

**BURSERACEAE** (P. W. Leenhouts, Leyden,  
in collaboration with C. Kalkman and H. J. Lam, Leyden)

Dioecious, rarely monoecious trees or shrubs. *Bark* of twigs with a whorl of resiniferous ducts, bordered on the outer side by a distinct, closed or more or less interrupted sinuous sclerenchymatic cylinder. *Pith* of the twigs, petioles and petiolules not rarely with vascular strands, those in the twigs mostly amphivasal with mainly sclerenchymatic xylem, those in the petioles and petiolules collateral and consisting of abundant phloem, the strands predominantly reduced to mere vestigial resiniferous ducts. *Leaves* imparipinnate, sometimes 1-foliolate; spirally arranged, very rarely in pseudowhorls, usually more or less crowded at the ends of the branchlets. *Stipules* absent, *Garuga* and *Canarium* excepted (see Morph.); in addition in *Garuga* stipellas are often present (fig. 6a). *Inflorescences* paniculate, if poor tending towards racemes or spikes (*Canarium*), axillary, often crowded at the ends of the branchlets, sometimes pseudoterminal (the subtending leaves or bracts early caducous), or terminal (apparently by suppression of the terminal bud). *Bracts* and *bracteoles* usually deltoid to subulate, in *Canarium subg. Canarium* often ovate to orbicular (see Morph.). *Flowers* 3–5-merous, generally greenish to creamy, usually unisexual (in *Malaysia* only *Garuga* excepted) with remains of the other sex, the androecium in ♀ flowers always only slightly reduced, the gynaecium in ♂ ones very slightly to entirely reduced. *Sepals* valvate, mostly connate. *Petals* in Mal. *spp.* free, induplicate-valvate, in the central part sometimes (especially *Canarium*) irregularly imbricate. *Stamens* usually twice as many as the petals, 1-whorled or indistinctly 2-whorled (in *Triomma* and a very few *Santirias* and *Canariums* as many as petals); filaments free or more or less united, not rarely adnate to the disk; anthers usually dorsifixed near the base (adnate in *Santiria sect. Icacopsis*), dehiscent lengthwise, introrse. *Disk* intrastaminal, *Triomma* excepted, variable in size and shape, in ♂ *Canarium* flowers often either consolidated with the remains of the pistil (*ovariodisk*), or replacing the latter, though usually still provided with a narrow central canal (fig. 20). *Ovary* usually isomerous, rarely meiomerous, each cell with 2 axile, epitropous, descending ovules; style simple, stigma globular, often slightly lobed. *Fruits* (in Mal. *spp.*) drupaceous with non-dehiscent, fleshy pericarp (in *Haplolobus* dry, in *Triomma* woody and dehiscent) and crustaceous to papyraceous endocarp; cells 1-seeded, often partly reduced. *Seed* exalbuminous; cotyledons entire or not, fleshy, containing oil.

Distr. About 16 genera and c. 550 *spp.* distributed through the tropics. The family is subdivided in 3 tribes:

The *Protieae* (6 genera) are centred in Central and S. America, the exceptions being *Garuga* (SE. Asia to Melanesia) and a few species of *Protium* (Madagascar, the Mascarenes, and SE. Asia to New Guinea inclusive).

The *Bursereae* (5 genera) are centred in Africa and continental S. Asia, with the exceptions of *Triomma* (W. Malaysia) and *Bursera* (Central and S. America).

The *Canarieae* (5 genera: *Dacryodes*, *Santiria*, *Haplolobus*, *Scutinanthe*, and *Canarium*) are nearly exclusively palaeotropical (*Dacryodes sect. Dacryodes*, comprising 2 *spp.* in Central and S. America), and especially Malaysian; a small number of species (in *Dacryodes*, *Santiria*, and *Canarium*) is African and very few, mainly Malaysian species, occur in Australia and the SW. Pacific Islands.

Ecol. Almost all Malaysian species are native of the tropical rain-forests at low to medium altitudes (rarely above c. 1000 m). *Protium javanicum* and *Garuga floribunda* apparently prefer monsoon forests or even (*Protium javanicum*) more open and periodically rather dry park- and woodlands. Among the non-Malaysian genera, *Bursera*, *Boswellia*, and *Commiphora* are confined to rather arid regions.

Dispersal. Fruits of Malaysian representatives are predominantly drupaceous. The only exception is *Triomma* with capsular fruits and seeds surrounded by a broad membranous wing facilitating dispersal by wind.

The drupaceous type of fruit is adapted to dispersal by animals, either in the air or on the ground. According to RIDLEY (Dispersal 1930, 346, 460) starlings feed on the fruit of *Canarium* in Ceylon, in which island it has also been observed that monkeys eat the drupes. In the Banda Islands TEMMINCK (Coup d'Éil 3, 1849, 294) found that pigeons swallow canary fruits, as do cassowaries and megapodes which pick them from the ground. WALLACE (Mal. Arch. ed. 5, 1874, 342) observed fruit pigeons in Batjan eating canary fruits, and WHITEHOUSE observed Torres Street pigeons eating the drupes of *Canarium australianum*. According to GUPPY (Obs. Nat. Pac. 2, 1906, 400) fruit pigeons have been observed to swallow *Canarium* drupes in the Solomon and Fiji Islands; stones obtained from crops of Fijian pigeons measured 3 by 2½ cm. He says: 'In the Solomon Islands birds stock the interior of the coral islets with trees of this genus and the ground below the trees is often strewn with disgorged stones.' GUPPY assumes the large drupes to have no capacity for dispersal by water. Though by compression of the sterile cells the stones will, generally, have no air compartments preventing them to sink in water, the fruits of some species may possess buoyancy capacity by virtue of the fibrous pericarp as is for example found in *Canarium megacarpum* and *C. kaniense* var. *globigerum* (fig. 21 a-e).

Long-distance dispersal seems not very likely and this fits with the fact that *Burseraceae* are exceedingly scarce in oceanic islands beyond continental reach. In Polynesia they are absent, in Micronesia only specimens of (a Philippine form of) the widely distributed *Canarium hirsutum* and a doubtful *Haplolobus* have been found. It is significant that in the continental or subcontinental islands of Melanesia quite a number of representatives have been found, some even endemic. Thus in Samoa three genera are represented, viz *Garuga*, *Haplolobus*, and *Canarium*. It is remarkable indeed that this distribution eastwards towards the Pacific as far as Palau and Samoa is an exact replica of the situation found in the *Proteaceae* with similar fruit structures, cf. p. 147.

Wood anatomy. DEN BERGER, Determinatietabel Malesië, Veenman, Wageningen (1949) pp. several (hand lens). DADSWELL & INGLE, Austr. J. Sc. Res. 1 (1948) 413; HEIMSCH, Lilloa 8 (1942) 122; METCALFE & CHALK, 1 (1950) 345; JANSSONIUS, Blumea 6 (1950) 431; MOLL & JANSSONIUS, Mikr. Holzes 2 (1908) 87; WEBBER, Lilloa 6 (1941) 441 with many ref. up to 1940. See also under genera and species.—The identification by JANSSONIUS, Key to Jav. woods, Brill, Leiden (1952) 45, 52, 53 is not exhaustive because no specimens-with-radial-gum-ducts seem to have been available (cf. MOLL & JANSS. l.c.).—The family is characterized by septate wood fibres constituting the ground tissue, and a paucity of wood parenchyma and so its genera are readily distinguishable from most of those of the *Anacardiaceae*. According to DADSWELL & INGLE l.c. confusion might arise only with *Microstemon*, *Odina* and *Pentaspadon*. These genera of the *Anacardiaceae* might be distinguished at present from the *Burseraceae* through the vessels with spiral thickenings (cf. HEIMSCH l.c.) in *Microstemon* and *Pentaspadon* and the combined occurrence of radial gum ducts and rather a large number of vessels per sq.mm in *Odina*. With the hand lens a distinction of the taxa is not always possible (cf. DEN BERGER l.c. several pp.)—C.A.R.-G.

Uses. Economically the family is not very important. Some species, especially of *Canarium*, are popular wayside trees. The wood of most species is rather soft and often cross-grained and commercially unimportant. The resin, which is abundant in many species, is of more importance (*Manila elemi* is produced by *Canarium luzonicum*). Of several species the seeds, which are rich in oil, are eaten.

Taxonomy. Though the *Burseraceae* are accepted to be taxonomically most closely related to the *Simaroubaceae* and the *Meliaceae*, in the herbarium *Burseraceae* are frequently confused with *Anacardiaceae*, specially in the sterile state; palynologically they are indistinguishable. The only decisive character is the number of ovules, which is two in every cell in the *Burseraceae* and one in the *Anacardiaceae*. Both families are characterized within the *Terebinthales* by the anatomy of the bark, containing a whorl of resiniferous ducts near the inner side which is closely surrounded by a very distinct, light-coloured, sinuous, sclerenchymatic band; in the *Anacardiaceae* this structure is often somewhat irregular. Moreover, the pith in the *Burseraceae* is usually rather compact and dull in cross-section; in the *Anacardiaceae* it is often more loose and shining (like elder-pith). In the forest both families are apparently more readily distinguishable; both are resiniferous, but the resin of the *Anacardiaceae* very quickly turns to black, that of the *Burseraceae* remains colourless or yellow, or, more rarely, turns slowly to black. Moreover, burseraceous resin seems to be more readily combustible. In the field *Burseraceae* are apparently rather well characterized by their almond-like smell, and by their bark, which is usually light-grey and rather smooth.

Though a distinct taxonomical relationship between *Burseraceae* and *Anacardiaceae* is declined by most authors, the characters mentioned above point rather to the reverse.

*Burseraceae* often possess buttresses (fig. 39), sometimes stilt-roots (fig. 11) or, more rarely, small pencil-like adventitious roots on warts of the trunk (fig. 26 & 30).

The subdivision of the family is exclusively based upon the structure of the fruits (see under Morph.). As a whole this subdivision seems to be rather natural, possibly with the exception of *Scutinanthus*, classified in the *Canarieae*, which in its other characters seems to be more closely related to *Garuga* of the *Proteae*.

**Morphology.** In a very few cases (especially *Canarium*) representatives of this family are said to be climbers. In nearly all these cases there is reason to doubt the reliability of the field notes. *Cf.*, p. 282a, 292b, and 296a. This point deserves the full attention of collectors!

The *vegetative buds* are naked or may be partly enclosed by the broadened, concave basal parts of the petioles; only in *Canarium subg. Canarium* the stipules usually serve as bud-scales.

As in the related families, *stipules* are wanting in most of the *Burseraceae*. If they are present the following cases can be observed (see fig. 22):

In a few species the lowest pair of leaflets is inserted at the very base of the petiole, forming a pair of *pseudostipules* (*Garuga*, *Dacryodes laxa*, *Canarium decumanum*); these leaflets are small and very caducous (fig. 22a). In *Dacryodes laxa* only the blades of these leaflets are very caducous, and the petiolules are persistent. These petiolules closely resemble the stipules of the next type.

In the second type the stipules are subulate (*Canarium sect. Pimela*) (fig. 22b-c). I doubt whether their resemblance to those of *Dacryodes laxa* points to a homology with the above mentioned petiolules or whether they are real stipules, as those species of *sect. Pimela* which are apparently most primitive (*C. balsamiferum* and *oleosum*) are devoid of stipules. Particularly the species with subulate stipules inserted remote from the base, I regard as probably the least primitive.

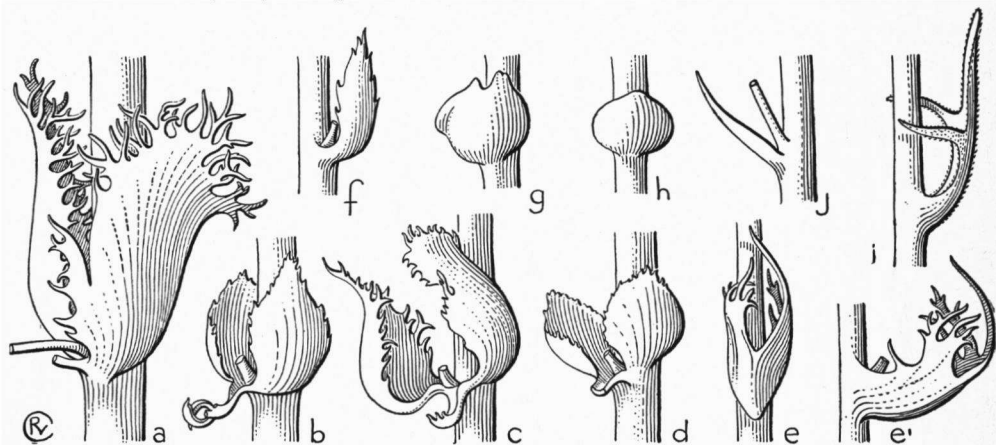


Fig. 1. Types of bracts in *Burseraceae*, illustrated by those of *Canarium*. a-h: a series of transitions from a stage with a reduced caducous bract between normal stipules (a) to the normal pseudobract of *sect. Canarium* consisting of 2 connate stipules without vestige of the original bract (h), all in *C. kaniense* LAUT. (CLEMENS 1288), i. much reduced leaf consisting of the base of the petiole and a pair of subulate stipules illustrating the assumed origin of the subulate bract as shown in j, the latter representing the type of bract typical for the rest of the family (i-j. after the Siamese *C. subulatum* GUILLAUM.: KERR 5405). (In most figures the pedicel or peduncle has been cut; all  $\times 2$ .)

The third type is represented by the foliar stipules of *Canarium sect. Canarium* (fig. 22d-k). In my opinion these are real stipules. In *C. littorale*, probably the most primitive species of this section, they are small, caducous, and inserted on the twig near the base of the petiole (fig. 22d). The main tendencies in this type of stipule are either to become larger and more or less deeply incised (fig. 22f-k), or to be pushed on the petiole (the shrivelled auricle-shaped ones, fig. 22e, & 25); in both cases they tend to become persistent.

The *bracts* are usually representing reduced leaves (probably the basal part of the petiole); in *Canarium sect. Canarium* they are derived from the connation of a pair of stipules, however, and therefore often resemble these very much, especially in the dentation of the margin (*pseudobracts*). Fig. 1.

The *disk* is nectariferous and is the only bright-coloured part (usually orange or red) of the flower.

The structure of the *fruits* is rather divergent in the different tribes (which are based on this character). The types are the following (see fig. 2):

1. In the *Protieae* the pyrenes are separate, and are only formed by the crustaceous endocarp; pericarp and mesocarp are fleshy or dry, and in the latter case dehiscent (fig. 2a, b).

2. In the *Burserae* the endocarpous pyrenes are more or less, yet not intimately, connate; pericarp and mesocarp are dry and dehiscent. In the subtribe *Commiphorinae* (no Malaysian genera) the receptacle of the flower takes no part in the forming of the fruit proper; in the subtribe *Burserinae* (in Malaysia: *Triomma*), an outgrowth of the receptacle forms the central fistulose part of the fruit and has produced wings between the pyrenes (fig. 2c).

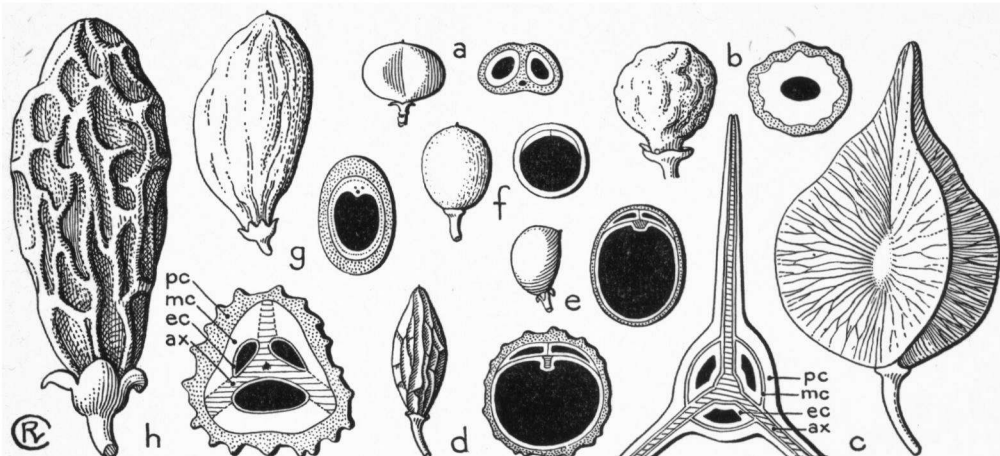


Fig. 2. Fruit structure in the Malaysian genera of *Burseraceae*. *a*. *Protium connarifolium* (PERK.) MERR., *b*. *Garuga floribunda* DECNE, *c*. *Triomma malaccensis* HOOK. f., *d*. *Dacryodes rostrata* (BL.) H. J. LAM, *e*. *Santiria rubiginosa* BL., *f*. *Haplolobus floribundus* (K.SCH.) H. J. LAM, *g*. *Scutinanthe brunnea* THW., *h*. *Canarium pseudopatentinerivium* H. J. LAM (*pc* = pericarp; *mc* = mesocarp; *ec* = endocarp; *ax* = axial part; dotted: fleshy parts; shaded: axial parts; black: cells; *b*  $\times 2$ , cross-sections of *c*, *d*, and *e*  $\times 4/3$ , all others  $\times 2/3$ ).

3. In the *Canarieae* the pericarp is fleshy and the solitary pyrene consists of the mesocarp and the endocarp, which are fully fused. In the subtribe *Dacryodiinae* (in Malaysia: *Dacryodes*, *Santiria*, *Haplolobus*, *Scutinanthe*) the receptacle takes no part in the forming of the fruit proper (fig. 2d-g); in the subtribe *Canariinae* (only *Canarium*), an outgrowth of the receptacle forms the central part of the pyrene and has produced wings between the cells as far as the surface of the pyrene, thus dividing the mesocarp into 3 (dehiscent) lids. These axial wings are usually quite distinct on the surface of the pyrene as the 'angle-ribs'; sometimes there is a distinct suture between them and the mesocarpal lids (fig. 2h).

An extensive treatment on the morphology of this family has been given by H. J. LAM, *Ann. Jard. Bot. Btuz* 42 (1931-32) 23-56 and 97-226.

Notes. As nearly all the species are dioecious, and moreover  $\sigma$  trees very rarely bear flowers and fruits at the same time, the keys to the species are, as far as possible, primarily based on vegetative characters. It appeared to be impossible, however, to frame a key to the genera based only on vegetative characters; without an intimate knowledge of the species it is indeed often very difficult and not rarely even impossible to refer sterile specimens definitely to a genus.

Accordingly, sterile material has a very much limited value; fruits are of primary importance.

When the trees are in flower, collectors should be aware, that they are dioecious!

The authors, responsible for the different genera, are: C. KALKMAN, Leyden, for *Garuga*, *Triomma*, *Dacryodes*, and *Santiria*, H. J. LAM, Leyden, for *Haplolobus*, and P. W. LEENHOUTS, Leyden, for the genera *Protium*, *Scutinanthe*, and *Canarium*; all wood-anatomical remarks are, as usual, by Mrs C. A. REINDERS-GOUWENTAK, Wageningen.

Thanks to the generous co-operation of Mr F. HUYSMANS, Head of the Photographic Division of Kebun Raya Indonesia, Bogor, excellent photographs of living material were obtained.

#### KEY TO THE GENERA

1. Flowers 5-4-merous. Fruits with 1 or more pyrenes. Pith of the branchlets without vascular strands.
2. Stipules present; stipellas often present. Flowers bisexual. Pith of the petioles usually with some vascular strands; margin of the leaflets mostly distinctly crenate-serrate . . . . . 2. *Garuga*
2. Stipules and stipellas absent. Flowers unisexual. Pith of the petioles without vascular strands; margin of the leaflets mostly entire.
3. Stamens 5. Disk extrastaminal. Fruits 3-winged . . . . . 3. *Triomma*
3. Stamens 8 or 10. Disk intrastaminal. Fruits globular or ellipsoid.
4. Receptacle of the flowers cupular. Pistil 3-merous. Fruits ellipsoid, 1-seeded. Leaflets not mucronulate . . . . . 7. *Scutinanthe*
4. Receptacle of the flowers flat. Pistil 4-5-merous. Fruits globular or oblique, with 1-5 one-seeded pyrenes. Leaflets often mucronulate . . . . . 1. *Protium*
1. Flowers 3-merous. Fruits with 1 pyrene. Pith of the branchlets with or without vascular strands.

- 5. Pyrene thick-walled, bony, 3-1-seeded; sterile cells slightly to strongly reduced. Pith of the branchlets almost always with vascular strands. Leaves often stipulate. Receptacle in ♀ flowers not rarely cupular. Disk and pistil often pilose; in ♂ flowers the pistil usually strongly reduced, sometimes fused with or replaced by the strongly developed disk . . . . . 8. *Canarium*
- 5. Pyrene thin-walled, papyraceous to crustaceous; 1-seeded; sterile cells totally flattened. Pith of the branchlets usually without vascular strands. Leaves exstipulate, *Dacryodes laxa* excepted. Receptacle always flat. Disk always, pistil nearly always glabrous, the latter in ♂ flowers usually moderately, never entirely reduced.
- 6. Stigma on the fruits always distinctly excentric; pericarp smooth when dry . . . . . 5. *Santiria*
- 6. Stigma on the fruits apical or nearly so; pericarp smooth or coarsely wrinkled when dry.
- 7. Dry fruits smooth; pyrene papyraceous; cotyledons entire, flat. Inflorescences axillary, usually small (c. 5-10 cm), mostly branched from the very base . . . . . 6. *Haplobolus*
- 7. Dry fruits coarsely wrinkled; pyrene cartilaginous; cotyledons compound and folded. Inflorescences usually larger and distinctly paniculate, axillary or terminal . . . . . 4. *Dacryodes*

1. PROTIUM

BURM. f. Fl. Ind. (1768) 88; SWART, Rec. Trav. Bot. Néerl. 39 (1942) 189, 228; LEENH. Blumea 7 (1952) 154.—*Tingulonga* O.K. Rev. Gen. Pl. 1 (1891) 107.—Fig. 4.

Trees, occasionally shrubs. *Pith of the branchlets* without vascular strands. *Leaves* without stipules; pith of the petioles without vascular strands; tips of the leaflets usually distinctly mucronulate. *Inflorescences* axillary, sometimes pseudo-terminal. *Flowers* 5-4-merous, possibly not always fully unisexual. *Sepals* more or less connate. *Stamens* twice as many as the petals, free, in ♀ flowers very slightly reduced, possibly sometimes fertile. *Disk* intrastaminal, annular, truncate to undulate, glabrous. *Pistil* isomerous, glabrous or pubescent, in ♂ flowers usually slightly reduced, often with sterile ovules in the cells. *Fruits* drupaceous, globose to ovoid, when dry the number of lobes coinciding with the number of developed stones; pericarp fleshy, containing the thin-walled, bony pyrenes; usually 1 or 2 cells nearly totally reduced; calyx persistent, not enlarged, lobes reflexed. *Cotyledons* plicate, lobed to palmatifid.

Distr. About 85 spp. especially in the American tropics, furthermore in Madagascar and the Mascarenes, in SE. Asia from India through *Malaysia* as far as New Guinea.

All Malaysian and both continental Asiatic species belong to *sect. Protium* (*sect. Eu-Protium* SWART, l.c. p. 189). Fig. 3.

Ecol. In *Malaysia* both under everwet and seasonal conditions, up to c. 800 m. Apparently *fl.* and *fr.* throughout the year, though flowers seem to be most abundant in the dry season and fruits in the wet season.

Note. There seems no necessity to keep the generic name *Protium* under the *nomina generica conser-vanda* of the code.

KEY TO THE SPECIES

- 1. Leaflets cuspidate, acumen 1-1½ cm long. Flowers 4-merous (rarely some 5-merous flowers in the same specimen) . . . . . 3. *P. connarifolium*
- 1. Leaflets short- and broadly acuminate, acumen often blunt. Flowers 5-merous (rarely some 4-merous flowers in the same specimen).
- 2. Petiolules of the lateral leaflets 1-3(-5) mm. Ovary and fruits glabrous . . . . . 1. *P. javanicum*
- 2. Petiolules of the lateral leaflets 5-18 mm. Ovary pubescent, fruits glabrescent. . . . . 2. *P. macgregorii*

1. *Protium javanicum* BURM. f. Fl. Ind. (1768) 88; DC. Prod. 2 (1825) 78; BL. Mus. Bot. 1 (1850) 229; MIQ. Fl. Ind. Bat. 1, 2 (1859) 654; ENGL. in DC. Mon. Phan. 4 (1883) 70, t. 2 f. 8-10; K. & V. Bijdr. 4 (1896) 22; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 207, f. 2<sup>1</sup>, 3-5; Rev. Gén. Bot. 22 (1910) 454, f. 4; Not. Syst. 2 (1913) 265; MERR. Int. Rumph. (1917) 305; DOCT. v. LEEUWEN, Zoocceidia (1926) 263, f. 440; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 16 f. 129; Bull. Jard. Bot. Btzg III, 12 (1932) 322, t. 4 f. 6; SWART, Rec.

Trav. Bot. Néerl. 39 (1942) 248; MEYER-DREES, Comm. For. Res. Inst. no 33 (1951) 43; LEENH. Blumea 7 (1952) 155, f. 1<sup>5</sup>.—*Tingulong* RUMPH. Herb. Amb. 7 (1755) 54, t. 23 f. 1.—*Amyris protium* L. Mant. Pl. (1767) 65.—*Bursera javanica* BAILL. Hist. Pl. 5 (1874) 296.—*P. zollingeri* ENGL. in DC. Mon. Phan. 4 (1883) 71.—*Tingulonga zollingeri* O.K. Rev. Gen. Pl. 1 (1891) 108.—*Tingulonga protium* O.K. Rev. Gen. Pl. 1 (1891) 108.—Fig. 4a-f.

Shrub to rather large tree, up to 25 m by 1.15 m;

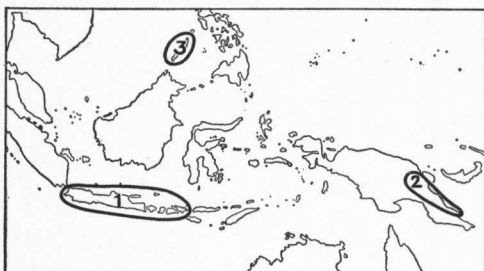


Fig. 3. Distribution of *Protium* in Malaysia. 1. *P. javanicum* BURM. f., 2. *P. macgregorii* (F. M. BAIL.) LEENH., 3. *P. connarifolium* (PERK.) MERR.

bole often short and crooked. *Branches* glabrescent, in young plants with up to  $2\frac{3}{4}$  cm long spines. *Leaves* (0-)2-4(-5)-jugate, glabrous. Lateral *petiolules* 1-3(-7) mm. *Leaflets* ovate to elliptic,  $3\frac{1}{4}$ -11 by  $1\frac{1}{2}$ -4 $\frac{1}{2}$  cm, rather stiff chartaceous; base usually cuneate; margin entire to crenate or serrulate, specially near the apex; apex gradually short-acuminate; nerves 8-13 pairs, straight, abruptly arched near the margin. *Inflorescences* axillary, glabrous to pubescent, ♂ broadly paniculate, (6-)10-15(-25) cm long, ♀ narrowly paniculate, lax,  $2\frac{1}{2}$ -14 cm long. *Flowers* (4-)5-merous, 2-2 $\frac{1}{2}$  mm long, glabrous to faintly puberulous. *Sepals* up to halfway connate,  $\frac{1}{2}$  mm long. *Pistil* glabrous, in ♂ flowers cylindrical, up to 1 mm high. *Fruits* oblique-ovoid to nearly globular (dependent on the number of developed fruit-cells), 8-14 mm long, pointed, glabrous, 2-4-seeded.

*Distr. Malaysia:* Java (in W. Java only on the N.-coast from Djakarta eastward, and near Palabuhanratu), Madura, Bawean, Kangean, Bali, Lombok, Sumbawa. Fig. 3.

*Ecol.* In primary and secondary forests, in more open land, along roads, along the inner border of tidal forests, sometimes on the beach, up to 800 m, distinctly preferring periodically dry regions and in Java mostly associated with teak. *Fl. fr.* throughout the year.

*Wood anat.* DEN BERGER, Med. Proefst. Thee 97 (1926) 68 & Atlas Pl. 12, fig. 46, Med. Proefst. Boschw. 13 (1926) 68 & Atlas Pl. 12, fig. 46, Determinatietabel Malesië, Veenman, Wageningen (1949) 42; REYES, Dep. Agr. & Comm. Manila, Techn. Bull. 7 (1938) 160 (hand lens); MOLL & JANSSONIUS, Mikr. Holzes 2 (1908) 98.

*Uses.* Though the wood is hard and does not easily split, it is not frequently used and for small tools only, as long, straight boles are rare. Apparently, the young leaves and the fruits are sometimes eaten, the old leaves are said to be used in native medicine.

*Vern.* *Katos* (*kētos*, *gētos*), *tanggulun* (*tangulong*, *tengulung*), S, *běrnang*, *gulun* (*běrnang*), *katos* (also *kētos*), *tregulun* (also *tenggulun*, *tenggulon*, *tinggulun*(g), *tingulun*, *tengolon*, *tranggulun*, *tregulun*), J, *tanggulun* (also *tangulun*, *tangkulun*, *i(r)engkulun*), Md, *tanggolon*, *tangkulun*, Kangean, *tengulun*, Bawean, *treggulun*, Bali, *ketimis*, *lo(w)a*, Sumbawa.

*Notes.* *P. zollingeri* represents a more pilose form, which is apparently restricted to E. Java (Besuki); this pubescence occurs, however, to various degree.

2. *Protium macgregorii* (F. M. BAIL.) LEENH. Act. Bot. Neerl. 2 (1953) 305.—*Bursera macgregorii* F. M. BAIL. Queensl. Agr. J. 3 (1898) 282.—*Santiria schlechteri* LAUT. Bot. Jahrb. 56 (1920) 333.—*P. connarifolium* (non MERR.) H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 320-321, *pro specim. novoguin.*; SWART, Rec. Trav. Bot. Néerl. 39 (1942) 258, 260, *ditto*.—*P. schlechteri* LEENH. Blumea 7 (1952) 157.

Moderate to large tree. Young *branchlets* slightly pubescent, older ones scabrous. *Leaves* (1-)2-3-jugate. Lateral *petiolules*  $\frac{1}{2}$ -1 $\frac{3}{4}$  cm. *Leaflets* ovate to lanceolate, 5-11 $\frac{1}{2}$  by 2 $\frac{1}{4}$ -5 $\frac{1}{2}$  cm, herbaceous to subcoriaceous, glabrous; base slightly oblique, cuneate to rounded; margin entire; apex with a short and broad, blunt to

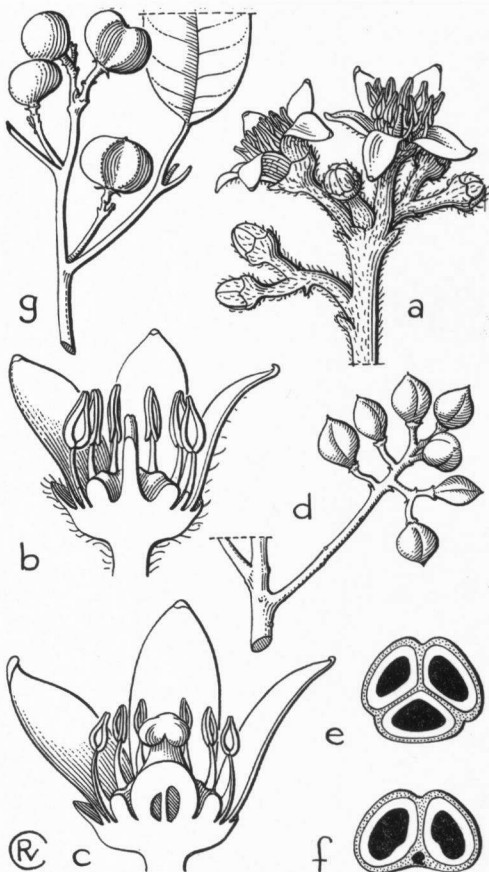


Fig. 4. *Protium javanicum* BURM. f., a & b. ♂, c. ♀, d-f. fruits.—*Protium connarifolium* (PERK.) MERR., g. fruits (a, e & f  $\times 2$ , b & c  $\times 10$ , d & g  $\times 2\frac{1}{3}$ ).

emarginate acumen; nerves 8–11 pairs, nearly straight, arched at some distance from the margin. *Inflorescences* axillary, paniculate, minutely puberulous, ♂ 5–15 cm, shortly stalked, ♀ more lax, 4–8 cm, peduncle up to half as long as the inflorescence. *Flowers* (♀ unknown) 5-merous, 2 mm long, nearly glabrous. *Sepals* nearly halfway connate, 1/2 mm. *Pistil* only very slightly reduced (always sterile?), minutely puberulous. *Fruits* obliquely ellipsoid, monopyrenous, 7 by 5 mm, or 2–4-lobed and 2–4-pyrenous, 8 by 8 mm, sparsely ferruginous-pilose, glabrescent.

Distr. *Malaysia*: NE. New Guinea (Morobe District mainly). Fig. 3.

Ecol. Mostly in parkland, sometimes in secondary forest, from low altitudes up to 800 m. *Fl.* and *fr.* May–Nov.

Uses. Planted as a shade-tree. Fruits eaten by the natives. Timber hard, used in house-building.

Vern. *Kaibas, kaigabu gabu, tawaia*.

Note. Allied to *P. javanicum* BURM. f.

3. *Protium connarifolium* (PERK.) MERR. Philip. J. Sc. 10 (1915) Bot. 30; En. Philip. 2 (1923) 348; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 94; Bull. Jard. Bot. Btzg III, 12 (1932) 320, t. 4 f. 5, excl. *specim. pap.*; SWART, Rec. Trav. Bot. Néerl.

39 (1942) 258, *ditto*; LEENH. *Blumea* 7 (1952) 155. —*Canarium connarifolium* PERK. Fragm. Fl. Philip. 2 (1904) 92. —*P. philippinensis* ELM. Leaf. Philip. Bot. 7 (1915) 2571. —Fig. 4g.

Rather large tree. *Branchlets* tomentose at the tip, glabrescent; pith scalariform to disappearing. *Leaves* (0–)1–2(–3)-jugate. Lateral *petiolules* (1/2–)1–1 1/2(–2) cm. *Leaflets* ovate to oblong, 3/4–1 1/4 by 1–5 1/4 cm, subcoriaceous, glabrous; base cuneate; margin entire; apex gradually long-acuminate, tip cuneate, acute; nerves 7–10 pairs, slightly curved, vaguely arched near the margin. *Inflorescences* axillary, ♀ sometimes pseudo-terminal, narrowly paniculate, thinly tomentose, ♂ 3 1/2–4 1/2 cm, ♀ 1–6 cm. *Flowers* 4(–rarely 5)-merous, c. 3 mm long, thinly tomentose. *Calyx* 1 mm high. *Pistil* tomentose, in ♂ flowers moderately reduced, though containing ovules. *Fruits* 7–8 by 5–13 mm, sparsely puberulous to glabrescent, 1–4-pyrenous.

Distr. *Malaysia*: Philippines (Palawan). Fig. 3.

Ecol. In forest along rivers at low altitudes, up to 600 m. *Fl.* *fr.* Febr.–May.

Vern. *Marangub*, Tag.

Note. This species stands taxonomically rather isolated.

## 2. GARUGA

ROXB. Pl. Corom. 3 (1811) 5, t. 208; KALKMAN, *Blumea* 7 (1953) 459, 498; Taxon 3 (1954) 124, *nom. cons. prop.*—*Capraria* RUMPH. Herb. Amb. 2 (1741) 139.—*Katou-kalesiam* ADANS. Fam. Pl. 2 (1763) 510, 534, *nom. rej. prop.*—Fig. 2b, 5–6.

Deciduous shrubs or trees. *Branchlets* without vascular strands in the pith. *Leaves* mostly stipulate and often with transitions from stipules to normal leaflets; margin of the leaflets crenate-serrate; stipellae often present. *Inflorescences* axillary, crowded at the ends of the branchlets, appearing before the leaves. *Flowers* bisexual, 5-merous; with a concave, globose or cupular receptacle. *Sepals* free. *Stamens* 10, free, inserted at the margin of the receptacle. *Disk* adnate to the receptacle, glabrous, with 10 lobes between the stamens. *Ovary* shortly stalked, 5-celled. *Fruits* drupaceous, pericarp fleshy. Pyrenes 1–5, small, furrowed, bony. *Cotyledons* contortuplicate, compound.

Distr. Four *spp.* in continental SE. Asia, a variety of one of these in *E. Malaysia* to N. Australia and Melanesia (Solomons, New Hebrides, Samoa, and Tonga).

1. *Garuga floribunda* DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 477; BL. Mus. Bot. 1 (1850) 228; MIQ. Fl. Ind. Bat. 1, 2 (1859) 655; BENTH. Fl. Austr. 1 (1863) 377; ENGL. in DC. Mon. Phan. 4 (1883) 6; F. M. BAIL. Queensl. Fl. 1 (1899) 222; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 96b, t. 14 f. 110, t. 15 f. 118c; Bull. Jard. Bot. Btzg III, 12 (1932) 326, t. 4 f. 7A; in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 3; WALKER, For. Solom. Isl. (1948) 102; MEIJER DREES, Comm. For. Res. Inst. no 33 (1951) 43; KALKMAN, *Blumea* 7 (1953) 463, f. 1 & 3.—Fig. 2b, 5, 6.

*var. floribunda.*—*Capraria* RUMPH. Herb. Amb. 2 (1741) 139.—*Guaiacum abilo* BLANCO, Fl. Filip.

(1837) 364.—*Icica abilo* BLANCO, Fl. Filip. ed. 2 (1845) 256.—*G. mollis* TURCZ. Bull. Soc. Imp. Nat. Mosc. 31, 1 (1858) 475; ENGL. in DC. Mon. Phan. 4 (1883) 6.—*Boswellia javanica* TURCZ. Bull. Soc. Imp. Nat. Mosc. 36, 2 (1863) 612; ENGL. in DC. Mon. Phan. 4 (1883) 7.—*G. pinnata* ROXB. *var. mollis* KURZ, J. As. Soc. Beng. 44, ii (1875) 141.—*G. pinnata* (non ROXB.) K. & V. Bijdr. 4 (1896) 17; DOCT. V. LEEUWEN, Zoocecidia (1926) 263; HEYNE, Nutt. Pl. (1927) 883.—*G. pacifica* BURK. J. Linn. Soc. Bot. 35 (1901) 30; CHRISTOPHERSEN, Bull. Bish. Mus. no 128 (1935) 111.—*G. abilo* MERR. Publ. Gov. Lab. Philip. no 35 (1905) 73; Sp. Blanc. (1918) 208; En. Philip. 2 (1923) 356; HEYNE, Nutt. Pl. (1927) 882.—*G. lit-*

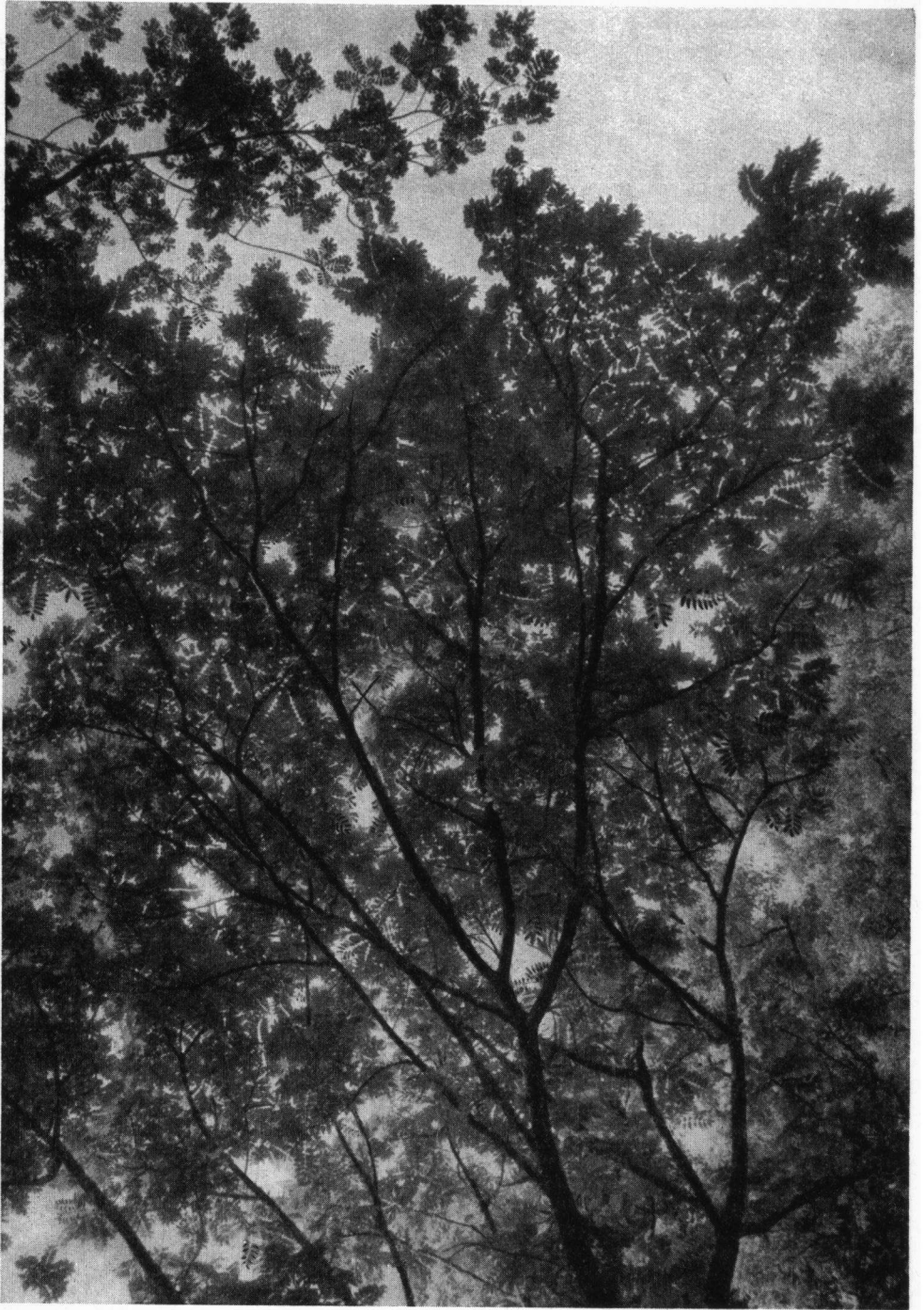


Fig. 5. *Garuga floribunda* DECNE (Cult. Hort. Bog. XI-D-2).





Fig. 6. *Garuga floribunda* DECNE. *a.* Leaf with stipellae and scars of the stipules, one leaflet underneath, *b.* apex of a leafless twig with a number of small lateral panicles; the terminal bud of the twig will develop into a leafy continuation, *c.* flower cut lengthwise, *d.* infructescence (*a-b* & *d*  $\times \frac{2}{3}$ , *c*  $\times 7$ ).

*toralis* MERR. Philip. J. Sc. 10 (1915) Bot. 27, incl. also var. *paucijuga*; En. Philip. 2 (1923) 356.—*G. clarkii* MERR. Philip. J. Sc. 10 (1915) Bot. 29; En. Philip. 2 (1923) 356.—*G. sp.* LANE-POOLE, For. Res. (1925) 99; CHRISTOPHERSEN, Bull. Bish. Mus. no 128 (1935) 111.

Buttressed tree, up to 35 by  $1\frac{1}{2}$ – $2\frac{1}{4}$  m. *Branchlets*  $\frac{1}{2}$ – $1\frac{1}{2}$  cm thick, minutely tomentose at the tips, glabrescent, often rough by many leaf-scars. *Leaves* crowded at the ends of the branchlets 4–10(–15)-jugate, usually tomentose when young and glabrescent, but indumentum very variable. *Stipules* inserted at the base of the petiole, oblong, 5–8 mm, caducous, basal pairs of leaflets often forming transitions to the stipules and caducous; stipellae often present. *Leaflets* elliptic, oblong-lanceolate or lanceolate, 5–19 by 2– $5\frac{1}{2}$ (–7) cm, rather stiff; base oblique, cordate to rounded (to cuneate); margin sometimes nearly entire; apex gradually acuminate, tip long and slender, blunt; nerves 10–20 pairs, slightly curved, not distinctly arching. *Panicles* 4–21(–30) cm, tomentose to glabrous; peduncle  $\frac{1}{2}$ –9 cm. *Flowers*  $3\frac{1}{2}$ –6 mm, receptacle cupular,  $1\frac{1}{2}$ –2 mm high. *Sepals*  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm. *Petals* inside tomentose, at least at the base. *Filaments* tomentose at the base. *Ovary* glabrous to pilose; style slightly tomentose to pilose. *Fruits* obliquely pear-shaped, 5–9 by 5–12 mm, glabrous or with some scattered hairs (to densely pubescent).

Distr. Melanesia, N. Australia, and Malaysia: Central and E. Java, Lesser Sunda Islands, NE. Borneo (Gaya Isl., once collected), Philippines, Celebes, Moluccas, and New Guinea.

A second variety, var. *gamblei* (KING ex SMITH) KALKMAN, is known from E. India, Sikkim, E. Pakistan, W. China, and Hainan.

Ecol. In primary and secondary, rain- and

monsoon-forests, specially in periodically dry regions, up to 400(–1200) m. *Fl.* mainly July–Nov. (Philippines March–June), *fr.* mainly Oct.–April (Philippines March–Oct.).

Wood anat. DEN BERGER, Med. Proefst. Thee 97 (1926) 67 & Atlas Pl. 12 fig. 45, Med. Proefst. Boschw. 13 (1926) 67 & Atlas Pl. 12 fig. 45 (*G. pinnata* ROXB.); REYES, Dep. Agr. & Comm. Manila, Techn. Bull. 7 (1938) 164 & Pl. 25 fig. 2 (hand lens); MOLL & JANSSONIUS, Mikr. Holzes 2 (1908) 93 (*G. pinnata* ROXB.); PEARSON & BROWN, Comm. Timb. India 1 (1932) 221.

Uses. Sometimes used as a shade tree. Timber rather good, moderately hard, heavy; in the ground it apparently decays very slowly. The bark is used in native medicine. A black dye is made out of a decoction of the leaves. The fruits are eaten.

Vern. *Ki langit*, W. Java, *biru, wiju*, W. & Central Java, *djaran, mangir*, Central Java, *surèn*, Central & E. Java, *kluntjing (klontjing)*, E. Java, *bèru, wuru*, Bali, *bogela*, Sumba, (*ai-ifeu, bilu, beook, wiu, wo'o*, Timor, *héu*, Wetar, *balu*, Borneo; Philippines: (*g*)*abito, bagulibas, ligason*, Tag., *baro, bulu, taliñganan, Sul., barus, bugu, Ibn., bio, biu, burus*, Ilk., *bitaurang, Bag., bogo, bugo*, P. Bis., C. Bis., *bogo*, Mag., *Kuy., bugo, Chab., dultit, Pang., malabolo*, Bik., *tumbarila*, Tagb.; *adju barru, bogu, bo'oh, buku, empo, (kaju) kambing, (tè)tul, (kètul, tètul)*, *wou*, Celebes, *tatula*, Talaud, *kambing*, Morotai, *wowoho*, Ternate, *ngowojo*, Tidore, *maruapisa*, W. New Guinea, *kagi-kagi*, Papua.

Excluded

*Garuga javanica* BL. Bijdr. (1826) 1165 = *Jagera javanica* (BL.) BL. Mus. Bot. 1 (1850) 227 (*Sapindac.*).

### 3. TRIOMMA

HOOK. f. Trans. Linn. Soc. 23 (1860) 171.—Fig. 2c, 7–8.

Dioecious tree. *Pith* of the *branchlets* without vascular strands. *Stipules* absent. *Inflorescences* axillary, together pseudoterminal. *Flowers* 5-merous. *Sepals* free. *Stamens* 5, episepalous, base of the filaments adnate to the disk. *Disk* 5-lobed, extrastaminal, lobes emarginate. *Pistil* triangular, 3-celled, in ♂ flowers entirely reduced. *Fruits* 3-winged, dry, woody, dehiscing with 3 woody valves. *Seeds* 3, broadly winged. *Cotyledons* folded, probably entire.

Distr. Monotypic, confined to W. Malaysia.

1. *Triomma malaccensis* HOOK. f. Trans. Linn. Soc. 23 (1860) 171; ENGL. in DC. Mon. Phan. 4 (1883) 30, t. 1 f. 22; KING, J. As. Soc. Beng. 62, ii (1894) 236; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 246, f. 143; ed. 2, 19a (1931) 419, f. 196; STAPP in HOOK. Ic. Pl. 29 (1906) t. 2824–2825; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 267, f. 49; RIDL, Fl. Mal. Pen. 1 (1922) 369; H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) t. 12 f. 96a, t. 13 f. 102 B2, t. 16 f. 130; Bull. Jard. Bot. Btzig III, 12 (1932) 332, t. 4 f. 8; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 32, cum fig.; KALKMAN,

Blumea 7 (1954) 499.—*Arytera? macrocarpa* MIQ. Sum. (1861) 510.—*Canarium mahassan* MIQ. Sum. (1861) 526; ENGL. in DC. Mon. Phan. 4 (1883) 148.—*Boswellia malaccensis* MARCH. Adansonia 8 (1867) 25.—*T. macrocarpa* BACK. ex THORENAAR, Med. Proefst. Boschw. no 16 (1926) 93, f. 9 & 9a; HEYNE, Nutt. Pl. (1927) 882.—Fig. 2c, 7, 8.

Very large tree, up to 60 m high and 1 m or more in diam.; buttresses 1–3 m high, often very broad. *Branchlets* slender, pilose to glabrous. *Leaves* (1)–2–5-jugate, petioles, rhachis, petiolules and midrib pilose to glabrous. *Leaflets* ovate to

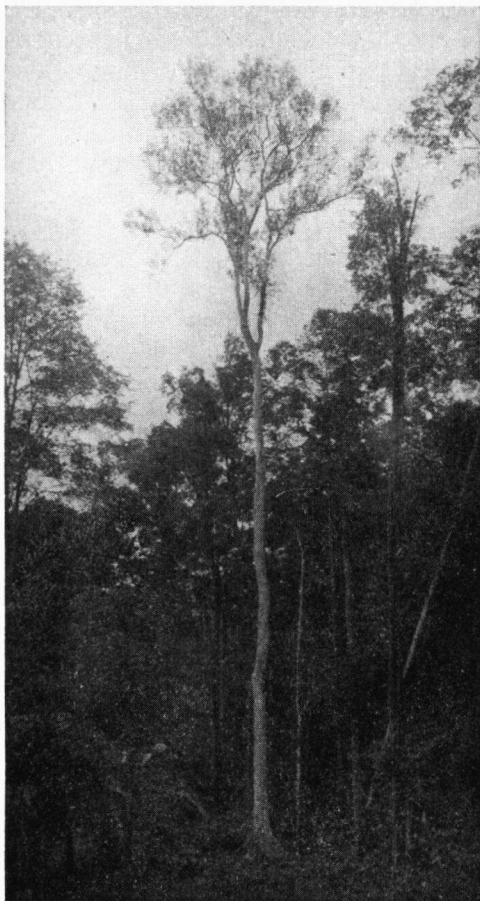


Fig. 7. *Triomma malaccensis* HOOK. f. Tree, c. 32 m high, Palembang (S. Sumatra) (Photogr. THORENAAR a. 1923).

oblong, (2-)4-15½ by (1-)2-5½(-6½) cm, chartaceous; base obliquely rounded, decurrent; margin entire; apex shortly blunt-acuminate; nerves 7-12 pairs (angle 60-80° near base to 30-50° near apex), usually slightly curved, not arching except the apical ones. *Inflorescences* repeatedly branched from the base, densely glandular-tomentose and

sometimes also pilose, ♂ ones 10-30 cm long, branches 6-10 cm, slender, ♀ ones 4-22 cm, branches 1-8½ cm, less slender. *Flowers* ♂ 2 mm long, ♀ 3 mm. *Sepals* and *petals* densely tomentose on either side. *Stamens* glabrous, in ♂ flowers often twisted. *Pistil* glabrous. *Infructescences* with a few fruits; calyx caducous. *Fruits* 5½-7½ cm long, wings 2-2½ cm broad. *Seeds* with broad, membranous wings, rounded at the base and acuminate at the apex.

*Distr. Malaysia:* Sumatra, Banka, Malay Peninsula, and Borneo.

*Ecol.* Frequent in old, rarely in secondary, forests; mostly on dry ground, rarely in permanently inundated places, up to 150(-400) m. *Fl.* Febr.-Nov., *fr.* Dec.-May.

*Wood anat.* DESCH, Mal. For. Rec. 15<sup>1</sup> (1941) 65, pl. 14 fig. 1 (hand lens); WEBBER, Lilloa 6 (1941) 450.

*Uses.* Timber rather soft, used for indoor constructions. Resin sometimes used for torches.

*Vern. Sumatra:* *résong, risung, r. batu, r. bunga, Langkat, andalhi batu, damar siap mata*, Batak, Asahan, *bajung* (or *majung*), *b. damar, b. kapur, damar asém*, Djambi, Palembang, *mérasam* (or *mahasan*), *m. itam, m. pujo, tēta tundju lanang*, Palembang, *asém (bulēt)*, Lampong; *Banka:* *médang ampal, rēngas, sudur bajan*; *Malay Peninsula:* *kédonong kejai, k. karet*; *Borneo:* *bésilok*, W. Born., *buno, damar lilin, damar umpak, djélmu pipit, kamandung, kapas mēlajang, lamai, rangarai*, SE. Born., *batu, kémbajau, marasam, njamut, pudurling*, Kutai, *bansision, binsian, maitus, mémpas, térosob*, Br. N. Born., *kémendrung*, P. Laut.

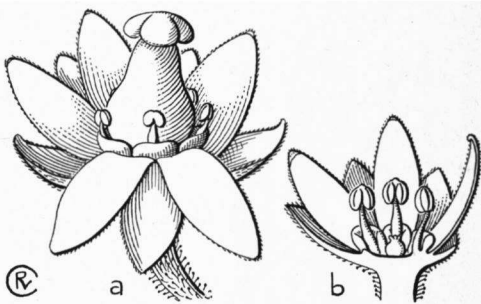


Fig. 8. *Triomma malaccensis* HOOK. f. a. ♀ flower, b. longitudinal section of ♂ flower, both × 10.

#### 4. DACRYODES

VAHL, Skrift. Dansk. Nat. Hist. Selsk. 4 (1810) 116; ENGL. in DC. Mon. Phan. 4 (1883) 151; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 334; KALKMAN, Blumea 7 (1954) 500.—*Pachylobus* G. DON, Gen. Syst. 2 (1832) 89; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 242; ed. 2, 19a (1931) 450.—*Canarium sect. Tenuipyrena* ENGL. in DC. Mon. Phan. 4 (1883) 104, *p.p.*—*Santiridium* PIERRE, Bull. Soc. Linn. Paris 2 (1896) 1282, *nom. illeg.*—*Curtisina* RIDL. J. Str. Br. R. As. Soc. no 82 (1920) 180.—*Hemisantiria* H. J. LAM, in Merr. Pl. Elm. Born. (1929) 118.—Fig. 2d, 10, 11.

Dioecious trees. *Pith of branchlets* without or with some, rarely with many, vascular strands. *Leaves* exstipulate, very rarely with a tendency to form pseudo-stipules. *Petioles* usually flattened to canaliculate, pith usually with few, sometimes with many, rarely without vascular strands. *Leaflets* entire. *Panicles* axillary and/or terminal. *Flowers* 3-merous. *Sepals* free or connate. *Petals* with a usually slightly thickened and inflexed apex. *Stamens* 6, glabrous; filaments free or their base to various degree connate with the disk. *Disk* intrastaminal, glabrous. *Pistil* 3(-2)-celled, usually glabrous, usually moderately reduced in the ♂ flowers; stigma sessile. *Fruits* drupaceous, oblong or ellipsoid, 1-seeded, stigma apical or nearly so; pericarp fleshy and rather thick, coarsely wrinkled when dry, glabrous; pyrene containing 1 fertile and 2 reduced cells; mesocarp membranous; endocarp cartilaginous; calyx caducous. *Seed* round in cross-section; cotyledons folded or contortuplicate, 3-partite, palmate or palmatifid.

Distr. About 40  *spp.* in tropical America (*c. 2 spp.: sect. Dacryodes*), tropical Africa (*c. 22 spp.: sect. Pachylobus* H. J. LAM, Ann. Jard. Bot. Btzg 42, 1932, 202) and in tropical Asia (*sect. Tenuipyrena* ENGL. in DC. Mon. Phan. 4, 1883, 104; 15  *spp.*, distributed in Cochinchina and Malaysia, with the exception of Central and East Java, the Moluccas, and the Lesser Sunda Islands). Fig. 9.

Ecol. Mainly trees of lowland rain-forests.

Wood anat. DESCH, Mal. For. Rec. 15<sup>1</sup> (1941) 63 (hand lens); HEIMSCH, Lilloa 8 (1942) 122. See also under the species.

Uses. The wood of some species is said to be used as a timber, but apparently it is not of great value. The fruits of some species are edible.

#### KEY TO THE SPECIES

1. Petioles longer than 18 cm.
2. Flowers glabrous.
  3. Pith of the branchlets with some vascular strands. Petioles 19-38 cm. Leaflets 20-60 cm long, with 18-38 pairs of nerves . . . . . 5. *D. kingii*
  3. Pith of the branchlets without vascular strands. Petioles 3-19 cm. Leaflets 6-30(-40) cm long, with 8-14 pairs of nerves . . . . . 14. *D. longifolia*
2. Flowers tomentose. Pith of the branchlets with some to many vascular strands. Petioles (3-)-6-14(-26) cm. Leaflets generally not longer than 20 cm, with 5-20 pairs of nerves . . . . . 9. *D. rostrata*
1. Petioles up to 16(-18) cm.
  4. Lower surface of the leaflets puberulous to pubescent or with patent hairs on all nerves and veins.
    5. Inflorescences axillary or lateral, vegetative terminal bud present.
      6. Leaf-rhachis not with swollen nodes.
        7. Leaves 5-9-jugate. Leaflets 10-20 cm long, with abruptly acuminate apex, undersurface pubescent throughout or at least on the midrib and main nerves, upper surface with a manifest to prominent reticulation. Fruits 1<sup>3</sup>/<sub>4</sub> cm or longer . . . . . 9. *D. rostrata*
        7. Leaves 1-4-jugate. Leaflets 5-12 cm long, with gradually acuminate apex, undersurface puberulous on all nerves and veins, upper surface smooth, with a hardly conspicuous reticulation. Fruits 1<sup>1</sup>/<sub>2</sub> cm long. . . . . 3. *D. puberula*
      6. Leaf-rhachis with swollen nodes . . . . . 1. *D. rugosa*
    5. Inflorescences terminal, sometimes with smaller additional axillary and/or lateral ones, vegetative terminal bud absent.
      8. Leaflets dull brown above. Flowers yellowish when dry. Branchlets ± persistently densely tomentose . . . . . 7. *D. rubiginosa*
      8. Leaflets shining, usually greenish. Flowers darkbrown when dry. Branchlets pubescent when young.
      9. Leaf-rhachis with distinctly swollen nodes. Petioles flattened or nearly terete. Leaflets usually elliptic, 6-22 × 2<sup>1</sup>/<sub>2</sub>-11 cm. Stamens adnate to the disk . . . . . 1. *D. rugosa*
      9. Leaf-rhachis not or indistinctly swollen on the nodes. Petioles strongly flattened at the base. Leaflets ovate to elliptic, 3-14 × 1<sup>1</sup>/<sub>2</sub>-6 cm. Stamens free . . . . . 2. *D. costata*
  4. Lower surface of the leaflets glabrous or hairy on the midrib only.
    10. Inflorescences terminal, sometimes with smaller additional axillary and/or lateral ones, vegetative terminal bud absent.
      11. Fruits more than 3 cm long.
        12. Leaflets brown when dry. Petioles puberulous, 9-14<sup>1</sup>/<sub>2</sub> cm, leaves further glabrous. Inflorescences puberulous . . . . . 8. *D. elmeri*
        12. Leaflets greenish when dry. Petioles, rhachis, petiolules and stalks of the inflorescences nearly always densely pilose, glabrescent. Petioles 1-14 cm . . . . . 4. *D. laxa*

11. Fruits up to 3 cm long, generally less than 2½ cm.
13. Stamens free from the disk.
  14. Petioles 4–8½(–15½) cm. Leaflets nearly always brown when dry. Veins conspicuous, not prominent underneath, transversely reticulate. Flowers 2–4 mm, cinnamon-brown when dry. Pedicels angular, ½–1 mm thick . . . . . 6. *D. incurvata*
  14. Petioles 1–5(–6½) cm. Leaflets in a dry state nearly always olive-green underneath with a brownish nervation. Veins very prominent underneath, distinctly transverse. Flowers 1½–2½ mm, darkbrown when dry. Pedicels terete, usually much less than ½ mm thick. . . . . 2. *D. costata*
13. Stamens connate with the disk.
  15. Leaf-rhachis with distinctly swollen nodes. Petioles flattened to nearly terete, with the leaf-rhachis and the inflorescences ± minutely pubescent to puberulous, glabrescent. Fruits 1½–2½ cm long . . . . . 1. *D. rugosa*
  15. Leaf-rhachis without swollen nodes. Petioles strongly flattened, with leaf-rhachis, petiolules and inflorescences nearly always densely pilose and glabrescent. Lowest pair of leaflets usually much smaller and rather early caducous. Fruits 2½–4½ cm long . . . . . 4. *D. laxa*
10. Inflorescences axillary or lateral, vegetative terminal bud present.
  16. Leaflets 3–6 times as long as wide.
    17. Pith of the branchlets without vascular strands. Undersurface of the leaflets without pitted dots on the intervenium . . . . . 14. *D. longifolia*
    17. Pith of the branchlets with some to many vascular strands. Intervenium of the undersurface of the leaflets provided with fine pitted dots . . . . . 9. *D. rostrata*
  16. Leaflets less than 3 times as long as wide.
    18. Pith of the branchlets and the petioles with some to many vascular strands.
      19. Petioles glabrous or puberulous and glabrescent.
        20. Upper surface of the leaflets with distinctly conspicuous to prominent venation, lower surface with fine pitted dots. Petioles terete or somewhat flattened. Fruits 1¾–3½(–4) cm long . . . . . 9. *D. rostrata*
        20. Venation not very conspicuous on the smooth upper surface of the leaflets, no pitted dots on the lower surface. Petioles strongly flattened. Fruits 4–4¾ cm long . . . . . 8. *D. elmeri*
      19. Petioles densely pubescent, strongly flattened . . . . . 10. *D. crassipes*
    18. Pith of the branchlets without vascular strands, some or none in that of the petioles.
      21. Fruits shorter than 2 cm.
        22. Leaf-rhachis with swollen nodes. Base of the leaflets usually cuneate, apex rather abruptly, narrowly long-acuminate . . . . . 1. *D. rugosa*
        22. Leaf-rhachis not swollen at the nodes. Base of the leaflets rounded, decurrent. Acumen rather broad . . . . . 15. *D. brevircemosa*
      21. Fruits longer than 2 cm.
        23. Leaf-rhachis with swollen nodes . . . . . 1. *D. rugosa*
        23. Leaf-rhachis not swollen at the nodes.
          24. Pith of the petioles without vascular strands. Ultimate base of the leaflets ± rounded. . . . . 13. *D. papuana*
      24. Pith of the petioles with one or some vascular strands. Ultimate base of the leaflets cuneately or acuminate contracted.
        25. Petals thick, with strongly inflexed apiculum and margins (less so in *var. merrillii*). Filaments confluent with the disk. Leaflets nearly orbicular to ovate, obovate or elliptic-oblong, with 6–10(–13) pairs of nerves . . . . . 11. *D. macrocarpa*
        25. Petals with slightly inflexed apiculum, margins not inflexed. Filaments free from the disk. Leaflets oblong to oblong-lanceolate, with 10–17 pairs of nerves. . . . . 12. *D. expansa*

1. *Dacryodes rugosa* (BL.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 203, t. 11 f. 64; Bull. Jard. Bot. Btzg III, 12 (1932) 345, t. 4 f. 12; in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 3; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 16, *cum fig.*; KALKMAN, Blumea 7 (1954) 505.—*Santiria rugosa* BL. Mus. Bot. 1 (1850) 212; ENGL. in DC. Mon. Phan. 4 (1883) 164.—*Santiria virgata* BL. Mus. Bot. 1 (1850) 213; ENGL. in DC. Mon. Phan. 4 (1883) 158.—*Canarium rugosum* MIQ. Fl. Ind. Bat. 1, 2 (1859) 649, *incl. also var. sumatranum*; Sum. (1861) 527.—*Canarium virgatum* MIQ. Fl. Ind. Bat. 1, 2 (1859) 650.—*Santiria fasciculata* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 539; ENGL. in DC. Mon. Phan. 4 (1883) 164; KING, J. As.

