COMBRETACEAE (A. W. Exell, British Museum, London)

Trees, shrubs or lianas, rarely subherbaceous. Glands (in Mal. *spp.*) often present on the leaf-bases or petioles, and in lower marginal crenations. Indumentum of simple hairs, glandular hairs or multicellular hairs secreting calcium oxalate and forming scales, or present beneath the cuticle making the surface of the leaf minutely verruculose and sometimes pellucid-punctate. *Leaves* opposite, verticillate, spiral, or alternate, petioled (rarely sessile), exstipulate, simple, almost always entire. *Flowers* ♀ or ♀ and ♂ in the same inflorescences, usually protogynous, usually actinomorphic, rarely slightly zygomorphic, in axillary or extra-axillary elongated or subcapitate spikes or racemes or in terminal and sometimes axillary panicles. *Receptacle* (calyx-tube) usually in two distinct parts, the lower receptacle surrounding and adnate to the inferior ovary and the upper receptacle produced beyond to form a short or long tube terminating in the calyx-lobes, the latter sometimes poorly developed. *Calyx*-lobes 4 or 5 (rarely 6–8) or almost absent, sometimes accrescent (*Calycopteris*). *Petals* 4 or 5 or absent, conspicuous or sometimes very small, inserted near the mouth of the upper receptacle. *Stamens* usually twice as many as the petals, borne inside the upper receptacle usually in two series, exserted or included; anthers dorsifixed, usually versatile (or rarely adnate to the filaments). *Disk* intrastaminal, usually present, hairy or glabrous. *Style* usually free (attached for part of its length to the upper receptacle in *Quisqualis*). *Ovary* inferior (semi-inferior in the West-African genus *Strephonema*), unilocular, with usually 2 (sometimes 2–6) pendulous, anatropous ovules of which only 1 usually developes. *Fruit* (botanically a pseudocarp) very variable in size and shape, fleshy or dry, usually indehiscent, often variously winged or ridged, 1-seeded. Albumen absent.

Distr. 18 genera with *c.* 450 *spp.* in the tropics and subtropics: 2 are circumtropical (*Combretum* and *Terminalia*), and are much the largest genera, 1 is confined to North Australia and Queensland (*Macropteranthes*), 2 confined to tropical Asia (*Finetia* and *Calycopteris*), 3 occur in Asia and Africa (*Anogeissus*, *Lumnitzera*, and *Quisqualis*), 1 is confined to Madagascar (*Calopyxis*), 3 are confined to tropical Africa (*Guiera*, *Pteleopsis* and *Strephonema*), 2 occur in tropical Africa and tropical America (*Conocarpus* and *Laguncularia*) and the remaining four (*Buchenavia*, *Bucida*, *Ramatuela* and *Thiloa*) are confined to tropical and subtropical America.

Ecol. Species of *Terminalia* are important constituents of both primary and secondary forests, more especially in the lower regions, only a few species reaching an altitude of about 2000 m. *Combretum* species are common lianas especially along banks of rivers and margins of forests. Two species of *Lumnitzera* play an important rôle in the mangrove-formation (a formation to which the genera *Lumnitzera* and *Laguncularia* are both confined). *Terminalia catappa* is a common constituent of the littoral forest, on the sandy beach-ridge or on rocky shores along eroding coasts. Most species are insect-pollinated.

According to RIDLEY (Disp. 102, 210) dispersal of the fruits is frequently through water agency, either sea-water (*Lumnitzera*, *Terminalia catappa*) or freshwater of streams and rivers (flat-fruited and drupaceous-fruited *Terminalia spp.* and *Combretum spp.* with narrow-winged or angled type of fruit). *Quisqualis* fruits are buoyant in both fresh and sea-water. In many other species of *Combretum* and *Terminalia* the fruits are provided with thin, papery wings and are dispersed by wind; their size probably prevents them from reaching great distances.

