the tube. Ovary hairy at the top. Fruits acute or acuminate towards both ends.
8. Inflorescences with usually more than 20 flowers. Leaves 12-33 by 4-14 cm. Stamens c. 10 mm exerted beyond the tube. Calyx lobes c. 3 times as long as broad 3. *P. perrottetiana*
8. Inflorescences with 6-10 flowers. Leaves 7-16 by 2½-7 cm. Stamens c. 5-6 mm exerted. Calyx lobes c. 2-2½ times as long as wide 7. *P. sogerensis*

1. Inflorescences axillary and occurring in the leaf axils of several nodes along the branches or branchlets, sometimes cauliflorous; peduncles 1-3 or sometimes several or many in each axil, each peduncle bearing 2-5(-8) flowers. Flowers usually heteromorphic (sessile stamens and an exserted style, or exserted stamens and a short style, and their intermediate forms). Fruits large, 3-5½ by 3-4½ cm; pericarp thick, 1-1½ cm. 8. *P. macrocarpa*

1. *Phaleria elegans* L. M. PERRY, J. Arn. Arb. 39 (1958) 422, f. c & d.—Fig. 3h-i.

Shrub or small tree, 2-3 m, sparsely branched. Branchlets reddish-brown, terete, glabrous, hollow. Leaves chartaceous to subcoriaceous, glabrous, oblanceolate, rarely elliptic-lanceolate, 18-30 by 5½-9 cm; base attenuate; apex acute to short-acuminate; margins recurved; nerves 8-12 pairs, elevated on both surfaces, spreading, curved towards the margin; veins slightly elevated on both surfaces, rather widely reticulate; petiole stout, about as thick as the branchlet, red when fresh (*vide* BRASS), reddish-brown to black when dry. Inflorescences terminal and/or in the axils of the terminal node, subsessile to short-peduncled (peduncle 5-9 mm in fruit), with small, decussate bracts towards the base. Involucral bracts cream-coloured (fleshy in bud), 8 or more, arranged in whorls, those of the inner whorl longer, oblong or ovate, 2½-3½ by 1-2 cm, obtuse or acute, slightly puberulous towards the upper part inside, especially near the margins, glabrescent, sometimes pellucid-dotted, 6-20-flowered. Flowers infundibular, 3¾-4¼ cm long. Floral tube 1¼-1½ cm diam. at the throat, densely pubescent outside and towards the base inside. Calyx lobes sparsely pubescent outside and densely pubescent inside, ± oblong, c. 9 by 5 cm, obtuse. Petaloid appendages rim-like. Stamens included, filamentous, 6-10 mm, free from the tube at the throat or slightly below it; anthers oblong, about 1½ mm long. Disk cup-shaped, crenulate, c. 2 mm long. Pistil included. Ovary glabrous, ellipsoid, c. 3 mm long, gradually narrowed towards the apex; style filiform, c. 3 cm; stigma globose. Fruit ellipsoid to fusiform, 2¾-3½ by 1½-1¾ cm, slightly compressed, acuminate on both ends. Seeds broadly ovate or obovate, or semiglobose, plano-convex, 10 by 7-10 mm, sharply pointed at the apex. Distr. *Malaysia*: New Guinea (Goodenough I.).

Ecol. Undergrowth of an oak forest and occasional in gullies in the forest, 1600-1750 m.

Note. This species is characterized by 8 or more, large involucral bracts which are caducous after anthesis, a wide floral tube which is densely pubescent outside, and the included stamens and style.

2. *Phaleria octandra* (L.) BAILL. Adans. 11 (1875) 321; MERR. Philip. J. Sc. 19 (1921) 367.—*Dais octandra* LINNÉ, Mant. Pl. 1 (1767) 69; BURM. f. Fl. Ind. (1768) 104, t. 32. f.2.—*Dais dubiosa* (non BL.) DECNE, Herb. Timor. (1834) 41; SPANOGHE, Linnæa 15 (1841) 335.—*Drimyspermum laurifolium* DECNE, Ann. Sc. Nat. Bot. II, 19 (1843) 39. t. 1, f. 1-12, as *Drimyspermum*; BLEEKER, Nat. Geneesk. Arch. N.I. 2 (1845) 75; ZOLL. Syst. Verz. 2 (1854) 117; MIQ. Fl. Ind. Bat.

1, 1 (1858) 885; BLUME & DE VRIESE, Ann. Hort. Bot. (Fl. Jard.) 2 (1859) 33, with pl.—*Drimyspermum burmanni* DECNE, Ann. Sc. Nat. Bot. II, 19 (1843) 40, as *Drimyspermum*; BLEEKER, Nat. Geneesk. Arch. N.I. 2 (1845) 75; MEISN. in DC. Prod. 14 (1857) 605.—*Drimyspermum blumei* (non DECNE) HASSK. Nat. Tijd. N.I. 10 (1856) 885.—*Drimyspermum ambiguum* MEISN. in DC. Prod. 14 (1857) 605, as *Drimyspermum*.—*Drimyspermum longifolium* MIQ. Fl. Ind. Bat. 1, 1 (1858) 885, as *Drimyspermum*.—*P. laurifolia* HOOK. f. Bot. Mag. (1869) t. 5787; VAL. Ic. Bog. 4 (1913) 211, t. 368, f. 1-3.—*P. ambigua* HOOK. f. Bot. Mag. (1896) t. 7471.—*P. longifolia* BOERL. Handl. 3 (1900) 111.—*P. laurifolia* var. *javanica* VAL. Ic. Bog. 4 (1913) 212, t. 368, f. 4-9; in K. & V. Bijdr. 13 (1914) 46; HALL. f. Med. Rijksherb. n. 44 (1922) 23.—*P. octandra* var. *laurifolia* WARB. ex VON MALM in Fedde, Rep. 34 (1934) 282.—*P. parvifolia* BACK. Blumea 5 (1945) 494.—Fig. 3m-o.

Shrub up to 5 m by 5 cm. Leaves chartaceous to subcoriaceous, elliptic-oblong, narrowly elliptic or obovate, (4-)13-26 by (1½-)3-8 cm; base attenuate, rarely short-acute; apex acuminate; nerves 9-11 pairs, slightly ascending and curved; veins rather widely reticulate, slightly elevated below, plane and visible above; petiole 6 mm. Inflorescences usually terminal and/or in the axils of the terminal node, sometimes in the axils along the branchlets (BEUMÉE 2405, Bo), 8-10(-15-∞)-flowered; peduncles very short to up to 1½ cm, usually with decussate, small, lanceolate scales at the base gradually increasing in size apically. Involucral bracts 4, rarely 5, ovate or obovate, 8-12 by 4-11 mm, puberulous on the upper part of both surfaces, persistent, rarely caducous after anthesis. Flowers (1-)1½-2¼ cm long. Floral tube cylindric, slightly swollen at the base, usually pubescent on both surfaces, sometimes glabrescent. Petaloid appendages sometimes rim-like. Calyx lobes 4 or 5, oblong or slightly elliptic or obovate, 4-7 by 2-3 mm, densely puberulous outside and at the upper part inside. Stamens and pistil long-exserted (up to 8 mm) in anthesis. Disk cup-shaped, membranous. Pistil 2-2½ cm long. Ovary glabrous, ellipsoid, narrowed into the filiform style; stigma capitate. Fruits ellipsoid, ovoid, sometimes slightly compressed, 11-16 by 9-15 mm, acute or attenuate and pointed towards both ends, usually 2-celled, 2- or 1-seeded, once found 3-seeded (VALETON 123, Bo).

Distr. Australia: North Queensland (MICHAEL 1250, Bo), and *Malaysia*: throughout Java, Madura, Bawean, and Lesser Sunda Islands (Bali to Timor and Tanimbar), Moluccas (Halmahera), and South New Guinea (Daru I.). Fig. 4.

Ecol. In beach-forest, common on sandy soil of teak forest in E. Java, rarely in primary and

secondary mixed forests, from the lowland up to 600 m, in Jamdena up to 800 m, in Timor up to 1000 m.

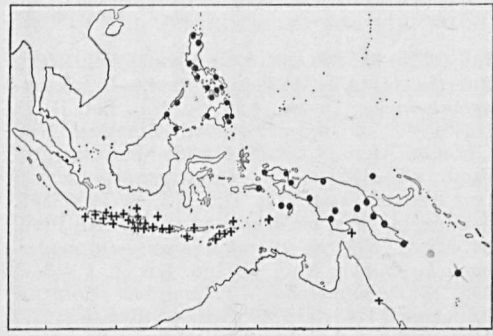


Fig. 4. Localities of *Phaleria octandra* (L.) BAILL. (+) and *P. perrottetiana* (DECNE) F.-VILL. (●).

Vern. *Kopinan, mritja sunda, pantjal pamor, J, kaju pateng*, Kangean, *mandalika, manpulang*, Bawean; Lesser Sunda Islands: *daun wèmpè, nu impi*, Jamdena, *koffifui*, Timor, *lolong*, Sumba; *pèpigéow*, Halmahera, Sawai lang.

Note. *Dais octandra* was first published by LINNAEUS in 1767 (Mant. Pl. 1, p. 69). There is a specimen in the Linnean Herbarium which bears LINNAEUS's handwriting and agrees with the original description with the exception that some of the flowers are sparsely pubescent outside.

In 1768, one year later, *Dais octandra* appeared in BURMAN's Fl. Ind. p. 104, t. 32 f. 2. There are two specimens of BURMAN's in the Herb. Delessert at Geneva; one of them bears in BURMAN's handwriting "*Dais octandra*" and the other has a label "Java Kleinhoff". These two specimens are similar to each other and may belong to one collection. They are also similar to the specimen in the Linnean Herbarium mentioned above but the flowers appear more pubescent on the outside of the floral tube. I assume BURMAN has sent his drawing with one of his specimens - which might have been the one which he had used for the description - to LINNAEUS, as LINNAEUS cited "Burm. Ind. t. 33, f. 2" in the description.

In 1876 BAILLON (Adansonia 11, p. 321) rightly transferred *Dais octandra* to *Phaleria* as *P. octandra*. He mentioned only BURMAN's publication and overlooked that of LINNAEUS. According to priority we should accept LINNAEUS as the author of *Dais octandra* and the specimen in the Linnean Herbarium as the holotype.

Because of some minor discrepancies between BURMAN's (*l.c.*) description and drawing, and both of them also not exactly agreeing with the specimens preserved in BURMAN's herbarium, DECAISNE (Ann. Sc. Nat. Bot. II, 19, 1843, 40) based a new species, *Drimyspermum burmanni*, on the specimens in the BURMAN Herbarium. However, the discrepancies have no value for defining species: the floral tubes are usually pubescent outside but rarely glabrous and, as pointed out by

VALETON (in K. & V. Bijdr. 13, 1914, 40), one can occasionally find glabrous flowers among the hairy ones (*cf.* KOORDERS 30200 β , 30145 β , and BUWALDA 7291).

In the Kew Herb. there are two specimens of cultivated origin identified as *Phaleria laurifolia*. One of them has flowers with a floral tube glabrous outside which has been used for the plate in CURTIS's Bot. Mag. t. 5787; the other has flowers with a floral tube pubescent outside. In other respects their characters entirely agree. It is not clear whether they were collected from the same or from different plants.

According to VALETON (Ic. Bog. 4, 1913, 47) *P. octandra* is slightly more xerophytic than the others and obviously cannot well maintain itself in rain-forest and the specimens which had been introduced in the Bogor Botanic Gardens have perished. The fibers which constitute the endo- and mesocarps form a rather thick layer, with a smooth, compact, shining inner surface, more loose than the peripheral parts but leaving no meshes among them.

In 1893 H. HALLIER (320, Bo) once collected it along the border of the Palace Garden (Hertenkamp) adjoining the Botanic Gardens at Bogor; it must have escaped or been derived from cultivation (*cf.* VALETON in K. & V. Bijdr. 13, 1914, 47). One specimen was collected by HOOGERWERF (42, Bo) in the beach forest of Udjungkulon, W. Java, which is apparently the western limit of this species.

P. octandra is closely related to *P. perrottetiana*. Some specimens collected at Sumbawa (ELBERT 3903, 3949, 3994, 4099, 4127) have 15-flowered inflorescences. One specimen collected in the Tanimber Is. (S. Moluccas) (BUWALDA 4369), has large leaves (20 by 9 cm) which are similar to those of *P. perrottetiana* both in size and shape.

3. *Phaleria perrottetiana* (DECNE) F.-VILL. Nov. App. (1880) 183; MERR. Sp. Blanc. (1918) 378; BROWN, Minor Prod. Philip. For. 1 (1920) 403; MERR. En. Philip. 3 (1923) 131; Philip. J. Sc. 29 (1926) 404; MERR. & PERRY, J. Arn. Arb. 22 (1941) 265.—*Drimyspermum perrottetianum* DECNE, Ann. Sc. Nat. Bot. II, 19 (1843) 40, as *Drimyspermum*; BLEEKER, Nat. Geneesk. Arch. N.I. 2 (1845) 75; MEISN. in DC. Prod. 14 (1857) 605; MIQ. Fl. Ind. Bat. 1, 1 (1857) 886.—*Dais laurifolia* (non JACQ.) BLANCO, Fl. Filip. (1837) 375, ed. 2 (1845) 263, ed. 3, 2 (1878) 125.—*Drimyspermum urens* (non REINW.) SCHEFF. Ann. Jard. Bot. Btzg 1 (1876) 46.—*Drimyspermum coccineum* (non *Dais coccinia* GAUDICH.) BECC. in d'Albertis, New Guinea 2 (1880) 398, as *Drimyspermum*, *quad specim.*—*P. blumei* (non BENTH.) HEMSL. Bot. Chall. 3 (1885) 244.—*P. splendida* VAL. Ic. Bog. 4 (1913) 219, t. 370 A-B.

Shrub, sometimes a tree, up to 8 m. Branches and branchlets glabrous and dark-brown. Leaves chartaceous, oblong-lanceolate, oblanceolate, or ovate-oblong, 11½-33 by 3½-14 cm; base cuneate, rounded; apex acuminate; margins slightly recurved; nerves (8-)13-22 pairs, distinct

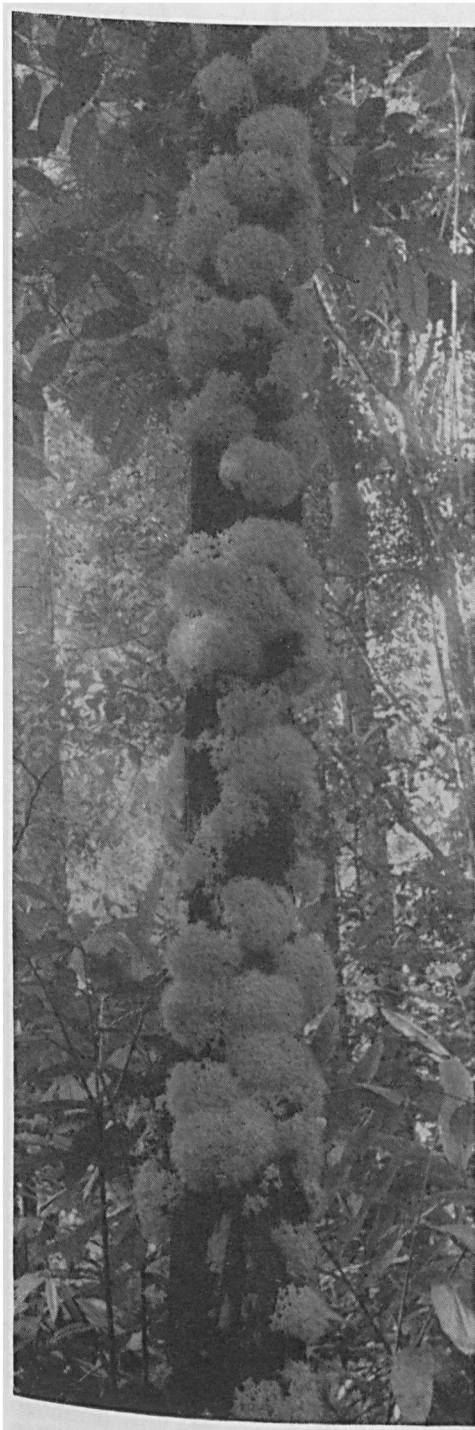


Fig. 5. A tree of *Phaleria* sp. in bridal attire.
Kebun Raya Indonesia, Bogor.

and elevated on both surfaces, curving and ascending towards the margin, veins and veinlets slightly reticulate; petiole $1\frac{1}{2}$ cm, slightly winged. *Inflorescences* terminal and/or axillary at the terminal node, sometimes in the axils of the upper two nodes of the branch, solitary, very rarely more than one in the same axil. Peduncle up to $3\frac{1}{2}$ cm; bracts small, lanceolate, 3 mm long, densely decussate at the basal part, persistent. Involucral bracts 4, caducous after anthesis, rarely persistent, oblong, obovate-oblong, 15 by 8 mm, obtuse at the apex, apiculate or obtuse, densely puberulous towards the upper part on both surfaces. *Flowers* (2-)3-4 $\frac{1}{2}$ cm long. Floral tube pubescent outside, villose at the lower half or lower $\frac{2}{3}$ inside. Calyx lobes 5-9 mm long. *Stamens* and style c. 10 mm exerted beyond the tube. Disk cup-shaped, sometimes consisting of 6 or 7 free lobes (PNH 33763). *Ovary* usually hairy at the apex or on one side of the ovary, usually 2-celled, sometimes 1-celled by abortion. *Fruits* usually 1-seeded, ovate, gradually narrowed towards the apex, acute at the base, $1\frac{1}{2}$ -3 by $1\frac{1}{4}$ -1 $\frac{3}{4}$ cm. *Seed* ellipsoid, plano-convex, 10 by 8 mm.

Distr. Louisiade Archipelago (Sudest I., Admiralty Is. and *Malaysia*: New Guinea (throughout), Moluccas (Kai Is. and Ceram), Philippines (throughout), and N. Borneo (Banguay I. and Lahat Datu). Fig. 4.

Ecol. In rain-forest at low and medium altitudes, one collection (NGF 8511) at 1140 m (Western Highlands, New Guinea).

Vern. New Guinea: *kwareo*, Wanigela, *bearoa*, Gabobora; Philippines: *aligpagi*, Davao, *bágo*, Bat., *tuba*, Cag.

Note. Some specimens collected at Davao Prov., Mindanao, Philippines (B.S. 48963, 49614 and MERRILL 11616) seem to be a distinct local form of *P. perrottetiana*; this form differs from the typical one only by the rather small flowers (c. 2 cm long) and the floral tube which is *glabrous* outside. Because of the presence of two kinds of flowers *P. perrottetiana* has been placed in the key twice.

Some specimens (*viz* CARR 11353, 11672, and HOOGLAND 3788) bear large fruits (c. 3 by $1\frac{3}{4}$ cm) with rather thick pericarps (c. 2 mm). Their enormous size might have been caused by the attack of insects, as there are always hole(s) on the pericarps and excrements of insects inside the fruits.

4. *Phaleria nisidai* KANEHIRA, Fl. Micron. (1933) 248, f. 116; Bot. Mag. Tokyo 47 (1933) 675.

Shrub or small tree, up to 3 m. Branchlets smooth, glabrous, yellowish-green to reddish-brown. *Leaves* chartaceous, greenish when dry and glabrous on both surfaces, elliptic-oblong, rarely lanceolate, 10-18 by $2\frac{1}{2}$ -6 $\frac{1}{2}$ cm; base obtuse, acute or cuneate; apex acuminate; nerves 6-10 pairs, curving and ascending towards the margin, elevated beneath, plane and distinct above, veins reticulate, usually rather dense, elevated beneath, distinct or obscure above.

Inflorescences terminal and/or in the axils of the terminal node, umbelliform, 10–12-flowered; peduncles c. 2–4 mm with a pair of opposite, green, and obovate-oblong bracts (4 by 2 mm) at the upper part; involucre bracts 4, green, glabrous, caducous after anthesis, oblong or elliptic-oblong, 8–10 by 4–6 mm. *Flowers* 2–3½ cm long. Floral tube cylindric, slightly dilated towards the top, glabrous outside, puberulous or pubescent inside. Calyx lobes 5(–4), oblong, ovate or orbicular, 2–4½ by 2–3 mm, puberulous on the margins and top outside and the whole surface inside. *Stamens* included; filaments ½–3 mm; anthers c. 1 mm long. Disk cup-shaped, crenate, membranous. Pistil usually shorter than the tube, rarely exerted. *Ovary* ovoid, c. 2½ mm long, hairy at the apex; style filiform; stigma oblong or slightly globose. *Fruits* globose or slightly obovoid, 1½–2 by 1½–2 cm, slightly compressed, constricted at the base into a 3 mm long stipe. *Seeds* broadly ellipsoid, 5½ by 7 mm.

Distr. Western Carolines (Palau: KANEHIRA 2445, K), in *Malaysia*: D'Entrecasteaux Is. (Normanby I.: BRASS 25827, K, L), New Britain (Gazelle Pen.: WATERHOUSE 908, K), Louisiade Archipelago (Misima I.: BRASS 27505; Rossel I.: BRASS 28284, L), and New Guinea (Eastern Highlands: NGF 9564).

Ecol. Rain-forests, lowland up to 600 m.

Note. All specimens cited above match very well with KANEHIRA's description and his fine drawing as well as his collection from the type locality (2445, K). This species is characterized by the leaves with rather dense venation and the flowers with included stamens and pistils.

5. *Phaleria capitata* JACK, Mal. Misc. (1822) 59; reimpr. in Hook. f. Comp. Bot. Mag. 1 (1835) 156; K. & V. Bijdr. 13 (1914) 41; S. MOORE, J. Bot. 63 (1925) Suppl. 89; HEYNE, Nutt. Pl. (1927) 1152.—*Dais dubiosa* BL. Cat. (1823) 69; Bijdr. (1826) 651; HASSK. Cat. Hort. Bog. (1844) 94; FILET, Pl. Bot. Tuin Weltevr. (1855) 50.—*Drimyspermum urens* REINW. Syll. Pl. Ratisb. 1 (1825) 15; DECNE, Ann. Sc. Nat. Bot. II, 19 (1843) 39; BLEEKER, Nat. Geneesk. Arch. N.I. 2 (1845) 74; MEISN. in DC. Prod. 14 (1857) 604; HOLTHUIS & LAM, Blumea 5 (1942) 216.—*Drimyspermum blumei* DECNE, Ann. Sc. Nat. Bot. II, 19 (1843) 39, as *Drimyspermum*; BLEEKER, Nat. Geneesk. Arch. N.I. 2 (1845) 74; ZOLL. Syst. Verz. 2 (1854) 117; MEISN. in DC. Prod. 14 (1857) 604; MIQ. Fl. Ind. Bat. 1, 1 (1857) 885.—*P. dubiosa* ZOLL. Nat. Geneesk. Arch. N.I. 1 (1844) 616.—*Drimyspermum laurifolium* (non DECNE) HASSK. Nat. Tijd. N.I. 10 (1856) 155.—*Drimyspermum phaleria* MEISN. in DC. Prod. 14 (1857) 604, as *Drimyspermum*; MIQ. Fl. Ind. Bat. 1, 1 (1858) 884.—*Drimyspermum cauliflorum* THW. En. Ceyl. Pl. (1860) 251, as *Drimyspermum*.—*P. cumingii* F.—VILL. Nov. App. (1880) 183; VIDAL, Phan Cuming. Philip. (1885) 140; Rev. Pl. Vasc. Filip. (1886) 230; BROWN, Minor Prod. Philip. For. 1 (1920) 403; MERR. Bull. Bur. For. Philip. 1 (1903) 43; En. Philip. 3 (1923) 131; KANEHIRA, Bot. Mag. Tokyo 45 (1931) 331; Fl.