Soc. Beng. 62, ii (1894) 255; RIDL. Fl. Mal. Pen. 1 (1922) 377, *var. puberula excl.*; HEYNE, Nutt. Pl. (1927) 881.—*Santiria longepaniculata* BAKER f. J. Bot. 62 (1924) Suppl. 17.—*Hemisantiria rugosa* H. J. LAM in Merr. Pl. Elm. Born. (1929) 119.—*Canarium moultonii* RIDL. Kew. Bull. (1930) 83. Tree 5–20(–35) m by 8–40(–100) cm, sometimes a large shrub; no buttresses. Branchlets 3–5 mm thick, smooth, long remaining pubescent; pith without vascular strands. Leaves (0)–2–4-jugate. Petioles terete to ± flattened at base, 3–9½ cm, pubescent or puberulous to glabrous, pith with 1 or few, rarely without vascular strands; base of the petiole, nodes of the rhachis, and ends of the petiolules distinctly swollen. Leaflets obovate or

ovate to oblong-lanceolate, 6–22 by 2½–11 cm, chartaceous, often bullate; indumentum variable; base oblique, cuneate to rounded; apex more or less abruptly acuminate, acumen ½–3½ cm by 1–3 mm, often slightly broadened at the tip, blunt; nervation usually distinctly prominent beneath, nerves 7–12 pairs (angle 50–80°), slightly curved, often arching near the margin. *Panicles* axillary, together pseudoterminal, rarely terminal, densely and minutely pubescent, ♂ slender, 15–60 cm long, laxly branched from the base, branches up to 25 cm long, flowers usually clustered; ♀ ones pyramidal, lax and relatively few-flowered, 2–25 (–40) cm, peduncle 0–4 cm, branches up to 9 cm long. *Flowers* 1½–2½ mm, sparsely pubescent to glabrous. *Calyx* in ♂ flowers ¾–1 mm, in ♀ ones 1–1½ mm. *Stamens* adnate to the disk, episepalous ones slightly longer. *Disk* cupular, thick. *Pistil* in ♂ flowers moderately to entirely reduced. *Fruits* ovoid, slightly oblique, 1½–2½ by ¾–1½ cm, rounded at both ends; flower remains long persistent. *Cotyledons* consisting of 3 separate, petioled lobes, contortuplicate.

*Distr. Malaysia:* S. Sumatra, Malay Peninsula, W. Java, and Borneo.

*Ecol.* Primary forests up to 900 m. *Fl.* mainly Sept.–Dec., *fr.* mainly May–July.

*Wood* anat. HEIMSCH, *Lilloa* 8 (1942) pl. 8 fig. 51.

*Uses.* Timber of little value.

*Vern.* Sumatra: *gita tjilok, kabau, kaju manau, k. napo, rihil*; Malay Peninsula: *kédondong, k. bulau puteh, k. mata hari, lélékup*; Borneo: *dayau, kambayu burong, kěmanyan, langsat burung, maram putis, owas-owas, paninasan burong, patiu, pitong kalaout, punan ratjang, sarè djani, talang sai, tompulan, tuli, tutu, watuk*.

*Notes.* Sterile specimens of this rather variable species are sometimes difficult to distinguish from *D. costata*. The petioles of *D. rugosa* are usually not so strongly flattened as those of *D. costata*; the leaf-rhachis is much more distinctly swollen on the nodes in *D. rugosa*, which generally makes a more slender impression. *D. costata* has—generally spoken—smaller leaves, shorter and less slender petioles, interjugae and petiolules, and

smaller leaflets. In some cases the identification of sterile specimens remains doubtful.

Two varieties can be distinguished:

*var. rugosa.*—All synonyms except those of *var. virgata*.

Leaflets glabrous or more or less appressedly pubescent underneath.

*Distr. Malaysia:* as the species.

*var. virgata* (BL.) H. J. LAM, *Ann. Jard. Bot. Btzig* 42 (1932) 203; *Bull. Jard. Bot. Btzig* III, 12 (1932) 348.—*Santiria virgata* BL.—*Canarium virgatum* MIQ.

Leaflets with erect hairs on midrib and nerves underneath.

*Distr. Malaysia:* Borneo.

2. *Dacryodes costata* (BENN.) H. J. LAM, *Ann. Jard. Bot. Btzig* 42 (1932) 204, t. 14 f. 106e; *Bull. Jard. Bot. Btzig* III, 12 (1932) 359, t. 5 f. 17; KALKMAN, *Blumea* 7 (1954) 508.—*Santiria costata* BENN. in *Hook. f. Fl. Br. Ind.* 1 (1875) 537; ENGL. in *DC. Mon. Phan.* 4 (1883) 157; KING, *J. As. Soc. Beng.* 62, ii (1894) 260; RIDL, *Fl. Mal. Pen.* 1 (1922) 380.—*Canarium costatum* RIDL, *Kew Bull.* (1930) 82.—Fig. 10.

Tree 20–30(–40) m by 20–100 cm, rarely with small buttresses. *Branchlets* c. ½ cm thick, minutely pubescent; pith without vascular strands. *Leaves* (1–)2(–4)-jugate, more or less densely pubescent except the upper surface of the leaflets. *Petioles* 1–5(–6½) cm, much flattened at base, pith with few vascular strands. *Leaflets* broadly elliptic to oblong, 3–16 by 1½–7½ cm, rigid, chartaceous to subcoriaceous, underneath more or less woolly pubescent on midrib and nerves, glabrescent; base hardly oblique, broadly cuneate to rounded; apex abruptly, shortly, and bluntly acuminate; nervation prominent beneath, nerves 6–13 pairs (angle c. 60°, at the base up to 90°), strongly curved, not arching except some apical ones. *Panicles* terminal and often in the uppermost leaf-axils, usually branched from the base, densely woolly pubescent, flowers in clusters; ♂ ones 6½–30 cm, much branched, branches spreading, up to 12 cm; ♀ ones 4–21 cm, narrowly paniculate to subracemose, branches up to 4 cm. *Flowers* small, slightly pubescent. *Calyx* ½–1 mm high. *Petals* glabrous. *Filaments* free from the disk. *Disk* annular to 6-lobed, thick. *Pistil* in ♂ flowers very reduced. *Infructescences* densely woolly pubescent. *Fruits* ovoid, hardly or not oblique, 12–19 by 8–12 mm, rounded at the base, more or less obtusely acute at the apex; wall of the pyrene rather thick and hard. *Cotyledons* folded, 3-lobed.

*Distr. Malaysia:* Sumatra, Banka, Billiton, Malay Peninsula, Borneo, and the Philippines (Leyte).

*Ecol.* Primary forests up to 100(–500) m. *Fl.* March–Oct., *fr.* apparently the whole year.

*Uses.* In Borneo the timber is used for light constructions, the bole for building proahs.

*Vern.* *Kédondong bési, kěning kěrak, mērasam pujo, rasak babi, rěsung, sěpah* (or *sěpat*) *burung*,

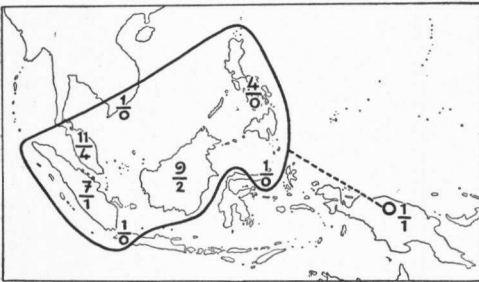


Fig. 9. Distribution of *Dacryodes* sect. *Tenuipyrena*. Above the hyphen the total number of species, below the hyphen the number of endemic species in each district or island.



Fig. 10. *Dacryodes costata* (BENN.) H. J. LAM. a. Twig with ♂ flowers, b. ♂ bud, c. ♂ bud in section, d. ♀ flower, one petal removed, e. infructescence (a and e  $\times 2\frac{1}{3}$ , b  $\times 10$ , c-d  $\times 13$ ).

si katjang, tjak sibi, tjétjibui, Sum., binjau, bunjau, sēkibai, sudur bajan, Banka, bērbing pinggan, Billiton, kēdongdong (mata-hari), Mal. Pen., basibasi, batu, bēlanak, buah, kēdungung, kramu, limat, Born.

Note. Sterile specimens are sometimes hard to distinguish from *D. rugosa* H. J. LAM; for the differences see under that species.

3. *Dacryodes puberula* (BENN.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 204; Bull. Jard. Bot.

Btzg III, 12 (1932) 354, t. 4 f. 14 (c. excl.); WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 18, cum fig.; KALKMAN, Blumea 7 (1954) 512.—*Santiria puberula* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 537; ENGL. in DC. Mon. Phan. 4 (1883) 161; KING, J. As. Soc. Beng. 62, ii (1894) 256; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 258, f. 39<sup>2</sup>.—*Santiria fasciculata* BENN. var. *puberula* RIDL. Fl. Mal. Pen. 1 (1922) 377.

Tree, 15–21 m, with small buttresses. Branchlets 2–3 mm thick, puberulous, glabrescent; pith.

without or with one vascular strand; terminal bud rather long and narrow. *Leaves* 1–4-jugate. *Petioles* slender, 2–6½ cm, flattened at the base, puberulous and glabrescent, pith with one to some vascular strands. *Leaflets* elliptic to ovate, 4½–12½ by 2½–6½ cm, thin, upper surface slightly pubescent on the base of the midrib, undersurface puberulous on nerves and veins; base usually very oblique, one half rounded to broadly cuneate, the other half cuneate; apex gradually to sub-abruptly acuminate, acumen short and blunt; nerves 7–11 pairs (angle 45–80°), curved near the margin, apical ones arching. *Panicles* (♀ unknown) axillary, 3½–12 cm, puberulent to glabrous; peduncle 0–2½ cm, branches few, spreading and lax, up to 5 cm. *Flowers* (♀ unknown) 2 mm, pubescent. *Calyx* minute. *Stamens* adnate to the disk. *Disk* with undulate rim. Rudiment of the *pistil* small. *Infructescences* 3–5 cm long, puberulous, peduncle 0–1½ cm. *Fruits* ellipsoid, c. 1½ by 1 cm, style-rudiment nearly apical; pericarp coarsely rugose when dry; wall of the pyrene rather thick.

*Distr. Malaysia:* Malay Peninsula (the Sumatra specimen mentioned by H. J. LAM, Bull. l.c., belongs to *Santiria apiculata* BENN.).

*Ecol.* Forests at low altitudes. *Fl.* Nov.–Dec., fr. Jan.

*Uses.* Timber very hard and durable, used in house-building.

*Vern.* *Kědongong*, *k. krut*, *k. sěrong*.

**4. *Dacryodes laxa* (BENN.) H. J. LAM, Ann. Jard. Bot. Btżg 42 (1932) 204, t. 15 f. 114, incl. also var. *forbesii*; Bull. Jard. Bot. Btżg III, 12 (1932) 355, t. 5 f. 15; HUSSON & H. J. LAM, Blumea 7 (1952) 166; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 19, *cum fig.*; KALKMAN, Blumea 7 (1954) 503.—*Canarium laxum* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 535; ENGL. in DC. Mon. Phan. 4 (1883) 139.—*Canarium fragile* ENGL. in DC. Mon. Phan. 4 (1883) 138.—*Santiria laxa* KING, J. As. Soc. Beng. 62, ii (1894) 254; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 12, t. 16; RIDL. Fl. Mal. Pen. 1 (1922) 377.—*Santiria forbesii* BAKER f. J. Bot. 62 (1924) Suppl. 16.**

Small tree, up to 15(–30) m by up to 62 cm diam. *Branchlets* 5–8 mm thick, young parts rather densely pilose to glabrous, as are the leaves (leaflets excepted), inflorescences and infructescences; pith sometimes with a few small, usually peripherally arranged vascular strands. *Leaves* 2–5(–7)-jugate, the lowest pair of leaflets tending towards pseudostipules, often rather early caducous except their petiolules. *Petioles* 1–14 cm long, at base much swollen and flattened to deeply furrowed, pith with some vascular strands. *Leaflets* (ovate to) oblong-lanceolate or oblanceolate, 5–20(–32½) by 2–6(–11) cm, rigidly chartaceous to pergamaceous, sometimes slightly bullate, glabrous or slightly pilose on the midrib beneath; base cuneate to rounded; apex (sub-)abruptly acuminate, acumen 1½–2½ cm, slender; nervation much prominent below, nerves (8–)10–24 pairs, straight or curved, more or less distinctly

arching. *Panicles* terminal, branched from the base, usually pilose, ♂ 35–80 cm long, main branches up to 40 cm, ♀ 10–85(–140) cm, main branches up to 30 cm long. *Flowers* long-stalked, ♂ 4 mm long, ♀ 6 mm. *Calyx* slightly pilose, 1–1½ mm high. *Petals* glabrous. *Filaments* adnate to the disk. *Disk* in ♂ flowers annular, in ♀ ones cupular, always thick. *Pistil* in ♂ flowers slightly reduced. *Fruits* oblong-ovoid, not or slightly oblique, usually slightly contracted at the apex, 2½–4½ by ¾–2 cm. *Cotyledons* contortuplicate, palmatifid.

*Distr. Malaysia:* Sumatra, Batu Islands, Malay Peninsula, Borneo.

*Ecol.* In primary forests at low and medium altitudes, in N. Sumatra and on Mt Kinabalu ascending to 900–1200 m, in Brunei once collected in swampy habitat. *Fl.* Febr.–April, Aug.–Oct., fr. May–Jan.

*Vern.* *Landoa*, Bencoolen, *kědongong*, *k. hutan*, *k. bulu*, *poko gumo*, *punting běliong*, Mal. Pen., *ibabu*, SE. Borneo.

**5. *Dacryodes kingii* (ENGL.) KALKMAN, nov. comb.—*Santiria floribunda* KING, J. As. Soc. Beng. 62, ii (1894) 254, *nom. illeg.*; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 16, t. 21; RIDL. Fl. Mal. Pen. 1 (1922) 376; *non Santiria floribunda* K.SCH. (1881), *quae est Haplolobus floribundus*.—*Santiria kingii* ENGL. in E. & P. Pfl. Fam. ed. 2, 19a (1931) 453.—*D. floribunda* H. J. LAM, Ann. Jard. Bot. Btżg 42 (1932) 204; Bull. Jard. Bot. Btżg III, 12 (1932) 357, t. 5 f. 16; KALKMAN, Blumea 7 (1954) 521.**

A small tree or large shrub, up to 12 m by 20 cm. *Branchlets* c. 2 cm thick, puberulous to glabrous; pith with some small, peripherally arranged vascular strands. *Leaves* 6–8-jugate. *Petioles* stout, 19–21 cm, much flattened and swollen at the base, pulverulent and glabrate, pith with many vascular strands. *Leaflets* oblong, 20–60 by 5½–13 cm, rigidly chartaceous, glabrous or slightly pubescent on the midrib underneath; base obliquely rounded; apex shortly and acutely acuminate; midrib and nerves very prominent beneath, nerves 18–38 pairs (angle from 90° near the base to 55–60° near the apex), curved. *Panicles* terminal, pendulous, lax, 35–120 cm long, minutely pulverulent, glabrescent, branches up to 55 cm long. *Flowers* (long-)stalked, glabrous, waxy, red, ♂ c. 3 mm, ♀ 5–6 mm. *Calyx* in ♂ flowers ½ mm high, in ♀ ones 2 mm. *Stamens* free, sometimes slightly adnate to the disk. *Disk* cupular, thick, more or less radially furrowed. *Pistil* not exert from the disk in ♂ flowers. *Fruits* oblong, contracted and acute at the apex, hardly oblique, 2–2¾ by 1–1¼ cm. *Cotyledons* folded, 3-lobed.

*Distr. Malaysia:* Malay Peninsula.

*Ecol.* Primary and secondary forests up to 400 m. *Fl.* April–July, fr. May, June, Sept.–Dec.

*Uses.* Leaves used for roofing.

**6. *Dacryodes incurvata* (ENGL.) H. J. LAM, Ann. Jard. Bot. Btżg 42 (1932) 204; Bull. Jard. Bot. Btżg III, 12 (1932) 362, t. 5 f. 19; KALKMAN, Blumea 7 (1954) 506.—*Canarium incurvatum* ENGL.**



in DC. Mon. Phan. 4 (1883) 138.—*Santiria nitida* MERR. Publ. Gov. Lab. Philip. no 35 (1906) 29; En. Philip. 2 (1923) 356.—*Canarium nitens* MERR. Philip. J. Sc. 10 (1915) Bot. 24; En. Philip. 2 (1923) 352.—*Hemisantria nitida* H. J. LAM in Merr. Pl. Elm. Born. (1929) 118.—*Canarium angulatum* RIDL. Kew Bull. (1931) 493.—*D. angulata* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 204; Bull. Jard. Bot. Btzg III, 12 (1932) 364, t. 5 f. 20.

Tree 10–30 m by 25–100 cm, buttresses 1–2 m high. *Branchlets* 2½–5 mm thick, pubescent to glabrous; pith with some to many, rarely without vascular strands. *Leaves* 1–4-jugate. *Petioles* (3½)–4½–8½–(15½) cm, usually strongly flattened at the base, pubescent, glabrescent, pith with some to many vascular strands. *Leaflets* lanceolate or elliptic to oblong, 4–22 by 2–9½ cm, rigidly pergamaceous, glabrous; base (subcordate to) rounded (to cuneate); apex usually rather abruptly, shortly and bluntly acuminate; nervation prominent beneath, nerves (6–)8–18 pairs (angle 60–90°), sinuous, curved, faintly arching near the margin. *Panicles* terminal, sometimes with additional axillary ones, often branched from the base, ♂ ones 3–17 cm, ♀ ones 8–21 cm. *Flowers* 2–4 mm, densely minutely tomentose. *Calyx* 1–1¼ mm high. *Filaments* free from the disk or slightly confluent with it. *Disk* cupular, 6-lobed. *Ovary* tomentose, pistil in ♂ flowers strongly reduced. *Fruits* ovoid, sometimes oblique, (1½)–1¾–2¾ by ¾–1¾ cm, acute at the apex, rounded at the base. *Cotyledons* contortuplicate, palmatifid (?).

*Distr. Malaysia:* Sumatra, Malay Peninsula, Borneo, and the Philippines (Mindoro, Luzon, Sibuyan, Negros, Panay, Mindanao).

*Ecol.* Primary forests, sometimes swampy, up to 100(–475) m. *Fl.* Febr.–March, *fr.* mainly Oct.–April.

*Wood* anat. REYES, Dep. Agr. & Comm. Manila, Techn. Bull. 7 (1938) 162, Pl. 24 fig. 2 (hand lens).

*Vern.* *Balan pèlapah, bantan burung, kèdongong kidjai, sau*, Sum., *rèsak paja*, Riouw-Lingga, *kèdongong, k. kèrut, k. matahari, kèrantai*, Mal. Pen., *bumbun, djèlmu pipit, kèmbajau* (or *kèmbojou*), *malinas, pongaluwon, pudauling, rawai, rèsak mèrkujung, tokul-gunung, unggit-unggit*, Born.; Philippines: *alipug-matsing, kamingi, korig* (or *kurig*), *mayagyat*, Tag., *baùli, Sul., kuragal, Sbl., sàyong*, P.Bis.

7. *Dacryodes rubiginosa* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 204; Bull. Jard. Bot. Btzg III, 12 (1932) 361, t. 5 f. 18; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 20, *cum fig.*; KALKMAN, Blumea 7 (1954) 21.—*Canarium rubiginosum* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 535, *nom. illeg.*; ENGL. in DC. Mon. Phan. 4 (1883) 136; KING, J. As. Soc. Beng. 62, ii (1894) 248; RIDL. Fl. Mal. Pen. 1 (1922) 374; *non Canarium rubiginosum* MIQ. Fl. Ind. Bat. 1, 2 (1859) 651, *quae est Santiria rubiginosa* BL.

Tree, 20–35 m by 25–60 cm. *Branchlets* ½ cm thick, young parts densely tomentose; pith with some very small, scattered vascular strands.

*Leaves* 2–4-jugate, densely pubescent. *Petioles* 3–8½ cm, much flattened at the base, pith with some vascular strands. *Leaflets* ovate or obovate to oblong, 4–20 by 2–7 cm, chartaceous, midrib and nerves on the undersurface densely pubescent; base cuneate to ± rounded; apex rather abruptly, shortly, and bluntly acuminate; nervation prominent beneath, nerves (7–)10–13 pairs (angle c. 70°), curved, not arching. *Panicles* (♀ unknown) terminal, lax, up to 30 cm long, branched from the base, branches up to 14 cm, densely tomentose. *Flowers* (♀ unknown) 2½–3 mm, tomentose. *Calyx* 1 mm high, nearly truncate. *Stamens* free. *Disk* cushion-shaped to cupular, radially furrowed. *Rudimentary pistil* very small. *Infructescences* terminal, broadly paniculate, 8–17½ cm long, stout, densely tomentose. *Fruits* ellipsoid, 2–2½ by 1–1¼ cm, rounded at base and apex, style-remains terminal. *Cotyledons* contortuplicate, palmatifid.

*Distr. Malaysia:* Malay Peninsula and Borneo. *Ecol.* Primary forests up to 175 m. *Fl.* Jan., April, *fr.* May, Oct.

*Vern.* *Kèdongong, suryan*, Mal. Pen., *bèngaja, bènung, huwung, kumbajan*, Born.

*Note.* Closely related to *D. incurvata* H. J. LAM, the differences being the dense tomentum of the branchlets, inflorescences and infructescences, the pubescence of the undersurface of the leaflets, and the broader and less slender infructescences in *D. rubiginosa*.

8. *Dacryodes elmeri* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 203; Bull. Jard. Bot. Btzg III, 12 (1932) 344, t. 4 f. 11; KALKMAN, Blumea 7 (1954) 521.—*Hemisantria* *prob. nov. sp.* H. J. LAM in Merr. Pl. Elm. Born. (1929) 199.

Tree, 75 cm in diam. *Branchlets* c. 1 cm thick, densely minutely villous, pith with many scattered vascular strands; terminal bud 1½ cm long, densely pubescent. *Leaves* 3–4-jugate. *Petioles* 9–14½ cm, strongly flattened at the base, puberulous, glabrescent, pith with many vascular strands. *Leaflets* oblong, 12–22 by 5–8½ cm, stiff chartaceous, glabrous; base oblique, cuneate or one half rounded; apex abruptly and shortly blunt-acuminate; nervation prominent beneath, nerves 13–18 pairs (angle 60–75°), curved, basal and apical ones arching. *Infructescences* and *flowers* unknown. *Fruiting panicles* axillary (?), puberulous, 17–45 cm, peduncle ¾–2 cm. *Fruits* ovoid, 4–4¾ by 2–2½ cm, base rounded, apex ± rounded, pericarp thin; pyrene crustaceous. *Cotyledons* contortuplicate, palmatifid.

*Distr. Malaysia:* N. Borneo (Elphinstone Prov.: Tawao), once collected.

*Note.* I have seen only parts of the infructescences. Regarding the relationship of this species with *D. incurvata* H. J. LAM and *D. rubiginosa* H. J. LAM, which have terminal inflorescences, I doubt whether they are axillary here, as is stated by LAM, *l.c.*

9. *Dacryodes rostrata* (BL.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 203, t. 11 f. 59, t. 13 f. 101,

t. 14 f. 106d and 111b; Bull. Jard. Bot. Btzg III, 12 (1932) 349, t. 4 f. 13; GUILLAUMIN, Fl. Gén. I.-C. Suppl. 1 (1946) 675, f. 831-2; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 17, *cum fig.*; KALKMAN, Blumea 7 (1954) 519.—*Santiria rostrata* BL. Mus. Bot. 1 (1850) 213; THORENAAR, Med. Proefst. Bosw. no 16 (1926) 91, f. 8 (anat. of bark).—*Santiria montana* BL. Mus. Bot. 1 (1850) 212.—*Dracontomelon? cuspidatum* BL. Mus. Bot. 1 (1850) 232; MIQ. Fl. Ind. Bat. 1, 2 (1859) 640.—*Canarium montanum* KORTHALS ex MIQ. Fl. Ind. Bat. 1, 2 (1859) 649.—*Canarium gilvescens* MIQ. Fl. Ind. Bat. 1, 2 (1859) 650.—*Canarium rostriferum* MIQ. Sum. 1 (1861) 526; ENGL. in DC. Mon. Phan. 4 (1883) 137, *incl. also var. cuspidatum*; GUILLAUMIN, Fl. Gén. I.-C. 1 (1911) 711.—*Canarium kadondon* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 535; ENGL. in DC. Mon. Phan. 4 (1883) 138; KING, J. As. Soc. Beng. 62, ii (1894) 247; RIDL. Fl. Mal. Pen. 1 (1922) 373; BURK. Dict. (1935) 430.—*Canarium minahassae* KOORD. [Minah. (1898) 376, 622, *nomen*] Nat. Tijd. N. I. 63 (1904) 96; Suppl. Cel. 2 (1922) t. 28; Suppl. 3 (1922) 14.—*Canarium articulatum* ENGL. ex KOORD. Nat. Tijd. N. I. 63 (1904) 97, *nomen*; Suppl. Cel. 2 (1922) t. 24; *ibid.* Suppl. 3 (1922) 13.—*Santiria samarensis* MERR. Philip. J. Sc. 10 (1915) Bot. 31; En. Philip. 2 (1923) 356.—*Canarium crassifolium* MERR. Philip. J. Sc. 10 (1915) Bot. 274.—*Canarium caudatifolium* MERR. Philip. J. Sc. 10 (1915) Bot. 315.—*Canarium cuspidatum* MERR. En. Born. (1921) 316.—*Hemisantiria rostrata* H. J. LAM in MERR. Pl. Elm. Born. (1929) 119.—*Canarium reticulatum* RIDL. Kew Bull. (1930) 83.—*Fig. 2d.*

Tree, 5–25(–35) m by 20–50(–120) cm, sometimes buttressed. *Branchlets* 4–10 mm thick, lenticellate, glabrous; pith with some to many dispersed vascular strands. *Leaves* 2–8(–10)-jugate, usually glabrous. *Petioles* terete or somewhat flattened at base, (3)–6–15(–26) cm, pith usually with many vascular strands. *Leaflets* ovate to oblong,  $3\frac{1}{2}$ –20 by  $1\frac{1}{2}$ –10 cm, rigid, chartaceous, glabrous or pubescent underneath; intervenium with pitted dots on lower surface (most distinct in *f. cuspidata* and *f. pallida*); base often very oblique, lower half cuneate, apical half rounded; apex usually abruptly acuminate, acumen up to 2(–4) cm by 1–2 mm, tip slightly broadened, blunt; midrib and nerves prominent beneath, nerves 5–20 pairs (angle 45–70°), strongly curved, geniculate close to the margin, apical ones sometimes arching. *Panicles* axillary, together usually pseudoterminal, long-peduncled, 5–35 cm long, densely and minutely tomentose, glabrescent, branches rarely exceeding 3 cm. *Flowers* tomentose, 2–4 mm long. *Calyx* in ♂ flowers 1–1½ mm high, in ♀ ones 1½–2 mm. *Petals* outside densely tomentose, inside slightly woolly except at the base. *Episepalous stamens* usually distinctly longer than the epipetalous ones, sometimes all adnate to the disk. *Disk* in ♂ flowers more or less cushion-shaped, in ♀ flowers cupular, rim 6-undulate. *Pistil* in ♂ flowers strongly to nearly entirely reduced. *Infructescences* stout, (nearly) glabrous, flower-

remains long persistent. *Fruits* ovoid to oblong, slightly oblique,  $1\frac{3}{4}$ – $3\frac{1}{2}$ (–4) by  $\frac{3}{4}$ – $1\frac{3}{4}$ (– $2\frac{1}{4}$ ) cm, somewhat contracted at the apex, rounded at the base. *Cotyledons* contortuplicate, deeply palmatifid, with c. 7 segments.

Distr. Cochin-China and *Malaysia*: Sumatra, Banka, Billiton, Malay Peninsula, Borneo, Philippines (Palawan, Luzon, Samar, Leyte, Mindanao), N. Celebes.

Ecol. Primary, sometimes secondary forests, rarely swamps, up to c. 600 m. *Fl.* mainly March–Oct., *fr.* mainly March–Sept.

Uses. Timber used for planks and for paddy-pounders. Resin used for making torches. The fruits are edible.

Vern. *Asém begomdang*, *a. duku*, *babak*, *batang dantan*, *kasei*, *kémbajau* (or *kumbajau*, *kémbajan*, *kambajan*), *k. békuwak*, *k. énggang*, *k. tikus*, *simalang*, *sulai(i)*, *tapus*, Sum., *anglip paja*, Simalulur, *layo*, Nias, *réngas burung*, *r. putih*, Banka, *kémbajau* (or *kumbajau*, *kémbajan*, *kambajan*, *kémajau*, *lémajau*), Banka, Billiton, *méngkélingan*, Billiton, *dumar békam*, *epie*, *kédondong (krut)*, *mansipot* (or *mansiput*), Mal. Pen., *kébyan ajér*, *k. burong*, *kélamok maruk*, *kéramu(h)*, *ungit*, Sarawak & Brunei, *ampadu kalui*, *kalasu*, *kédondong (krut)*, *kélamok maruk*, *kémbajau* (or *kumbajau*, *kémbajan*, *kambajan*), *k. lamak*, *k. teta*, *k. utan*, *masam*, *mérading*, *njihah*, *tindjau*, S. & E. Born., *kumabang*, *péninasan*, *piramuh*, Br. N. Born., *salong banggi*, Labuan; Philippines: *lunai*, Lan., *palaspas*, Bik., *pili-hanai*, C. Bis.; *madesi*, *wuwuk*, Cel. Minahasa.

Note. Extremely polymorphous species, specially in its vegetative characters; some forms can be distinguished, but their boundaries are vague and intermediate specimens are not infrequent (*cf.* KALKMAN, *l.c.*).

10. *Dacryodes crassipes* KALKMAN, Blumea 7 (1954) 516, f. 5.

Tree ? *Branchlets* c. 1 cm thick, lenticellate, puberulous at the tip; pith with many vascular strands. *Leaves* 3–4-jugate. *Petioles* ( $4\frac{1}{2}$ – $7\frac{1}{2}$ –10 cm, strongly flattened at the base, densely pubescent, pith with many vascular strands. *Leaflets* ovate, 5–12½ by 3–6½ cm, coriaceous, glabrous; base rounded to subcordate; apex rather abruptly, shortly, and bluntly acuminate; nerves 10–13 pairs (angle 80–85°), straight, apical ones arching; intermediate veins distinctly developed. *Infructescences* and *flowers* unknown. *Infructescences* axillary, together pseudoterminal, stout,  $7\frac{1}{2}$ –10 cm, hardly branched, pubescent. *Fruits*: only sterile ones known.

Distr. *Malaysia*: Sumatra (Indragiri), once collected at 50 m. *Fr.* Aug.

Note. Very incompletely known (only with galls and sterile fruits), but probably belonging to *Dacryodes*, and related to *D. rostrata* H. J. LAM.

11. *Dacryodes macrocarpa* (KING) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 203, t. 5 f. 8, t. 14 f. 106c and 111; Bull. Jard. Bot. Btzg III, 12 (1932) 342, t. 4 f. 10; WYATT-SMITH, Man. Mal. Timb. Trees,

Burser. (1953) 15, *cum fig.*; KALKMAN, *Blumea* 7 (1954) 514.—*Santiria macrocarpa* KING, J. As. Soc. Beng. 62, ii (1894) 256; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 13, t. 17; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 258, f. 39<sup>1</sup>; RIDL, Fl. Mal Pen. 1 (1922) 378.—*Santiria elliptifolia* MERR. Philip. J. Sc. 13 (1918) Bot. 305; En. Philip. 2 (1923) 355.—*D. kostermansii* KALKMAN, *Blumea* 7 (1954) 515, f. 4.—Fig. 11.

0-4 cm, branches up to 12 cm. *Flowers* 4-6 mm, glabrous. *Filaments* confluent with the disk. *Disk* cupular, the rim undulate. *Pistil* in ♂ flowers rather strongly reduced. *Fruits* ovoid, faintly trigonous in cross-section, 2<sup>1</sup>/<sub>4</sub>-3<sup>1</sup>/<sub>2</sub> by 1<sup>1</sup>/<sub>4</sub>-2 cm, stigmatic scar (nearly) apical. *Cotyledons* folded, 3-lobed.

*Notes.* This species is remarkable for its canaroid features: the thick and large petals with



Fig. 11. Stilt-roots in *Dacryodes macrocarpa* (KING) H. J. LAM. Swampy forest, Mawai-Jemaluang Rd, 13<sup>1</sup>/<sub>2</sub> mile, E. Johore (photogr. CORNER, Sept. 1935).

Tree, 10-25(-40) m by up to 65 cm, with stilt-roots or (stilted) buttresses (?always). *Branchlets* 4-8 mm thick, lenticellate, glabrous; pith without vascular strands. *Leaves* (0-)-2-5-jugate, glabrous. *Petioles* flattened at base, 1<sup>1</sup>/<sub>2</sub>-7<sup>1</sup>/<sub>2</sub> cm, pith with 1 or few vascular strands. *Leaflets* elliptic-obovate, ovate or elliptic-oblong, sometimes nearly orbicular, 4-16<sup>1</sup>/<sub>2</sub> by 3-12 cm, thin-coriaceous; base often oblique, rounded to broadly cuneate, ultimate base cuneately or acuminate contracted; apex blunt and emarginate to shortly, broadly, and bluntly acuminate; nerves 6-14 pairs (angle 55-75°), curved, only the apical ones arching. *Inflorescences* axillary, together pseudo-terminal, broadly paniculate, 6-25 cm, glabrous, peduncle

induplicate margins and inflexed apiculum and the large and faintly trigonous fruits. Three varieties can be distinguished.

KEY TO THE VARIETIES

1. Leaves up to 3-jugate.
2. Leaf-rhachis and petiolules glabrous, blackish when dry. Midrib and nerves not sharply prominent on the lower surface. *var. macrocarpa*
2. Leaf-rhachis and petiolules puberulous to glabrous, brown when dry. Midrib and nerves sharply prominent on the lower surface. *var. kostermansii*
1. Leaves 4-5-jugate . . . . *var. merrillii*

*var. macrocarpa*.—*Santiria macrocarpa* KING.—*D. macrocarpa var. genuina* H. J. LAM, Ann. l.c.; Bull. l.c. 343.

Leaves (0)2(–3)-jugate. Petioles 1<sup>1</sup>/<sub>2</sub>–5(–7) cm. Nerves 6–10(–12) pairs (angle 55–65°). Pedicels 4–5 mm. Calyx 2<sup>1</sup>/<sub>2</sub>–3 mm.

Distr. *Malaysia*: Sumatra, Lingga, Malay Peninsula, and Borneo.

Ecol. Primary forests, up to 50(–400) m, apparently mostly in low, wet or swampy localities. Fl. Sept.–March, fr. Oct.–April.

Uses. The timber is sometimes used.

Vern. *Bantar burung, lëntambung, sumbulajang, Sum., kabu-kabu hutan, mēdang malai*, Lingga Arch., *kēdondong*, Mal. Pen., *kambasina, karawas burung, madang lada, m. talsak, paoh-paoh*, Born.

*var. kostermansii* (KALKM.) KALKMAN, *nov. stat.*—*D. kostermansii* KALKM.

Leaves 2–3-jugate. Petioles 4<sup>1</sup>/<sub>2</sub>–7<sup>1</sup>/<sub>2</sub> cm. Nerves (8–)10–14 pairs (angle from c. 75° at base to c. 60° near apex). Flowers unknown.

Distr. *Malaysia*: S. and E. Borneo.

Ecol. Primary forests up to 50 m. Fr. April.

Uses. Fruits edible.

Vern. *Asam, asēm, rarawa pipit*.

*var. merrillii* H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 203; Bull. l.c. 344.—*Santiria elliptifolia* MERR.

Leaves 4–5-jugate. Nerves 8–13 pairs (angle 65–75°). Pedicels 1<sup>1</sup>/<sub>2</sub>–3 mm long. Calyx in ♂ flowers (♀ flowers unknown) 1<sup>1</sup>/<sub>2</sub>–1 mm. Fruits unknown.

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

12. *Dacryodes expansa* (RIDL.) H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 204; Bull. Jard. Bot. Btzig III, 12 (1932) 366, t. 5 f. 21; KALKMAN, Blumea 7 (1954) 510, f. 2.—*Canarium expansum* RIDL. Kew Bull. (1930) 83.

Small, buttressed tree, 10–25 m. *Branchlets* 1<sup>1</sup>/<sub>2</sub>–1<sup>1</sup>/<sub>2</sub> cm thick, glabrous; pith without vascular strands. *Leaves* 2–4(or more?)-jugate, glabrous. *Petioles* 5–9<sup>1</sup>/<sub>2</sub> cm, not or slightly flattened, pith with some vascular strands. *Leaflets* oblong to oblong-lanceolate, 8–30 by 3<sup>1</sup>/<sub>2</sub>–10 cm, coriaceous or chartaceous; base cuneate; apex shortly acuminate; nervation prominent below, nerves 10–17 pairs (angle 50–80°), curved, not arching. *Panicles* (♀ unknown) lax, axillary or on leafless axillary shoots with terminal buds, (5–)13–21 cm, glabrous, peduncle 0–5<sup>1</sup>/<sub>2</sub> cm, branches up to 11 cm. *Flowers* (♀ unknown) 1<sup>1</sup>/<sub>2</sub> cm, glabrous. *Calyx* 2 mm. *Filaments* free. *Disk* cupular to annular, thick and radially furrowed or more or less undulate. *Pistil* moderately reduced. *Infructescences* axillary (?), 9–27 cm, glabrous, peduncle 6–7 cm. *Fruits* broad-ellipsoid, slightly triangular in cross-section, 3<sup>1</sup>/<sub>2</sub>–3<sup>3</sup>/<sub>4</sub> by 2–3 by 2<sup>1</sup>/<sub>2</sub>–3 cm, style-remains slightly to rather strongly excentric; pericarp coarsely wrinkled and pustular when dry; wall of the pyrene woody, 1–1<sup>1</sup>/<sub>2</sub> mm thick.

Distr. *Malaysia*: Borneo (Sarawak and Brunei). Ecol. Primary forests up to 100 m. Fl. Jan. fr. July–Aug.

Uses. The fruits are eaten.

Vern. *Sabal, sibut*, Brunei.

13. *Dacryodes papuana* HUSSON, Blumea 7 (1952) 167, f. 1; KALKMAN, Blumea 7 (1954) 513.

Tree, 30 m high. *Branchlets* 4–6 mm thick, glabrous; pith without vascular strands. *Leaves* 2-jugate, glabrous. *Petioles* c. 5 cm, slightly flattened at base, pith without vascular strands. *Leaflets* elliptic, 8<sup>1</sup>/<sub>2</sub>–11<sup>1</sup>/<sub>2</sub> by 4–5 cm, subcoriaceous; base slightly oblique, broadly cuneate; apex shortly, broadly and bluntly acuminate; nerves 7–11 pairs (angle c. 50°), curved, not arching. *Infructescences* and flowers unknown. *Infructescences* axillary, 11–12 cm, with few fruits. *Fruits* ellipsoid, 2<sup>3</sup>/<sub>4</sub>–3 by 1<sup>1</sup>/<sub>2</sub> cm, stigmatic scar apical, pericarp thick and fleshy. *Cotyledons* contortuplicate.

Distr. *Malaysia*: NW. New Guinea (Idenburg River), once collected.

Ecol. Primary forest at 650 m. Fr. April.

Note. Nearest related to *D. macrocarpa* H. J. LAM.

14. *Dacryodes longifolia* (KING) H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 202; Bull. Jard. Bot. Btzig III, 12 (1932) 340, t. 4 f. 9; KALKMAN, Blumea 7 (1954) 509.—*Santiria longifolia* KING, J. As. Soc. Beng. 62, ii (1894) 258; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 14, t. 19; RIDL. Fl. Mal. Pen. 1 (1922) 379.—*Curtisina penangensis* RIDL. J. Str. Br. R. As. Soc. no 82 (1920) 180; Fl. Mal. Pen. 1 (1922) 491.

Tree. *Branchlets* 1<sup>1</sup>/<sub>2</sub>–1 cm thick, lenticellate, glabrous; pith without vascular strands. *Leaves* 3–15-jugate, glabrous. *Petioles* 2<sup>1</sup>/<sub>2</sub>–18<sup>1</sup>/<sub>2</sub> cm, strongly flattened above, pith with one or few vascular strands. *Leaflets* ovate to narrowly oblong, 6–30(–42) by 2<sup>1</sup>/<sub>2</sub>–8 cm, stiff, chartaceous; base broadly cuneate to rounded; apex tapering, bluntly acuminate; nerves 8–14 pairs (angle 60–65°), curved, apical ones arching. *Panicles* (♀ unknown) axillary, up to 12 cm long, glabrous, branched from the base, branches up to 4 cm long. *Flowers* (♀ unknown) 3<sup>1</sup>/<sub>2</sub> mm, glabrous. *Calyx* 1<sup>1</sup>/<sub>2</sub> mm. *Stamens* free or confluent to the disk. *Disk* cupular with subtruncate rim. *Pistil* moderately reduced. *Infructescences* axillary, pyramidal, 2–15(–23) cm, glabrous, peduncle 0–3<sup>1</sup>/<sub>2</sub> cm, branches stout, up to 9<sup>1</sup>/<sub>2</sub> cm. *Fruits* ovoid, slightly oblique, 1<sup>1</sup>/<sub>2</sub>–2<sup>3</sup>/<sub>4</sub> by 1<sup>1</sup>/<sub>4</sub>–1<sup>1</sup>/<sub>2</sub> cm, style-remains somewhat excentric; wall of the pyrene very thin.

Distr. *Malaysia*: Malay Peninsula (Perak, P. Penang).

Notes. For about 50 years this species has not been recollected; it is known from 5 old specimens only. LAM, l.c., divides it in two varieties, adding that 'more material may reduce them into forms or even eliminate them'. The two varieties differ only in leaf-characters which have possibly no taxonomic value.

*var. longifolia*.—*Santiria longifolia* KING.—*D. longifolia var. typica* H. J. LAM, l.c.

Leaves 6–15-jugate; petiolules 1½–3 cm; leaflets 20–30(–42) by 3–8 cm.

Distr. *Malaysia*: Malay Peninsula: Perak.

Ecol. In open localities and jungle, up to 250 m. *Fr.* Nov.

*var. penangensis* (RIDL.) H. J. LAM, l.c.—*Curtisina penangensis* RIDL.

Leaves 3–5-jugate; petiolules ½–1½ cm; leaflets 6–18 by 2½–6½ cm.

Distr. *Malaysia*: Malay Peninsula: P. Penang.

Ecol. Hill forests, c. 600 m. *Fl.* May, *fr.* June.

15. *Dacryodes breviracemosa* KALKMAN, *Blumea* 7 (1954) 511, f. 3.

Tree, c. 18 m, slightly buttressed. *Branchlets* c. 4 mm thick, ferruginous-tomentose at the extreme tips, pith without vascular strands. *Leaves* 2-jugate,

glabrous. *Petioles* 3–4½ cm, flattened at the base, pith with some vascular strands. *Leaflets* ovate-oblong, 7½–11 by 3½–6 cm; base rounded, shortly contracted at the ultimate base; apex gradually narrowed into a rather broad acumen; nerves 10–12 pairs (angle from 75° at the base to 45° in the apex), curved, only the apical ones arching. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, together pseudoterminal, 3–6 cm, with 1–4 fruits; peduncle ½–1 cm. *Fruits* ellipsoid, 16–18 by 9–11 mm, stigmatic scar nearly apical, base rounded, apex broadly acute. *Cotyledons* contortuplicate (?), palmate.

Distr. *Malaysia*: Malay Peninsula (Trengganu), once collected, at 30 m. *Fr.* Oct. Possibly the sterile specimen bb. 24829 from Sumatra (Kuantan) belongs also to this species.

Vern. *Kédondong*.

Note. Nearest related to *D. longifolia* H. J. LAM.

### 5. SANTIRIA

BL. Mus. Bot. 1 (1850) 209; ENGL. in DC. Mon. Phan. 4 (1883) 152; H. J. LAM, Bull. Jard. Bot. Btzig III, 12 (1932) 367; KALKMAN, *Blumea* 7 (1954) 522.—*Trigonochlamys* HOOK. f. Trans. Linn. Soc. 23, 1 (1860) 170.—*Icicaster* RIDL. J. Str. Br. R. As. Soc. no 75 (1917) 15.—Fig. 2e, 13–15.

Dioecious trees. *Pith* of the *branchlets* usually without vascular strands. *Leaves* without stipules. *Petiole* either terete or the upper surface flat or channelled, pith usually with vascular strands. *Leaflets* entire. *Inflorescences* usually axillary, rarely truly terminal. *Flowers* 3-merous. *Sepals* free or connate. *Petals* with a usually slightly thickened and inflexed apex. *Stamens* 6 or 3, glabrous; anthers adnate or basi- to dorsifix. *Disk* intrastaminal, glabrous. *Pistil* 3-celled, glabrous, in ♂ flowers usually moderately reduced; stigma (sub)sessile. *Fruits* drupaceous, usually irregularly globose or ellipsoid, always more or less oblique, stigma excentric, sometimes near the pedicel; pericarp rather thin and solid, very slightly wrinkled when dry; pyrene containing one fertile and 2 sterile cells; endocarp crustaceous, thin; calyx usually persistent, not or slightly enlarged. *Seed* subglobular; cotyledons pinnate, folded or contortuplicate.

Distr. About 18 *sp.* in the Old World tropics. Two sections (*sect. Santiria* and *Icicopsis*) are exclusively Malaysian; the third one, *sect. Santiriopsis* (ENGL.) H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 204, comprising c. 6 *sp.*, is restricted to tropical West Africa. In Malaysia the genus is predominantly West Malaysian (*excl.* Java and the Lesser Sunda Islands), very few species occur in the Philippines, Celebes, the Moluccas, and New Guinea. Fig. 12.

Ecol. Trees of old, mainly primary, forests at low to medium altitudes, up to 1500 m; on dry to swampy ground.

Wood anat. DEN BERGER, Med. Proefst. Thee 97 (1926) 65, Med. Proefst. Boschw. 13 (1926) 65; DESCH, Mal. For. Rec. 15<sup>1</sup> (1941) 64 (hand lens); HEIMSCHE, Lilloa 8 (1942) 122. See also under species.

Uses. Of some species the seeds are edible. The wood of several species is locally used for house-building, etc.; it is not of a very good quality.

#### KEY TO THE SPECIES

1. Lower surface of the adult leaflets densely pubescent on all nerves and mostly also on the veins.
2. Veins distinctly transverse.
3. Filaments free from the disk . . . . . 8. *S. nervosa*
3. Filaments more or less adnate to the disk.
4. Flowers 2–4 mm long, sepals up to 1½ mm long, petals 2–2½ mm. Upper surface of the petioles sharply flattened or channelled to terete.

5. Stigma on the fruit less than 90° excentric. Leaflets with a minute, conspicuous but not prominent reticulation on the upper surface; pubescence on lower surface consisting of simple hairs. 1. *S. tomentosa*
5. Stigma on the fruit near the pedicel. Leaflets with a lax and very distinct reticulation on the upper surface; pubescence on the lower surface consisting of branched hairs . . . 7. *S. conferta*
4. Flowers 4½ mm long (♂ unknown), calyx 2½–3 mm, petals 3–3½ mm. Petioles deeply channelled. 3. *S. grandiflora*
2. Veins not distinctly transverse.
6. Petioles terete or hardly flattened. Terminal bud small, ¼–1 cm, narrow or broad.
7. Stigma on the fruit 90° or more excentric. Anthers basi- to dorsifix.
8. Sepals nearly free. Pith of the branchlets with many vascular strands . . . . . 2. *S. mollis*
8. Calyx nearly truncate. Pith of the branchlets without vascular strands. 9. *S. apiculata var. pilosa*
7. Stigma on the fruit up to 90° excentric. Anthers adnate.
9. Flowers 2–3 mm long. Stamens 3. Stigma on the fruits slightly excentric. Leaflets villous underneath specially on the nerves and on the midrib above. . . . . 12. *S. rubiginosa var. mana*
9. Flowers 4–10 mm long. Stamens 6. Stigma on the fruits c. 90° excentric. Midrib of the leaflets pubescent to pilose underneath, otherwise leaflets glabrous. Branchlets and petioles minutely pubescent . . . . . 11. *S. griffithii*
6. Petioles sharply flattened or channelled. Terminal bud 2–3 cm long, narrow . . . . . 7. *S. conferta*
1. Lower surface of the adult leaflets glabrous, or slightly pubescent on the midrib (and the lower nerves) only.
10. Upper surface of the petioles terete or hardly flattened at the base.
11. Veins distinctly transverse . . . . . 8. *S. nervosa*
11. Veins not distinctly transverse.
12. Flowers 4–10 mm, calyx 3–7 mm long . . . . . 11. *S. griffithii*
12. Flowers 2–4 mm, calyx ½–2½ mm long.
13. Stigma on the fruits less than 90° excentric.
14. Stamens 3, sometimes with rudiments of the 3 others; anthers adnate . . . . . 12. *S. rubiginosa*
14. Stamens 6, anthers basi- to dorsifix.
15. Leaflets reddish-brown when dry, averagely ovate-oblong and c. 2–2½ times as long as broad; venation not prominent underneath. Flowers 2 mm long, calyx ½–¾ mm; filaments adnate to the disk. Fruits 9–15 by 7–12 mm . . . . . 4. *S. laevigata f. glabrifolia*
15. Leaflets yellowish brown or greyish when dry, averagely more elliptic-oblong and c. 2½–3 times as long as broad; venation ± prominent underneath. Flowers 2½–4 mm long, calyx 1–2 mm; filaments free or slightly adnate to the disk. Fruits 13–22 by 10–20 mm. 5. *S. oblongifolia*
13. Stigma on the fruits 90° or more excentric, often close to the pedicel.
16. Petiolules 3–¾ cm long . . . . . 6. *S. ridleyi*
16. Petiolules ½–2 cm long.
17. Inflorescences branched from the base or with a short peduncle. Calyx subtruncate, 1–1½ mm. Pith of the branchlets without vascular strands . . . . . 9. *S. apiculata*
17. Inflorescences branched from halfway upwards. Sepals nearly free, 1½–2½ mm. Pith of the branchlets with many vascular strands . . . . . 2. *S. mollis*
10. Upper surface of the petioles distinctly flattened or channelled at the base.
18. Veins distinctly transverse.
19. Flowers 4½ mm long (♂ unknown); sepals 2½–3 mm; petals 3–3½ mm . . . . . 3. *S. grandiflora*
19. Flowers 2–4 mm long; calyx up to 1½ mm.
20. Calyx 1½ mm long. Stamens free from the disk . . . . . 8. *S. nervosa*
20. Calyx ½–¾ mm long. Stamens more or less adnate to the disk.
21. Stigma on the fruits near the pedicel. Peduncle 0–2 cm . . . . . 7. *S. conferta*
21. Stigma on the fruits less than 90° excentric. Peduncle 1½–12½ cm. 4. *S. laevigata f. laevigata*
18. Veins not distinctly transverse.
22. Leaves usually very large, up to 135 cm long, leaflets up to 47 cm long, petioles 23–35 cm. Tips of the branchlets with undeveloped, 2–5 cm long, leaf-bases, similar to the bracts of the inflorescence. . . . . 10. *S. megaphylla*
22. Leaves and leaflets smaller. Petioles rarely longer than 20 cm (unknown in *S. ridleyi*). Bract-like undeveloped leaf-bases at the tip of the branchlets absent.
23. Peduncle 1½–12½ cm long. Stigma on the fruit up to 90° excentric. 4. *S. laevigata f. laevigata*
23. Peduncle 0–3 cm long. Stigma on the fruit more than 90° excentric.
24. Panicles slender, rhachis at the base up to 3 mm thick . . . . . 9. *S. apiculata*
24. Panicles stout, rhachis at the base more than 4 mm thick.
25. Reticulations distinct on either surface of the leaflets. Infructescences 4½–19 cm long. Petiolules 1–2½ cm long . . . . . 7. *S. conferta*
25. Reticulations inconspicuous, especially on the upper surface. Infructescences c. 25 cm long. Petiolules 3–4 cm long . . . . . 6. *S. ridleyi*

1. Section *Santiria*

*Santiria* sect. *Eusantiria* ENGL. in DC. Mon. Phan. 4 (1883) 157.

Veins usually  $\pm$  transversely reticulate. Receptacle not concave. Calyx usually with short lobes, rarely sepals nearly free. Stamens 6, anthers basi- to dorsifix (fig. 13c-d).

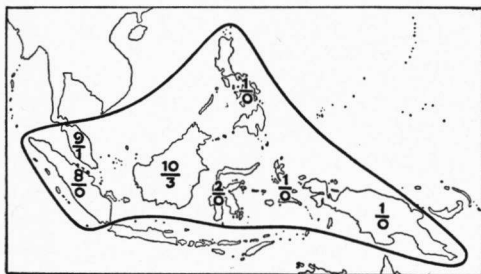


Fig. 12. Distribution of *Santiria* sections *Santiria* and *Icicopsis*. Above the hyphen the total number of species, below the hyphen the number of endemic species in each district or island.

1. *Santiria tomentosa* BL. Mus. Bot. 1 (1850) 211; ENGL. in DC. Mon. Phan. 4 (1883) 159; HEYNE, Nutt. Pl. (1927) 881; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 14 f. 107e; Bull. Jard. Bot. Btzg III, 12 (1932) 391, t. 7 f. 33; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 26, cum fig.; KALKMAN, Blumea 7 (1954) 529.—*Canarium korthalsii* MIQ. Fl. Ind. Bat. 1, 2 (1859) 645.—*S. multiflora* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 538; ENGL. in DC. Mon. Phan. 4 (1883) 159; KING, J. As. Soc. Beng. 62, ii (1894) 261; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 243, f. 139; ed. 2, 19a (1931) f. 216 D-F; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 258, f. 39<sup>5</sup>; RIDL. Fl. Mal. Pen. 1 (1922) 380.—*Canarium micrantherum* STAPP ex RIDL. Kew Bull. (1930) 82.—*S. mollissima* RIDL. Kew Bull. (1930) 85; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 67; Bull. Jard. Bot. Btzg III, 12 (1932) 390, t. 7 f. 32; KALKMAN, Blumea 7 (1954) 532.

Tree, 15–35 m by 20–80 cm, rarely with buttresses, sometimes monoecious? Branchlets 2–15 mm thick, more or less angular, more or less densely woolly pubescent, as are the leaves (upper surface of the leaflets excepted), inflorescences and infructescences; terminal bud  $1\frac{1}{4}$ – $1\frac{3}{4}$  cm long, subacute. Leaves 0–4(–5)-jugate. Petioles ( $1\frac{1}{2}$ –) 3–24 $\frac{1}{2}$  cm, flattened at the base to terete. Leaflets ovate to oblong (terminal ones sometimes obovate),  $5\frac{1}{2}$ –28(–34) by  $2\frac{1}{2}$ –9(–12 $\frac{1}{2}$ ) cm, upper surface glabrous except the midrib (and the bases of the nerves), lower surface woolly pubescent (very rarely to subglabrous); base rounded or one half broadly cuneate; apex gradually to abruptly acuminate; nervation prominent underneath, nerves (9–)11–26(–29) pairs (angle 60–80°, in the base up to 90°), usually not arching. Panicles axillary, lax, 2–38 cm, peduncle  $1\frac{1}{4}$ –7 cm, branches up to 17 $\frac{1}{2}$  cm. Flowers 2–3 mm long. Calyx  $1\frac{1}{2}$ –1

mm high, nearly truncate, outside sparsely pubescent. Filaments adnate to the disk, in  $\sigma$  flowers epispetalous ones often distinctly longer than epipetalous ones. Disk cupular, fleshy, rim undulate. Pistil in  $\sigma$  flowers much reduced. Infructescences up to 22 cm long. Fruits irregularly globular to oblong,  $1\frac{1}{4}$ –2 by  $3\frac{1}{4}$ –2 cm, stigma less than 90° excentric.

Distr. Malaysia: Sumatra, Banka, Billiton, Malay Peninsula, and Borneo.

Ecol. Primary forests on dry or swampy grounds, sometimes in periodically inundated localities, at low altitudes (rarely higher than 250 m). Fl. June–Nov., fr. July–May.

Uses. The timber, though not very durable, is used for indoor-construction. The fruits, after being boiled, are eaten; an edible oil is pressed out of the pericarp.

Vern. *Kabu, kaju langik, ('m)parak, pègah* (or *pègo*), *sèrantai*, Sum., *asèm-asèm, kèdongong, lèmbuk, mèngkabu*, Banka, *kèrantai*, Billiton, *kèdongong, kèrantai, kumbul nyiur, pangong, surian, ta-tahu, tèrantai*, Mal. Pen., *bantrang, djabai, garunggung, kadjang karang, kahingai, kaju djagung, kambaloh, kembajau, kurihang, mèrangan mèrah, mohontowong, njatu kolan, tahengai*, Born.

Note. By reducing *S. mollissima* to *S. tomentosa* the variability of the latter is only slightly increased. Between 'typical' *S. mollissima* (small leaves and terete petioles) and 'typical' *S. tomentosa* (large leaves and strongly flattened petioles) all transitions exist.

2. *Santiria mollis* ENGL. in DC. Mon. Phan. 4 (1883) 156, t. 3 f. 37–38; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 206, t. 16 f. 128, excl. var. *sessilis*; Bull. Jard. Bot. Btzg III, 12 (1932) 388, t. 6 f. 30; KALKMAN, Blumea 7 (1954) 530, f. 9.—*Canarium hirtipetalum* RIDL. Kew Bull. (1930) 84.

Tree, 25–40 m by 40–70 cm, buttressed. Branchlets 7–9 mm thick, verrucose, young parts densely ferruginously woolly-tomentose to glabrous, as are the petioles, and the lower surface of the leaflets; pith with rather many, small and dispersed or more or less peripherally arranged vascular strands; terminal bud c.  $\frac{1}{2}$  cm long. Leaves 2–4(–5)-jugate. Petioles 5–8 cm, not or hardly flattened at the base. Leaflets ovate to oblong,  $5\frac{1}{2}$ –14 $\frac{1}{2}$  by 3–4 $\frac{1}{2}$  cm, (glabrous or) tomentose underneath; base rounded (to cuneate); apex gradually long-acuminate; nervation prominent underneath, nerves 9–15 pairs (angle c. 70°), curved, not distinctly arching. Panicles ( $\sigma$  unknown) axillary, 5–23 cm, tomentose, long-stalked, branches up to 9 cm long. Flowers ( $\sigma$  unknown) 3–4 mm long, tomentose. Calyx  $1\frac{1}{2}$ –2 $\frac{1}{2}$  mm high, segments nearly free. Petals

sericeous tomentose at both sides. *Filaments* adnate to the disk. *Disk* cupular with undulate rim. *Pistil* in ♂ flowers strongly reduced. *Infructescences* 9–19 cm long, lenticellate, shortly tomentose. *Fruits* subglobose, 15–18 by 12–14 mm, stigma 90° or more excentric.

Distr. *Malaysia*: Borneo.

Ecol. Primary forests up to 250 m. *Fl.* Febr.–April, *fr.* April.

Vern. *Kumbajau burung*, SE. Born.

3. *Santiria grandiflora* KALKMAN, *Blumea* 7 (1954) 525, f. 7.

Tree 25–30 m by 50 cm. *Branchlets* c. 1 cm thick, tips puberulent; terminal bud acute, 2–3 cm long. *Leaves* 4–5-jugate. *Petioles* 11½–16½ cm, deeply channelled at the base, rims of the groove incurved. *Leaflets* oblong or oblong-lanceolate, 11–27 × 4–7 cm, the lower surface pubescent on the nerves; base rounded; apex acuminate, acumen 6–15 mm long, rather narrow; nervation prominent underneath; nerves 15–24 pairs, hardly conspicuous on the upper surface, nearly straight, rather abruptly arching close to the margin; veins transverse. *Panicles* (♂ unknown) axillary, pseudo-terminal, 10–16 cm long, densely pubescent. *Flowers* (♂ unknown) 4½ mm long, pubescent. *Calyx* 2½–3 mm high, segments nearly free. *Filaments* adnate to the disk. *Disk* annular. *Infructescences* and *fruits* unknown.