Wood anat. DEN BERGER, Determinatietabel van Malesië, Veenman, Wageningen (1949) on several pages (handlens); DESCH, Man. Malayan Timb., Mal. For. Rec. 15 (1941) 83; METCALFE & CHALK, Anat. Dic. 1 (1950) 617; MOLL & JANSSONIUS, Mikr. Holzes 3 (1914) 359; PANSHIN, Philip. J. Sc. 48 (1932) 182; PEARSON & BROWN, Comm. Timb. 1 (1932) 496; REYES, Commonwealth Philip. Dept Agric. Techn. Bull. 7 (1938) 364. For details see under species.

For review of research on mangrove anatomy and water relations see: Fl. Mal. I, 4 (1953) 513, for growth ring development in connection with bud burst (*Terminalia catappa* L.): COSTER, Ann. Buitenzorg 37 (1927) 116. JANSSONIUS (Blumea 6, 1950, 407) points out that the family has many features in common with other families and suggests that its wood structure indicates affinity especially with the *Leguminosae* and *Sapindaceae* and bears some relation to *Meliaceae*.—C.A.R.-G.

Uses. Some *Terminalia* species produce fairly good timber but in general the wood is rather soft and inferior. The fruits of this genus are often edible. A few species are planted as ornamental trees and some *Combretum* species are grown as stove plants in temperate countries. *Quisqualis indica* is often planted in gardens as an ornamental climber and a decoction of its fruits has been used as a vermicide. The wood of *Lumnitzera spp.* is sometimes used for fencing and local building purposes.

Notes. The family is related to the *Rhizophoraceae* and to the *Myrtaceae*. It was founded by R. BROWN (Prod. 1, 1810, 351) and delimited much as at present. HOOKER *f.* (in BENTH. & HOOK. *f.* Gen. Pl. 1, 1867, 683) profoundly modified this conception of the family by including the genera *Illigera*, *Gyrocarpus* and *Sparattanthelium*, plants with quite a different facies which are now placed in the *Hernandiaceae*. For an account of the relationships between the genera of *Combretaceae* see EXELL (J. Bot. 69, 1931, 113).

Three main evolutionary tendencies are observable in the family or can at least be reasonably postulated:

1) A gradual elongation of the upper receptacle, especially in *Combretum*, and reaching its highest development in *Quisqualis*, making pollination only possible by long-tongued insects.

2) A congestion of the flowers in densely-flowered spikes or racemes accompanied often by reduction in the size of the petals.

3) Distribution by means of winged fruits (though riverine species often have water-borne fruits and many species of *Terminalia* have edible fruits presumably dispersed by animals).

These three tendencies seem to have been to some extent independent of each other and the combination of 2 and 3 provides a spatial problem, that of allowing for the expansion of the wings of the fruit in a congested inflorescence. This problem has received various solutions in the family such as reduction of the wings to two or three (*Terminalia spp.*), interspersal of ♀ and ♂ flowers (*Pteleopsis* and *Terminalia*), the fitting together of the fruits into a cone-like structure (*Conocarpus*) *etc.*.

For a general account of the anatomy and pharmacology of the *Combretaceae* see HOLTERMANN, 'Beiträge zur Anatomie der Combretaceen' (Christiania, 1893) and LEFÈVRE, 'Contribution à l'étude anatomique et pharmacologique des Combretacées' (Lons-Le-Saunier, 1905).

The main precursors of this revision were written by the late D. F. VAN SLOOTEN in his 'Bijdragen tot de kennis der Combretaceae and Flacourtiaceae van Nederlandsch Indië' (Utrecht, 1919)—henceforth cited as Bijdr. Combr.—and in Bull. Jard. Bot. Buitenzorg III, 6 (1924), both dealing only with the species occurring in Indonesia. I am deeply indebted to him for putting his manuscript notes at my disposal.