Micron. (1933) 248.—*P. urens* KOORD. Minah. (1898) 577; Suppl. 2 (1922) t. 98; Suppl. 3 (1922) 48.—*P. cauliflora* BEDD. For. Man. Bot. (= Fl. Sylv. vol. 3) (1873) 180, t. 25, f. 5; TRIM. Fl. Ceyl. 3 (1895) 459; Hook. f. Fl. Brit. Ind. 5 (1886) 199.— Fig. 3a–g, 6.

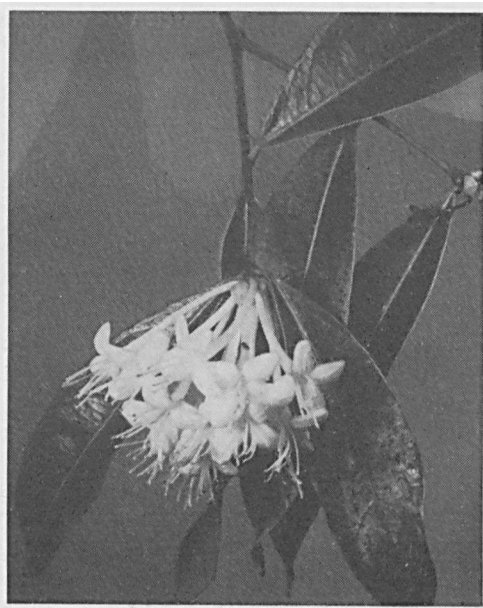


Fig. 6. *Phaleria capitata* JACK. Botanic Gardens, Singapore, Febr. 1952 (Photogr.

M. R. HENDERSON).

Shrub or small tree, up to 9 m by 16 cm. Branchlets reddish-brown. *Leaves* chartaceous, glabrous, in dry state reddish-brown above, pale brown beneath; elliptic-oblong, (11–)15½–21(–26) by (3½–)5½–7(–10) cm; base acute to attenuate, rarely rounded; apex narrow acute to acuminate, acumen 1¼–2½ cm; margins sometimes recurved in dry state; nerves 8–10 pairs, elevated beneath, slightly elevated above; veins loosely reticulate, distinct beneath, obscure above; petiole 5 mm. *Inflorescences* usually terminal and/or in the leaf axils of the terminal node, solitary, sometimes cauliflorous, subsessile or on very short (c. 3 mm) peduncles, with decussate, small bracts at the base. Involucre bracts 4, oblong, ovate or obovate, 6 by 3 mm, usually caducous after anthesis sometimes persistent, usually 8-flowered. *Flowers* 2½–4½ cm long. Floral tube cylindric, gradually enlarged towards the top, glabrous on both surfaces. Calyx lobes oblong or elliptic, 6–7 by 2–3½ mm, puberulous inside and towards the upper part and margins outside, sometimes glabrous outside. *Stamens* and style usually exerted sometimes up to 5 mm. Pistil sometimes shorter than the tube or about as long as it (BAKHUIZEN VAN DEN BRINK 5063, BAKHUIZEN VAN DEN BRINK f. 688, and San A 3140). Disk

cup-shaped. Ovary ellipsoid, glabrous, apex narrowed into the filiform style; stigma capitate, $1\frac{1}{2}$ by 1 mm. Fruits subglobose, $1-1\frac{1}{2}$ cm in diam., sometimes short-acute at the apex, usually 2-celled, 2-seeded; endocarp inside with distinct meshes.

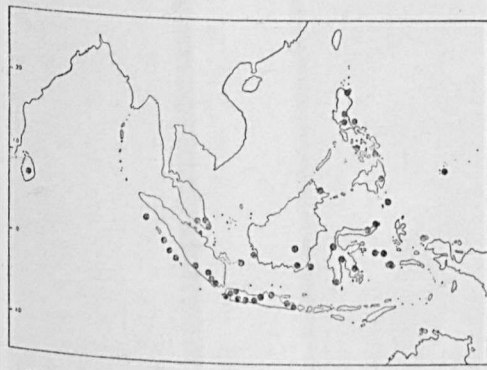


Fig. 7. Localities of *Phaleria capitata* JACK.

Distr. Ceylon, Carolines (Palau, *vide* KANEHIRA), and Malaysia: Malaya (cult. and natur.), Sumatra, Java, Borneo, Philippines, Celebes, Moluccas (Buru), and New Guinea (Waigeo I.). Fig. 7.

Ecol. In primary and secondary forests, from the lowland up to 1200 m.

Uses. (Cf. HEYNE, *l.c.*; BURK. Dict. 2, 1935, 1703). Tough fibres of the bark have been used for cordage and tying material. The fruits are sweet and edible. The seeds are used for scurfy eruptions in children.

Vern. Sumatra: *suwa lansat*, Simalur, *rimbò suloh*. Lamboeng: Java: *godong-laweh*, *kakapassan*, *ki-angkrieng*, *ki tangkieh*, S, *kojotan*, *lawé*, *lawéan*, *lawé-lawé*, *ulati*, J; Borneo: *djarum djarum*; Celebes: *suka*, Bug., *sunsuan*, *susuan*, Minah.; Moluccas: *la'awan'a*, Sanga & Talaud Is.

Notes. The mesocarp of the fruit is fleshy and rather soft. The endocarp consists of interwoven fibres which form a characteristic network; through the meshes one can see the testa of the exposed seed (cf. VALETON, *l.c.* Bog. 4, 1914, 21²). Fig. 3g.

There are two specimens collected by CORNER (S.F. 28481 and 32776, SING) at Johore, Malay Peninsula, which might have escaped or been derived from cultivation.

6. *Phaleria coccinea* (GAUDICH.) F. v. M. Descr. Not. 2 (1885) 9. *quoad basionym*; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 459.—*Dais coccinea* GAUDICH. Vov. Uranie (1826) 443, t. 44.—*Pseudais coccinea* DECNE, Ann. Sc. Nat. Bot. II, 19 (1843) 41; BLEEKER, Nat. Geneesk. Arch. N.I. 2 (1845) 77; MEISN. in DC. Prod. 14 (1857) 603; Mio. Fl. Ind. Bat. 1, 1 (1858) 883.—*Drimyspermum revolutum* T. & B. Nat. Tijds. N.I. 27 (1864) 30.—*Drimyspermum cumingii* MEISN. in DC. Prod. 14 (1857) 605, as *Drimyspermum*.—*P. vriesii* BAILL. Adansonia 11 (1875) 329.—*P. zippellii* BAILL. *l.c.*—*Drimyspermum coccineum* BECC. in

D'Albertis, New Guinea 2 (1880) 398, *quoad basionym*, as *Drimyspermum*.—*P. revoluta* BOERL. Handl. 3 (1900) 111; VAL. Ic. Bog. 4 (1913) 215, t. 369.—*P. amboinensis* MERR. Philip. J. Sc. 11 (1916) Bot. 294.—*P. platyphylla* MERR. Philip. J. Sc. 14 (1919) 429; En. Philip. 3 (1923) 131.—*P. subcaudata* MERR. & PERRY, J. Arn. Arb. 22 (1941) 265.

Small tree, up to 5 m. Branchlets red-brownish, usually hollow. Leaves chartaceous to coriaceous, glabrous on both surfaces; obovate, elliptic, elliptic- to lanceolate-oblong, obovate- to oblanceolate-oblong, ovate-oblong, $15\frac{1}{2}-26$ by $6-11\frac{1}{2}$ cm; base rounded to cuneate; margins slightly recurved; apex short-acute, acute, up to 2 cm acuminate; nerves 8-14 pairs, prominent and elevated beneath, slightly elevated or plane above, curving and ascending towards the margins; veins loosely reticulate; petiole thick, c. 5-7 mm long. Inflorescences terminal or/and axillary at the terminal node, rarely cauliflorous, (15-)20-many-flowered; peduncle up to $2\frac{1}{2}$ cm. Bracts small, lanceolate, ovate to obovate, 3-10 mm long; involucre bracts 4, elliptic- or obovate-oblong, obtuse, 4-12 by 2-5 mm, caducous after anthesis, rarely persistent. Flowers $2\frac{1}{2}-3\frac{1}{2}$ cm long. Floral tube glabrous outside, glabrous or sparsely puberulous to pubescent inside. Calyx lobes obovate-oblong or oblong, 5-7 by 2-3 mm, reflexed, usually puberulous on both surfaces. Stamens and style up to 8-10 mm exerted. Disk cup-shaped. Ovary villous or puberulous at the top, 2-celled, very rarely 1-celled. Fruits ellipsoid, $1\frac{1}{2}-2$ by 1 cm, blunt at both ends, sometimes apiculate at the apex. Seeds ovoid, $6\frac{1}{2}$ by 5 mm.

Distr. New Britain and Malaysia: Philippines (Panay and Mindanao), Moluccas (Sula Is., Ambon, Ceram, and Key Is.), New Guinea (Sorong, Waren, Hollandia, Central and South Division, Nabire, Sepik region).

Ecol. In rain-forests from the lowland up to 300 m.

7. *Phaleria sogerensis* S. MOORE, J. Bot. 61 (1923) Suppl. 43.

Shrub up to 2 m. Branchlets reddish- to dark-brown, glabrous. Leaves papery, rarely subcoriaceous, glabrous on both surfaces, sometimes brownish or brownish-green when dry, elliptic-oblong, oblong-lanceolate to lanceolate; 7-16 by $2\frac{1}{2}-7$ cm; cuneate to attenuate towards the base; acuminate at the apex, sometimes with an acumen c. 2 cm long; nerves 6-10 pairs, spreading towards the margin and then curved upwards, prominent and elevated beneath, slightly elevated above; veins reticulate, distinct beneath, obscure above; petiole c. 5 mm. Inflorescences terminal, and/or in the leaf axils of the terminal one or two nodes, 6-10-flowered; peduncle none to 12 mm; involucre bracts 4, slightly obovate, c. 5 by 3 mm, usually caducous, sometimes persistent. Flowers $1\frac{1}{2}-2(-2\frac{1}{2})$ cm long. Floral tube glabrous on both surfaces, rarely puberulous inside. Calyx lobes slightly oblong, 5-8 mm long, densely puberulous inside and on the margins outside. Stamens and

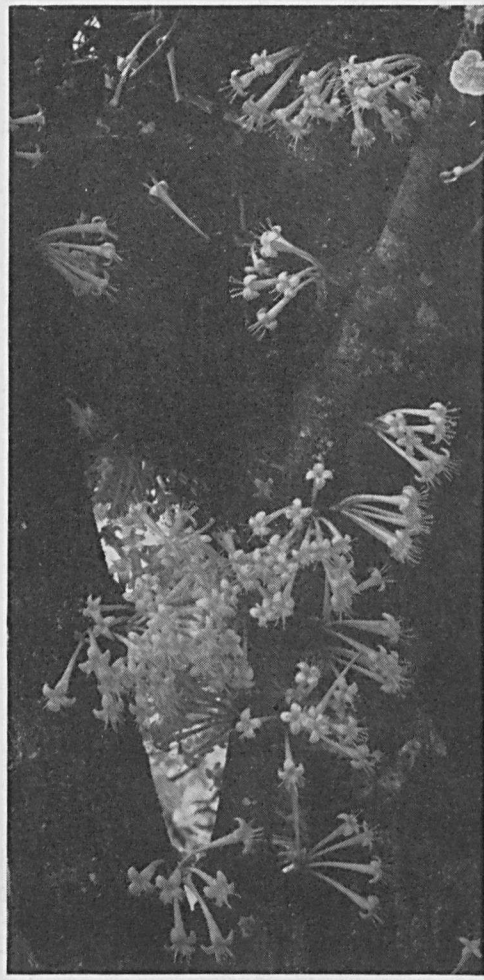


Fig. 8. *Phaleria macrocarpa* (SCHEFF.) BOERL. Kebun Raya Indonesia, Bogor (C.H.B. VIII-G-93).

pistil slightly exerted. Disk cup-shaped, crenate, c. $\frac{3}{4}$ mm long. *Ovary* usually pubescent or puberulous at the apex, rarely glabrescent or glabrous. *Fruits* ellipsoid, acute or acuminate towards both ends, $1\frac{1}{2}$ by 1 cm, rarely the basal part of the endocarp inside with small meshes. *Seeds* ellipsoid, plano-convex, 8 by 5 mm with a caruncle-like appendage, c. $1\frac{1}{2}$ mm long.

Distr. *Malaysia*: New Guinea (Sogere, Kanosia, Koitaki, Boridi, and Hollandia).

Ecol. In forests at low and medium altitudes, sometimes up to 1400 m.

8. *Phaleria macrocarpa* (SCHEFF.) BOERL. Handl. 3 (1900) 111; L. M. PERRY, J. Arn. Arb. 39 (1958) 420, fig. a-b.—*Drimyspermum macrocarpum* SCHEFF. Ann. Bot. Gard. Btzg 1 (1876) 46, as *Drimyspermum*.—*P. octandra* (non (L.) BAILL.)

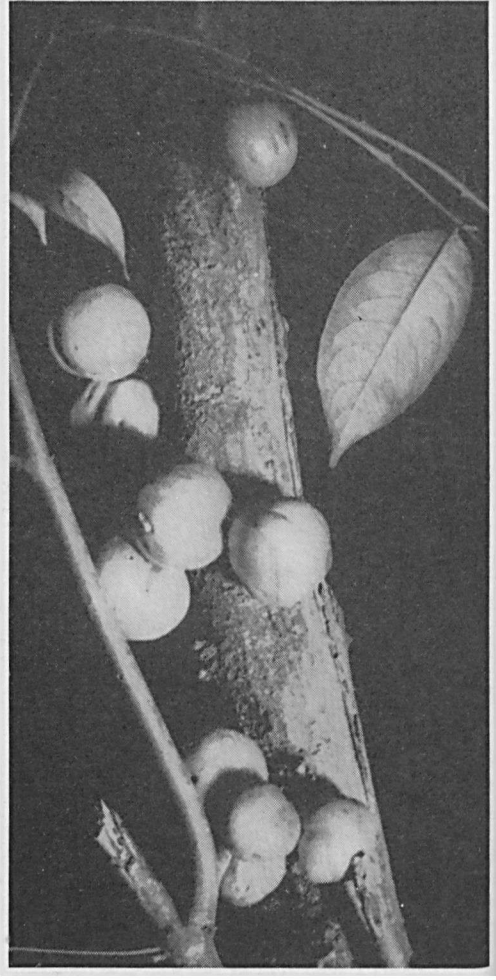


Fig. 9. *Phaleria macrocarpa* (SCHEFF.) BOERL. with its beautiful, glossy, bright-red fruits. Cultivated in Kebun Raya Indonesia, Bogor.

K. SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 93; WARB. Bot. Jahrb. 13 (1891) 337.—*P. papuana* WARB. ex K. SCH. & LAUT. Fl. Schutzgeb. (1900) 460; GILG, Nova Guinea 8 (1910) 411.—*P. sp.* GILG, l.c.—*P. calantha* GILG, l.c.—*P. wichmannii* VAL. Ic. Bog. 4 (1913) 222, t. 371.—Fig. 3j-l, 8-9.

Shrub or small tree, up to 18 m by 15 cm. Young branches hollow. *Leaves* chartaceous to subcoriaceous, glabrous, ovate-oblong, elliptic-oblong, lanceolate, oblong-lanceolate, 10-25 by 3-10 cm; base cuneate or rounded; apex shortly acute to acuminate, acumen up to 2 cm; nerves 6-11 pairs, spreading towards the margins, sometimes their distal end curving upwards and united loop-like, elevated and distinct on both surfaces; veins loosely reticulate, sometimes subperpendicular to the midrib, slightly elevated on both surfaces. *Inflorescences* terminal and in the axils

along the branchlets, sometimes cauliflorous, 1 to 5, rarely more peduncles in each axil; peduncles 0 or up to 2½ cm (cf. bb 25746), each 2-5(-8)-flowered; involucre bracts 4, small, obovate, oblong, caducous, 7 by 2 mm. *Flowers* 1½-4 cm long. Floral tube glabrous on both surfaces, sometimes puberulous and hairy on the inside towards the base. Calyx lobes oblong, 4 by 2 mm, reflexed, densely puberulous inside and on the margins outside. *Stamens* sessile or up to 6 mm exerted. *Ovary* glabrous; style shorter than or as long as the tube or c. 5-10 mm exerted. *Fruits* subglobose to broadly ellipsoid or rounded, sometimes slightly obovate and stipe-like narrowed towards the base, 3-5½ by 3-4½ cm, exocarp woody when dry. *Seed* subglobose or slightly ovate, c. 1½ by 1¼ cm.

Distr. *Malaysia*: common in western New Guinea.

Ecol. Primary and secondary forests, from the lowland up to 550 m, once at 1260 m.

Uses. It is cultivated in Sabron near Hollandia on clay soil at 120 m. The bark is used by the Papuans for making bags (BW 5468).

Vern. *Dalom*, Sentani, *kotteh*, Djair, *matoniek*, Andjai.

Note. *Phaleria macrocarpa* was first described as *Drimysnermum macrocarpum* by SCHEFFER (l.c.) based on fruiting specimens collected by TEYSMANN (7786, L, Bo) near Doré, western New Guinea. These young fruits are ellipsoid or slightly obovoid (15 by 12 mm) and narrowed stipe-like towards the base. This shape is not un-

common and can also be observed in for example bb 25746, BW 5468 from Hollandia, and NGF 7298 from Morobe Distr. The vegetative and morphological characters of the type agree with those of *P. calantha* and *P. wichmannii*.

The type of *P. wichmannii* was collected by ATASRIP (139, Bo, L; cult. in Hort. Bog. under n. VIII. G. 75) in northern Dutch New Guinea; its flowers have a long, exerted style and almost sessile stamens.

The type of *P. calantha* was collected by VERSTEEG (1939, Bo, L. K; cult. in Hort. Bog. under n. VIII. G. 93) at Merauke, southern Dutch New Guinea; its flowers have long filamentous stamens and a style shorter than or as long as the floral tube. The fruits of these two 'species' collected from the cultivated plants mentioned above are very similar, large and fleshy. I assume that the flowers are heteromorphous and these two 'species' represent two forms of one species. Moreover, two other forms have been found, viz one with both stamens and style exerted as represented for example by KLOSS s.n. (13/1 & 16/1, 1912 [1913], BM) and HOGLAND 4520 (Bo, G, L), and another one with short-filamentous stamens and a short style, represented by NGF 9564 (L).

Excluded

Phaleria axillaris ELMER, Leaflet Philip. Bot. 8 (1915) 2840 is according to MERRILL (En. Philip. 3, 1923, 535) = *Tricalysia tinagoensis* ELMER (*Rubiaceae*).

3. ENKLEIA

GRIFF. Calc. J. Nat. Hist. 4 (1844) 234, in note; VAN TIEGH. Bull. Soc. Bot. Fr. 40 (1893) 69; DOMKE, Bibl. Bot. 111 (1934) 121, t.4 f.36n & map 3.—*Linostoma* subg. *Linostoma* KURZ, J. As. Soc. Beng. 39, ii (1870) 83; reimpr. Flora 53 (1870) 372.—*Linostoma* WALL. ex ENDL.: BENTH. & HOOK. f. Gen. Pl. 3 (1883) 197, p.p.—*Macgregorianthus* MERR. Philip. J. Sc. 7 (1912) Bot. 312.—Fig. 10.