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

Ecol. In primary forest below 300 m. *Fl.* Aug.

Uses. The fruits are said to be edible.

Note. Related to *S. tomentosa* BL. and specially to *S. laevigata* BL.

4. *Santiria laevigata* BL. *Mus. Bot.* 1 (1850) 211, t. 40, *incl.* also *var. appanata*; BENN. in Hook. f. *Fl. Br. Ind.* 1 (1875) 538; ENGL. in DC. *Mon. Phan.* 4 (1883) 165; KING, J. As. Soc. *Beng.* 62, ii (1894) 257; RIDL. *Fl. Mal. Pen.* 1 (1922) 378; HEYNE, *Nutt. Pl.* (1927) 881; H. J. LAM, *Bull. Jard. Bot. Btzg III*, 12 (1932) 382, t. 6 f. 28; WYATT-SMITH, *Man. Mal. Timb. Trees, Burser.* (1953) 24, *cum fig.*; KALKMAN, *Blumea* 7 (1954) 535.—*S. rufescens* BL. *Mus. Bot.* 1 (1850) 213.—*Canarium laevigatum* MIQ. *Fl. Ind. Bat.* 1, 2 (1859) 648.—*Canarium rufescens* MIQ. *Fl. Ind. Bat.* 1, 2 (1859) 650.—*Canarium eupteron* MIQ. *var. puberulum* MIQ. *Sum.* (1860) 526.—*S. glabrifolia* ENGL. in DC. *Mon. Phan.* 4 (1883) 164.—*S. violacea* H. J. LAM, *Ann. Jard. Bot. Btzg* 42 (1932) 205, t. 14 f. 107d; *Bull. Jard. Bot. Btzg III*, 12 (1932) 379, t. 6 f. 26; KALKMAN, *Blumea* 7 (1954) 540.

Tree, 15–30(–45) m by 25–70(–more than 100) cm, often with buttresses. *Branchlets* ¼–1½ cm thick, glabrous; pith without or with up to 20 scattered vascular strands; terminal bud ½–2½ cm long. *Leaves* 1–5-jugate, glabrescent. *Petioles* 3–18(–22½) cm, channelled at the base to terete. *Leaflets* ovate to oblong, 5–26(–35) by 2–8(–11) cm, glabrous or sometimes tomentose on the midrib underneath; base rounded to cuneate; apex acutely short-acuminate; midrib and nerves

(rather) prominent underneath, nerves 8–22 pairs (angle 70–90°), straight, curving and usually arching near the margin. *Panicles* axillary, pubescent when young, ♂ ones 4–37 cm, branches up to 18 cm, ♀ ones (2½–)5–27 cm, branches up to 12 cm. *Flowers* 2 mm long, subglabrous. *Calyx* ½–¾ mm high. *Filaments* adnate to the disk. *Disk* cupular. *Pistil* in ♂ flowers very small. *Fruits* obliquely globular (to oblong), (1–)1¼–2 by (¾–)1¼–2 cm, stigma up to 90° excentric.

Distr. *Malaysia*: Sumatra, Banka, Billiton, Malay Peninsula, Borneo, Central Celebes.

Ecol. Forests up to 1200–1500 m, sometimes in lowland peat forest (specially *f. glabrifolia*). *Fl.* mainly July–Dec., *fr.* mainly July–Febr.

Wood anat. DESCH, *Mal. For. Rec.* 15<sup>1</sup> (1941) 64, Pl. 13 fig. 1 (hand lens); HEIMSCH, *Lilloa* 8 (1942) Pl. 8 fig. 47.

Uses. The timber is used for posts and planks, and for chopping-knife handles. The fruits are edible.

Vern. Sumatra: *dalhi*, *hatapul miak*, Tapanuli, *bintanak*, *b. nasi*, *damar putih*, *gëdungung*, *katuko lagau*, *lalan*, *madang këladi*, *m. lantjik*, *sumbulajang*, W. Coast, *damar taktahan*, *kaju kalas*, *logan*, *murak*, *rësung bunga*, E. Coast, *balam pauh*, *lalan*, *siampi*, *tërantai*, Bengkalis, (*balam*) *parak*, *balam putih*, *mëdang këladi*, *parah putih*, Bencoolen, *amparah*, *malapara*, *pëgah kabu-kabu*, *tengeh*, *tëtak tundjuk*, Palemb., *bangkiring uding bungo*, *b. u. pajo*, *marapujan uding*, *silaora*, *umawak putih*, Simalur; *bërëmbang*, *gerunggang*, *kabu-kabu*, *mëngkabu*, *ranggun*, Banka, *chenarah*, *gerunggun*, *këdongong*, *kërantai*, *kumbooi nyior*, *ledah kerah*, *panjang bruang*, *surian*, Mal. Pen., *bërambang*, *berinas*, *biumbang*, W. Born., *asëm*, *gandis*, *kambajau burung*, *merambang*, *mëräsam*, *pasan*, *pusan*, SE. Born., *bakata* (*pute*), *longori*, *tapi-tapi* (or *topi-topi*), Cel.

Notes. The following two forms can be distinguished:

*f. laevigata*.—All synonyms mentioned under the species except *S. glabrifolia*.

*Branchlets* ½–1½ cm thick; pith sometimes with vascular strands. *Leaves* 2–5-jugate. *Petioles* 4½–18(–22½) cm, sharply flattened at the base to channelled, rarely nearly terete. *Leaflets* oblong to elliptic, (5–)12½–26(–35½) by 2–8(–11) cm; on the lower surface midrib prominent and reticulations less conspicuous than the veins. *Panicles* 6½–37 cm. *Fruits* 12–20 by (10–)14–18 mm.

Distr. As the species.

*f. glabrifolia* (ENGL.) H. J. LAM, *Ann. Jard. Bot. Btzg* 42 (1932) 205; *Bull. Jard. Bot. Btzg III*, 12 (1932) 384.—*S. glabrifolia* ENGL.

*Branchlets* 3–6 mm thick; pith without vascular strands. *Leaves* 1–3-jugate. *Petioles* 3–8½(–11) cm, terete or hardly flattened. *Leaflets* ovate to elliptic, (4½–)6–15½ by 2½–7 cm; on the lower surface midrib not prominent and reticulations as conspicuous as the veins. *Panicles* 4–27 cm. *Fruits* 9–15 by 7–12 mm.



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

**5. Santiria oblongifolia** BL. Mus. Bot. 1 (1850) 211; ENGL. in DC. Mon. Phan. 4 (1883) 162; KING, J. As. Soc. Beng. 62, ii (1894) 257; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 14, t. 18; RIDL. Fl. Mal. Pen. 1 (1922) 379; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 372, t. 5 f. 22; KALKMAN, Blumea 7 (1954) 537.—*Canarium oblongifolium* MIQ. Fl. Ind. Bat. 1, 2 (1859) 645.—*Canarium euperon* MIQ. Fl. Ind. Bat. 1, 2 (1859) 648, excl. var. *puberula* MIQ. Sum. (1860) 526; ENGL. in DC. Mon. Phan. 4 (1883) 147.—*S. maingayi* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 538; ENGL. in DC. Mon. Phan. 4 (1883) 165.—*S. caesia* ENGL. in DC. Mon. Phan. 4 (1883) 166.—*S. latifolia* STAPF ex RIDL. Kew Bull. (1930) 86.

Tree, 20–30(–42) m by 40–90(–120) cm, sometimes with small buttresses. *Branchlets* 4–6 mm thick, minutely tomentose to glabrous; terminal bud 1–2 cm long. *Leaves* (2–)3–5-jugate, (sub-)glabrous. *Petioles* 4–12(–19) cm, terete or slightly flattened at the base. *Leaflets* oblong to ovate, (6–)8–17(–25) by (1½–)3–6(–10) cm, rather rigid, sometimes slightly pubescent on the midrib beneath; base cuneate to rounded; apex gradually to rather abruptly, short and bluntly acuminate; nervation prominent underneath; nerves 9–16 pairs (angle 60–70°), slightly curved, not arching. *Panicles* either axillary, together pseudoterminal, or terminal, broad, 15–40 cm long, peduncle 0–9 cm, branches up to 15 cm, densely pubescent to glabrate. *Flowers* sparsely pubescent to glabrous, in ♂ 2½–3 mm long, ♀ 4 mm. *Calyx* deeply cleft, in ♂ flowers 1 mm high, in ♀ flowers 2 mm. *Filaments* free or slightly adnate to the disk. *Disk* cupular, thick, rim truncate to undulate. *Pistil* in ♂ flowers slightly reduced. *Infructescences* stout, verrucose. *Fruits* oblique, oblong-ellipsoid to globular, 1¼–2½ by 1–2 cm, stigma little (less than 90°) excentric, often one or two sides of the fruit more or less flattened.

Distr. *Malaysia*: Sumatra, Banka, Malay Peninsula, and Borneo.

Ecol. Primary, sometimes secondary, forests, usually on dry, rarely on temporarily inundated, grounds, up to 300 m altitude, but some records from 900–1950 m (Sumatra W. Coast, Mt Kinabalu). *Fl.* May–Aug., *fr.* mainly Aug.–Febr.

Vern. Sumatra: *damar djuruwing*, *d. tjulak*, *Atjeh*, *damar ariung*, *d. sirasih*, *gadondong*, *kaju kapur*, *k. putih*, *kédundung*, *lagan*, *paruh-paruh*, *tajan*, W. Coast, *babeko*, *kondoi*, *médang batu*, *m. sabo*, *tenan*, Bengkalis, *lalan*, Djambi, *bajung sisip*, *kabu-kabu*, *kaju latjak*, *kédondong pèrgam*, *médang pèlan*, *meleparak*, *mèrasam putih*, *parak lumu*, *pègah katulu*, *tètak tundjuk*, Palembang; *kédondong*, Mal. Pen., *asém garunggang*, SE. Born.

Note. Nearest allied to *S. laevigata* BL.

**6. Santiria ridleyi** H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 205; Bull. Jard. Bot. Btzg III, 12 (1932) 379, t. 6 f. 25; KALKMAN, Blumea 7 (1954) 538.

Small tree. *Branchlets* unknown. *Leaves* c. 4-

jugate, glabrous. *Leaflets* oblong, 15–20 by 6–7½ cm, subcoriaceous; base rounded; apex more or less abruptly short-acuminate; midrib and nerves prominent underneath, nerves 10–13 pairs (angle 60–80°), curved, not or indistinctly arching. *Infructescences* and *flowers* unknown. *Infructescences* (detached ones) broadly paniculate, –23 cm, branched from the base, glabrous, branches up to 17 cm; remains of filaments free or slightly adnate to the disk. *Fruits* angular-ovoid, 12–19 by 11–15 mm, stigma more than 90° excentric.

Distr. *Malaysia*: Malay Peninsula (Perak: G. Keledang), once collected.

Ecol. *Fr.* Sept.

Note. This very incompletely known species resembles in many respects *S. oblongifolia* BL.; it is mainly different from the latter species by the much more excentric stigma on the fruits.

**7. Santiria conferta** BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 537; ENGL. in DC. Mon. Phan. 4 (1883) 160; KING, J. As. Soc. Beng. 62, ii (1894) 261; RIDL. Fl. Mal. Pen. 1 (1922) 379; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 16 f. 131, incl. also var. *wrayi*; Bull. Jard. Bot. Btzg III, 12 (1932) 380, t. 6 f. 27; KALKMAN, Blumea 7 (1954) 528, f. 8.—*S. wrayi* KING, J. As. Soc. Beng. 62, ii (1894) 259; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 15, t. 20; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 258, f. 39<sup>b</sup>; RIDL. Fl. Mal. Pen. 1 (1922) 379.

Tree, 6–24 m, with small buttresses. *Branchlets* ½–1½ cm thick, pubescent or glabrous; terminal bud 2–3 cm long. *Leaves* 2–7-jugate. *Petioles* (4½–)7½–29 cm, strongly channelled at the base. *Leaflets* lanceolate to oblong, 6½–26 by 3–10 cm, upper surface glabrous, under surface densely pubescent when young, glabrescent; base rounded (or one half cuneate); apex tapering or short-acuminate; midrib and nerves strongly prominent underneath, on upper surface nerves and veins rather distinct; nerves (9–)11–19 pairs (angle 60–80°), curved near the margin, specially at base and apex arching. *Panicles* axillary, 3½–13 cm, contracted, pubescent to glabrous; peduncle 0–2 cm. *Flowers* 2–4 mm long, pubescent. *Calyx* ½–¾ mm high. *Filaments* more or less adnate to the disk. *Disk* cupular. *Pistil* in ♂ flowers strongly reduced. *Infructescences* 4½–19 cm, pubescent. *Fruits* 1–1¼ by ¾–1½ cm, stigma strongly excentric, near the pedicel.

Distr. *Malaysia*: S. Sumatra and Malay Peninsula.

Ecol. Forests, usually under 100 m alt. (once 240–300 m, once 1150 m). *Fl.* Jan.–Febr., and Aug.–Sept., *fr.* Febr.–March, June, Dec.

Vern. *Buli kurus*, *lalan*, *mèrdondong*, Sum., *kédondong*, *k. bulau*, *kèrantai mèrah*, Mal. Pen.

**8. Santiria nervosa** H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 206, t. 11 f. 65; Bull. Jard. Bot. Btzg III, 12 (1932) 387, t. 6 f. 29; KALKMAN, Blumea 7 (1954) 539.

Tree, 25–30 m by 20–100 cm, with up to 2½ m high buttresses, which are 1½ m spreading. *Branchlets* 4–8 mm thick, the tips ferruginous-

tomentose; terminal bud  $1\frac{1}{2}$ –1 cm long. *Leaves* 1–3-jugate. *Petioles* 4–9(–14) cm, slightly to strongly flattened at the base. *Leaflets* oblong to ovate (to suborbicular),  $5\frac{1}{2}$ –17(–22) by 3–7 $\frac{1}{2}$  (–10 $\frac{1}{2}$ ) cm, lower surface pubescent to glabrous, indumentum partly or entirely consisting of stellate hairs; base broadly cuneate to rounded; apex subabruptly, short and bluntly acuminate; nervation rather prominent underneath; nerves 10–15(–18) pairs (angle 65–80°, near the base up to 90°), more or less curved, not distinctly arching except at base and apex; reticulations minute. *Panicles* axillary, often representing short, leafless shoots with terminal buds, narrow,  $1\frac{1}{2}$ –5 $\frac{1}{2}$  cm, ferruginous-tomentose. *Flowers* c. 2 mm long, sessile, glabrous. *Calyx*  $1\frac{1}{2}$  mm. *Stamens* free from the disk. *Disk* thick-annular or (in ♀ flowers) cupular, radially furrowed and with undulate rim. *Pistil* in ♂ flowers moderately reduced. *Infructescences* and *fruits* unknown.

Distr. *Malaysia*: Sumatra, Banka, Malay Peninsula, and Borneo.

Ecol. Primary and secondary forests, up to 60 (–350) m. *Fl.* Febr.–March.

Vern. *Bantan burung, kědondong tundjuk, sisip banièng*, Sum., *asam-asam*, Banka, *kědudong*, Mal. Pen., *ėngai, mēndjėlih*, Born.

9. *Santiria apiculata* BENN. in Hook. f. *Fl. Br. Ind.* 1 (1875) 537; ENGL. in DC. *Mon. Phan.* 4 (1883) 163; KING, *J. As. Soc. Beng.* 62, ii (1894) 259; GUILLAUMIN, *Ann. Sc. Nat. IX*, Bot. 10 (1909) f. 39<sup>8</sup>, 40<sup>2</sup>; RIDL. *Fl. Mal. Pen.* 1 (1922) 378; HEYNE, *Nutt. Pl.* (1927) 881; H. J. LAM, *Ann. Jard. Bot. Btzg* 42 (1932) t. 11 f. 66, t. 14 f. 107f; *Bull. Jard. Bot. Btzg III*, 12 (1932) 375, t. 5 f. 23; KALKMAN, *Blumea* 7 (1954) 538.—*S. beccarii* ENGL. in DC. *Mon. Phan.* 4 (1883) 162.—*S. teysmannii* ENGL. in DC. *Mon. Phan.* 4 (1883) 162.—*S. pilosa* ENGL. in DC. *Mon. Phan.* 4 (1883) 159; H. J. LAM, *Bull. Jard. Bot. Btzg III*, 12 (1932) t. 7 f. 31; KALKMAN, *Blumea* 7 (1954) 531.—*S. glabra* MERR. *Philip. J. Sc.* 10 (1915) Bot. 30; *En. Philip.* 2 (1923) 355.—*S. lagunensis* MERR. *Philip. J. Sc.* 10 (1915) Bot. 31; *En. Philip.* 2 (1923) 355.—*S. minutiflora* RIDL. *J. Str. Br. R. As. Soc.* no 82 (1920) 175; *Fl. Mal. Pen.* 1 (1922) 377.—*S. brachystachys* RIDL. *Kew Bull.* (1925) 79.—*Canarium parviflorum* RIDL. *Kew Bull.* (1930) 80.—*S. rubra* RIDL. *Kew Bull.* (1930) 86; H. J. LAM, *Bull. Jard. Bot. Btzg III*, 12 (1932) 378, t. 6 f. 24; KALKMAN, *Blumea* 7 (1954) 540.—Fig. 13a–e.

Tree, 6–20(–40) m by 30–60(–100) cm. *Branchlets* 3–5 mm, densely pubescent or glabrous except the minutely pulverulent tip; terminal bud  $1\frac{1}{2}$ –1 cm long. *Leaves* (0–)1–2(–4)-jugate, glabrous or lower surface pubescent on all nerves. *Petioles* 2–9 $\frac{1}{2}$ (–14) cm, usually hardly flattened at the base (distinctly flattened in *var. rubra*). *Leaflets* ovate (rarely lanceolate) to elliptical,  $5\frac{1}{2}$ –16(–20) by 2–6(–9 $\frac{1}{2}$ ) cm, chartaceous, usually rather thin; base obliquely rounded to narrowly attenuate; apex subabruptly acuminate; on lower surface midrib and nerves prominent, veins and reticulations not very distinct; nerves 6–14 pairs (angle

65–75°), sinuous, arching. *Panicles* axillary (very rarely together pseudoterminal), broad, 0–4 cm peduncled, glabrous or pubescent, ♂ ones  $4\frac{1}{2}$ –17 (–27) cm, branches up to 10 cm; ♀ ones (2–)3 $\frac{1}{2}$ –14 (in fruit up to 18) cm, branches up to  $5\frac{1}{2}$  cm (in fruit up to 10 cm). *Flowers* (sub)glabrous, 2–2 $\frac{1}{2}$  mm long. *Calyx* 1–1 $\frac{1}{2}$  mm high, subtruncate. *Filaments* more or less adnate to the disk. *Disk* thick, cupular or infundibuliform, with 6 interstaminal lobes in ♂ flowers, more truncate in ♀ ones. *Pistil* in ♂ flowers moderately reduced. *Fruits* very oblique, globose or ellipsoid, (8–)10–18 by 6–13 mm, stigma very excentric, usually more than 90°, sometimes near the pedicel; sometimes more-seeded.

Distr. *Malaysia*: Sumatra (also Nias Isl.), Malay Peninsula, Borneo, Philippines (Luzon, Leyte, Mindanao), Central and S. Celebes, and the Moluccas (Morotai, Ceram, Ambon).

#### KEY TO THE VARIETIES

1. Leaves glabrous.
2. Flowers yellowish. Petioles 2–9 cm, hardly flattened at the base; leaflets light-coloured when dry, greenish or brownish.
  - var. apiculata*
  2. Flowers red. Petioles  $4\frac{1}{2}$ –14 cm, strongly flattened at the base; leaflets dark-coloured when dry, upper surface greyish or brown, lower surface dark brown. . . . *var. rubra*
1. Lower surface of the leaflets pubescent on all nerves. . . . *var. pilosa*

*var. apiculata*.—All synonyms mentioned under the species except *S. rubra* and *S. pilosa*.

Leaves glabrous. Petioles 2–9 cm, hardly flattened at the base. Leaflets light-coloured when dry. Flowers yellowish. Fruits 10–18 by 7–13 mm.

Distr. *Malaysia*: As the species.

Ecol. Primary forests, usually on dry, rarely on swampy grounds, preferably at low altitudes, rarely up to c. 1200 m. *Fl.* Febr.–May, Aug.–Nov., *fr.* May–June, Oct.–Jan.

Uses. The wood is rather hard and used for rifle-butts; in Sum. West Coast the timber should be used in the mines, in West Ceram for house construction.

Vern. *Babi kurus, bako tjtjėrek, barih-batih, kalek duku, kědondong tundjuk*, Sum., *eu fusi*, Nias, *kědondong, k. bulau, k. kru(i)t, kėlat jawa, kurantai batu, planking, sėrapoh*, Mal. Pen., *pėlajah bukit*, Born.

*var. rubra* (RIDL.) KALKMAN, *nov. stat.*—*S. rubra* RIDL.

Leaves glabrous. Petioles  $4\frac{1}{2}$ –14 cm long, strongly flattened at the base. Upper surface of the leaflets dark when dry, greyish or brown, lower surface dark brown. Flowers red. Fruits 8–11(–13) by 6–8 mm.

Distr. *Malaysia*: Malay Peninsula and Borneo (Sarawak).

Ecol. *Fl.* Jan.–Febr., *fr.* Febr.–March.

Vern. *Damar chabok, kědondong, suryan batu*, Mal. Pen.

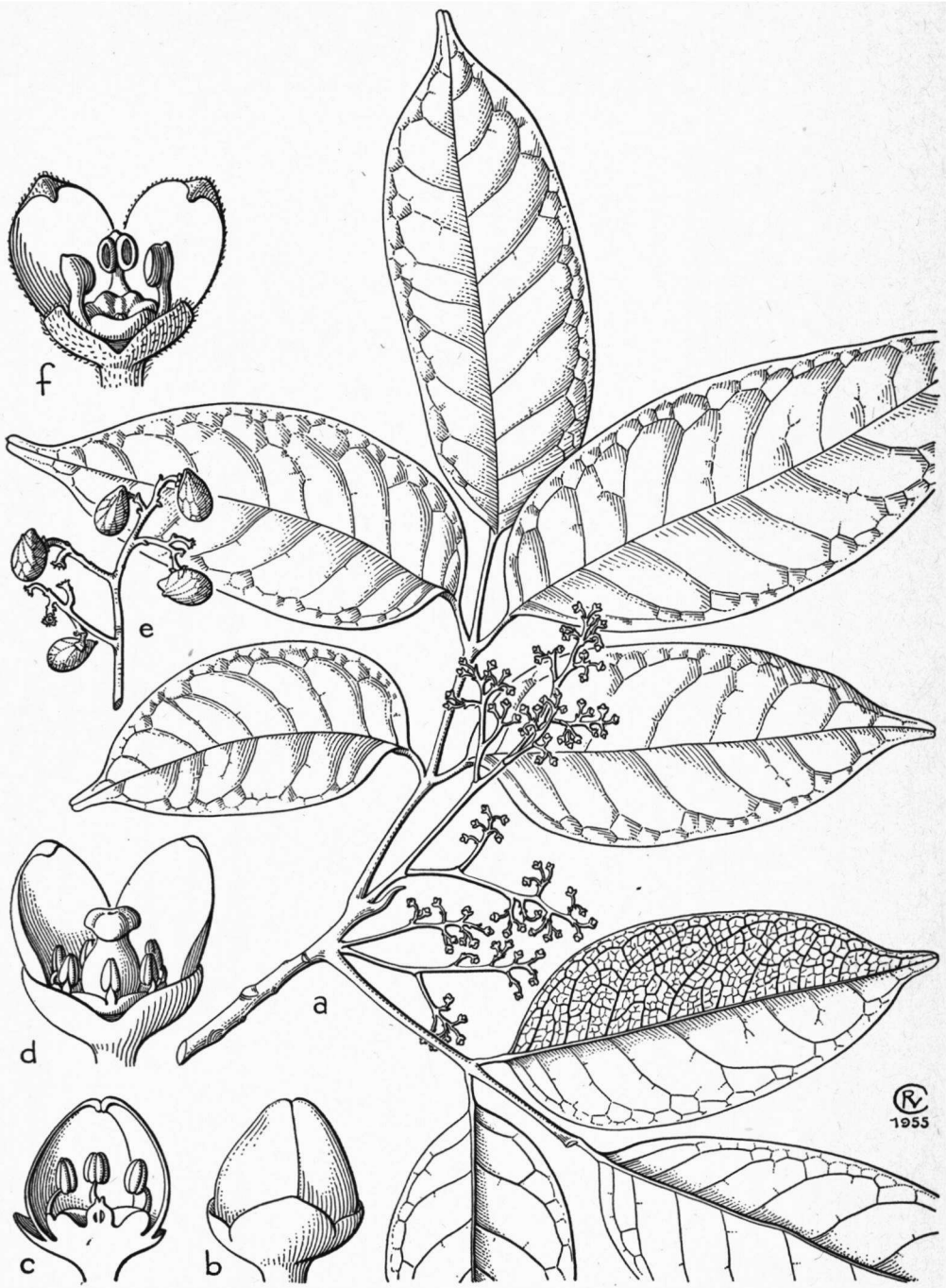


Fig. 13. *Santiria apiculata* BENN. a. Twig with ♀ flowers, b. ♀ bud, c. section of ♂ flower, d. ♀ flower, one petal removed, e. infructescence.—*Santiria rubiginosa* BL. f. ♂ flower, one petal removed (a and e × 2/3, b-d and f × 13).

*var. pilosa* (ENGL.) KALKMAN, *nov. stat.*—*S. pilosa* ENGL.

Petioles 2½–9½ cm, hardly flattened at the base. Upper surface of the leaflets pubescent on the midrib, lower surface pubescent on all nerves. Fruits 10–15 by 7–11 mm.

Distr. *Malaysia*: Borneo.

Ecol. Primary forests up to 1100 m. *Fl.* Oct., *fr.* May, Sept.

10. *Santiria megaphylla* KALKMAN, *Blumea* 7 (1954) 533, f. 10.

Tree, 23–25 m. *Branchlets* 2–3 cm thick, glabrous except the tips; terminal bud 1½–3 cm long; next to normal leaves, there are undeveloped leaf-bases, 2–5 by ½ cm, similar to those, which serve as bracts to the inflorescences. *Leaves* 3–5-jugate, glabrous, (60–)80–135 cm long. *Petioles* 23–35 cm,

channelled at the base. *Leaflets* elliptic-ovate to elliptic-oblong (terminal one obovate-oblong), (15–)24–47 by (5½–)11–18 cm, coriaceous; base rounded to broadly cuneate; apex acuminate; midrib and nerves prominent on either surface, nerves 8–14 pairs (angle 60–70°), faintly curved, not arching except sometimes in basal and apical part; veins prominent underneath. *Panicles* (♂ unknown) axillary, crowded at the tips of the branchlets, 12–32 cm long, shortly pubescent, peduncle (1–)3–10 cm. *Flowers* (♂ unknown) c. 2 mm long, puberulous. *Calyx* 1 mm long. *Petals* suborbicular. *Filaments* adnate to the cupular disk. *Infructescences* 20–38 cm, shortly pubescent. *Fruits* ovoid, 1½–1¾ by 1–1¼ cm, stigma near the pedicel.

Distr. *Malaysia*: Borneo (Br. N. Borneo and Sarawak).

Ecol. *Fl.* May, *fr.* Jan., May.

## 2. Section *Icicopsis*

BENN. in Hook. *f.* *Fl. Br. Ind.* 1 (1875) 536.—*Trigonochlamys* HOOK. *f.* *Trans. Linn. Soc.* 23 (1860) 170.—*Santiria sect. Trigonochlamys* H. J. LAM, *Ann. Jard. Bot. Btzg* 42 (1932) 206.

Veins ± longitudinally stretched. Receptacle sometimes slightly concave. Sepals nearly free. Stamens 6 or 3, in the latter case rudiments of the epipetalous ones sometimes present, anthers adnate (fig. 13f).

11. *Santiria griffithii* (HOOK. *f.*) ENGL. *Bot. Jahrb.* 1 (1881) 43; in DC. *Mon. Phan.* 4 (1883) 155, t. 3 f. 33–35; in E. & P. *Pfl. Fam.* 3, 4 (1896) f. 139A–C; ed. 2, 19a (1931) f. 216A–C; GUILLAUMIN, *Ann. Sc. Nat.* IX, *Bot.* 10 (1909) f. 38, 39<sup>4</sup>, and 40<sup>4</sup>; HEYNE, *Nutt. Pl.* (1927) 881; H. J. LAM, *Ann. Jard. Bot. Btzg* 42 (1932) t. 14 f. 107a; *Bull. Jard. Bot. Btzg III*, 12 (1932) 394, t. 7 f. 34; WYATT-SMITH, *Man. Mal. Timb. Trees, Bursar.* (1953) 27, *cum fig.*; KALKMAN, *Blumea* 7 (1954) 545.—*Trigonochlamys griffithii* HOOK. *f.* *Trans. Linn. Soc.* 23 (1860) 170, t. 27; BENN. in Hook. *f.* *Fl. Br. Ind.* 1 (1875) 539; KING, *J. As. Soc. Beng.* 62, ii (1894) 251; RIDL, *Fl. Mal. Pen.* 1 (1922) 381.—*S. bornensis* ENGL. *Bot. Jahrb.* 1 (1881) 43; in DC. *Mon. Phan.* 4 (1883) 156, t. 3 f. 36.

Tree, 12–35(–45) m by 50–80(–120) cm, with buttresses. *Branchlets* 4–6 mm thick, verrucose, the young parts minutely pubescent; pith with a peripheral layer of sclerenchymatic strands; terminal bud 3–6 mm long. *Leaves* (3–)5–10-jugate. *Petioles* 3–8(–10) cm, hardly flattened at the base, minutely pubescent as are the rachis and petioles. *Leaflets* elliptical-lanceolate to oblong-lanceolate, 3–10(–17½) by 1–3½(–4½) cm, chartaceous, usually pubescent to pilose on midrib (and nerves) underneath; base rounded or broadly cuneate; apex more or less gradually narrowed into a short to rather long and slender, blunt acumen; nerves 11–15(–20) pairs (angle c. 70°, at the base up to 90°), slender, straight, near the margin more or less distinctly arching. *Panicles* axillary, up to 20 cm long, branches up to 12 cm, densely and

minutely pubescent. *Flowers* 4–10 mm long, tomentose. *Calyx* 3–7 mm, deeply cleft. *Petals* also partly pubescent inside. *Stamens* 6, filaments adnate to the disk. *Disk* cupular, the base thick, the rim abruptly thin and erect. *Pistil* in ♂ flowers strongly reduced. *Fruits* (sub)sessile, obliquely globose, 8–13 by 8–16 mm, stigma c. 90° excentric.

Distr. *Malaysia*: Sumatra, Banka, Malay Peninsula, and Borneo.

Ecol. Primary and secondary forests on dry, rarely on swampy soils, up to 300 m. *Fl.* mainly June–Sept., *fr.* Jan.–Dec., specially Sept.

Uses. The wood is rather hard and durable; it is used for constructions.

Vern. Sumatra: *kompas*, W. Coast, *andlahi tunggal*, E. Coast, *bebeka*, *kědundung*, *kěmėti*, *měrdjėlajan*, *pakubajan*, *pėtai belalang*, *piras*, *pungung kidjang*, *sėmasan pujo*, Palembang.; *kělinggir bejan*, *mėmbalu*, *mėnjantiung*, *měrdjatang*, *mėsanit*, *rėngas (mėrah)*, Banka, *bebras*, *kasai bukit*, *kědong*, *k. kėrat*, *k. pasir*, *kėmpas roman*, Mal. Pen.; Borneo: *langguk*, *mėramun*, *pegah*, W. Born., (*t*)*ampiras*, *bine*, *bumbun gunung*, *bunjau*, *buno*, *kapalan*, *kumbajau burung*, *tjėlandjap laki gunung*, SE. Born., *pamutalun*, N. Born.

Notes. For the distinction of this species from *S. rubiginosa* BL. which it resembles closely in its vegetative parts, see there. As in that species, the nervation is very much alike that of *Koordersiodendron pinnatum* MERR. (*Anacardiaceae*), which has usually larger leaflets and more-jugate leaves, and which never possesses vascular strands in the pith of the petioles.

12. *Santiria rubiginosa* BL. Mus. Bot. 1 (1850) 213; ENGL. in DC. Mon. Phan. 4 (1883) 158; H. J. LAM, Ann. Jard. Bot. Botzg 42 (1932) t. 14 f. 107b, 112a, t. 16 f. 126c; Bull. Jard. Bot. Botzg III, 12 (1932) 399, t. 7 f. 37; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 28, cum fig.; KALKMAN, Blumea 7 (1954) 542.—*Canarium rubiginosum* MIQ. Fl. Ind. Bat. 1, 2 (1859) 651.—*S. planchonii* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 536; ENGL.



Fig. 14. *Santiria rubiginosa* BL. Tree c. 35 m high, Palembang (S. Sumatra) (photogr. THORENAAR, a. 1925).

in DC. Mon. Phan. 4 (1883) 154, t. 3 f. 24-32; in E. & P. Pfl. Fam. ed. 2, 19a (1931) f. 216 G-J; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 39<sup>3</sup>, 40<sup>3</sup>.—*S. parviflora* ENGL. in DC. Mon. Phan. 4 (1883) 155; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 39<sup>7</sup>; RIDL. Kew Bull. (1930) 86.—*Canarium planchonii* KING, J. As. Soc. Beng. 62, ii (1894) 240.—*Icicaster planchonii* RIDL. J. Str. Br. R. As. Soc. no 75 (1917) 15; Fl. Mal. Pen. 1 (1922) 381.—*S. lamprocarpa* LAUT. Bot. Jahrb. 56 (1920) 337,

f. 3; E. & P. Pfl. Fam. ed. 2, 19a (1931) f. 217; H. J. LAM, Ann. Jard. Bot. Botzg 42 (1932) t. 11 f. 71; Bull. Jard. Bot. Botzg III, 12 (1932) 402, t. 7 f. 38.—*S. havilandii* RIDL. Kew Bull. (1930) 85.—*S. pedicellata* RIDL. Kew Bull. (1930) 86; H. J. LAM, Ann. Jard. Bot. Botzg 42 (1932) t. 11 f. 73; Bull. Jard. Bot. Botzg III, 12 (1932) 398, t. 7 f. 36.—*S. minimiflora* RIDL. Kew Bull. (1930) 87; H. J. LAM, Ann. Jard. Bot. Botzg 42 (1932) t. 11 f. 72; Bull. Jard. Bot. Botzg III, 12 (1932) 398, t. 7 f. 35.—*S. nana* H. J. LAM, Ann. Jard. Bot. Botzg 42 (1932) 207; Bull. Jard. Bot. Botzg III, 12 (1932) 403, t. 7 f. 39; KALKMAN, Blumea 7 (1954) 541, f. 11.—Fig. 2e, 13f, 14, & 15.

Tree, up to 30(-45) m by 65 cm, buttressed. Branchlets up to 1/2 cm thick, glabrous except the tips; terminal bud 2-4 mm long. Leaves 1-5(-6)-jugate. Petioles 1 1/2-7 1/2 cm, not or hardly flattened at the base, glabrous or more or less pubescent. Leaflets elliptic or ovate to lanceolate-oblong, 3-11(-15) by 1-5 1/2(-7) cm, glabrous except sometimes a slight pubescence on the midrib underneath; base more or less broadly cuneate; apex gradually or more or less abruptly, bluntly acuminate; nerves 9-15 pairs (angle 60-80°), very slender, nearly straight, forked near the margin and more or less distinctly arching. Panicles axillary, (1-)-4-17 cm, without or (specially ♀ ones) with a short peduncle, branches up to 10 cm long, glabrous or minutely pulverulent. Flowers 2-3 mm long, slightly pubescent or glabrous. Sepals nearly free, 1-2 1/2 mm. Stamens 3, filaments adnate to the disk; sometimes rudiments of 3 epipetalous ones present. Disk cupular with truncate rim. Pistil in ♂ flowers much reduced. Fruits oblique, irregularly globular or ellipsoid, 8-13 by 7-9 mm, stigma less than 90° excentric.

Distr. Malaysia: Sumatra, Banka, Billiton, Malay Peninsula, Borneo, and New Guinea (Biak, Sepik).

Notes. Sterile specimens can sometimes hardly be distinguished from *S. griffithii* ENGL. and the identification of such specimens is therefore not always certain. *S. rubiginosa* has usually fewer pairs of leaflets, which are, however, larger. Narrow-leaved specimens are closely resembling *Koordersiodendron pinnatum* MERR. (*Anac.*), which, however, can be distinguished by the absence of vascular strands in the pith of the petioles, and by the usually more-jugate leaves, and very short petiolules.

KEY TO THE VARIETIES

- 1. Leaflets glabrous, except sometimes a slight pubescence on the midrib underneath.
- 2. Pedicels 1-3 mm, shorter than or as long as the flowers var. *rubiginosa*
- 2. Pedicels 2-6 mm, longer than the flowers. var. *pedicellata*
- 1. Leaflets pilose on either surface, specially underneath and on the nerves . . . . var. *nana*

var. *rubiginosa*.—All synonyms except those of the other varieties.

Branchlets glabrous except the tips. Leaflets



Fig. 15. *Santiria rubiginosa* BL. Fruiting twig (Cult. Hort. Bog. III-B-49).

3-11(-15) by 1-5<sup>1</sup>/<sub>2</sub>(-7) cm, glabrous except sometimes the midrib underneath. Pedicels 1-3 mm, shorter than or as long as the flowers.

Distr. *Malaysia*: as the species.

Ecol. Primary forests, sometimes also in more open localities, sometimes on swampy or temporarily inundated grounds, up to 600 m, but once collected at 1200 m (Fraser Hill, Pahang). *Fl.* (Jan., March) July-Oct., *fr.* Oct.-June.

Vern. Sumatra: *kalek inai*, *kalok pinang masak*, W. Coast, *babi kurus*, *paha rusa*, *résung*, E. Coast, *kédonong serik*, Djambi, *tadjam tumpul*, Bencoolen, *kédundung*, *kémèti*, *marasam*, *mèrdjélajan*, *pakubajan*, *piras*, *punggung kidjang* (or *hidjang*), Palemb., *mosiolo*, Nias; *mértukul*, *mesànèn*, Banka, *malansatan*, Billiton, *maradjalai*, Riouw; Mal. Pen.: *babi kurus*, Perak, *kédonong matahari*, *kilat*, Selang., *kédonong bukit*, *sèryuan batu*, Joh., *surian*; Borneo: *asam*, *salak gading*, *utah* (*putah*),

Sarawak, *barempau*, *mèlangsat*, *palai*, W. Born., *asèm*, *batu*, *bunjau*, *buno putih*, *kauwtjuli*, *maniaran*, *pangahuli*, *pèlang*, *tubulo*, S. & E. Born.

*var. pedicellata* (RIDL.) KALKMAN, *Blumea* 7 (1954) 544.—*S. pedicellata* RIDL.—*S. minimiflora* RIDL.

As *var. rubiginosa*, but pedicels longer than the flowers, 2-6 mm long.

Distr. *Malaysia*: Borneo (Sarawak, W. Borneo).

*var. nana* (H. J. LAM) KALKMAN, *nov. stat.*—*S. nana* H. J. LAM.

As *var. rubiginosa*, but branchlets densely pilose, as are the petioles, rhachis, petiolules and inflorescences. Leaflets pilose on either surface.

Distr. *Malaysia*: Sumatra (E. Coast) and the Malay Peninsula (Selangor).

Ecol. Swampy forests at low altitudes. *Fl.* Nov., *fr.* Jan.

Vern. *Babi kurus*, Sum.

## 6. HAPLOLOBUS

H. J. LAM, *Ann. Jard. Bot. Btzig* 42 (1931) 25, (1932) 207; *Bull. Jard. Bot. Btzig* III, 12 (1932) 404; HUSSON & H. J. LAM, *Blumea* 7 (1953) 413.—*Santiria sect. Anisandra* LAUT. *Bot. Jahrb.* 56 (1920) 332, 340; ENGL. in *E. & P. Pfl. Fam.* ed. 2, 19a (1931) 455.—Fig. 2f, 16.

Usually small, dioecious trees, not heavily buttressed. *Pith of the branchlets* without vascular strands. *Leaves* without stipules; medulla of the petioles with vascular strands; leaflets entire. *Inflorescences* mostly axillary, rarely also terminal on larger branchlets, or on smaller axillary shoots which may bear one or a few leaves, or show an obsolete vegetative bud, which is getting overtopped; usually branched from near the base. *Flowers* 3-merous, small. *Calyx* 3-dentate to sub-truncate. *Petals* with slightly thickened and inflexed tip. *Stamens* 6, glabrous, free or adnate to the disk. *Disk* intrastaminal, 6-lobed, glabrous, undulate or truncate. *Pistil* glabrous, stigma (sub)sessile; in ♂ flowers slightly reduced. *Fruits* rarely larger than 2½ cm long, mostly ovoid or ellipsoid, more rarely globular or pointed at apex; pericarp thin and dry; pyrene papyraceous, 1-seeded, 2 cells fully compressed; calyx persistent, not enlarged. *Seed* shaped as the fruit; cotyledons planoconvex, thick, entire.

Distr. About 22 spp. from Borneo eastwards through Malaysia (the Philippines excepted) to ?Micronesia (Palau), and Melanesia (New Britain, New Ireland, the Solomons, New Hebrides, Fiji, and Samoa), definitely centering in East Malaysia; *H. aneityensis* HUSSON exclusively Melanesian.

Ecol. Primary forests, 0-1800 m alt. Some species, e.g. *H. clementium* in the Cyclops Range, and *H. acuminatus* f. *glabrior* near Hollandia, are reported to grow gregariously.

Notes. This is the only genus of the *Burseraceae*, in which glands and domatia in the nerve axils are known to occur and they are restricted to a few species only. Transitions between the glabrous glands and the hairy domatia are known in *H. monticola*; otherwise they do not occur together in one species.

Though by its fruit characters well-defined as a genus, delimitation of species proves to be difficult, both on account of a natural variability, it seems, and by the inadequacy of material. For this reason the status of several species is not as satisfactorily clear as compared with species in other genera of this family. Abundant future material will tend, possibly, to decrease the number of species.

KEY TO THE SPECIES

1. At least part of the leaflets with glabrous glandular pits in the axils of the nerves below, sometimes also on the blade between the nerves.
2. Leaflets narrowly oblong, 3¾-7 by 1½-2½ cm, incl. a c. 1 cm long, narrow acumen; nerves 4-5 pairs; reticulations very minute; leaves 1-2-jugate. . . . . 1. *H. microphyllus*
2. Leaflets 3-5½ cm broad, short- and broadly acuminate; nerves 6-12 pairs; reticulations not very minute; leaves 1-3-jugate.
3. Leaves 1-2-jugate; leaflets ovate to elliptic, 5-10½ by 3-5½ cm; nerves 6-9 pairs. . . . . 2. *H. glandulosus*
3. Leaves 2-3-jugate; leaflets oblong to oblong-lanceolate, 10-16½ by 4½-5½ cm; nerves 10-12 pairs. . . . . 3. *H. monticola*
1. No glandular pits or only domatia present.
4. Leaflets 1½-6 by ½-2½ cm, distinctly acuminate, acumen ½-1½ cm long . . . . . 4. *H. ledermanni*
4. Leaflets larger, if distinctly acuminate the acumen much shorter than ½-¾ of the blade.
5. Young parts and inflorescences woolly pubescent (in *H. acuminatus* f. *glabrior* glabrous); leaflets more or less sparsely pubescent underneath, particularly along the nerves.
6. ♀ Inflorescences (and infructescences) 1-7 cm long, leaflets not very rigid.
7. Branchlets not rough, 4-5 mm diam. Leaflets generally oblong, rather long, not abruptly acuminate. ♀ Inflorescences 1-7 cm long; ♂ ones 7-12 cm . . . . . 5. *H. acuminatus*  
Note. f. *glabrior* has the inflorescences entirely glabrous and the leaflets only slightly hairy.
7. Branchlets rough, c. 1 cm diam. Leaflets broadly elliptic, short and abruptly acuminate. ♀ Inflorescences 1-2 cm long (♂ unknown) . . . . . 6. *H. mollis*
6. ♀ Inflorescences (and infructescences) 10-13 cm long (♂ unknown). Leaflets rigid, abruptly acuminate. Branchlets 1 cm diam. . . . . 7. *H. robustus*
5. Young parts not woolly pubescent. Leaves entirely glabrous, or, if pubescent, than either: leaflets 21-36 by 7½-10 cm and petioles with 14-19 vascular strands in the pith, or: (♀) inflorescences axillary, glabrous, and leaflets smaller.
8. Leaflets rather large, (12-)20-40 by 8-18 cm; pith of the petioles with 14-25(-40) vascular strands.
9. Leaflets oblong-lanceolate, 21-36 by 7½-10 cm; base more or less acute; nerves 25-30 pairs, nerves and veins prominent and subpubescent underneath; leaves c. 6-jugate; petiole 13 mm thick at the base . . . . . 8. *H. beccarii*
9. Leaflets broadly oblong, (12½-)24-38 by (6½-)10-17½ cm; base rounded to subcordate; nerves (9-)12-18 pairs, veins hardly prominent and glabrous underneath; leaves 3-5-jugate; petiole 8 mm thick at the base . . . . . 9. *H. moluccanus*

8. Leaflets usually smaller; pith of the petioles with up to 10–12 vascular strands.
10. Pith of the petioles with (1–)3–12 vascular strands; leaflets, at least in fertile branchlets, fairly large, 10–22 cm long.
11. Inflorescences axillary to terminal, ♀ ones and infructescences (without the fruits) 2<sup>1</sup>/<sub>2</sub>–13 cm long.
12. ♂ Inflorescences widely branched, slender, many-flowered, 10–22 cm long, ♀ ones more stiff, little branched, few-flowered, c. 10 cm long. Leaves 2–3(–4)-jugate; petioles 7–11 cm, pith with (1–)4–8(–9) vascular strands; leaflets ovate to oblong, 9–21 by 4–10 cm, rather thin, greenish when dry with dark brown midrib; base broadly rounded; reticulation above not dense and minute. Fruits 12–16 by 7–11 mm, dull. . . . . 10. *H. celebicus*
12. ♂ Inflorescences not many-flowered, not widely branched, rather stiff, 5–15 cm long, ♀ ones 2<sup>1</sup>/<sub>2</sub>–10 cm long. Leaves 0–2(–3)-jugate; petioles 3–9 cm, pith with 10–12 vascular strands; leaflets broad-ovate to obovate, 5–18(–21) by 5–9 cm, rather thin; base broad; reticulation above not dense and minute. Fruits 12–22 by 8<sup>1</sup>/<sub>2</sub>–14 mm, dull. . . . . 11. *H. maluensis*
12. Inflorescences stiff, often (sub)terminal, ♂ ones 6–17 cm long, ♀ ones and infructescences (without the fruits) 2<sup>1</sup>/<sub>2</sub>–14 cm. Leaves (1–)2–4-jugate; petioles 4–9 cm, pith with 1–8(–11) vascular strands; leaflets oblong to ovate-elliptic, 7<sup>1</sup>/<sub>2</sub>–20 by 4–9 cm, rigid; base rounded to subcordate; reticulation often fairly minute and dense above. Fruits 15–19 by 9–15 mm, shining. . . . . 12. *H. floribundus* (see also 13. *H. versteeghii*)
11. Inflorescences axillary, ♀ ones and infructescences (without the fruits) 2<sup>1</sup>/<sub>2</sub>–5<sup>1</sup>/<sub>2</sub> cm long.
13. Nervation strongly prominent beneath. Infructescences thick and strong, c. 7 cm long. Branchlets 8–9 mm thick, heavily pustulate. . . . . 13. *H. versteeghii*
13. Nervation not strongly prominent beneath. Infructescences slender, 2<sup>1</sup>/<sub>2</sub>–5 cm long. Branchlets 4–5 mm thick, not heavily verrucose.
14. Leaflets oblong, usually 14–22 by 7–9 cm; nerves 9–17 pairs. Fruits 12–16 by 10–12 mm. . . . . 14. *H. hussonii*
14. Leaflets ovate, usually 10–13 by 5–7 cm; nerves 7–8 pairs. Fruits 23–26 by 13–18 mm. . . . . 15. *H. megacarpus*
10. Pith of the petioles with 1–3(–5) vascular strands; leaflets, at least in fertile branchlets, smaller, 3–12(–18) cm long.
15. Leaves 0–2-jugate; leaflets more or less rigid, acute or gradually acuminate. Inflorescences (♂ unknown in *H. clementium*) and infructescences 1–6 cm long.
16. Pith of the petioles with 2–5 vascular strands; nerves 11–14 pairs. . . . . 18. *H. clementium*
16. Pith of the petioles with 1 vascular strand; nerves 6–9 pairs.
17. Leaves 0(–1)-jugate; leaflets 6–12<sup>1</sup>/<sub>2</sub> by 2<sup>1</sup>/<sub>2</sub>–5<sup>3</sup>/<sub>4</sub> cm, rigid, often with distinct hair tufts (domatia) in the nerve axils beneath; reticulation very minute; petiolules long and slender. ♂ Inflorescences very slender. . . . . 16. *H. monophyllus*
17. Leaves 0–2-jugate; leaflets 3<sup>1</sup>/<sub>2</sub>–8<sup>1</sup>/<sub>4</sub> by 1<sup>1</sup>/<sub>4</sub>–5 cm, very stiff, sometimes with tiny glandular pits, but without domatia; reticulation minute; petiolules short and stout. ♂ Inflorescences fairly rigid. . . . . 17. *H. nubigenus*
15. Leaves 1–4-jugate; leaflets either thin or, if rigid, small (up to 14 by 6 cm) and then ♂ inflorescences up to 18 cm long and widely branched.
18. Base of the leaflets rounded to subcordate. ♂ Inflorescences 6–21, ♀ ones 3–14 cm long, widely branched. . . . . 12. *H. floribundus*
18. Base of the leaflets narrowly (to broadly) acute. ♂ Inflorescences rather variable.
19. Leaflets rather rigid, up to 13 by 5<sup>1</sup>/<sub>4</sub> cm. ♀ Inflorescences 3–6 cm long. . . . . 19. *H. borneensis*
19. Leaflets either rather thin, or larger.
20. Leaflets rather rigid, often broad at the base. . . . . 12. *H. floribundus*
20. Leaflets thin, 2<sup>1</sup>/<sub>2</sub>–3 times as long as broad. ♂ Inflorescences 1<sup>1</sup>/<sub>2</sub>–8 cm long, very slender, not widely branched, few-flowered. . . . . 20. *H. anisander*
20. Leaflets thin but stiff, c. 2 times as long as broad. ♂ Inflorescences 4–8 cm long, widely branched, rather many-flowered. . . . . 21. *H. leifolius*

1. *Haplolobus microphyllus* HUSSON, *Blumea* 7 (1953) 423, f. 2.

Tree c. 20 m high. *Branchlets* 1<sup>1</sup>/<sub>2</sub>–3(–5) mm thick, lenticellate, terminal bud slightly tomentose to glabrous. *Leaves* 1–2-jugate, glabrous. *Petioles* flattened to slightly canalicate above; pith with 1(–3) vascular strands. *Leaflets* lanceolate to oblong-lanceolate, 3<sup>3</sup>/<sub>4</sub>–7 by 1<sup>1</sup>/<sub>2</sub>–2<sup>1</sup>/<sub>2</sub> cm, chartaceous; base obliquely rounded to acute; apex abruptly acuminate, acumen 9–12 mm long, slender, tip blunt, emarginate; nerves 4–5 pairs (angle 40–50°), curved, gradually arching, with

glandular pits in the axils below. *Inflorescences* (♂ unknown) axillary, racemose, c. 5 cm long, glabrous, few-flowered, without bracts and bracteoles (?). *Flowers* (♂ unknown) glabrous. *Calyx* 2<sup>1</sup>/<sub>2</sub> mm high. *Petals* unknown. *Stamens* free, glabrous. *Disk* 6-undulate, fleshy, glabrous. *Infructescences* and *fruits* unknown.

*Distr. Malaysia:* West New Guinea (Bernhard Camp, on the Idenburg River), once collected in primary forest at 1780 m. *Fl. Jan.*

*Note.* Closely related to *H. ledermannii* in which the leaves are glandless.



**2. *Haplolobus glandulosus* HUSSON, Blumea 7 (1953) 423, f. 3.**

Large tree. *Branchlets* 3–5 mm thick, glabrous. *Leaves* 1–2-jugate, glabrous. *Pith of the petioles* with 1–3 vascular strands. *Leaflets* ovate to elliptic, 5–10½ by 3–5½ cm, coriaceous; base rounded to broadly acute; apex shortly and bluntly acuminate; nerves 6–9 pairs (angle 50–80°), curved, distinctly arching near the margin; glandular pits 1–2 mm long, bullate above, margin often pilose. *Inflorescences* (only young, ♀ ? ones known) axillary, 1½–2½ cm long, branched from the base, few-flowered and with some intermingled vegetative buds, glabrescent. *Flowers, infructescences, and fruits* unknown.

Distr. *Malaysia*: E. New Guinea (Morobe Distr.).

Ecol. Alt. c. 1750 m; fl. (juv.) Jan.

Notes. Obviously allied to the equally mountainous *H. microphyllus*, from which it differs by the much larger leaflets with much shorter acumen. Most akin, however, is *H. monticola*, which has still larger leaflets with smaller and hardly bullate glandular pits and a much wider reticulation, 2–3-jugate leaves, and larger inflorescences without vegetative bud. Furthermore it is related to *H. floribundus*, a lowland species, which lacks the glandular pits; to *H. nubigenus*, distinguished by its 0–1-jugate leaves and smaller and more rigid leaflets, occasionally with tiny glandular pits; and to *H. monophyllus*, which has usually unifoliolate, long-petioled leaves and domatia instead of glandular pits.

**3. *Haplolobus monticola* HUSSON, Blumea 7 (1953) 425, f. 4.**

Tree, 24–27 m by 60 cm. *Branchlets* 3–6 mm thick, lenticellate, glabrous. *Leaves* 2–3-jugate. *Pith of the petioles* with 1–3 large vascular strands. *Leaflets* oblong to oblong-lanceolate, 10–16½ by 4½–5½ cm, chartaceous, glabrous; base slightly oblique, rounded to acute; apex shortly and bluntly acuminate; nerves 10–12 pairs (angle 60–75°), curved, not arching except near the apex; glandular pits ½–1 mm long, margin often pilose, the larger and more hairy ones sometimes on the blade between the nerves. *Inflorescences* (♂ unknown) axillary, broadly paniculate, up to 7½ cm long, branched from the base, branches up to 1½ cm long, many-flowered, glabrous. *Flowers* (♂ unknown) 2 mm, glabrous. *Calyx* 1 mm. *Stamens* adnate to the disk. *Disk* 6-undulate, thick. *Infructescences and fruits* unknown.

Distr. *Malaysia*: New Guinea.

Ecol. Primary forests at c. 1000 m. Fl. March.

Note. This species is undoubtedly related to *H. nubigenus*, which differs by its 0–2-jugate leaves, its smaller leaflets, and its much more minute reticulation.

**4. *Haplolobus ledermannii* (LAUT.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207; Bull. Jard. Bot. Btzg III, 12 (1932) 408, t. 8 f. 41; HUSSON & H. J. LAM, Blumea 7 (1953) 427.—*Santiria ledermannii* LAUT. Bot. Jahrb. 56 (1920) 334.—*Santiria caudata* LAUT. Bot. Jahrb. 56 (1920) 336.**

Tree, (1½–)15–20 m high. *Branchlets* 1–5 mm diam., glabrous. *Leaves* (1–)2–4-jugate, (sub-)glabrous. *Pith of the petioles* with 1(–2) vascular strands. *Leaflets* obovate to oblanceolate or lanceolate, (1–)2–6 by (1½–)1–2½ cm, rigid, glabrous except sometimes a few hairs on the lower side of the midrib; base rounded to broadly cuneate; apex gradually narrowed into a rather long, blunt acumen; nerves very slender, 6–10 pairs (angle 60–70°), straight, curved near the margin, not arching; reticulations very minute and dense. *Inflorescences* axillary, rarely together pseudo-terminal, paniculate or subracemose, branched from the base, glabrous, ♂ ones 1–2 cm, ♀ ones up to 5 cm. *Flowers* glabrous, c. 2½ mm. *Calyx* 1 mm. *Stamens* free. *Disk* in ♂ flowers more or less undulate, in ♀ ones truncate. *Fruits* ovoid to ellipsoid, 7–9 by 5–6 mm.

Distr. *Malaysia*: NE. New Guinea (Sepik area).

Ecol. Mountain forests at 850–1400 m. Fl. Aug., Nov., March, fr. Oct.

Note. The nearest ally is *H. microphyllus*, which is distinguished by 1–2-jugate leaves provided with glandular pits.

**5. *Haplolobus acuminatus* (K.SCH.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207, t. 7 f. 46; Bull. Jard. Bot. Btzg III, 12 (1932) 410, t. 8 f. 43; HUSSON & H. J. LAM, Blumea 7 (1953) 427, f. 5; H. J. LAM, Blumea 8 (1955) 175.—*Santiria acuminata* K.SCH. in K. SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 64; K. SCH. & LAUT. Fl. Schutzgeb. (1901) 378; RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 25; LAUT. Bot. Jahrb. 56 (1920) 337.—*Canarium pachypodum* LAUT. Bot. Jahrb. 56 (1920) 324.—*H. pachypodus* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207; Bull. Jard. Bot. Btzg III, 12 (1932) 411, t. 8 f. 44.—Fig. 16a–d.**

Tree, (4–)c. 25 m high. *Branchlets* 4–10 mm, often verrucose, young parts densely pilose. *Leaves* 1–4-jugate. *Pith of the petioles* with 1–17 vascular strands. *Leaflets* ovate (to lanceolate), 4–22 by 2–12 cm, chartaceous, sometimes more or less bullate, above glabrous or pilose on the nerves only, beneath densely woolly pubescent on the nerves to subglabrous; base cuneate to subcordate; apex more or less abruptly, shortly and bluntly acuminate; nervation prominent beneath, nerves 7–20 pairs (angle 60–80°), curved, not arching except in the apex; intermediate veins sometimes distinctly developed. *Inflorescences* axillary, paniculate, with a short peduncle, sometimes with a vegetative terminal bud, densely woolly pubescent, glabrescent or glabrous, ♂ ones 7–12 cm long, rather dense and many-flowered, ♀ ones 1–7 cm, more lax, branches always very short. *Flowers* usually glabrous, 1½–2½ mm. *Calyx* ¾ mm high. *Stamens* free or slightly adnate to the disk. *Disk* cupular, truncate or irregularly undulate. *Infructescences* sparsely pubescent. *Fruits* 13–19 by 8–12 mm, ovoid, slightly pointed at the apex.

Distr. *Malaysia*: New Guinea.

Ecol. Primary forests up to 700 m. Fl. March, July, Oct.–Nov., fr. Oct.–March.



Fig. 16. *Haplolobus acuminatus* (K.SCH.) H. J. LAM *f. glabrior* H. J. LAM, *a.* Twig with ♀ flowers, *b.* ♀ flower in section, *c.* section of ♂ flower, *d.* cross-section of petiole.—*Haplolobus floribundus* (K.SCH.) H. J. LAM. *e.* infructescence (*a* and *e* × 2/3, *b* and *c* × 17, *d* × 7).

Vern. *Kao*, Hollandia.

Notes. Two forms can be distinguished:

*f. acuminatus*. Inflorescences and nervation on the underside of the leaflets densely woolly pubescent.

*f. glabrior* H. J. LAM, *Blumea* 8 (1955) 175. Inflorescences glabrous, leaves subglabrous.

This species is related to *H. robustus*, which differs by rigid leaflets with abrupt and short

acumen, and longer and much broader (♀) inflorescences; probably also related to *H. maluensis*, which differs by longer and more lax inflorescences.

6. *Haplolobus mollis* H. J. LAM, *Blumea* 8 (1955) 177, f. 1.

Tree c. 20 m high. Branchlets c. 1 cm diam., verrucose. Leaves 1-3-jugate. Pith of the petioles

with 8–10 vascular strands. *Leaflets* elliptic to obovate, 7–19 by 5–11½ cm, glabrous above, softly pubescent underneath; base rounded to subcordate, often oblique; apex abruptly and short acuminate; nervation prominent beneath; nerves 8–15 pairs (angle 70–80°), much curved, near the margin more or less arching. *Inflorescences* (♂ unknown) small, pilose, 1½–2 cm long, on stout, short, axillary shoots. *Flowers* (♂ unknown) 3 mm long, glabrous. *Calyx* spreading, 2 mm wide. *Stamens* free. *Disk* undulate. *Infructescences* and *fruits* unknown.

*Distr. Malaysia:* Moluccas (Halmaheira: G. Sembilan), once collected.

*Ecol.* Primary rain-forest, 600 m. *Fl.* Sept.

*Note.* The branchlets and leaves remind of *H. moluccanus*, from which the present species differs, however, by fewer vascular strands in the petiolar pith, smaller, broader, and pubescent leaflets, and much smaller ♀ inflorescences.

**7. *Haplolobus robustus* H. J. LAM, Blumea 7 (1953) 429, f. 6.**

*Tree*, c. 20 m by 40 cm. *Branchlets* c. 1 cm diam., tips densely pubescent, as are the leaves and inflorescences. *Leaves* 2–3-jugate. *Pith of the petioles* with c. 15 vascular strands. *Leaflets* oblong, 14–21 by 6–9 cm, rigid, densely woolly pubescent beneath and on the midrib above; base rounded to subcordate; apex abruptly, shortly and bluntly acuminate; nervation prominent beneath, nerves 12–16 pairs (angle c. 70°), curved, not distinctly arching except the apical ones. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, 10–13 cm long, rigid, densely woolly pubescent, shortly stalked, branches up to 8½ cm long. *Fruits* subglobular, 10–13 by 7–10 mm.

*Distr. Malaysia:* West New Guinea (incl. also Numfoor Isl.).

*Ecol.* Primary rain-forest up to 850 m. *Fr.* March.

*Vern. Wom*, Numfoor.

*Note.* A characteristic species, apparently close to *H. acuminatus*, but distinguished by rigid, oblong leaflets, robust branchlets and infructescences, and long and broad panicles.

**8. *Haplolobus beccarii* HUSSON, Blumea 7 (1953) 431, f. 7.**

*Tree. Branchlets* 1¾–2¼ cm diam., lenticellate. *Leaves* 6-jugate. *Pith of the petioles* with 15–20 vascular strands. *Leaflets* lanceolate-oblong, 21–36 by 7½–10 cm, chartaceous, pubescent on the nerves beneath; base slightly oblique, cuneate; apex rather abruptly, long, and acutely acuminate; nervation prominent beneath, nerves 25–30 pairs (angle 70–80°), curved, arching near the margin. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, 4–7 cm long, densely minutely pubescent, branched from (near) the base. *Fruits* oblong to subglobose, 13–15 by 12 mm.