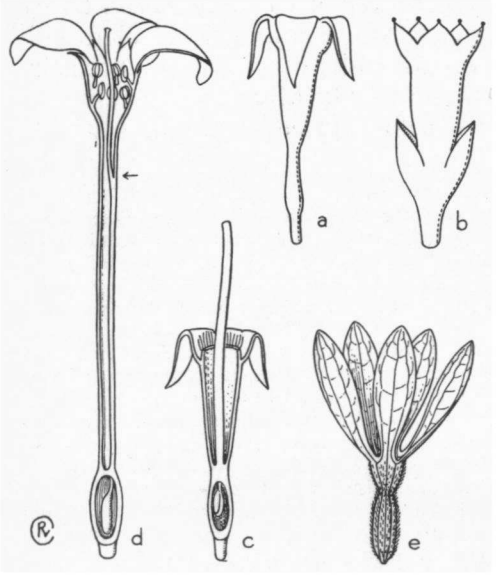

Fig. 1. Diagrams to illustrate the key to the genera. —*a.* Receptacle with calyx-lobes in *Combretum latifolium*, *b.* receptacle with calyx-lobes and 2 adnate bracteoles in *Lumnitzera racemosa*, *c.* vertical section of receptacle in *Combretum latifolium* showing inferior ovary, free style and upper (hairy) free part of disk inserted at apex of lower portion of upper receptacle, *d.* vertical section of flower of *Quisqualis indica* showing adnation of style to upper receptacle, *e.* fruit of *Calycopteris floribunda* showing accrescent calyx-lobes.

KEY TO THE GENERA

1. Receptacle without adnate bracteoles (fig. 1a). Leaves opposite, verticillate, or alternate.
2. Petals present (in Malaysian species).
3. Style not adnate to the inner wall of the upper receptacle (fig. 1c). Leaves often scaly. **1. Combretum**
3. Style adnate for part of its length to the inner wall of the upper receptacle (fig. 1d). **2. Quisqualis**
2. Petals absent. Leaves not conspicuously scaly.
4. Calyx-lobes not accrescent . . . . . **3. Terminalia**
4. Calyx-lobes very conspicuous, accrescent, persistent at time of fruiting (fig. 1e). **4. Calycopteris**
1. Receptacle with two adnate bracteoles (fig. 1b). Leaves alternate. Petals present. Trees of the mangrove formation . . . . . **5. Lumnitzera**

1. COMBRETUM

LOEFL. Iter Hispan. App. (1758) 308, *nom. cons.*[1]; SLOOT. Bijdr. Combr. (1919) 31; Bull. Jard. Bot. Btzg III, 6 (1924) 50.—*Grislea* LINNÉ, Sp. Pl. 1 (1753) 348.—*Cacoucia* AUBL. Pl. Guian. 1 (1775) 450, t. 179.—*Poivrea* COMM. [*ex* JUSS. Gen. Pl. (1789) 320 *in syn., sphalm.* '*Pevraea*'] *ex* THOU. Obs. Pl. Iles Austr. Afr. (1801) 28. —*Embryogonia* BL. Mus. Lugd. Bat. 2 (1852) 122.

Trees, shrubs or (probably always in Malaysia) woody climbers, very rarely subherbaceous. *Leaves* opposite, verticillate or rarely alternate, usually petiolate, almost always entire, glabrous or hairy, often conspicuously scaly and often with domatia. Petiole sometimes persisting after the fall of the leaf forming a thorn. *Flowers* usually ♂, actinomorphic or more rarely somewhat zygomorphic, 5- or 4-merous, in elongated or subcapitate, axillary or extra-axillary spikes or racemes or in terminal or terminal and axillary often leafy panicles, glabrous or hairy, often scaly. *Receptacle* (calyx-tube) glabrous or hairy, often scaly, sometimes glandular usually clearly divided into a lower part (lower receptacle) surrounding and adnate to the ovary, and an upper part, varying from patelliform to elongate infundibuliform, terminating in the calyx-lobes. Upper receptacle sometimes visibly differentiated into a lower part containing the disk and an often more expanded upper part. *Calyx*-lobes usually 4 or 5 (rarely more), deltoid to almost subulate or filiform, sometimes scarcely developed. *Petals* usually 4 or 5 (very rarely absent and never in Malaysian species), small and inconspicuous or showy and exceeding the calyx-lobes; white, yellow, orange, red or purple, glabrous or hairy, occasionally scaly. Stamens usually twice as many as the petals, inserted inside the upper receptacle, often in two series, usually exserted. Anthers dorsifixed, versatile. Disk intra-staminal, glabrous or hairy, with or without a free margin, sometimes absent or very small. Style simple, free, usually exserted, rarely very short. Ovary completely inferior, unilocular with usually 2 (occasionally up to 6) pendulous ovules. *Fruit* (pseudocarp) 4–5-winged, ridged or angled, sessile or stipitate, usually indehiscent, 1-seeded; pericarp usually thin and papery, sometimes leathery, more rarely fleshy.