Lianas. *Leaves* alternate, sometimes opposite towards the upper part of the branchlets, penninerved with oblique and subparallel cross-bar veins. *Inflorescences* paniculiform, terminal, lax, bearing a few flowers on the top of the ramifications, each of which always bears a few conduplicate or involute, linear, lanceolate or oblong bracts; these bracts are subopposite, opposite or alternate, usually perpendicular to the ramification and sometimes slightly curved upwards when young, the basal two accrescent and leafy in fruit, horizontally spreading or sometimes reflexed, slightly enlarged at their attachment (not enlarged in the extra-Mal. sp.). *Flowers* 5-merous, articulated at the base of the pedicel. Floral tube cylindrical, shortly puberulous outside, glabrous inside. Calyx lobes puberulous on both surfaces. *Petaloid appendages* twice as many as calyx lobes — or the same number and then each bifid —, linear or oblong, membranous, entire or emarginate, inserted at the throat of the tube. *Stamens* included, twice as many as calyx lobes, in two series, the upper series free from the tube and inserted just below the throat, the lower series a little below the upper series, sessile, subsessile or short-filamentous; filaments if present slightly broadening towards the base of the anthers;

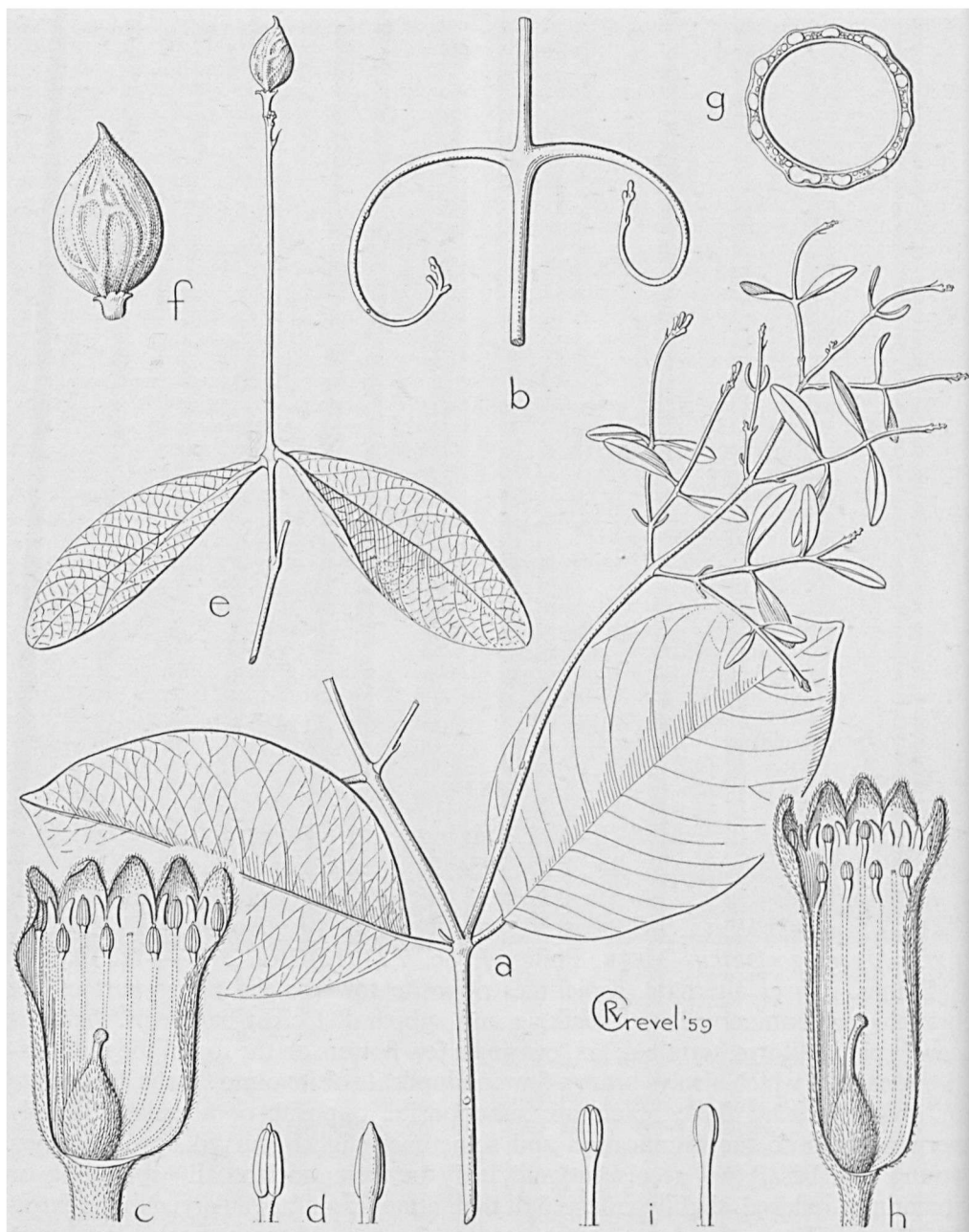


Fig. 10. *Enkleia malaccensis* GRIFF. a. Habit, $\times \frac{2}{3}$, b. part of stem with hook-like branchlets, $\times \frac{2}{3}$, c. opened flower, $\times 6$, d. stamens, $\times 13$, e. infructescence with two leafy bracts, $\times \frac{2}{3}$, f. fruit, $\times 2$, g. cross-section showing structure of pericarp, $\times 4$.—*E. paniculata* (MERR.) HALL. f. h. Opened flower, $\times 6$, i. stamens, $\times 13$ (a KEITH 9234, b MAINGAY 1308/2, c–d HEYNE s.n., e ELMER 20834, f KOSTERMANS 7034, h–i ZIPPELIUS 148*).

anthers linear or oblong, slightly apiculate or obtuse; connectives distinct on the dorsal side and almost as broad as the two locules. Disk none or obscure, sometimes represented by some minute scales. Ovary sessile, ellipsoid or ovoid, densely

hairy; style terminal, distinct; stigma oblong. *Fruits* ovoid or ellipsoid, prominently ribbed and reticulate (in the herbarium), surrounded at the base by the torn remains of the floral tube, with thin exocarp and hard endocarp. *Seed* the same shape as the fruit, testa membranous.

Distr. Species 3, distributed in the Andaman Is., Burma, Siam, Indo-China, and *Malaysia*: Sumatra, Malay Peninsula, Borneo, Philippines, and New Guinea.

Ecol. In lowland forests.

KEY TO THE SPECIES

1. Leaves subcoriaceous to coriaceous, rather dark often red-brown when dry, usually broad-elliptic and bluntish. Floral tube not twisted after anthesis. Stamens sessile or shortly filamentous in the upper series; anther longer than the filament, acute and apiculate at the top. 1. *E. malaccensis*
1. Leaves chartaceous, pale (greenish or light brown) when dry, usually ovate-oblong and rather acutish. Floral tube twisted after anthesis. Stamens distinctly filamentous in the upper series; anther shorter than or as long as the filament, obtuse to truncate at the top 2. *E. paniculata*

1. *Enkleia malaccensis* GRIFF. Calc. J. Nat. Hist. 4 (1844) 235, in note; GILG in E. & P. Pfl. Fam. III, 6a (1894) 231; GAMBLE, J. As. Soc. Beng. 75, ii (1912) 262, *excl. syn.*; HALL, f. Med. Rijksherb. n. 44 (1922) 24; RIDL, Fl. Mal. Pen. 3 (1924) 147; FISCHER, Kew Bull. (1932) 182; BURK. Dict. 1 (1935) 925; LÉANDRI, Rev. Int. Bot. Appl. & Agr. Trop. 29 (1949) 505; Proc. 8th Pac. Sc. Congr. Manila 4 (1957) 585.—*Lasiosiphon scandens* ENDL. Gen. Pl. Suppl. 4, 2 (1847) 67, *nom. illegit.*; MEISN. in DC. Prod. 14 (1857) 598; MIQ. Fl. Ind. Bat. 1, 1 (1858) 881.—*E. malayana* GRIFF. Not. As. 4 (1854) 363.—*Linostoma scandens* KURZ, J. As. Soc. Beng. 39, ii (1870) 83; reimpr. Flora 53 (1870) 371; Hook. f. Fl. Brit. Ind. 5 (1886) 198, *excl. syn.*; BOERL. Handl. 3 (1900) 111; HEYNE. Nutt. Pl. (1927) 1152.—*E. riouwensis* HALL, f. Med. Rijksherb. n. 44 (1922) 25.—*E. coriacea* HALL, f. l.c.—Fig. 10a-g.

Climber up to 30 m by 10 cm. Branchlets sometimes transformed into hook-like organs, reddish brown. Branchlets, inflorescences, and young leaves always ferruginous-pubescent. *Leaves* subcoriaceous to coriaceous, upper surface dull, olivaceous when dry, undersurface usually brownish, or reddish brown, pubescent on both surfaces, sometimes glabrescent; usually broad-elliptic and bluntish, $5\frac{1}{2}$ -14 by 3-7 cm, obtuse or rounded at both ends, rarely short-acute; nerves 12-20 pairs, distinct and plane beneath, visible and impressed above, veins distinct beneath, obscure above; petiole 6-12 mm, pubescent. *Inflorescences* terminal, up to 30 cm long, flowers (4-)6-8(-14) on each ramification; leafy bracts chartaceous, oblong, 4-5 by 1-2 cm. *Flowers* c. 8 mm long, yellowish or whitish, short-pedicelled. Calyx lobes c. 2 mm long, 3 of them larger and ovate, 2 smaller and lanceolate. *Petaloid appendages* 10, linear, c. $\frac{3}{4}$ mm. *Stamens* c. 8 mm, sessile or shortly filamentous. *Pistil* included, c. 3 mm long; ovary c. 2 mm; style short; stigma slightly capitate. *Fruits* ovoid, $1\frac{1}{4}$ by $\frac{1}{2}$ cm.

Distr. Andaman Is., Burma (Tenasserim and Prome, *vide* KURZ), Indo-China (Laos and Cambodia), and *Malaysia*: Sumatra (Palembang), Riouw, Banka, Malay Peninsula (Singapore and Malacca), and Borneo.

Ecol. In lowland forests.

Uses. Said to give an inferior scented 'gaharu' wood (*vide* HEYNE, l.c.). The bast fibers can be used for tying purpose.

Vern. *Akar kareh hitam, akar panas, akar puchong kapur, garu buaja, kapang akar, M, tementak akar, Banka, terap akar, Sum.*; Borneo: *aka dian, Kaya, akar garu, Dusun, tuba-tuba, Bajau.*

2. *Enkleia paniculata* (MERR.) HALL, f. Med. Rijksherb. n. 44 (1922) 26.—*Macgregorianthus paniculatus* MERR. Philip. J. Sc. 7 (1912) Bot. 312; GILG in E. & P. Pfl. Fam. Nachtr. 4 (1915) 212; MERR. En. Philip. 3 (1923) 132.—*E. zippellana* HALL, f. l.c.—Fig. 10h-i.

Climbing shrub. Branchlets puberulous, glabrescent. *Leaves* chartaceous to subcoriaceous, when dry the upper surface light-brown, glabrous and shining, the lower surface somewhat paler, dull, sparsely puberulous, glabrescent; ovate-(rarely elliptic)-oblong, $5\frac{1}{2}$ -11 by 3-5 cm; base acute to obtuse; apex acute to \pm acuminate; nerves 11-15 pairs, slightly ascending towards the cartilaginous margin and united with it, elevated beneath, slightly elevated or plane above; veins slightly elevated beneath, plane or slightly impressed above; petiole 5-8 mm, densely puberulous. *Inflorescences* in the upper axils, up to 28 cm long, densely puberulous; leafy bracts oblong, $2\frac{1}{2}$ -6 by $\frac{3}{4}$ -2 cm. Pedicels 3-5 mm. *Flowers* pale-green, c. 1 cm long. Floral tube cylindrical and distinctly costate inside, c. 8 mm long, densely puberulous outside, glabrous inside, twisted after anthesis. Calyx lobes oblong, c. 2 mm long, densely puberulous outside and on the margins or sometimes the whole surface inside. *Petaloid appendages* oblong, membranous, emarginate or slightly erose at the top, $\frac{1}{3}$ -1 mm long. *Stamens* of the upper series $1\frac{1}{2}$ -2 mm long with filaments as long as or longer than the anthers, those of the lower series c. 1 mm long, sessile or shortly filamentous; anthers c. $\frac{1}{2}$ mm long, obtuse or slightly apiculate. *Ovary* ovoid or ovoid-oblong, c. $2\frac{1}{2}$ mm long, densely pubescent; style filiform, c. $1\frac{1}{2}$ mm; stigma obovoid, papillose. Fruit ovoid, $1\frac{1}{2}$ by 1 cm.

Distr. *Malaysia*: Philippines (Luzon) and western New Guinea.

Ecol. In hill-side forests (Philip.) or lowland rain-forest, 50 m.

Note. According to HALLIER *f. (l.c.)* *E. zippeliana* is similar to *E. paniculata*, but would differ in leaves shortly and sparsely puberulous beneath, with conspicuous and slightly prominent network of veins on both surfaces, branchlets, petioles and panicles minutely rusty (not gray-)tomentose, and

geographic distribution. However, from the two sheets of the type of *E. paniculata* (B.S. 12360, Bo, L) as compared with the type of *E. zippeliana* (ZIPPÉLIUS 148/a, L), it appears that these differences are only quantitative. There are only *young* flowers on the Philippine specimens and the floral characters are similar to those in the New Guinea specimen in the same stage.

4. LINOSTOMA

WALL. [Cat. (1831) no 4203, *nomen*] *ex* ENDL. Gen. Pl. (1837) 331; Suppl. 4, 2 (1847) 67; BENTH. & HOOK. *f.* Gen. Pl. 3 (1883) 197, *p.p.*; DOMKE, Bibl. Bot. 111 (1934) 120, map 3.—*Nectandra* (*non* BERG. 1767) ROXB. [Hort. Beng. (1814)

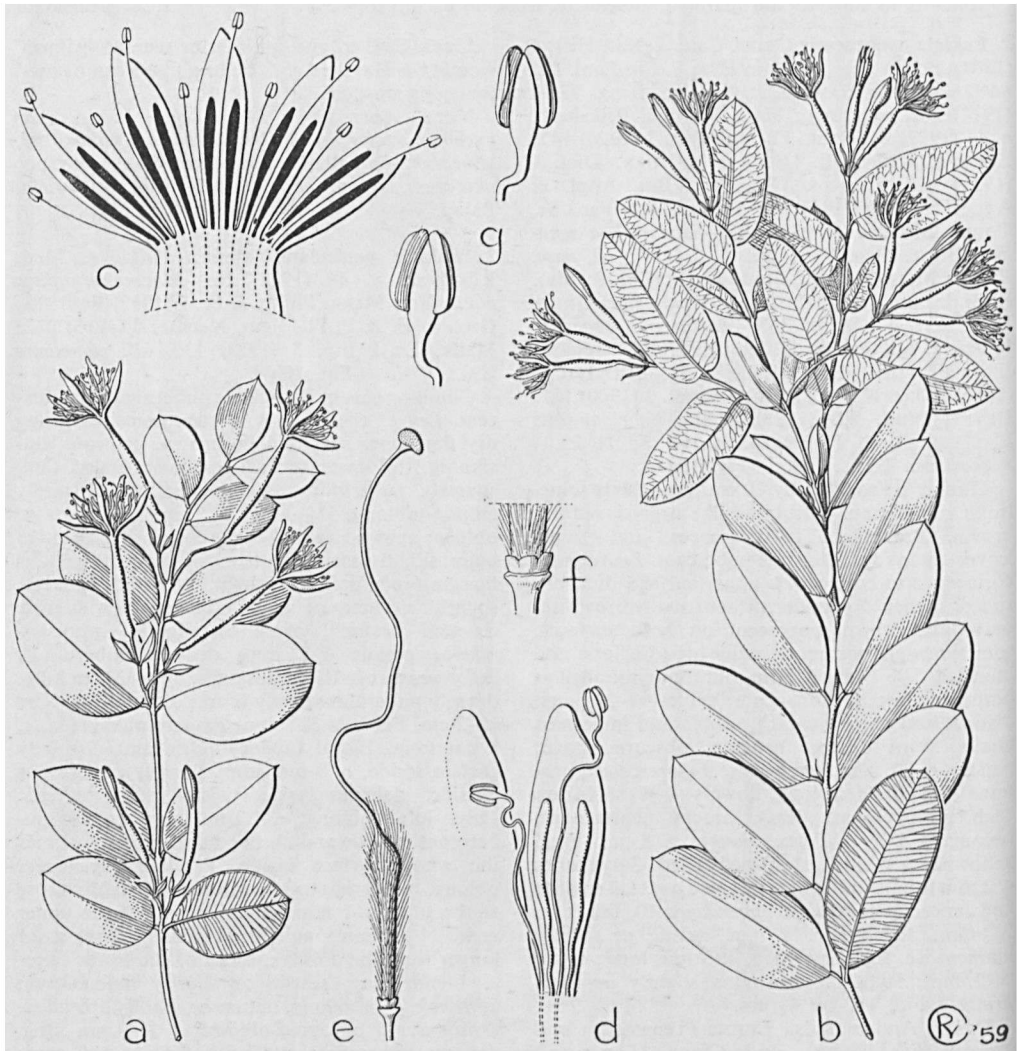


Fig. 11. *Linostoma longiflorum* HALL. *f.* a. Habit, $\times \frac{2}{3}$.—*L. pauciflorum* GRIFF. b. Habit, $\times \frac{2}{3}$, c. upper part of opened flower, schematic, showing positions of stamens and petaloid scales, $\times 3$, d. the same in detail, $\times 4$, e. pistil, $\times 4$, f. disk at base of ovary, $\times 8$, g. stamens, $\times 13$ (a HAVILAND 1759, b-g H. M. BURKILL 240).

(90), *nomen*] Fl. Ind. ed. CAREY 2 (1832) 425, *non* ROLAND. *ex* ROTTB.—*Lino-*
stoma sect. Eulinostoma MEISN. in Mart. Fl. Bras. 5, 1 (1855) 71.—*Psilaea* MIQ.
Sum. (1861) 355.—*Linostoma subg. Nectandra* [(*non* BERG.) ROXB.] KURZ, J. As.
Soc. Beng. 39, ii (1870) 83; reimpr. Flora 53 (1870) 372.—Fig. 11.

Lianas, rarely erect shrubs. *Leaves* opposite or subopposite, glabrous, with fine parallel nerves; margins somewhat reflexed. *Inflorescences* umbelliform or paniculiform, few-flowered, usually on the terminal part of the lateral branchlets, rarely axillary; bracts 2, rarely 3 or 4, discoloured, opposite or alternate. *Flowers* cylindrical, lobes 5, imbricate, then spreading; pedicels articulated at the base. *Petaloid appendages* 10, long club-shaped or filiform, inserted at the throat of the tube. *Stamens* twice as many as the calyx lobes, unequal in length, free from the tube at the throat; filaments long and slender, usually exerted, broadened into the connective; anthers oblong, slightly separated by the connective except at the top. Disk obscure, sometimes just a short toothed ring at the base of the ovary. *Ovary* stipitate, oblong or slightly obovate-oblong, densely hairy; style long, filiform; stigma capitate. *Fruits* ovoid or globose, surrounded by the cleft base of the floral tube; pericarp red, crustaceous. *Seeds* of the same shape as the fruit; testa membranous.

Distr. About 6 *spp.*, distributed in Siam (Chiengmai, Singora, and Dulit), Burma (Tenasserim, Silhet, and Chittagong), southern Indo-China (Annam, Laos, Cochinchina), and *Malaysia*: Malay Peninsula, Sumatra, and Borneo.

Ecol. In primary and secondary forests, once found in swamp forest, from the lowland up to 1300 m.

Taxon. The genus has been subdivided into two sections by HALLIER *f.* (Med. Rijksherb. n. 44, 1922, 27) and the two species in our region both belong to the *sect. Psilaea* (MIQ.) HALL. *f. l.c.* 28.

KEY TO THE SPECIES

1. Bracts leafy, ovate, as large as the ordinary leaves, 23–40 by 14–20 mm, usually opposite or subopposite, covering at least the lower half of the flower. Flowers 2–2½ cm long 1. *L. pauciflorum*
1. Bracts small, lanceolate, much smaller than the ordinary leaves, 10 by 3 mm, alternate or opposite, at most covering the base of the flower. Flowers 3–3½ cm long 2. *L. longiflorum*

.. *Linostoma pauciflorum* GRIFF. Calc. J. Nat. Hist. 4 (1844) 234, in note; GAMBLE, J. As. Soc. Beng. 75, ii (1912) 261; MEISN. in DC. Prod. 14 (1857) 600; MIQ. Fl. Ind. Bat. 1, 1 (1858) 882; KURZ, J. As. Soc. Beng. 39, ii (1870) 83; For. Fl. Burm. 2 (1877) 334; HOOK. *f.* Fl. Br. Ind. 5 (1886) 198; BOERL. Handl. 3 (1900) 107, 111; RIDL. J. Str. Br. R. As. Soc. n. 59 (1911) 164; Fl. Mal. Pen. 3 (1924) 146.—*Psilaea dalbergioides* MIQ. Sum. (1861) 355.—*L. leucodipterum* HALL. *f.* Med. Rijksherb. n. 44 (1922) 28; AIRY SHAW, Kew Bull. (1940) 262.—Fig. 11b–g.

A climber up to 24 m, rarely a shrub or small tree up to 7 m (*cf.* H. M. BURKILL & SHAH 240). Branches long, slender, black when dry. Leaves chartaceous, glabrous, rather glaucous beneath, elliptic, 1½–4(–6) by 1–2(–3½) cm; apex obtuse and mucronate or shortly acute; base acute, cuneate, obtuse, or rounded; petiole *c.* 2 mm. *Inflorescences* terminal or rarely axillary, (1–)2–4 flowered, nodding, umbelliform, provided with 2 opposite or subopposite leafy bracts at the lower half of the peduncle, besides sometimes a small linear bract (5–7 mm long) at the top of the peduncle; leafy bracts usually smaller than but sometimes as large as the ordinary leaves, ovate or oblong-ovate, 2½–4 by 1½–2 cm, whitish when dry,

translucent and with less lateral nerves than the leaves. Peduncles 5–10 mm; pedicels *c.* 7 mm. *Flowers* green to greenish-white. Floral tube slender, slightly narrowed towards both ends, 12–15 mm long, usually glabrous on both surfaces. Calyx lobes linear. *Petaloid appendages* club-shaped or filiform, *c.* 5 mm long. *Stamens* 7–10 mm, usually exerted. *Ovary* including the stipe 4–6 mm long; style 15–18 mm, terminal or slightly sublateral; stigma capitate. *Fruits* ellipsoid, *c.* 1¼ cm long, narrowed to both ends.

Distr. S. Siam (Singora, Dulit), Burma (Tenasserim and E of Tounghoa in the Martaban Hills), and *Malaysia*: Sumatra (Simalur), Malay Peninsula (Perlis, Kedah, Dindings, Penang, and Singapore), and Borneo (W. Borneo).

Ecol. In primary and secondary forests, from the lowland up to *c.* 1300 m.

Vern. *Bëbora*, *kakat bëtul*, *kakrat butu* or *butol*, *përakat bëtul*, *tuba bara*, M.

Use. The Burmese use it medicinally (*cf.* BURK. Dict. 2, 1935, 1352; field note on CURTIS 3197).

2. *Linostoma longiflorum* HALL. *f.* Med. Rijksherb. n. 44 (1922) 29.—Fig. 11a.

A slender climbing shrub. *Leaves* chartaceous, glabrous, dull on both surfaces, ovate, 3–3½ by

1½–2½ cm; apex obtuse and mucronate; base rounded, sometimes shortly acute. *Flowers* solitary or sometimes 2, axillary, or terminal on the short branchlets in the inferior leaf-axils of the branch; peduncle c. 5 mm, provided with 2 small bracts; pedicels c. 7 mm. *Flowers* green. Floral tube slightly ellipsoid, 2–2½ cm long, glabrous outside, sparsely pubescent inside. Calyx lobes

oblanceolate, c. 10 mm long. *Petaloid appendages* 10, club-shaped, c. 6 mm long. *Stamens* c. 10 mm, usually exserted. *Ovary* c. 7 mm long, surrounded at the base by a very short disk; style long filiform, 3½ cm; stigma capitate. *Fruit* unknown.

Distr. *Malaysia*: Borneo (Sarawak).

Ecol. Primary peat-swamp forest, at low altitude (*vide* J. A. R. ANDERSON 9047).

5. WIKSTROEMIA

ENDLICHER, *Prod. Fl. Norfolk.* (1833) 47, as *Wickstroemia*, *nec* SCHRADER 1821 (*Theac.*), *nec* SPRENGEL 1821 (*Comp.*), *nom. gen. cons.*; *Gen. Pl.* (1837) 332, *Suppl.* 4 (1847) 68; DOMKE, *Bibl. Bot.* 111 (1934) 124, t.4 f.36 r & s, map 6, *excl. syn.* *Stellera* L. n. 2.—*Capura* LINNÉ, *Mant. Pl.* 2 (1771) 149, *nom. gen. rejic.*—*Diplomorpha* MEISN. *Denkschr. K. Bayer. Bot. Ges. Regensb.* 3 (1841) 289.—**Fig. 12.**

Shrubs or undershrubs, sometimes trees. *Leaves* opposite or decussate, very rarely ternate, of various texture and shapes. *Inflorescences* terminal and/or axillary, fascicled or solitary, spicate, racemose, umbelliform or capitate, often ebracteate. *Flowers* subsessile or distinctly pedicelled, 4- or 5-merous; pedicel articulated. Floral tube cylindrical or tubular, sometimes slightly funnel-shaped, usually caducous after anthesis, rarely persistent for some time. *Petaloid appendages* O. Calyx lobes usually in two pairs, imbricate, the external ones cucullate and usually slightly longer than the inner ones. *Stamens* sessile or filamentous, twice as many as the lobes, included, in two distinct series, usually both free from the upper half of the tube; anthers oblong, basifixed. Disk membranous, cup-shaped and slightly crenate or dentate, deeply lobed, or free and scale-like. Pistil sessile, rarely short-stiped, included. *Ovary* usually ellipsoid, glabrous or hairy at the top, 1-celled; style terminal, short, distinct or obscure; stigma large, capitate or disciform, rarely cylindrical to ovoid. *Fruits* drupaceous, sometimes surrounded by the dried remains of the floral tube; pericarp fleshy or membranous. Seeds of the same shape as the fruit; embryo with thickened or flattened cotyledons and short or slightly elongated hypocotyl.