*Distr. Malaysia:* Borneo (Sarawak), once collected, *fr.* June.

*Note.* This species stands quite apart in the genus; its only possible relation is not with the

second Bornean species, *H. borneensis*, but rather with *H. acuminatus* from New Guinea.

**9. *Haplolobus moluccanus* H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 207, t. 7 f. 45, t. 11 f. 60; Bull. Jard. Bot. Btzig III, 12 (1932) 407, t. 8 f. 40; HUSSON & H. J. LAM, Blumea 7 (1953) 433.**

*Tree*, 16–28 m by 30–55 cm. *Branchlets* 1–1½ cm diam., lenticellate, glabrous except the tips. *Leaves* 3–5-jugate, glabrous. *Pith of the petioles* with 10–40 vascular strands. *Leaflets* ovate to oblong, 12–38 by 7–18 cm; base slightly oblique, broadly cuneate to subcordate; apex shortly and bluntly acuminate; nervation strongly prominent beneath, nerves (9–)12–18 pairs (angle 60–80°), faintly curved, distinctly arching. *Inflorescences* (♀ unknown) axillary, broadly paniculate, 23–32 cm long, densely pulverulent, glabrescent, lower branches slightly shorter than the inflorescences, many-flowered. *Flowers* (♀ unknown) minute, glabrous. *Calyx* very short. *Stamens* free or the epipetalous ones slightly adnate to the petals. *Disk* cupular, thick, with truncate rim. *Infructescences* broadly paniculate, 7–19 cm long, (sub)glabrous, shortly stalked, branches up to 14 cm long. *Fruits* oblong to ellipsoid, 17–22 by 8½–12 mm.

*Distr. Malaysia:* Moluccas (Morotai, Halmaheira, Batjan).

*Ecol.* Primary forests up to c. 100 (once 500) m. *Fl.* Oct., April, *fr.* Dec.

*Vern. Lian(a)*, Morotai, *damar tai babi*, *liana*, *liha*, *ode mayoko*, Halmaheira, *dian*, Batjan, *daun lebar*.

*Notes.* This species, together with *H. celebicus*, *anisander*, *floribundus* and *maluensis*, forms a large and wide-spread complex, in which specific delimitations are very hard to draw. Any subdivision seems more or less arbitrary. This group ranges from Celebes to East New Guinea and perhaps New Britain. Generally speaking, the size of the leaflets, their width, and the dimensions of the inflorescences seem to decrease from W. to E., and the same is true for the number of vascular strands in the petiole. There are, however, some irregularities and in cases of sterile specimens it is often impossible to state their proper taxonomic position.

**10. *Haplolobus celebicus* H. J. LAM, Blumea 3 (1938) 111, *cum fig.*; HUSSON & H. J. LAM, Blumea 7 (1953) 435; H. J. LAM, Blumea 8 (1955) 177.**

*Tree*, 20–30 m by 30–70 cm. *Branchlets* 4–7 mm thick, lenticellate, glabrous except the terminal bud. *Leaves* 1–4-jugate, glabrous. *Pith of the petioles* with (1–)4–9 vascular strands. *Leaflets* ovate to oblong-lanceolate, 9–21 by 4–10 cm, chartaceous; base slightly oblique, rounded to cuneate; apex rather abruptly, bluntly acuminate; nerves (6–)8–11 pairs (angle 50–80°), faintly curved, vaguely arching. *Inflorescences* (♀ unknown) axillary, broadly paniculate, 10–22 cm long, glabrous, branched from the base, many-flowered, intermingled with vegetative buds. *Flowers* (♀ unknown) minute, glabrous. *Calyx* 1

mm high. *Stamens* free. *Disk* thick, 6-undulate. *Infructescences* c. 10 cm long, glabrous, branched from the base. *Fruits* ovoid or slightly oblique, 12–16 by 7–11 mm.

*Distr. Malaysia:* Central Celebes; dubious (sterile) specimens also from the Moluccas (Morotai, Batjan, Sula Islands), and Palau (even genus not quite certain).

*Ecol.* Primary forests up to 250 m. *Fl.* Oct.–Nov., *fr.* March.

*Vern. Bakata putih, tapitapi, tumoni putih.*

*Notes.* The nearest relative is *H. moluccanus*, which differs from *H. celebicus* by its generally broader leaflets with much more numerous vascular strands in the pith of the petioles. On the other hand, *H. celebicus* is clearly allied with *H. floribundus* and *H. anisander*, which have both leaflets of the same type as the narrower *celebicus* specimens. *H. floribundus*, however, has stiffer leaflets and fairly large and spreading, often sub-terminal inflorescences, and seems restricted to New Guinea. *H. anisander*, on the other hand, occurs from the Moluccas to East New Guinea or even New Britain. It is particularly difficult to name sterile specimens. The inflorescences of *H. anisander* are much smaller than in *H. celebicus* and the number of vascular strands is mostly small (1–5).

**11. *Haplolobus maluensis* (LAUT.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 208, t. 12 f. 97; Bull. Jard. Bot. Btzg III, 12 (1932) 416, t. 8 f. 49; HUSSON & H. J. LAM, Blumea 7 (1953) 436, f. 8; H. J. LAM, Blumea 8 (1955) 177.—*Santiria maluensis* LAUT. Bot. Jahrb. 56 (1920) 334.**

*Tree*, 10–30 m high. *Branchlets* 4–7 mm thick, verrucose, glabrous except the pulverulent terminal bud. *Leaves* 0–2(–3)-jugate, glabrous. *Pith of the petioles* with 10–12 vascular strands. *Leaflets* broad-ovate to oblong, 5–21 by 2–9 cm, coriaceous; base rounded to subacute; apex gradually to subabruptly, shortly and bluntly acuminate; nerves 10–14 pairs (angle 60–70°), slender, straight, not arching but in the apex. *Inflorescences* axillary, paniculate, glabrous, ♂ ones 5–13 cm, branched from the base, ♀ ones 2½–10 cm, short-stalked. *Flowers* 1½–2 mm, glabrous. *Calyx* ½–¾ mm. *Stamens* in ♂ flowers free, in ♀ ones slightly adnate to the disk. *Disk* cupular, thick, the rim truncate. *Fruits* globose to somewhat ellipsoid, 12–19 by 8–13 mm.

*Distr. Malaysia:* East New Guinea (dubious specimens also from the Geelvink Bay).

*Ecol.* Primary forests up to 200 m. *Fl.* July–Nov., *fr.* Jan.–March, Aug.

*Vern. Ongo, Papua.*

*Notes.* Belongs to the group of *H. moluccanus*; moreover possibly related to *H. acuminatus*, though the leaflets show no trace of pubescence. As all the original material of this species apparently is lost, it is difficult to establish its exact taxonomic position.

**12. *Haplolobus floribundus* (K.SCH.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207; Bull. Jard.**

**Bot. Btzg III, 12 (1932) 412, t. 8 f. 45; HUSSON & H. J. LAM, Blumea 7 (1953) 436; H. J. LAM, Blumea 8 (1955) 177.—*Santiria floribunda* K.SCH. in K. SCH. & HOLLER. Fl. Kais. Wilh. Land (1889) 63; K. SCH. & LAUT. Fl. Schutzgeb. (1901) 378.—*Canarium furfuraceum* LAUT. Bot. Jahrb. 56 (1920) 325.—*Santiria sepikensis* LAUT. Bot. Jahrb. 56 (1920) 333.—*H. furfuraceum* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207, t. 11 f. 63; Bull. Jard. Bot. Btzg III, 12 (1932) 409, t. 8 f. 42.—*H. sepikensis* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 208, t. 11 f. 62; Bull. Jard. Bot. Btzg III, 12 (1932) 416, t. 8 f. 48.—Fig. 2f, 16e.**

*Tree*, 10–30(–36) m by 20–75 cm, buttresses, if present, up to 2 m high. *Branchlets* 5–9 mm thick, lenticellate, younger parts pubescent. *Leaves* 1–4-jugate. *Pith of the petioles* with 1–4(–11) vascular strands. *Leaflets* oblong, 7–20 by 3–9 cm, rigid; base more or less broadly cuneate; apex long acuminate; nerves 7–13 pairs (angle 60–70°), curved, not arching but in the apex; reticulations very dense. *Inflorescences* axillary and sometimes terminal, broadly paniculate, rigid, minutely pubescent, glabrescent, without or with a short peduncle, the ♂ ones 8–23(–28) cm, ♀ ones 4–14 cm. *Flowers* 2½–3½ mm long, glabrous. *Calyx* 1½ mm, subtruncate. *Stamens* free or slightly adnate to the disk. *Disk* cupular, the rim 6-undulate to truncate, in ♂ flowers very thick, in ♀ ones thinner. *Fruits* ovoid, somewhat acute at the apex, 16–18 by 9–11 mm.

*Distr. Malaysia:* New Guinea.

*Ecol.* Primary forests up to 900 m. *Fl.* May–July, Nov., *fr.* Jan., May.

*Vern. Bowi, djaato, jakko, Manokwari, ongo, jondopu, Papua, ratiungga, Milne Bay.*

*Notes.* In the above delimitation, *H. floribundus* is a relatively common, widely spread and extremely variable species; it is closely related to and possibly conspecific with *H. celebicus* and *anisander*. A striking characteristic of the present species is the occasional occurrence of terminal inflorescences.

**13. *Haplolobus versteeghii* H. J. LAM, Blumea 7 (1953) 440, f. 9.**

*Tree*, 23–26 m by 55 cm. *Branchlets* 8–9 mm thick, verrucose-lenticellate, as are the petioles and inflorescences. *Leaves* 4-jugate, glabrous. *Pith of the petioles* with 3–7 vascular strands. *Leaflets* ovate to oblong, 9½–19 by 4½–7½ cm, rigid; base slightly oblique, rounded to broadly acute; apex shortly and bluntly acuminate; nervation strongly prominent beneath, nerves 10–15 pairs (angle 60–70°), faintly curved, arching at some distance from the margin. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, 7 cm long, branched from the base, branches thick, lenticellate. Immature *fruits* ovoid, 12 mm long.

*Distr. Malaysia:* West New Guinea (Idenburg River).

*Ecol.* Primary forests at c. 1150 m. *Fr.* (juv.) Febr.

*Note.* This species seems to be related to *H. floribundus*, but it is distinctly different by the

coarsely prominent venation and the thick branchlets and strong petioles.

**14. *Haplolobus hussonii* H. J. LAM, *Blumea* 7 (1953) 443, f. 10.**

Tree (?), entirely glabrous. *Branchlets* 4–5 mm thick. *Leaves* 2(–3)-jugate. *Pith of the petioles* with 1–10 vascular strands. *Leaflets* (lanceolate-)oblong, 10–22 by  $4\frac{1}{2}$ – $8\frac{1}{2}$  cm, thinly coriaceous; base subrotundate to cuneate; apex gradually, obtusely long-acuminate; nervation rather prominent beneath, nerves 10–14 pairs (angle 60–90°), faintly curved, arching. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, branched from the base,  $2\frac{1}{2}$ – $5\frac{1}{2}$  cm long. *Fruits* olive-shaped, 12–16 by 10–12 mm.

*Distr. Malaysia:* West New Guinea.

*Ecol.* Up to 400 m alt. *Fr.* April.

**15. *Haplolobus megacarpus* H. J. LAM, *Blumea* 7 (1953) 443, f. 11; *Blumea* 8 (1955) 178, f. 2.**

Tree, entirely glabrous. *Branchlets* c. 4 mm thick. *Leaves* (1–)2–3-jugate. *Pith of the petioles* with 5–12 vascular strands. *Leaflets* ovate to lanceolate,  $8\frac{1}{2}$ – $16\frac{1}{2}$  by 5–7 cm; base broadly cuneate, abruptly contracted; apex abruptly, shortly and bluntly acuminate; nervation prominent beneath, nerves 7–8 pairs (angle 50–60°), curved, not distinctly arching. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, branched from the base,  $2\frac{1}{2}$ –5 cm, rather rigid, with few fruits. *Fruits* olive-shaped, 23–28 by 13–18 mm.

*Distr. Malaysia:* West New Guinea (Japen & Numfoor Isl.). *Fr.* April.

*Note.* Perhaps related to *H. leifolius*, which differs by the much smaller fruits and the less numerous vascular strands in the pith of the petioles.

**16. *Haplolobus monophyllus* H. J. LAM, *Blumea* 7 (1953) 445, f. 12.**

Tree, 10 m by 20 cm, fully glabrous. *Branchlets* 2–4 mm thick. *Leaves* 0–1-jugate. *Pith of the petioles* with 1 vascular strand. *Leaflets* ovate,  $6$ – $12\frac{1}{2}$  by  $2\frac{1}{2}$ – $5\frac{3}{4}$  cm, coriaceous, rather rigid; base broadly cuneate, decurrent; apex gradually to subabruptly, shortly and bluntly acuminate; nerves 6–9 pairs (angle 65–80°), faintly curved, rather abruptly arching close to the margin; reticulations dense; domatia present in most of the nerve-axils beneath. *Inflorescences* (♀ unknown) axillary, paniculate  $\frac{3}{4}$ –5 cm long, slender, without or with a short peduncle, branches up to 2 cm long. *Flowers* (♀ unknown) c. 1 mm long. *Calyx* c.  $\frac{1}{2}$  mm high, sparsely pilose, glabrescent. *Stamens* adnate to the disk. *Infructescences* and *fruits* unknown.

*Distr. Malaysia:* Moluccas (Morotai).

*Ecol.* Alt. 1000 m. *Fl.* May.

*Notes.* On account of the very few leaflets, the dense reticulation, the single vascular strand in the pith of the petiole and the short, few-flowered inflorescences, the present species is undoubtedly most closely allied to *H. nubigenus* from New Guinea. The very striking domatia link it both

with the gland-bearing mountain species *H. glandulosa*, *monticola*, and *microphyllus*, and again with *H. nubigenus*, which is sometimes provided with tiny glands.

**17. *Haplolobus nubigenus* (LAUT.) H. J. LAM, *Ann. Jard. Bot. Btzg* 42 (1932) 208, t. 11 f. 61; *Bull. Jard. Bot. Btzg* III, 12 (1932) 415, t. 8 f. 47; HUSSON & H. J. LAM, *Blumea* 7 (1953) 447.—*Santiria nubigena* LAUT. *Bot. Jahrb.* 56 (1920) 335.—*Santiria triphylla* LAUT. *Bot. Jahrb.* 56 (1920) 336.**

Tree, 5–20 m high. *Branchlets* 3–6 mm thick, glabrous except the pubescent tips. *Leaves* 0–3-jugate, glabrous. *Pith of the petioles* with 1–few vascular strands. *Leaflets* elliptic to elliptic-lanceolate,  $4$ – $11\frac{1}{2}$  by  $1\frac{1}{2}$ –6 cm, rigidly coriaceous; base subrotundate to cuneate; apex obtuse or more or less broadly and bluntly acuminate; nervation rather prominent beneath, nerves 6–9 pairs (angle 50–60°), curved, not arching but in the apex; reticulation dense, sometimes with some minute glandular pits in the nerve-axils. *Inflorescences* axillary, paniculate, 1– $3\frac{1}{2}$  cm, without or with a short peduncle, glabrous or slightly pulverulent, branches up to 8 mm long. *Flowers*  $1\frac{1}{2}$  mm, glabrous. *Calyx*  $\frac{3}{4}$  mm high. *Stamens* free. *Disk* shallowly cupular to annular, truncate. *Fruits* unknown.

*Distr. Malaysia:* East New Guinea.

*Ecol.* Primary forests at 200–1500 m. *Fl.* Oct.–Dec.

*Note.* Apparently related to the group of *H. glandulosus*.

**18. *Haplolobus clementium* HUSSON, *Blumea* 7 (1953) 449, f. 13; H. J. LAM, *Blumea* 8 (1955) 179.**

Tree, 15–25 m by 20–60 cm, sometimes with small buttresses; glabrous except the youngest parts. *Branchlets* 3–5 mm thick. *Leaves* 0–2-jugate. *Pith of the petioles* with 2–5 vascular strands. *Leaflets* oblong-lanceolate, 3–17 by 2– $6\frac{1}{2}$  cm, chartaceous; base oblique, broadly cuneate; apex subabruptly, bluntly acuminate; nerves 6–16 pairs (angle 70–80°), curved, arching. *Inflorescences* (♂ unknown) axillary,  $\frac{1}{2}$ –4 cm, usually branched from the base, when young densely minutely pubescent. *Flowers* (♂ unknown) 1– $1\frac{1}{2}$  mm. *Calyx* 1 mm high. *Stamens* free. *Disk* annular. *Fruits* oblong, occasionally somewhat obliquely pointed with 3 small ribs at the apex, 10–15 by 7–10 mm.

*Distr. Malaysia:* New Guinea.

*Ecol.* Forests at 600–1000 m. *Fl.* Febr., *fr.* Oct., Febr. In the Cycloop Range near Hollandia reported to grow gregariously.

*Notes.* A mountain species characterized by its longish pointed leaflets and more or less crowded short ♀ inflorescences.

**19. *Haplolobus borneensis* H. J. LAM, *Bull. Jard. Bot. Btzg* III, 12 (1932) 418, t. 14 f. 93; HUSSON & H. J. LAM, *Blumea* 7 (1953) 452; H. J. LAM, *Blumea* 8 (1955) 179, f. 3.**

Tree, 12–27 m by 18–120 cm. *Branchlets* 2–4 mm thick, glabrous. *Leaves* 2–3-jugate, glabrous. *Pith of the petioles* with 1–5 vascular strands.

*Leaflets* ovate to lanceolate, 3 $\frac{1}{2}$ –13 by 1 $\frac{1}{4}$ –5 $\frac{1}{2}$  cm, chartaceous; base cuneate; apex more or less abruptly, bluntly acuminate; nerves 7–10 pairs (angle 45–70°), slender, straight to faintly curved, vaguely arching; intermediate veins often well developed. *Inflorescences* axillary, glabrous, ♂ ones broadly paniculate, 6–18 cm, without or with a short peduncle, the branches up to 11 cm long; ♀ inflorescences 3–6 cm long, branched from the base. *Flowers* glabrous, ♂ ones 2–2 $\frac{1}{2}$  mm, ♀ 3–3 $\frac{1}{2}$  mm long. *Calyx* 1 mm. *Stamens* in ♂ flowers free or the epipetalous ones slightly confluent with the petals, in ♀ flowers all adnate with the disk halfway up. *Disk* small, annular. *Infructescences* and *fruits* unknown.

Distr. *Malaysia*: North Borneo (Mt Kinabalu).

Ecol. Primary forests at 1500 m. *Fl.* Nov.–Dec., April.

Notes. This species seems to be related with Papuan species, rather than with the second Bornean species (*H. beccarii*), but it is difficult to state which Papuan species is nearest. The ♂ inflorescences resemble those of *H. floribundus*, the ♀ ones those of *H. acuminatus* f. *glabrior*, but the leaves are glabrous and quite differently shaped, and the reticulation is more lax.

20. *Haplolobus anisander* (LAUT.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207; Bull. Jard. Bot. Btzg III, 12 (1932) 414, t. 8 f. 46; HUSSON & H. J. LAM, *Blumea* 7 (1953) 452.—*Santiria anisandra* LAUT. Bot. Jahrb. 56 (1920) 339, f. 4; E. & P. Pfl. Fam. ed. 2, 19a (1931) f. 218.

Tree, (5–)20–30 m by c. 35–40 cm. *Branchlets* 2–6 mm thick, young parts dark furfuraceous-pubescent, soon glabrate. *Leaves* 0–3-jugate, glabrous. *Pith of the petioles* with 1–4(–5) vascular strands. *Leaflets* ovate-lanceolate, 6–11 $\frac{1}{2}$ (–20) by 2–5(–8) cm, thin; base cuneate; apex gradually to subabruptly, short-acuminate; nerves 7–12 pairs (angle 60–70°), curved, not arching but in the apex; reticulations little conspicuous, rather lax; sometimes with some small domatia in the nerve-axils. *Inflorescences* axillary, paniculate, 1 $\frac{1}{2}$ –8 cm, mostly branched from the base, very slender, specially ♂ ones. *Flowers* c. 2 mm, glabrous. *Calyx* c. 1 mm. *Stamens* free or slightly confluent with

the disk. *Disk* annular, in ♂ flowers thick and nearly cushion-shaped, the rim somewhat undulate. *Infructescences* and *fruits* unknown.

Distr. *Malaysia*: Moluccas (Morotai, Halmaheira, Batjan, Banggai Islands, Buru, Ceram), New Guinea; a dubious specimen from New Britain.

Ecol. Primary forests up to 400(–1000) m. *Fl.* April–May (July, Oct.).

Vern. *Lawai*, Ceram.

Notes. Unfortunately the specific epithet refers to an incorrect observation. In fact, the androecium, like in all other species of the genus, is isodynamous, at least in adult flowers, and all stamens are inserted outside the fleshy disk.

The demarcation between the present species and *H. moluccanus*, *floribundus*, and *celebicus*, is very vague, and therefore the naming of sterile specimens often remains doubtful.

21. *Haplolobus leefolius* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 208; Bull. Jard. Bot. Btzg III, 12 (1932) 417, t. 8 f. 50; HUSSON & H. J. LAM, *Blumea* 7 (1953) 454, f. 15.—*Santiria leaeifolia* LAUT. Bot. Jahrb. 56 (1920) 335.

Tree, 12–15 m high. *Branchlets* 2–4 mm thick, glabrous. *Leaves* (1–)2–3-jugate, glabrous. *Pith of the petioles* with 1–5 vascular strands. *Leaflets* ovate, 7–15 $\frac{1}{2}$  by 3 $\frac{1}{2}$ –7 cm, chartaceous, rather thin; base cuneate; apex long, narrowly, and bluntly acuminate; nerves 8–12 pairs (angle 60–70°), slender, faintly curved, not distinctly arching but in the apex; veins and reticulations little conspicuous. *Inflorescences* (♀ unknown) axillary, paniculate, 4–8 cm, often branched from the base and sometimes with an obsolete vegetative bud. *Flowers* (♀ unknown) 1 $\frac{1}{2}$ –2 mm long, glabrous. *Calyx*  $\frac{1}{2}$  mm. *Stamens* free. *Disk* cupular with undulate rim. *Infructescences* slender, 2–4 cm. *Fruits* globular, 11–13 mm diam., pericarp with 6 faint grooves from the base, 3 of which may reach the apex; pyrene with 3 shallow and short ribs near base and apex.

Distr. *Malaysia*: New Guinea.

Ecol. At 200–400 m. *Fl.*, fr. Oct.

Note. Perhaps related to *H. megacarpus* (see there).

## 7. SCUTINANTHE

THWAITES in Hook. J. Bot. Kew Misc. 8 (1856) 266; LEENH. *Blumea* 7 (1952) 160.—*Canarium* sect. *Scutinanthæ* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 531.—Fig. 2g & 18.

Dioecious trees. *Pith of the branchlets* without vascular strands. *Leaves* without stipules; pith of the petiole without vascular strands. *Leaflets* entire. *Inflorescences* axillary, paniculate. *Flowers* 5-merous; receptacle cupular. *Sepals* free. *Petals* free, with slightly thickened apex. *Stamens* 10, confluent at the base, episepalous ones slightly longer, in ♀ flowers all sterile, though only slightly reduced in size. *Disk* nearly entirely adnate to the receptacle, intrastaminal. *Pistil* with a 3-celled, pilose ovary; in ♂ flowers only slightly reduced. *Fruits* drupaceous, stigmatic scar (nearly) apical; pericarp fleshy; mesocarp consisting of long, radially arranged,

pallisadoid cells; pyrene hard and bony, usually 2 cells strongly reduced; calyx persistent, not enlarged. *Seed* 1; cotyledons contortuplicate, entire, leafy.

*Distr.* Two  *spp.* in Ceylon, S. Burma, W. Malaysia & Celebes. *Fig.* 17.  
*Ecol.* Primary forests up to 900 m.

KEY TO THE SPECIES

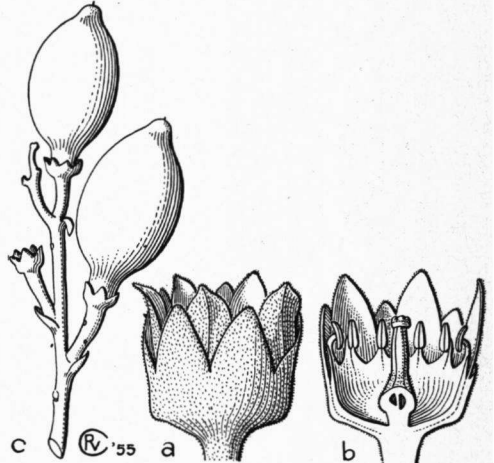
- 1. Sepals 1½–2 mm, at least half as long, in most cases (nearly) as long as the petals. Young parts and inflorescences densely pubescent. Nerves 8–15 pairs, prominent beneath, usually arching. 1. *S. brunnea*
- 1. Sepals ½–1(–2) mm, often much shorter than the petals. Young parts and inflorescences much less pubescent. Nerves 4–8(–10) pairs, less prominent and less distinctly arching. 2. *S. brevisepala*

1. *Scutinanthe brunnea* THWAITES in Hook. J. Bot. Kew Misc. 8 (1856) 267, t. 8B; JADIN, Contr. Téréb. (1894) 90; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) f. 141; ed. 2, 19a (1931) f. 220; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 261, f. 42; HEYNE, Nutt. Pl. (1927) 882; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 95, t. 13 f. 103, t. 14 f. 112b; Bull. Jard. Bot. Btzg III, 12 (1932) 420; LEENH. Blumea 7 (1952) 162; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 30, cum fig.—*Garuga brunnea* MARCH. Adansonia 8 (1867) 34, 66.—*Canarium brunneum* BEDDOME, Fl. Sylv. 1 (1868) t. 127; ENGL. in DC. Mon. Phan. 4 (1883) 105, t. 3 f. 6–14; TRIM., Fl. Ceyl. 1 (1893) 238, t. 23.—*Fig.* 2g & 18.

Tree up to 30(–40) m by 80 cm, rarely with up to 1 m high buttresses. *Branchlets* 4–10 mm thick; young parts, inflorescences, rhachis, petiolules and underside of the midrib densely and minutely ferrugineously pubescent. *Leaves* (2–)4–7-jugate. *Leaflets* ovate to oblong, 3–20 by 1½–7 cm, rather rigidly chartaceous, glabrous except the midrib underneath; base rounded to broadly cuneate; apex rather abruptly, slender and acutely acuminate; nerves 8–15 pairs (angle 55–70°), slightly curved, often arching. *Inflorescences:* ♂ broadly paniculate, 13–30 cm long, main branches up to 19 cm; ♀ narrowly paniculate, 4½–25 cm long, branches up to 7 cm. *Flowers* 4–6 mm long, densely pubescent; cupular receptacle 2–2½ mm high. *Sepals* 1½–2 mm. *Ovary* in ♀ flowers densely pubescent, in ♂ ones slightly pubescent to glabrous.

*Distr.* Ceylon and *Malaysia:* Sumatra, Malay Peninsula, and Borneo. *Fig.* 17.

*Ecol.* Non-inundated primary forests, in *Malaysia* only at low altitudes, in Ceylon up to 900 m. *Fl.* mainly Aug.–Jan.; *fr.* Sept. (Mal. Pen.), Jan.–Febr. (Sum.).



*Fig.* 18. *Scutinanthe brunnea* THW. Flower and infructescence (a and b × 3, c × ½).

Wood anat. DESCH, Mal. For. Rec. 15<sup>1</sup> (1941) 64, pl. 13 fig. 2 (hand lens).

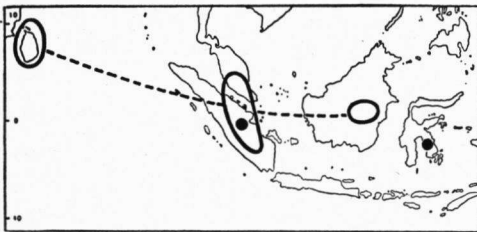
*Uses.* The fruits are sometimes eaten. Timber only for local use.

*Vern.* *Luwing*, Palemb., *kajam pëngali*, *këdon-dong*, *këranlai*, *sëngkuang*, *suryan*, *tajam bëlat*, Mal. Pen., *nytoh*, Brunei.

*Note.* Not unlike *Dracontomelum mangiferum* BL. (*Anacardiaceae*) in its vegetative parts; different by its small or absent buttresses, its creamy-white to colourless, sticky exudate, and the absence of resiniferous ducts in the medulla of the petioles.

2. *Scutinanthe brevisepala* LEENH. Blumea 7 (1952) 162, f. 1.

Tree c. 25 m. *Branchlets* 3–6 mm thick, lenticellate, tips scabrous to slightly hairy. *Leaves* 1–5-jugate, glabrous. *Leaflets* lanceolate to oblong, 5–6½(–16) by 1¾–2¾(–6) cm, coriaceous; base subrotundate; apex more or less abruptly, slender, obtusely acuminate; nerves 4–8(–10) pairs (angle c. 60°), curved, not distinctly arching. *Inflorescences*



*Fig.* 17. Distribution of *Scutinanthe*. *S. brunnea* THW. (o), *S. brevisepala* LEENH. (●).

*Fruits* slightly oblique, ellipsoid, 4½–6¼ by 2¼–3 by 1¾–2½ cm, densely ferrugineously tomentose. *Seed* 1(–2); cotyledons on the seedling leafy, 8 by 6 cm, with cordate base and acutely acuminate apex.

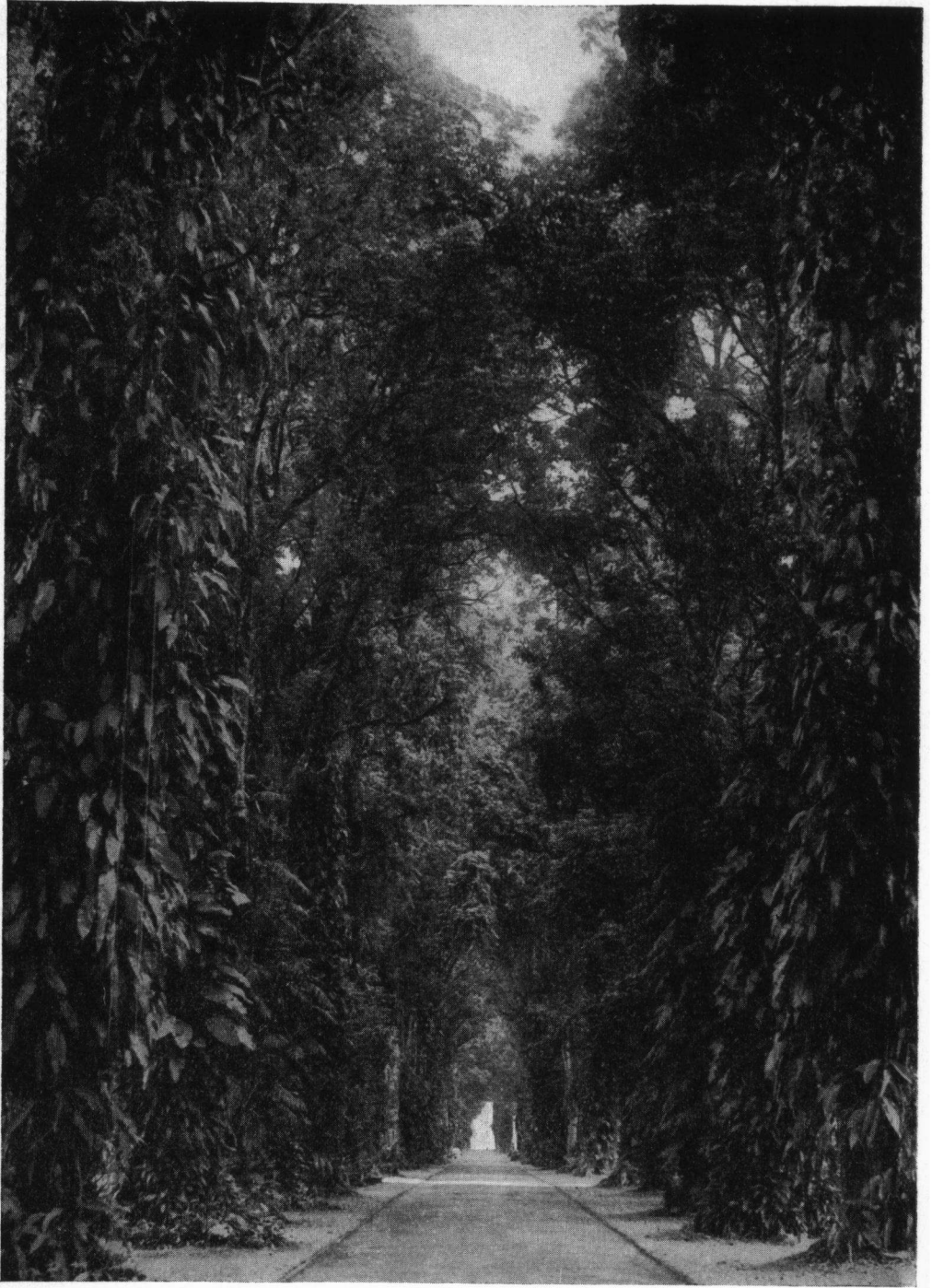


Fig. 19. The new Kenari avenue of *Canarium vulgare* LEENH. in Kebun Raya Indonesia, about 70 years old, trees c. 30 m tall, stems clothed with *Araceae*, *Freycinetia*, and other climbers.



(♀ unknown) pseudoterminal, narrowly paniculate, 8–13 cm long. *Flowers* (♀ unknown) 4 mm long, scabrous, the cupular receptacle 2 mm high. *Sepals*  $1\frac{1}{2}$ –1(–2) mm high. *Ovary* in ♂ flowers sometimes densely tomentose. *Fruits* unknown.

*Distr.* S. Burma (King Isl.) and *Malaysia*: Sumatra (Indragiri, once collected), SE. Celebes (two collections). Fig. 17.

*Ecol.* Primary forests up to 350 m. *Fl.* Apr. (Sum.), Nov. (Cel.).

*Vern.* *Mardjélai*, Sum., *kobili*, Cel.

### Excluded

*Scutinanthe boerlagei* HOCHR. Pl. Bog. Exs. (1904) 64, based on a tree cultivated in the Botanic Gardens, Bogor, *sub no* III.J.27 is according to H. J. LAM (Bull. Jard. Bot. Btzg III, 12, 1932, 422) = *Walsura robusta* ROXB. (*Meliaceae*).

*Scutinanthe engleri* ELM. (Leaf. Philip. Bot. 1, 1908, 298) is according to MERR. (En. Philip. 2, 1923, 380) = *Walsura sumatrana* MIQ. = *Heynea sumatrana* ROXB. (*Meliaceae*).

## 8. CANARIUM

STICKM. Herb. Amb. (1754) 10 (erroneously *Cenarium*); LINNÉ, Amoen. Ac. 4 (1759) 121; ENGL. in DC. Mon. Phan. 4 (1883) 101; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931–32) 23, 97; Bull. Jard. Bot. Btzg III, 12 (1932) 422.—*Nanari* ADANS. Fam. Pl. 2 (1763) 342.—*Pimela* LOUR. Fl. Cochinch. (1790) 407.—*Canariopsis* BL. ex MIQ. Fl. Ind. Bat. 1, 2 (1859) 651.—*Sonzaya* MARCH. Adansonia 8 (1868) 64.—Fig. 1, 2h, 19–48.

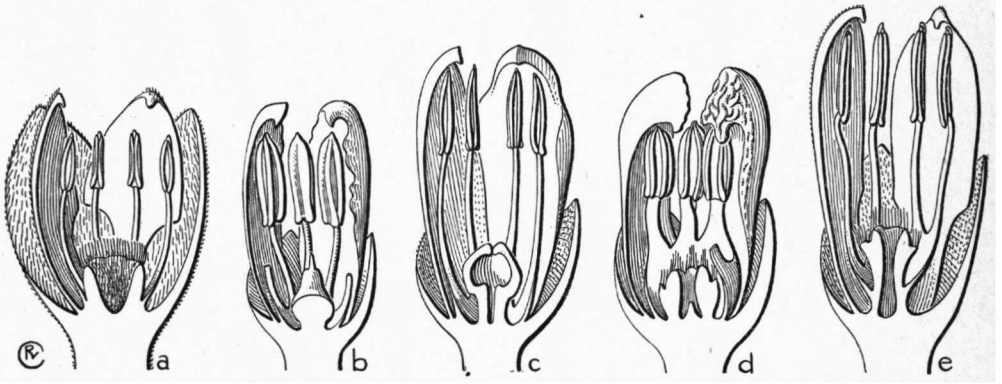


Fig. 20. Longitudinal sections of ♂ *Canarium* flowers. *a.* *C. grandifolium* (RIDL.) H. J. LAM with unguiculate petals, *b.* *C. oleosum* ENGL., showing an ovariodisk with rudimentary style, *c.* *C. gracile* ENGL., *d.* *C. polyphyllum* K.SCH., provided with strongly thickened petals with rugose sides, *e.* *C. schlechteri* LAUT. (*a* × 3, *b–e* × 6).

Trees, occasionally shrubs (or ?climbers, see p. 211); pith of the branchlets nearly always with vascular strands. *Leaves* spirally arranged, very rarely in pseudowhorls; pinnate, very rarely unifoliolate; usually with a pair of stipules near or on the petiole; base of the petiole and ends of the petiolules often swollen. *Panicles* axillary or terminal, bracteate, sometimes, especially ♀ ones, reduced to racemes or spikes. *Flowers* 3-merous. *Receptacle* in ♀ flowers sometimes slightly concave (then disk adnate to it, and pistil shortly stalked). *Sepals* usually about halfway connate; outside hairy or glabrous, inside nearly always densely sericeous. *Petals* free, usually imbricate, in the central part thickened and induplicate-valvate near the apex, tip inflexed; outside usually more or less hairy except the base and margins, inside very rarely hairy. *Stamens* 6, epipetalous ones sometimes more or less to totally reduced; free to entirely connate, sometimes adnate to the disk; in ♀ flowers sterile and often less well developed. *Disk* intrastaminal, in ♀ flowers often for the greater part adnate to the receptacle; usually 6-lobed, in ♂

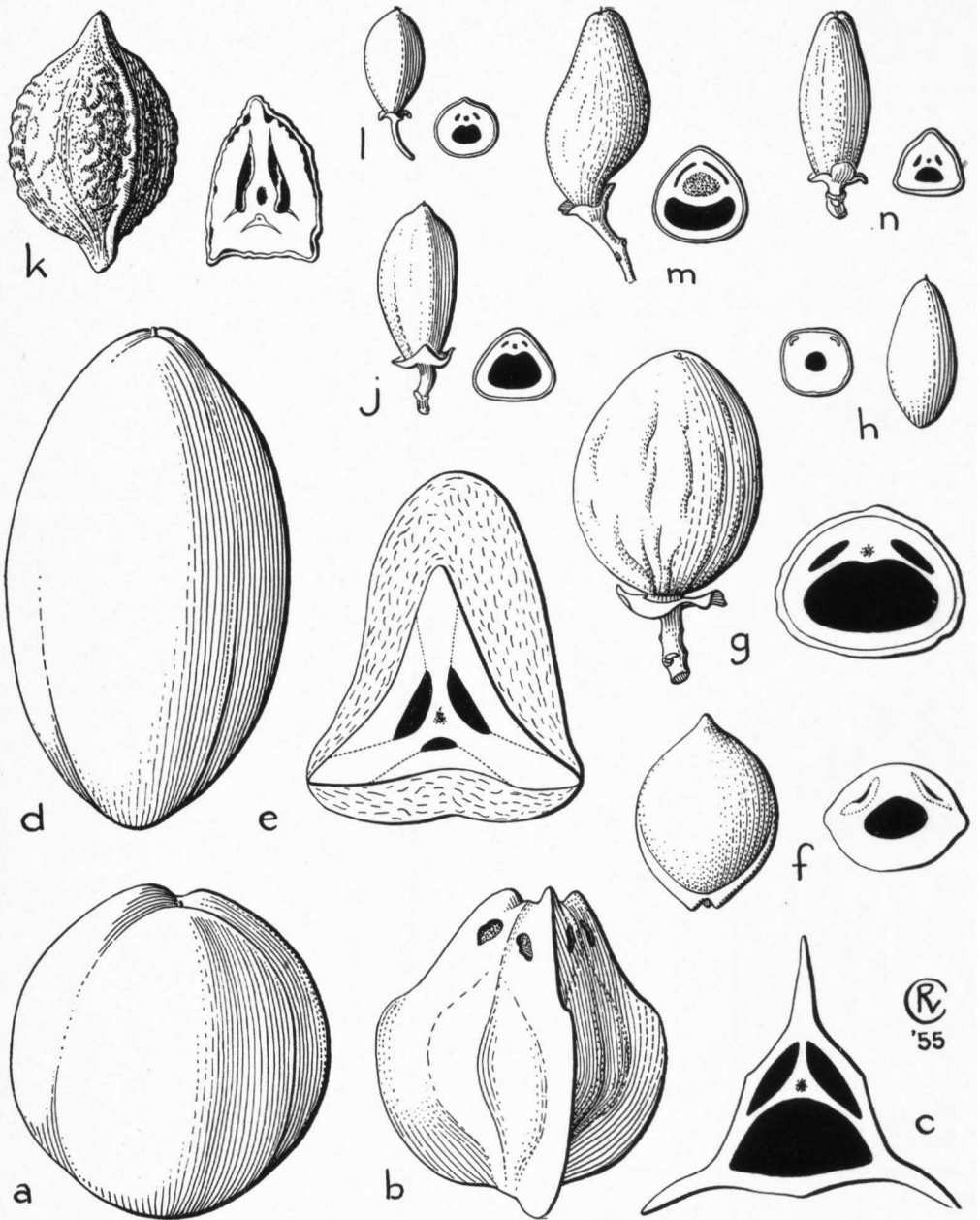


Fig. 21. Different kinds of fruits in *Canarium*. a-c. *C. kaniense* LAUT. var. *globigerum* LEENH., d-e. *C. megacarpum* LEENH., f. *C. salomonense* B. L. BURTT ssp. *papuanum* LEENH., g. *C. indicum* L., h. *C. maluense* LAUT. ssp. *maluense*, specimen with entirely marginal sterile cells, j. *C. denticulatum* BL., k. *C. cestracion* LEENH., l. *C. oleosum* (LAMK) ENGL., m. *C. gracile* ENGL., n. *C. pilosum* BENN. ssp. *pilosum* (of each taxon a fruit—in b, f, and k a pyrene—in habit and in cross-section; cells black, axial cavity dotted; all  $\times 4/3$ ).

flowers often strongly developed. *Pistil* in ♂ flowers usually very reduced to absent, sometimes united with the disk in an 'ovariodisk', which even can bear a 'style'; pistil sometimes fully replaced by the strongly developed disk. *Pistil* in ♀ flowers 3-celled (in Mal. spp.), sometimes seemingly stalked (the stalk representing the fertile part of the ovary). *Fruits* usually plum-shaped, drupe-like, nearly always blue-black when ripe (white in *C. album* from SE. Asia, red in *C. euryphyllum* var. *euryphyllum*). hairy, especially near base and apex, or glabrous; pericarp fleshy, rarely fibrous; pyrene stony, 3-celled, 1 or 2 cells often slightly to nearly entirely reduced (in the latter case endocarp very rarely absent). *Cotyledons* palmatifid to 3-foliolate, contortuplicate or folded.

Distr. About 100 spp. in the tropics of the Old World, centering in *Malaysia*, subg. *Canarium* extending to SE. Asia, Ceylon, the Mascarenes, Madagascar, and Africa, and to North Australia, Micronesia (Palau), and Melanesia to Fiji, Tonga and Samoa Islands; subg. *Canariellum* nov. stat. (*Canariellum* ENGL. in E. & P. Fl. Fam. 3, 4, 1896, 242) is restricted to E. Queensland and New Caledonia & adjacent islands. Fig. 23.

Ecol. Mainly large trees of primary and secondary rain-forests at low altitudes; sometimes in monsoon- or more open forests, parklands and (in Australia) on coastal dunes, rarely ascending up to c. 1800 m; some spp. are apparently abundant in secondary forests. None of the species is consistently a typical dominant in the rain-forest, though *C. vulgare* may locally occur gregariously as the main constituent of the upper canopy in rather dry rain-forests (Kangean Isl., S. Port. Timor). *Fl.* mainly in the dry season, fr. mainly in the wet season, though many species apparently are flowering and fruiting all the year round.

Wood anat. DEN BERGER, Med. Proefst. Thee 97 (1926) 65 & Atlas pl. 11 fig. 44, Med. Proefst. Boschw. 13 (1926) 65 & Atlas item; DESCH, Mal. For. Rec. 15<sup>1</sup> (1941) 62 (hand lens); HEIMSCH, Lilloa 8 (1942) 122. See also under species.

Uses. The timbers are soft to moderately hard and probably not very durable in exposed positions, therefore not of great commercial value and only locally used. (The wood of the African *C. schweinfurthii*, of *C. euryphyllum* from the Andamans, and of some Indian species seems to be of some importance in the world trade.) The resin is locally used; only that of *C. luzonicum* ('*Manila-elemi*') is of more than local importance. The fruits and especially the oily seeds of many species are in some way used as food; the only ones reaching the world market are those of Philippine *C. ovatum* ('*Pili-nuts*') and the Chinese *C. album* and *pimela* ('*Chinese olives*'). Some *Canariums* are planted as shade trees, along roads, and in nutmeg-plantations (preferably *C. vulgare* and the Ceylonese *C. zeylanicum*).

Vern. The only two wide-spread names in Malaysia are *kanari* (*kĕnari*), principally a Moluccan name, now in use in the greater part of the Archipelago, and *kĕdongong* in the Malay Peninsula, the latter a name freely used also for other *Burseraceae*, specially *Dacryodes*, but also for some *Meliaceae*, and *Anacardiaceae* (specially *Spondias*).

#### KEY TO THE SPECIES

1. Stipules (at least in the terminal bud) or their (sometimes inconspicuous!) scars present.
2. True stipules absent, but a basal pair of dwarf leaflets inserted at the base of the petiole (fig. 22a), caducous, leaving a small (c. 1 mm) c. circular scar; main nerves tortuous, dissolving into a lax marginal reticulation. Terminal bud 4-5 cm long . . . . . 27. *C. decumanum*
2. True stipules present; basal pair of leaflets not inserted at the base of the petiole, not dwarfed; main nerves nearly always different, if tortuous and dissolving towards the margin, than terminal bud less than 1 cm.
3. Stipules subulate, rarely narrowly lanceolate; scars circular, minute (fig. 22b-c).
4. Terminal bud c. 3 cm long, slender, curved, ferruginous-tomentose . . . . . 42. *C. sumatranum*
4. Terminal bud up to 1 cm long.
5. Leaflets distinctly densely papillose underneath, rough on the touch, sometimes pilose.
  34. *C. merrillii*
5. Leaflets not papillose underneath.
6. Stipules 1½-3½ cm long, filiform, inserted mostly at the base of the petiole, sometimes up to 5 mm on the petiole, exceeding the terminal bud (fig. 22c). Branchlets hollow. Inflorescences and infructescences large, laxly paniculate. Stamens 3. Fruits acute-ovate, up to 1½ by 1 cm.
  50. *C. acutifolium* var. *acutifolium*
6. Stipules up to 1½ cm long, not distinctly exceeding the terminal bud. Branchlets solid. Stamens 6.
7. Branchlets 1½-3 cm diam., pith thick and soft. Petioles stout, up to 2 cm thick, acute-angled. Stipules inserted on the petiole, up to 5 cm from its base. Fruits prickly-hairy. 43. *C. hirsutum*
7. Branchlets up to 1½(-2) cm diam., pith different. Petioles more slender, not acute-angled. Stipules inserted on the twig or on the petiole up to 2 cm from its base. Fruits not prickly-hairy.

8. Apex of the leaflets rounded to obtuse, rarely shortly blunt-acuminate; nerves 15–24 pairs, rather dense (distance along midrib c.  $\frac{1}{2}$  cm), angle 75–80°, usually slightly tortuous, fading towards the margin; base usually rounded to subcordate, in the upper pair of leaflets the lower half mostly decurrent to the base of the petiolule (fig. 44) . . . 38. *C. australianum*
8. Apex of the leaflets acuminate (sometimes not very distinct), nerves rarely more than 20 pairs, usually less dense and angle more acute, not tortuous, never fading towards the margin; base never as oblique as above.
9. Panicles (also in fruit) 35–40 cm long, pyramidal-paniculate, axillary. Fruits acute-ovoid, up to  $1\frac{1}{2}$  by 1 cm . . . . . 50. *C. acutifolium*
9. Inflorescences either terminal, or: smaller, racemose to rather narrowly paniculate. Fruits usually otherwise.
10. Nerves 20–25 pairs, faintly curved, abruptly arching close to the margin. Leaves 6–7-jugate. Leaflets 10–12 by 3–3 $\frac{1}{2}$  cm. Pistil and fruit glabrous . . . . . 32. *C. kostermansii*
10. Nerves mostly less than 20 pairs. Leaves mostly up to 5-jugate. Leaflets usually larger and specially wider. Pistil (and fruit sometimes, specially near the apex) pilose.
11. Inflorescences and infructescences terminal (lower branches sometimes in the upper leaf-axils).
12. Inflorescences narrowly paniculate to racemose, up to 25 cm long; infructescences subracemose. Stipules subulate, inserted on the petiole, usually at some distance (–2 cm) from its base. Flowers slender, corolla 3–4 times as long as the calyx. . . . . 33. *C. pilosum ssp. pilosum*
12. Inflorescences and infructescences pyramidal, laxly dichotomously branched, up to 40 cm long. Stipules inserted either at the base of the petiole, or on the petiole up to 5 mm from its base, usually distinctly flattened, c. 2 mm wide at the base, sometimes inserted on a rim (fig. 22b). Flowers less slender; corolla c. 2 times as long as the calyx.
13. Leaves 1–2(–3)-jugate, thinly and shortly pubescent as are the branchlets. . . . . 37. *C. fusco-calycinum*
13. Leaves 3- or more-jugate, subglabrous as are the branchlets . . . . . 36. *C. dichotomum*
11. Inflorescences and infructescences all axillary.
14. Inflorescences (specially ♀ ones) and infructescences nearly always spicate to narrowly racemose, rarely compoundly spicate or narrowly paniculate (♂ flowers usually in sessile to very shortly stalked glomerules). Flowers 3–7 mm long, the buds minutely globose (in the sometimes rather similar *C. vrieseanum* the buds are rather large and spindle-shaped), corolla c. 2 times as long as the calyx; stamens mostly free. Fruits usually acute-ovoid, sometimes subglobular to ellipsoid, up to  $1\frac{1}{2}$  by  $1\frac{1}{4}$  cm, mostly glabrous . . . . . 51. *C. asperum*
14. Inflorescences racemose (♀) to paniculate (♂). Flowers larger; corolla mostly more exerted; stamens in ♂ flowers usually confluent at base and sometimes adnate to the disk. Fruits 2 cm long (in that case more or less velvety tomentose) or more, greatest width central.
15. Stipules inserted on the branchlet, next to the base of the petiole, linear, glabrous. Branchlets with peripheral and central vascular strands in the pith; soon glabrescent. Leaves glabrous; leaflets usually shortly and bluntly acuminate.
16. Leaflets 5–11 by 2–4 $\frac{1}{2}$  cm. Pyrene of the fruits more or less prominently 3-keeled. . . . . 45. *C. chinare*
16. Leaflets 11–20 by 4 $\frac{1}{2}$ –8 cm. Pyrene either smooth, or: deeply furrowed and distinctly 6-ribbed.
17. Leaflets oblong, 11–20 by 4 $\frac{1}{2}$ –7 cm; nerves 10–12 pairs. Fruits peculiar-shaped (fig. 21k) . . . . . 48. *C. cestracion*
17. Leaflets oblique-ovate, 12–15 by 6–8 cm; nerves 14–16 pairs. Fruits ellipsoid. . . . . 44. *C. macadamii*
15. Stipules usually inserted on the petiole (sometimes up to 2 cm from its base), subulate, pilose. Pith of the branchlets mostly with only peripheral vascular strands. Branchlets and leaves long remaining somewhat pilose. Leaflets usually with long and slender acumen.
18. Branchlets, leaves, inflorescences, and infructescences usually remaining fulvous- to ferruginous-tomentose for a long time (if glabrous, branchlets 1–1 $\frac{1}{2}$  cm thick, gnarly). Leaflets mostly elliptical-oblong. Inflorescences usually cylindrical-paniculate, laxly branched; flower-buds slender, spindle-shaped, closed. Stamens in ♂ flowers confluent to various degree. Fruit calyx deeply 3-lobed. Fruits ellipsoid, usually velvety pubescent . . . . . 49. *C. vrieseanum*
18. Branchlets, leaves, and inflorescences either ferruginously hairy, or soon glabrescent. Leaflets ovate to lanceolate. Stamens either distinctly connate, or adnate to the disk. Fruit calyx not deeply 3-lobed. Fruits early glabrescent.

- 19. Tips of the branchlets puberulous, glabrescent; central vascular strands in the pith forming a second cylinder. Nerves usually slightly sunken at the upper side of the leaflets. At least some of the filaments in ♂ flowers less than halfway connate, all adnate to the disk; disk cylindrical, 3 mm high (fig. 20e). Fruits spindle-shaped, 4 by 2 cm . . . . . 52. *C. schlechteri*
- 19. Tips of the branchlets, leaves and inflorescences shaggy ferruginous-pilose, glabrescent. Pith of the branchlets usually without central vascular strands. Nervation prominulous. Filaments connate halfway up or more, not adnate to the disk. Disk in ♂ flowers cupular, 1 mm high. Fruits usually prismatic, slightly blunt 3-angular, truncate, with 3 distinct shoulders, up to 3<sup>1</sup>/<sub>4</sub> by 1<sup>1</sup>/<sub>2</sub> cm (fig. 21n).  
33. *C. pilosum ssp. pilosum*
- 3. Stipules not subulate; scars mostly linear, or, if on the petiole, drop-shaped (fig. 22d-k).
- 20. Stipules distinctly (usually more than halfway) incised, rather persistent, parallel-veined (fig. 22i-k).
- 21. Flowers 11-15 mm long. Fruit calyx 2-2<sup>1</sup>/<sub>2</sub> cm diam.; fruits 5 by 3<sup>1</sup>/<sub>2</sub> cm or more. Stipules deeply pectinate, few-lobed, lobes broad (fig. 22j). Leaflets glabrous to slightly scabrous beneath, entire.
- 22. Stipules inserted at or near the base of the petiole, slightly incised, persistent, glabrous. Leaves glabrescent. Pistil glabrous . . . . . 21. *C. karoense*
- 22. Stipules inserted on the petiole, distinctly pectinate, semi-persistent, fulvous-tomentose (fig. 22j). Leaflets usually slightly scabrous below. Pistil pilose . . . . . 22. *C. megalanthum*
- 21. Flowers 3-9 mm long. Fruit calyx c. 1<sup>1</sup>/<sub>2</sub> cm diam.; fruits 3<sup>1</sup>/<sub>2</sub> by 2 cm or less. Stipules usually with many, linear to subulate, often branched, lobes (fig. 22i & k). Leaflets often distinctly tomentose beneath, margin usually more or less dentate.
- 23. Coarse. Stipules inserted at, rarely on, the base of the petiole, usually large (2-9 by 1<sup>1</sup>/<sub>2</sub>-3<sup>1</sup>/<sub>2</sub> cm), incised all round, lobes often branched, those near the base longest and most densely branched (fig. 22i). Leaflets rather densely tomentose beneath, nerves very prominent.  
19. *C. odontophyllum*
- 23. Slender. Stipules usually inserted on the petiole, smaller (up to 4 by 1<sup>1</sup>/<sub>2</sub> cm), deeply pectinate (fig. 22k). Leaflets usually glabrous to sparsely pilose, rarely tomentose and with prominent nerves beneath . . . . . 20. *C. denticulatum*
- 20. Stipules entire or the margins crenate to fimbriate (though in the latter case the lobes are subulate and rebranched, and up to c. 1<sup>1</sup>/<sub>2</sub> cm long, the incisions never reach the base of the stipule; moreover, the venation is coarsely reticulate), persistent or caducous (fig. 22d-h).
- 24. Stipules auricle-shaped, small and shrivelled, inserted on the petiole, usually subsistent; scars drop-shaped (fig. 22e, 25).
- 25. Leaflets not entire. Inflorescences axillary.
- 26. Stipules persistent. Twigs, leaves, and inflorescences pubescent. Stamens adnate to the disk.  
20. *C. denticulatum ssp. kostermansii*
- 26. Stipules very caducous. Twigs and leaves glabrous, inflorescences minutely pubescent. Stamens in ♂ flowers halfway connate . . . . . 3. *C. perlisanum*
- 25. Leaflets entire. Inflorescences terminal.
- 27. Leaflets abruptly acuminate; acumen 3-15 mm long, up to 3 times as long as wide, blunt to emarginate. Nerves rather dense (distance along the midrib up to c. 1 cm), nearly transverse to the midrib, straight, rather abruptly arching near the margin.
- 28. Leaflets broadly elliptic, up to 10 by 5 cm; nerves up to 14 pairs . . . . . 13. *C. salomonense*
- 28. Leaflets narrowly elliptic (at least 12 by 4 cm) or broadly ovate (at least 14 by 7 cm); nerves 15-20 pairs . . . . . 8. *C. maluense*
- 27. Leaflets gradually acuminate; acumen 6-25 mm long, 3 or more times as long as wide, blunt or acute. Nerves rather lax (distance along the midrib 1-2 cm), oblique to the midrib, curved, gradually arching near the margin.
- 29. Leaflets 5-15 by 2<sup>1</sup>/<sub>2</sub>-7 cm, c. 1<sup>3</sup>/<sub>4</sub>-2<sup>1</sup>/<sub>2</sub> times as long as wide; caudate-acuminate, acumen 1-2 cm long, c. 1/5 the length of the blade. ♂ Flowers with 3 stamens; ovariodisk with 'style' (cf. fig. 20b). Fruits 4<sup>3</sup>/<sub>4</sub>-7<sup>1</sup>/<sub>2</sub> by 1<sup>1</sup>/<sub>4</sub>-2 cm; pyrene acute-3-angular.  
5. *C. caudatum f. auriculiferum*
- 29. Leaflets 8-21 by 3<sup>1</sup>/<sub>2</sub>-10 cm, c. 2<sup>1</sup>/<sub>2</sub> times as long as wide; shortly, broadly, and bluntly, to caudate-acuminate, acumen 1-1<sup>1</sup>/<sub>2</sub> cm long, c. 1/10 the length of the blade. ♂ Flowers with 6-3 stamens; ovariodisk without 'style'. Fruits 3-5<sup>1</sup>/<sub>2</sub> by 1<sup>1</sup>/<sub>2</sub>-2<sup>3</sup>/<sub>4</sub> cm; pyrene blunt-3-angular.
- 30. Young parts, inflorescences, and leaves (the upper side of the leaflets excepted) rather densely pilose. ♂ Flowers 8 mm long . . . . . 12. *C. piloso-sylvestre*
- 30. Glabrous. ♂ Flowers 4 mm long . . . . . 11. *C. sylvestre*
- 24. Stipules not auricle-shaped, flattish, mostly inserted near or at the base of the petiole (sometimes partly on the twig), caducous to persistent; scars elliptic to linear (fig. 22d & f-h).
- 31. Leaflets glaucous-waxy beneath, entirely dentate . . . . . 1. *C. littorale f. pruinosum*

31. Leaflets not glaucous-waxy beneath.
32. Nervation very regular, nerves dense, nearly straight and parallel (angle 75–85°), abruptly and distinctly arching. Leaflets regular, elliptic to elliptic-ovate; the base equilateral, rather broad; apex abruptly, shortly, broadly, and bluntly acuminate. Stipules inserted on the base of the petiole or partly on the twig, small, reniformous, very caducous (*cf.* fig. 22d).  
8. *C. maluense*
32. Nervation less regular; leaflets and/or stipules different.
33. Leaflets pubescent beneath, nearly always dentate.
34. Stipules circular, 1–2 by 1–1<sup>3</sup>/<sub>4</sub> cm, crenulate, usually inserted on the base of the petiole, semi-persistent. Leaflets subglabrous, nervation not very prominent. 2. *C. latistipulatum*
34. Either stipules reniformous, smaller, entire, usually inserted on the branchlet near the base of the petiole, caducous (fig. 22d); or: leaflets densely pubescent beneath, nervation strongly prominent.
35. Fruits spindle-shaped, rarely more than 6 by 3 cm; pericarp fleshy; pyrene rounded 3-angular in cross-section. In the pith of the branchlets nearly always all vascular strands peripherally arranged . . . . . 1. *C. littorale*
35. Fruits ovate, 3-angular in cross-section, c. 8 by 5 cm; pericarp fibrous; pyrene 3-winged (fig. 21d–e). Pith of the branchlets with many scattered vascular strands, no distinct peripheral cylinder . . . . . 9. *C. megacarpum*
33. Leaflets glabrous (except some occasional hairs on the midrib and the nerves beneath); margin entire to partly, rarely wholly, crenate or dentate.
36. Leaflets not totally entire.
37. Leaflets and stipules coriaceous . . . . . 7. *C. kinabaluense*
37. Leaflets and stipules chartaceous to herbaceous.
38. Inflorescences axillary. Filaments in ♂ flowers halfway connate . . . 3. *C. perlisanum*
38. Inflorescences terminal. Filaments in ♂ flowers slightly connate.
39. Stipules subsistent, inserted on the base of the petiole. Leaflets wholly distinctly serrate. ♂ Flowers 1<sup>1</sup>/<sub>4</sub> cm long; disk without 'style' . . . . . 2. *C. latistipulatum*
39. Stipules very caducous, partly inserted on the twig. Leaflets slightly dentate to serrate in the apical part only. ♂ Flowers c. 8 mm long; disk with 'style' (fig. 20b).  
1. *C. littorale*
36. Leaflets entire.
40. Stipules dentate to fimbriate (fig. 22h), usually persistent.
41. Inflorescences all axillary . . . . . 21. *C. karoense*
41. Inflorescences terminal, lower branches sometimes in the upper leaf-axils.
42. Pyrene 3–4 cm diam., acutely deltoid in cross-section, sometimes winged (fig. 21a–c), sides usually concave. Stipules repeatedly deeply dentate to fimbriate (fig. 22h).  
16. *C. kaniense*
42. Pyrene 2–3 cm diam., rounded triangular in cross-section, the sides usually convex (fig. 21g). Stipules dentate . . . . . 15. *C. indicum var. indicum*
40. Stipules entire (sometimes slightly undulate), often caducous (fig. 22d & f–g).
43. Very coarse: stipules persistent, 4–12 by 4–14 cm, subcoriaceous, margin undulating and more or less slit up; leaflets thick-coriaceous, 25–35 by 13–16 cm.  
15. *C. indicum var. platyceroidium*
43. Much more slender; stipules up to 5 by 2 cm, entire; leaflets smaller.
44. Stipules persistent, inserted on the petiole at some distance from its base.
45. Stipules inserted at c. 1/2 cm from the base of the petiole, deltoid to lingulate, very stiff (fig. 22f). Inflorescences axillary . . . . . 18. *C. ovatum*
45. Stipules inserted at 1/2–1 1/2 cm from the base of the petiole, oblique-obovate, less stiff. Inflorescences terminal . . . . . 10. *C. lamii*
44. Stipules rather to—mostly—very caducous, usually inserted at the base of the petiole.
46. Stipules oblong, 1–5 by 1/2–1 3/4 cm, rather caducous, inserted on the very base of the petiole or partly on the twig; scar linear, c. 1/2 cm long (fig. 22g) . . . 14. *C. vulgare*
46. Stipules reniformous, much smaller, very caducous, usually inserted at the conjunction of petiole and branchlet, sometimes on the petiole at c. 1/2 cm from its base; scar elliptic (or, in the latter case, drop-shaped), 1–2 mm long (fig. 22d).
47. Inflorescences axillary. Stipules inserted on the petiole at some distance from its base.  
17. *C. luzonicum*
47. Inflorescences terminal. Stipules inserted at the conjunction of petiole and branchlet.
48. Leaflets cuneate at the base, long-acuminate to caudate at the apex. Stamens in ♂ flowers 3 . . . . . 5. *C. caudatum f. caudatum*
48. Leaflets broadly cuneate to rounded at the base, apex not caudate. Stamens in ♂ flowers 6.
49. ♂ Inflorescences very lax, branches long and transverse. ♂ Flowers 13 mm long.  
6. *C. divergens*

49. ♂ Inflorescences not very lax. ♂ Flowers c. 8 mm long.
50. Veins and reticulations nearly invisible in dried specimens; nerves 5–10–15 pairs, mutual distance along the midrib 1–1½ cm . . . . . 4. *C. patentinervium*
50. Veins and reticulations more or less prominent and distinctly visible on the under-surface of the leaflet; nerves 11–15 pairs, mutual distance along the midrib usually up to 1 cm . . . . . 1. *C. littorale*
1. Stipules and their scars absent.
51. Terminal bud 3–5 cm long.
52. Practically glabrous. Leaves 7–11-jugate; leaflets often distinctly stalked, 2½–4 times as long as wide. Inflorescences broadly paniculate. Apical part of the petals strongly thickened, with rugose lateral surface (fig. 20d). Stamens connate. Fruits 1½ by 1 cm . . . . . 42. *C. sumatranum*
52. More or less densely pubescent to tomentose. Leaves 3–6-jugate; leaflets subsessile, 2(–3) times as long as wide. Inflorescences narrowly paniculate. Petals only slightly thickened in the apical part. Stamens free. Fruits 7 by 4½ cm or more . . . . . 26. *C. pseudodecumanum*
51. Terminal bud up to 1½ cm long.
53. Inflorescences terminal. Petals distinctly unguiculate (fig. 20a).
54. Leaves 1–2(–4)-jugate, usually glabrous; leaflets entire; apex shortly blunt-acuminate; leaflets greenish when dry . . . . . 23. *C. pseudopatentinervium*
54. Leaves (2)–3–7-jugate, very rarely glabrous; leaflets usually minutely fimbriate-serrate; apex blunt or acutely acuminate; leaflets usually brownish when dry.
55. Leaflets elliptic, base cuneate; leaves 2–3-jugate . . . . . 24. *C. grandifolium*
55. Leaflets more or less irregularly shaped, either greatest width near the base or margins parallel; base rounded or truncate to subcordate; leaves (2)–3–7-jugate . . . . . 25. *C. apertum*
53. Inflorescences axillary (with some very rare exceptions). Petals not unguiculate.
56. Leafy part of the branchlets (often much) more than 1 cm diam. (up to 3 cm).
57. Leaflets narrowly lanceolate, 13–20 by 3½–5 cm. Flowers 7 mm long, slender. Fruits 5 by 2½ cm. . . . . 41. *C. pseudosumatranum*
57. Leaflets usually broader, usually more than 5 cm wide. Flowers 1–1¼ cm long; corolla conical, densely pilose. Fruits up to 3 by 2½ cm . . . . . 43. *C. hirsutum*
56. Leafy part of the branchlets at most 1 cm diam., mostly much less; if more, than nerves up to 15 pairs and reticulations very dense, tessellate-like and prominent in dried specimens.
58. Reticulations very dense, tessellate-like, prominent on both surfaces; leaflets mostly large and relatively broad (9–24 by 2–9¼ cm); nerves 8–15 pairs, obliquely patent, curving towards the margin, not distinctly arching . . . . . 29. *C. balsamiferum*
58. Either reticulations not very dense, not tessellate-like on both surfaces, or: leaflets narrow (6¼–15 by 1¼–4 cm) and nerves 15–20 pairs, nearly transverse, distinctly arching at 1–2 mm from the margin.
59. Leaves, inflorescences, and infructescences manifestly lax (lateral petiolules 1–1½ cm, terminal ones 3–4 cm, petioles 10–14 cm, interjugal parts 4–8 cm). Disk in ♂ flowers pistilloid, globular, stalked, hollow (fig. 20c). Fruits oblique, bulging on one side; central canal much widened (fig. 21m) . . . . . 35. *C. gracile*
59. Leaves, inflorescences, and infructescences not very lax. ♂ Flowers and fruits different.
60. Leaflets narrow (6¼–15 by 1¼–4 cm); nerves nearly transverse, faintly curved, distinctly arching. Leaves 6–12-jugate . . . . . 46. *C. rigidum*
60. Leaflets nearly always broader; nerves otherwise. Leaves up to 8-jugate.
61. Leaflets pubescent.
62. Acumen of the leaflets long and slender; base usually cuneate. Flowers (1)–1½ cm long; petals not strongly thickened in the apical part; filaments slightly confluent or free. Fruits up to 3 by 1¾ cm, broadly triangular in cross-section . . . . . 31. *C. euryphyllum*
62. Acumen of the leaflets short; base rounded to subcordate. Flowers 6 mm long; petals towards the apex strongly thickened and with rugose lateral surfaces (fig. 20d); filaments halfway connate. Fruits at least 4 by 2 cm, deltoid in cross-section . . . . . 47. *C. polyphyllum*
61. Leaflets glabrous.
63. Filaments at least halfway connate.
64. Nerves 14–17 pairs; leaflets 7–16 by 2½–6 cm. Filaments halfway connate; stamens in ♀ flowers as long as the pistil. Fruit calyx ½ cm diam. . . . . 39. *C. intermedium*
64. Nerves 10–12 pairs; leaflets 4–12 by 2–3½ cm. Filaments nearly wholly connate, sometimes with interstaminal teeth; stamens in ♀ flowers about half as long as the pistil. Fruit calyx c. 1 cm diam. . . . . 40. *C. kipella*
63. Filaments free or confluent at the base only.
65. Stamens pilose. Fruits shortly ovoid, 3½ by 2½ cm, cells equally well developed. . . . . 30. *C. trigonum*
65. Stamens glabrous. Fruits either relatively longer, or much smaller, always 1 or 2 cells strongly reduced.