Distr. About 250 *spp.* throughout the tropics (except Australia), most abundant in tropical Africa, extending in the New World from Mexico to N. Argentina, in Africa from the Sudan to SW. Africa and Natal, across Arabia to northern India and thence E to S. China and S to Ceylon and New Guinea.

The Malaysian species belong to the following sections:

sect. Kaloëdron MIQ. (*C. trifoliatum*)
sect. Glandulosae ENGL. & DIELS (*C. nigrescens*)
sect. Acuminatae ENGL. & DIELS (*C. acuminatum*)
sect. Dasystachyae ENGL. & DIELS (*C. porterianum* and *C. yunnanense*)
sect. Squamosae ENGL. & DIELS (*C. punctatum*)
sect. Tetragonocarpus CLARKE (*C. tetralophum*)
sect. Quisqualoides CLARKE (*C. latifolium* and *C. sundaicum*)

C. borneense (fruits unknown) and *C. tetralophoides* (fruit winged, not angled) seem to be related to *C. tetralophum* and *C. goldieanum* probably belongs to *Sect. Trichopetalae* ENGL. & DIELS.

Ecol. The Malaysian species are mainly woody climbers of low-lying frequently flooded forests mostly between sea-level and about 100 m, but *C. sundaicum* has been found up to 250 m, *C. latifolium* up to 1000 m, and *C. punctatum ssp. punctatum* up to 1300 m. They frequently occur along river-banks, on the margins of primary forests and in secondary forest.

The narrow-winged or angled type of fruit in this genus seems associated with riverine habitats and

(1) The name is conserved as *Combretum* L. in LOEFL. but there is no general agreement as to which names in LOEFLING's 'Iter Hispanicum' ought to be attributed to LINNAEUS. The type species in the International Code of Botanical Nomenclature (1952) 122 is wrongly cited as *Combretum fruticosum* (LOEFL.) FAWC. & RENDLE. It should be *C. fruticosum* (LOEFL.) STUNTZ.

is correlated with dispersal by water as reported by RIDLEY (Disp. 102, 210) for *C. trifoliatum* and *C. tetralophum*, which he characterizes as riparian climbers.

Uses. *Combretum spp.* are of no economic importance in Malaysia but some introduced species are grown in gardens as ornamental climbers of which the most beautiful one is *C. grandiflorum* Don.

Notes. The flowers shrink appreciably on drying and measurements in the descriptions have been taken as far as possible from boiled up specimens. Species of *Malpighiaceae* often mistaken, when in fruit, for species of *Combretum* can be distinguished by the superior ovary and bifid hairs. Wingless fruits of *Combretum* can be distinguished from those of *Terminalia* by the absence of a sclerenchymatous layer in the pericarp so that they are easily cut across while those of *Terminalia* are usually somewhat or very resistant. Fruits of *C. trifoliatum* are sometimes mistaken for those of *Quisqualis indica*.