Distr. About 70 *spp.*, in SE. Asia, through *Malaysia* to Australia, Fiji, and Polynesia.

Taxon. All Malaysian species belong to *subg. Wikstroemia*.—*Sect. Euwikstroemia* MEISN. in *DC. Prod.* 14 (1857) 543.—*Subg. Euwikstroemia* DOMKE, *Bibl. Bot.* 111 (1934) tab. facing p. 58 (Type species: *W. australis* ENDL.).

Nomencl. In LINNAEUS'S *Sp. Pl.* (1753) Addenda 559, there are two species described under the genus *Stellera*, viz 1. *S. passerina* L. from Europe, and 2. *S. chamaejasme* L. from Siberia. As these two species belong to different genera, the generic typification of *Stellera* L. and its delimitation has caused much controversy and confusion. As far as I could trace, FASANO (*Atti Ac. Sc. Fis. Mat. Napoli* 1787, 1788, 235) has been the first to point out that these two species do not belong to one genus; he proposed a new genus *Ligia* (= *Thymelaea*) typified by *Stellera passerina* L. and left *S. chamaejasme* L. in *Stellera*.

In 1844, C. A. MEYER (*Bull. Ac. Imp. Sc. St. Pétersb.* 1, 1843, 359; reimpr. *Ann. Sc. Nat. Bot.* II, 19, 1843, 49) again clearly indicated *Stellera chamaejasme* L. as the type species of the genus *Stellera*. This has been followed by MEISNER (in *DC. Prod.* 14, 1857, 548), LECOMTE (*Not. Syst.* 3, 1914, 212), STAFF (in *Curtis's Bot. Mag.* 1924, t. 9028), and HITCHCOCK & GREEN (*Proposals by British Botanists* 1929, 150).

DOMKE merged *Stellera* L. with *Wikstroemia*, in transferring its type species, *S. chamaejasme* L., to *Wikstroemia*, retaining the taxon as a separate subgenus *Chamaejasme* [AMMAN] DOMKE (*cf. Notizbl. Berl.-Dahl.* 11, 1932, 362; *Bibl. Bot.* 111, 1934, tab. facing p. 58, and p. 124). Accordingly he made the new combination, *W. chamaejasme* (L.) DOMKE. As REHDER has correctly pointed out (*J. Arn. Arb.* 15, 1934, 106–107) this is against the Rules of Nomenclature, because if *Stellera* and *Wikstroemia* are united for taxonomic reasons, *Stellera* has priority over *Wikstroemia*, unless *Stellera* is proposed as a *nom. gen. rejic.*

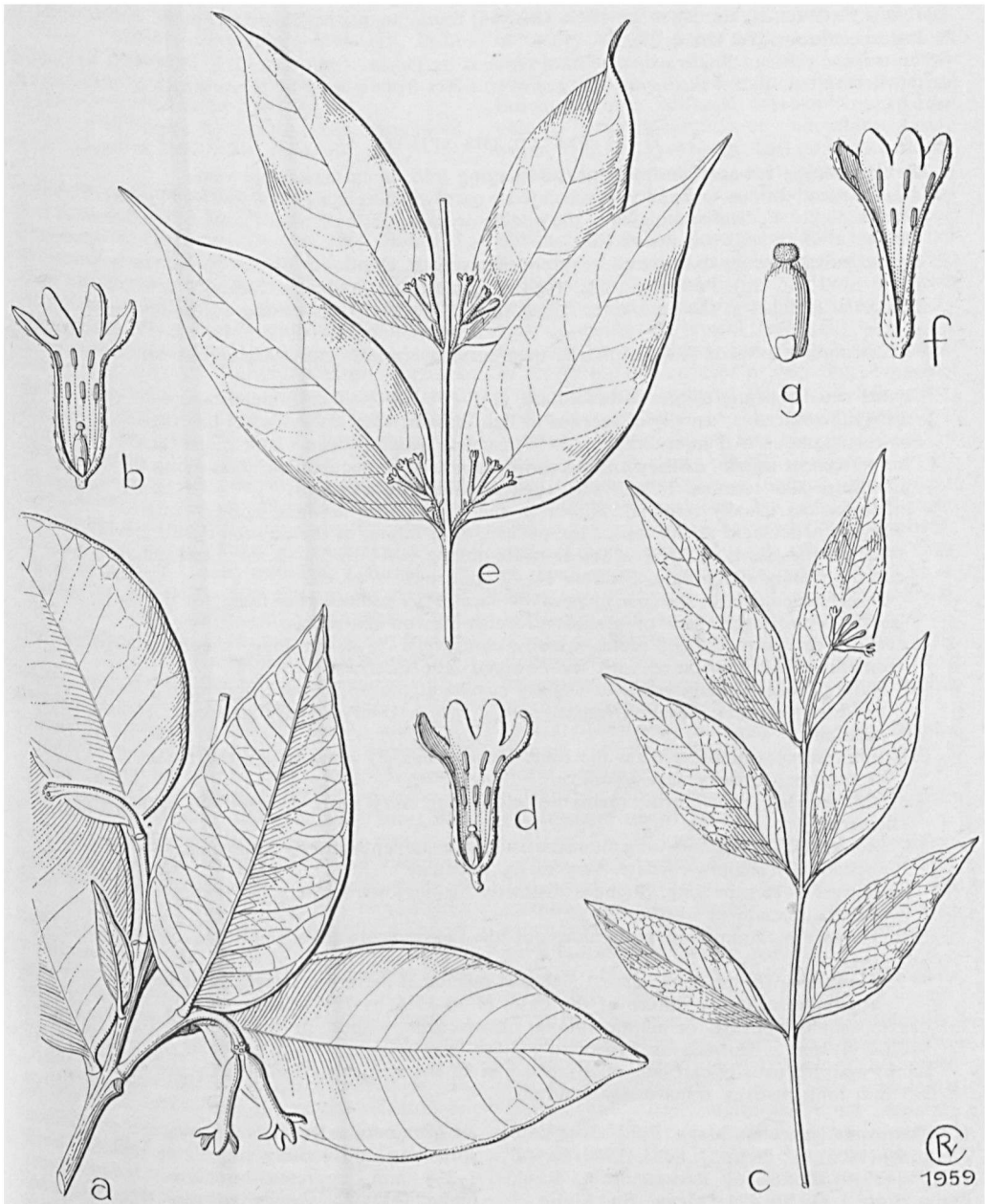


Fig. 12. *Wikstroemia brachyantha* MERR. a. Habit, $\times \frac{2}{3}$, b. opened flower, $\times \frac{4}{3}$.—*W. androsaemifolia* DECNE. c. Habit, $\times \frac{2}{3}$, d. opened flower, $\times 3$.—*W. tenuiramis* MIQ. e. Habit, $\times \frac{2}{3}$, f. opened flower, $\times 3$, g. pistil with scale-like disk at base, $\times 7$ (a-b CLEMENS 32439, c COERT 41, d RANT s.n., e-f For. Dep. N. Borneo 4173).

REHDER (*l.c.*) and POBEDIM (Fl. U.S.S.R. 15, 1949, 502) have, however, retained *Wikstroemia* and *Stellera* as two distinct genera.

If DOMKE's system will be followed, it will be desirable to conserve *Wikstroemia* against *Stellera*. Uses. The bark is used for tying purpose, rope-making, and is also used in the manufacture of bank-notes and other strong papers (*cf.* BROWN, Min. Prod. Philip. For. 1, 1920, 403).

Notes. FAGERLIND (Hereditas 26, 1940, 38 & 48) found an agamogenic clone of *W. indica* which is an intraspecific triploid ($2n = 27$).

The tropical African *Englerodaphne* GILG, reduced by DOMKE (Bibl. Bot. 111, 1934, 134) to *Gnidia*, looks astonishingly like *Wikstroemia* and seems to differ from it only by the presence of petaloid appendages.

KEY TO THE SPECIES

1. Nerves running towards the margin and merging into an intramarginal vein.
2. Leaves membranous to papery, lanceolate to narrow-lanceolate (3–8½ by ½–2½ cm). Peduncle slender, terete. Pedicel articulated at the middle or the upper half, after falling of the flower or fruit leaving a short stalk on the rachis 1. *W. lanceolata*
2. Leaves subcoriaceous to coriaceous, rarely chartaceous, elliptic- or ovate-oblong, rarely lanceolate (5–15 by 2½–5 cm). Peduncle stout, slightly angular and gradually thickened towards the apex. Pedicel articulated at the base, after falling of the flower or fruit leaving a prominent scar on the rachis 2. *W. brachyantha*
1. Nerves running towards the margin and then curving upwards, not merging into an intramarginal vein.
3. Leaves usually ovate, elliptic to lanceolate, (1¾–15½ by ¾–5 cm), membranous to chartaceous, rarely subcoriaceous; usually olivaceous to light-brown; apex always acute to acuminate; margins not cartilaginous. All internodes of the branchlets usually distinct and more than 1 cm long.
4. Inflorescences usually axillary and occurring in *several* subsequent leaf axils along the branchlets, sometimes also terminal in addition. (Leaves rather discoloured). 3. *W. tenuiramis*
4. Inflorescences usually terminal, and/or in the axils of the terminal node.
5. Flowers articulated at the top of the pedicel, after falling of the flower or fruit leaving a short stalk on the rachis. (Leaves ovate or ovate-oblong, 4–14 by 3½–5 cm; base usually obtuse or cuneate, rarely subcordate. Flowers 1¼–2 cm long) 4. *W. ovata*
5. Flowers articulated at the base or near the base of the pedicel, after falling of the flower or fruit leaving a prominent scar or a short protuberance on the rachis.
6. Inflorescences racemose; rachis usually elongating, ½–4 cm long, usually many-flowered, sometimes also associated with few-flowered inflorescences.
7. Inflorescences usually erect, or slightly curved at the upper part, very rarely nodding from the base. Flowers loosely arranged on the rachis. Ovary usually glabrous. Anthers usually apiculate. 5. *W. polyantha*
7. Inflorescences nodding from the base. Flowers densely arranged on the rachis. Ovary hairy at the top. Anthers usually obtuse 6. *W. venosa*
6. Inflorescences umbelliform; rachis not elongating, very short or less than ½ cm long, few-flowered.
8. Flowers (15–)18–22 mm long. Stamens usually sessile; anthers 1½–2 mm long. Leaf base obtuse, occasionally shallow-cordate, very rarely attenuate 7. *W. meyeniana*
8. Flowers 9–15 mm long. Stamens distinctly filamentous; anthers 1–1½ mm long. Leaf base acute, attenuate or obtuse.
9. Flowers 9–12 mm long, puberulous outside. Leaves acute at both ends, 1¾–5½(–8) by ¾–2½(–4) cm 8. *W. androsaemifolia*
9. Flowers c. 15 mm long, almost glabrous outside at maturity. Leaves acuminate at the apex, attenuate, acute or obtuse at the base, (4–)6–15½ by (2½–)3–5 cm 9. *W. ridleyi*
3. Leaves usually obovate- or elliptic-oblong, oblanceolate, elliptic, or rarely ovate, 1¼–4½(–7) by ½–2(–3½) cm, subcoriaceous, brown to reddish-brown; apex usually rounded or obtuse, rarely acute; margins usually cartilaginous; internodes of the branchlets usually obscure or very short, 2–5 mm long (usually transversely fissured). 10. *W. indica*

1. *Wikstroemia lanceolata* MERR. Publ. Govt Lab. Philip. 29 (1905) 31; Philip. J. Sc. 1 (1906) Suppl. 101; 5 (1910) Bot. 366; BROWN, Min. Prod. Philip. For. 1 (1920) 404; MERR. En. Philip. 3 (1923) 133.—*W. angustissima* MERR. Philip. J. Sc. 7 (1912) Bot. 92; En. Philip. 3 (1923) 132.

An undershrub up to 4 m. Young branchlets densely appressed-pubescent and glabrescent. Leaves membranous to papery, glabrous, rarely sparsely pubescent on the midrib beneath, lanceolate to narrowly lanceolate, 3–8½ by ½–2½ cm; base obtuse; apex acuminate; nerves 10–16 pairs, sometimes branched and irregular, slightly elevated beneath, visible or obscure above, obliquely spreading to the margins and united into

an intramarginal vein; veins obscure or distinctly spreading and loosely reticulate; petiole short, 1–2½ mm, appressed-hirtellous. Inflorescences umbelliform to shortly spicate, terminal, very rarely axillary; peduncles very short, sometimes up to 1½ cm, (1–)3–5(–20)-flowered; pedicels c. 1–1½ mm, appressed-hirtellous. Flowers green or yellowish-green, 6–15 mm long, puberulous, glabrescent outside. Calyx lobes ovate or oblong, obtuse, c. 1 mm long. Stamens sessile or short-filamentous, c. ¾–1½ mm long. Disk 2 free scales, linear or slightly oblong. Ovary ovoid, slightly hairy at the apex; style obscure; stigma subglobose. Fruits short-ovoid, c. 8 by 5 mm, usually glabrous sometimes sparsely hairy at the top.

pericarp fleshy. *Seeds* 6 mm long.

Distr. *Malaysia*: Philippines (Palawan, Mindoro, and Luzon).

Ecol. Common on forested slopes at low and medium altitudes up to 1300 m.

Vern. Philippines: *karanpinig*, Neg., *maragawa*, *salágip*, *salagó*, Tag., *suka*, *tuka*, Ilk.

4. *Wikstroemia brachyantha* MERR. Philip. J. Sc. 13 (1918) Bot. 313; En. Philip. 3 (1923) 132.—*W. crassifolia* MERR. ex DOMKE, Bibl. Bot. 111 (1934) tab. facing p. 58.—Fig. 12a–b.

Shrub or small tree up to 3½ m by 2½ cm. Branchlets puberulous, light brown. Branches reddish-brown and usually transversally fissured. *Leaves* subcoriaceous to coriaceous, rarely chartaceous, in dry condition both surfaces olivaceous-brown to brownish, glabrous and shining, elliptic-oblong to ovate-oblong, rarely lanceolate, 5–15 by 2½–5 cm; base obtuse to cuneate; apex acuminate; nerves 12–15 pairs, elevated and prominent beneath, slightly elevated or plane above, obliquely spreading towards the margin and united with the intramarginal vein; veins anastomosing, almost as prominent as the nerves; petiole 2–3 mm, glabrous. *Inflorescences* terminal or/and in the leaf axils at the terminal node, distinctly peduncled; peduncles stout, brownish-pubescent, sometimes angular or flattened and gradually thickening towards the top, usually bent slightly downward, sometimes with 1 or 2 bracts below the 6 to 8 apical flowers. *Flowers* yellowish, yellowish-green or green, subsessile. Floral tube 10–12 mm long, sparsely puberulous outside, glabrous inside. Calyx lobes 4, ovate-oblong, 1½–3 mm long, obtuse. Two series of *stamens* close to each other, on very short filaments; anthers oblong, obtuse, 1½ mm long. Disk 2 free, oblong, 2-lobed scales. *Ovary* ellipsoid or slightly obovoid-oblong, 3 mm long, hairy at the top; style distinct, filiform, c. 1 mm; stigma globose, papillose. *Fruits* red, broadly ellipsoid, 12 by 9 mm.

Distr. *Malaysia*: Borneo (Kinabalu) and Philippines (Luzon and Catanduanes).

Ecol. In the Philippines in primary forests at low and medium altitudes, in Borneo (Mt Kinabalu) in damp and mossy forests at 1400–2800 m.

Note. This species is characterized by its usually thick leaves with prominent venation especially on the lower surface, a marginal vein on each side, and the stout peduncle.

3. *Wikstroemia tenuiramis* MIQ. Sum. (1861) 141 & 354; BOORSMA, Bull. Dép. Agric. I.N. n. 7 (1907) 19; HEYNE, Nutt. Pl. (1927) 1152; BURK. Dict. (1935) 2258.—*W. acuminata* MERR. J. Str. Br. R. As. Soc. n. 76 (1917) 99; En. Born. (1921) 417; Un. Cal. Publ. Bot. 12 (1929) 218.—*W. clementis* MERR. J. Str. Br. R. As. Soc. n. 76 (1917) 99; En. Born. (1921) 417; HEINE, Pfl. Clemens Kinabalu (1953) 69.—Fig. 12e–g.

Shrub or small tree, up to 10 m. Branchlets light-brown to dark-brown, sparsely pubescent, glabrescent. Branches smooth, reddish-brown,

glabrous. *Leaves* membranous to papery, glabrous, in the dry state the upper surface subolivaceous or light-brown, rather shining, lower surface dirty-white or light-green, rather dull, sometimes light-brown on both surfaces, ovate-oblong, elliptic-oblong, broadly-elliptic, or lanceolate, rarely ovate, 6–12 by 1½–4½ cm; base cuneate, acute or obtuse; apex acuminate, the acumen up to c. 1 cm; nerves 7–12 pairs, rather irregular, slightly elevated, rarely indistinct on both surfaces, obliquely ascending close towards the margin and then curved upward; veins loosely anastomosing, reticulations usually obscure on both surfaces; petiole c. 4 mm. *Inflorescences* usually axillary and occurring in several leaf axils along the branches or branchlets, sometimes also terminal or on the top of a reduced or very short branchlet with bract-like reduced leaves, 1–5-flowered; peduncle very short to 1½ cm, appressed-puberulous. *Flowers* 10–13 mm long, yellowish, or cream (*vide* CLEMENS 20980), subsessile. Floral tube scattered-puberulous outside, glabrescent. Calyx lobes ovate-oblong, 2–3 mm long. *Stamens* with c. ½ mm space between the two whorls, those of the upper series sessile or sometimes some of them shortly filamentous, those of the lower series always shortly filamentous; anthers linear, 1–1½ mm long, acute or slightly apiculate. *Ovary* oblong or slightly obovoid-oblong, c. 2 mm long, glabrous or a few hairs at the top; style very short or sessile; stigma capitate, papillose. *Fruits* yellow, green or orange, ovoid, c. 8 by 5 mm.

Distr. *Malaysia*: Sumatra (Menggala), Banka, Borneo (N. Borneo, Brunei, Sarawak, and S. Borneo: Sampit).

Ecol. In forests, swampy land, and hills, from the lowland up to 1600 m.

Uses. According to BOORSMA (*l.c.*) it provides a scented wood which is used only occasionally. The wood is harder than that of *Aquilaria* and scentless, but when burned it gives forth a fragrance similar to that of *Aloe*-wood. In Banka the bark is used for making ropes.

Vern. *Injat*, Brunei, *kaju lingau*, *Menggala*, *mënamëng*, *tëmëntak tindat*, Banka.

Note. This species can easily be distinguished from related ones by the axillary inflorescences which occur in several leaf axils along the branchlets or branches, the more or less discoloured leaves, and the usually indistinct venation.

Mrs CLEMENS once noted this species to be a vine (*n.* 31292) but I believe this to be due to erroneous information by her native collectors.

4. *Wikstroemia ovata* C. A. MEY. [Bull. Ac. Imp. Sc. St. Pétersb. Cl. Ph.—M. 1 (1843) 357; reimpr. Ann. Sc. Nat. Bot. II, 20 (1843) 50, *nomen*] ex MEISN. in DC. Proc. Bot. 14 (1857) 544; MIQ. Fl. Ind. Bat. 1, 1 (1858) 880; F.—VILL. Nov. App. (1880) 182; VIDAL, Phan. Cuming. (1885) 140; Rev. Pl. Vasc. Filip. (1886) 230, *excl. syn. Daphne aquilaria* BLANCO; MERR. Philip. J. Sc. 1 (1906) Suppl. 101; Sp. Blanc. (1918) 279; BROWN, Min. Prod. Philip. For. 1 (1920) 404; MERR. En. Philip. 3 (1923) 133, *excl. citation of VIDAL*, Synopsis; QUIS. Med. Pl.

Philip. (1951) 637.—*Daphne indica* (non LINNÉ) BLANCO, Fl. Filip. (1837) 309, ed. 2 (1845) 215, ed. 3, 2 (1878) 38.—*Daphne foetida* (non LINNÉ) BLANCO, l.c. 308, as *phaetida*, ll. cc. 217, 37.

Shrub up to 5 m by 7–8 cm. Young branchlets appressed-hirtellous, glabrescent or glabrous. *Leaves* membranous or papery, glabrous, rarely sparsely pubescent on the midrib beneath; ovate to ovate-oblong, 4–14 by 3½–5 cm; base usually obtuse or cuneate, rarely subcordate; apex acuminate; nerves 8–12 pairs, curved and ascending, slightly elevated below, distinct above; veins reticulate, distinct beneath, visible or obscure above, petiole 3 mm, sparsely appressed-hirtellous. *Inflorescences* terminal, short-spicate or umbelliform, peduncled, sparsely puberulous, sometimes with 1 or 2 caducous bracts, 7–20-flowered. *Flowers* 1¼–2 cm long, greenish, yellowish, at the upper end of the peduncle, short-pedicelled. Floral tube cylindrical, sparsely puberulous outside. Calyx lobes oblong, obtuse, 2–4 mm long. *Stamens* sessile or on short filaments; anthers 1–1½ mm, slightly apiculate. Disk 2 free, oblong, scales. *Ovary* ellipsoid, 2–3 mm long, hairy at the apex; style distinct, filiform, ¾–1¼ mm; stigma capitate. *Fruits* subglobose to slightly ellipsoid, 8–10 by 6–8 mm.

Distr. *Malaysia*: Borneo (North Borneo, Sebattik I., Sampit, and Pulu Lampei) and the Philippines (Palawan, Mindoro, Luzon, Negros, and Mindanao). Fig. 13.

Ecol. In thickets, primary and secondary forests at low and medium altitudes up to 800 m.

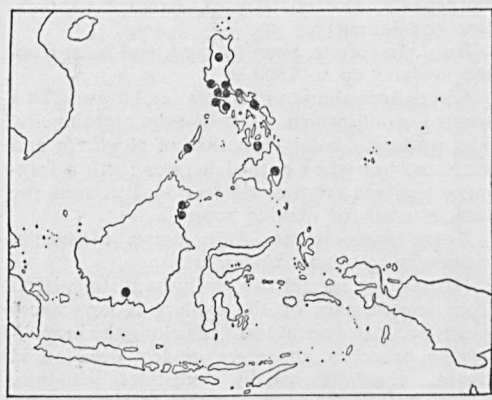


Fig. 13. Localities of *Wikstroemia ovata* C. A. MEY. ex MEISN.