66. Fruits less than 2 by 1½ cm, ovoid to obovoid (fig. 211). Inflorescences usually 30–45 cm long. Disk in ♂ flowers pistilloid, tapering into a short 'style' (fig. 20b). 28. *C. oleosum*
66. Fruits at least 2½ by 1¼ cm, shaped otherwise. Inflorescences rarely longer than 20 cm. Disk in ♂ flowers not solid and without a 'style'.
67. Fruits broadly elliptic, broadly triangular in cross-section, up to 3 by 1½ cm. Branchlets soon glabrescent. . . . . 31. *C. euryphyllum* var. *euryphyllum*
67. Fruits spindle-shaped, rounded deltoid in cross-section, 3¾–4½ by 1½ cm. Branchlets subsersistently pilose . . . . . 33. *C. pilosum* ssp. *borneense*

### 1. Section Canarium

*Sect. Canaria* DC. Prod. 2 (1825) 79.—*Sect. Progressiva* and *sect. Regressiva* *subsect. Auriculata* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 214 and 209.

*Stipules* either foliaceous (fig. 22d & f–i) or pectinate (fig. 22j–k), enveloping the terminal bud, or small and shrivelled, auricle-shaped (fig. 22e & 25), rarely absent; scars mostly linear or, if on the petiole, drop-shaped. *Bracts* usually consisting of the persistent connate stipules, concave, enveloping the flower buds (fig. 1a–h), rarely lanceolate to subulate. *Leaflets* brownish when dry; margin entire to dentate; indument, if present, shortly tomentose. *Inflorescences* usually terminal, rarely all axillary. *Stamens* usually free or adnate to the disk, very rarely up to halfway connate. ♀ *Flowers* nearly always with a concave receptacle; in that case disk adnate to the receptacle and pistil stalked; *disk* and *pistil* usually glabrous. *Calyx* in fruit rarely less than 1 cm diam., usually flat with undulate margin, or more or less funnel-shaped, often densely tomentose. *Fruits* rather large, usually 5–7 cm long; pyrene smooth, sometimes with angle- and median ribs.

Distr. Africa, Madagascar, Mascarenes, Ceylon, Andamans and Nicobars, Indo-China, *Malaysia*, Solomon Isl., New Hebrides, Fiji, Samoa, and Tonga. The absence of the section in continental Asia outside the Malay Peninsula (except some specimens of *C. littorale* in Indo-China) is remarkable.

1. *Canarium littorale* BL. Bijdr. (1826) 1164; R. & S. Syst. 7 (1830) 1625; BL. Mus. Bot. 1 (1850) 218; MIQ. Fl. Ind. Bat. 1, 2 (1859) 645; ENGL. in DC. Mon. Phan. 4 (1883) 126; K. & V. Bijdr. 4 (1896) 36; BACK. Schooffl. (1911) 198; KOORD. Exk. Fl. Java 2 (1912) 433; HEYNE, Nutt. Pl. (1927) 877; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 13 f. 104g, t. 15 f. 119b; Bull. Jard. Bot. Btzg III, 12 (1932) 498, t. 13 f. 82; CORNER, Ways. Trees (1940) t. 39, sub *C. sp.*; H. J. LAM, in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 5; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 11, cum fig.; non RIDL. Fl. Mal. Pen. 1 (1922) 375 (= *C. pateniternivium* MIQ.).—*C. glaucum* BL. Mus. Bot. 1 (1850) 219; MIQ. Fl. Ind. Bat. 1, 2 (1859) 645; ENGL. in DC. Mon. Phan. 4 (1883) 140; KING, J. As. Soc. Beng. 62, ii (1894) 249; MERR. En. Born. (1921) 317; non HOCHR. Bull. Inst. Bot. Btzg no 22 (1905) 69 (= *Protium serratum* ENGL.).—*C. tomentosum* BL. Mus. Bot. 1 (1850) 219; MIQ. Fl. Ind. Bat. 1, 2 (1859) 644; ENGL. in DC. Mon. Phan. 4 (1883) 120; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 214, t. 12 f. 93, t. 15 f. 119d, e, incl. var. *typicum* et var. *flavum*; Bull. Jard. Bot. Btzg III, 12 (1932) 496, t. 12 f. 81; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 10, cum fig.—*C. serricuspae* MIQ. Fl. Ind. Bat. 1, 2 (1859) 649; ENGL. in DC. Mon. Phan. 4 (1883) 148; HEYNE, Nutt. Pl. (1927) 878.—*C. serrulatum* MIQ. Fl. Ind. Bat. 1, 2 (1859) 646; Ann. Mus. Bot.

Lugd. Bat. 4 (1869) 116.—*C. purpurascens* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 532; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 115; KING, J. As. Soc. Beng. 62, ii (1894) 245; RIDL. J. Str. Br. R. As. Soc. no 33 (1900) 58; Fl. Mal. Pen. 1 (1922) 370; BURK. Dict. (1935) 432; non HENDERS. J. Mal. Br. R. As. Soc. no 17 (1939) 39 (= *perlisanum* LEENH.).—*C. rufum* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 533; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 107; KING, J. As. Soc. Beng. 62, ii (1894) 244; RIDL. J. Str. Br. R. As. Soc. no 33 (1900) 58; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 17, 22<sup>14</sup>, 23<sup>4</sup>; RIDL. Fl. Mal. Pen. 1 (1922) 372; BUCKLEY, Mal. For. Rec. 11 (1932) 34; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 79, t. 13 f. 104 l; Bull. Jard. Bot. Btzg III, 12 (1932) 494, t. 12 f. 80; BURK. Dict. (1935) 432; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 9, cum fig.—*C. secundum* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 532; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 116; KING, J. As. Soc. Beng. 62, ii (1894) 250; RIDL. J. Str. Br. R. As. Soc. no 33 (1900) 58; HOCHR. Pl. Bog. Exs. (1904) 62; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 9; RIDL. Fl. Mal. Pen. 1 (1922) 375; BURK. Dict. (1935) 432.—*C. acutum* ENGL. in DC. Mon. Phan. 4 (1883) 113.—*C. bennettii* ENGL. in DC. Mon. Phan. 4 (1883) 119.—*C. giganteum* ENGL. in DC. Mon. Phan. 4 (1883) 106.



—*C. pruinoseum* ENGL. in DC. Mon. Phan. 4 (1883) 106; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 69; Bull. Jard. Bot. Btzg III, 12

(1932) 492, t. 12 f. 79.—*C. pseudocommune* HOCHR. Pl. Bogor. EXS. (1904) 60, incl. also var. *subelongatum*; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 22<sup>2</sup>; HOCHR. Ann. Jard. Bot. Btzg Suppl. 3 (1910) 842, incl. also var. *genuinum*.—*C. subtruncatum* (non ENGL.) BAKER in RENDLE, J. Bot. 72 (1924) Suppl. 16.—*C. flavum* RIDL. Kew Bull. (1930) 81.

Tree (3–)10–30(–44) m by 20–70(–100) cm, sometimes buttressed. *Branchlets* 1/4–1 cm thick, glabrescent; pith with some large to many small vascular strands, all or part of them peripherally arranged. *Stipules* caducous, inserted on the branchlet near the base of the petiole, reniformous, 5 by 4 mm, with various intergrades to: subpersistent and inserted on the base of the petiole, semi-rotundate, 17 by 12 mm, margin repandous; nearly always tomentose. *Leaves* (0–)2–6-jugate, 17–60 cm long, glabrous to tomentose. *Leaflets* ovate to oblong-lanceolate, 3–27 by 1–9 cm, chartaceous to coriaceous, smooth to bullate, glabrous—sometimes waxy white beneath—to densely tomentose beneath and on the midrib above; base cuneate to faintly cordate, slightly inequilateral; margin entire to dentate or serrulate; apex (gradually to) rather abruptly shortly acute-acuminate, acumen mostly dentate or serrate; nerves 9–22 pairs (angle 60–90°, gradually decreasing from base to apex), slightly curved, often partly arching near the margin. *Inflorescences* terminal, sometimes with additional ones in the upper leaf-axils, paniculate (♂) to subracemose (♀), 5–40 cm long, often densely reddish-brown tomentose, sometimes glabrous. *Bracts* concave. *Flowers* 8–13 mm long, outside densely ferruginously pubescent. *Calyx* 4–9 mm high. *Stamens* 6, filaments glabrous, in ♂ flowers often slightly connate, adnate to the disk, in ♀ flowers inserted on the rim of the disk. *Disk* in ♂ flowers from globular, solid, tapering into a style-like appendix, to: cupular, thick-fleshy, without any rudiment of the pistil; 1–3 mm high, nearly always glabrous; in ♀ flowers minute, faintly 6-undulate, glabrous to tomentose. *Pistil* glabrous or pilose. *Infructescences* 5–25 cm long, densely tomentose, with 1–6 fruits; calyx funnel-shaped, triangular, c. 8 mm diam., to: flat, orbicular, 1 1/2 cm diam., with undulate margin. *Fruits* ellipsoid (to obovoid), rounded triangular in cross-section, 4 1/2–7 by 1 1/2–3 cm, sparsely pilose to glabrous; pyrene smooth, acutely triangular in cross-section; lids 2–4 mm thick. *Seeds* 1–2, sterile cells moderately reduced.

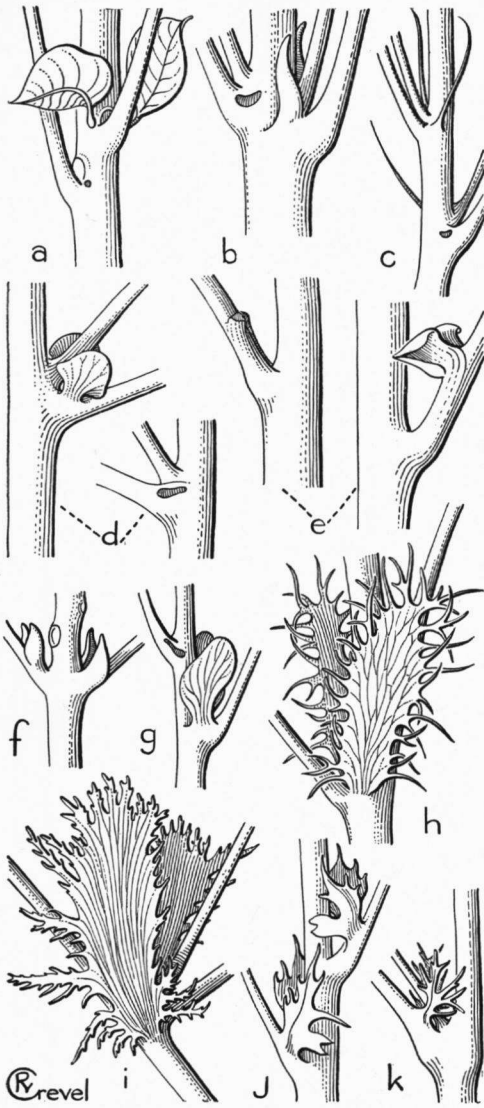


Fig. 22. Different kinds of stipules (and their scars) in *Canarium*. a. Pseudostipules in *C. decumanum* GAERTN.—b–c. Lanceolate to subulate stipules in sect. *Pimela*: b. *C. dichotomum* (BL.) MIQ., c. *C. acutifolium* (DC.) MERR. var. *acutifolium*.—d–k. Foliar stipules in sect. *Canarium*: d. *C. caudatum* KING f. *caudatum*, e. *C. sylvestre* GAERTN. with auricle-shaped stipules, f. *C. ovatum* ENGL., g. *C. vulgare* LEENH., h. *C. kaniense* LAUT., i. *C. odontophyllum* MIQ., j. *C. megalanthum* MERR., k. *C. denticulatum* BL. (d and e × 2, the others × 2/3; scars of stipules shaded).

Distr. Indo-China and *Malaysia*: Sumatra, Malay Peninsula, W.–E. Java, Borneo. Fig. 24. HOCHREUTNER described his *C. pseudocommune* var. *subelongatum* after a specimen in the Bogor botanical garden, which according to him originated from Buru, Moluccas; possibly this should be Buru near Sumatra, in the Riouw Archipelago. The Celebes-specimens, mentioned by H. J. LAM, Bull., l.c., belong in my opinion to *C. maluense* LAUT. Ecol. Rain-forests on dry or swampy soils, under everwet or (in E. Java) subseasonal condi-

tions, mostly at low altitudes, rarely up to 2000 m. *Fl.* mainly Nov.–Apr.; *fr.* mainly May–Sept.

Wood anat. BEEKMAN, *Med. Proefst. Boschw.* 5 (1920) 56, DESCH, *Mal. For. Rec.* 15<sup>1</sup> (1941) 66 (hand lens); MOLL & JANSONIUS, *Mikr. Holzes* 2 (1908) 107; WEBBER, *Lilloa* 6 (1941) 450.

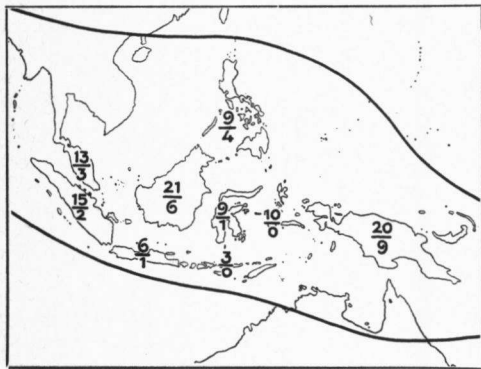


Fig. 23. Distribution of the genus *Canarium* within Malaysia. The number above the hyphen refers to the total number of species, that below the hyphen to the number of endemic species in each island or district.

Uses. The wood is used for house-building, though it is rather soft. The resin is used as a *damar*; in Indo-China it is said to be very sought after by the Chinese as a medicine against itch.

Vern. Sumatra: *madang tjingi*, Atjeh, *andalha*, *basang*, *lalen*, Tapanuli, *damar hija-hija*, *d. kitimbalun*, *kalèk djambu*, *matanbango*, W.C., *kèdondong* (*tjèlana*), E.C., *damar asam*, *d. pau*, Bencoolen, *kadundung asèh*, *kaju têngiling*, *mardundung*, *tètak tundjuk*, Palembang, *kaju ariong*; Mal. Pen.: *buak kawa*, *chabok*, *damar kijai*, *gèrinu*, *kasumba*, *kèdondong bulan*, *k. gègaji*, *k. kana*, *k. kèjai*, *k. mata hari*, *k. pasir*, *kèrat tèlampok*, *k. tèlunjok*, *kèrjijoh*, *mèdang bèladuk*, *m. bulanati*, *mèlang*, *sangol* (*sungol*) *hutam*; Java: *ki kanari*, *ki tuwak*, *tanglar*, Sund., *dahu*, *dèluwak*, *gijubug*, *sadjèng*, Jav., *bulu*, Mad.; Born.: *mekos*, Brunei, *damar kahingai*, *djèl(è)mu* (*nanking*), *kawangan*, *kurihang*, S.E., *bèkatan*, *rupai*.

Notes. Very variable, both in vegetative parts and, to a lesser degree, in the flowers. A number of extreme forms in the Malay Peninsula and Borneo surround a variable central form in Sumatra with which they are connected by a large number of transitional specimens. The only form which can sharply be defined is *f. pruinatum* (ENGL.) LEENH. *nov. stat.* (*C. pruinatum* ENGL.), confined to Sarawak and characterized by close-dentate leaflets waxy-white beneath.

2. *Canarium latistipulatum* RIDL. *Kew Bull.* (1930) 81; H. J. LAM, *Ann. Jard. Bot. Btzg* 42 (1932) t. 5 f. 15, t. 15 f. 119a; *Bull. Jard. Bot. Btzg* III, 12 (1932) 508, t. 13 f. 86.—*C. littorale* (non BL.) H. J. LAM, in *Merr. Pl. Elm. Born.* (1929) 116.

Tree 5–7 m by 10–15 cm. *Branchlets* c. 1/2 cm thick, glabrescent; pith with a peripheral cylinder of vascular strands appressed to the wood. *Stipules* subsistent, inserted on the base of the petiole (up to 2 1/2 mm high), rounded-ovate, 1–2 by 1–1 3/4 cm, margin minutely crenulate. *Leaves* 3–5-jugate. *Leaflets* oblong-lanceolate, 7–17 by 4–7 cm, chartaceous, subglabrous; base broadly cuneate; margin serrate or dentate; apex abruptly rather long and slender acute-acuminate; nerves 9–13 pairs (angle 60–70°), slightly curved, distinctly arching close to the margin. *Inflorescences* (♀ unknown) terminal, laxly paniculate, 15–30 cm long, glabrescent. *Flowers* (♂) 1 1/4 cm, outside pulverulent. *Calyx* 3–5 mm high. *Stamens* glabrous, slightly connate at the base, sometimes adnate to the disk. *Disk* cupular, thick and fleshy, 1–2 mm high, glabrous, without pistil. *Infructescences* terminal, paniculate, 5 1/2 cm, densely tomentose, with 3 fruits; calyx funnel-shaped, triangular, 7 by 11 mm. *Fruits* unknown.

Distr. *Malaysia*: Borneo (Sarawak and Br. N. Borneo). Fig. 24.

Ecol. Lowland forest up to 150 m, apparently rare. *Fl.* Febr., *fr.* July.

Vern. *Dayaw*, *Kedayan*, Br. N. B., *moitos hutan*, Sarawak.

3. *Canarium perlisianum* LEENH. *Blumea* 8 (1955) 186.—*C. ? purpurascens* HENDERS. *J. Mal. Br. R. As. Soc.* 17 (1939) 39.

Tree c. 10 m. *Branchlets* 1/2 cm thick, glabrous; pith with a peripheral cylinder of small vascular strands. *Stipules* caducous, inserted on the petiole 1/2–1 cm from its base, scars 3 mm long. *Leaves* 2-jugate, glabrous. *Leaflets* subsessile, broadly-elliptic, 11–16 by 5–7 cm, chartaceous; base rounded; margin crenulate, specially near the apex; apex gradually, long and broadly, blunt-acuminate; nerves 14–18 pairs (angle c. 50°), straight, gradually arching close to the margin. *Inflorescences* (♀ unknown) axillary, narrowly paniculate, up to c. 13 cm long, most of the flower-clusters nearly sessile, glabrescent. *Bracts* concave. *Flowers* (♂) 8 mm, outside thinly tomentose. *Calyx* 4 mm high. *Stamens* glabrous, filaments halfway connate. *Disk* cylindrical, 6-lobed, 1 mm high, thinly pilose on the conical upper surface, with a central canal; no pistil. *Infructescences* and *fruits* unknown.

Distr. *Malaysia*: Malay Peninsula (Perlis), once collected. Fig. 24.

Ecol. Limestone hill, 70 m, *fl.* April.

Note. Taxonomically a rather remarkable species. Apparently related to *C. littorale* BL., though the axillary inflorescences and the connate stamens are quite unusual in this section, as is the combination of rather many nerves and stipules which are inserted on the petiole.

4. *Canarium patentinervium* MIQ. *Sum.* (1861) 526; *KURZ*, *J. As. Soc. Beng.* 44, ii (1875) 142, *sphalm. patentissimum*; ENGL. in *DC. Mon. Phan.* 4 (1883) 148; HOCHR. *Pl. Bog. Exs.* (1904) 59, *incl. var. genuinum* and *var. meizocarpum*; GUILLAUMIN,

Ann. Sc. Nat. IX, Bot. 10 (1909) f. 223<sup>7</sup>; HEYNE, Nutt. Pl. (1927) 878; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931) t. 5 f. 11, t. 6 f. 29c; Bull. Jard. Bot. Btzg III, 12 (1932) 506; CRETZORI, in Fedde, Rep. 36 (1934) 267, incl. also var. *nitidum*.—*C. subrepandum* MIQ. Sum. (1861) 525.—*C. nitidum* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 533; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 108; KING, J. As. Soc. Beng. 62, ii (1894) 251; RIDL. J. Str. Br. R. As. Soc. no 33 (1900) 58; Fl. Mal. Pen. 1 (1922) 373; BURK. Dict. (1935) 431.—*C. parvifolium* BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 536; Pharm. J. Trans. III, 6 (1875) 104; ENGL. in DC. Mon. Phan. 4 (1883) 140; KING, J. As. Soc. Beng. 62, ii (1894) 241.—*C. ? littorale* (non BL.) RIDL. Fl. Mal. Pen. 1 (1922) 375.

Tree 12–40 m by 20–50(–180?) cm. *Branchlets* 1/2 cm thick, glabrescent; pith with a peripheral cylinder of rather large vascular strands and mostly some scattered small ones in the central part. *Stipules* caducous, inserted at the conjunction of branchlet and petiole, about reniformous, 3–5(–12) mm. *Leaves* (2–)3–4(–5)-jugate, 15–37 cm long, glabrous. *Leaflets* ovate to oblong-lanceolate, 4 1/4–6 1/2–18 by 1 1/2–3 1/2–7 1/4 cm, coriaceous, shining beneath; base subequilateral, broadly cuneate (to subcordate); margin entire; apex gradually to sub abruptly, shortly and bluntly acuminate; nerves 5–15 pairs (angle 60–70°), widely spaced, slightly curved, distinctly arching at some distance from the margin, not very conspicuous above; reticulations nearly inconspicuous. *Inflorescences* terminal, some main branches sometimes in the upper leaf-axils, ♂ ones laxly paniculate, (7–)15–20(–30) cm long, thinly tomentose, many-flowered; ♀ ones more dense, 2–10 cm long, more densely tomentose and few-flowered. *Flowers* 3/4–1 cm, pubescent outside. *Calyx* nearly truncate, in ♂ flowers 2 1/2–4 mm high, in ♀ ones 6 mm. *Stamens* 6, glabrous, in ♂ flowers slightly connate at the base and sometimes adnate to the disk, in ♀ flowers rather strongly reduced, inserted on the disk. *Disk* in ♂ flowers pistilloid, globular, sometimes stalked, tapering into a long style-like appendix, in total 2 mm high; in ♀ flowers adnate to the receptacle, if this is concave; always glabrous. *Pistil* glabrous. *Infructescences* 6–8 cm long, densely and shortly, ferruginously woolly-tomentose, with 1–2(–4) fruits; calyx flat, 3-lobed, 11–14 mm diam. *Fruits* ellipsoid to obovoid, round to rounded-triangular in cross-section, glabrous, 3–6 by 1 3/4–3 cm; pyrene smooth; lids 3–5 mm thick. *Seeds* 1–3; sterile cells more or less reduced.

*Distr. Malaysia:* Sumatra, Malay Peninsula, Banka, Anambas Islands, Borneo. Fig. 24.

*Ecol.* Primary forests, up to 450 m (rarely up to 1150 m), fl. mainly Nov.–May; fr. mainly Sept.–April.

*Vern.* Sumatra: *kaju pandan*, *madang merpalam*, *W.C.*, *kaju kana*, *palam palam*, *E.C.*, *kédonong tulang*, *téta tundju*, Palembang; Mal. Pen.: *kaju kédapak*, *kana hutan*, *kédonong*, *k. batu*, *k. bulan*, *k. kérot*, *k. krut*; Borneo: *bélasah*, *keramah*.

*Notes.* Nearest related to *C. littorale* BL.; some intermediate specimens are known from

Sumatra and Banka. However, the two species are nearly always quite distinguishable, specially in their leaf-characters.

Some specimens from the Mahakam river, E. Borneo, are intermediate between this species and *C. maluense* LAUT.

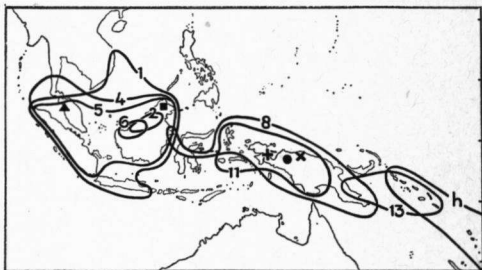


Fig. 24. Distribution of *C. littorale* BL. and its allies. 1. *C. littorale* BL., 2. *C. latistipulatum* RIDL., 3. *C. perlisanum* LEENH. (▲), 4. *C. patentinervium* MIQ., 5. *C. caudatum* KING, 6. *C. divergens* ENGL., 7. *C. kinabaluense* LEENH. (■), 8. *C. maluense* LAUT., 9. *C. megacarpum* LEENH. (●), 10. *C. lamii* LEENH. (×), 11. *C. sylvestre* GAERTN., 12. *C. pilososylvestre* LEENH. (+), 13. *C. salomonense* B. L. BURTT, h. *C. harveyi* SEEM.

In its vegetative parts very similar to the Malay Peninsular specimens of *C. caudatum* KING, a species with only 3 stamens in the ♂ flowers.

In my opinion the majority of the species of *sect. Canarium* have been derived from *C. patentinervium* and in a lesser degree from *C. littorale* BL.

5. *Canarium caudatum* KING, J. As. Soc. Beng. 62, ii (1894) 240; RIDL. Fl. Mal. Pen. 1 (1922) 370; Kew Bull. (1930) 81; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931–32) t. 5 f. 12, t. 11 f. 57, t. 13 f. 104m; Bull. Jard. Bot. Btzg III, 12 (1932) 443, t. 9 f. 54.—*C. pauciflorum* RIDL. Kew Bull. (1930) 80; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 55, t. 15 f. 119c; Bull. Jard. Bot. Btzg III, 12 (1932) 502, t. 13 f. 83.—Fig. 22d.

Tree up to 18 m by 40 cm. *Branchlets* c. 3 mm thick, glabrescent; pith with a peripheral cylinder of large and small vascular strands. *Stipules* from: very caducous, inserted at the conjunction of branchlet and petiole, reniformous, c. 2 mm long, to: subsistent, inserted on the petiole up to 3/4 cm from its base, auricle-shaped, 3–5 mm long. *Leaves* 0–3(–4)-jugate, glabrous. *Leaflets* elliptic-ovate to elliptic-lanceolate, tapering at base and apex, 5 1/2–12(–17) by 2 1/2–5(–7 1/4) cm, subcoriaceous; base cuneate; margin entire; apex caudate-acuminate; nerves 7–11 pairs (angle 60–80°), curved, distinctly arching at some distance from the margin, not very conspicuous. *Inflorescences* terminal, laxly paniculate, thinly tomentose to glabrous, ♂ ones 10–30 cm long, ♀ ones 7–15 cm. *Flowers* subglabrous, ♂ ones 3–6 mm, ♀ ones 7–10 mm. *Calyx* subtruncate, in ♂ flowers 1–2 mm high, in ♀ ones 4 mm. *Stamens* glabrous, in ♂ flowers 3,

adnate to the disk, in ♀ flowers 6, slightly confluent at the base, inserted on the disk. *Disk* in ♂ flowers consisting of 3 tomentose alternistaminal lobes, which are adnate to the rudimentary pistil, the latter being glabrous, flat, tapering into a filiformous, rudimentary style; in ♀ flowers glabrous, adnate to the receptacle and to the stamens. *Pistil* glabrous. *Infructescences* up to 15 cm long with few fruits; calyx funnel-shaped, faintly 3-lobed, 7–9 mm diam. *Fruits* spindle-shaped, triangular in cross-section,  $4^{3/4}$ – $7^{1/2}$  by  $1^{1/4}$ – $2^{1/4}$  cm, glabrous; pyrene acutely triangular; lids c.  $1/4$  cm thick. *Seeds* 1–2; sterile cells rather strongly reduced.

Distr. *Malaysia*: Sumatra, Malay Peninsula, Borneo. Fig. 24.

Ecol. Primary forests, sometimes bamboo-forests, up to c. 250 m, fl. mainly April–July, fr. mainly Oct.

Vern. Sumatra: *kaju damar arijong*; Mal. Pen.: *buah kayak, kédondong kuning*; damar *bédundung*.

Notes. The following two forms can be distinguished:

*f. caudatum*. Stipules small, reniformous, inserted partly on the branchlet (fig. 22d). Leaves and flowers large. Occupies the area of the species.

*f. auriculiferum* LEENH. *Blumea* 8 (1955) 181. Stipules auricle-shaped, inserted on the petiole. Leaves and flowers small. Sumatra and Borneo.

The major part of the specimens can be definitely referred to one of these forms, although a few are transitional. *Forma caudatum* is, specially in the Malay Peninsula, closely resembling *C. patentinervium* MIQ., from which it differs essentially only in its 3-staminate ♂ flowers.

6. *Canarium divergens* ENGL. in DC. Mon. Phan. 4 (1883) 143; H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) t. 12 f. 89; Bull. Jard. Bot. Btzig III, 12 (1932) 503, t. 13 f. 84.

Tree. *Branchlets* c.  $1/4$  cm thick, glabrous; pith with a peripheral cylinder of vascular strands and some central scattered ones. *Stipules* caducous, inserted on the base of the petiole, probably small. *Leaves* (1)–2–3-jugate. *Leaflets* oblong-lanceolate to elliptic-oblong,  $5^{1/2}$ – $10^{1/2}$  by  $2^{1/2}$ – $4^{1/2}$  cm, subcoriaceous, glabrous; base broadly cuneate to rounded; margin entire; apex subabruptly, broadly blunt-acuminate; nerves 8–11 pairs (angle 50–60°), straight to faintly curved, abruptly arching close to the margin. *Inflorescences* (♀ unknown) terminal and in the upper leaf-axils, broadly and very laxly paniculate, 10–15 cm long, with c. 12–15 flowers, subglabrous. *Flowers* (♂)  $1^{1/4}$  cm long, outside pubescent. *Calyx* 9 mm long. *Stamens* glabrous, often connate at base and adnate to the disk. *Disk* semiglobular to conical, 1 mm high, bearing on its top the tiny rudimentary pistil, glabrous. *Infructescences* and *fruits* unknown.

Distr. *Malaysia*: Borneo (Sarawak: Mattang), twice collected. Fig. 24.

Note. Apparently related to *C. patentinervium* MIQ.

7. *Canarium kinabaluense* LEENH. *Blumea* 8 (1955) 182, f. 1.

Tree 20 m by 25 cm. *Branchlets*  $1^{1/2}$ – $3^{1/4}$  cm thick, often lenticellate, glabrescent; pith with a peripheral cylinder of small vascular strands. *Stipules* subsistent, inserted on the base of the petiole, suborbicular to elliptic,  $3^{1/4}$ – $2^{1/2}$  by  $3^{1/4}$ –2 cm, subcoriaceous, densely sericeous-pubescent to glabrous, entire to denticulate, nerves anastomosing, conspicuous. *Leaves* 2–4-jugate. *Leaflets* broadly lanceolate to ovate or elliptic, 8–15–20 by ( $3^{1/2}$ –)  $5^{1/2}$ –10 cm, coriaceous, glabrous; base rounded to broadly cuneate; margin crenulate to the apex; apex rather abruptly broadly acute-acuminate; nerves (8)–11–12(–19) pairs (angle variable), straight to curved, gradually arching at some distance from the margin. *Inflorescences* unknown. *Infructescences* terminal, laxly paniculate, 15–20 cm long, glabrescent, with c. 12 fruits; calyx widely funnel-shaped,  $1^{1/4}$  cm diam., with remnants of an annular, fimbriate disk and free stamens. *Fruits* narrowly spindle-shaped, triangular in cross-section, acute at base and apex, 6– $6^{1/2}$  by 2–3 cm, glabrous; pyrene rounded triangular, smooth except the 3 acute angle ribs near the apex; lids 3 mm thick. *Seed* 1; sterile cells more or less strongly reduced and more or less shifted to the surface.

Distr. *Malaysia*: N. Borneo. Fig. 24.

Ecol. Altitude mostly 1000–1500 m, fl. fr. Dec.–Jan.

Notes. Related to *C. patentinervium* MIQ. and to *C. divergens* ENGL. Referred by MERRILL (J. Str. Br. R. As. Soc. no 86, 1922, 318) to *C. pseudo-commune* HOCHR., by H. J. LAM (Bull. Jard. Bot. Btzig III, 12, 1932, 498) to *C. littorale* BL.

8. *Canarium maluense* LAUT. Bot. Jahrb. 56 (1920) 323, f. 1; LANE-POOLE, For. Res. Pap. (1925) 99; H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) t. 12 f. 90; Bull. Jard. Bot. Btzig III, 12 (1932) 504, t. 13 f. 85; LEENH. *Blumea* 8 (1955) 184, f. 5b.—*C. lian* H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 209, t. 12 f. 92, t. 15 f. 116b; Bull. Jard. Bot. Btzig III, 12 (1932) 440, t. 9 f. 52.—*C. quadrangulare* H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 219, f. 104o, f. 116c; Bull. Jard. Bot. Btzig III, 12 (1932) 441, t. 14 f. 94.

Note. This species is intermediate between the West-Malaysian *littorale*-group (species 1–7) and the East-Malaysian species (9–13) with auricle-shaped stipules.

*ssp. maluense*.—*C. lian* H. J. LAM.—*C. quadrangulare* H. J. LAM.—Fig. 21h.

Tree 15–40 m by 15–60 cm. *Branchlets* 3–7 mm thick, glabrescent, often lenticellate; pith rather loose, vascular strands from many scattered small ones to some large peripheral ones. *Stipules* from caducous, inserted at the base of the petiole, scaly, 3 by 2 mm, to: persistent, inserted on the petiole up to  $3/4$  cm from its base, auricle-shaped, up to  $1^{1/2}$  by  $1^{1/4}$  cm. *Leaves* 1–4-jugate. *Leaflets* ovate to oblong-elliptic, 4–15–25 by 3–10 cm, (sub)coriaceous, smooth to more or less bullate, subglabrous, rarely rather densely tomentose beneath; base broadly cuneate to subcordate, nearly equi-

lateral; margin entire; apex rather abruptly, shortly and bluntly acuminate, acumen often emarginate; nerves rather dense, 10–25 pairs (angle 90–60°, decreasing from base to apex), straight to faintly curved, abruptly arching at some distance from the margin. *Inflorescences* terminal and in the upper leaf-axils, paniculate, 1<sup>1</sup>/<sub>2</sub>–10 cm long, tomentose, flowers clustered. *Flowers* 3–6 mm long, outside tomentose. *Calyx* 1–4 mm high. *Stamens* 6 (in ♂ flowers a slight tendency to reduce this number), glabrous, in ♂ flowers more or less adnate to the disk, in ♀ flowers inserted on its rim. *Disk* glabrous to pilose, in ♂ flowers ovoid to globular, solid, 1/2–1 mm high; in ♀ ones adnate to the receptacle. *Pistil* partly pubescent. *Infructescences* paniculate, 4–10 cm long, tomentose to lenticellate, with up to 20 fruits; calyx flat to saucer-shaped, indistinctly 3-lobed, 1–1<sup>1</sup>/<sub>4</sub> cm diam. *Fruits* ovoid to ellipsoid, round (to quadrangular) in cross-section, 1<sup>3</sup>/<sub>4</sub>–3 by 1–1<sup>3</sup>/<sub>4</sub> cm, glabrous; pyrene smooth, round to blunt-angular; lids 3–4 mm thick. *Seeds* 1(–2); sterile cells strongly reduced, sometimes more or less displaced to the periphery.

Distr. *Malaysia*: Central Celebes, Moluccas (Morotai, Batjan, Aru Islands), New Guinea (incl. also Schouten Island). Fig. 24.

Ecol. Primary rain-forests, 0–1100 m, fl. fr. Jan.–Dec.

Vern. *Kapur-barus*, *morohulo* (*motaha*), Celebes, *lian*, Morotai, *pujut*, *tebèngè*, Batjan, *aruk*, *nanari laki-laki* (♂), *n. pèrampuan* (♀), *nasbin* (♀), *nasnon* (♂), *sisilo*, New Guinea.

Notes. *Ssp. maluense* is a rather variable population showing in many characters a gradual change from West to East. The main variations are found in the insertion of the stipules, the form of the leaflets, the number of the nerves, and the reduction of the sterile cells in the fruits. No sharply defined forms can be distinguished.

*ssp. borneense* LEENH. *Blumea* 8 (1955) 184.

Tree up to 20 m by 40 cm, buttressed. *Stipules* caducous, small, inserted at the conjunction of branchlet and petiole. *Leaflets* elliptic, 6–15 by 2<sup>3</sup>/<sub>4</sub>–5<sup>1</sup>/<sub>2</sub> cm (c. 2<sup>1</sup>/<sub>2</sub> times as long as broad); nerves 10–12(–15) pairs. *Inflorescences* laxly paniculate, few-flowered. *Flowers* 8–9 mm long. *Stamens* slightly connate at base. *Disk* in ♂ flowers pistilloid, gradually narrowed into a filiformous rudimentary style. *Pistil* glabrous. *Infructescences* and *fruits* unknown.

Distr. *Malaysia*: E. Borneo (Peak of Balikpapan). Fig. 24.

Ecol. Alt. 0–700 m, fl. June–July.

Note. Intermediate between on one side *C. patentinervium* and *C. caudatum* and on the other side *C. maluense ssp. maluense*.

9. *Canarium megacarpum* LEENH. *Blumea* 8 (1955) 186, f. 3. —Fig. 21d–e.

Tree 35 m by 40 cm. *Branchlets* 1<sup>1</sup>/<sub>4</sub> cm thick, glabrescent; pith with many scattered small vascular strands. *Stipules* caducous, inserted on the base of the petiole, reniformous, 5 by 8 mm, densely

tomentose, margin denticulate. *Leaves* 4–5-jugate. *Leaflets* ovate to elliptic-oblong, 15–17<sup>1</sup>/<sub>2</sub>(–19) by 5–7(–8<sup>1</sup>/<sub>2</sub>) cm, subcoriaceous, shortly fulvous-tomentose on midrib above and on all nerves beneath; base rounded to truncate; margin entire; apex rather abruptly shortly acute-acuminate; nerves 17–22 pairs (angle 55°), straight to faintly curved, only in the apical part distinctly arching. *Inflorescences*, *flowers* and *infructescences* unknown. *Fruits* ovoid, triangular in cross-section, 8 by 5 cm, glabrous; pericarp 1/2 cm thick, fibrous; pyrene sharply 3-winged, lids concave, scaberulous, 3–3<sup>1</sup>/<sub>2</sub> mm thick. *Seeds* 2; sterile cell moderately reduced.

Distr. *Malaysia*: Dutch North New Guinea, once collected. Fig. 24.

Ecol. Primary forest. Fr. April.

Vern. *Anaiwokar*, Idore dial.

10. *Canarium lamii* LEENH. *Blumea* 8 (1955) 184, f. 2.

Tree 20 m by 50 cm. *Branchlets* 6–7 mm thick, scurfy; pith with a peripheral cylinder of small vascular strands. *Leaves* 3-jugate, glabrous. *Stipules* subsistent, inserted on the petiole, 1–1<sup>1</sup>/<sub>2</sub> cm from its base, decurrent, oblique-obovate, 1<sup>1</sup>/<sub>4</sub>–2 by 1 cm, rather stiff. *Leaflets* ovate to lanceolate, 11–18 by 6–7 cm, coriaceous; base slightly oblique, rounded; margin entire; apex rather abruptly, shortly and bluntly acuminate; nerves 10–12 pairs (angle 60–80°), moderately curved, more or less distinctly arching close to the margin. *Inflorescences* and *flowers* unknown. *Infructescences* terminal, small, with 1 fruit; calyx flat, orbicular, 1<sup>3</sup>/<sub>4</sub> cm diam. *Fruits* ovoid, 6 by 4 cm, glabrous; pericarp 1/2–3/4 cm thick, fibrous; pyrene smooth, rostrate at the apex, in cross-section rounded triangular; the lids 3/4 cm thick, very hard. *Seeds* 1–2.

Distr. *Malaysia*: New Guinea (Hollandia), once collected in young secondary forest at very low alt., fr. in Oct. Fig. 24.

Vern. *Djaäto kénari*.

Note. Apparently related to *C. harveyi* SEEM., a Melanesian species, which occurs from the Solomon Islands to Samoa.

11. *Canarium sylvestre* GAERTN. *Fruct.* 2 (1791) 99, t. 102; DC. *Prod.* 2 (1825) 79; HEYNE, *Nutt. Pl.* (1927) 879; H. J. LAM, *Ann. Jard. Bot. Btzig* 42 (1932) t. 11 f. 54, t. 13 f. 104f, t. 15 f. 116a; Bull. *Jard. Bot. Btzig* III, 12 (1932) 442, t. 9 f. 53; non BL. *Mus. Bot.* 1 (1850) 217 (= *C. denticulatum* BL.).—*C. sylvestre alterum* RUMPH. *Herb. Amb.* 2 (1741) 155, t. 49.—*C. sylvestre* WILLD. *Sp. Pl.* 4 (1805) 760; ROXB. *Hort. Beng.* (1814) 49; Fl. Ind. 3 (1832) 137, excl. *syn. Pimela nigra* et *C. pimela*.—*C. simplicifolium* ENGL. in DC. *Mon. Phan.* 4 (1883) 146.—*C. branderhorstii* LAUT. *Bot. Jahrb.* 56 (1920) 322.—*C. appendiculatum* LAUT. *Bot. Jahrb.* 56 (1920) 331.—Fig. 22e.

Tree c. 20 m by 40 cm, sometimes buttressed. *Branchlets* c. 1/2 cm thick, glabrescent; pith with some large peripheral vascular strands, sometimes also some central ones. *Stipules* persistent, inserted

on the petiole at  $\frac{1}{4}$ –1 cm from its base, auricle-shaped,  $1\frac{1}{2}$ –4 mm long, thinly tomentose. *Leaves* 0–3-jugate, glabrous. *Leaflets* oblong-lanceolate to elliptic-oblong, 8–21 by  $3\frac{1}{2}$ –10 cm, chartaceous, reddish-brown to cinnamonaceous when dry; base cuneate; margin entire; apex subabruptly, long,

Vern. *Kai ia, nierlaaj*, Ceram, *kénari hutan, k. janele, nanari*, Ambon.

Note. BLUME, *l.c.*, misinterpreted a specimen of *C. denticulatum* BL. f. *fissistipulum* LEENH. as belonging to this species, and so erroneously recorded *C. sylvestre* from Sumatra. In this he

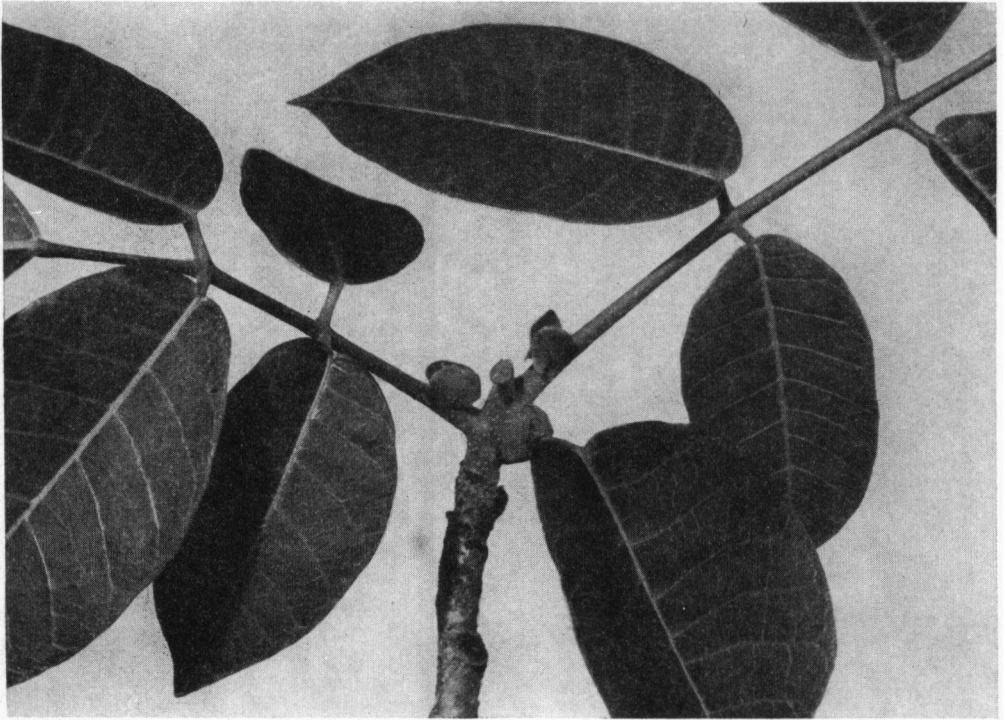


Fig. 25. Auricle-shaped stipules in *C. zeylanicum* (RETZ.) BL. from Ceylon (Cult. Hort. Bog. VII-B-13).

and slender, blunt-acuminate; nerves 8–15 pairs (angle 60–70°), faintly curved, distinctly arching near the margin. *Inflorescences* (♀ unknown) terminal and sometimes in the upper leaf-axils, paniculate, 4–32 cm long, glabrous. *Flowers* (♂) c. 3 mm long, glabrous outside. *Calyx* 2–3 mm high. *Stamens* 6–3, free, glabrous. *Disk* cushion-shaped, solid, c. 1 mm high, glabrous. *Infructescences* terminal, narrowly paniculate, 6–7 cm long, with few fruits; calyx flat, triangular to nearly orbicular, 9–12 mm diam. *Fruits* ovoid,  $3\frac{1}{2}$ – $5\frac{1}{2}$  by  $1\frac{1}{2}$ – $2\frac{3}{4}$  cm, round to bluntly triangular in cross-section, glabrous; pyrene smooth with a blunt rib in the apical part of each angle; lids  $2\frac{1}{2}$ – $3\frac{1}{2}$  mm thick. *Seeds* 3–1; sterile cells mostly slightly reduced.

Distr. *Malaysia*: Moluccas (Morotai, Buru, Ceram, Ambon), New Guinea. Fig. 24.

Ecol. In primary mixed and sagu forests at low altitudes, up to 850 m, fl. mainly Aug., fr. April–Sept.

Uses. The wood, the resin and the seeds are sometimes used; they are of minor importance.

was followed by MIQUEL (1859 & 1860) and by ENGLER (1883).

## 12. *Canarium piloso-sylvestre* LEENH. *Blumea* 8 (1955) 186.

Large tree. *Branchlets* c. 4 mm thick, long remaining densely ferruginously woolly pubescent; pith with a number of small vascular strands, most of them arranged into a peripheral cylinder. *Stipules* subsistent, inserted on the petiole up to 8 mm from its base, auricle-shaped to lingulate, up to 6 by  $3\frac{1}{2}$  mm, stiff, pilose. *Leaves* 1–2-jugate. *Leaflets* elliptic to obovate, 10–12 by  $4\frac{1}{2}$ –6 cm, chartaceous, reddish-brown when dry, glabrous above, sparsely pilose beneath; base equilateral, cuneate; margin entire; apex rather abruptly long and slender blunt-acuminate; nerves 11–12 pairs (angle 60–70°), curved, distinctly arching at c. 3 mm from the margin, slightly sunken above. *Inflorescences* (♀ unknown) terminal, narrowly paniculate, c. 15 cm long, densely woolly pubescent. *Flowers* (♂) 8 mm long, glabrous outside. *Calyx*  $\frac{1}{4}$  cm high, subtruncate. *Stamens* 3,

slightly adnate to the disk, glabrous. *Disk* cylindrical, solid, 3-lobed, 2 mm high, glabrous. *Infructescences* and *fruits* unknown.

Distr. *Malaysia*: W. New Guinea (MacCluer Bay), once collected. Fig. 24.

Ecol. Alt. 50 m, fl. May.

Note. Closely related to *C. sylvestre* GAERTN.

13. *Canarium salomonense* B. L. BURTT, Kew Bull. (1935) 302.

*ssp. papuanum* LEENH. Blumea 8 (1955) 188, f. 5f.—Fig. 21f.

Buttressed tree up to 30 m by 30–50 cm, sometimes with stilt-roots. *Branchlets*  $1\frac{1}{2}$ – $3\frac{1}{4}$  cm thick, glabrescent; pith with several small vascular strands, partly peripherally arranged. *Stipules* subcaducous, inserted on the petiole at 4–15 mm from its base, auricle-shaped, 3–4 by 7 mm. *Leaves* 2–3-jugate. *Leaflets* elliptic, 7–10 by 3–5 cm, chartaceous to coriaceous, glabrous; base rounded to subcordate; margin entire; apex abruptly, short- and blunt-acuminate; nerves 8–14 pairs (angle c. 70°) straight to slightly curved, distinctly arching at some distance from the margin. *Inflorescences* terminal, short ferruginous-pubescent, glabrescent, ♂ ones laxly paniculate, 20–30 cm long, many-flowered, ♀ ones more slender, 8–20 cm long, less-flowered. *Flowers* tomentose outside, ♂ ones 4– $5\frac{1}{2}$  mm long, ♀ ones c. 1 cm. *Calyx* in ♂ flowers 2 mm, in ♀ flowers  $5\frac{1}{2}$  mm. *Stamens* 6, glabrous, adnate to the disk. *Disk* glabrous, in ♂ flowers cylindrical, 6-lobed, 1 mm high, with a central canal, in ♀ flowers adnate to the receptacle, free rim 6-undulate,  $1\frac{1}{2}$  mm high. *Pistil* glabrous, in ♂ flowers none. *Infructescences* 10–12 cm long, with 1–4 fruits; calyx flat, faintly 3-lobed to orbicular, 1 cm diam. *Fruits* flattened ellipsoid, c.  $3\frac{1}{2}$  by  $2\frac{1}{4}$  by  $1\frac{1}{2}$  cm, glabrous; pericarp fibrous; pyrene smooth, pointed at the base and with 3 strong, blunt, white ribs at the apex; lids 3–5 mm thick. *Seed* 1; sterile cells strongly reduced.

Distr. *Malaysia*: E. New Guinea (Papua, Northern Div.). Fig. 24.

Ecol. Rain-forest up to 400 m alt., fl. fr. Sept.

Uses. In the Solomon Islands *ssp. salomonense* is cultivated for its seeds.

Vern. *Akoreh*, *bananga*, *fifi(u)*, *pèpèura*.

14. *Canarium vulgare* LEENH. Bull. Bish. Mus. no 216 (1955) 31, f. 13; Blumea 8 (1955) 188.—*C. vulgare tertia et quarta species* RUMPH. Herb. Amb. 2 (1741) 146, t. 47 F–I; LOTSY, in Rumph. Ge-denkb. (1902) t. opp. p. 46.—*C. commune* L. Mant. 1 (1767) 127, *pro min. part.*, *type excl.*; BL. Bijdr. (1826) 1161, *p.p.*; R. & S. Syst. 7, 2 (1830) 1622; BL. Mus. Bot. 1 (1850) 214, *incl. also var. minor*; MIQ. Fl. Ind. Bat. 1, 2 (1859) 643; BENN. in Hook. f. Fl. Br. Ind. 1 (1875) 531; Pharm. J. Trans. III, 6 (1875) 102; ENGL. in DC. Mon. Phan. 4 (1883) 112, t. 2 f. 35–39; KING, J. As. Soc. Beng. 62, ii (1894) 246; E. & P. Pfl. Fam. 3, 4 (1896) f. 136 A–E; ed. 2, 19a (1931) f. 211 A–E; K. & V. Bijdr. 4 (1896) 35; BACK. Fl. Bat. 1 (1907) 264;

Schoolf. (1911) 198; KOORD. Exk. Fl. Java 2 (1912) 433; Koord. Atlas 1 (1913) t. 149; HEYNE, Nutt. Pl. (1927) 873; PETCH, Ann. R. Bot. Gard. Perad. 11 (1930) 279, t. 35 & 36; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) f. 51, t. 15, f. 124; Bull. Jard. Bot. Btzg III, 12 (1932) 509; VAN

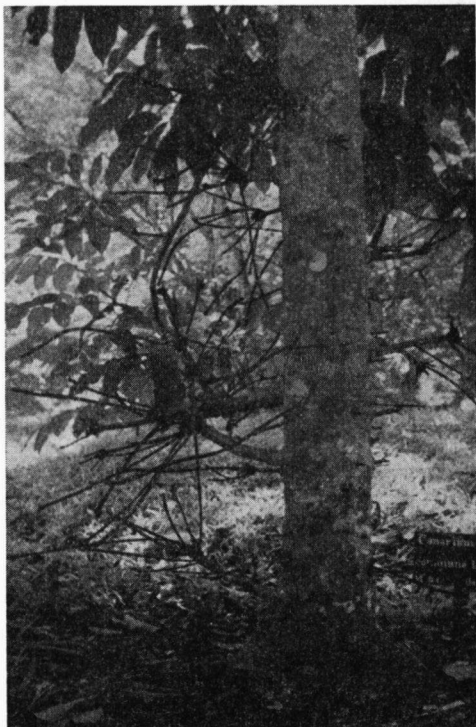


Fig. 26. Adventitious roots in *Canarium vulgare* LEENH., young stage (Cult. Hort. Bog. VI–D–1).

HEURN & H. J. LAM, Blumea Suppl. 1 (1937) 97; STEEN. Trop. Natuur 27 (1938) 54; CORNER, Ways. Trees (1940) 178, t. 38; H. J. LAM in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 5; STEEN. Fl. Sch. Indon. ed. 2 (1951) 232.—Fig. 19, 22g & 26–30.

Tree up to 45 m by 70 cm; buttresses up to 3 m high and  $1\frac{1}{2}$  m wide. *Branchlets* c.  $\frac{1}{2}$  cm thick, smooth, glabrous; pith with many vascular strands, partly peripherally arranged. *Stipules* rather caducous, inserted at the conjunction of the petiole and the branchlet, rarely entirely on the base of the petiole, oblong, 1–5 by  $\frac{1}{2}$ – $1\frac{1}{4}$  cm, apex rounded, margin entire, glabrous to slightly pulverulent. *Leaves* (2–)4–5-jugate, glabrous. *Leaflets* ovate to oblong, 5–16 by  $2\frac{1}{2}$ –7(–10) cm, chartaceous to subcoriaceous; base often slightly oblique, (broadly) cuneate; margin entire; apex gradually to subabruptly, rather long and slender-acuminate; nerves 12–15 pairs (angle 60–70°), straight to faintly curved, gradually arching at some distance from the margin. *Inflorescences* terminal (basal branches often axillary), broadly



Fig. 27. *Canarium vulgare* LEENH. (Cult. Hort. Bog., Nov. 1955).



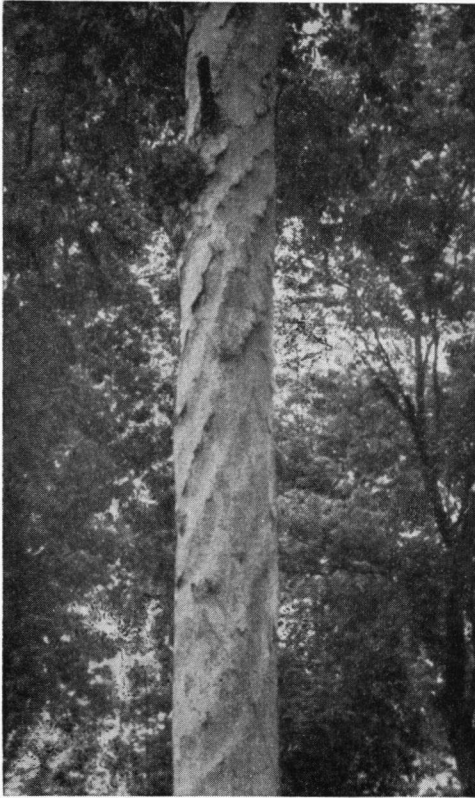


Fig. 28. *Canarium vulgare* LEENH. showing spiral peeling of the bark (Bogor, roadside).