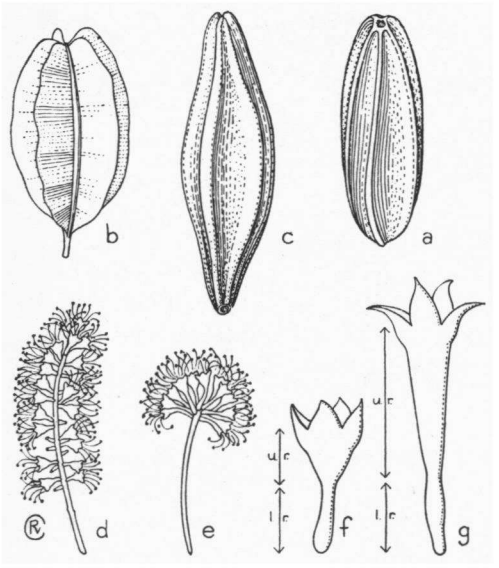

Fig. 2. Diagrams to illustrate the key to the *Combretum* species.—*a.* Fruit of *C. trifoliatum* with 5 narrow wings, *b.* fruit of *C. goldieanum* with 5 broad wings, *c.* fruit of *C. acuminatum* with 4 narrow wings, *d–e.* spikes of *C. punctatum ssp. squamosum* and *ssp. punctatum*, *f–g.* shape of upper receptacle (*u.r.*) and lower receptacle (*l.r.*) in *C. tetralophum* and *C. sundaicum*.

KEY TO THE SPECIES

1. Flowers 5-merous. Fruit narrowly or broadly 5-winged.
2. Leaves usually 3–4(–5)-verticillate. Upper receptacle shallow-cupuliform, less than 1 mm long. Wings of fruit narrow, stiff, 3 mm broad (fig. 2a) . . . . . **1. C. trifoliatum**
2. Leaves opposite. Upper receptacle elongate-infundibuliform, 6–7 mm long. Wings of fruit thin, flexible, 6–7 mm broad (fig. 2b) . . . . . **2. C. goldieanum**
1. Flowers 4-merous. Fruit narrowly or broadly 4-winged.
3. Branchlets and inflorescences with dense or rather sparse papillose or shortly stalked glandular hairs (in addition to a pilose indumentum) . . . . . **3. C. nigrescens**
3. Branchlets and inflorescences not glandular but sometimes scaly.
4. Calyx-lobes deltoid or broadly ovate, sometimes scarcely developed, not more than 1 mm long (in dried specimens).
5. Fruit narrowly 4-winged or 4-ridged (fig. 2c).
6. Rhachis nearly glabrous. Upper receptacle campanulate. Petals very small. Fruit 3½–6½ cm long. **4. C. acuminatum**
6. Rhachis ferrugineous-pubescent. (Fruit unknown.) . . . . . **8. C. borneense**
5. Fruit broadly 4-winged with thin, flexible wings.
7. Leaves densely covered with greyish-white scales nearly contiguous on the lower surface of the leaf.
8. Flowers in elongated spikes (fig. 2d). Leaves usually broadly elliptic. **5. C. punctatum *subsp.* squamosum**
8. Flowers in subcapitate spikes (fig. 2e). Leaves usually lanceolate or narrowly elliptic. **5. C. punctatum *subsp.* punctatum**
7. Leaves only sparsely scaly, scales never contiguous.
9. Flowers 2–4 mm long from the rhachis to the tips of the calyx-lobes. Lower receptacle not more than 1 mm long (in dried specimens) . . . . . **6. C. porterianum**
9. Flowers 4–8 mm long from the rhachis to the tips of the calyx-lobes. Lower receptacle 1½ mm long or longer.
10. Leaves nearly glabrous or pubescent only on the nerves beneath.
11. Leaves with individually conspicuous golden-brown or reddish-brown scales on the lower surface . . . . . **7. C. yunnanense**
11. Leaves without individually conspicuous scales, coriaceous. Inflorescences ferrugineous-pubescent or tomentellous. (Fruit unknown.) . . . . . **8. C. borneense**
10. Leaves densely pubescent or tomentellous on the lower surface . . . **9. C. tetralophoides**

4. Calyx-lobes triangular to elongate-triangular, at least 1½ mm long, usually 2 mm long or longer. Flowers 7–10 mm long from the rhachis to the tips of the calyx-lobes.
12. Tubular basal portion of the upper receptacle only about 1–1½ times as long as broad (fig. 2f) and separated from the lower receptacle (ovary) by a somewhat constricted portion. Petals usually equalling or exceeding the calyx-lobes. Fruit with 4 narrow, stiff wings or ridges. **10. C. tetralophum**
12. Tubular basal portion of the upper receptacle 2–3 times as long as broad (fig. 2g) or whole upper receptacle narrowly infundibuliform. Petals shorter than the calyx-lobes. Fruit broadly 4-winged.
13. Spikes more or less elongated. Upper and lower receptacle and rhachis of inflorescence with a finely velutinous indumentum concealing any scales. . . . . **11. C. latifolium**
13. Spikes capituliform. Upper and lower receptacle and rhachis scaly, otherwise nearly glabrous. **12. C. sundaicum**
13a. Intermediates (from Luzon) between the two preceding species (*?latifolium* × *sundaicum*). **12a. C. confusum**