Uses. This plant has been used by the Filipinos as a purgative. The leaves are a strong purgative when chewed and swallowed and one bowel movement is produced for every taken. The fresh bark or branches of this plant are tied round about the neck of a patient to relieve bronchial catarrh (cf. GARCIA, Philip. J. Sc. 51, 1933, 485–494; QUIS. l.c.).

Vern. Philippines: *arandón*, *ilk*, *dapnit*, *suka*, *Bon.*, *salagó*, Tag.; Borneo: *gélam hutan*, Brunei, *pait-pait*, Bajau.

5. *Wikstroemia polyantha* MERR. Philip. J. Sc. 10 (1915) Bot. 332; En. Philip. 3 (1923) 133.—*W. candolleana* (non MEISN.) RIDL. Trans. Linn. Soc. Bot. II, 3 (1893) 341, as *candollei*, corr. p. 456; J. Str. Br. R. As. Soc. n. 35 (1901) 180; Fl. Mal. Pen. 3 (1924) 145; BURK. & HEND. Gard. Bull. S.S. 3 (1925) 417; HEYNE, Nutt. Pl. (1927) 1152; BURK. Dict. (1935) 2258; SYMINGTON. J. Mal. Br. R. As. Soc. 14 (1936) 358.—*W. junghuhnii* (non MIQ.) K. & V. Bijdr. 13 (1914) 58, *sphalm. junghuhniana*.—*W. ridleyi* (non GAMBLE) GIBBS, J. Linn. Soc. Bot. 42 (1914) 132; MERR. En. Born. (1921) 417.—*W. calva* BACK. Blumea 5 (1945) 494.

Shrub or small tree up to 7 m by 7½ cm. Branchlets reddish to dark-brown, sparsely puberulous, glabrescent. *Leaves* membranous, chartaceous, rarely subcoriaceous, glabrous on both surfaces, rarely scattered hairy beneath especially on the midrib, in dry condition light-brown to dark-brown above, paler beneath, ovate-oblong, elliptic-oblong, or lanceolate, 6–9(–12) by 1½–3½ (–4½) cm; base acute to cuneate, sometimes obtuse or rounded; apex acuminate, rarely acute; margins sometimes slightly recurved; nerves 8–15 pairs, irregular, often branched, elevated beneath, distinct or plane above, obliquely ascending towards the margin; veins obscure on both surfaces, sometimes as distinct as the nerves; petiole 2–4 mm, sparsely pubescent. *Inflorescences* terminal or/and in the axils at the terminal node, spicate, gradually elongating, up to 4 cm, rarely to 6 cm, erect or slightly curved, very rarely nodding (S.F. 20726), with 6 to many flowers; peduncle distinct, sparsely hairy. *Flowers* c. 10 mm long, yellow, yellowish-green, or rarely white (fide RIDLEY), loosely arranged on the rachis; pedicels very short, ½–1 mm, puberulous, articulated at the base. Floral tube scattered puberulous outside, glabrous inside. Calyx lobes oblong or ovate-oblong, 1½–3½ mm long. *Anthers* linear, c. 1 mm long, the two series close to each other; filaments c. ½ the length of the anther. Disk 2 free, linear or obovate-oblong, c. 1 mm long, irregularly lobed or dentate scales. *Ovary* ellipsoid or obovoid, 1½–2½ mm long, glabrous or sparsely hairy at the top; style distinct, as long as or slightly longer than the stigma; globose or slightly oblong, c. ½ mm long, papillose. *Fruits* ovoid, red, c. 8½ by 5½ mm.

Distr. *Malaysia*: Malay Peninsula (Pahang, Kedah, Perak, Johore, Kelantan, Selangor, and Gunong Korbu), Java (western part), North Borneo, and Philippines (Luzon).

Ecol. In forests, from the lowland up to 2200 m. Use. The wood yields incense.

Vern. *Chandan pèlaudok*, M.

Notes. BACKER (l.c.) has pointed out that the name "*Wikstroemia junghuhniana*" (non MIQ.) given by KOORDERS & VALETON (l.c.) was an error because they intended to identify their specimen (KOORDERS 26824 β and J. J. SMITH 292, Bo) as *W. junghuhnii* MIQ. (= *W. androsaemifolia* DECNE). The sheets cited by KOORDERS & VALETON under "*W. junghuhniana*" as mentioned above differ from *W. junghuhnii* MIQ. and belong to

different species; therefore, BACKER provided them with a new name "*Wikstroemia calva*" to indicate the 'completely glabrous ovary tip'. However, whether the ovary is glabrous or hairy at the apex is not a constant character as some specimens (e.g. VAN STEENIS 4187 & 12930) have both kinds of ovaries. Specimens collected at high altitude have thicker and reddish-brown leaves.

The species is characterized by the long-spicate inflorescences which are gradually elongating during flowering time. It is closely related to *W. nutans* CHAMP. from Kwangtung, China, differing from it by the larger leaves, distinct style, and the approximate insertion of the two whorls of stamens.

The inflorescences are erect or slightly curved with the exception of one specimen (S.F. 20726) collected in Pahang at c. 2100 m, which has both erect and nodding ones.

6. *Wikstroemia venosa* MERR. & PERRY, J. Arn. Arb. 22 (1941) 266.

Shrub, c. 1 m. Young branchlets densely yellowish-brown puberulous; older ones reddish- or dark-brown, puberulous, glabrescent. *Leaves* chartaceous or subcoriaceous, lower surface of the young leaves densely pubescent on the midrib and scattered pubescent on the lamina, glabrescent; in dry condition light brown or brown above and shining, glaucous beneath; ovate-oblong to lanceolate, 2-7 by 1-3 cm; base obtuse or cuneate; apex acute to acuminate; nerves 7-10 pairs, rather irregular, obliquely spreading towards the margin and then slightly curved ascending, elevated beneath, plane or slightly depressed above; petiole c. 2 mm long, puberulous. *Inflorescences* terminal, nodding, sessile or up to 1 cm peduncled; spicate, rachis elongated, 1/2-2 cm, puberulous. *Flowers* crowded, c. 8 mm, green; pedicel c. 1 mm, articulated at the base, puberulous. Floral tube scattered-puberulous outside and glabrous inside, sometimes glabrous outside. Calyx lobes oblong or ovate-oblong, 2-2 1/2 mm long. *Stamens* shortly filamentous; anthers linear, c. 1 mm long, obtuse, the space between the two series c. 3/4 mm. Disk 2 free linear scales, bilobed at the top, sometimes disk cup-shaped and arose at the top, 1/2-1 mm long. *Ovary* slightly obovate-oblong, c. 1 1/2 mm long, sparsely strigose at the top; style short, c. 1/4 mm; stigma capitate. *Fruits* ellipsoid, 6-8 mm long, slightly narrowed at both ends. *Seed* similar in shape to the fruit.

Distr. *Malaysia*: New Guinea (Balim Valley, Manokwari, Humboldt Bay, Hollandia, and Rona (Central Div.)).

Ecol. Deforested slopes, grassland, occasionally on grassy banks of streams, lowland up to 1900 m.

7. *Wikstroemia meyeniana* WARB. in Perk. Fragm. Fl. Philip. (1905) 171; MERR. Philip. J. Sc. 1 (1904) Suppl. 101; BROWN, Min. Prod. Philip. For. 1 (1920) 404, t. 23; MERR. En. Philip. 3 (1923) 133. —*Daphne cannabina* (non LOUR.) SCHAUER, Nov. Act. Caes. Leop.-Car. 19 (1843) Suppl. 1, 411. —*W. longifolia* LECOMTE, Not. Syst. 3 (1914) 128;

Fl. Gén. I.-C. 5 (1915) 167; LÉANDRI, Proc. 8th Pac. Sc. Congr. 4 Bot. (1957) 582, incl. var.—*W. fenicis* MERR. Philip. J. Sc. 13 (1918) Bot. 312; En. Philip. 3 (1923) 132.

Shrub up to 3 m. Young branchlets sparsely pubescent, glabrescent, sometimes glabrous. *Leaves* papery, glabrous, olivaceous, shining, lanceolate rarely elliptic-lanceolate, (5-)9 1/2-13 by (1 1/2-) 3 1/2-4 1/2 cm; base obtuse occasionally shallow-cordate or attenuate; apex acuminate; nerves 9-14 pairs, slightly curved and ascending, elevated beneath, visible or obscure above, veins reticulate, slightly elevated beneath, obscure above; petiole 3-4 mm. *Inflorescences* terminal and axillary, umbelliform, sometimes occurring on short, reduced branchlets associated with reduced leaves (2-3 cm long) and resembling a leafy panicle, (2-)5-6 (-10)-flowered; peduncle up to 3 cm, densely appressed-hirtellous. *Flowers* greenish-yellow, (15-) 18-22 mm long, densely puberulous outside. Floral tube cylindrical. Calyx lobes narrow-oblong, 2-3 1/2 mm long. *Stamens* usually sessile rarely some of them on short filaments, 1 1/2-2 mm long. Disk 2 free, oblong scales. *Ovary* slightly obovoid, 2-2 1/2 mm long, hairy at the apex; style distinct, 1/2-1 mm long; stigma oblong, 1/3-1/2 mm long. *Fruit* ovoid, c. 8 by 6 mm.

Distr. Indo-China and *Malaysia*: Philippines (Luzon to Mindanao).

Ecol. In primary humid forests at low and medium altitudes, up to c. 400 m.

Vern. Philippines: *sagú*, Tag., *salagó*, Bik., Tag.

8. *Wikstroemia androsaemifolia* DECNE, Ann. Sc. Nat. Bot. II, 20 (1843) 50; in Jacq. Voy. Bot. (1844) 146; BLEEKER, Nat. Geneesk. Arch. N.I. 2 (1845) 74; MEISN. in DC. Prod. 14 (1857) 546; MIQ. Fl. Ind. Bat. 1, 1 (1858) 879; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 77, p. 5.—*W. spanoghii* DECNE, Ann. Sc. Nat. Bot. II, 20 (1843) 50; in Jacq. Voy. Bot. (1844) 146; BLEEKER, Nat. Geneesk. Arch. N.I. 2 (1845) 74; MEISN. in DC. Prod. 14 (1857) 545; MIQ. Fl. Ind. Bat. 1, 1 (1858) 879.—*Eriosolena viridiflora* ZOLL. & MOR. Nat. Geneesk. Arch. N.I. 1 (1844) 615, excl. syn. Hassk. Cat. 117; ZOLL. Syst. Verz. 2 (1854) 116.—*W. candolleana* MEISN. in DC. Prod. 14 (1857) 544; K. & V. Bijdr. 13 (1914) 56; MIQ. Fl. Ind. Bat. 1, 1 (1858) 878; HALL. f. Med. Rijksherb. n. 12 (1912) 26; K. & V. Bijdr. 13 (1914) 56; HEYNE, Nutt. Pl. (1927) 1152; BURK. Dict. 2 (1935) 2258.—*W. junghuhnii* MIQ. Fl. Ind. Bat. 1, 1 (1858) 879; HALL. f. Med. Rijksherb. n. 44 (1922) 30.—Fig. 12c-d.

Shrub up to 2 1/2 m by 4 cm. Young branchlets slightly flattened at the nodes, densely appressed-pubescent, glabrescent. Branches terete, reddish-brown, glabrous; axillary buds densely covered with golden-coloured hairs. *Leaves* papery, glabrous, rarely sparsely hairy on the lower surface and especially on the nerves and veins of young leaves, in dry state light-greenish, light-brown or greenish-brown to brownish and shining on the upper surface; pale-greenish, light-yellowish-green or light-brown and dull on the under-

surface; elliptic, elliptic- or ovate-oblong, rarely broadly elliptic, $1\frac{3}{4}$ - $5\frac{1}{2}$ (-8) by $\frac{3}{4}$ - $2\frac{1}{2}$ (-4) cm; base acute; apex acute to narrow-acute, very rarely obtuse; nerves 8-11 pairs, elevated below and slightly depressed above, obliquely spreading towards the margin and then curved upward; veins almost as distinct as the nerves, loosely reticulate beneath, obscure above; petiole c. 2 mm. *Inflorescences* umbelliform or spicate, 5-10-flowered, terminal and in the axils of the terminal node, so usually 3 inflorescences at the top of the branchlet, of which usually the middle one (sometimes also the lateral ones) is provided with a pair of bracts or reduced leaves; peduncle obscure to $3\frac{1}{2}$ cm, erect or slightly curved; pedicels c. 1 mm, articulated at the base. *Flowers* light-green or yellowish-green. Floral tube slightly pubescent outside, 9-12 mm long. Calyx lobes oblong, or slightly ovate, fleshy, 2- $3\frac{1}{2}$ mm long, obtuse. Disk 2, rarely 3 free, linear scales. *Stamens* filamentous; anther c. 1 mm long, obtuse, the space between the anthers of upper and lower series 1- $1\frac{1}{2}$ mm. *Ovary* ellipsoid or slightly obovoid, $1\frac{1}{2}$ - $2\frac{1}{2}$ mm long, pilose at the top, sometimes glabrescent; style obscure to 1 mm long; stigma globose, c. $\frac{1}{4}$ mm in diam. *Fruits* red, oblong, rounded.

Distr. *Malaysia*: Central and East Java, Madura, Kangean Arch., Lesser Sunda Islands (Flores and Timor), Borneo (North Borneo, Koetai and Balikpapan), Celebes (Bonthain, Manado, and G. Pangararan), and W. New Guinea.

Ecol. In lowland forests from near the beach up to 1800 m, in Celebes at 2200-2400 m.

Note. There are two authentic sheets of *W. androsaemifolia* in the Nat. Hist. Mus., Paris; one is labelled as 'Java Leschenault' and the other as 'Daphne n. 341'. Apparently these specimens may belong to one collection, as they are very similar. The leaves are papery and rather discoloured, brownish above, light-brown beneath, and not larger than 6 by $2\frac{1}{2}$ cm. The flowers are about 10 mm long, sessile, and fascicled or crowded on a short peduncle (c. 10 mm). The ovary is sparsely hairy or glabrous at the top.

The type of *W. spanoghii* was collected by SPANOGHE (s.n., L) in Timor. Its leaves are rather membranous, pale-greenish beneath, light-greenish above, and the size is up to 8 by $2\frac{1}{2}$ cm. It has longer, spicate inflorescences and the longest peduncle is c. $2\frac{1}{2}$ cm. The ovary is densely hairy at the top, and the style is obscure.

When one compares the type specimens of these two species they do not seem to be conspecific. However, after examining a large range of specimens, there are too many intermediate forms in which the differential characters break down. Consequently I have interpreted them as forms of one variable species.

The type specimen of *W. junghuhnii* MIQ. collected by JUNGHUHN (s.n., L) on Mt Ungaran (Central Java) and some specimens (e.g. KOORDERS 43148 β , 43875 β , 43876 β , and VAN STEENIS 17974) collected on mountains between 1100-

1800 m have leaves with distinct, densely reticulated venation, and flowers with distinct peduncles and short styles.

HANDEL-MAZZETTI described a different species from Yunnan, China, as *W. androsaemifolia* in 1923. If this proves to be a good species it must be renamed.

9. *Wikstroemia ridleyi* GAMBLE, Kew Bull. (1912) 200; J. As. Soc. Beng. 75, ii (1912) 260; RIDL. Fl. Mal. Pen. 3 (1924) 146, f. 147; BURK. Dict. (1935) 2258.

Shrub up to 2 m. Branchlets reddish-brown, sparsely puberulous and glabrescent. *Leaves* membranous to chartaceous, usually olive-brown when dry, glabrous on both surfaces, rarely sparsely puberulous on the midrib beneath, elliptic-oblong, lanceolate, ovate-oblong or ovate, 4- $15\frac{1}{2}$ by $2\frac{1}{2}$ - $4\frac{1}{2}$ cm; base attenuate, acute or obtuse; apex acuminate; nerves 7-12 pairs, slightly curved towards the margin and then upward, slightly elevated on both surfaces; veins obscure on both surfaces; petiole 2-3 mm, sparsely puberulous when young. *Flowers* c. 15 mm long, yellow or greenish-yellow, 6-14, umbelliform on a terminal, very short, slightly puberulous peduncle; pedicels c. 1 mm, articulated towards the base, puberulous. Floral tube sparsely puberulous outside, glabrescent, glabrous inside. Calyx lobes ovate-oblong, obtuse, $3\frac{1}{2}$ -4 mm long. *Stamens* shortly filamentous, free from the tube at the upper half, the two series c. 1 mm apart; anthers linear, obtuse or slightly apiculate, c. $1\frac{1}{2}$ mm long. Disk 2 free linear, c. 1 mm long, 2-lobed scales. *Ovary* ellipsoid or slightly obovoid, $1\frac{1}{2}$ -2 mm long, hairy at the apex; style very short or obscure; stigma globose and papillose. *Fruits* red, ellipsoid or ovoid, 8 by 5 mm. Seeds ovoid, the same shape as the fruit.

Distr. Lower Siam (Telok Udang) and *Malaysia*: Malay Peninsula, chiefly on the east coast (Kelantan, Trengganu, Pahang, Burau Bay).

Ecol. Sandy open coastal country.

Uses. The species contains a purgative substance and the leaves are eaten as an aperient. The bark is used as entering into a compound potion against small-pox; it is pounded and converted into a poultice for applying to boils, or merely tied round the neck to stop vomiting. It is also used as a fish-poison. The fruits are poisonous (cf. BURKILL).

Vern. *Děpu, dėpu pelandok, M; dalu pelandok* is a misprint (cf. BURKILL, l.c.).

Note. According to RIDLEY this plant was brought from Pekan (not: Penang!) to Singapore in 1890 and "ran wild for some time in Tanglin, Singapore".

Three specimens have been cited in the original description, collected by RIDLEY at Pahang (Kuala Brawas: RIDLEY 1583, lectotype and Pekanbaru: RIDLEY s.n., Aug. 1889, paratype) and Tringganu (Pulo Katan: RIDLEY s.n., Aug. 22, 1899, paratype).

10. *Wikstroemia indica* (L.) C. A. MEY. Bull. Ac. Sc. St. Pétersb. 1 (1843) 357; reimpr. Ann. Sc. Nat.

Bot. II, 20 (1843) 50; MEISN. in DC. Prod. 14 (1857) 543; MIQ. Fl. Ind. Bat. 1, 1 (1858) 880; BENTH. Fl. Austr. 6 (1873) 37; F.-VILL. Nov. App. (1880) 182; VIDAL, Rev. Pl. Vasc. Filip. (1886) 229; FORB. & HEMSL. J. Linn. Soc. Bot. 26 (1894) 398; BOERL. Handl. 3 (1900) 111; BAILEY, Queensl. Fl. pt 4 (1901) 1369; BOLD. Zakfl. (1916) 171; MERR. Sp. Blanc. (1918) 279; BROWN, Min. Prod. Philip. For. 1 (1920) 404; MERR. En. Philip. 3 (1923) 132; REHDER, J. Arn. Arb. 15 (1934) 103; MERR. Comm. Lour. (1935) 278; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 77, p. 4; HOLTH. & LAM, Blumea 5 (1942) 216.—*Daphne indica* LINNÉ, Sp. Pl. (1753) 375.—*Daphne aquilaria* BLANCO, Fl. Filip. (1837) 310; ed. 2 (1845) 216; ed. 3, 2 (1878) 39.—*W. viridiflora* MEISN. Denkschr. K. Bayer. Bot. Ges. Regensb. 3 (1841) 286; DECNE, in Jacq. Voy. Bot. 4 (1844) 145; MEISN. in DC. Prod. 14 (1857) 546; MIQ. Fl. Ind. Bat. 1, 1 (1858) 879; VIDAL, Rev. Pl. Vasc. Filip. (1886) 229; MERR. Philip. J. Sc. 3 (1908) Bot. 422; BACK. Ann. Jard. Bot. Btzg Suppl. 3 (1909) 419; K. & V. Bijdr. 13 (1914) 54; RIDL. Fl. Mal. Pen. 3 (1924) 145; GUILLAUMIN, J. Arn. Arb. 13 (1932) 88; BURK. Dict. (1935) 2259; LÉANDRI, Proc. 8th Pac. Sc. Congr. Manila 4 (1957) 582.—*W. ovata* (non C. A. MEY.) VIDAL, Synopsis (1883) 229.—*W. indica* var. *viridiflora* HOOK. f. Fl. Br. Ind. 5 (1886) 195.—*W. linearifolia* ELM. Leaf. Philip. Bot. 2 (1910) 680; MERR. Fn. Philin. 3 (1923) 133.—*W. pulgarensis* ELM. Leaf. 5 (1913) 1844; MERR. En. Philip. 3 (1923) 133.—*W. pachyphylla* MERR. Philip. J. Sc. 12 (1917) Bot. 297; En. Philip. 3 (1923) 133.—*W. subcoriacea* MERR. J. Str. Br. I. As. Soc. n. 76 (1917) 100; En. Born. (1921) 417; HEINE, Pfl. Clemens Kinabalu (1953) 69.—*Daphne* sp. STEEN. Bull. Jard. Bot. Btzg III, 13 (1933) 254.

Shrub up to 3 m. Branchlets black-brown, scattered puberulous, glabrescent, sometimes transversally fissured. Internodes usually very short or even obscure. Leaves chartaceous to subcoriaceous, in dry condition usually brown to reddish-brown, sometimes glaucescent, sparsely puberulous beneath, glabrescent, or glabrous, shining above and rather dull beneath, obovate- or elliptic-oblong, oblanceolate, elliptic, rarely ovate, $1\frac{1}{4}$ – $4\frac{1}{2}$ (–7) by $\frac{1}{2}$ – 2 (– $3\frac{1}{4}$) cm; base cuneate to attenuate; apex rounded, obtuse, sometimes slightly emarginate, or acute; margins usually cartilaginous; nerves 5–12 pairs, irregular, and often branched, obliquely ascending towards the margin, rarely the basal 1 or 2 nerves on each side ascending along the margin towards the top, usually distinct beneath obscure above, sometimes obscure on both surfaces; veins obscure or invisible on both surfaces. Petiole c. 2 mm. In-

florescence terminal, sometimes 1–2 additional ones in the axils of the terminal node, few-flowered, subsessile, sometimes on a very short peduncle; pedicels $1\frac{1}{2}$ –2 mm, articulated at the base. Flowers green, 10–12 mm long, sparsely puberulous outside, glabrous inside. Calyx lobes 2–3 mm long, broadly ovate or oblong, obtuse. Stamens very shortly filamentous, rarely sessile; anthers linear, c. 1 mm long, sometimes those of the lower series slightly shorter, obtuse rarely apiculate at the apex, the two series c. 1 mm apart. Disk 2 free, linear, c. $\frac{3}{4}$ mm long scales with narrowed or obliquely truncate top, sometimes lobed or crenate at the apex. Ovary slightly obovoid or elliptic, c. $1\frac{1}{2}$ mm long, sparsely hairy or glabrous at the top; style very short or obscure; stigma globose, c. $\frac{1}{3}$ mm diam. Fruits broadly ellipsoid, c. 6 by 4 mm, red.