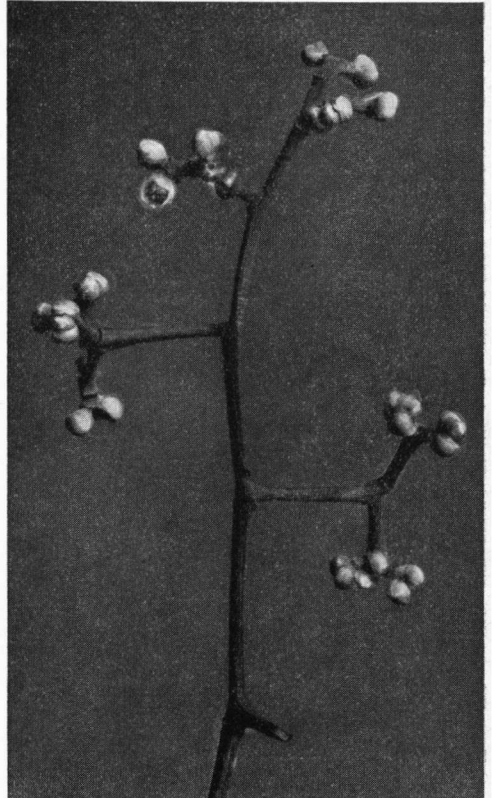


Fig. 29. *C. vulgare* LEENH. ♂ Inflorescence (Cult. Hort. Bog. VI-D-1a).

paniculate, minutely pulverulent, ♂ ones up to 35 cm long, main branches up to 20 cm, ♀ ones up to 20 cm long, main branches up to 10 cm. *Bracts* concave. *Flowers* tomentose, ♂ (sub)sessile, 5 mm long, ♀ stalked, 6-7(-12) mm, often with a concave receptacle. *Stamens* free, glabrous. *Disk* glabrous, in ♂ flowers solid, rather variable in form and shape, sometimes with a style-like appendix; in ♀ flowers adnate to the receptacle but for the rim. *Ovary* glabrous, in ♂ flowers none. *Infructescences* broadly paniculate, up to c. 15 cm long, with up to c. 12 fruits; calyx flat, orbicular with undulate margin, 7-13 mm diam. *Fruits* ovoid, round to slightly trigonous in cross-section,  $3\frac{1}{2}$ -5 by  $1\frac{1}{2}$ -3 cm, glabrous; pyrene smooth with 3 blunt, white ribs near the base; lids c. 4 mm thick. *Seeds* 3-1; sterile cells not strongly reduced.

*Distr. Malaysia:* Kangean & Bawean Isl. (near E. Java), Lesser Sunda Islands (Flores, Timor, Wetar, Tanimbar), Celebes, Moluccas (Talaud, Morotai, Sula, Ceram, Banda, Aru). Fig. 35.

Possibly naturalized in some other parts of Malaysia, cultivated in tropical regions all over the world.

*Ecol.* Mainly in primary forests on limestone,

sometimes locally gregarious, *fl.* mainly March-June (Java: Aug.-Dec.), *fr.* mainly April-May.

*Wood anat.* DEN BERGER, Med. Proefst. Thee 97 (1926) 66 & Atlas pl. 11 fig. 44, Med. Proefst. Boschw. 13 (1926) 66 & Atlas ditto (*C. commune* L.) (hand lens); MOLL & JANSSONIUS, Mikr. Holzes 2 (1908) 108 (*C. commune* L.).

*Uses.* Planted as a shade-tree in nutmeg-plantations and as a roadside tree. The timber is rather soft and mainly used as firewood; in Bawean and Kangean it is also used for canoe-building; sometimes paddles are made out of the buttresses. The resin is not abundant and without importance. The seeds are highly estimated as a titbit, and are sometimes used as a substitute for almonds; the oil from the seeds is used as a substitute of coconut-oil. An emulsion of the seeds can be of importance as a baby-food (HEYNE, *l.c.*). For an analysis of the seed-oil see STEGER & VAN LOON, Rec. Trav. Chim. Pays-Bas 59 (1940) 168.

*Vern.* *Kanari*, M, *Java-almond*, E, *amand de Java*, Fr, *pokok kēncari*, *rata kukana*, Mal. Pen., *kanari pandjang*, Sumatra, *kituwak*, Java, S, *kaju kanari*, *kanalè*, *kanali*, Kangean, *kodja*, Flores, Timor, *knarje*, Tanimbar, *dèdi*, *kapur baru*, *rèri*,



Fig. 30. Adventitious roots in *Canarium vulgare* LEENH., older stage (Makasser, a. 1937).

(w) *ipalo*, Celebes, *naki*, Talaud, *hika*, (o) *niar(a)*, Morotai, *njha ambon*, *n. furu*, Ternate, *jal*, *jar*, Ambon.

Note. Closely related to *C. indicum* L. and for a long time not distinguished as a separate species; in consequence the synonymy of these two species is very complicated (see LEENHOUTS, Bull. Bish. Mus. *l.c.*).

15. *Canarium indicum* LINNÉ, Amoen. Acad. 4 (1759) 143; LEENH. Bull. Bish. Mus. no 216 (1955)

26, f. 12.—*C. vulgare prima et secunda species* RUMPH. Herb. Amb. 2 (1741) 145, t. 47 A–E.—*C. zephyrinum* RUMPH. Herb. Amb. 2 (1741) 151, t. 48; DUCHESNE, Rép. Pl. Utiles (1836) 289; BL. Mus. Bot. 1 (1850) 217; MIQ. Fl. Ind. Bat. 1, 2 (1859) 643; non F.-VILL. Nov. App. (1880) 40 (= *C. ovatum* ENGL.); ENGL. in DC. Mon. Phan. 4 (1883) 149; MERR. Int. Rumph. (1917) 304; HEYNE, Nutt. Pl. (1927) 879.—*C. commune* L. Mant. 1 (1767) 127, *pro maj. part., typo incl.*; Syst. Veg. ed. 13 (1774) 741; LAMK, Enc. Bot. 1 (1783) 598; L. Syst. Veg. ed. 14 (1784) 885; ed. 15 (1797) 928; KOEN. & SIMS, Ann. Bot. 1 (1805) 360; WILLD. Sp. Pl. 4, 2 (1805) 759, *incl. also var. β*; DC. Prod. 2 (1825) 79, *incl. also var. zephyrinum*; R. & S. Syst. 7, 1 (1829) 78, non 7, 2 (1830) 1622 (= *C. vulgare* LEENH.); non BLANCO, Fl. Filip. (1837) 791 (= *C. asperum* BENTH.); non F.-VILL. Nov. App. (1880) 40 (= *C. luzonicum* A. GRAY); MERR. Int. Rumph. (1917) 301; *see also under C. vulgare* LEENH.—*C. mehenbethe* GAERTN. Fruct. 2 (1791) 98, t. 102, *nom. illeg.*; MIQ. Fl. Ind. Bat. 1, 2 (1859) 643; ENGL. in DC. Mon. Phan. 4 (1883) 149; in E. & P. Pfl. Fam. 3, 4 (1896) f. 136 F–H; ed. 2, 19a (1931) f. 211 F–H; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 12–13; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931–32) t. 5 f. 13–14, t. 15 f. 122a; Bull. Jard. Bot. Btzg III, 12 (1932) 515; VAN HEURN & H. J. LAM, Blumea Suppl. 1 (1937) 97; C. T. WHITE, J. Arn. Arb. 31 (1950) 91.—*C. moluccanum* BL. Mus. Bot. 1 (1850) 216, *incl. also var. obtusatum*; K. & V. Bijdr. 4 (1896) 33, 313; Ic. Bog. 1 (1897) t. 9; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 22<sup>1</sup>, f. 28; BACK, Schooffl. (1911) 197; KOORD. Exk. Fl. Java 2 (1912) 433; LAUT. Bot. Jahrb. 56 (1920) 320, *incl. also var. palla* and *f. porphyropyrena*; HEYNE, Nutt. Pl. (1927) 873.—*C. subtruncatum* ENGL. in DC. Mon. Phan. 4 (1883) 109.—*C. amboinense* HOCHR. Pl. Bog. Exs. (1904) 55; Bull. Inst. Bot. Btzg no 22 (1905) 5; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 22<sup>2</sup>; HOCHR. Ann. Jard. Bot. Btzg Suppl. 3 (1910) 841; HEYNE, Nutt. Pl. (1927) 873.—*C. shortlandicum* RECHINGER, in Fedde, Rep. 11 (1912) 184.—*C. polyphyllum* (non K.SCH.) KRAUSE, Tropenpflanzer 17 (1913) 147.—*C. grandistipulatum* LAUT. Bot. Jahrb. 56 (1920) 321; LANE-POOLE, For. Res. (1925) 189.—*C. nungii* GUILLAUMIN, J. Arn. Arb. 12 (1931) 236.

*var. indicum*.—Fig. 21g & 31–34.

Tree up to 40 by 1 m, with buttresses. Branchlets 7–13 mm thick, glabrescent; pith with a peripheral cylinder of small vascular strands close to the inner side of the wood, central part with a second cylinder or some dispersed strands. Stipules persistent, inserted at the conjunction of branchlet and petiole—very rarely on the petiole up to 2 cm from its base—ovate to oblong, 1<sup>1</sup>/<sub>2</sub>–6 by 1<sup>1</sup>/<sub>4</sub>–4 cm, striate to reticulate, pulverulent to glabrous, often slightly cordate at base, margin coarsely to minutely fimbriate-dentate. Leaves 3–7-jugate, glabrous. Petiolules rather long (3/4–3 cm) and slender. Leaflets oblong-obovate to oblong-lanceolate, (5<sup>1</sup>/<sub>2</sub>–7)–28 by (2–)3<sup>1</sup>/<sub>2</sub>–11 cm, herbaceous



Fig. 31. *Canarium indicum* L. var. *indicum*. ♂ (Cult. Hort. Bog. II-M-G-88).

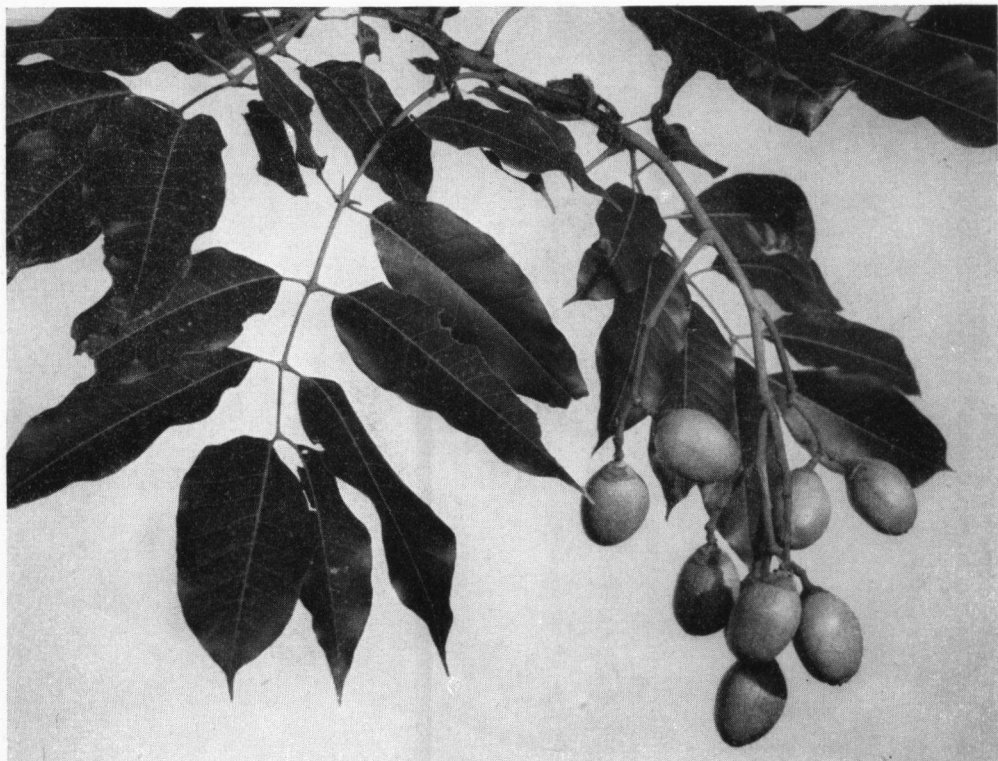


Fig. 32. *Canarium indicum* L. var. *indicum*. (Cult. Hort. Bog. II-M-G-88).

to coriaceous; base oblique, rounded to broadly cuneate; margin entire; apex gradually to sub-abruptly, bluntly acuminate; nerves (8-)10-15(-20) pairs (angle 85-55°, decreasing from base to apex), straight to faintly curved, faintly or not arching near the margin. *Inflorescences* terminal, broadly paniculate, 15-40 cm long, minutely tomentose, rather many-flowered; bracts concave, dentate at the apex, caducous. *Flowers* tomentose, ♂ ones subsessile, c. 1 cm long, ♀ ones shortly stalked, up to 1½ cm long, with a concave receptacle. *Calyx* in ♂ flowers 5-7 mm long, in ♀ ones 7-10 mm. *Stamens* glabrous, in ♂ flowers free, in ♀ flowers adnate to the disk. *Disk* in ♂ flowers cushion-shaped, 1 mm high, glabrous, in ♀ flowers adnate to the receptacle except the minutely pilose margin. *Pistil* in ♂ flowers minute to none, in ♀ glabrous. *Infructescences* large, with up to c. 30 fruits; calyx flat, orbicular, margin often ruptured, 1¾-2½ cm diam. *Fruits* ovoid, round to slightly triangular in cross-section, 3½-6 by (1½-)2-3 cm, glabrous; pyrene rounded triangular in cross-section, smooth except the 3 more or less acute ribs at base and apex; lids 3-4 mm thick. *Seeds* usually 1; sterile cells slightly reduced.

*Distr.* Solomon Islands, New Hebrides, New Britain, New Ireland, and *Malaysia*: N. Celebes

(very probably naturalized), Moluccas (Ternate, Sula, Ceram, Ambon, Kei), and New Guinea. Fig. 35. Often cultivated, specially in Melanesia.

*Ecol.* Rain-forests at low altitude, rarely up to c. 250 m; planted up to 600 m or more. *Fl.* mainly Oct.-Dec., *fr.* mainly July-Dec.

*Wood* anat. WEBBER, Lilloa 6 (1941) 450 (*C. mehenbethene* GAERTN.).

*Uses.* Mainly the same as in *C. vulgare* LEENH., though of less importance. In Melanesia the seeds apparently are highly estimated as a food and several races are cultivated, mainly varying in the form and shape of the fruits.

*Vern.* *Kanari ambon*, *k. boh*, *S. kanaren*, *J. kanari ternate*, Minah., *njiha ambon*, *n. furu*, *n. sidaga*, Ternate, *kanari pandjang*, Batjan, *jal, jar*, Ambon, *nanari*, Banda, *kanari bagéa*, *k. bésar*, *k. nēgri*, Moluccas, *baga*, *djaäto*, *galep*, *kanali*, *kubika*, *mahei*, *nawakara ai*, *tosar*, *totam*, *vo*, *wau*, N. Guinea, *a ngallip*, *baga*, *galapuar*, *galapuat*, *galip*, *garikoko*, *kalukalulu*, *lauele*, New Britain, *a ngarkok*, *hinuei* (♀), *h. annan* (♂), *h. palla*, *minuei*, New Ireland.

*Notes.* Closely related to and for a long time confused with *C. vulgare* LEENH., moreover related to *C. kaniense* LAUT. For an account of the complicated nomenclature see LEENH. *l.c.*



Fig. 33. *C. indicum* L. var. *indicum*. Left: ♂ flowers, one petal of single flower removed; right: ♀ flowers part of single flower cut away (Cult. Hort. Bog. respectively VI-D-4 and VI-B-65a).

var. *platycerioideum* LEENH. Blumea 8 (1955) 182.

Very coarse. Branchlets up to 2½ cm thick. Stipules sometimes only inserted on the base of the petiole, orbicular to obovate, 4–12 by 4–14 cm, subcoriaceous, glabrous, margin undulating, nervation lax, anastomosing (stipules resembling the basal leaves of *Platycerium*). Leaves 5–8 (or more?)-jugate, 80–135 cm long. Leaflets inequilateral, ovate, 25–35 by 13–16 cm. Flowers unknown.

Fruits 6 by 3½–4 cm.

Distr. *Malaysia*: NW. New Guinea (Vogelkop).

Ecol. Collected only at altitudes up to 30 m. Vern. *Anai, motarè, penies, sumgui*.

16. *Canarium kaniense* LAUT. Bot. Jahrb. 56 (1920) 322; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 15 f. 121; Bull. Jard. Bot. Btzg III, 12 (1932) 515, t. 13 f. 88.—*C. gawadaense* BAKER f. J. Bot. 61 (1923) Suppl. 7; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 13 f. 104n; Bull. Jard. Bot. Btzg III, 12 (1932) 527, t. 14 f. 91.—Fig. 1a–h.

var. *kaniense*.—Synonymy as above.

Tree up to 40 m by 75 cm, sometimes with buttresses. Branchlets ½–1 cm thick, glabrescent; pith with one or two concentric cylinders of vascular strands. Stipules subsistent, inserted either on the branchlet or on the petiole, elliptic to obovate, 1–3 by ½–2 cm, subcoriaceous, minutely pubescent to glabrous, margin repeatedly and more or less deeply dentate to slightly fimbriate, nervation coarse, anastomosing. Leaves 3–5(–6)-jugate, glabrous. Leaflets ovate to elliptic, 8–12 by 3½–7 cm, chartaceous to subcoriaceous; base slightly oblique, broadly cuneate to rounded; margin entire; apex gradually to subabruptly, shortly to rather long (up to 15 × 3 mm), blunt-acuminate; nerves 9–15 pairs (angle 50–80°), straight to faintly curved, sometimes arching near the margin. Inflorescences (♀ unknown) terminal and in the upper leaf-axils, narrowly paniculate, c. 30 cm long, densely tomentose, main branches up to c. 9 cm; flowers in glomerules; bracts like the stipules, though smaller and less deeply fimbriate. Flowers (♀ unknown) subsessile, 7 mm long, pubescent. Calyx 5 mm. Stamens glabrous, slightly adnate to the disk. Disk annular, 1–2 mm high, thinly pilose. Pistil columnar, 1½ mm high,



Fig. 34. *Canarium indicum* L. var. *indicum*. ♀ (Cult. Hort. Bog. VI-B-83).

glabrous. *Infructescences* terminal, narrowly paniculate, 25–30 cm long, thinly pilose, with 5–6 fruits; calyx flat, orbicular, 1½–2 cm diam., with remnants of an annular disk and of free stamens. *Fruits* ovoid, deltoid in cross-section, 5–6 by 3–4 cm, glabrous; pericarp fleshy; pyrene smooth, triangular, with hollow sides, sometimes with acute angle-ribs and/or faint median ribs; lids 2–5 mm thick. *Seeds* 1(–2); sterile cells slightly reduced.

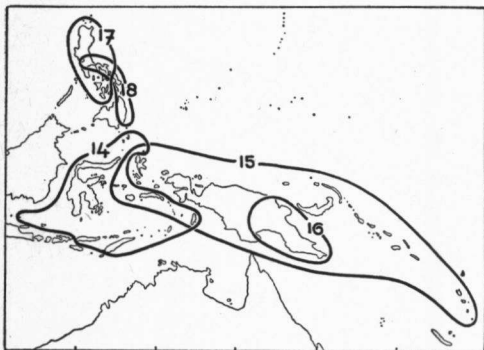


Fig. 35. Distribution of: 14. *C. vulgare* LEENH., 15. *C. indicum* L., 16. *C. kaniense* LAUT., 17. *C. luzonicum* (BL.) A. GRAY, 18. *C. ovatum* ENGL.

Distr. *Malaysia*: E. New Guinea. Fig. 35.

Ecol. In forests at (25–)1000–2000 m alt., fl. Dec., fr. Jan.–March.

Uses. The oily seeds are eaten.

Vern. *Piu*, Waigani, *usasi*, Upper Waria.

Note. Related to *C. indicum* L.; differing by its stipules and fruits.

*var. globigerum* LEENH. *Blumea* 8 (1955) 182.—Fig. 21a–c, 22h.

Stipules 3½–8 by 2–4 cm, the dentate margin densely fimbriate, segments subulate and branched, up to 2 cm. Leaves 4–6-jugate. Leaflets ovate to oblong, mostly 15–25 by 9 cm; abruptly caudate-acuminate, acumens up to 30 by 1 mm; nerves 12–18 pairs. Fruits globular, c. 5 cm diam.; epicarp egg-shell-like, pericarp somewhat fibrous; pyrene acutely 3-winged, specially in the lower half, lids slightly concave with a faint median rib; lids 1½ mm thick.

Distr. and ecol. Like *var. kaniense*.

Vern. *Utèti*, Orokaiva.

Note. Sharply defined only by its fruit-characters. As both varieties are very inadequately known, their status is still uncertain.

17. *Canarium luzonicum* (BL.) A. GRAY, Wilkes Exp. Bot. (1854) 374; MIQ. Fl. Ind. Bat. 1, 2 (1859) 651; ENGL. in DC. Mon. Phan. 4 (1883) 150; MERR. Publ. Gov. Lab. Philip. no 27 (1905) 30; no 29 (1905) 53; GUILLAUMIN, Bull. Soc. Bot. Fr. 55 (1908) 616, t. 19 f. 2; MERR. Philip. J. Sc. 3 (1908) Bot. 80; WHITFORD, Bull. For. Bur. Philip. 10<sup>1</sup> (1911) 56; MERR. Sp. Blanc. (1918) 207; W. H.

BROWN, Min. Prod. Philip. For. 2 (1921) 40, 300, f. 11; MERR. En. Philip. 2 (1923) 351; H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) t. 11 f. 56; Bull. Jard. Bot. Btzig III, 12 (1932) 532; BURK. Dict. (1935) 430; MANALO & WEST, Philip. J. Sc. 78 (1950) 111; QUIS. Med. Pl. Philip. (1951) 475.—*C. album* (non DC.) BLANCO, Fl. Filip. (1837) 793; ed. 2 (1845) 546; ed. 3, 3 (1879) 201; MERR. Publ. Gov. Lab. Philip. no 27 (1905) 30.—*Pimela luzonica* BL. Mus. Bot. 1 (1850) 220.—*C. commune* (non L.) F.-VILL. Nov. App. (1880) 40.—*C. triandrum* ENGL. in DC. Mon. Phan. 4 (1883) 145, t. 3 f. 19–22; JADIN, Contr. Téréb. (1894) t. 15 f. 9A.—*C. polyanthum* PERK. Fragm. Fl. Philip. 1 (1904) 95.—*C. carapifolium* PERK. Fragm. Fl. Philip. 1 (1904) 91.—*C. oliganthum* MERR. Philip. J. Sc. 10 (1915) Bot. 23; H. J. LAM, Bull. Jard. Bot. Btzig III, 12 (1932) 534.

Tree up to 35 m by 1 m or more. *Branchlets* 4–6(–8) mm thick, glabrescent, lenticellate; pith with many peripherally arranged vascular strands. *Stipules* caducous to subsistent, inserted on the base of the petiole (up to 5 mm from the branchlet), orbicular, c. 8 mm diam., pubescent. *Leaves* 3–5-jugate, glabrous. *Leaflets* lanceolate to oblong, 6½–25 by 3½–8½ cm, subcoriaceous; base equilateral, broadly cuneate to cordate; margin entire; apex gradually, long and broadly, blunt-acuminate; nerves 14–18 pairs (angle c. 65°), straight to slightly curved, gradually to subabruptly arching at some distance from the margin. *Infructescences* axillary, together pseudoterminal, paniculate, glabrescent, ♂ ones 10–25 cm long, ♀ ones 5–18 cm; main branches up to 4½ cm long, in ♂ ones many-flowered, in ♀ ones 3–5-flowered. *Flowers* subsessile, pubescent, ♂ 2½–4 mm long; ♀ 6–8 mm, with a concave receptacle. *Calyx* ♂ 1½ mm high, ♀ 5 mm. *Stamens* glabrous, ♂ 6–3, free, ♀ 6, slightly connate at the base. *Disk* ♂ cushion-shaped, flat, solid, ⅓ mm high, densely tomentose; ♀ adnate to the receptacle, with a free rim, glabrous. *Pistil* ♂ none, ♀ pilose. *Infructescences* 4–10 cm long, glabrous, with 1–4 fruits; calyx flat, bluntly triangular, 10–12 mm diam. *Fruits* shortly ovoid to ellipsoid, round to bluntly triangular in cross-section, 2½–3¾ by 1½–2 cm, glabrous; pyrene smooth; lids c. 2½ mm thick. *Seeds* 1(–2); sterile cells small.

Distr. *Malaysia*: Philippines (Mindoro, Luzon, Alabat Isl., Masbate, Ticao Isl., Bohol). Fig. 35.

Ecol. Common in primary forests at low and medium altitudes. Fl. (Apr.–)Aug.–Sept.(–Oct.), fr. (Aug.–)Jan.–Febr.(–May).

Wood anat. REYES, Dep. Agr. & Comm. Manila, Techn. Bull. 7 (1938) 161 (hand lens).

Uses. The timber, which is not very hard, is sometimes used. This tree is the principal source of *manila-elemi* (see BROWN, *op. cit.* 40; VALENZUELA *et al.*, Philip. J. For. 6, 1949, 54; MANALO & WEST, *l.c.*; QUIS. *l.c.*). The seeds are eaten as *pili nuts*, though the main source of these is *C. ovatum* ENGL.

Vern. *Alaagi*, *alanki*, *ananggū*, *anteng*, *bakoog*, *ilk*, *antang*, *ibn*, *bakan*, *Ting*, *belis*, *pilauai*, *pisa*, *sahing*, *tugtugin*, *Tag*, *bulau*, *Pang*, *malapili*, *Bik*.

*pagsahiñgin*, *pagsainguin*, Rizal, *palsahiñgin*, Laguna, *pili*. The resin is known as *brea blanca* or *manila-elemi*; the fruits: *Chinese olives* or *pili nuts*.

18. *Canarium ovatum* ENGL. in DC. Mon. Phan. 4 (1883) 110; W. H. BROWN, Min. Prod. Philip. For. 2 (1921) 114, 300, f. 40; MERR. En. Philip. 2 (1923) 352; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 88, t. 15 f. 120b; Bull. Jard. Bot. Btzg III, 12 (1932) 533; BURK. Dict. (1935) 431; QUIS. Med. Pl. Philip. (1951) 476, 1036.—*C. pachyphyllum* PERK. Fragm. Fl. Philip. 1 (1904) 94.—*C. melioides* ELM. Leaf. Philip. Bot. 3 (1911) 1079; MERR. En. Philip. 2 (1923) 351.—Fig. 22f.

Tree up to 20 m by 50 cm. *Branchlets* 6–12 mm thick, glabrous, lenticellate; pith with many small vascular strands appressed to the wood. *Stipules* persistent, inserted on the petiole up to 6 mm from its base, deltoid to linguulate, 5–20 by 3–10 mm, acute, stiff-chartaceous, glabrescent. *Leaves* 2–4-jugate, glabrous. *Leaflets* ovate to elliptic, 4–24 by 2–12 cm, stiff-coriaceous; base oblique, (cuneate to) rounded to subcordate; margin entire; apex (rather) abruptly acuminate, acumen cuneate to long and slender, blunt; nerves 8–12 pairs (angle 60–90°), straight to faintly curved, rather abruptly or gradually arching at some distance from the margin. *Inflorescences* axillary, close together at the ends of the branches, narrowly paniculate to nearly racemose, 3–12 cm long, glabrescent, few-flowered; main branches decussate, up to 2½ cm, with up to 5 flowers. *Bracts* concave. *Flowers* (sub)sessile, pubescent, up to 12 mm long, ♀ ones with a slightly concave receptacle. *Calyx* ♂ 7 mm high; ♀ 8–9 mm. *Stamens* 6, glabrous, ♂ slightly adnate to the disk, ♀ inserted on the rim of the disk. *Disk* ♂ cylindrical, 3–3½ mm high, solid, densely tomentose, rim 6-lobed; ♀ adnate to the receptacle, with 6-lobed rim, glabrous. *Pistil* ♂ none, ♀ glabrous. *Infructescences* 3–9 cm long, with 1(–2) fruit(s); calyx flat, orbicular, 1¾–2 cm diam. *Fruits* ovoid to ellipsoid, acute, triangular in cross-section, 3½–6¼ by 2–2¾ cm, glabrous; pyrene triangular in cross-section, the sides slightly furrowed, angle-ribs rounded except at the acute base and apex; lids 1½–2 mm thick. *Seed* 1; sterile cells strongly reduced.

Distr. *Malaysia*: Philippines (S. Luzon, Polillo, Samar, Leyte, Mindanao). Fig. 35. Sometimes cultivated, also in other parts of Malaysia and in Micronesia and Melanesia.

Ecol. Primary forests, up to 500 m. Fl. May–July, fr. Oct.–Dec.(–June).

Uses. One of the sources of *manila-elemi* (together with *C. luzonicum* A. GRAY) and the main source of *pili nuts*, which are used as almonds, and of *pilinut oil* (BROWN, l.c.; BURK. l.c.; QUIS. l.c.) and *pili-pulp oil* (L. T. MARAÑON et al., Philip. J. Sc. 83, 1955, 359).

Vern. Ananggi, Sorsogon, *basidd*, *liputi*, (*pili*)-*pilau*, Tayabas, (*ogat*)-*biauan*, Bagobos, *ogot*, Mindanao, *pilau*, Polillo, *pili*.

19. *Canarium odontophyllum* MIQ. Sum. (1861) 525; Ann. Mus. Bot. Lugd. Bat. 4 (1869) 117;

ENGL. in DC. Mon. Phan. 4 (1883) 108; H. J. LAM in Merr. Pl. Elm. Born. (1929) 118; Ann. Jard. Bot. Btzg 42 (1932) t. 15 f. 122b; Bull. Jard. Bot. Btzg III, 12 (1932) 519, t. 14 f. 89.—*C. beccaril* ENGL. in DC. Mon. Phan. 4 (1883) 107.—*C. palawanense* ELM. Leaf. Philip. Bot. 5 (1913) 1754.—*C. multifidum* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 215, t. 15 f. 122c; Bull. Jard. Bot. Btzg III, 12 (1932) 520.—Fig. 22i.

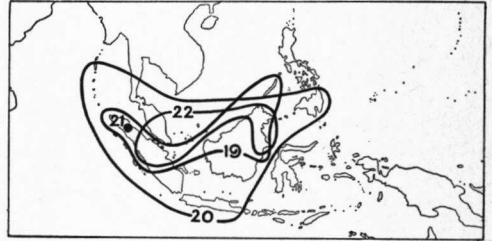


Fig. 36. Distribution of *Canarium denticulatum* BL. and allies: 19. *C. odontophyllum* MIQ., 20. *C. denticulatum* BL., 21. *C. karoense* H. J. LAM, 22. *C. megalanthum* MERR.

Tree up to 35 m by 50 cm, with buttresses. *Branchlets* ¾–3 cm thick, densely rusty tomentose, often glabrescent; pith with a peripheral cylinder of many small vascular strands. *Stipules* persistent, inserted near or on the base of the petiole, orbicular and dentate to oblong and repeatedly slit into 2–4 cm long lobes, specially at the base and apex, 2–9 by 1½–3½ cm, minutely tomentose, subglabrescent, nervation coarse, anastomosing. *Leaves* 3–8-jugate. *Leaflets* oblong to lanceolate, 15–40 by 5–10 cm, coriaceous, sparsely pilose to densely tomentose beneath and on the midrib above; base subequilateral, broadly cuneate to subcordate; margin dentate to serrate; apex abruptly, short and slender, acute-acuminate; nervation slightly sunken above, strongly prominent beneath; nerves 15–28 pairs (angle 55–65–90°), straight to faintly curved, gradually curving towards the margin, rarely distinctly arching; intermediate veins often strongly developed. *Inflorescences* axillary, together pseudoterminal (sometimes truly terminal?), laxly paniculate, densely tomentose, ♂ ones 30–50 cm long, many-flowered, ♀ ones 15–20 cm long and with few flowers. *Bracts* often persistent, gradually passing into the stipules. *Flowers* pubescent outside, ♂ 4–7 mm long, ♀ 8–9 mm, with a slightly concave receptacle. *Calyx* 3-parted, ♂ 2½–4½ mm high, ♀ 8 mm. *Stamens* glabrous, ♂ adnate to the disk, ♀ inserted on the rim of it. *Disk* glabrous, ♂ circular, flat, slightly concave in the center, 6-lobed, ¼–1 mm high; ♀ adnate to the receptacle, rim 1 mm high, faintly 6-lobed. *Pistil* ♂ strongly reduced to none, ♀ glabrous. *Infructescences* mostly broadly paniculate, 20–35 cm long, densely tomentose, with up to 40 fruits; calyx saucer-shaped, triangular, c. 1½ cm diam. *Fruits* ovoid to ellipsoid, rounded triangular in cross-section,

2<sup>1</sup>/<sub>2</sub>-3<sup>1</sup>/<sub>2</sub> by 1<sup>3</sup>/<sub>4</sub>-2 cm, glabrous; pyrene smooth, faintly 3-ribbed; lids 1<sup>1</sup>/<sub>2</sub>-2<sup>1</sup>/<sub>2</sub> mm thick, bony. Seed 1; sterile cells more or less reduced.

Distr. *Malaysia*: Sumatra, Borneo, Philippines (Palawan). Fig. 36.

Ecol. In primary forests, up to 450 m. *Fl.* March-April and Sept.-Oct., *fr.* May-Nov.

Uses. Wood rather soft and of little use. Seeds edible.

Vern. *Danau madjang, kadjay, Sum., bundui bundui, dabai, dabang, dabu, dawai, kambajau (këmbajau, kumbajau), kurihang, Borneo.*

Notes. Related to *C. denticulatum* BL. Specimens from N. and E. Borneo usually possess large and deeply incised stipules, thinner and less pilose leaves with less prominent venation.

20. *Canarium denticulatum* BL. Bijdr. (1826) 1162; R. & S. Syst. 7, 2 (1830) 1623; BL. Mus. Bot. 1 (1850) 217, *incl.* also *var. latifolia*; MIQ. Fl. Ind. Bat. 1, 2 (1859) 644; ENGL. in DC. Mon. Phan. 4 (1883) 136; K. & V. Bijdr. 4 (1896) 39; BACK. Schoolfl. (1911) 197; KOORD. Exk. Fl. Java 2 (1912) 434; RIDL. Fl. Mal. Pen. 1 (1922) 374; HEYNE, Nutt. Pl. (1927) 876; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 13 f. 104a, t. 15 f. 123 a & c; Bull. Jard. Bot. Btzg III, 12 (1932) 521, t. 14 f. 90; in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 6.—*C. sylvestre* (non GAERTN.) BL. Mus. Bot. 1 (1850) 217; MIQ. Fl. Ind. Bat. 1, 2 (1859) 644; Sum. (1861) 205; ENGL. in DC. Mon. Phan. 4 (1883) 114.—*C. fissistipulum* MIQ. Sum. (1861) 525; ENGL. in DC. Mon. Phan. 4 (1883) 115; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 70, t. 15 f. 123b; Bull. Jard. Bot. Btzg III, 12 (1932) 524.—*C. spectabile* MIQ. Ann. Mus. Bot. Lugd. Bat. 4 (1869) 116; ENGL. in DC. Mon. Phan. 4 (1883) 147.—*C. coccineo-bracteatum* KURZ, J. As. Soc. Beng. 41, ii (1872) 296.—*C. fuscum* ENGL. in DC. Mon. Phan. 4 (1883) 116; K. & V. Bijdr. 4 (1896) 47; ROBINSON, Philip. J. Sc. 3 (1908) Bot. 185; BACK. Schoolfl. (1911) 197; KOORD. Exk. Fl. Java 2 (1912) 434.—*C. manii* KING, J. As. Soc. Beng. 62, ii (1894) 247.—*C. kunstleri* KING, J. As. Soc. Beng. 62, ii (1894) 248.—*C. laciniatum* ELM. Leaf. Philip. Bot. 3 (1911) 1084; MERR. En. Philip. 2 (1923) 350.—Fig. 21j, 22k.

Note. *C. denticulatum* is related to both *C. odontophyllum* MIQ. and probably to *C. karoense* H. J. LAM.

*ssp. denticulatum*.—Fig. 37.

Tree 20-30(-50) m by 40-80 cm, sometimes with low buttresses, rarely a shrub. *Branchlets* 4-8 mm thick, minutely tomentose, usually glabrescent; pith with many small vascular strands, arranged into 1 or 2 peripheral cylinders. *Stipules* persistent, inserted on the petiole, (0-)-3-6 mm from the base, curved, pectinate to dendriform, the lobes lacinate to subulate, base narrow, (1<sup>1</sup>/<sub>2</sub>-)1-2<sup>1</sup>/<sub>2</sub>(-4) by 3<sup>1</sup>/<sub>4</sub>-1<sup>1</sup>/<sub>2</sub> cm, minutely tomentose. *Leaves* 2-6-jugate, 30-45 cm long, *glabrous*. *Leaflets* inequilateral, ovate to lanceolate, (5-)-12-20 by 2-15 cm, coriaceous, glabrous (rarely sparsely pilose); base oblique, rounded; margin entire to sparsely

dentate towards the apex (rarely totally dentate); apex subabruptly, long acute-acuminate; nerves (9-)-11-17(-21) pairs (angle variable, 65-85°), faintly curved, gradually to abruptly distinctly arching at some distance from the margin, moderately prominent beneath. *Inflorescences* axillary, together pseudoterminal (rarely truly terminal), laxly and narrowly paniculate, 15-25 cm long, densely rusty tomentose, main branches up to 5 cm, ♂ with many clustered flowers, ♀ with 5-7 flowers. *Bracts* gradually passing into the stipules. *Flowers* densely pubescent, ♂ 4<sup>1</sup>/<sub>2</sub> mm long, ♀ 7 mm with a slightly concave receptacle. *Calyx* ♂ 4 mm high, ♀ 5 mm. *Stamens* glabrous, ♂ adnate to the disk, ♀ inserted on the disk. *Disk* glabrous, ♂ annular, 12-lobed, 3<sup>1</sup>/<sub>4</sub> mm high, fleshy; ♀ adnate to the receptacle, free rim 1<sup>1</sup>/<sub>2</sub> mm high. *Pistil* glabrous, in ♂ flowers 1<sup>1</sup>/<sub>4</sub>-1<sup>1</sup>/<sub>2</sub> mm high. *Infructescences* up to 20 cm long, densely tomentose, with 2-10 fruits; calyx broadly funnel-shaped, triangular, 12-14 mm diam. *Fruits* ellipsoid, faintly triangular in cross-section, 2<sup>1</sup>/<sub>2</sub>-3 by 1<sup>1</sup>/<sub>4</sub>-1<sup>1</sup>/<sub>2</sub> cm, glabrous; pyrene smooth; lids 1-1<sup>1</sup>/<sub>2</sub> mm thick, bony. *Seeds* (3-)-1; sterile cells strongly reduced, often without lumen.

Distr. S. Andamans, S. Burma, and *Malaysia*: Sumatra (also Simalur), Malay Peninsula (Perak), Java (E to Mt Wilis), Borneo, Philippines (Basilan, Mindanao). Fig. 36.

Ecol. Rain-forests at low altitudes, up to 700 m. *Fl.* Sum. mainly July-Sept., Mal. Pen. March.-July, Java June-Oct., Philip. April and Sept.-Oct., *fr.* Sum. mainly July-Sept., Mal. Pen. Jan., Java Sept.-Nov., Philip. May-July.

Wood anat. MOLL & JANS. Mikr. 2 (1908) 107.

Vern. *Andalhe, asëm, a. anda, a. damar, bëka, damar mërasam, d. gota, madang rabung, mawah, mëdang, rësung, tandikeh, tjintjin memal, Sumatra, bangkiring bala(h) (ujul), b. uding, ganggo uding, silaora (delok), s. pajo, Simular, sudur bajan, Banka, kanari alas, ki-solok, ki-tuak, maranginang, pisitatan laju, S, këdojo, kënarèn, ra(h)u (wulan), sadijeng, wuloh bëras, J, kanari utan, k. wana, langseb alas, Java, adal, alab-alab, bangkulat, djëlalal gunung, indalus, kambayan, kayamuk, këlamoh, kuningam, lambuakat, madamsat, pënanasan borong, pinayasan, pininasan, talangsai, Borneo; Philippines: kalisan, Mbo, lancha-lancha, Sul., lankangan, Lam., ogat, Bag., kaju noach.*

*ssp. kostermansii* LEENH. Blumea 8 (1955) 181.

The main differences with *ssp. denticulatum* are: More slender tree, 12-20 m by 30 cm. All parts long remaining ferruginous-pubescent. Leaves 2-4-jugate. Leaflets stiff-herbaceous, *densely pubescent beneath* and on the midrib above, *more or less glabrescent*; base nearly equilateral, sometimes broadly cuneate; margin entirely densely serrate (to dentate); apex more gradually, rather short- and slender-acuminate; nerves (14-)-18-20 pairs, less distinctly arching. *Inflorescences* up to 35 cm long, more lax and with more flowers; main branches ♂ up to 15 cm, repeatedly branched, ♀ up to 8 cm, with up to 12 flowers. *Fruits* possibly slightly smaller (ripe fruits unknown).





Fig. 37. *C. denticulatum* BL. a. Twig with ♂ flowers, b. ♂ flower, c. ditto, in section, d. section of ♀ flower, e. stamens and disk in ♀ flower ( $a \times \frac{1}{2}$ ,  $b-d \times 5$ ,  $e \times 7$ ).

Distr. *Malaysia*: Borneo (E. Kutei: Sangkulirang).

Ecol. *Fl.* June–July, *fr.* Nov.

Vern. *Damar lilin*.

21. *Canarium karoense* H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 215, t. 15 f. 120a; Bull. Jard. Bot. Btzig III, 12 (1932) 514, t. 13 f. 87.

Tree. *Branchlets* c. 1 cm thick, minutely tomentose, glabrescent; pith with a number of peripherally arranged small vascular strands. *Stipules* persistent, inserted partly or entirely on the base of the petiole, ovate to lanceolate, coarsely pectinate, 1½–5 by 1½–3 cm, subcoriaceous, glabrous, lobes blunt, nervation anastomosing. *Leaves* 4–7-jugate, glabrescent. *Leaflets* ovate to oblong, 8–22 by 4–8 cm, subcoriaceous, glabrous; base broadly cuneate to rounded; margin entire; apex subabruptly, short- and blunt-acuminate; nerves 10–15 pairs (angle 55–70°), curving, not distinctly arching. *Inflorescences* (♂ unknown) axillary, narrowly paniculate to racemose, 5–9 cm long, tomentose. *Flowers* unknown. *Calyx* in very young fruits 12 mm high, tomentose. *Stamens* and *disk* unknown. *Pistil* glabrous, stalked. *Infructescences* and *fruits* unknown.

Distr. *Malaysia*: N. Sumatra (Karo Distr.), once collected. Fig. 36.

Ecol. Frequent in old forests, altitude unknown. *Fl.* Nov.–Dec.

Vern. *Banga kĕrah*.

Note. Possibly conspecific with *C. megalanthum* MERR.

22. *Canarium megalanthum* MERR. Philip. J. Sc. 30 (1926) 81; H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) t. 11 f. 68, t. 16 f. 127d1; Bull. Jard. Bot. Btzig III, 12 (1932) 446, t. 9 f. 55.—Fig. 22j.

Tree up to 40 m by 60–70 cm, without buttresses. *Branchlets* ½–1 cm diam., rusty-tomentose; pith with a peripheral cylinder of scattered vascular strands. *Stipules* subpersistent, inserted on the petiole at ¼–¾(–3) cm from its base, 6–8 by 10–20 mm, deeply 3–4-lobed, stiff, densely and minutely fulvous-tomentose. *Leaves* (3–)4–5-jugate. *Leaflets* obovate, lanceolate or oblong, 9–20 by 4½–8½ cm, coriaceous, glabrescent; base oblique, cuneate to cordate; margin entire; apex gradually to abruptly, shortly and slenderly acute-acuminate; nerves (10–)13–19 pairs (angle 60–70°), faintly curved, abruptly, usually distinctly, arching close to the margin. *Inflorescences* pseudoterminal to terminal, terminal ones broadly and laxly paniculate, 25 cm long (♀), main branches up to 9 cm, with few flowers; pseudoterminal ones narrowly paniculate, 25–30 cm long (♂), main branches 6–11 cm, paniculate, c. 10-flowered; minutely tomentose. *Flowers* pubescent, ♂ 11 mm, ♀ 13–15 mm. *Calyx* broadly cupular, ♂ 7 mm, ♀ 9 mm. *Corolla* ♀ pubescent at both sides, ♂ inside glabrous. *Stamens* adnate to the disk, filaments glabrous. *Disk* glabrous, ♂ saucer-shaped, 1 mm high, rim undulate; ♀ cupular, 2½–3 mm high, truncate. *Pistil* long-pilose; ♂ none. *Infructescences* c. 25 cm long, sparsely tomentose, with 4–5 fruits;

calyx saucer-shaped, 3-lobed, 2–2½ cm diam. *Fruits* ellipsoid, sometimes acute, bluntly triangular in cross-section, 5–5½ by 3½–4 cm, sparsely, near the apex densely, ferruginously tomentose; pyrene smooth with 3, blunt to acute, angle-ribs, specially near the apex; lids 1–2 mm thick. *Seed* 1, spindle-shaped, acuminate at base, 4 by 1½ cm; fertile cell in cross-section circular, 1½ cm diam., sterile cells strongly reduced, without lumen.

Distr. *Malaysia*: Sumatra, Malay Peninsula, Borneo. Fig. 36.

Ecol. Rain-forests, up to 360 m. *Fl.* Sum.: Aug., Borneo: March, *fr.* May–July.

Uses. The wood is said to be hard. In Brunei this species is cultivated for its edible seeds which are among the largest of this genus. The resin is said to be abundant.

Vern. *Kamatoa*, *m(ĕ)ritus*, *rarawa damar*, Borneo.

Note. A rather remarkable species, without any doubt related to *C. denticulatum* BL., and possibly conspecific with the insufficiently known *C. karoense* H. J. LAM.

23. *Canarium pseudopatentinervium* H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 214, t. 13 f. 104e; Bull. Jard. Bot. Btzig III, 12 (1932) 490, t. 12 f. 77.—Fig. 2h.

Tree 20–38 m by 20–60 cm. *Branchlets* c. ¾ cm diam., glabrescent; pith with many peripherally arranged small vascular strands and often with a central cavity. *Stipules* none. *Leaves* 1–2(–4)-jugate, glabrescent. *Leaflets* ovate to elliptic, rarely oblong, 5–12½ by 2¼–7 cm, rigid, (sub)glabrous; base rounded (to broadly cuneate); margin entire; apex short-blunt-acuminate; nerves 7–14 pairs (angle 70–80°), faintly curved, not distinctly arching. *Inflorescences* (♂ unknown) terminal, paniculate, 8–15 cm long, densely

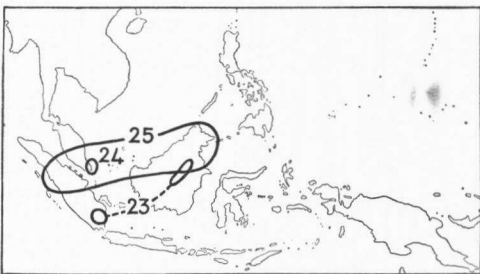


Fig. 38. Distribution of: 23. *C. pseudopatentinervium* H. J. LAM, 24. *C. grandifolium* (RIDL.) H. J. LAM, 25. *C. apertum* H. J. LAM.

tomentose, main branches up to 4 cm, racemose, with 10–15 flowers. *Bracts* subulate. *Flowers* (♂ unknown) subsessile, densely tomentose, buds 7 mm long. *Petals* distinctly unguiculate, apex incrassate-inflexed. *Stamens* free, glabrous. *Disk* adnate to the slightly concave receptacle, free rim 1 mm high, 6-lobed, the whole disk except for the outer base of the rim long-pilose. *Pistil*

densely pubescent. *Infructescences* c. 7 cm long, with 1 fruit; calyx flat, 3-lobed, c. 2 cm diam. *Fruits* ellipsoid, circular to rounded-triangular in cross-section, 5–7 by 2–3 cm, glabrous; pyrene truncate-triangular in cross-section with hollow sides, smooth or with a faint median rib on the lids, acutely angular and acute at both ends; lids 3–4 mm thick. *Seeds* 1(–2); sterile cells moderately reduced.

Distr. *Malaysia*: S. Sumatra, Banka, Borneo. Fig. 38.

Ecol. Primary forests, up to 700 m. *Fl.* March–April, *fr.* July and Oct.

Vern. *Tetak tundjuk*, Sumatra, *asam-asam*, Banka, *batu putih*, *engai*, *kélimah manuk*, *ukut*, Borneo.

Note. Closely related to *C. apertum* H. J. LAM and to *C. grandifolium* H. J. LAM, the only other species with unguiculate petals.

**24. *Canarium grandifolium* (RIDL.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 215; Bull. Jard. Bot. Btzg III, 12 (1932) 527.—*Trigonochlamys grandifolia* RIDL. J. Str. Br. R. As. Soc. no 54 (1910) 31; Fl. Mal. Pen. I (1922) 381.—Fig. 20a.**

Tree 35 m by 60 cm. *Branchlets*  $1/2$ – $3/4$  cm diam., densely fulvous-tomentose when young; pith dark-brown, hard, with peripherally arranged small vascular strands. *Stipules* none. *Leaves* 2–3-jugate, 25–40 cm long. *Leaflets* elliptic, 10–17 by 5–8 cm, stiff-chartaceous to coriaceous, densely tomentose beneath and on the midrib above, nervation prominent beneath; base slightly oblique, broadly cuneate to rounded; margin revolute, minutely fimbriate-serrate to entire; apex rather abruptly short-acute-acuminate; nerves 10–14 pairs (angle 65–75°), faintly curved, sometimes arching close to the margin. *Inflorescences* terminal, densely ferruginously tomentose, ♂ paniculate, c. 18 cm long, flowers clustered, ♀ racemose to spicate, 6–10 cm long, with c. 12–15 flowers. *Bracts* subulate. *Flowers* pubescent, ♂ 13 mm, ♀ 15 mm with a slightly concave receptacle. *Calyx* ♂ 11 mm, ♀ 15 mm. *Petals* unguiculate, apex inflexed-acuminate, incrassate. *Stamens* free, glabrous. *Disk* ♂ cupular, 1 mm high, densely erect-pilose, ♀ densely pubescent, adnate to the receptacle, free rim 1 mm. *Pistil* not stalked, densely woolly pubescent; ♂ none. *Infructescences* and *fruits* unknown.

Distr. *Malaysia*: Malay Peninsula (Johore, Singapore), apparently rare. Fig. 38.

Ecol. *Fl.* Febr.

Note. Closely related to *C. apertum* H. J. LAM.

**25. *Canarium apertum* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 214, t. 5 f. 6; Bull. Jard. Bot. Btzg III, 12 (1932) 491, t. 12 f. 78; BUCKLEY, Mal. For. Rec. no 11 (1932) 36; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 8, cum fig.—*Santiria serrulata* ENGL. in DC. Mon. Phan. 4 (1883) 160, non *C. serrulatum* MIQ. 1859.**

Tree 25–30(–43) m by 40–100 cm. *Branchlets*  $1/2$ – $3/4$  cm diam., sparsely tomentose or glabrescent; pith dark-brown, hard, with a peripheral scleren-

chymatic cylinder (vascular strands usually invisible). *Stipules* none. *Leaves* 2–7-jugate. *Leaflets* oblong-elliptic to ovate, 4–13(–15 $1/2$ ) by 2–5(–9) cm, rigid, subcoriaceous, subglabrous to more or less pubescent, specially on the prominent nerves beneath; base nearly equilateral, rounded to subcordate; margin often revolute, fimbriate, serrate (rarely dentate or repandous) to entire; apex acute to rounded, rarely emarginate; nerves 11–16(–18) pairs (angle c. 65°), straight or more or less irregularly curved, sometimes arching close to the margin. *Inflorescences* (♀ unknown) terminal, broadly paniculate, 10–30 cm long, densely rusty pubescent, main branches up to 13 $1/2$  cm, broadly paniculate, many-flowered. *Bracts* subulate. *Flowers* (♀ unknown) c. 1 cm long, pubescent. *Calyx* 8–9 mm. *Petals* unguiculate, apex inflexed-acuminate, incrassate. *Stamens* free, glabrous. *Disk* cup-shaped, 1 mm high, densely erect-pilose. *Pistil* none. *Infructescences* terminal and sometimes in the upper leaf-axils, 6–8 cm long, rusty tomentose to glabrous, with 1 fruit; calyx saucer-shaped to cupular, deeply 3-lobed, 12–15 mm diam., with the remains of 6 stamens and a 1–2 mm high, faintly 6-lobed, rusty long-pilose disk. *Fruits* ovoid, acuminate, circular in cross-section, 4–5 by 2–2 $3/4$  cm, fulvously tomentose, specially near the base and apex; pyrene rounded in cross-section, angle-ribs blunt, lids with a faint median rib each; lids up to 7 mm thick, very hard. *Seeds* 1(–2); sterile cells nearly invisible.

Distr. *Malaysia*: Sumatra, Malay Peninsula, Borneo. Fig. 38.

Ecol. Primary forests up to 200(–500) m. *Fl.* Febr. (Mal. Pen.), May–June (Borneo); *fr.* May (Mal. Pen.), Aug. (Borneo), Nov. (Sum.).

Wood anat. DESCH, Mal. For. Rec. 15<sup>1</sup> (1941) 63 (hand lens).

Vern. *Këdongdong kidjai*, *k. rusa*, Sum., *këdongdong sengeh*, Mal. Pen., *këdamu bikin*, *lanamun*, *tjêlemu*, Borneo.

Notes. Closely related to *C. grandifolium* H. J. LAM, and also to *C. pseudopatentinervium* H. J. LAM.

It is very remarkable, that 2 out of these 3 species were at first described as *Santiria* (incl. also *Trigonochlamys*). Yet the fruit- and flower-characters are typically those of *Canarium*.

#### Incertae sedis

*Sect. Regressiva* subsect. *Foliola* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 209.

The relationship of the next 2  *spp.*, which are mutually closely related, is uncertain. In fertile characters they are close to *sect. Canarium*, in vegetative characters they remind of some species of *sect. Pimela*, specially of *C. australianum*.

**26. *Canarium pseudodecumanum* HOCHR. Pl. Bog. Exs. (1904) 61; Bull. Inst. Bot. Btzg no 22 (1905) 88; Ann. Jard. Bot. Btzg Suppl. 3 (1910) 851; HEYNE, Nutt. Pl. (1927) 878; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 13 f. 104a; Bull. Jard. Bot. Btzg III, 12 (1932) 438, t. 9 f. 51; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 6,**

*cum fig.*—*Canariopsis decumana* (non BL.) MIQ. Sum. (1861) 206, 527.—*Canarium decumanum* (non GAERTN.) ENGL. in DC. Mon. Phan. 4 (1883) 132; H. J. LAM in Merr. Pl. Elm. Born. (1929) 116.

Tree up to 50 m by 165 cm, with large buttresses. *Branchlets* ( $\frac{3}{4}$ –)1 $\frac{1}{2}$ –2 $\frac{1}{2}$  cm diam., angular, glabrescent, leaf-scars large, terminal bud slender, 3–5 cm by 7–9 mm, densely ferrugineously woolly pubescent; pith thick, with many small vascular strands, appressed to the thin wood-cylinder. *Stipules* none. *Leaves* often nearly in whorls of four, (3–)4–6-jugate. *Leaflets* nearly sessile, lanceolate to oblong, 5–28(–33) by (2–)3–10(–12) cm, subcoriaceous, subglabrous above, densely minutely tomentose to sparsely stellately pubescent or nearly glabrous beneath; base rounded to subcordate; margin minutely serrulate (to subtentire); apex rather abruptly, shortly acute-acuminate; nerves 20–25 pairs (angle variable), tortuous, more or less distinctly arching towards the margin, prominent beneath; reticulations very dense, waffle-like beneath. *Inflorescences* ( $\varnothing$  unknown) axillary, narrowly paniculate, up to 16 cm long, many-flowered, tomentose; flowers in glomerules. *Bracts* lanceolate to subulate. *Flowers* ( $\varnothing$  unknown) 7–9 mm long, pubescent. *Calyx* 3 $\frac{1}{2}$  mm high. *Stamens* free, glabrous. *Disk* cupular, 2 mm high, fleshy, densely erectly pilose. *Pistil* none. *Infructescences* unknown; calyx with remnants of a 6-lobed, fimbriate disk. *Fruits* ellipsoid, subtrigonus in cross-section, 7–8 $\frac{1}{2}$  by 4 $\frac{1}{2}$ –6 cm, densely tomentose when young, glabrescent, scurfy; pyrene

smooth, with 3 angle-ribs near the apex and often a faint median rib on each of the lids; lids 4–5 mm thick. *Seeds* (3–)2–1; all cells irregular-shaped, sterile ones slightly or not reduced.

*Distr.* *Malaysia:* Sumatra, Malay Peninsula, Borneo.

*Ecol.* Primary forests, up to 280 m. *Fl.* Apr. (Mal. Pen.), Oct. (Borneo), *fr.* March and Aug.–Nov. (Sum.).

*Uses.* The wood is very soft. The abundant resin is used for caulking canoes. An edible oil is pressed out of the seeds, which also are eaten.

*Vern.* *Damar likat, kadungdung, (kaju) tandikat, tondikat, tahola, toktohan*, Sumatra, *han*, S. Thailand, *damar kangar, lamèh, meo, myior*, Malay Peninsula, *djèlapat gala-gala sèmut, djèlmu, tam-pang kidjang*, Borneo, *lantuay (lantu air)*.

*Notes.* Closely related to *C. decumanum* GAERTN. The two species are nearly vicariads, even in Borneo.

27. *Canarium decumanum* [RUMPH. Herb. Amb. 2 (1741) 166, t. 55] GAERTN. Fruct. 2 (1791) 99, t. 102; WILLD. Sp. Pl. 4, 2 (1805) 760; DC. Prod. 2 (1825) 80; R. & S. Syst. 7, 1 (1829) 80; non ENGL. in DC. Mon. Phan. 4 (1883) 132 (= *C. pseudo-decumanum* HOCHR.); K. & V. Bijdr. 4 (1896) 48, 313; Ic. Bog. 1 (1897) t. 8; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 22<sup>13</sup>, 23<sup>5</sup>; BACK. Schoolfl. (1911) 198, *excl. specim. sumatr.*; KOORD. Exk. Fl. Java 2 (1912) 434; SENN in Karsten & Schenk, Veget. Bild. 10, 4 (1912) t. 22; KOORD. Atlas 1



Fig. 39. Buttresses in *Canarium decumanum* GAERTN. (Cult. Hort. Bog. VI-E-5 & 16). Trees 33 years old.

(1913) t. 150; MERR. Int. Rumph. (1917) 300; HEYNE, Nutt. Pl. (1927) 876; non H. J. LAM in Merr. Pl. Elm. Born. (1929) 116 (= *C. pseudodecumanum* HOCHR.); H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931-'32) t. 6 f. 24-44, f. 52, t. 15 f. 115a; Bull. Jard. Bot. Btzg III, 12 (1932) 435; F. H. HILDEBRAND, Het Bosch 11 (1934) 267; H. J. LAM, in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 5.—*Pimela decumana* BL. Mus. Bot. 1 (1850) 223.—*Canariopsis decumana* BL. ex MIQ. Fl. Ind. Bat. 1, 2 (1859) 652; non MIQ. Sum. (1861) 206, 527 (= *C. pseudodecumanum* HOCHR.).—Fig. 22a, 39 & 40.

Tree, 30-60 by  $1\frac{1}{2}$ -2 m, with very large buttresses (up to 8 m high and 5 m wide). *Branchlets* 1- $1\frac{1}{2}$  cm diam., angular, glabrescent, with large leaf-scars, terminal bud slender, acute, 4-5 cm by 6 mm, densely brown-tomentose; pith thick with many peripherally arranged small vascular strands. *Stipules* represented by the basal pair of leaflets, which are rather caducous—leaving a small circular scar—, inserted at the conjunction of branch and petiole and very small (petiolule 4-10 mm, blade  $1\frac{1}{2}$ - $2\frac{1}{2}$  by  $\frac{3}{4}$ -2 cm). *Leaves* spirally arranged, (3-)-4-5(-6)-jugate, 35-45 cm long. *Leaflets* ovate to oblong, 5-10-30 by  $2\frac{1}{2}$ -5-10 cm, stiff-chartaceous to coriaceous, glabrescent; base rounded to subcordate; margin entire; apex gradually long and acutely acuminate; nerves 17-22-26 pairs (angle c.  $60^\circ$ ), tortuous, towards the margin dissolving into a lax marginal reticulation, rather prominent beneath, some of the nerves more or less reduced (similar to intermediate veins); reticulations dense. *Inflorescences* axillary, narrowly paniculate, densely minutely tomentose,  $\sigma$  4-19 cm long, many-flowered, main branches up to  $6\frac{1}{2}$  cm, flowers clustered;  $\rho$  5-7 cm, few-flowered, main branches very short. *Bracts* lanceolate to subulate. *Flowers* pubescent,  $\sigma$  7-9 mm,  $\rho$  8-14 mm. *Calyx*  $\sigma$   $3\frac{1}{2}$  mm high,  $\rho$   $4\frac{1}{2}$ -7 mm. *Stamens* free, glabrous. *Disk*  $\sigma$  cushion-shaped, 2 mm high, faintly 6-lobed, densely pilose;  $\rho$  6-lobed, 1 mm high, fimbriate. *Pistil* pubescent,  $\sigma$  none. *Infructescences* subracemose, with few fruits; calyx flat, 1 cm diam. *Fruits* ellipsoid, subtrigonus in cross-section, 7- $8\frac{1}{2}$  by  $4\frac{1}{2}$ -6 cm, glabrescent, scabrous; pyrene smooth except of 3 angle-ribs near the apex and a faint median rib on each of the lids; lids 4-5 mm thick. *Seeds* (3-)-2-1; cells irregularly shaped, sterile ones not or slightly reduced.

*Distr. Malaysia*: E. Borneo, Moluccas (Morotai, Ternate, Batjan, Ceram), New Guinea (Vogelkop). According to RUMPHIUS (*l.c.*), also in S. Celebes, Buton, Halmaheira, the Sula Islands, and Buru. Not rarely cultivated, specially in Java.