1. Combretum trifoliatum VENT. Choix Pl. (1808) t. 58; DON, Trans. Linn. Soc. Lond. 15 (1827) 419, 439; MIQ. Fl. Ind. Bat. 1, 1 (1855) 610; Suppl. (1860) 328; KURZ, For. Fl. Burm. 1 (1877) 461; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 454; K. SCHUM. & HOLLR. Fl. Kais. Wilh.Land (1889) 84; KING, J. As. Soc. Beng. 66, 2 (1897) 336; RIDL. J. Str. Med. Assoc. 5 (1897) 130 (*trifoliastrum*); BACKER, Schoolfl. Java (1911) 492; KOORD. Exk. Fl. 2 (1912) 670; SLOOT. Bijdr. Combr. (1919) 40; Bull. Jard. Bot. Btzg III, 6 (1924) 51; GAGNEP. Fl. Gén. Indo-Chine 2 (1920) 743; MERR. En. Born. (1921) 423; DIELS, Bot. Jahrb. 57 (1922) 427; RIDL. Fl. Mal. Pen. 1 (1922) 708; CRAIB, Fl. Siam. En. 1 (1931) 621; Burkill, Dict. 1 (1935) 645; MEEUSE in BACK. Fl. Jav. (em. ed.) 4, fam. 101 (1944) 2.—*C. lucidum* BL. Bijdr. Fl. Ned. Ind. (1825) 641.—*Cacoucia? trifoliata* DC. Prod. 3 (1828) 22.—*Cacoucia lucida* HASSK. Cat. Hort. Bog. (1844) 254; Flora 27, 2 (1844) 607.—*Embryogonia lucida* BL. in Mus. Bot. Lugd.-Bat. 2 (1855) 122, t. 52 (1856).— **Fig. 2a.**

Climbing or scrambling shrub, 2–5 m. Young branchlets appressed fulvous-pubescent, soon glabrescent. *Leaves* usually 3–4–(5-)verticillate, coriaceous or subcoriaceous, elliptic to lanceolate, usually subglabrous above, glabrous below except for domatia and an occasional line of fulvous pubescence along the midrib, 8–16 by 3–5½ cm, normally acute and mucronulate at the apex (rarely rounded), usually slightly rounded at the base, nerves 6–8 pairs; petiole ferrugineous appressed-pubescent, eventually glabrescent, nigrescent and rather shiny when old, 4–7 mm long. *Inflorescence* a terminal or axillary panicle 8–20 cm long of spikes 2–5 cm long. *Flowers* 5-merous white or yellowish-white, sweet-scented, protogynous, mostly in whorls of 3. *Lower receptacle* (ovary) densely cinereous- or fulvous-sericeous, 1–1⅕ mm long; upper receptacle shallow-cupuliform, cinereous- or fulvous-sericeous, ⅘–1 mm deep and 3–3½ mm across, with 5 ovate-triangular *calyx*-lobes 1 by 1⅕ mm. *Petals* 5, narrowly elliptic, densely pubescent, 1–1.4 by 0.2–0.4 mm. Stamens 10, filaments 4–5 mm long, anthers ½ mm long, exserted. Disk glabrous inside with densely barbate margin. Style 5 mm long. *Fruit* sessile, narrowly ellipsoid, glabrous, shiny black-brown, (2½–)3–3½ by 1–1.2 cm with (4–)5(–6) rigid wings 3–4 mm broad.