Distr. India, SE. Asia, through Malaysia to Australia (N. Australia, Queensland, and N.S. Wales) and Melanesia (as far E as Fiji), in Malaysia not found in the seasonal parts: absent from the Lesser Sunda Islands, in Java only found in the vicinity of Bogor and once found at 1100 m near Sindanglaja as an escape from the Botanic Gardens, now locally thoroughly naturalized and slowly spreading along roadsides and in other anthropogenic terrain (BACKER, 1909 *l.c.*).

Ecol. In thickets and secondary growths, obviously very soil-tolerant and occurring in various biotopes, for example on sandy soil near the beach, on limestone of a ridge top, on granite peaks, along river-banks, and on open hill-sides, from the lowland up to 1300 m, a few above 2200 m even up to 2700 m (in Celebes and New Guinea).

Vern. Borneo: *lajak*, M; Philippines: *inyam*, P. Bis., *arandón*, *baleo*, Ilk., *palupó*, *titpuho*, Iv., *salagó*, Tag., Bis., Bik., *talo*, Bik.; Celebes: *pérápata* or *posi-posi*, Manado.

Note. *W. indica* is a widely distributed species and is very variable in its vegetative parts. As pointed out by BENTHAM in a note under *W. indica* (Fl. Austr. 6, 1873, 37), "it is, however, not always easy to determine the limits to be assigned to it". FAGERLIND (*l.c.*) has found apomixis in this species, which may give an explanation of its great vegetative variability and difficulties involving in specific demarcation. With a large number of specimens of this species available, no sharply defined infraspecific taxa or forms can be distinguished.

Excluded

W. amplifolia (SCHLTR) DOMKE (Bibl. Bot. 111, 1934, 60) of New Caledonia (isotype: SCHLECHTER 14749, L) has erroneously been recorded for New Guinea by DOMKE (*l.c.*).

6. DAPHNE

LINNÉ, Gen. Pl. ed. 5 (1754) 167; Sp. Pl. (1753) 356; MEISN. in DC. Prod. 14 (1857) 530; GILG, in E. & P. Pfl. Fam. 3, 6a (1894) 237; DOMKE, Bibl. Bot. 111 (1934) 130, t.4 f.i & map 8.—*Scopolia* LINNÉ f. Suppl. (1781) 409, non JACQ. 1764, nec *al.*—*Eriosolena* BL. Bijdr. (1826) 651; VAN TIEGH. Bull. Soc. Bot. Fr. 40 (1893) 67; DOMKE, Bibl. Bot. 111 (1934) 70–83, 130, t.4 f.36 C & map 10.—

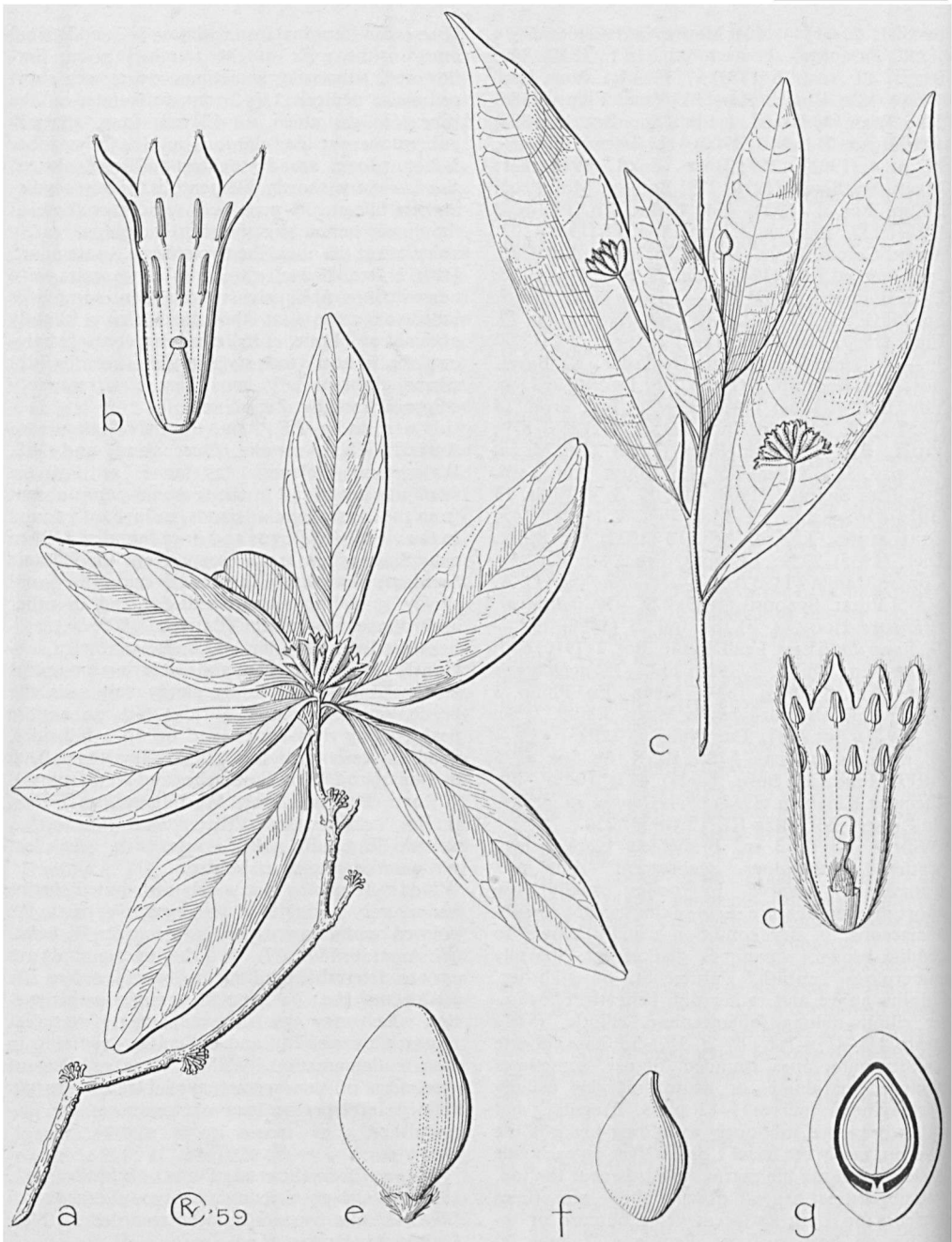


Fig. 14. *Daphne luzonica* C. B. ROB. *a.* Habit, $\times \frac{2}{3}$, *b.* opened flower, $\times 4$.—*D. composita* (L. f.) GILG. *c.* Habit, $\times \frac{2}{3}$, *d.* opened flower, $\times 4$, *e.* fruit, $\times 2$, *f.* seed, $\times 2$, *g.* longitudinal section of fruit, $\times 2$ (*a-b* BS 40335, *c-d* RAHMAT SI BOEEA 11238, *e-g* SF 51832).

Daphne sect. *Eriosolena* MEISN. Denkschr. K. Bayer. Bot. Ges. Regensb. 3 (1841) 283; in DC. Prod. 14 (1857) 540.—Fig. 14.

Shrubs, rarely small trees or dwarf shrubs. *Leaves* spirally arranged, sometimes^{es} subopposite or crowded towards the upper part of the branchlets. *Inflorescence*^{es}

usually capitate, ebracteate or surrounded by caducous bracts, terminal and/or axillary, sessile or peduncled, sometimes racemose or a few flowers in a fascicle, rarely paniculiform, usually with some linear bracteoles in the leaf axils or at the base of the peduncle. *Flowers* 4-merous, sessile. Floral tube cylindrical or slightly infundibuliform, glabrous or pubescent outside, usually caducous after anthesis, rarely persistent and surrounding the fruit (in extra-Mal. *spp.*). Calyx lobes 4, erect or spreading, alternating longer and shorter. *Petaloid appendages* none. *Stamens* 8, in two rows, sessile or on short filaments; anthers linear, dorsio-basifixed. Disk annular and entire, or membranous and irregularly toothed or split, sometimes elongated on one side, or obscure, or absent. Pistil always included in the floral tube. *Ovary* ovoid, sessile or slightly stalked, usually hairy towards the top or in the upper half; sometimes glabrous; style sessile or short-filiform, terminal, sometimes slightly lateral (in extra-Mal. *spp.*); stigma globose or capitate. *Drupe* ovoid or ellipsoid, with fleshy or dry pericarp, endocarp sclerified. *Seed* similar in shape to the fruit; testa crustaceous.

Distr. Species c. 70, distributed in the Old World on the northern hemisphere, from Europe and northern Africa to eastern Asia and Malaysia.

Ecol. The genus is represented in Malaysia by two species of widely different affinity. *D. composita* belongs to a small section *Eriosolena* (BL.) MEISN. (cf. GILG in E. & P. Pfl. Fam. 3, 6a, 1894, 238) which is restricted to the undergrowth of the montane rain-forest of SE. continental Asia and West Malaysia, centering in Asia. *D. luzonica* belongs to a section *Daphnanthoides* GILG (*l.c.*) which occurs chiefly in the Himalaya, China, Japan, and Formosa, and has reached northern Luzon where it occurs at high-montane altitude.

Note. *Scopolia* (non JACQ. *nec al.*) LINNÉ *f.* and *Eriosolena* BL. which are congeneric and even based on the same species (though with different type specimens) have been separated from *Daphne* because the flower of this taxon possesses a tubular hypogynous disk, it being absent in *Daphne*. In 1841 MEISNER (*l.c.*) reduced *Eriosolena* BL. to a section of *Daphne* and in 1857 (*l.c.*) he reduced also *Scopolia* L. *f.* to *Daphne*. The reduction of *Eriosolena* has been adopted *e.g.* by BAILLON (Hist. Pl. 6, 1877, 131), BENTHAM & HOOKER (Gen. Pl. 3, 1880, 190), GILG (in E. & P. Pfl. Fam. 3, 6a, 1894, 238), BOERLAGE (Handl. 3. 1900, 105), BACKER (Bekn. Fl. Java, em. ed., 4A, 1945, fam. 77, p. 5), and others.

1118 VAN TIEGHEM (Bull. Mus. Hist. Nat. Paris VII, 17, p. 195; Bull. Soc. Bot. Fr. 40, p. 68) restored *Eriosolena* to generic rank, basing himself on anatomical characters of the branches and leaves and the presence of a tubular disk.

In 1914 H. LECOMTE (Not. Syst. 3, 99) agreed with VAN TIEGHEM, adding that *Eriosolena* was, besides, characterized by typical, caducous, involuclral bracts. In passing it may be remarked that such bracts also occur in *Daphne s. str.* *Eriosolena* has been further upheld by HALLIER *f.* (Med. Rijksherb. n. 44, 1922, 30), DOMKE (Bibl. Bot. 111, 1934, 130), LÉANDRI (Rev. Intern. Bot. App. Agr. Trop. 29, 1949, 503, and Proc. 8th Pac. Sc. Congr. Manila 4, 1957, 581) and some others.

In 1915, however, H. LECOMTE (Bull. Mus. Hist. Nat. Paris 21, p. 291-292) reversed his opinion on the status of *Eriosolena*. After having examined all the species of *Daphne* contained in the Paris Herbarium, he observed that they possessed, without exception, a very clear annular disk, sometimes developed into a truly cupular disk surrounding the base of the ovary. for example in *D. papyracea* WALL. *ex* STEUD. (*D. cannabina* (non LOUR.) WALL.)! He further advanced that the anatomical data found by VAN TIEGHEM (Ann. Sc. Nat. Bot. VII, 17, 1893, 185) concerning the origin of periderm, the presence or absence of internal phloem in the leaves, the existence or absence of crystals and their nature, although they are interesting in themselves, cannot serve for solving the question about the rank (generic or sectional) of *Eriosolena*. He did not recognize it as a separate genus to which I agree.

KEY TO THE SPECIES

1. Flowers in distinctly peduncled (2½-6½ cm) heads enveloped by two caducous, involuclral bracts. Floral tube densely appressed-hairy outside. Disk distinct, membranous, cup-shaped. Ovary densely hairy at the top 1. *D. composita*
1. Flowers in sessile or short peduncled (0-3 mm) heads without involuclral bracts. Floral tube glabrous outside. Disk obscure, ring-like. Ovary glabrous 2. *D. luzonica*

1. *Daphne composita* (L. *f.*) GILG in E. & P. Pfl. Fam. 3, 6a (1894) 238; KOORD. Exk. Fl. Jav. 2 (1912) 657; GAMBLE, J. As. Soc. Beng. 75, ii (1912) 258; K. & V. Bijdr. 13 (1914) 49; KOORD. Fl.

Tjib. 2 (1923) 201; BURK. & HOLT. Gard. Bull. S.S. 3 (1923) 70; BURK. & HEND. *ibid.* 3 (1925) 417; MOORE, J. Bot. Suppl. 63 (1925) 89; HOCHR. Candollea 2 (1925) 443, *incl. var. montana* HOCHR.

and var. *montana* f. *macrophylla* HOCHR.; BURK. Dict. (1935) 765; CORNER, Ways. Trees (1940) 633, f. 240; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 77, p. 5; HEYNE, Nutt. Pl. (1927) 1152.—*Scopolia composita* L.f. Suppl. (1781) 409.—*D. javanica* THUNB. Mus. Nat. Acad. Upsal. App. 11 (1806) 4, *nomen*; Fl. Jav. (1825) 13.—*D. pendula* SM. Pl. Ic. ined. 2 (1790) 34, t. 34, *nom. illegit.*; WIKSTR. Kongl. Vet. Acad. Handl. (1818) 296; MEISN. Denkschr. K. Bayer. Bot. Ges. Regensb. 3 (1841) 285; in DC. Prod. 14 (1857) 540, *incl. β montana* MEISN. and *γ concolor* MEISN.; MIQ. Fl. Ind. Bat. 1, 1 (1858) 877; KURZ, For. Fl. Burm. 2 (1877) 333; HOOK. f. Fl. Br. Ind. 5 (1886) 194; BOERL. Handl. 3 (1900) 111; RIDL. Fl. Mal. Pen. 3 (1924) 144.—*Eriosolena montana* BL. Bijdr. (1826) 651; HASSK. Cat. Hort. Bog. (1844) 92, *incl. α macrophylla* HASSK. and *β minor* HASSK.; ZOLL. Nat. Geneesk. Arch. N.I. 1 (1844) 616; Syst. Verz. 2 (1854) 116.—*D. montana* MEISN. Denkschr. K. Bayer. Bot. Ges. Regensb. 3 (1841) 284.—*Eriosolena composita* VAN TIEGH. Ann. Sc. Nat. Bot. VII, 17 (1893) 196; Bull. Soc. Bot. Fr. 40 (1893) 68; MERR. Contr. Arn. Arb. 8 (1934) 111.—*Eriosolena pendula* BL. ex LECOMTE, Not. Syst. 3 (1914) 101.—Fig. 14c-g.

Shrub or small tree up to 10 m by 16 cm. *Leaves* chartaceous to subcoriaceous, usually brownish above and glaucous beneath when dry, elliptic-oblong to lanceolate, (3½–)7–14(–20) by (1½–)2–5 cm; base attenuate; apex acuminate; nerves 9–14 pairs, distinct and elevated beneath, visible or obscure above, sometimes distinct on both surfaces; petiole 3–5 mm. *Inflorescences* axillary, solitary or very rarely 2 inflorescences in an axil (cf. KING's coll. 6940); involucre bracts 2, ovate-oblong to oblong, 1–1½ cm long, minutely pubescent outside; peduncle 2½–6½ cm, usually nodding, with several small linear bracts at the base, (4–)7–12-flowered. *Flowers* light-yellowish or white, fragrant, 10–15 mm long, sessile, densely covered with appressed, golden-yellowish or whitish hairs outside. Calyx lobes convolute, 2 longer and 2 shorter, lanceolate or ovate-oblong, rarely oblong, 2–4 by 1 mm. *Stamens* sessile or with short filaments; anthers linear, 1–1½ mm long. *Ovary* ellipsoid, 1½–2 mm, densely hairy; style c. 1½ mm; stigma globose. *Fruits* ellipsoid or ovoid, 10–15 by 5 mm, black (BACKER *s.n.*) or red (BACKER 14479).

Distr. India, Burma (Southern Shan States, Tenasserim and Tounghoo), Indo-China (Annam), China (Yunnan), and Malaysia: Sumatra, Malay Peninsula, Borneo, and West Java.

Ecol. In rain-forests (900–1000–)1200–2000 m. Use. The bark is used as binding material. Vern. *Kakapasan* (also used for *Phaleria*), *kemandèn*, *S*, *ki-salam*, *J*; Sum.: *kulei manis rimbo*.

Note. *Daphne javanica* THUNB. (1806, *l.c.*) is a *nomen nudum*. There is a specimen under that name bearing THUNBERG's handwriting in his herbarium at Uppsala, kindly sent on loan from there.

This specimen might have come from Java as the epithet indicated (cf. also WIKSTR. Kongl. Vet. Acad. Handl. 1818, 297). It is distinctly *D. composita*. On the back of the sheet at the upper left corner is written in THUNBERG's handwriting "e Ceilona. Thunberg", for this reason the species has also been listed in THUNB. Fl. Ceilan. (1825) 5. However, the genus does not occur in Ceylon and the record of this specimen from Ceylon is apparently an error.

2. *Daphne luzonica* C.B. ROB. Bull. Torr. Bot. Cl. 35 (1908) 72, 75; MERR. Philip. J. Sc. 5 (1910) Bot. 366; En. Philip. 3 (1923) 132; STEEN. Bull. Jard. Bot. Btzg 13 (1934) 254.—Fig. 14a-b.

Slender shrub up to 1½ m. Branchlets light brown to reddish-brown, glabrous. *Leaves* chartaceous to subcoriaceous, glabrous on both surfaces, narrow elliptic-oblong, 8–9 by 2¼–2½ cm; base cuneate to attenuate; apex acuminate; nerves 6–8 pairs, distinct beneath, obscure above, curved ascending; petiole almost absent, up to 3 mm. *Inflorescences* sessile or up to 3 mm peduncled, few- to many-flowered; pedicels 1 or 2 mm. Buds very acute. *Flowers* c. 10 mm long, articulated at the base. Calyx lobes ovate, 2½–3 mm by 2 mm, very acute. *Stamens* subsessile, or with a very short filament; anthers 1½–2 mm long. Disk ring-like. Ovary ellipsoid-oblong, 3 by 1 mm, glabrous; style obscure; stigma globose. *Fruit* (young) ovoid, 7 by 4 mm.

Distr. Malaysia: Philippines (N. Luzon: Benguet Prov.).

Ecol. In the mossy forest on the higher mountains, 2000–2500 m.

Note. The leaves are similar to those of *D. odora* THUNB., from which it differs by obviously smaller flowers, absence of bracts below the umbel, and absence of the typical yellow tomentum on peduncle and pedicels. From *D. kiusiana* MIQ. it differs in the glabrous flowers, from the Formosan *D. arisanensis* HAYATA by the absence of floral bracts, the very acute calyx lobes, shorter pedicels, longer anthers, and larger calyx tube.

Though MERRILL (1908, *l.c.*) suggested that there is a closely allied form in Yunnan, I have not succeeded in identifying it with a Chinese species.

Excluded

Daphne decandra BL. Bijdr. (1825) 650 is according to SLEUMER (Fl. Mal. I, 5, 1954, 91) = *Casearia velutina* BL. (Flacourt.) (cf. also MIQ. Fl. Ind. Bat. 1, 1, 1858, 709).

Eriosolena affinis ZOLL. Syst. Verz. 2 (1854) 116. I have seen two sheets, one from Paris, with ZOLLINGER's own handwriting and the type number 3209, collected in Lombok, and one at Leyden. MIQUEL (Fl. Ind. Bat. 1, 1, 1858, 878) already had suggested it to represent a *Rubiaceae* and I have to thank Dr BAKHUIZEN VAN DEN BRINK for the final reduction to *Antirrhoea hexasperma* (ROXB.) MERR. En. Philip. 3 (1923) 540 (*Rubiaceae*).

7. GYRINOPS

GAERTN. Fruct. 2 (1791) 276, t.140 f.6; DOMKE, Bibl. Bot. 111 (1934) 119, map 2; QUIS. J. Arn. Arb. 27 (1946) 404.—*Lachnolepis* MIQ. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 132.—*Brachythalamus* GILG, Bot. Jahrb. 28 (1900) 146.—*Aquilaria* sect. *brachythalamus* HALL. f. Med. Rijksherb. n. 44 (1922) 19.—*Aquilaria* sect. *Gyrinops* HALL. f. l.c.—*Aquilaria* sect. *Lachnolepis* HALL. f. l.c.—Fig. 15.

Trees or shrubs. Leaves spirally arranged, usually with distinctly parallel veins joining the several intramarginal veins; margin thickened. Inflorescences terminal or axillary, sessile or short-peduncled, in fascicles or a few flowers at the top of a peduncle, with 2 or 3 small caducous bracts. Flowers 5-merous, pedicels articulated at the base. Floral tube cupular to cylindrical, puberulous outside, inside puberulous with reflexed hairs arranged in lengthwise lines towards the upper part, sometimes glabrous. Calyx lobes 5, spreading, puberulous on both surfaces. Petaloid appendages 5, distinct, or united in a ring (*G. moluccana* and *G. decipiens*), inserted at the throat of the tube, alternating with the calyx lobes, usually densely hairy. Stamens 5, episealous, free from the tube, inserted at the same level as the petaloid appendages or slightly below, sessile or subsessile, linear, basifixed. Disk shortly cup-shaped or ring-like, scale-like, or none. Ovary ellipsoid or obovoid, pilose, sessile or short-stiped, 2-celled; style terminal, distinct or obscure; stigma small. Fruits a loculicidal capsule, obovoid or ellipsoid, long-stiped and emerging from the top or from the side of the floral tube. Seeds slightly ovoid, plano-convex, usually with a caruncle-like appendage at the chalazal end.

Distr. Species 8, distributed in Ceylon (*G. walla* GAERTN.), and Malaysia (Lesser Sunda Islands, Celebes, Moluccas, and New Guinea). Fig. 16.

The distribution pattern is very similar to that of *Trichadenia* (see vol. 5, p. 39).

Ecol. In forests from the lowland up to 900 m.