*Ecol.* Primary forests at low altitudes. *Fl.* April-May, *fr.* June-Nov.

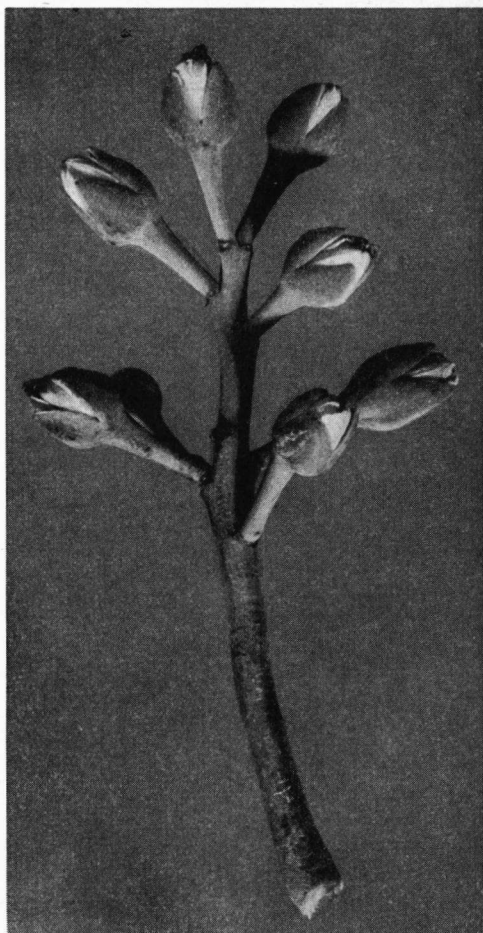


Fig. 40. *Canarium decumanum* GAERTN.  $\rho$  (Cult. Bogor Palace Garden VII-9), c.  $\times$  2.

*Uses.* The resin and the seeds are used, but they are of no great importance.

*Vern.* *Kĕnari babi*, *k. sabrang*, Java, *djilapat*, *djĕlamu*, Borneo, *hapo*, *hoburu*, Morotai, (*njiha*) *hafo*, Ternate, *glama*, Ceram, *kanari kĕtjil*, Ambon, *damar amin*, *hafu bopolulo*, *h. gogira*, *h. sula*, *jal amin*, *jalo halat*, *jar amin*, *kamal amin*, *kami*, *kĕnari bĕsar*, *k. sula*, Moluccas.

*Notes.* Closely related to *C. pseudodecumanum* HOCHR.

Young specimens very much resemble *Flindersia schottiana* F. MUELL. (*Rutac.*), which however can easily be recognized by the presence of distinct pellucid oil-glands in the leaflets.

## 2. Section *Pimela*

DC. Prod. 2 (1825) 80.—*Pimela* LOUR. Fl. Coch. (1790) 407.—*Sect. Regressiva subsect. Subulata* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 209.

*Stipules* subulate to lanceolate, not rarely absent; scars orbicular, minute. *Bracts* deltoid to subulate, not consisting of connate stipules (fig. 1i-j). *Leaflets* greyish-green when dry; margin entire to serrate; indument, if present, mostly consisting of hispid hairs. *Inflorescences* mostly axillary to pseudoterminal, very rarely terminal. *Stamens* often partly to entirely connate, rarely adnate to the disk. *Receptacle* in ♀ flowers nearly always flat, very rarely slightly concave. *Disk* usually 6-lobed, often pilose. *Pistil* very rarely stalked, mostly pilose. *Calyx* in fruit rarely more than 1 cm diam., outside usually glabrous, inside mostly sericeous, flat, lobes often reflexed. *Fruits* small, 2½-3½(-5) cm long; pyrene often with angle- and median ribs, sometimes entirely tuberculate.

Distr. Continental SE. Asia from S. India to S. China and Hainan, Andamans, *Malaysia*, Carolines, New Britain, N. Queensland, Solomon Isl., New Hebrides, Fiji, Samoa, and Tonga.

28. *Canarium oleosum* (LAMK) ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 241, f. 136 Q-S; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 246, f. 8, 18. 22<sup>s</sup>, 23<sup>12-13</sup>, 25, 26P, 30; Rev. Gén. Bot. 22 (1910) 454, f. 2, t. 12 f. 2; MERR. Int. Rumph. (1917) 303; HEYNE, Nutt. Pl. (1927) 878; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 91, t. 13 f. 100-101; Bull. Jard. Bot. Btzg III, 12 (1932) 483, t. 11 f. 74; MEYER DREES, Comm. For. Res. Inst. no 33 (1951) 43.—*Nanarium minimum sive oleosum* RUMPH. Herb. Amb. 2 (1741) 162, t. 54.—*Amyris oleosa* LAMK, Enc. 1 (1783) 362.—*C. microcarpum* WILLD. Sp. Pl. 4 (1806) 760; POIR. in LAMK, Enc. Suppl. 2 (1811) 72; MIQ. Fl. Ind. Bat. 1, 2 (1859) 646; ENGL. in DC. Mon. Phan. 4 (1883) 125; VORDERMAN, Teysmannia 5 (1894) 111; HOCHR. Bull. Inst. Bot. Btzg no 22 (1905) 90, incl. f. minor; BOORSMA, Bull. Dép. Agr. Ind. Néerl. no 7 (1907) 29.—*C. laxiflorum* DECNE, Nouv. Ann. Mus. Hist. Nat. Paris, 3 (1834) 477; SPANOGHE, Linnaea 15 (1841) 188.—*C. pimela* (non KOEN.) SPANOGHE, Hook. Comp. Bot. Mag. 1 (1835) 346.—Fig. 20b, 21i, & 41.

Tree 17-20(-30) m by 25-50 cm; sometimes buttressed. *Branchlets* ¼-½ cm thick, soon glabrescent; pith with a peripheral cylinder of vascular strands. *Stipules* none. *Leaves* (0-)3-5 (-7)-jugate, glabrous. *Leaflets* ovate to lanceolate, 2-18 by 1-7 cm, thin-chartaceous; base slightly oblique, cuneate to rounded; margin entire; apex gradually narrowed into a short, broad and blunt acumen; nerves 10-15 pairs (angle 60-80°), straight to slightly curved, rather abruptly and conspicuously arching at some distance from the margin; intermediate veins strongly developed; reticulations lax. *Inflorescences* axillary, slender, narrowly and laxly paniculate, (4-)30-45 cm, glabrous; branches patent but for the longer basal ones, up to 4½ cm (♂ ones sometimes up to 10 cm), long-stalked, ♂ ones many-flowered, ♀ ones up to 5-flowered. *Flowers* 5-7 mm long, glabrous, ♀ ones sometimes with a slightly concave receptacle. *Calyx* 2-3 mm high. *Stamens* glabrous, in ♂ flowers slightly connate at the base, in ♀ flowers free. *Disk* in ♂ flowers pistilloid, ovoid, sometimes shortly stalked, 1½ mm high, pilose at the apex, tapering into a short, style-like appendix; in ♀ flowers cupular, 6-undulate, 1 mm high, fimbriate.

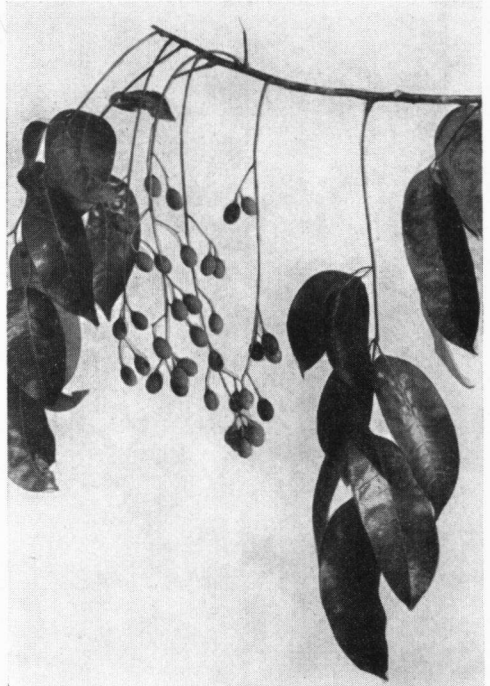


Fig. 41. *Canarium oleosum* (LAMK) ENGL. with fruits (Cult. Hort. Bog. VI-E-13).

*Pistil* glabrous (very rarely tomentose). *Infructescences* slender, with up to 5 fruits; calyx flat, triangular, 3½-5 mm diam., with reflexed lobes. *Fruits* ovoid to obovoid, round in cross-section, 1¼-2 by ¾-1¼ cm, glabrous; pyrene faintly 6-ribbed, sometimes slightly rugose; lids 2 mm thick. *Seed* 1; sterile cells nearly obsolete.

Distr. New Britain and *Malaysia*: Lesser Sunda Islands (Alor, Timor, Wetar), N. Celebes, Moluccas (Morotai, Ternate, Batjan, Obi, Buru, Kei Islands), and New Guinea. Fig. 42.

Ecol. Primary and secondary forests, mostly below 400 m, rarely up to 700(-1200) m. *Fl.*

May–Nov., fr. May–Oct. (Dec. in New Britain).

Uses. The wood can be used as a light constructional timber. The wood of the buttresses is said to be one of the components of the scented wood *kaju rasamala*. The oily parts of the resin are used as a balm on wounds and for hair lotions; in New Guinea for the latter purpose it is mixed with coconut-oil.

Vern. Lesser Sunda Islands: *bamkalang babi*, Alor, *kesi*, *rani kalang bahi*, Timor; Moluccas: *iale (jalo) bandang*, Alf., *anto*, Ternate, *damar putih*, Batjan, *kaju rasamala*, Batjan, Obi, Buru, *kota aros*, Buru, according to RUMPHIUS: *kanari (nanari) minjak*, Ambon, *aihau madelle*, Hitu, *janiri*, Manipa, *jasesel*, Bonoa; New Guinea: *manoi*, Centr. Div.; New Britain: *iqaqalip*, *puogo*.

Notes. Closely related to *C. balsamiferum* WILLD. and on the whole rather uniform. The two forms, mentioned by H. J. LAM (Bull. 1932, l.c.), a small-leaved and a large-leaved one, are only vaguely distinguishable.

Some specimens from New Guinea have rather coriaceous leaflets; they have been collected at c. 1000 m. Some specimens, specially one from Morotai (MAIN & ADEN 1425), are long remaining densely tomentose.

GUILLAUMIN (Fl. Gén. I.-C. 1, 1911, 710) was the first to record this species from Indo-China. In this he based himself on *Pimela oleosa* LOUR., typified by Indo-Chinese material and with a reference to the E. Malaysian *Nanarium oleosum* of RUMPHIUS (the type of *Amyris oleosa* LAMK). POIRET l.c. erroneously referred LOUREIRO's species to *C. microcarpum* WILLD. See also MERRILL (Comm. Lour. 1935, 227). Already ENGLER (1883, l.c.) expressed doubt about this synonymy and H. J. LAM (Ann. Jard. Bot. Btzg 42, 1932, 208) gave a new name to the species of LOUREIRO, viz *C. engleri* H. J. LAM, which is up till now only known from LOUREIRO's description.

29. *Canarium balsamiferum* WILLD. Sp. Pl. 4 (1806) 760; ENGL. in DC. Mon. Phan. 4 (1883) 150; MERR. Int. Rumph. (1917) 301; HEYNE, Nutt. Pl. (1927) 876; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 16 f. 127c2; Bull. Jard. Bot. Btzg III, 12 (1932) 485, t. 12 f. 75; CRETZOIU, in Fedde, Rep. 36 (1934) 266, incl. var. *typicum* and var. *englerianum*.—*C. odoriferum* leve RUMPH. Herb. Amb. 2 (1741) 156, t. 50.—*Boswellia balsamifera* SPRENG. Syst. Veg. 2 (1825) 313.—*Pimela glabra* BL. Mus. Bot. 1 (1850) 222, excl. *basinym Boswellia glabra* ROXB.—*Pimela paucijuga* BL. Mus. Bot. 1 (1850) 226.—*Canariopsis glabra* BL. ex MIQ. Fl. Ind. Bat. 1, 2 (1859) 653.—*Canariopsis paucijuga* BL. ex MIQ. l.c.; ENGL. in DC. Mon. Phan. 4 (1883) 151; MERR. Int. Rumph. (1917) 305.—*C. celebicum* ENGL. ex KOORD. Nat. Tijd. N. I. 63 (1903) 97, nomen; KOORD. Suppl. Cel. 2 (1922) t. 31; op. cit. Suppl. 3 (1922) 17.—*C. englerianum* HOCHR. Pl. Bog. Exs. (1904) 56; Ann. Jard. Bot. Btzg Suppl. 3 (1910) 845.—*C. longissimum* HOCHR. Pl. Bog. Exs. (1904) 58; Ann. Jard. Bot. Btzg Suppl. 3 (1910) 846.—*C. rooseboomii* HOCHR. Pl. Bog. Exs. (1904) 62; Ann. Jard. Bot. Btzg Suppl. 3 (1910)

848.—*C. poeloetimbeo* ENGL. ex HOCHR. Pl. Bog. Exs. (1904) 58, nomen; KOORD.-SCHUM. Syst. Verz. 3 (1914) 61.

Buttressed tree, 17–28 m by 20–40(–70) cm. Branchlets  $\frac{1}{2}$ – $1\frac{3}{4}$  cm thick, glabrescent; pith with many vascular strands, which are sometimes

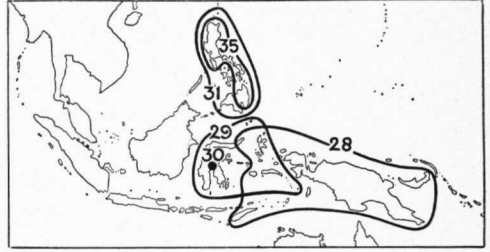


Fig. 42. Distribution of *C. oleosum* and allies: 28. *C. oleosum* (LAMK) ENGL., 29. *C. balsamiferum* WILLD., 30. *C. trigonum* H. J. LAM, 31. *C. euryphyllum* PERK., 35. *C. gracile* ENGL.

arranged in two concentric cylinders. *Stipules* none. *Leaves* (3–)5–8-jugate, glabrous. *Leaflets* lanceolate to oblong, 9–24 by 2–9 $\frac{1}{4}$  cm, herbaceous to coriaceous; base broadly cuneate to slightly cordate; margin entire; apex acute, rather abruptly, short (c. 1 cm) and slenderly blunt-acuminate; nerves 8–15 pairs (angle 60–70°), little curved, rarely distinctly arching close to the margin; reticulations very slender and rather dense. *Inflorescences* axillary, glabrescent, slender, ♂ ones narrowly panicleate, 10–50 cm, main branches c. 2(–10) cm, patent, panicleate, 3–11-flowered; ♀ ones mostly racemose, 4–10 cm. *Flowers* (nearly) glabrous, ♂ ones 1 cm long, ♀ ones 5–6 mm. *Calyx* 3–5 mm high. *Stamens* glabrous, in ♂ flowers connate for 1–2 mm, in ♀ ones very slightly connate. *Disk* in ♂ flowers thick and ovoid to club-shaped, 4 mm high, more or less deeply (3–)6-lobed, with a central canal, pubescent, inner side and apex with long, erect hairs; in ♀ flowers cupular,  $\frac{3}{4}$  mm high, 6-undulate, pubescent outside and long-fimbriate. *Pistil* densely pubescent except at the base; in ♂ flowers none. *Infructescences* in the more coarse specimens short and dense, 5–8 cm long, with 2–5 rather large, fertile fruits; in more slender specimens up to 25 cm long, slender, fruits smaller and often some of them sterile; calyx c. 7 mm diam., flat, 3-lobed, lobes reflexed. *Fruits* ovoid, acute, specially at the apex, round or slightly trigonous in cross-section, 2–2 $\frac{1}{2}$ –4 by 1 $\frac{1}{4}$ –2 cm, glabrous or slightly pubescent at the top; lids conspicuous, faintly keeled, c. 2 $\frac{1}{2}$  mm thick. *Seeds* 3.

Distr. *Malaysia*: Celebes, Moluccas (Talaud Islands, Morotai, Halmahera, Buru, Ambon, Kai Islands). Fig. 42.

Ecol. In primary forests from low altitudes up to c. 700 m. *Fl. fr.* (mainly) May–July.

Uses. According to RUMPHIUS the aromatic oil from the resin is highly estimated, as it is sweeter scented than that of most other *Canarium* species known to him.

Vern. Celebes: *damar nitih, kanari in talun, rerih in talim, solo (lewo)*, Minah., *dadjaro*, Tobelo, *wangkilowu*, Central Cel., *lembao*, S. Cel., *salong baling, tulu-tim-beo*; Moluccas: *matimpuné, nakimpuné*, Talaud, *okie*, Buru, *kamakoan*, Ambon; *dammar sèlan*.

Notes. The best subdivision of this variable species is that given by H. J. LAM (Bull. 1932, l.c.). As the characters are very vague and as the 3 forms are not geographically separated, he did not provide them with names.

The species is closely related to *C. trigonum* H. J. LAM and less so to *C. oleosum* ENGL.

30. *Canarium trigonum* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 219; Bull. Jard. Bot. Btzg III, 12 (1932) 487, t. 14 f. 95.

Tree, 20–28 m by 20–30 cm. *Branchlets* 3–4 mm thick, glabrescent; pith with a peripheral cylinder of some large to many small vascular strands, in the latter case appressed to the wood. *Stipules* absent. *Leaves* 2–5-jugate, glabrous. *Leaflets* elliptic-lanceolate, 5½–15 by 2½–5 cm, chartaceous; base cuneate; margin entire; apex acute, rather abruptly, long and slender (5–15 by 1½–2 mm) blunt-acuminate; nerves 7–12 pairs (angle 55–65°), curved, not arching except in the apical part; reticulations lax. *Inflorescences* axillary, glabrous, slender, ♂ ones narrowly paniculate, c. 20 cm long, main branches patent, up to 1½ cm, 2–3-flowered; ♀ ones racemose, 4–8 cm long, with few flowers only. *Flowers* nearly glabrous, ♂ ones 4–5, ♀ 7–8 mm long. *Calyx* c. 3 mm long. *Stamens* in ♂ flowers connate for 1 mm, filaments pilose, anthers acute-acuminate; in ♀ flowers free, totally pilose. *Disk* cylindrical in ♂ flowers, 2 mm high, densely pubescent, with or without a central canal; in ♀ flowers cupular, 6-lobed, 1 mm high, fimbriate. *Pistil* densely pilose, in ♂ flowers absent. *Infructescences* small, with only one fruit; calyx flat with reflexed lobes, 7 mm diam. *Fruits* shortly ovoid, trigonous in cross-section, c. 3½ by 2½ cm; pyrene rounded-triangular in cross-section, the sides flat to slightly concave; lids thick; cells equally well developed.

Distr. *Malaysia*: Central Celebes. Fig. 42.

Ecol. In old forests, 200 m. *Fl. fr.* May–July.

Vern. *Karèmatu, morohulo*, Tobelo.

Note. This apparently rare species is closely related both to *C. balsamiferum* WILLD. and to *C. euryphyllum* PERK.

31. *Canarium euryphyllum* PERK. Fragm. Fl. Philip. 1 (1904) 99; MERR. En. Philip. 2 (1923) 350; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 80; Bull. Jard. Bot. Btzg III, 12 (1932) 531.—*C. perkinsae* MERR. Publ. Gov. Lab. Philip. no 35 (1906) 26; En. Philip. 2 (1923) 352.—*C. todayense* ELM. Leaf. Philip. Bot. 3 (1911) 1087.—*C. purpureum* ELM. Leaf. Philip. Bot. 4 (1912) 1503.—*C. ramosii* MERR. Philip. J. Sc. 8 (1913) Bot. 374, incl. also *var. parvum*; En. Philip. 2 (1923) 353; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 532.—*C. paucinervium* MERR. Philip. J. Sc. 9 (1914) Bot. 364; En. Philip. 2 (1923) 352.—*C.*

*stenophyllum* MERR. Philip. J. Sc. 10 (1915) Bot. 25; En. Philip. 2 (1923) 354.—*C. microphyllum* MERR. Philip. J. Sc. 13 (1918) Bot. 304; En. Philip. 2 (1923) 351.

Note. The leaflets of Philippine specimens of this and some other species are very variable in shape and size; on these characters a number of local species have been based.

*var. euryphyllum*.—*C. perkinsae* MERR.—*C. todayense* ELM.—*C. purpureum* ELM.—*C. stenophyllum* MERR.—*C. microphyllum* MERR.

Tree 10–15(–40) m by 10–25(–40) cm. *Branchlets* ¼–½ cm thick, soon glabrescent; pith with a peripheral cylinder of small vascular strands, the few central ones rarely arranged into a second cylinder. *Stipules* none. *Leaves* (2–)4–7-jugate, (nearly) glabrous. *Leaflets* elliptic (to lanceolate), slightly falcate, 4½–10–12 by 2–4 cm, very rarely nearly orbicular and straight, 3½ cm diam., mostly chartaceous, glabrous or subglabrous; base cuneate (to rounded); margin entire; apex abruptly, long and slender, blunt-acuminate; nerves (5–)8–10(–15) pairs (angle variable), straight, gradually curved towards the margin and indistinctly arching at c. 2 mm from it. *Inflorescences* axillary, narrowly paniculate to racemose, 15–20 cm, glabrescent; partial panicles often sessile, 2–3(–5)-flowered, rarely stalked, up to 3½ cm long and up to 12-flowered. *Flowers* c. 1 cm long, glabrous to very shortly pilose outside, specially the corolla. *Calyx* 3 mm high, widely cupular. *Corolla* much exerted, not slender. *Stamens* glabrous, in ♂ flowers faintly connate. *Disk* in ♂ flowers tubular to cupular, up to 2½ mm high, fimbriate, on the inner side densely pilose; in ♀ flowers annular, 6-undulate, 1 mm high, long-pilose. *Pistil* pilose, in ♂ flowers nearly always totally absent. *Infructescences* 10–20 cm long, glabrous, with up to 5 fruits; calyx flat, triangular, 5 mm diam., lobes reflexed. *Fruits* broadly elliptic, broadly triangular in cross-section, 2¾–3 by 1¼–1½ cm, glabrescent except for the apex, red; pyrene smooth; lids 2 mm thick; fruits often sterile. *Seed* 1; sterile cells rather strongly reduced.

Distr. *Malaysia*: Philippines (Palawan excepted). Fig. 42.

Ecol. Rather common tree in forests, up to 500 m (on Mt Katanglad, Mindanao, once collected at 1700 m). *Fl. Nov.*–June, *fr.* (mainly) April–Aug.

Uses. The wood is often said to be very hard.

Vern. *Anlian*, *C. Bis.*, *batuan-babui*, Mindoro, *bolabog, buntirau, magosayag*, *P. Bis.*, *indur, pararuy*, Mindoro, *mayakyat, tabuali*, Tag., *ogat*, Bag., *palaspas*, Polillo, *malatagun*, Luzon, Camarines Sur.

*var. ramosii* (MERR.) LEENH. nov. stat.—*C. ramosii* MERR.—*C. paucinervium* MERR.

The main differences to *var. euryphyllum* are: Rather densely, hirsutely pilose on the branchlets, petioles, leaf-axes, petiolules and leaflets (midrib above, all nerves beneath). Leaves mainly 2–4-jugate. Leaflets less falcate, mainly 12–18 by 4½–6 cm, less stiff. Inflorescences more often paniculate



and more-flowered. Flowers longer (14 mm). Fruits slightly broader ( $1\frac{1}{2}$ - $1\frac{3}{4}$  cm), black; no sterile ones seen.

Distr. *Malaysia*: Philippines (Samar, Leyte, Mindanao: Surigao Prov. only).

Ecol. In forests at low altitudes. *Fl.* June-Sept., *fr.* (mainly) April-Aug.

Vern. *Malapilali*, *milipilali*, S. L. Bis.

**32. *Canarium kostermansii* LEENH.** *Blumea* 8 (1955) 191, f. 5a.

Tree, 30 m by 60 cm. *Branchlets* rather slender, up to 1 cm thick, brown tomentose; pith with 2 concentric cylinders of vascular strands. *Stipules* very caducous, inserted on the petiole 3-5 mm from its base, subulate, c. 6 mm, leaving a prominent scar. *Leaves* 6-7-jugate. *Leaflets* lanceolate, slightly oblique, 10-12 by 3-3½ cm, rather stiff chartaceous, glabrous; base unequally, broadly cuneate; margin entire; apex gradually narrowed into a long and slender (up to 15 by 3-4 mm), acute acumen; nerves 22-25 pairs (angle c. 60°), straight, faintly curving towards the margin, abruptly arching very close to the margin. *Inflorescences* (♂ unknown) axillary, racemose, 10-15 cm long, thinly tomentose, glabrescent. *Flowers* (♂ unknown) 12 mm long, with a slightly concave receptacle. *Calyx* 9 mm high. *Stamens* 4¼ and 5½ mm long, connate for 1½ mm; filaments glabrous. *Disk* annular, ½ mm high, up to 1½ mm fimbriate. *Pistil* glabrous. *Infructescences* unknown. *Fruits* (mature ones unknown) glabrous, 1-seeded.

Distr. *Malaysia*: Borneo (E. Kutei), once collected, 100 m, *fl.* June. Fig. 43.

Vern. *Ngalin*.

Note. This species is apparently related to *C. pilosum* BENN.

**33. *Canarium pilosum* BENN.** in Hook. *f. Fl. Br. Ind.* 1 (1875) 533; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 121; KING, J. As. Soc. Beng. 62, ii (1894) 243; RIDL, J. Str. Br. R. As. Soc. no 33 (1900) 58; Fl. Mal.

Pen. 1 (1922) 372, f. 39, *incl.* also var. *hirtellum*; H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 212, t. 13 f. 104i, *incl.* also var. *hirtellum*; Bull. Jard. Bot. Btzig III, 12 (1932) 472, t. 11 f. 68; BURK. Dict. (1935) 432; LEENH. Bull. Bish. Mus. no 216 (1955) 24, f. 11.—*C. grandiflorum* BENN. in Hook. *f. Fl. Br. Ind.* 1 (1875) 533; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 122; KING, J. As. Soc. Beng. 62, ii (1894) 242; RIDL, J. Str. Br. R. As. Soc. no 33 (1900) 58; Fl. Mal. Pen. 1 (1922) 370; BURK. Dict. (1935) 429.—*C. hirtellum* BENN. in Hook. *f. Fl. Br. Ind.* 1 (1875) 534; Pharm. J. Trans. III, 6 (1875) 103; Hook. *Ic. Pl.* 16 (1887) t. 1575; ENGL. in DC. Mon. Phan. 4 (1883) 121; KING, J. As. Soc. Beng. 62, ii (1894) 244.—*C. motleyanum* ENGL. in DC. Mon. Phan. 4 (1883) 133; MERR. En. Born. (1921) 317.—*Dacryodes scandens* HUSSON, *Blumea* 7 (1952) 164, f. 1; KALKMAN, *Blumea* 7 (1954) 518.

Note. Two subspecies can be distinguished; a few intermediate specimens have been collected in S. Sumatra and E. Borneo. *C. pilosum* approaches *C. merrillii* in its *ssp. borneensis*.

*ssp. pilosum*.—*C. grandiflorum* BENN.—*C. hirtellum* BENN.—*C. motleyanum* ENGL.—Fig. 21n.

Tree, 10-28(-37) m by 20-45(-65) cm; buttresses, if present, up to 1 m high. *Branchlets* slender, ½-1 cm thick, long remaining densely woolly pubescent; pith with a peripheral cylinder of vascular strands, rarely also some in the central part. *Stipules* mostly persistent, inserted at the base of the petiole or on the petiole up to 2¼ cm from the base, subulate, up to 2 cm. *Leaves* (1-)-2-4(-6)-jugate, more or less pubescent in all parts, rarely entirely glabrous. *Leaflets* ovate to oblong-lanceolate, 4-25 by 1½-10 cm, chartaceous, totally glabrous to pubescent on the midrib above and woolly pubescent beneath; base rounded to broadly cuneate; margin minutely serrulate to entire; apex gradually to subabruptly, short and bluntly to long and acutely acuminate; nerves 8-15 pairs (angle from base to apex 80-50°), curving, geniculate near the margin, often more or less arching. *Inflorescences* axillary to pseudo-terminal, rarely terminal, glabrescent, rather few-flowered, ♂ ones narrowly paniculate, 4-10-26 cm long, ♀ ones more racemose, 1½-10 cm. *Flowers* 1-1¼ cm long, slender, specially the ♂ ones, densely pubescent outside. *Calyx* in ♂ flowers 2-4 mm high, in ♀ ones 5-6 mm. *Stamens* glabrous, in ♂ flowers 6-8 mm long, connate for 2-3 mm; in ♀ flowers 4 mm long, nearly entirely connate. *Disk* cupular, up to 1 mm high, pilose. *Pistil* pilose, in ♂ flowers very small. *Infructescences* 1½-10 cm long, with 1-4(-8) fruits crowded at the top of the stalk; calyx saucer-shaped, 3-lobed, 6-13 mm diam. *Fruits* oblong (to ovoid), at the apex nearly always truncate and with 3 'shoulders', rarely tapering, mostly rounded 3-angular in cross-section, ( $1\frac{3}{4}$ -) $2\frac{1}{4}$ - $3\frac{1}{4}$  by ( $\frac{3}{4}$ -) $1$ - $1\frac{1}{2}$  cm, glabrous except sometimes at the apex; pyrene smooth, the sides concave to faintly keeled; lids  $1\frac{1}{2}$ (-3) mm thick. *Seed* nearly always 1, the sterile cells strongly reduced.

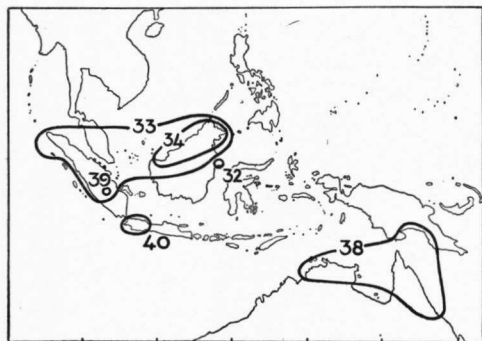


Fig. 43. Distribution of *C. pilosum* and allies: 32. *C. kostermansii* LEENH., 33. *C. pilosum* BENN., 34. *C. merrillii* H. J. LAM, 38. *C. australianum* F.v.M., 39. *C. intermedium* H. J. LAM, 40. *C. kipella* (BL.) MIQ.

Distr. *Malaysia*: Sumatra (*incl.* also Simalur), Malay Peninsula, Borneo. A specimen from the Fiji Islands (Viti Levu: GILLESPIE 3434) is very probably derived from a cultivated or naturalized tree. Fig. 43.

Ecol. Rather common in primary forests, also in swamps, up to c. 350–(1250) m. *Fl.* (Dec.–) March–Aug. (–Oct.), *fruiting* (March–) April–July (–Nov.).

Uses. The wood is said to be durable against insects and is used for house-building.

Vern. Sumatra: *bantan kerosoh*, *damar kunang*, *kaju putih*, *merasam daun alus*, Palembang., *medang serababa*, Lamp., *awa surian*, *bangkiring sito bulung*, *surian uding*, *s. pajo*, *s. silai*, *s. sito bulung*, *tutun surian*, Simalur; Malay Peninsula: *kadondong krat*, *kéjam pénggéli*; Borneo: *alum pesa*, W. Born., *keramah batu*, Sarawak, *damar lilin*, SE. Born.

Note. In one specimen (HENDERSON SF. 21429) I found fertile fruits and ♂ flowers.

*ssp. borneensis* LEENH. *Blumea* 8 (1955) 193, f. 5d.—*Dacryodes scandens* HUSSON.

Tree c. 10–(25) m high, very rarely a pseudo-liane. Stipules absent. Leaves 0–5-jugate. Leaflets always glabrous; base sometimes subcordate; margin always entire; intermediate veins more strongly developed. Inflorescences narrower and with few flowers. Flowers glabrous, ♂ ones c. 5 mm long, less slender. Stamens in ♂ flowers slightly confluent at base. Disk in ♂ flowers rather variable, with or without a rudimentary pistil. Pistil in ♀ flowers glabrous. Fruits ellipsoid to fusiform, tapering at base and apex,  $3\frac{3}{4}$ – $4\frac{1}{2}$  by  $1\frac{1}{2}$  cm.

Distr. *Malaysia*: Borneo (Mt Kinabalu).

Ecol. In forests, c. 1500 m. *Fl.* Sept.–Oct. (Jan., March), *fr.* April, July, Sept.–Oct.

34. *Canarium merrillii* H. J. LAM, in *Merr. Pl. Elm. Born.* (1929) 117; *Ann. Jard. Bot. Btzig* 42 (1932) 213, t. 16 f. 133, *incl. var. originarium & var. villosum*; *Bull. Jard. Bot. Btzig* III, 12 (1932) 489, t. 12 f. 76.

Small tree, 10–20 m by 15–40 cm. *Branchlets* slender, glabrescent; pith not very compact, with some large peripheral vascular strands. *Stipules* very caducous, inserted at the base of the petiole, or on the petiole up to 1 cm from the base, subulate, 2–5 mm. *Leaves* 0–5-jugate. *Leaflets* (ob)ovate to lanceolate, (3–) $5\frac{1}{2}$ –16 by (1 $\frac{1}{4}$ –) $2\frac{3}{4}$ – $5\frac{1}{2}$  cm, stiff chartaceous, upper side glabrous except the midrib, lower side with scattered to crowded papillae, sometimes each of them provided with a soft hair; base cuneate; margin entire; apex subabruptly narrowly acute-acuminate; nerves 6–14 pairs (angle 50–60°), gradually curving, more or less distinctly arching at some distance from the margin. *Inflorescences* glabrous or slightly pubescent, either in the upper leaf-axils, narrowly paniculate, few-flowered, or together forming one lax terminal panicle, in the latter case up to 30 cm long, main branches up to 15 cm, laxly paniculate, the ♂ ones with 15–20 flowers, ♀ ones with fewer flowers. *Flowers* 8–9 mm long, rather slender, nearly glabrous outside. *Calyx* 4–5

mm high. *Stamens* glabrous, in ♂ flowers 8 mm long, connate for  $1\frac{1}{2}$ – $2\frac{1}{4}$  mm, in ♀ flowers 4–5 mm, connate for 2 mm. *Disk*  $1\frac{1}{2}$  mm high, fimbriate, in ♂ flowers cupular, rather thick, in ♀ flowers thinner and slightly 6-undulate. *Pistil* glabrous, in ♂ flowers absent. *Infructescences* shorter and more compressed than the inflorescences, main branches with 3–6 fruits each; calyx saucer-shaped, 3-lobed, 6–7 mm diam. *Fruits* elliptic, tapering specially to the apex, trigonous in cross-section,  $2\frac{1}{2}$ –3 by  $1.1$ – $1\frac{1}{2}$  cm, glabrous; pyrene rounded 3-angular, smooth; lids  $1\frac{1}{2}$ – $1\frac{1}{2}$  mm thick, bony. *Seeds* 1–(2), sterile cells compressed, linear.

Distr. *Malaysia*: Borneo (specially Br. N. Borneo). Fig. 43.

Ecol. In old forests, mostly at high altitudes (1000–1600 m), rarely in the lowlands. *Fl.* Sept.–March, *fr.* Jan.–Dec.

Uses. The wood is soft.

Vern. *Ogod*, Tambunan, *paninasan*, Kedayan, *piramu*, Sungei.

Notes. This species is related to *C. pilosum* BENN. (Sumatra, Malay Peninsula, Borneo), specially to its *ssp. borneensis* LEENH. and to *C. album* (LOUR.) DC. (Indo-China).

Though the inflorescences often look like being truly terminal, the terminal bud nearly always evolves after anthesis and the infructescences are then segregated into a number of axillary ones.

35. *Canarium gracile* ENGL. in *DC. Mon. Phan.* 4 (1883) 140; *ELM. Leaf. Philip. Bot.* 3 (1911) 1078; *MERR. En. Philip.* 2 (1923) 350; H. J. LAM, *Ann. Jard. Bot. Btzig* 42 (1932) t. 12 f. 84; *Bull. Jard. Bot. Btzig* III, 12 (1932) 531.—*C. antonii* ELM. [ex MERR. *En. Philip.* 2 (1923) 350, in *syn.*] *Leaf. Philip. Bot.* 10 (1939) 3711, *descr. angl.*—*Fig.* 20c & 21m.

Often shrub-like tree, 5–15 m by 5–25 cm. *Branchlets* slender, glabrescent; pith loose with indistinct vascular strands, most of them peripherally arranged. *Stipules* absent. *Leaves* (1–)4–5 (–7)-jugate, glabrous. *Leaflets* oblique-elliptic, slightly falcate, (5–)8–14 by (2–)3– $4\frac{1}{2}$  cm, chartaceous; base cuneate; margin entire; apex abruptly, rather long and broadly (up to 2 by  $\frac{1}{2}$  cm) blunt-acuminate, acumen curved; nerves 9–11 pairs (angle c. 75° at the broader, 50–60° at the narrower side), straight to faintly curved, gradually more so towards the margin, more or less distinctly arching in the apical part only; reticulations lax. *Inflorescences* axillary, broadly and laxly paniculate, ♂ ones mostly 30–40 cm, ♀ ones 60–80 cm long, glabrous; all axes very slender; main branches patent, up to 10 cm (♀ ones up to 15 cm), repeatedly laxly cymose, terminal parts monochasial, 2–3 cm long, c. 10-flowered (♀ ones with fewer flowers); *bracts* broadly deltoid. *Flowers* 6–7 mm long, slender, glabrous outside, ♀ ones sometimes with a slightly concave receptacle. *Calyx* 3– $3\frac{1}{2}$  mm high. *Stamens* glabrous, slightly confluent at the base. *Disk* in ♂ flowers strongly developed,  $2\frac{1}{2}$  mm high, glabrous, c. globose, 6-lobed,  $\frac{1}{2}$  mm stalked, with a narrow central, conical canal, which is sometimes closed at the

top, and which sometimes includes a minute rudiment of the pistil; in ♀ flowers 1 mm high, annular, faintly 6-lobed. *Pistil* glabrous. *Infructescences* with few fruits; calyx saucer-shaped, 3-lobed, 1 cm diam. *Fruits* ovate-oblong to bottle-shaped, bulging on one side, blunt at base and apex, the latter pointed by the persistent style-base, round in cross-section,  $2\frac{1}{2}$ – $3\frac{1}{2}$  by  $1\frac{1}{4}$ – $1\frac{1}{2}$  cm, smooth, glabrous; pericarp very thin; pyrene smooth; lids  $1$ – $1\frac{1}{2}$  mm thick, bony. *Seed* 1; sterile cells much reduced, linear, c. 6 by 1 mm; central canal strongly developed, 4–5 mm diam.

Distr. *Malaysia*: Philippines (Palawan excepted). Fig. 42.

Ecol. In primary forests at low and medium altitudes, rarely up to 600 m. *Fl.* Jan.–Oct., *fr.* (Jan.–)May–July.

Uses. Wood moderately hard.

Vern. *Bago*, Mindanao, *gisauan*, *kiod*, Mbo., *mamali*, Ma., *pagsahing-an-dagat*, *palaspas*, *pai-sahing-in*, *piling-langgam*, *tiui*, Tag., *piling-okai*, Bik., *piling-langgam*, *salong-igbabau*, P. Bis., *sahing-sahing*, Mang., *tumagasag*, Bag.

36. *Canarium dichotomum* (BL.) MIQ. *Fl. Ind. Bat.* 1, 2 (1859) 648, incl. also var. *lucidula*; ENGL. in DC. Mon. Phan. 4 (1883) 141; H. J. LAM, in Merr. Pl. Elm. Born. (1929) 116; Bull. Jard. Bot. Btzig III, 12 (1932) 447, t. 9 f. 57.—*Pimela dichotoma* BL. Mus. Bot. 1 (1850) 222.—*C. endertii* H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 210, t. 15 f. 117a; Bull. Jard. Bot. Btzig III, 12 (1932) 450, t. 10 f. 60; Kew Bull. (1936) 17.—Fig. 22b.

Tree, 15–32 m by 15–60 cm, rarely shrub-like and up to 7 m high; buttresses up to  $1\frac{1}{2}$  m high. *Branchlets*  $\frac{1}{2}$ –2 cm thick, glabrescent; pith with a peripheral cylinder of minute vascular strands. *Stipules* caducous to persistent, inserted at the base of the petiole or slightly on the latter, subulate to linear, often abruptly broadened at base,  $\frac{1}{2}$ – $1\frac{1}{2}$  cm. *Leaves* 3–5(–8)-jugate, glabrous. *Leaflets* ovate to oblong, 5–25(–36) by  $2\frac{1}{2}$ –9(– $13\frac{1}{2}$ ) cm, chartaceous to coriaceous; base oblique, rounded to broadly cuneate; margin entire; apex gradually to subabruptly blunt-acuminate, acumen rather short and broad ( $-1\frac{1}{2}$  by  $\frac{1}{2}$  cm); nerves 9–18 pairs (angle variable), straight to slightly curved, gradually, mostly distinctly, arching close to the margin. *Inflorescences* terminal, sometimes some additional axillary ones in the uppermost leaf-axils, laxly paniculate, glabrous, ♂ ones 19–42 cm long, many-flowered, ♀ ones 6–25 cm, with few flowers, axes dark red (*statu vivo*); main branches in ♂ inflorescences repeatedly dichotomous, up to 25 cm long, in ♀ ones not distinctly dichotomous, up to 6(–20) cm, flowers in cymules. *Flowers* (nearly) sessile, 6–9(–12) mm long, sometimes (even ♂ ones) with a slightly concave receptacle (best developed in the large-flowered, coarse Borneo-specimens), glabrous outside. *Calyx* 5–8 mm high. *Stamens* glabrous, in ♂ flowers confluent at the base, in ♀ flowers connate for the greater part; thecae in ♂ ones distinctly acuminate. *Disk* 1 mm high, in ♂ flowers cupular to flattened, pilose within, in ♀ flowers annular, faintly 6-undulate,

minutely tomentose, margin fimbriate. *Pistil* in ♂ flowers much reduced, pilose; in ♀ flowers glabrous, sometimes with a 1 mm high pseudogynophore. *Infructescences* up to 40 cm long, main branches up to 17 cm, with 1–2(–10) fruits; calyx funnel-shaped, trigonous, 8–10 mm diam. *Fruits* narrowly oblong, acute at both ends, trigonous in cross-section,  $2\frac{3}{4}$ –4 by 1–2 cm, glabrous; pyrene acutely to rounded triangular; lids rarely with a median rib,  $1\frac{1}{2}$ –2 mm thick. *Seeds* 1–2, sterile cells moderately reduced.

Distr. *Malaysia*: Sumatra, Borneo.

Ecol. In primary forests on dry grounds, at low altitudes (up to 850 m). *Fl.* mainly June–Aug., *fr.* (mainly) Sept.

Uses. The resin is clear and should be useful.

Vern. Sumatra: *tuala-tuala*, E.C., *damar mata kutjing*, W.C., *damar itam*, Bencoolen, *damar lang*, *pladjau*, Palemb.; Borneo: *arasa*, *kédonong*, *ketio bukit*, *médang tehr*, Sarawak, *balajan*, *kanda dahan*, Br. N. Borneo, *bangkukuk*, *dawai*, *kronrang*, *mutjih*, SE. Borneo.

Notes. A rather variable species. At first sight it seems possible to distinguish a coarse form, mainly collected in Borneo and representing *C. endertii* H. J. LAM, and a more slender form, comprising the Sumatra specimens, which is *C. dichotomum* MIQ. *sensu stricto*. Typical specimens of *C. endertii* differ from typical specimens of *C. dichotomum* in their glabrescence, more linguulate, persistent stipules inserted on the petiole, larger inflorescences and flowers, and ♀ flowers with a concave receptacle. As there are intermediate to various degree an acceptable demarcation of two taxa is rendered impossible. The only thing to be said is that the Borneo specimens often look slightly coarser than the Sumatra ones.

37. *Canarium fusco-calycinum* STAFF ex RIDL. Kew Bull. (1930) 82; H. J. LAM, Bull. Jard. Bot. Btzig III, 12 (1932) 449, t. 9 f. 58.

Tree. *Branchlets* slender, minutely villous; pith with peripheral vascular strands. *Stipules* caducous, inserted at the base of the petiole, linear, 7 by 2 mm. *Leaves* 1–2(–3)-jugate. *Leaflets* ovate to oblong, 2–25 by  $1\frac{1}{2}$ – $12\frac{1}{2}$  cm, stiff chartaceous, glabrous above except on the midrib, more or less densely pubescent beneath; base broadly cuneate to faintly cordate; margin entire; apex rounded, abruptly shortly and broadly to long, slender and acutely acuminate; nerves 10–24 pairs (angle 55–65°), faintly curved, geniculate near the margin, sometimes (in large leaflets) distinctly arching. *Inflorescences* (♀ unknown) terminal, pyramidal-paniculate, up to 40 by 30 cm, villous, many-flowered; main branches up to 20 cm, broadly paniculate. *Flowers* (♀ unknown) subsessile, buds ovoid, closed, 9 mm long. *Stamens* connate for the greater part. *Disk* cupular, small, erectly pilose, without rudimentary pistil. *Infructescences* and *fruits* unknown.

Distr. *Malaysia*: Borneo (Sarawak).

Ecol. *Fl.* April, Dec.

Notes. This apparently rare species is allied to *C. vrieseanum* ENGL. and *C. pilosum* BENN.

*C. decipiens* H. J. LAM (Ann. Jard. Bot. Btzg 42, 1932, 209) is probably conspecific (see under doubtful species).

38. *Canarium australianum* F.v.M. Fragm. 3 (1862) 15; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 529; WHITE, Proc. R. Soc. Queensl. 47 (1936) 55.—*C. australasicum* F.v.M. ex BENTH. Fl. Austr. 1 (1863) 377; ENGL. in DC. Mon. Phan. 4 (1883)



Fig. 44. *Canarium australianum* F.v.M. a. Twig with ♂ flowers and a ♀ inflorescence, b. ♀ flower, c. ditto, in section, d. ♂ flower in section, e. infructescences, f. cross-section of fruit, g. ditto of twig (a and e × 1/2, b × 3, c-d × 5, f nat. size, g × 2).

120; JADIN, Contr. Téréb. (1894) 88, f. 43; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) f. 136 J-P; ed. 2, 19a (1931) f. 211 J-P; F. M. BAIL. Rep. Br. New Guin. (1898) 31; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 2217; WHITE, Proc. R. Soc. Queensl. 34 (1922) 38; non *C. australasicum* LEENH. *Blumea* 7 (1952) 159, *quae est C. bailey-anum* LEENH.—*Sonzaya australiana* MARCH. *Adansonia* 8 (1868) 27, 64, t. 5.—Fig. 44.

Tree, 20–(30) m by 45 cm. *Branchlets* c. 1 cm thick, young parts shortly ferruginously pubescent; pith with many small vascular strands, for the greater part (rarely all of them) peripherally arranged. *Stipules* caducous, inserted at the base of the petiole, rarely on the latter up to 11 mm from the base, subulate, 7–15 mm. *Leaves* 3–4(–6)-jugate. *Leaflets* ovate, 7–11(–17) by 3–7 cm, thinly coriaceous, glabrous or minutely tomentose beneath; base rounded to truncate, rarely cuneate or cordate, slightly oblique, in the apical pair of leaflets the lower leaflet-half mostly decurrent to the base of the petiole; margin entire or slightly dentate; apex rounded to acute, sometimes truncate or shortly and broadly blunt-acuminate; nerves 15–24 pairs (angle mostly 75–80°), straight to slightly curved, often tortuous, rather abruptly distinctly arching at some distance from the margin. *Inflorescences* axillary, narrowly paniculate, fulvous tomentose; ♂ ones c. 25 cm long, ♀ ones 8–15 cm; branches up to 3 cm, ♂ ones with c. 12 flowers, ♀ ones with 3–4 flowers. ♂ *Flowers* 4–5 mm long, ♀ 6½ mm. *Calyx* respectively 2½ and 3½ mm high. *Stamens* glabrous, connate, in ♂ flowers for about half the length of the filaments, in ♀ flowers almost wholly. *Disk* in ♂ flowers truncate, deeply 6-grooved, ¾ mm high, with a central canal, outside glabrous, upper surface and inside densely woolly pubescent; in ♀ flowers annular, ¾ mm high, 6-lobed, glabrous. *Pistil* tomentose, in ♂ flowers nearly totally reduced. *Infructescences* up to 18 cm long with up to 5 fruits; calyx spreading, 3-angular, 9–10 mm diam. *Fruits* ovoid, round to rounded-triangular in cross-section, c. 2 by 1¼ cm, glabrous; pyrene rugulose, faintly 3-ribbed to the apex; lids 2 mm thick. *Seed* 1; sterile cells rather strongly reduced.

*Distr.* N. Australia (NE. Queensland and Arnhemland) and *Malaysia*: SE. New Guinea (Wassi Kussa, Mabaduan, Pt Moresby). Fig. 43.

*Ecol.* In Papua only found in rain-forest (Mabaduan) and in monsoon-forest (Wassi Kussa), in Australia also in more open forests on rather dry, sandy soil, and on coastal, sparsely timbered dunes, always at low altitudes; apparently restricted to regions subject to a periodically dry period. *Fl.* Nov.–April, *fr.* (mainly) April–June.

*Uses.* In Australia, tin fossickers and miners are said to prefer the wood of this tree above all others available for making pick- and axe-handles. The resin is used by the aborigines for spear fastening.

*Notes.* Two varieties can be distinguished: *var. australianum* with densely short-tomentose under-surface of the leaflets, and *var. glabrum* LEENH. (*Blumea* 8, 1955, 189) with glabrous leaflets. Both

varieties are also found in New Guinea. They do not exclude each other geographically.

According to WHITEHOUSE (*in sched.*), the fruits are eaten by birds, specially by Torres Street pigeons.

39. *Canarium intermedium* H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) 213, t. 11 f. 76, t. 13 f. 104b; Bull. Jard. Bot. Btzig III, 12 (1932) 482.

Tree c. 35 m by 50–85 cm. *Branchlets* c. 9 mm thick, soon glabrescent; pith with many vascular strands, part of them peripherally arranged. *Stipules* absent. *Leaves* 3–6-jugate. *Leaflets* lanceolate, 4–12 by 2–3½ cm, chartaceous, glabrous; base rather oblique, broadly cuneate; margin entire; apex gradually, shortly and broadly blunt-acuminate; nerves 10–12 pairs (angle 50–60°), straight to faintly curved, gradually and distinctly arching at 1½–2 mm from the margin. *Inflorescences* (♂ unknown) axillary, narrowly paniculate, 11–18 cm, soon glabrescent; main branches up to 4½ cm, often with only one well-developed flower. *Flowers* (♂ unknown) 7 mm, glabrous. *Calyx* 4–6 mm high. *Stamens* glabrous, 3–3½ mm long, filaments almost wholly connate, sometimes with interstaminal teeth. *Disk* minute, annular, pilose. *Pistil* glabrous, stalked. *Infructescences* c. 15 cm, with 2–3 fruits, glabrous; calyx flat, 3-angular, 11 mm diam. *Fruits* elliptic, faintly trigonous in cross-section, c. 3 by 2 cm, apparently containing 2 seeds; sterile cell not very reduced.

*Distr.* *Malaysia*: S. Sumatra, in forest, 600–900 m. Fig. 43.

*Vern.* *Damar asam*, M.

*Note.* This species is closely related to *C. kipella* (BL.) MIQ. from W. Java.

40. *Canarium kipella* (BL.) MIQ. Fl. Ind. Bat. 1, 2 (1859) 646; ENGL. in DC. Mon. Phan. 4 (1883) 129; K. & V. Bijdr. 4 (1896) 41; BACK. Schoolf. (1911) 197; KOORD. Exk. Fl. Java 2 (1912) 433; H. J. LAM, Ann. Jard. Bot. Btzig 42 (1932) t. 13 f. 104d, t. 15 f. 117c; Bull. Jard. Bot. Btzig III, 12 (1932) 480, t. 11 f. 73; in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 6.—*C. pimela* (non KOEN.) BL. Bijdr. (1826) 1162.—*Pimela kipella* BL. Mus. Bot. 1 (1850) 220.—*Pimela kitengo* BL. Mus. Bot. 1 (1850) 221.—*C. kitengo* MIQ. Fl. Ind. Bat. 1, 2 (1859) 647; ENGL. in DC. Mon. Phan. 4 (1883) 148; K. & V. Bijdr. 4 (1896) 46; BACK. Schoolf. (1911) 199; KOORD. Exk. Fl. Java 2 (1912) 433.

Tree, 25 m, with small buttresses. *Branchlets* c. 8 mm thick, lenticellate, young parts densely ferruginously woolly tomentose; pith with many vascular strands, sometimes arranged into 1 or more concentric cylinders. *Stipules* (nearly?) always absent. *Leaves* 4–8-jugate. *Leaflets* oblong-lanceolate, 7–16 by 2½–5(–6) cm, thinly chartaceous, glabrous; base often oblique, cuneate to truncate; margin entire; apex gradually shortly (c. 1 cm), broadly, and bluntly acuminate; nerves 14–17 pairs (angle 60–70°), faintly to strongly curved, gradually, often rather distinctly, arching at 1 mm from the margin. *Inflorescences* axillary, narrowly paniculate, densely woolly pubescent, glabrescent, ♂ ones 9–27

cm long; ♀ ones 7–15 cm; partial panicles about decussate, patent, rather long-stalked, ♂ ones up to 4–5 cm long, with up to 12 flowers, ♀ ones 2½ cm long, with 8–10 flowers. *Flowers* 7–8 mm long, slightly pubescent outside. *Calyx* ¼ cm high, nearly truncate. *Stamens* glabrous, 6–7 mm long, connate for 3–4 mm. *Disk* pilose, in ♂ flowers subglobose, 1½–2 mm high, with a central canal, in ♀ flowers cupular, 1 mm high, 6-undulate. *Pistil* glabrous, in ♂ flowers absent. *Infructescences* up to 20 cm long, thinly pilose, branches with 1 fruit only; calyx spreading, ½ cm diam. *Fruits* ovoid, round in cross-section, 2½–3¼ by 1–1½ cm, glabrous; pyrene ± 6-angular; lids rather thick. *Seeds* 1–2; sterile cell(s) often very reduced.

Distr. *Malaysia*: W. Java (Mt Salak; Palauanratu). Fig. 43.

Ecol. In (?) hill forests, apparently a rare species.

*Fl.* April–May, *fr.* May.

Wood anat. MOLL & JANS. Mikr. 2 (1908) 108.

Vern. *Ki hudji, ki pëla, ki tenjo, ki tuak.*

Note. Closely related to *C. intermedium* H. J. LAM.

41. *Canarium pseudosumatranum* LEENH. Blumea 8 (1955) 193, f. 4.—*C. sumatranum* (non BOERL. & KOORD.) H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 474, *pro min. parte* (incl. t. 11 f. 69b); WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 7, *cum fig.*

Tree, up to c. 50 m by 120 cm, with short thick buttresses. *Branchlets* stout, c. 12 mm thick, glabrous but for the tomentose terminal bud; pith with a peripheral cylinder of small vascular strands closely appressed to the wood. *Stipules* absent. *Leaves* 7–9-jugate, glabrous. *Leaflets* narrowly lanceolate, 13–20 by 3½–5 cm, stiff-chartaceous; base slightly oblique, rounded to subcordate, often slightly decurrent; margin entire; apex gradually, long (c. 1 cm) and slender blunt-acuminate; nerves 16–20 pairs (angle c. 55°), straight to slightly curving, close to the margin strongly curving and indistinctly arching. *Inflorescences* (♀ unknown) axillary, narrowly paniculate, c. 20 cm long, glabrous, partial panicles nearly decussate, patent, up to 2 cm long, shortly stalked, laxly cymose, many-flowered; *bracts* small, triangular. *Flowers* (♀ unknown) 1 mm pedicelled, 7 mm long, slender. *Calyx* 2 mm high, (sub-)glabrous. *Petals* outside towards the top slightly rugose. *Stamens* glabrous, unequally high confluent at the base (c. 2–4 mm). *Disk* tubular, 1 mm high, thick-fleshy, on the rim and the inner side densely pilose; no pistil. *Infructescences* unknown. *Fruits* ovoid, round in cross-section, 5 by 2½ cm, glabrous; pericarp rather thick; pyrene with blunt angle-ribs, lids very distinct, each with an acute median rib; lids 2½ mm thick. *Seeds* 2, sterile cell slightly smaller.

Distr. *Malaysia*: Malay Peninsula. Fig. 45.

Ecol. Lowland and hill forests, *fl.* March–May, *fr.* Dec.

Vern. *Kala, këdongong sênggèh, lamshu, sën(g)(a), surian (patu).*

42. *Canarium sumatranum* BOERL. & KOORD. in KOORD.-SCHUM. Syst. Verz. 2 (1910) 25; GUILLAUMIN, Ann. Jard. Bot. Btzg 26 (1912) 211, t. 16; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931–32) t. 5 f. 3, t. 11 f. 78, t. 16 f. 132; Bull. Jard. Bot. Btzg III, 12 (1932) 474, t. 11 f. 69, *excl. fr.*

Tree up to 50 m by 120 cm, with up to 1½ m high buttresses; in young specimens the stem and branches thorny. *Branchlets* stout, 1½–2 cm thick, glabrous except the densely reddish-brown tomentose terminal bud which is c. 3½ cm long, acute and often curved; pith thick with numerous, scattered, small vascular strands, most of them crowded towards the periphery. *Stipules* nearly always absent, if present early caducous, inserted at the base of the petiole, subulate, c. 3 mm. *Leaves* 7–11-jugate, often without a terminal leaflet. *Leaflets* oblong, c. 20 by 5–8 cm, herbaceous (to subchartaceous), glabrous; base very broad, subcordate to broadly cuneate; margin entire; apex rounded, abruptly shortly and blunt-acuminate, or gradually long (–2½ cm) acute-acuminate; nerves 20–26 pairs (angle 80–90°), s-shaped to faintly curving, close to the margin abruptly strongly curving upwards and more or less distinctly arching. *Inflorescences* (♀ unknown) axillary, broadly and laxly paniculate, up to 45 cm long, many-flowered, slightly puberulous towards the tips or glabrous, main branches up to 17 cm, narrowly paniculate on a long stalk; *bracts* minute, squamate. *Flowers* (♀ unknown) subsessile, 8–9 mm long, glabrous outside. *Calyx* 3 mm high. *Petals* towards the top much incrassate with rugose lateral surfaces. *Stamens* glabrous, 7 mm long, connate for (2–)4–5 mm. *Disk* about globular, with 6 thick lobes and a central canal, 1 mm high, minutely pubescent, without pistil. *Infructescences* laxly paniculate, 20–30 cm long, with c. 15–20 fruits, glabrous; calyx saucer-shaped, triangular, 7 mm diam.; remains of the disk faintly 6-lobed, about 1 mm high, fimbriate. *Fruits* ovoid, rounded 3-angular in cross-section, 1½ by 1 cm, glabrous; pyrene nearly smooth; lids 1 mm thick. *Seeds* 2, sterile cell slightly smaller.

Distr. *Malaysia*: Sumatra, Malay Peninsula. Fig. 45.

Ecol. In primary and secondary forests, up to 500 m, *fl.* May, Oct., Nov. (Sum.), *fr.* Oct. (Mal. Pen.).

Wood anat. WEBBER, Lilloa 6 (1941) 450, Pl. 3 fig. 7.

Vern. Sumatra: *anglip batu, Simalur, bënëmil, buwil, Sum. E.C., damar lang, Palemb., damar gung, Lamp., mandung këmajan.*

Notes. In the Malay Peninsula the closely related *C. pseudosumatranum* LEENH. is much more common than this species. These two species were always confused, though they differ in many points.

The thorns, which are unique in the genus, are acutely conical, up to 7 by 4 by 3 mm, concentrically scaly, grey; probably they are derived from adventitious buds.