Distr. Burma, Siam, Laos, Cambodia, Cochinchina, throughout *Malaysia:* not yet recorded from the Philippines, Moluccas, and the Lesser Sunda Islands (except Bali), in Java only along the north coast. Fig. 3.

Ecol. In lowlying frequently flooded areas, along banks of rivers and lakes, in bush or forest, borders of teak-forest, on limestone (Celebes) or alluvial river-clay both under everwet and seasonal conditions; fruit dispersed by water; *fl.* May–Nov.

Uses. RIDLEY (*cf.* BURKILL, Dict. 645) records the fruits as a vermifuge for *Ascaris* and GRESHOFF demonstrated a saponin in them (Kew Bull. 1909, 406). EDELING recorded the fruits as edible near Djakarta but this may be incorrect.

Vern. *Kubaing*, Djambi, *sěpang*, *akar nangkei*, Palembang, *akar song song harus*, M, *palawan*, Bantam, *kaju pělawad*, Bidara tjina, *areuj ki tjalung*, S, *gangang*, *tjěklok*, J, *tew*, New Guinea.

Notes. Collectors mostly give this species as a scrambling shrub but it has occasionally (perhaps incorrectly?) been described as a small tree and RIDLEY (*l.c.*) says it is a 'big climber'.

2. Combretum goldieanum F.v.M. Descr. Not. Pap. Pl. 4 (1876) 66; WHITE, Proc. R. Soc. Queensl. 34 (1922) 47; BAK. *f.* J. Bot. 61 (1923) Suppl. 13; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 51.— **Fig. 2b.**

Scandent shrub. Young branchlets cinereous, glabrescent. *Leaves* opposite, petioled, oblong-elliptic, acuminate at the apex, rounded at the base, minutely punctulate above, densely lepidote

Fig. 3. Localities of *Combretum trifoliatum* VENT. in Malaysia.

below but individual scales not conspicuous, 7–15 by 4–10 cm, sericeous when young, eventually glabrescent except for domatia. *Spikes* axillary, 6–8 cm long, occasionally branched. *Flowers* 5-merous, red, sessile. *Lower receptacle* (ovary) densely sericeous, 3–4 mm long; upper receptacle elongate-infundibuliform, appressed-pubescent, 8–9 mm long with 5 broadly deltoid *calyx*-lobes which are no more than blunt teeth at the apex of the tube. *Petals* 5, obovate-elliptic to oblong-lanceolate, 2½ by 1½ mm, pubescent outside, glabrous inside. Stamens 10; filaments dark red, exserted for 13–14 mm beyond the mouth of the tube, 5 attached at the margin of the disk and 5, alternating with the former, attached 3 mm from the base of the upper receptacle; anthers red, oblong, 1.2 by 0.8 mm. Disk cupular, *c.* 1 mm deep, barbate on the margin. Style 23 mm long, exserted for 14 mm beyond the mouth of the tube. *Fruit* broadly elliptic to suborbicular in outline, up to 2½ by 2 cm with 5 thin, flexible wings up to 8 mm broad.

Distr. *Malaysia:* SE. New Guinea (Port Moresby, Rigo Distr., Kappa Kappa, and Yule Island).

Ecol. Little known. Fide WHITE (*l.c.*) 'this rambling scandent shrub is very common about Port Moresby and with its brilliant red flowers is quite a conspicuous feature in the vegetation'. The elongation of the upper receptacle makes it only suitable for pollination by fairly long-tongued insects; the fruits are of the broadly winged wind-distributed type.

Note. Both F. VON MUELLER and VAN SLOOTEN have rightly pointed out the resemblance between this species and various African species of *Combretum* but it has not been identified with any African or Madagascar species so that its claim to be indigenous in New Guinea can scarcely be denied. I would myself relate it to the Indian species *C. pilosum* ROXB. (*sect. Trichopetalae* ENGL. & DIELS, mainly African).

Specimens from Port Moresby collected by FORBES and GOLDIE possess larger flowers and fruits than specimens collected by BRASS and LISTER TURNER from Rigo District and Kappa Kappa respectively; but the difference does not seem to be greater than that commonly met with in the species of this genus when enough material is available to show the range of variation.