KEY TO THE SPECIES

1. Floral tube tubular, 12–14 mm long. Fruits emerging from the lateral slit of the floral tube.
2. Leaves narrow-lanceolate, 5–8 times as long as wide. Flowers in a raceme. 1. *G. moluccana*
2. Leaves elliptic-oblong to ovate-lanceolate, c. 2½ times as long as wide. Flowers in an umbel.
3. Nerves prominent and spaced beneath, 16–20 pairs. Inflorescences 12–14-flowered. Pedicels c. 2 mm. Petaloid appendages united in a ring. Fruits ovoid-oblong, c. 22½ mm long; valves c. 3 mm thick at the suture. 2. *G. decipiens*
3. Nerves obsolete and close to each other, 25–35 pairs. Inflorescences 2–3-flowered. Pedicels 3–5 mm. Petaloid appendages distinct and connected only at the base. Fruits pyriform, c. 17½ mm long. Valves ¾–4/8 mm thick at the suture. 3. *G. ledermannii*
1. Floral tube cupular, 2–5 mm long. Fruits emerging from the top of the intact floral tube.
4. Leaves usually narrow-lanceolate, 1½–10 by 1/8–1 cm. Petaloid appendages oblong, as long as the stamens. 4. *G. salicifolia*
4. Leaves elliptic-oblong or ovate-oblong, very rarely lanceolate, 6–15 by 1½–5 cm. Petaloid appendages shorter than the stamens.
5. Pedicels more than twice as long as the floral tube. Petaloid appendages transverse-oblong. 5. *G. caudata*
5. Pedicels usually shorter than the floral tube. Petaloid appendages deltoid or slightly oblong.
6. Nerves and veins usually similar. Pistil usually shorter than the floral tube. Style none. Fruits obovoid-oblong or ellipsoid, acuminate. 6. *G. versteegii*
6. Nerves distinct and more prominent than the veins. Pistil usually longer than the floral tube. Style distinct. Fruits pyriform, acute, bearing the persistent, curved style. 7. *G. podocarpus*

1. *Gyrinops moluccana* (MIQ.) BAILL. *Adansonia* 11 (1875) 326; GILG in E. & P. Pfl. Fam. 3, 6a (1894) 225; BOERL. Handl. 3 (1900) 111; QUIS. J. Arn. Arb. 27 (1946) 404.—*Lachnolepis moluccana* MIQ. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 132.—

Aquilaria moluccana HALL. f. Med. Rijksherb. n. 44 (1922) 19.—Fig. 15a-d.

Shrub. Leaves chartaceous, glabrous, oblong-lanceolate, (8–)18–24 by (1½–)2–3 cm; base obtuse; apex acuminate; nerves 23–32 pairs, slightly

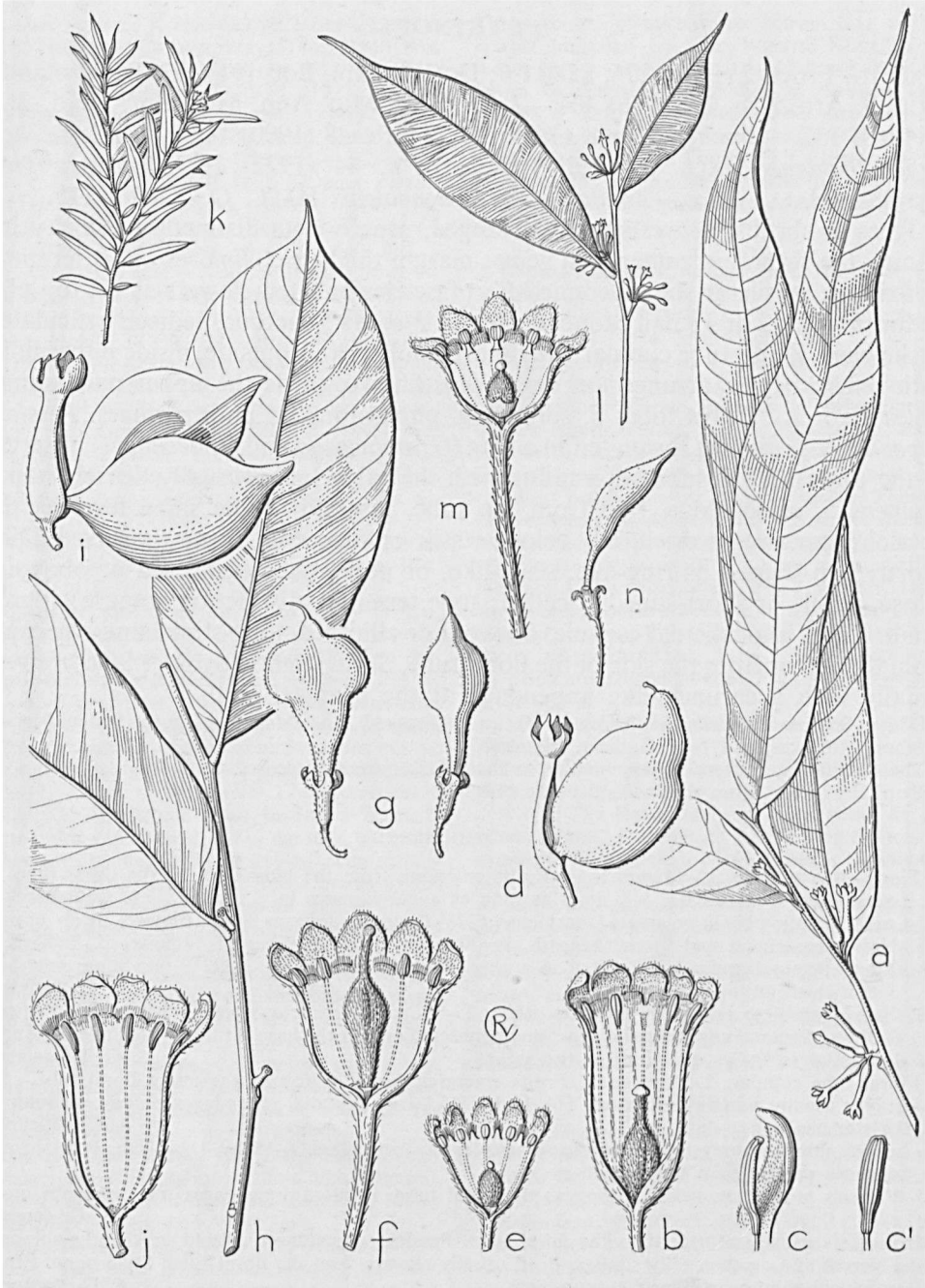


Fig. 15. *Gyrinops moluccana* (MIQ.) BAILL. *a*. Habit, $\times \frac{2}{3}$, *b*. opened flower, one anther removed, $\times 3$, *c*. attachment of stamen, $\times 7$, *c'*. stamen, $\times 7$, *d*. fruit bulging out of floral tube, $\times 2$.—*G. versteegii* (GILG) DOMKE. *e*. Opened flower, $\times 5$.—*G. podocarpus* (GILG) DOMKE. *f*. Opened flower, $\times 5$, *g*. frontal and lateral view of fruit protruding from floral tube, $\times 2$.—*G. decipiens* DING HOU. *h*. Habit, $\times \frac{2}{3}$, *i*. dehiscent fruit bulging out of floral tube, $\times 2$, *j*. opened floral tube of fig. *i*, $\times 3$.—*G. salicifolia* RIDL. *k*. Habit, $\times \frac{2}{3}$.—*G. caudata* (GILG) DOMKE. *l*. Habit, $\times \frac{2}{3}$, *m*. opened flower with characteristic long pedicel, $\times 5$, *n*. young fruit protruding from floral tube, $\times 2$ (*a-d* DE VRIESE & TEYSMANN *s.n.*, *e* VERSTEEG 1381, *f-g* PLEYTE 567, *h-j* KJELLBERG 889, *k* KANEHIRA & HATUSIMA 12443, *l-m* BECCARI PP 911).

curved and ascending, at c. 60° to the midrib, distinct or visible beneath, indistinct above; veins \pm parallel. *Inflorescences* axillary, sometimes on the branches, simple, rarely branched, 3–5-flowered; peduncle almost none up to c. 10 mm, sometimes 2 or 3 in an axil; pedicels c. 4 mm. *Flowers* long-tubular, c. 15 mm. Calyx lobes oblong, c. 3 mm long, erect, the apex slightly incurved. *Petaloid appendages* usually united behind the stamens, with hairs almost as long as themselves. *Stamens* inserted slightly below the appendages, sometimes the lower part of the anthers adnate to the tube. Pistil c. 4 mm long. *Ovary* ovoid or ellipsoid, gradually narrowed into a distinct style, pilose; stigma ovoid. *Fruits* emerging through the lateral slit of the floral tube, ovoid, shortly stalked, sparsely pilose, ovoid, 1½ by 1 cm, 1- or 2-seeded. *Seeds* ovoid, with a short and thick appendage at the base.

Distr. *Malaysia*: Moluccas (Buru: Kajeli and Halmahera), thrice collected. Also cultivated in Hort. Bog. (from seed of Buru).

Note. One specimen collected from a cultivated plant in Hort. Bog. has smaller leaves (8–14½ by 1½–2¼ cm).

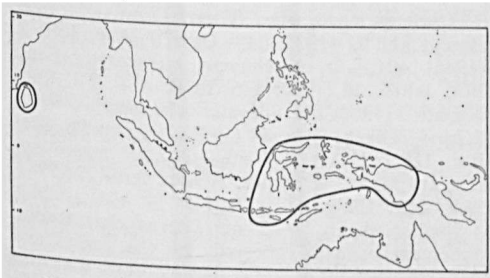


Fig. 16. Distribution of *Gyrinops* GAERTN.

2. *Gyrinops decipiens*, nov. sp.

Differt ab *G. moluccana* foliis elliptico-vel subobovato-oblonga, pedunculis brevibus validis apiceque incrassatis, floribus umbellatis, antheris liberis, pericarpio late suturato. *Typus* G. KJELLBERG 889, Bo, L.—Fig. 15h–j.

Small tree, c. 4 m. *Leaves* chartaceous, glabrous, rarely sparsely hairy beneath, shining on both surfaces when dry, elliptic- or slightly obovate-oblong, 14–17 by 5–7 cm; base narrowly cuneate; apex shortly acuminate; nerves 16–20 pairs, slightly curved or obliquely spreading towards the margin, elevated beneath, visible sometimes obscure above. *Infructescences* terminal and axillary, umbelliform, 12–14-flowered; peduncle very short to 2¼ cm, thick, accrescent, knob-like thickened at the top; pedicels c. 2 mm. *Flowers* long-tubular, c. 15 mm long. *Floral tube* almost glabrous inside. Calyx lobes oblong, 3–4 mm long. *Petaloid appendages* united behind the stamens with hairs as long as themselves. *Stamens* inserted slightly below the appendages. *Fruits* ovoid-oblong, c. 2¼ by 1¼ cm, acuminate to the apex, suture surface c. 3 mm wide. *Seeds* unknown.

Distr. *Malaysia*: Central Celebes (Wavatoli, Palarahi).

Ecol. In rain-forest, at 100 m.

Note. This species is closely related to *G. moluccana* by the long tubular flowers with petaloid appendages united into a ring and fruits emerging through the lateral slit, but differs from it by the characters shown in the key.

The leaves are similar to those of *Aquilaria beccariana*.

3. *Gyrinops ledermannii* DOMKE, Notizbl. Berl.-Dahl. 11 (1932) 349.

Shrub. *Leaves* subcoriaceous, glabrous except sparse hairs at the lower parts on both surfaces and the midrib beneath, oblong- or ovate-lanceolate, sometimes obovate-lanceolate, 6½–12 by 2½–5 cm; base rather acute or shortly narrowed towards the petiole; apex acute or acuminate; nerves spreading, obsolete, close to each other, among which c. 25–35 stronger pairs, curved and ascending towards the apex. *Infructescences* pseudo-lateral or terminal, subsessile, 2–3-flowered; pedicels thin, 3–5 mm. *Floral tube* cylindrical, indistinctly ribbed, 13 mm long, 1½ mm in diam. Calyx lobes ovate, 1½–2 by c. ½ mm, the outer lobes acute and the inner ones obtuse, pubescent outside, tomentose inside, and also with a tuft of hairs at the top. *Petaloid appendages* \pm rectangular, c. ¾ by ½ mm, obtuse, connected at the base, villose. *Stamens* sessile, oblong, 1–1¼ by ½ mm. *Fruits* \pm pyriform, c. 1¾ by ½ cm (including stipe 3 mm and acute and cuspidate apex 4 mm), short pilose, compressed, irregularly, transversely \pm rugose. *Seeds* 2 or 1 by abortion, c. 9 mm long (including an appendage c. 3 mm long), woolly.

Distr. *Malaysia*: New Guinea (Sepik R., Station Mt Pflugst: LEDERMANN 7401).

Ecol. Slope in dense, virgin forest, at the foot of the mountain, 0–200 m altitude.

Note. The type specimen of this species is not available and no additional material has been collected in that area. The description above is extracted from the original one. From DOMKE's detailed description, this is a distinct species characterized by the long floral tubes, distinct petaloid appendages and the leaves with many obscure nerves. It is closely allied to *G. moluccana* and *G. decipiens* by the flower with a tubular floral tube and the fruit emerging from the lateral slit of it, but differs from both of them by the characters given in the key.

4. *Gyrinops salicifolia* RIDL. Trans. Linn. Soc. Bot. II, 9 (1916) 145.—*Gyrinopsis salicifolia* QUIS. J. Arn. Arb. 27 (1946) 407.—Fig. 15k.

Slender shrub, c. 1 m. Branchlets light brown, pubescent. *Leaves* sparsely pubescent on the midrib and sometimes on the nerves and veins beneath, lanceolate to linear-lanceolate, 1½–10 by ½–1 cm; base cuneate; apex acuminate and pointed; nerves and veins similar and equally strong, slightly visible beneath, obscure above; petiole c. ½ mm. *Inflorescences* terminal, sessile, 3–5-flowered; pedicel c. 2 mm. *Flowers* pale

yellow, c. 3 mm long. Floral tube c. 2½ mm long, cupular, pilose outside. Calyx lobes oblong, c. 1 mm long, puberulous. *Petaloid appendages* oblong, c. ½ mm long, shortly hairy. *Stamens* sessile, as long as the petaloid appendages. Disk obscure, ring-like. Pistil c. 2 mm long, densely short-hairy. *Ovary* obovate, 1 mm long; style filiform, c. 1 mm; stigma obscure. *Fruit* unknown.

Distr. *Malaysia*: western New Guinea (Utakwa and Nabire).

Ecol. In fringing rain-forest, 300 m.

5. *Gyrinops caudata* (GILG) DOMKE, Notizbl. Berl.-Dahl. 11 (1932) 349; QUIS. J. Arn. Arb. 27 (1946) 404.—*Brachythalamus caudatus* GILG, Bot. Jahrb. 28 (1900) 147; in E. & P. Pfl. Fam. Nachtr. 3 (1903) 238.—Fig. 15l-n.

Shrub or tree up to 17 m by 36 cm, *vide* BW 6738. Branchlets greyish, whitish pubescent and glabrescent. *Leaves* chartaceous, glabrous, dull beneath and shining above, elliptic-oblong, ovate-oblong, rarely lanceolate, 6–13 by 1½–4 cm; base cuneate; apex up to 1½ cm, acuminate; nerves and veins scarcely distinguishable, numerous, parallel, visible beneath, obscure above; petiole c. 3 mm. *Inflorescences* axillary or terminal, 3–10-flowered, sessile and peduncled, peduncle up to 8 mm. *Flowers* c. 5 mm pedicelled. Floral tube cupular, 2 mm long. Calyx lobes oblong, 1 mm long. *Petaloid appendages* transverse-oblong, c. ½ mm long. *Stamens* subsessile, slightly longer than the appendages. *Ovary* ovoid, densely pilose; style very short; stigma capitate.

Distr. *Malaysia*: New Guinea (Sidai and Mt Arfak).

Ecol. Primary forest, 5–20 m (*vide* BW 6738).

Vern. *Niwawur*, Amberbaken language.

Note. This species is easily recognized by the pedicel usually c. 2 times as long as the floral tube.

6. *Gyrinops versteegii* (GILG) DOMKE, Notizbl. Berl.-Dahl. 11 (1932) 349; QUIS. J. Arn. Arb. 27 (1946) 404.—*G. walla* (non GAERTN.) KOORD. Minah. (1898) 577; BOERL. Handl. 3 (1900) 111.—*Brachythalamus versteegii* GILG, Nova Guinea 8 (1910) 410.—*Aquilaria versteegii* HALL. f. Med. Rijksherb. n. 44 (1922) 19.—*G. sp.* HALL. f. l.c. 20.—Fig. 15e.

Shrub up to 6 m, or tree up to 21 m by 65 cm (*vide* bb 21394, Bo). *Leaves* chartaceous to subcoriaceous, pubescent, especially on the nerves and veins beneath, glabrescent or glabrous, dull and yellowish-brown beneath, shining and reddish-brown above, elliptic-oblong, ovate-oblong, or obovate-oblong, 5–14 by 1½–5 cm; base cuneate; apex up to 2 cm narrow-acuminate; nerves and veins similar, numerous, slightly oblique and parallel; petiole short, 3–5 mm. *Inflorescences* sessile, usually terminal, consisting of 6 to 8 flowers, rarely axillary, or on the branchlets; pedicels

1–3 mm. *Flowers* white, yellowish, light greenish, or yellowish-green. Floral tube cupular, c. 3½ mm long. Calyx lobes oblong, c. 1 mm long. *Petaloid appendages* deltoid, about half as long as the anther, densely hairy. *Stamens* sessile, c. ¾ mm. Disk scale-like. Pistil c. 2½ mm long, densely puberulous, except the stigma. *Ovary* ovoid, c. 1 mm long, narrowed towards the apex; style absent; stigma ovoid. *Fruits* yellow, slightly obovoid or ellipsoid, 2½ by 1 cm, shortly acuminate to the apex, attenuate to the base. *Seeds* ovoid, planoconvex, 9 by 6 mm, with a caruncle-like appendage at the base, c. 2 mm thick.

Distr. *Malaysia*: Lesser Sunda Islands (Lombok, Sumbawa, Flores, and Sumba), NE. Celebes (Minahassa), and West New Guinea (Alkmaar Bivouac and Somula).

Ecol. In forests, scattered, from the lowland up to 900 m.

Vern. *Këtëmunan*, Lombok, *ruhu wama*, Sumba, *seke*, Flores.

Note. Closely related to *G. podocarpus*; more material is needed to verify whether it deserves specific distinction.

7. *Gyrinops podocarpus* (GILG) DOMKE, Notizbl. Berl.-Dahl. 11 (1932) 349; QUIS. J. Arn. Arb. 27 (1946) 404.—*Brachythalamus podocarpus* GILG, Bot. Jahrb. 28 (1900) 146; in E. & P. Pfl. Fam. Nachtr. 3 (1908) 238.—*Aquilaria podocarpus* HALL. f. Med. Rijksherb. n. 44 (1922) 19; DOMKE, Bibl. Bot. 111 (1934) t. 2 f. 10.—*G. ledermannii* (non DOMKE) MERR. & PERRY, J. Arn. Arb. 22 (1941) 264.—Fig. 15f-g.

Slender shrub, ½–2 m. *Leaves* chartaceous, pubescent beneath especially on the nerves and veins, glabrescent or sometimes glabrous, glabrous above, elliptic-oblong, narrow-oblong, slightly obovate-oblong, 10–15 by 3–5 cm, base cuneate, apex up to 2½ cm acuminate; nerves 25–40 pairs, distinct beneath, obscure above; veins and veinlets visible beneath, indistinct above, sometimes nerves and veins similar. *Inflorescences* terminal or axillary, sessile or with a short peduncle up to 6 mm, 2–6-flowered; pedicels 2–3 mm, pubescent. *Flowers* white, 4–5 mm long. Floral tube cupular. Calyx lobes ovate, 1–1½ mm long. *Petaloid appendages* deltoid or slightly oblong, ¼–½ mm long, densely whitish hairy. *Stamens* sessile. Disk shortly cup-shaped, crenate. Pistil shortly stipitate, densely hairy except the stigma, c. 4½ mm long. *Ovary* oblanceolate; style distinct, c. 1½ mm; stigma capitate. *Fruit* (young) green, pyriform, 15 by 6 mm, densely puberulous, acute to the apex and crowned by the persistent, curved style, stipe-like, cuneate towards the base.

Distr. *Malaysia*: West New Guinea (Ramo, Sorong, Monep, and Idenburg R.).

Ecol. In primary forests, from the lowland up to 750 m.

Vern. *Kokkoree*, Asmat language.

8. DRAPETES

BANKS *ex* LAMK, J. Hist. Nat. Paris 1 (1792) 188, t.10 f.1a-d; PERSOON, Syn. 1 (1805) 148; GAERTN. Fruct. 3 (1807) 199, t. 215; ENDL. Gen. Pl. (1837) 33; Suppl. 4 (1847) 61; BENTH. Fl. Austr. 6 (1873) 35; BENTH. & HOOK. f. Gen. Pl. 3 (1880) 196; DOMKE, Bibl. Bot. 111 (1934) 138, map 17.—*Kelleria* ENDL. Gen. Pl. Suppl. 4 (1847) 61; DOMKE, Bibl. Bot. 111 (1934) 137, map 16.—*Daphnobryon* MEISN. in DC. Prod. 14 (1857) 566.—*Drapetes sect. Daphnobryon* BOERL. Handl. 3 (1900) 106.—Fig. 17.

Dwarf shrubs with creeping, radiant, or \pm tufted and glabrous stems, sending out fibrous roots from beneath, the lower part of the stems marked with prominent scars of fallen leaves. *Leaves* subopposite or spiral, more or less appressed, sessile, narrow-linear, convex on the dorsal side, plane or slightly concave on the ventral side, with 5-9 striated longitudinal nerves; apex obtuse, with a tuft of hairs; margins ciliate especially in the young ones. *Flowers* aggregated in small, sessile, terminal heads almost entirely immersed in the leaves; pedicels short, articulated at the apex, articulation hairy. Floral tube continuous, or circumsciss above the ovary (S. American *sp.*), usually pilose outside, glabrous inside, caducous after anthesis. Calyx lobes 4, slightly spreading. *Petaloid appendages* inserted at the mouth of the tube, consisting of 1-2 episepalous scales (or 0). *Stamens* 4, free from the tube at the mouth, alternate with the lobes; filaments slender, basifixed, usually longer than the anthers; anthers oblong or sometimes subglobose. Pistil sometimes abortive. Fertile pistil usually included, rarely exerted. *Ovary* ellipsoid or slightly obovoid, 1-celled, pilose or hairy in the upper half or at the apex; style linear, lateral, usually longer than the ovary, caducous after anthesis; stigma capitate and nanillose when young. *Fruit* a small drupe with a thin-fleshy pericarp. Seed similar in shape to the fruit, closely enveloped by the endocarp.

Distr. Species 4, three of them in S. America (Fuegia and Falkland Is.), New Zealand, Tasmania, and Australia, one in *Malaysia* (New Guinea and North Borneo). Fig. 18.

Ecol. On dry grassy, or rocky places in the mountains, in the tropics almost confined to subalpine and alpine heights.

Note. *Drapetes* was described in 1792 by LAMARCK (*l.c.*) with only one species, *D. muscosus*, known from Fuegia and the Falkland Islands in S. America. Its perianth tube (*i.e.* floral tube) is circumsciss above the ovary, whence the upper part falls away after anthesis; there are no scales at the throat. The style is terminal. Since then some other species have been described from the Old World.