43. *Canarium hirsutum* WILLD. Sp. Pl. 4 (1805) 760; ENGL. in DC. Mon. Phan. 4 (1883) 150; MERR. Int. Rumph. (1917) 302; HEYNE, Nutt. Pl. (1927) 877; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 13 f. 104c, t. 15 f. 117d, t. 16 f. 127d3 and f. 134; Bull. Jard. Bot. Btzg III, 12 (1932) 466, t. 11 f. 67; BURK. Dict. (1935) 430; H. J. LAM in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 7; LEENH. Bull. Bish. Mus. no 216 (1955) 14, f. 7.—*C. odoriferum hirsutum* RUMPH. Herb. Amb. 2 (1741) 157, t. 51.—*C. hispidum* BL. Cat. (1823) 109; Bijdr. 17 (1826) 1163, incl. also var. *scabrum*; R. & S. Syst. 7 (1829–30) 81, 1624; HASSK. Flora 27 (1844) 617, incl. var. *majus*; ENGL. in DC. Mon. Phan. 4 (1883) 131, incl. also var. *tomentellum*; K. & V. Bijdr. 4 (1896) 43; KOORD. Minah. (1898) 375; SOLER. Syst. Anat. Dicot. (1899) 217, f. 43F; HOCHR. Bull. Inst. Bot. Btzg no 22 (1905) 86, incl. *f. minor*; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 238, f. 22<sup>4</sup>; BACK. Schoolfl. (1911) 198; KOORD. Exk. Fl. Java 2 (1912) 433; BLAAUW, De tropische Natuur in Schetsen en Kleuren ed. 2 (1917) t. 6; RIDL. Fl. Mal. Pen. 1 (1922) 374; HENDERS. Gard. Bull. S.S. 5 (1930) 91.—*Boswellia hirsuta* SPRENG. Syst. Veg. 2 (1825) 313, non SM. in REES, 1819.—*C. altissimum* BL. Bijdr. 17 (1826) 1163; ENGL. in DC. Mon. Phan. 4 (1883) 130; MERR. En. Philip. 2 (1923) 355.—*Pimela hirsuta* BL. Mus. Bot. 1 (1850) 223.—*Pimela hispida* BL. Mus. Bot. 1 (1850) 224, incl. also var. *axillaris*, *imbricata* and *scabra*.—*Pimela altissima* BL. Mus. Bot. 1 (1850) 225.—*C. multipinnatum* LLANOS, Fragm. Pl. Filip. (1851) 107; BLANCO, Fl. Filip. ed. 3, 3 (1879) 87; F.-VILL. Nov. App. (1880) 40; MERR. Sp. Blanc. (1918) 207; En. Philip. 2 (1923) 351; BEANS & al. Philip. J. Sc. 48 (1932) 299–302, t. 2 f. 2.—*Canariopsis altissima* BL. ex MIQ. Fl. Ind. Bat. 1, 2 (1859) 651.—*Canariopsis hispida* BL. ex MIQ. Fl. Ind. Bat. 1, 2 (1859) 652, incl. also var. *tomentella*.—*Canariopsis hirsuta* BL. ex MIQ. Fl. Ind. Bat. 1, 2 (1859) 653.—*C. riedelianum* ENGL. in DC. Mon. Phan. 4 (1883) 130.—*C. greshoffii* KOORD. Minah. (1898) 375; Nat. Tijd. N. I. 63 (1903) 95; Suppl. Cel. 2 (1922) t. 26; op. cit. 3 (1922) 14.—*C. emarginatum* ENGL. ex KOORD. Nat. Tijd. N. I. 63 (1903) 97, nomen; Suppl. Cel. 2 (1922) t. 25; op. cit. 3 (1922) 13.—*C. bersamifolium* PERK. Fragm. Fl. Philip. 1 (1904) 90.—*C. radlkoferi* PERK. Fragm. Fl. Philip. 1 (1904) 96.—*C. warburgianum* PERK. Fragm. Fl. Philip. 1 (1904) 99; MERR. En. Philip. 2 (1923) 355.—*C. ahernianum* MERR. Philip. J. Sc. 1 (1906) Suppl. 70; WHITFORD, Philip. J. Sc. 1 (1906) Suppl. 415; MERR. En. Philip. 2 (1923) 415.—*C. racemosum* MERR. Philip. J. Sc. 3 (1908) Bot. 141; ELM. Leaf. Philip. Bot. 3 (1911) 1077; MERR. En. Philip. 2 (1923) 353.—*C. nervosum* ELM. Leaf. Philip. Bot. 2 (1908) 482; Leaf. Philip. Bot. 7 (1915) 2566; MERR. En. Philip. 2 (1923) 352.—*C. costulatum* ELM. Leaf. Philip. Bot. 3 (1911) 1080; MERR. En. Philip. 2 (1923) 349.—*C. ellipsoideum* MERR. Philip. J. Sc. 10 (1915) Bot. 26; En. Philip. 2 (1923) 350.—*C. robustum* MERR. Philip. J. Sc. 11 (1916) Bot. 184; En. Philip. 2 (1923) 353.—*C. subcordatum* RIDL. J. Str. Br. R. As. Soc. no 82 (1920)

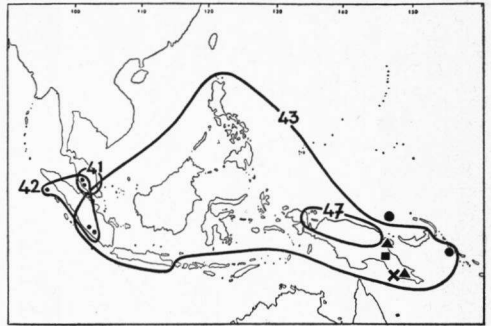


Fig. 45. Distribution of *Canarium hirsutum* and allies: 41. *C. pseudosumatranum* LEENH., 42. *C. sumatranum* BOERL. & KOORD. (known localities indicated by dots), 43. *C. hirsutum* WILLD., 44. *C. macadamii* LEENH. (■), 45. *C. chinare* GRUTT. & H. J. LAM (●), 46. *C. rigidum* (BL.) ZIPP. ex MIQ. (▲), 47. *C. polyphyllum* K.SCH., 48. *C. cestraceum* LEENH. (X).

175; Fl. Mal. Pen. 1 (1922) 374.—*C. longiflorescens* ELM. [ex MERR. En. Philip. 2 (1923) 352, in syn.] Leaf. Philip. Bot. 10 (1939) 3713, descr. angl.—*C. oxygonum* QUIS. & MERR. Philip. J. Sc. 37 (1928) 155.—*C. bataanense* MERR. ex SASAKI, Cat. Gov. Herb. Formosa (1930) 295, nomen.—*C. multijugum* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 212, t. 5 f. 5; Bull. Jard. Bot. Btzg III, 12 (1932) 476, t. 11 f. 7.

KEY TO THE VARIETIES

1. Pyrene with some straight ribs only (at most 3 at every angle and a median one on every lid); fruits very variable, mostly densely pilose. Leaves 4–12-jugate; leaflets usually broader, specially near the base. Inflorescences narrowly paniculate . . . . . *ssp. hirsutum*
2. Stipules present . . . . . *var. hirsutum*
2. Stipules absent . . . . . *var. beccarii*
1. Pyrene deeply irregularly furrowed all over the surface; fruits short and broad, sparsely pilose to nearly glabrous. Leaves 6–10-jugate; leaflets relatively narrow, sparsely tomentose to glabrous. Inflorescences rather broadly paniculate . . . . . *ssp. multicosulatum*
3. Stipules absent . . . . . *var. multicosulatum*
3. Stipules present . . . . . *var. leeuwenii*

*ssp. hirsutum*.—All synonyms mentioned under the species except two varieties.

Tree c. 10–25(–48) m by 20–60(–200) cm. Branchlets very stout, 1½–3 cm thick, the tip ferruginously pubescent; pith large, with many small vascular strands, which are all or nearly all appressed to the wood-cylinder (rarely all scattered). Stipules nearly always present, rather caducous, inserted on the petiole ½–5 cm from its base, subulate, 4–12 mm, pubescent. Petiole thick (up to 2 cm at the base) with sharp edges. Leaves 4–13-jugate, up to 2 m long, pubescence

variable. *Leaflets* subsessile except the basal ones, mostly ovate to rather narrowly lanceolate, 5-45 by 2½-15 cm, chartaceous, rough to sparsely pilose; base rounded to cordate; margin entire; apex gradually to rather abruptly short-acuminate; nerves 12-30 pairs (angle 60-90°), straight to slightly curved, usually not arching but for the apical ones. *Inflorescences* axillary, laxly paniculate (♂) to subracemose (♀), ♂ up to 70 cm long, ♀ up

tating, stiff, reddish-brown hairs, ovoid, 2-6¼ by 1¾-4½ cm, otherwise rather variable (see varieties).

Distr. Carolines (Palau), Solomon Islands, and throughout *Malaysia*, not yet known from the Lesser Sunda Islands. Fig. 45.

Ecol. Rather common in primary, rarely in secondary forests, in wet to dry localities, mostly at low altitudes (rarely up to 1800 m). *Fl. fr.*



Fig. 46. *Canarium hirsutum* WILLD. ♂ (Cult. Hort. Bog. VI-D-7).

to 30 cm, ♂ flowers usually crowded in many-flowered glomerules, ♀ ones single or in few-flowered cymules; usually densely tomentose. *Flowers* 1-1¼ cm long, short-stalked. *Calyx* shallowly cupular, subtruncate, 1½-3½ mm high. *Corolla* much exerted, densely appressedly fulvous-tomentose without. *Stamens* free, filaments slender, pilose, in ♂ flowers c. 1 cm, twisted, in ♀ flowers c. ½ cm. *Disk* in ♀ flowers 6-lobed, 1 mm high, pilose, in ♂ flowers cupular, c. 2 mm high, densely erect-pilose. *Pistil* sometimes stalked, densely pilose; in ♂ flowers (nearly) absent. *Inflorescences* recurved to pendulous, racemose, up to c. 15 cm long and with few fruits, to paniculate, more than 30 cm long and with many fruits; calyx 4-16 mm diam., flat, lobes often recurved. *Fruits* nearly always with long-remaining, irri-

throughout the year, *fl.* specially Febr.-July, *fr.* specially April-Sept.

Wood anat. MOLL & JANSSONIUS. Mikr. Holzes 2 (1908) 102 (*C. hispidum* BL.).

Uses. Wood moderately hard to rather soft. 'According to the natives of Bukidnon decoction of roots is good for stomach trouble' (SULIT). Resin rather abundant and probably of some importance (see BUCKLEY, Mal. For. Rec. no 11, 1932, 29).

Vern. Sumatra: *Damar mata kutjing putih*, W. Coast; Malay Peninsula: *si(si)kat*, Perak, *sengei*, Pahang, *damar degun*; Java: *dahu*, *ki bontèng*, *ki gugula*, *ki harèpang*, *ki lang(g)ir*, *ki mèrang*, *ki tiwu*, *ki tuwak*, W. Java, *kènarèn*, *klawer*, *rahu (lanang)*, *sapi*, *trawel*, Central Java, *djambejan*, *djaran*, *djunggrang*, *kaju*, *kèdojo*, *kèna-*



rèn, kètèh, surèn, E. Java, *biru*; Kangean: *kanale bulu*; Bawean: *kadudja*; Borneo: *kurihang*, E. Born., *kambayau burong*, *lampakau*, *lukangi*, Br. N. Born., *kieng*; Anambas Isl.: *si(si)kat*; Karimata: *bajur*; Philippines: *aduas*, *dulit*, *katong-matsing*, *kiñao-aeta*, *kuyag*, Tag., *bakayan*, *bugo*, P. Bis., *malapiljai*, S.L. Bis., *paluahan*, C. Bis., *salong*, Bis., *buang-amu*, Lan., *hagushus*, Bik., *ibeng*, Klg., *ibu*, Mbo, *kalana*, *ogat-somagasa*, Bag., *kal-làg*, Ibn, *kiñaotao*, Neg., *mala-apayos*, Pang., *pala-iàñgan*, Ilk, *kibang*, Mindoro, *kadabu-dabu*, *ogat-calauwa*, Mindanao; Celebes: *bobang*, *kanari jaki*, *kanene uwak sèla*, *kuni uwak*, *mahakalu*, (*ma*)*malapa(k)*, *mamalopok*, *mawowang*, *mohong kalau*, *papoko*, *solo lèwo*, N. Cel., *lahu*, Central Cel., *tontong*, Mak., *raganogalu*, Buton, *saumbawa*; Moluccas: *mede-mede*, Morotai, *loli hapo*, *mede-mede*, *niha i fufuru*, *titi ma silo*, Halmahera, *kénari utan*, *njiha banga*, *sesilo*, Ternate, *hahume lassai*, Manipa, *sowe waer*, Wai, *dok*, Ceram, *kamakoan*, Ambon; *pokok damar degun*, Mal.

Notes. In one specimen (Mindanao: L. ZWICKEY 601) I found the petals densely, appressedly pilose within; in another ♂ specimen (Celebes: POSTHUMUS 2344) the stamens were slightly confluent at the base.

*Boswellia hirsuta* SMITH in REES (Cycl. 39, 2, 1819) is not, as mentioned in the Index Kewensis, synonymous with this species; the description, given by SMITH, is based on a remark by ROXBURGH (Pl. Corom. 3, 1811, 5) referring to a plant from the Ballagat Mountains, which in all probability is a true *Boswellia*, and which has wrongly been associated with *Canarium odoriferum hirsutum* RUMPH. by ROXBURGH.

*var. hirsutum*.—Fig. 46.

Stipules present. Pyrene with 3–12 straight ribs; fruit long remaining pilose. Seeds 1–2, sterile cells more or less reduced.

Distr. Carolines (Palau Isl.) and throughout Malaysia, except New Guinea and New Britain.

Note. Widely distributed variety, specially polymorphous in fruit characters which tend to be more or less geographical.

*var. beccarii* LEENH. *Blumea* 8 (1955) 189.

Pith of the branchlet with many, scattered, small, vascular strands. Stipules absent. Leaflets sparsely, patently stiff-pilose on the nerves beneath; nerves 14–16 pairs. Fruit ellipsoid, round in cross-section, acute at apex,  $2\frac{3}{4}$ –3 by  $1\frac{3}{4}$ –2 cm; pyrene rostrate, gibbous, angle-ribs acute, lids with acute median rib; 2 sterile cells.

Distr. Malaysia: SE. Celebes.

Note. The taxonomic position and status of this variety remains doubtful.

*ssp. multicostulatum* LEENH. *Blumea* 8 (1955) 191, f. 5e.—*C. hirsutum* WILLD. f. ζ (*multicostulatum*) H. J. LAM.—*C. multijugum* H. J. LAM.

*var. multicostulatum*.

Stipules absent. Leaves 9–10-jugate. Nerves 20–25(–30) pairs. Leaflets glabrous. Fruits broadly

ovate terete, 2 by  $1\frac{1}{2}$ – $1\frac{3}{4}$  cm, nearly glabrous; pyrene deeply and irregularly furrowed.

Distr. Malaysia: Moluccas (Halmahera).

*var. leeuwenii* LEENH. *Blumea* 8 (1955) 191.—*C. hirsutum* WILLD. f. ♂ (*leeuwenii*) H. J. LAM.

Pith of the branchlets very fibrous. Stipules present. Leaves 6-jugate. Leaflets glabrescent; nerves 14–15 pairs. Fruits nearly globose,  $3\frac{1}{2}$  by  $2\frac{3}{4}$  by  $2\frac{3}{4}$  cm, nearly glabrous, with very thick (4 mm), fibrous pericarp; pyrene irregularly shallowly furrowed (peach-like), 2 cells sterile.

Distr. Solomon Islands, New Britain, and Malaysia: New Guinea.

44. *Canarium macadamii* LEENH. *Blumea* 8 (1955) 191, f. 5c.

Large tree. Branchlets slender, somewhat scabrous, lenticellate; pith with a peripheral cylinder of vascular strands, central ones more or less clearly cylindrically arranged. Stipules inserted at the base of the petiole, linear, 5–6 mm, glabrous, as are the leaves and the inflorescences. Leaves 2–4-jugate. Leaflets oblique-ovate, 12–15 by 6–8 cm, subcoriaceous; base very oblique, rounded; margin entire; apex abruptly, shortly (5 mm) blunt-acuminate; nerves 14–16 pairs (angle 60–70°, in the basal part up to 90°), straight to slightly curved, vaguely to distinctly arching close to the margin. Inflorescences (♀ unknown) axillary, narrowly paniculate, c. 12 cm long; branches up to  $2\frac{1}{2}$  cm, with up to 15 clustered flowers. Flowers (♂) 7 mm long, short-pedicelled, glabrous outside, with a slightly concave receptacle. Calyx  $4\frac{1}{2}$  mm high. Stamens slightly confluent at base. Disk conical,  $1\frac{1}{2}$  mm high, halfway with a 6-lobed rim, glabrous, with a central canal, widening to the base and enclosing the rudimentary pistil. Infructescences unknown, calyx flat, triangular, 5 mm diam., lobes reflexed. Fruits ellipsoid, round in cross-section,  $3\frac{1}{2}$  by  $1\frac{1}{2}$  cm, acuminate at the apex, glabrous; pyrene smooth; lids 3 mm thick. Seed 1, sterile cells moderately reduced.

Distr. Malaysia: New Guinea (Morobe Distr.: Wau), once collected. Fig. 45.

Ecol. Forested slope, on rich clay or loam soil, locally common, 1500 m.

45. *Canarium chinare* GRUTTERINK & H. J. LAM, in LEENH. Bull. Bish. Mus. no 216 (1955) 7, f. 4.

Tree up to 25 m. Branchlets slender, scabrous, tips sparsely appressedly pubescent; pith with many vascular strands, partly arranged in a peripheral cylinder. Stipules caducous, inserted at the conjunction of petiole and branchlet on a faintly prominent 2–3 mm long rim, oblong-lingulate to subulate,  $1\frac{1}{2}$ – $6\frac{1}{2}$  mm. Leaves 2–4-jugate, glabrous. Leaflets oblong-elliptic (to oblong-ovate), 5–11 by  $2\text{--}4\frac{1}{2}$  cm, coriaceous; base cuneate; margin entire; apex abruptly, bluntly short-acuminate; nerves 10–14 pairs (angle 50–55°), gradually curved towards the margin, apical ones always, the rest sometimes distinctly arched. Inflorescences and flowers unknown. Infructescences axillary, subracemose, 4–8 cm long, with

1–2 fruits; calyx saucer-shaped, 3-lobed, 8 mm diam.; remains of 6 fimbriate disk-lobes present. *Fruits* subovoid, tapering at the base, about round in cross-section; pyrene more or less prominently 3-keeled; lids c. 2½ mm thick. *Seed* 1, sterile cells very slightly reduced.

Distr. Solomon Islands, in *Malaysia*: Admiralty Islands (Los Negros). Fig. 45.

Ecol. Rain-forests, up to 950 m. *Fr.* Febr. (Admir. Isl.), Aug. (Solomon Isl.).

Note. The identity of the Los Negros specimen (NGF 558) is not quite certain.

46. *Canarium rigidum* (BL.) ZIPP. ex MIQ. Fl. Ind. Bat. 1, 2 (1859) 648; ENGL. in DC. Mon. Phan. 4 (1883) 142, t. 3 f. 3–5; in E. & P. Pfl. Fam. 3, 4 (1896) f. 136 V–W; ed. 2, 19a (1931) f. 211 V–W; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 85; Bull. Jard. Bot. Btzg III, 12 (1932) 478, t. 11 f. 71, excl. syn. *Pimela* (*Canariopsis*, *Canarium*) *angustifolia* BL.—*Pimela rigida* BL. Mus. Bot. 1 (1850) 222.

Slender tree up to 25 m. *Branchlets* rather stout, 7–12 mm thick, glabrous but for the tips; pith with a peripheral closed cylinder of small vascular strands. *Stipules* absent. *Leaves* 6–12-jugate, glabrous. *Lateral petiolules* 2–11 mm. *Leaflets* lanceolate, 6¼–15 by 1¼–4 cm, chartaceous; base rounded to subcordate; margin entire; apex gradually, long and slender-acuminate; nerves 15–20 pairs (angle 70–85°), irregular, not to faintly curved, abruptly arching at c. 1–2 mm from the margin; intermediate veins strongly developed. *Inflorescences* (♀ unknown) axillary, laxly paniculate, 10–20 cm long, glabrous, peduncle globular-thickened at the base; main branches subdecussate, up to 5 cm, dichotomously branched, crowded 9–12-flowered. *Flowers* (♀ unknown) subsessile, glabrous, 6 mm long. *Calyx* 3 mm high. *Petals* much incrassate towards the apex, the broadened and flattened margins of the apical part rugose. *Stamens* glabrous, 4½–5 mm long, connate for 2 mm. *Disk* cushion-shaped with elevated margin, 1 mm high, minutely pubescent on the upper surface, with a central canal, but without a rudimentary pistil. *Infructescences* 12–25 cm long, with 1–3 fruits, glabrous; main branches up to 6 cm; calyx shallowly saucer-shaped with a 3-lobed margin; remains of a circular, fimbriate disk present. *Fruits* ellipsoid, tapering at the base, acuminate at the apex, rounded 6-angular in cross-section, 4 by 2–2½ cm, glabrous; pericarp rather thick and fleshy; pyrene circular in cross-section with many irregular, longitudinal ribs, which are up to 5 mm high and 1–2 mm wide; lids 2½ mm thick. *Seed* 1, sterile cells only slightly reduced.

Distr. *Malaysia*: New Guinea. Fig. 45.

Ecol. Primary and secondary forests, both at low altitude and up to 1000–1200 m, *fr.* March.

47. *Canarium polyphyllum* K.SCH. in K.SCH. & HOLLER. Fl. Kais. Wilh. Land (1889) 63; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 77; Bull. Jard. Bot. Btzg III, 12 (1932) 479, t. 11 f. 72;

non KÄRNBACH, Bot. Jahrb. Beibl. 37 (1893) 16, and M. KRAUSE, Tropenpflanzer 17 (1913) 147, cum fig. (very probably these both refer to *C. indicum* L.).—*C. ledermannii* LAUT. Bot. Jahrb. 56 (1920) 328, f. 2A–E.—Fig. 20d.

Tree, up to 30 m high, with buttresses. *Branchlets* c. ¾ cm thick, glabrous, the velvety young parts excepted; pith with many minute vascular strands, closely appressed to the wood-cylinder. *Stipules* absent. *Leaves* 3–8-jugate. *Leaflets* narrowly oblong, 5½–20 by 2½–8 cm, chartaceous, glabrous but for the minutely pubescent midrib above and midrib and main nerves beneath; base rounded (to subcordate); margin entire; apex rounded, rather abruptly, shortly and acute-acuminate; nerves 11–24 pairs (angle 60–70–90°), slightly irregular, strongly curving towards the margin, indistinctly arching remote from it; intermediate veins strongly developed. *Inflorescences* (♀ unknown) axillary, laxly paniculate, 15–48 cm long, pubescent towards the tips; partial panicles up to 8 cm long, long-stalked, cymose, c. 15-flowered, flowers clustered; *bracts* persistent, deltoid, 1 mm long. *Flowers* (♀ unknown) subsessile, 6 mm long, glabrous, pink. *Calyx* 2½–3 mm high. *Petals* thickened towards the apex, the inflexed apiculum much thickened and rugose. *Stamens* glabrous, c. 4½ mm long, connate for c. 1½ mm. *Disk* 1 mm high, cushion-shaped, faintly 6-lobed, deepened towards the centre, narrowed at base, long-pilose on the upper surface; no pistil. *Infructescences* racemose to paniculate, 10–25 cm long, with 5–7 fruits, glabrescent; main branches up to 5 cm long, with 1–2 fruits; calyx flat, faintly 3-lobed to circular, 8–10 mm diam., margin slightly undulate; remains of a 6-lobed, long-fimbriate disk present. *Fruits* ellipsoid, tapering at both ends, rounded 3-angular to circular in cross-section, 4–5 by 2–2½ cm, glabrous; angle-ribs of the pyrene acute, surface of the lids slightly undulate; lids c. 1 mm thick. *Seed* 1, sterile cells slightly reduced.

Distr. *Malaysia*: New Guinea. Fig. 45.

Ecol. In dense to open primary forests, up to c. 400 m, *fl.* June–Nov., *fr.* Sept.

Vern. *Hoddjai*, Manokwari.

48. *Canarium cestracon* LEENH. Blumea 8 (1955) 189, f. 5g.—Fig. 21k.

Tree c. 20 m. *Branchlets* 8 mm thick, glabrous; pith fibrous by many, scattered small vascular strands. *Stipules* very caducous, inserted on the twig near the base of the petiole, leaving a minute scar. *Leaves* 3–5-jugate, glabrous. *Leaflets* ovate-lanceolate, 11–20 by 4½–7 cm, stiff-chartaceous; base rounded to broadly cuneate; margin entire; apex gradually narrowed into a short, broad and blunt acumen; nerves 10–12 pairs (angle 65–75°), straight to faintly curved, more strongly curved towards the margin, more or less distinctly arching at some distance from it. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, racemose, 15–20 cm long, with 1–3 fruits, glabrous; calyx flat, 3-angular, 6–8 mm diam., lobes reflexed. *Fruits* ellipsoid, acuminate at base and

apex, narrowly triangular in cross-section, 4-4<sup>1</sup>/<sub>2</sub> by 2<sup>1</sup>/<sub>2</sub>-2<sup>3</sup>/<sub>4</sub> by c. 1<sup>1</sup>/<sub>2</sub> cm, glabrous; pyrene deeply furrowed, angle-ribs very prominent, as are the median ribs of the lids; lids 3<sup>1</sup>/<sub>2</sub> mm thick. *Seeds* 1-2; fertile cells long and narrow, sterile ones nearly fully reduced.

Distr. *Malaysia*: E. New Guinea (Central Prov.), once collected. Fig. 45.

Ecol. In forests, 500 m. Fr. July.

49. *Canarium vrieseanum* ENGL. in DC. Mon. Phan. 4 (1883) 142, t. 3 f. 15-18; KOORD. Suppl. Cel. 2 (1922) t. 30; Suppl. 3 (1922) 17; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 455, t. 10 f. 63.—*C. williamsii* C. B. ROBINSON, Philip. J. Sc. 3 (1908) Bot. 185; W. H. BROWN, Min. Prod. Philip. For. 2 (1921) 302, f. 37; MERR. En. Philip. 2 (1923) 355.—*C. tongcalingii* ELM. Leaf. Philip. Bot. 3 (1911) 1082; MERR. En. Philip. 2 (1923) 354.—*C. sibulanense* ELM. Leaf. Philip. Bot. 3 (1911) 1085; MERR. En. Philip. 2 (1923) 353.—*C. dolichophyllum* MERR. Philip. J. Sc. 10 (1915) Bot. 20; En. Philip. 2 (1923) 350.—*C. villosiflorum* ELM. Leaf. Philip. Bot. 7 (1915) 2569.

Tree 15-25(-31) m by 30-45 cm, buttresses small or absent. *Branchlets* slender to rather stout, nearly always densely, minutely woolly ferruginous-pubescent, as are the leaves, inflorescences and sometimes the infructescences; pith with a peripheral cylinder of rather large vascular strands. *Stipules* inserted on the petiole up to 1<sup>1</sup>/<sub>2</sub> cm from the base, often ribbon-shaped, tapering, and falcate, 2<sup>1</sup>/<sub>2</sub>-1 cm. *Leaves* 3-5(-7)-jugate. *Leaflets* ovate to oblong, 7-30 by 3-12 cm, chartaceous, more or less densely fulvous-pubescent on the midrib above and on all nerves beneath, rarely nearly glabrous; base slightly oblique, rounded to cuneate; margin entire; apex rather abruptly, up to 3 cm long, slender-acuminate; nerves rather prominent beneath, 12-18(-24) pairs (angle 55-75°), parallel, straight or slightly curved, more strongly curving towards the margin, gradually and vaguely arching close to it. *Inflorescences* axillary, narrowly paniculate (♂) to racemose (♀), 20-30(-60) cm long, 1-3(-5) cm wide, main branches patent, about 1<sup>1</sup>/<sub>2</sub> cm long, 3-5-flowered (♀ ones 1-3-flowered), rarely some basal ramifications strongly developed. Buds fusiform, slender, fulvous-tomentose, closed. *Flowers* 6-10 mm long, nearly sessile. *Calyx* 6-8 mm high. *Stamens* glabrous, in ♂ flowers slightly and irregularly confluent at the base; in ♀ flowers free. *Disk* in ♀ flowers faintly 6-lobed, 1-2 mm high, fimbriate; in ♂ flowers ovoid, 1 mm high, pilose, with a central canal. *Pistil* densely pilose, ♂ none. *Infructescences* ascending to erect, 10-20(-45) cm long, with c. 5-10(-40) fruits; calyx flat, deeply 3-lobed (lobes not reflexed), 3<sup>1</sup>/<sub>4</sub>-1<sup>1</sup>/<sub>2</sub> cm diam. *Fruits* ovoid, acute, round in cross-section, 1<sup>3</sup>/<sub>4</sub>-3<sup>1</sup>/<sub>4</sub> by 3<sup>1</sup>/<sub>4</sub>-2<sup>1</sup>/<sub>4</sub> cm, remaining velvety for a long time; pyrene very faintly 6-ribbed, nearly smooth; lids c. 2<sup>1</sup>/<sub>2</sub> mm thick. *Seed* 1.

Distr. *Malaysia*: Philippines (Mindanao, according to H. J. LAM also in Luzon), Central and N. Celebes. A record from Buru, Moluccas, based

on a cultivated tree in the Bogor Botanical Garden, is doubtful. Fig. 47.

Ecol. In primary and secondary forests up to 500 m, fl. July-Dec.(-Febr.), fr. Dec.-Febr. (Celebes), March-June (Philip., *f. stenophyllum*), July-Oct. (Philip., *f. williamsii*).

Uses. The wood is said to be rather tough and hard, rarely more soft. The seeds are edible. Locally the resin is used for lighting purposes.

Vern. Mindanao: *gapog*, *gisau*, Sul., *biauan*, *magasurud*, *Bag*, *ogat*, *sagasa(k)*, Mbo.; Celebes: *are*, *kon ne uwal*, *solo (lewo, in koko)*, Minahasa.

Notes. Rather polymorphous species, which can easily be subdivided into three local forms.

The typical form (*f. vrieseanum*), which is restricted to Celebes, is the more slender one: branchlets less than 1 cm thick, leaves 3-5-jugate, leaflets lanceolate and moderately hairy, inflorescences narrowly paniculate, infructescences mostly racemose.

The second form, *f. williamsii* (C. B. ROB.) LEENH. *nov. stat.* (syn.: *C. williamsii* C. B. ROB., *C. dolichophyllum* MERR., *C. villosiflorum* ELM.), from Mindanao, is characterized by its stouter and more pilose habit, with 6-7-jugate leaves, large and ovate leaflets, and larger and more widely paniculate inflorescences and infructescences, the latter with many more fruits.

The third form, *f. stenophyllum* LEENH. (Blumea 8, 1955, 194), is restricted to Davao Prov. (Mindanao). This is also a rather stout form, characterized by its many-jugate, nearly glabrous leaves with oblong, stiff leaflets, c. 20 by 4 cm; nerves many and dense; fruits rather small (c. 1<sup>3</sup>/<sub>4</sub> by 1<sup>1</sup>/<sub>4</sub> cm), as are the inflorescences.

This species is related to *C. asperum* BENTH., specially to its *var. clementis* LEENH. from the Philippines.

50. *Canarium acutifolium* (DC.) MERR. Int. Rumph. (1917) 302; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 58, t. 13 f. 104j, t. 15 f. 117b; Bull. Jard. Bot. Btzg III, 12 (1932) 451, t. 10 f. 61; H. J. LAM & HUSSON, Blumea 7 (1952) 164; CHATTAWAY, Austr. J. Bot. 1 (1953) 30, f. 3.—*Dammara nigra* RUMPH. Herb. Amb. 2 (1741) 160, t. 52.—? *C. nigrum* ROXB. [Hort. Beng. (1814) 49, *nomen*] Fl. Ind. ed. CAREY 3 (1832) 138.—*Marnigia acutifolia* DC. Prod. 2 (1825) 79; HENSCH. Vita Rumph. (1833) 116.—*Pimela acutifolia* BL. Mus. Bot. 1 (1850) 221.—*Pimela laxiflora* BL. Mus. Bot. 1 (1850) 221.—*C. longiflorum* ZIPP. *ex* MIQ. Fl. Ind. Bat. 1, 2 (1859) 647; ENGL. in DC. Mon. Phan. 4 (1883) 125.—*C. rostratum* ZIPP. *ex* MIQ. Fl. Ind. Bat. 1, 2 (1859) 647, *nom. illeg.*; ENGL. in DC. Mon. Phan. 4 (1883) 128.—*C. lineistipula* K. SCH. & LAUT. Fl. Schutzgeb. (1901) 379; LAUT. Bot. Jahrb. 56 (1920) 331; LANE-POOLE, For. Res. (1925) 98.—*C. aemulans* LAUT. Bot. Jahrb. 56 (1920) 326, f. 2 F-O; ENGL. in E. & P. Pfl. Fam. ed. 2, 19a (1931) f. 213 F-O; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 81; Bull. Jard. Bot. Btzg III, 12 (1932) 453.—*C. legitimum* (*non* MIQ.) HEYNE, Nutt. Pl. (1927) 877, *pro maj. parte*.—*C. leeuwenii* H. J. LAM, Ann. Jard. Bot.

Btzg 42 (1932) 210; Bull. Jard. Bot. Btzg III, 12 (1932) 449, t. 9 f. 59.

Distr. *Malaysia*: Central Celebes, Moluccas, and New Guinea. Fig. 47.

Notes. The inflorescences of this species sometimes contain witches' brooms like those which are common in *C. asperum* BENTH. Cf. fig. 48.

Apparently *var. acutifolium* is the most primitive (6 stamens), *var. acutifolium* the most specialized form of this species (3 stamens); *var. aemulans* is interrelated between the two forms, differing mainly from the latter by the number of stamens. The species as a whole is closely related to *C. asperum* BENTH. *ssp. papuanum* LEENH.

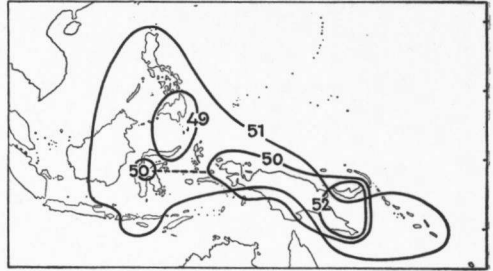


Fig. 47. Distribution of *Canarium asperum* and allies: 49. *C. vrieseanum* ENGL., 50. *C. acutifolium* (DC.) MERR., 51. *C. asperum* BTH., 52. *C. schlechteri* LAUT.

#### KEY TO THE VARIETIES

1. Stamens 3 . . . . . *var. acutifolium*
1. Stamens 6.
2. Nerves 20–25 pairs . . . . . *var. celebicum*
2. Nerves 12–15 pairs . . . . . *var. aemulans*

*var. acutifolium*.—Synonymy as above, with the exception of *C. aemulans*.—Fig. 22c.

Tree, 20(–40) m by 20–90 cm; buttresses, if present, up to 3 m high. *Branchlets* up to 1½ cm thick, soon glabrescent; pith with a peripheral cylinder of vascular strands, closely appressed to the wood-cylinder, central part nearly always disappearing (very probably by the action of ants). *Stipules* subsistent, inserted at the base of the petiole, filiform, 1½–3½ cm long. *Leaves* (2)–3–5 (–7)-jugate. *Leaflets* ovate to narrowly oblong, 12–30 by 4–11½ cm, chartaceous, glabrous; base slightly oblique, rounded to broadly cuneate; margin entire; apex abruptly, rather long and slender (¾–2 by ¼ cm) blunt-acuminate; nerves 11–15–20 pairs (angle 80–90°), slightly, towards the margin more strongly, curved, more or less distinctly arching close to the margin. *Inflorescences* axillary, laxly pyramidal-paniculate, nearly always glabrous, ♂ ones up to 50 cm, ♀ ones up to 40 cm long, main branches up to 20 cm, partial panicles long-stalked, many-flowered. *Flowers* c. 4 mm long, shortly pedicelled, glabrous outside, ♀ ones with a slightly concave receptacle. *Calyx* 2–2½ mm high. *Stamens* 3, free, glabrous. *Disk* glabrous, in ♂ flowers irregularly shaped, 1½ mm high, with a central canal in which the minute rudimentary pistil is immersed; in ♀ flowers a faintly 3-lobed rim, 1 mm high. *Pistil* glabrous. *Infructescences* like the inflorescences, rigid, with many fruits; calyx flat, triangular, 3–3½ mm diam., tips of the lobes reflexed. *Fruits* ovoid, acute, round in cross-section, 12–15 by 8–10 mm, glabrous; pericarp thin; pyrene tuberculate; lids 1½–2 mm thick. *Seed* 1, sterile cells strongly reduced.

Distr. *Malaysia*: Moluccas (Kei Islands, according to RUMPHIUS also on Manipa, Kelang, Ceram, and Ambon), New Guinea (incl. also P. Japen, Waigeo, Misool, and Aru Islands).

Ecol. In New Guinea apparently the most common species of the genus, both in primary

and in secondary forests, specially in more open places (forest-edges, river-banks, clearings), mostly on wet (sometimes temporarily inundated) clayey soil, up to c. 200(–700) m. *Fl.* mainly July–Sept., *fr.* mainly Jan.–March.

Uses. Wood rather soft to very hard, tough, but easily splitting. The resin, though abundant, seems to be of little importance; it is used for lighting purposes and for caulking boats.

Vern. Moluccas: *isse felu*, *jar (jal) mete*, *kama mete*, *solo kokelu*, Ambon, *canari itam*, *damar itam*, *dammar galla-galla*; New Guinea: *sakenau*, Waigeo, *bowwie*, (i) *ja(k)ko*, *je*, *kwasodja*, *mengkis*, *sumgui*, *wassedjah*, Vogelkop, *kieta*, *ogoseya*, Gulf Distr., *degantoto*, *mundrum*, *nuri (nuri)*, *ongoi*, *orngo*, *sisira*, *wairo*, N. Div., *rogoray*.

Notes. I have included *C. leeuwenii* H. J. LAM in this variety. The only specimen known of this is DOCTERS VAN LEEUWEN 10643; it bears very young fruits and differs from typical *C. acutifolium* by its dense, hirsute, reddish-brown tomentum. The hairiness is very variable in most species of *Canarium*, and this specimen was collected at a rather high altitude (700 m).

PLEYTE noted on his no 1020 from Misool that the specimen was a pseudoliana 30 m by 4 cm; other collections from him in adjacent localities are, however, from trees; I have my doubts about this field note.

*var. celebicum* LEENH. Blumea 8 (1955) 188.

Branchlets solid; pith with a peripheral cylinder of vascular strands and some scattered ones in the central part. Stipules inserted on the petiole at 1–5 mm from the base, up to 1½ cm. Leaflets oblong to lanceolate, 10–22 by 4–6 cm; the apex more gradually narrowed; nerves 20–25 pairs, nearly straight. Inflorescences and flowers (♂ unknown) thinly tomentose. Stamens 6. Disk 6-lobed, pilose as is the pistil. Fruit-calyx 5–6 mm diam.

Distr. *Malaysia*: Central Celebes.

Ecol. Collected at 250–400 m; *fl.* July.

*var. aemulans* (LAUT.) LEENH. *nov. stat.*—*C. aemulans* LAUT.

Differing from *var. celebicum* in its leaflets,

which are ovate to oblong, 7–18 by  $3\frac{1}{4}$ – $8\frac{1}{2}$  cm, abruptly acuminate, and with 12–15 pairs of nerves. Fruits subglobose,  $1\frac{1}{4}$  by  $1\frac{1}{2}$  cm; sterile cells less reduced.

Distr. New Britain and Malaysia: NE. New Guinea (Kani Mts).

Ecol. Up to 1000 m, fl. fr. Dec., April–May.

**51. *Canarium asperum* BENTH.** in Hook. Lond. J. Bot. 2 (1843) 215; ENGL. in DC. Mon. Phan. 4 (1883) 135; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 461, t. 10 f. 66; MEIJER DREES, Comm. For. Res. Inst. no 33 (1951) 42; LEENH. Bull. Bish. Mus. no 216 (1955) 10, f. 5; Blumea 8 (1955) 189.—*Dammara nigra legitima* RUMPH. Herb. Amb. 2 (1741) t. 53.—*C. commune* (non L.) BLANCO, Fl. Filip. (1837) 791; MERR. Publ. Gov. Lab. Philip. no 27 (1905) 30; Sp. Blanc. (1918) 207.—*C. pimela* (non KOEN.) BLANCO, Fl. Filip. ed. 2 (1845) 545, t. 343; ed. 3, 3 (1879) 200, t.; MERR. *ll.cc.*—*Pimela legitima* BL. Mus. Bot. 1 (1850) 222.—*Pimela villosa* BL. Mus. Bot. 1 (1850) 223.—*Pimela denticulata* BL. Mus. Bot. 1 (1850) 226.—*C. legitimum* MIQ. Fl. Ind. Bat. 1, 2 (1859) 647; ENGL. in DC. Mon. Phan. 4 (1883) 127; MERR. Int. Rumph. (1917) 300.—*Canariopsis villosa* MIQ. Fl. Ind. Bat. 1, 2 (1859) 652.—*Canariopsis aspera* MIQ. Fl. Ind. Bat. 1, 2 (1859) 653.—*Canariopsis denticulata* BL. ex MIQ. Fl. Ind. Bat. 1, 2 (1859) 654.—*C. villosum* BENTH. & HOOK. f. ex F. VILL. Nov. App. (1880) 40; VIDAL, Sinopsis (1883) 19, t. 28 f. A; W. H. BROWN, Min. Prod. Philip. For. 2 (1921) 49, f. 13; MERR. En. Philip. 2 (1923) 354; F. M. YENKO *et al.* Philip. J. Sc. 55 (1934) 5, 9, t. 7 f. 3.—*C. molle* ENGL. in DC. Mon. Phan. 4 (1883) 109.—*C. minutiflorum* ENGL. in DC. Mon. Phan. 4 (1883) 123; MERR. En. Philip. 2 (1923) 351.—*C. zollingeri* ENGL. in DC. Mon. Phan. 4 (1883) 127; KOORD. Exk. Fl. Java 2 (1912) 434; HEYNE, Nutt. Pl. (1927) 880.—*C. cumingii* ENGL. in DC. Mon. Phan. 4 (1883) 132; ELM. Leaf. Philip. Bot. 3 (1911) 1077.—*C. luxurians* ENGL. in DC. Mon. Phan. 4 (1883) 146, *nom. illeg.*—*C. solo* ENGL. ex KOORD. Nat. Tijd. N. I. 63 (1903) 98, *nomen*; Suppl. Cel. 2 (1922) t. 29; *op. cit.* Suppl. 3 (1922) 16.—*C. treubianum* ENGL. ex KOORD. Nat. Tijd. N. I. 63 (1903) 98, *nomen*; Suppl. Cel. 2 (1922) t. 32; *op. cit.* Suppl. 3 (1922) 18.—*C. calophyllum* PERK. Fragm. Fl. Philip. 1 (1904) 91; MERR. En. Philip. 2 (1923) 349; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 83; Bull. Jard. Bot. Btzg III, 12 (1932) 529.—*C. juglandifolium* PERK. Fragm. Fl. Philip. 1 (1904) 93; MERR. Publ. Gov. Lab. Philip. no 35 (1906) 28.—*C. lucidum* PERK. Fragm. Fl. Philip. 1 (1904) 94; MERR. En. Philip. 2 (1923) 351; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 82; Bull. Jard. Bot. Btzg III, 12 (1932) 530.—*C. polyneurum* PERK. Fragm. Fl. Philip. 1 (1904) 96; MERR. En. Philip. 2 (1923) 353.—*C. stachyanthum* PERK. Fragm. Fl. Philip. 1 (1904) 97; MERR. Publ. Gov. Lab. Philip. no 35 (1906) 29.—*C. thyrsoideum* PERK. Fragm. Fl. Philip. 1 (1904) 98; MERR. Publ. Gov. Lab. Philip. no 35 (1906) 28.—*C. valetonia-num* ENGL. [ex KOORD. Nat. Tijd. N. I. 63 (1903)

98, *nomen*] ex HOCHR. Pl. Bogor. Exs. (1904) 63; Bull. Inst. Bot. Btzg no 22 (1905) 86; Ann. Jard. Bot. Btzg Suppl. 3 (1910) 850; KOORD. Suppl. Cel. 2 (1922) t. 33; *op. cit.* Suppl. 3 (1922) 18.—*C. koordersianum* ENGL. [ex KOORD. Nat. Tijd. N. I. 63 (1903) 97, *nom. nud.*] ex HOCHR. Pl. Bogor. Exs. (1904) 63; KOORD. Suppl. Cel. 2 (1922) t. 27; *op. cit.* Suppl. 3 (1922) 14.—*C. reticulatum* MERR. Philip. J. Sc. 3 (1908) Bot. 141; En. Philip. 2 (1923) 353; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 530, *non C. reticulatum* RIDL. Kew Bull. (1930) 83 *quae est Dacryodes rostrata* H. J. LAM.—*C. clementis* MERR. Philip. J. Sc. 3 (1908) Bot. 142; ELM. Leaf. Philip. Bot. 3 (1911) 1078, *incl. var. perumbrinum*.—*C. leyteana* ELM. Leaf. Philip. Bot. 3 (1911) 1081.—*C. apoense* ELM. Leaf. Philip. Bot. 3 (1911) 1083; MERR. En. Philip. 2 (1923) 349.—*C. ogat* ELM. Leaf. Philip. Bot. 3 (1911) 1086; MERR. En. Philip. 2 (1923) 352; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 352.—*C. sibuyanense* ELM. Leaf. Philip. Bot. 4 (1912) 1502.—*C. euphlebium* MERR. Philip. J. Sc. 8 (1913) Bot. 372; En. Philip. 2 (1923) 350.—*C. wenzelii* MERR. Philip. J. Sc. 9 (1914) Bot. 363; En. Philip. 2 (1923) 355.—*C. heterophyllum* MERR. Philip. J. Sc. 10 (1915) Bot. 19; En. Philip. 2 (1923) 350.—*C. lagunense* MERR. Philip. J. Sc. 10 (1915) Bot. 21; En. Philip. 2 (1923) 350.—*C. barnesii* MERR. Philip. J. Sc. 10 (1915) Bot. 22; En. Philip. 2 (1923) 349.—*C. sanchezii* MERR. Philip. J. Sc. 10 (1915) Bot. 27; En. Philip. 2 (1923) 353.—*C. agusanense* ELM. Leaf. Philip. Bot. 7 (1915) 2564; MERR. En. Philip. 2 (1923) 349.—*C. subvelutinum* ELM. Leaf. Philip. Bot. 7 (1915) 2566.—*C. urdanetense* ELM. Leaf. Philip. Bot. 7 (1915) 2568; MERR. En. Philip. 2 (1923) 354; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 531.—*C. samarense* MERR. Philip. J. Sc. 11 (1916) Bot. 183; MERR. En. Philip. 2 (1923) 353.—*C. tamborae* LAUT. Bot. Jahrb. 56 (1920) 327.—*C. fulvum* LAUT. Bot. Jahrb. 56 (1920) 330; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 16 f. 127c<sup>1</sup>; Bull. Jard. Bot. Btzg III, 12 (1932) 458, t. 10 f. 64.—*C. unifoliolatum* MERR. Philip. J. Sc. 17 (1921) 267; En. Philip. 2 (1923) 354; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 533.—*C. papuanum* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 211, t. 12 f. 86, t. 13 f. 104k; Bull. Jard. Bot. Btzg III, 12 (1932) 459, t. 10 f. 65.

Notes. *C. luxurians* ENGL. was based upon a specimen with witches' brooms in the inflorescences, a feature which is rather common in this species, and which is furthermore only known from *C. acutifolium* (DC.) MERR. They represent very dense, but sterile structures, up to 25 cm diam. (see fig. 48); according to K. B. BOEDJON they are caused by a fungus. A figure of the abnormal flower is given by H. J. LAM, Bull. *l.c.* t. 10 f. 66d.

The identity of *C. fulvum* LAUT., the type specimen of which consists only of young leaves and ♂ flowers (with nearly free stamens) remains uncertain as the decisive differential characters between *C. asperum* and *C. schlechteri* are found in the mature leaves, the fruits, and sometimes in the ♂ flowers (if the stamens are connate).

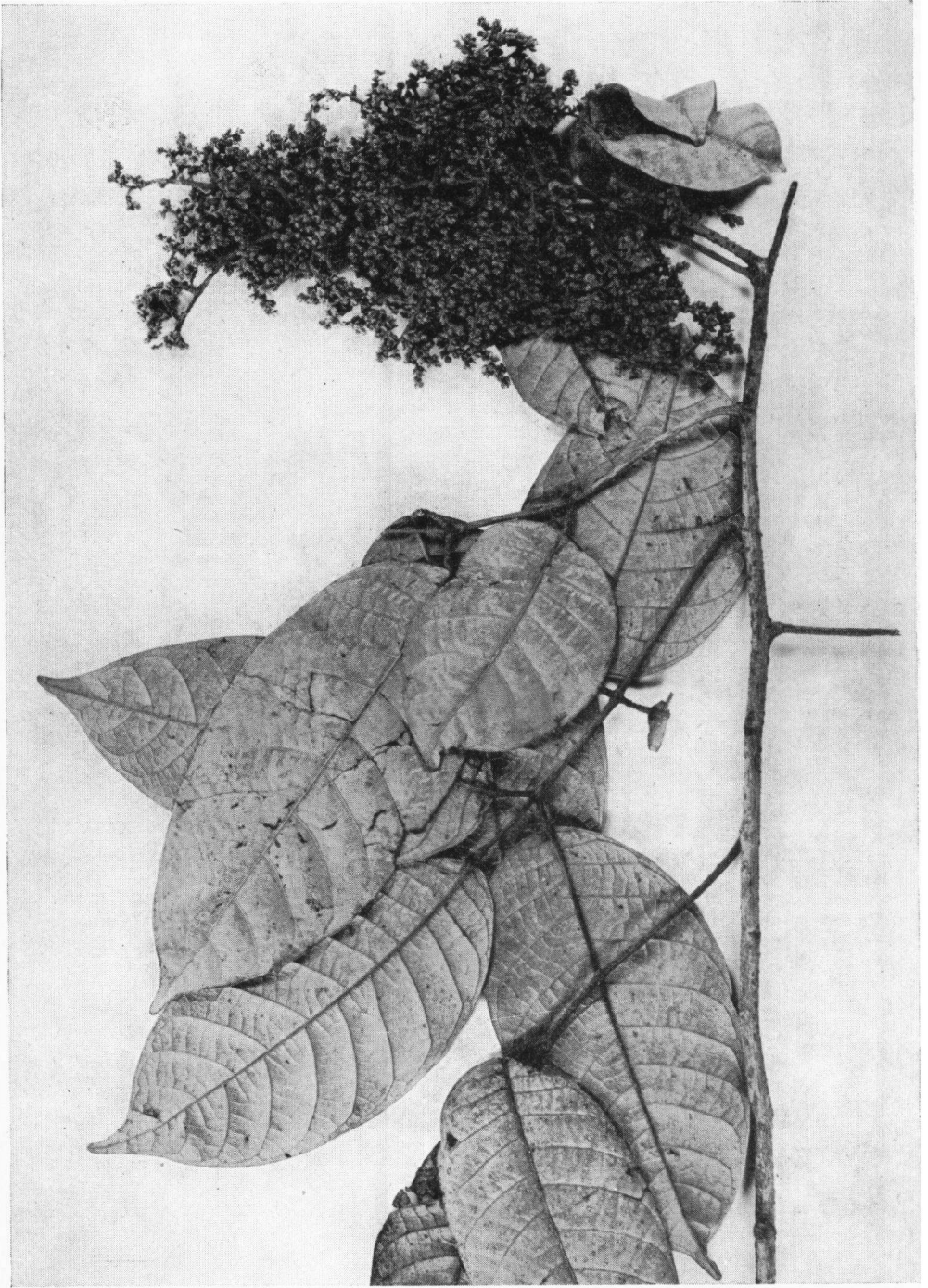


Fig. 48. Witches' broom in the inflorescence of *Canarium asperum* BTH. (MAIN & ADEN 946).

## KEY TO THE INFRASPECIFIC TAXA

1. Inflorescences spicate to narrowly paniculate.  
     *var. asperum*  
 1. Inflorescences more widely branched.  
 2. Inflorescences compoundly spicate.  
     *var. clementis*  
 2. Inflorescences paniculate . . . *ssp. papuanum*

*subsp. asperum var. asperum*.—All synonyms of the species except *C. clementis* MERR., *C. leytnense* ELM., *C. wenzelii* MERR., and *C. papuanum* H. J. LAM.

Tree 8–35 m by 5–70 (more than 100) cm, rarely a shrub, very rarely buttressed. *Branchlets* rather slender, nearly always glabrous but for the tip; number and arrangement of vascular strands in the pith very variable. *Stipules* subsistent or caducous, inserted beside the petiolar base or rarely on the petiole up to 1 1/4 cm from the base, subulate, 1–10 mm. *Leaves* 0–6-jugate. *Leaflets* very variable, ovate to elliptic, rarely obovate or lanceolate, 4–30 by 2–10 cm, generally rather rigid, chartaceous to coriaceous, glabrous or more or less pilose on the midrib above and on all nerves beneath; base rounded to cuneate, slightly oblique; margin entire, in young plants often serrulate to dentate and with tufts of hair on the teeth; apex mostly more or less abruptly, up to c. 2 cm long, tapering to narrowly, acutely to bluntly acuminate; nerves rather prominent beneath, (7–)12–15 (–20) pairs (angle 50–80°), straight to slightly curved, sometimes abruptly arching close to the margin. *Inflorescences* axillary, spicate to subracemose, ♂ ones sometimes narrowly paniculate, these up to c. 40 cm long, ♀ ones 1–20 (–32) cm, mostly slender and flexible, pendulous to ascending, sometimes rigid and erect; more or less hirsutely pubescent to glabrous. *Flowers* 3–7 mm long, ♀ ones very rarely with a slightly concave receptacle. *Calyx* 1 1/2–5 mm high. *Stamens* glabrous, 1 1/2–5 mm long, free, rarely slightly connate at the base or adnate to the disk. *Disk* pilose, in the ♀ flowers 3- or 6-lobed to subtruncate, c. 1 mm high; in the ♂ flowers cup-shaped with sometimes a small ovarial rudiment, to subglobose, with or without a central canal, more or less 6-lobed, up to 1 1/2 mm high. *Pistil* pubescent, rarely glabrous. *Infructescences* (nearly) spicate, flexible to rigid, with many fruits; *calyx* c. 2 1/2–5 mm diam. with strongly reflexed lobes (*asperum*-type) to c. 1 cm diam., funnel-shaped, deeply 3-lobed (*calophyllum*-type). *Fruits* ovoid to subglobose, subacute, round or slightly trigonous in cross-section, 9–14 by 4–11 mm, glabrous; pyrene smooth to slightly rugose, rarely very faintly 6-ribbed; lids c. 2 mm thick. *Seed* 1; sterile cells nearly to entirely reduced.

*Distr.* Solomon Islands, in *Malaysia*: Bawean & Kangean Isl. near E. Java, Lesser Sunda Isl. (Sumbawa, Sumba, Flores; according to MEIJER DREES also in Timor), Borneo (apparently rare), Philippines, Celebes, Moluccas, and New Guinea. Fig. 47.

*Ecol.* Apparently common in primary and secondary forests on very different, dry to wet,

sometimes marshy, soils, sometimes found in more open forests or savannahs. Mainly occurring at low altitudes, up to c. 500 m, more rarely, specially in the Philippines, found at altitudes above 1000 m (up to 1800 m). *Fl. fr.* chiefly March–Oct.

Wood anat. REYES, Dep. Agr. & Comm. Manila, Techn. Bull. 7 (1938) 161, pl. 24 fig. 3 (hand lens); WEBBER, Lilloa 6 (1941) 450.

*Uses.* The wood is said to be moderately hard, sometimes hard to very hard, or rather soft; it is of little durability. The resin is locally used for fuel and lighting purposes and sometimes recorded as caulking material for canoes and for painting hats. For the composition of the resin see BROWN, l.c. (under *C. villosum*).

*Vern. Kaju pukél, kědu (kěntu), popoah, Bawean, kanang, Kangean, kahé, karitak ku kasih, Sumba, hetji, kessi, Sumbawa, enduèng, kadjawanda, nangi (watu), neni, Flores, pu(lo)t, Borneo; Philippines: alagatlí, anagatlí, ananggi, anunggi, malapilauai, nani-saliing, pacharingen, pagsaingan, pagsaingin, pagsahingín-maliit, pal(a)sahingen, panhinhin, patsaingin, pilauai bulog, sahing, saliang, Tag., antang, Ibn., Neg., antel, anten(g), dolit, Ilk., bakayan, bua, lonai, magsaguid, milipili, panganhawon, saleng, salngan, salong, salosadugan, sanai, saong-saong, sulusalungan, Bis., bakiaua, dalit, Pang., biawan, sandoka, Ma., binsauan, gotkuton, Mbo., brea, Zamboanga, bulo, Pamp., chaiket, chamusil, kihu, tabul, Ig., danganarai, gapog, Sub., dilit, palsaingín, Sbl., gagnan, malolugna, sagasa(g), sauangan, Buk., giret, koribo, Neg., ogat, Bag., pili pili, Bik., pisa, Ting., pulutan, Lan., anagalti; Celebes: damar djahat, d. reri, kénari jaki, solo, s. in tanah, s. kulo, s. lewo, s. ni tiei, s. réndai, Minah., damar-damar, prèmpang, S. Cel.; damara, Saleier, biolo, P. Muna, kanaré, Buton; Moluccas: nakimbarawo, natimbarawo, Talaud, Karakelang, niriha, wehaka, Morotai, njiha puru, Ternate, dammar djadjaruwa, Batjan, damar itam, Ambon; N. Guinea: ijako, mangkès, mengkès, Manokwari, manifen, Biak.*

*Notes.* The type variety of this extremely variable species is itself also rather polymorphous, specially in leaf characters, particularly in the Philippines.

*var. clementis* (MERR.) LEENH. *nov. stat.*—*C. clementis* MERR.—*C. leytnense* ELM.—*C. wenzelii* MERR.

*Leaves* 3–4 (–5)-jugate. *Leaflets* medium-sized (10–17 by 5–8 cm), glabrous to densely ferruginously tomentose beneath; nerves 15–20 pairs; veins transverse, dense. *Inflorescences* compoundly spicate, flowers in glomerules.

*Distr. Malaysia:* Philippines (Luzon, Leyte, Mindanao).

*ssp. papuanum* (H. J. LAM) LEENH. Bull. Bish. Mus. no 216 (1955) 12.—*C. asperum* BENTH.; LAUT. Nova Guinea 8 (1912) 827; Bot. Jahrb. 56 (1920) 327.—*C. papuanum* H. J. LAM.

*Inflorescences* more widely and laxly paniculate. *Distr. Malaysia:* New Guinea, (low to) 1000–1800 m.

Notes. Rather dubious taxon, which for the time being can probably best be inserted here.

Rather variable in its vegetative and its flower parts. The ovariodisk in the ♂ flowers is quite variable in shape: the toadstool-shaped one, mentioned by H. J. LAM, I have also observed in some Philippine specimens of *ssp. asperum*. The triangular fruits, also mentioned by H. J. LAM, though looking quite different from those of *ssp. asperum*, are in my opinion of minor importance, as they are all young or sterile.

DOCTERS VAN LEEUWEN 10536 is said to have been collected of a climbing plant.

52. *Canarium schlechteri* LAUT. Bot. Jahrb. 56 (1920) 328; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 87, t. 15 f. 117c; Bull. Jard. Bot. Btzg III, 12 (1932) 454, t. 10 f. 62.—*C. gutur* DE MIKLOUHO-MACLAY, Proc. Linn. Soc. N.S.W. 10 (1885) 353, 357, *nomen*.—Fig. 20e.

Tree up to 25 m by 30–40 cm, sometimes faintly buttressed. *Branchlets* slender, glabrescent; pith with many rather small vascular strands, peripheral ones distinctly, central ones more or less distinctly, cylindrically arranged. *Stipules* inserted on the petiole up to 3 cm from the base, rather caducous, filiform, 2–3 mm. *Leaves* 3–6 jugate, glabrous to about woolly pubescent. *Leaflets* ovate to lanceolate, (5–)12–20 by (3–)5–7 cm, subcoriaceous, glabrous or thinly puberulous on the midrib above and on the nerves beneath; base slightly oblique, rounded to subcordate, sometimes attenuate; margin entire; apex acute, more or less abruptly short acute-acuminate; nerves 11–20 pairs (angle 50–60°), straight to slightly curved, not to distinctly and abruptly arching near the margin, nerves and veins often slightly sunken above, prominent beneath; intermediate veins not rarely well developed. *Inflorescences* (♀ unknown) axillary, narrowly paniculate, 12–22 cm long, sparsely tomentose to glabrous, main branches up to 1½ cm, up to 9-flowered; *bracts* subsistent, subulate, up to 8 mm. ♂ *Flowers* (♀ unknown) slender, 8–9 mm long, short-stalked. *Calyx* nearly truncate, 3 mm high, tomentose to scabrous. *Stamens* 7–8 mm long, glabrous, irregularly confluent at the base for up to 2 mm, tube more or less adnate to the disk. *Disk* 3 mm high, narrowly cupular to cylindrical, rim pilose, truncate to somewhat undulate, rudimentary ovary minute. *Infructescences* axillary, up

to c. 10 cm long, glabrous, with 1–3 fruits; calyx saucer-shaped, triangular, 1 cm diam.; remains of the disk 1 mm high, slightly 6-lobed, fimbriate. *Fruits* fusiform, acute, round to slightly triangular in cross-section, 4 by 2 cm, glabrous; pyrene acutely 6-ribbed to deeply furrowed all over the surface; lids c. 3 mm thick; cells small, elliptic to round. *Seeds* 1–2.

Distr. New Britain and *Malaysia*: E. New Guinea. Fig. 47.

Ecol. Rain-forests up to 250 m, *fl.* June, Aug., and Nov., *fr.* March, May–Sept.

Uses. Produces a damar-like resin. The seeds are edible.

Vern. New Guinea: *bitung*, Morobe, *aropir*, *banaga*, *ongoi*, *pipiu*, *tawaia*, North. Div., *guttur*, Maclay Coast, *dokolo*, Upper Waria, *laudindiniha*, Dawa Dawa; New Britain: *apete*, Rabaul.

Note. See for the identity of *C. fulvum* LAUT. under the former species.

#### Doubtful

*Canarium decipiens* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 209; Bull. Jard. Bot. Btzg III, 12 (1932) 447, t. 9 f. 56.

The type specimen of this species (unknown coll. 296 in BO) is very scanty and the locality is unknown. In my opinion it is possibly related to or even conspecific with *C. fusco-calycinum* STAPP.

#### Excluded

*Canarium angustifolium* (BL.) MIQ. Ann. Mus. Bot. Lugd. Bat. 4 (1869) 117; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 479, t. 11 f. 71d, *sub C. rigidum* ZIPP.—*Pimela angustifolia* BL. Mus. Bot. 1 (1850) 226.—*Canariopsis angustifolia* MIQ. Fl. Ind. Bat. 1, 2 (1859) 653.

The type consists of a twig with leaves apparently taken from a sapling or sucker. It is certainly not *burseraceous* and possibly represents a young specimen of a *Connaracea* or a *Meliaceae*.

*Canarium vrieseo-teysmannii* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 216; Bull. Jard. Bot. Btzg III, 12 (1932) 528, t. 14 f. 92.

The type (JUNGHUHN, Sumatra, in L; erroneously localized as 'DE VRIESE & TEYSMANN, Moluccas') consists of incomplete leaves and loose ♂ inflorescences. In all probability it is *meliaceous*; the leaves exactly match those of *Aphanamixis*, the flowers apparently differ from any known *Meliaceus* genus; it is possibly a mixture.

#### Excluded

*Amyris ? maritima* JACQ. Enum. Pl. Carib. (1760–61) 19; LLANOS, Mem. R. Acad. Cienc. Madr. IV, III, 2 (1856) 503 ('*Ansyrus*'); F.-VILL. Nov. App. (1880) 41.—LLANOS refers with doubt a fruit from the forests of 'Angat' to this American *rutaceous* plant, classified by FERNANDEZ-VILLAR in the *Burseraceae*.

*Boswellia ? integra* and *obliqua* BLANCO, Fl. Filip. ed. 2 (1845) 242–243 = ? *Dysoxylum sp.* (*Meliac.*), cf. MERR. Sp. Blanc. (1918) 210.

*Bursera ? nitida* (TURCZ.) F.-VILL. Nov. App. (1880) 41 = *Glycosmis pentaphylla* (RETZ.) CORREA (*Rutac.*), cf. MERR. En. Philip. 2 (1923) 334.

*Ganophyllum* BL. Mus. Bot. 1 (1850) 230 and *Filicium* THW. En. Pl. Zeyl. (1864) 408 are *Sapindaceae*.

*Icica ? timoriensis* DC. Prod. 2 (1825) 78 = *Pleiogynium timoriense* (DC.) LEENH. Blumea 7 (1952) 159 (*Anacardiaceae*).