In 1847 ENDLICHER (*l.c.*) based a new genus *Kelleria* on *D. dieffenbachii* HOOK. from New Zealand, which should differ from *Drapetes sens.str.* by the continuous perianth tube, the presence of 4 appendages alternating with one stamens at the throat of the perianth tube, and the capitate stigma.

HOOKER *f.* (in Hook. J. Bot. Kew. Misc. 5, 1853, 300) maintained that all species of *Drapetes* resemble each other very closely and form one natural genus without necessity to recognize *Kelleria* as a distinct genus.

In 1857 MEISNER (*l.c.*) proposed a new genus *Daphnobryon* for *Drapetes ericoides* HOOK. *f.* from Borneo and *D. tasmanicus* HOOK. *f.* from Tasmania. This should be characterized by 8 appendages alternating in pairs with the stamens and by the distinctly lateral style.

VAN TIEGHEM (Bull. Soc. Bot. Fr. 40, 1893, 72) stated that the anatomical characters of the twigs of *Drapetes*, *Kelleria*, and *Daphnobryon* as a group closely agree and differ profoundly from those found in all other *Thymelaeaceae*. Still, because of the different origin of the periderms, different texture of the cells in the pith, and the quantity of the lignified peridermic fibers in the meristele in the limbs of their leaves, he found reason to maintain the three genera as distinct.

DOMKE (*l.c.*) maintained only *Drapetes* and *Kelleria*. *Drapetes* being characterized: floral tube cylindrical, circumsciss. No appendages. Style terminal. Leaves ovate, semi-amplexicaulous; S. America. *Kelleria*: floral tube short-cylindric or funnel-shaped, continuous. Appendages present. Style lateral. Leaves needle-like, not semi-amplexicaulous, spiral or decussate; New Zealand to Borneo.

BENTHAM (*l.c.* 36) pointed out that whether the perianth is circumsciss above the ovary or not "is no more than what is admitted as sectional only in *Pimelea*". As for the pairs of appendages, whether they

are distinct or confluent into a single entire or notched one, is not constant, as has been pointed out by BENTHAM (*l.c.* 36) and GILG (*Bot. Jahrb.* 18, 1894, 514, f. 9A). I have also observed this variation in a single specimen (TRAVERS *s.n.*, IV, 1909, New Zealand), and even in a single flower! Because of the great resemblance in habit and the number of stamens being the same as that of the perianth lobes, BENTHAM (*l.c.* 36) and BENTHAM & HOOKER *f.* (*Gen. Pl.* 3, 1880, 196) reduced *Kelleria* and *Daphnobryon* to *Drapetes*. I have followed them in this treatment and believe the first and last could be distinguished in the rank of sections.

1. *Drapetes ericoides* HOOK. *f.* *l.c.* *Pl.* (1852) t. 895; STAPF, *Trans. Linn. Soc. II*, 4 *Bot.* (1894) 221; BOERL. *Handl.* 3 (1900) 111; GIBBS, *J. Linn. Soc. Bot.* 42 (1914) 132; MERR. *En. Born.* (1921) 417. — *Daphnobryon ericoides* MEISN. in *DC. Prod.* 14 (1857) 566; MIQ. *Fl. Ind. Bat.* 1, 1 (1858) 881. — *Kelleria papuana* DOMKE, *Bot. Jahrb.* 62 (1929)

484; STEEN. *Bull. Jard. Bot. Btzig* 13 (1934) 254. — *Kelleria ericoides* DOMKE, *Bot. Jahrb.* 62 (1929) 485; STEEN. *Bull. Jard. Bot. Btzig* 13 (1934) 254. — *Kelleria patula* MERR. & PERRY, *J. Arn. Arb.* 22 (1941) 267.—**Fig. 17.**

Stem reddish- or dark-brown, up to 50 cm; young branchlets villous, glabrescent. *Leaves* 3–5

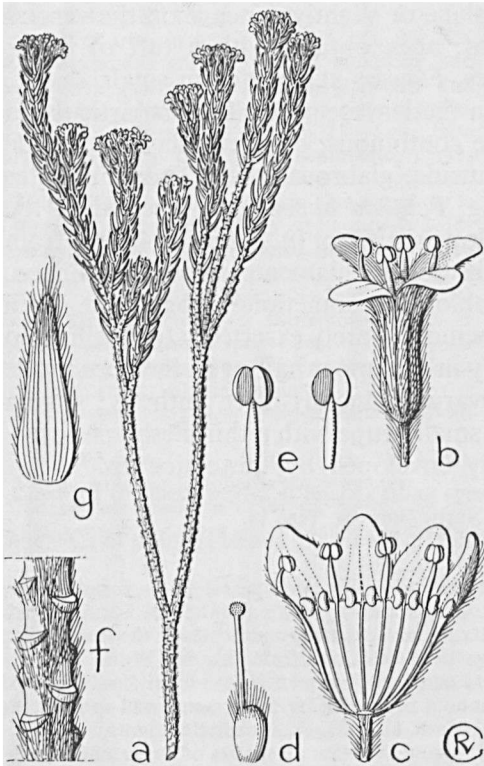


Fig. 17. *Drapetes ericoides* HOOK. *f.* *a.* Habit, nat. size, *b.* flower, $\times 6$, *c.* opened flower, pistil removed, $\times 6$, *d.* pistil, $\times 6$, *e.* stamens, $\times 13$, *f.* stem showing leaf-scars, $\times 6$, *g.* leaf, $\times 6$ (ROBBINS 315).

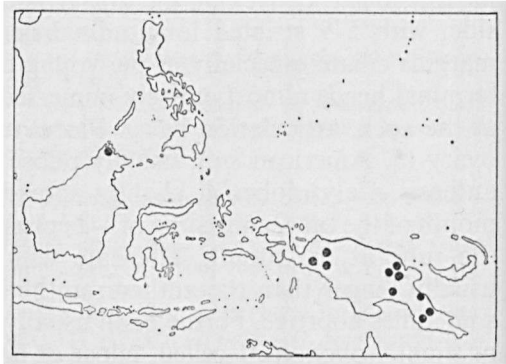


Fig. 18. Localities of *Drapetes ericoides* HOOK. *f.*

by $\frac{2}{3}$ mm. *Inflorescences* (1)–4–9-flowered; pedicels short, *c.* $\frac{1}{2}$ mm. *Flowers* white, cylindric, slightly expanded towards the apex, 3–5 mm long, 12-costate. *Calyx* lobes ovate, obtuse, 1–1½ mm long. *Stamens* *c.* 1 mm long; anthers as long as or slightly shorter than the filaments. *Petaloid appendages* always 8, in 4 episepalous pairs. *Pistil* 2–3 mm long, the abortive ones only *c.* 1 mm. *Fruits* ellipsoid.

Distr. Malaysia: Borneo (Mt Kinabalu) and New Guinea (Mt Carstensz, Lake Habbema, Mt Wilhelmina, Mt Doorman, Hagen Range, Mt Giluwe, Mt Wilhelm, Mt Albert Edward, Mt Victoria, and Central Div.). **Fig. 18.**

Ecol. Alpine plant, on dry grasslands, shallow soil over rocks on sheltered grasslands, plentiful on sandy banks of streams, and in cracks of granite, usually occurring from 3000 to over 4000 m.

9. PIMELEA

BANKS & SOLAND. *ex GAERTN. Fruct.* 1 (1788) 186, *nom. gen. cons.*; MEISN. in *DC. Prod.* 14 (1857) 496; BENTH. *Fl. Austr.* 6 (1873) 1; DOMKE, *Bibl. Bot.* 111 (1934) 138, map 18, *non Banksia* FORST. 1776.—*Thecanthes* WIKSTR. *Kongl. Vet. Acad. Handl. Stockh.* (1818) 269, 271.—**Fig. 19–20.**

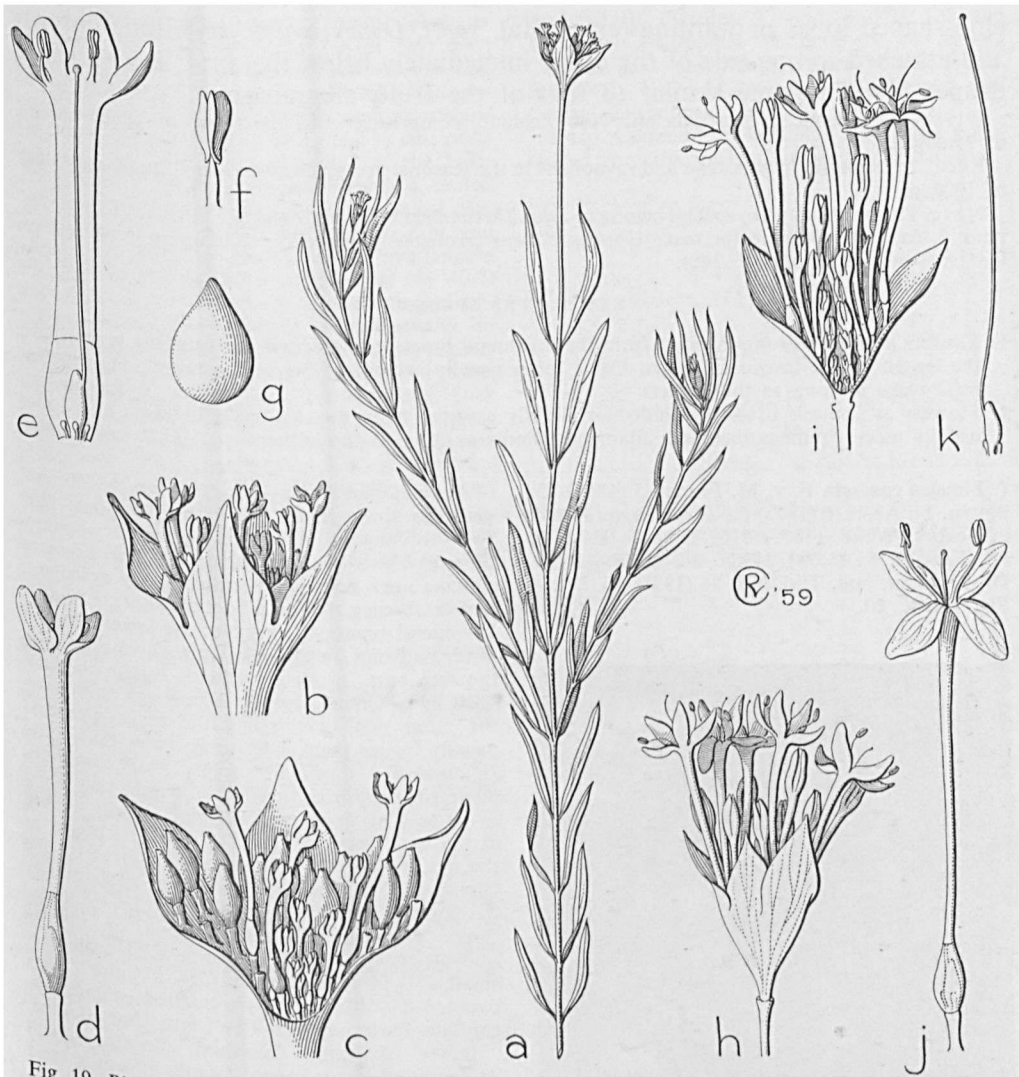


Fig. 19. *Pimelea cornucopiae* VAHL. a. Habit, $\times \frac{2}{3}$, b. inflorescence, $\times 2$, c. longitudinal section of inflorescence, $\times 2$, d. flower, $\times 4$, e. opened flower, $\times 4$, f. stamen, $\times 13$, g. seed, $\times 13$.—*P. concreta* F. v. M. h. Inflorescence, $\times 2$, i. longitudinal section of inflorescence, $\times 2$, j. flower, $\times 4$, k. pistil, $\times 4$ (a WOMERSLEY & VAN ROYEN 5853, b-g WOMERSLEY 8767, h-k VAN STEENIS 3304).

Herbs, shrubs or undershrubs (extra-Mal. *spp.*). Leaves opposite or decussate, sometimes subopposite, or alternate. Inflorescences terminal or axillary (extra-Mal. *spp.*), capitate, rarely spicate or solitary (extra-Mal. *spp.*); involucre bracts partially united, or free (extra-Mal. *spp.*), 4, or in extra-Mal. *spp.* 4-6(-8) or more, sometimes wanting. Flowers bisexual, sometimes unisexual by abortion or dioecious (extra-Mal. *spp.*), at least in Mal. *spp.* developing centripetally. Floral tube tubular, often silky villous outside, in Mal. *spp.* circumsciss above the ovary. Calyx lobes 4, spreading or erect. Petaloid appendages 0, but the throat usually thickened or rim-like folded. Stamens 2, inserted in the throat of the tube and opposite the 2 outer calyx lobes. Disk consisting of 4, scale-like, filiform or

club-shaped lobes or wanting (extra-Mal. *spp.*). Ovary ovoid; style long-filiform and attached to one side of the ovary immediately below the apex. Fruit a small drupe. Seed in shape similar to that of the fruit, albuminous.

Distr. Subendemic in Australia and New Zealand, comprising *c.* 80 *spp.*, two of which extend to Malaysia.

Ecol. In Malaysia in grassland and savannahs in the seasonal areas, mostly at low altitude, ascending to 1000 m.

Note. The two Malaysian species belong to *subg. Thecanthes* (WIKSTR.) MEISN. *ex* GILG (in E. & P. Pfl. Fam. 3, 6a, 1894, 243); in the text "Untergen." was erroneously printed as "Unterfam.", *cf.* also DE DALLA TORRE & HARMS p. 340).

KEY TO THE SPECIES

1. Flowers at anthesis long-exserted from the involuclral bracts, the exserted parts usually longer than the length of the involuclral lobes. Calyx lobes usually spreading. Stamens exserted; filaments at least twice as long as the anthers 1. *P. concreta*
1. Flowers at anthesis usually included or slightly exserted from the involuclral bracts. Calyx lobes usually erect. Stamens included; filaments almost as long as the anthers. 2. *P. cornucopiae*

1. *Pimelea concreta* F. v. M. Fragm. 5 (1865) 73; BENTH. Fl. Austr. 6 (1873) 6.—*P. brevituba* FAWC. in Forbes, Wand. (1885) 516; GILG in E. & P. Pfl. Fam. 3, 6a (1894) 243, f. 84, D, E.—*P. sp.* DAMMERMAN, Nat. Tijd. N.I. 86 (1926) 45, f. 1.—Fig. 19h–k, 20.



Fig. 20. *Pimelea concreta* F. v. M. Sumba (Photogr. DE VOOGD).

Annual, simple or branched, up to 50 cm, glabrous throughout. Leaves membranous, narrowly oblong or oblong-lanceolate, or obovate-oblong, 1¾–3½ cm by 4–8 mm; base acute to obtuse; apex acuminate and minutely apiculate; nerves obscure, 4–6 pairs; petiole short, *c.* 1 mm. Involuclral bracts 4, united at the lower third or lower half into an obconical cup, 7–15 mm long, the free parts ovate or deltoid, rarely obovate, 4–10 by 6–8 mm, acute or acuminate, imbricate, the outer pair overlapping the inner pair and usually longer than wide rarely wider than long. Inflorescences terminal, usually more than 50-flowered; peduncles variable in length, very short or up to 4½(–7) cm; pedicels flat, usually dilated at the base, very short to 1½ mm, articulated at the top. Flowers 10–15 mm long, inserted on the cup-shaped part of the involuclre, centripetally developing, white to rose. Floral tube cylindrical. Calyx lobes 4, imbricate, oblong or slightly obovate-oblong, 2–2½ mm long. Disk scale-like, small, *c.* ½ mm long. Stamens 2½–3½ mm. Ovary ovoid, 1–1½ mm long; style exserted; stigma subcapitate. Fruits ovoid, 2–4 by 1 mm, short-stalked.

Distr. Australia (Northern Territory) and Malaysia: Lesser Sunda Islands (Sumba and Timor). Fig. 21.

Ecol. Grassland and sandy ground, from the lowland up to 1000 m.

Vern. *Tua leu*, Timor.

Note. Some specimens collected in Sumba have the involuclral bracts deltoid and slightly wider than long.

2. *Pimelea cornucopiae* VAHL, En. Pl. 1 (1804) 305; R. BR. Prod. (1810) 359; MEISN. in DC. Prod. 14 (1857) 496; F. v. M. Fragm. 7 (1869) 3; BENTH. Fl. Austr. 6 (1873) 6; F. v. M. Descr. Not. 2 (1885) 8; BAILEY, Queensland Fl. pt 4 (1901) 1363.—*Thecanthes cornucopiae* WIKSTR. Kongl. Vet. Acad. Handl. Stockh. (1818) 271.—*P. philippinensis* C. B. ROB. Philip. J. Sc. 6 (1911) Bot. 345; MERR. En. Philip. 3 (1923) 134.—Fig. 19a–g.

Annual up to 50 cm tall. Leaves membranous,

lanceolate, narrowly oblong, rarely obovate-lanceolate, (1¼–)2–3½ cm by 1½–6(–7½) mm; apex acuminate; base obtuse; nerves obscure, 3–6 pairs; petiole very short, c. 1 mm. *Inflorescences* terminal, 15–40-flowered; peduncles variable in length, very short, or up to 5½ cm; pedicels 1–5 mm, flat but not dilated at the base, articulated at the top. Involucral bracts 4, united at the lower third or half into an obconical cup, 7–10(–15) mm long, the free parts ovate and acuminate, imbricate, the outer pair overlapping the inner pair, longer than wide, 6–8 by 2½–4(–7) mm. *Flowers* 7–10 mm long, inserted on the cup-shaped part of the involucre, white, usually included in the involucral bracts, sometimes slightly protruding beyond them. Calyx lobes 4, imbricate, oblong, or slightly obovate, 1–2 mm long. Disk small and obscure. *Stamens* 1–1½ mm, slightly shorter than the calyx lobes. *Ovary* ovoid, 1½ mm long; style slightly protruding beyond the floral tube; stigma small, globose. *Fruits* ellipsoid, 3 by 1½ mm, slightly stiped.

Distr. Australia (Queensland), D'Entrecasteaux Is. (Fergusson I.), New Britain, Louisiade

Archipelago (Misima I. and Sudest I.), and *Malaysia*: Philippines (extreme N of Luzon, Cagayan Prov. near Sanchez Mira, once collected, B.S. 7410, US) and New Guinea (Western and Central Divisions). Fig. 21.

Ecol. Common on savannah ridges and grasslands, from the lowland rarely up to 570 m.

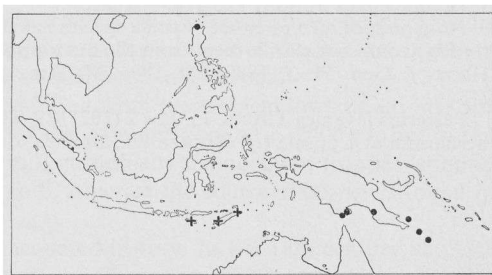


Fig. 21. Localities of *Pimelea concreta* F. v. M. (+) and *P. cornucopiae* VAHL. (●) in Malaysia; both species also occur in Australia.

10. AMYXA

Cf. AIRY SHAW, Fl. Mal. I, 4 (1953) 363, f.5.—Fig. 22.

1. *Amyxa pluricornis* (RADLK.) DOMKE, Bibl. Bot. 111 (1934) 116; AIRY SHAW, Fl. Mal. I, 4 (1953) 363.—Fig. 22.

SHAW questioned whether the fruit of this small Bornean tree is dehiscent. Judging from fruiting material collected in Sept. 1958 by M. JACOBS (n. 5376) near Belaga, in the Third Division of Sarawak, this seems indeed to be the case, though the spontaneous dehiscence of the almost mature fruit happened during the process of drying the specimens. But the dehiscence of the valves appears so regular along distinct sutures that there seems to be hardly any doubt that dehiscence will

also take place in nature. The seed colours are marked: fruit green, softish, seed dark glossy brown, funicle partly very fleshy, aril-like, white. How these colours will be at complete maturity is unknown; they may change at the last moment. Tropical fruits are often devoured by animals before maturity. When mature the attractive seed with its contrasting colours will dangle out of the dehiscent capsule hanging on the thin basal part of the funicle from the apex of the valve; it is likely to be dispersed by animals.

Distr. Now also twice collected by KOSTERMANS in West Kutai, East Borneo.

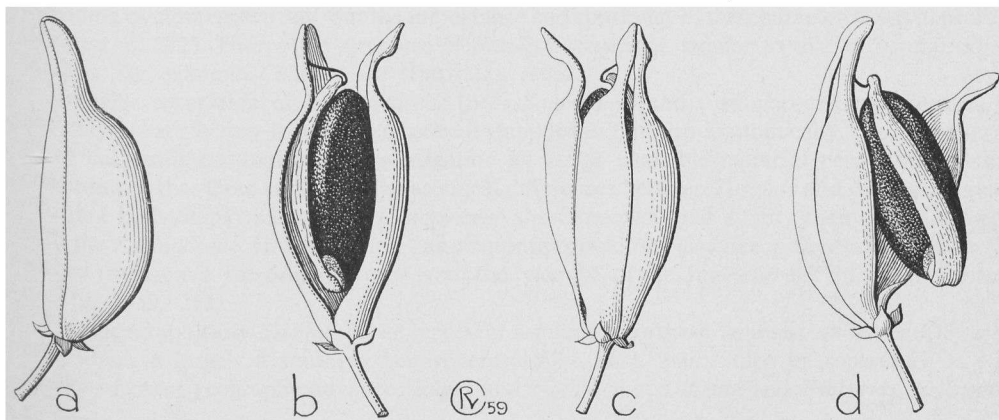


Fig. 22. Fruit of *Amyxa pluricornis* (RADLK.) DOMKE, nat. size. When collected it was still closed, but dehiscent during drying with 3 valves showing the dark seed and the funicle which is thread-like at the base but thickened, pale, and fleshy in its apical part. In nature the seed is in the ripe state probably dangling from the dehiscent fruit (JACOBS 5376).

Excluded and Doubtful

Gnidia oppositifolia (non L.) BLANCO, Fl. Filip. (1837) 299, and *Gnidia? philippinica* MEISN. in DC. Prod. 14 (1857) 592 are according to EXELL (Fl. Mal. I, 4, 1954, 555) = *Terminalia polyantha* PR. (Combret.).

Hornera JUNGH. Tijd. Nat. Gesch. Phys. 7 (1840) 314.

H. glomerata JUNGH. *l.c.* 316.—Japan.

H. umbellata JUNGH. *l.c.* 316.—Japan.

No type specimen of either of these species has been as yet located. Dr VAN STEENIS and Dr HATUSIMA (*in litt.*) could not clarify them from the description. They might not be natives of Japan (*cf.* BENTH. & Hook. *f.* Gen. Pl. 3, 1880, 188–189). Mr AIRY SHAW (*in litt.*) assumes them to be Lauraceous.

Passerina javanica THUNB. Fl. Jav. 2 (1825) 19. The type specimen could not be found in THUNBERG's herbarium at Uppsala (*cf.* BACKER *c.s.*, Blumea 6, 1950, 358) and the description is entirely inadequate.