3. Combretum nigrescens KING, J. As. Soc. Beng. 66, 2 (1897) 340; RIDL. Fl. Mal. Pen. 1 (1922) 710.—*C. kunstleri* KING, *l.c.*; CRAIB, Fl. Siam. En. 1 (1931) 617.—*C. scortechinii* KING, *op. cit.* (1897) 341.—*C. glandulosum* SLOOT. Bijdr. Combr. (1919) 39, t. 1, f. A; *non C. glandulosum* F. HOFFM. (1889).—*C. nigrescens var. kunstleri* RIDL. Fl. Mal. Pen. 1 (1922) 710.—*C. adenophorum* SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 56.—*C. elmeri* MERR. Pl. Elm. Born. (1929) 241.

Large climber up to 10–20 m. Young branchlets with a fulvous-patent-pilose (rarely appressed pilose) indumentum interspersed with glandular hairs, sometimes with the long patent hairs very few and the glandular hairs much denser. *Leaves* opposite, papyraceous, narrowly elliptic or narrowly oblong-elliptic, sparsely pilosulose above or nearly glabrous except for appressed hairs towards the base of the midrib, rather sparsely appressed-pilose or nearly glabrous below, up to 13 by 4½ cm, acuminate at the apex, cordate (rarely cuneate) at the base; nerves 6–10 pairs; petiole patent-pilose often glabrescent, 2–8 mm long. *Inflorescence* a terminal or axillary panicle, 10–15 cm long, ultimate branches slender. *Flowers* white or greenish-white, 4-merous, sessile. *Lower receptacle* (ovary) pubescent or pilose, 1 mm long; upper receptacle cupuliform, viscid, puberulous, 1½ by 3 mm with triangular, acute *calyx*-lobes, ¾ by 1 mm. *Petals* 4, elliptic, pubescent, 1½ by 0.8 mm. Stamens 8, exserted; filaments 3–3½ mm long; anthers ¾ mm long. Disk small, densely pilose. Style 3½–4 mm long. *Fruit* 1½–3½ by 1.3–2 cm, glandular or glabrous, oblong-elliptic in outline with 4 membranous wings 4–6 mm broad and with the withered flower sometimes remaining attached to the apex of the fruit until the latter is mature or nearly so.

Distr. Siam, in *Malaysia:* SW. Sumatra, Malay Peninsula, Br. N. Borneo.

Ecol. In dense or open jungle from sea-level to 150 m.

Uses. The leaves are used in Pahang for poulticing wounds.

Vern. *Gĕgambir, pĕnon, pokok tulang dayong*, Mal. Pen.

Note. The amount of indumentum is very variable some specimens having densely pilose branches and inflorescences while others are very glandular with sparse long hairs.

C. adenophorum SLOOT., known only from one collection (FORBES 3100, SW. Sumatra), differs only in having cuneate leaf-bases. Further collecting is likely to provide intermediates.

4. Combretum acuminatum ROXB. [Hort. Beng. (1814) 28 *nom. nud.*; *ex* DON, Trans. Linn. Soc. Lond. 15 (1827) 440 *nom. nud.*] Fl. Ind. ed. CAREY 2 (1832) 228; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 455; BAK. *f.* in ANDREWS, Mon. Christm. Isl. (1900) 178; RIDL. J. Str. Br. R. As. Soc. 45 (1905) 191; MERR. Philip. J. Sc. C. Bot. 4 (1909) 648; KOORD. Exk. Fl. 2 (1912) 620; SLOOT. Bijdr. Combr. (1919) 33; GAGNEP. Fl. Gén. I.-C. 2 (1920) 745; MERR. En. Born. (1921) 422; RIDL. Fl. Mal. Pen. 1 (1922) 708; MERR. En. Philip. 3 (1923) 148; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 57; BURKILL, Dict. 1 (1935) 644; MEEUSE in BACK. Fl. Jav. (em. ed.) 4, fam. 101 (1944) 4.—*C. costatum* ROXB. [Hort. Beng. (1814) 28 *nom. nud.*] Fl. Ind. 2 (1832) 227; KURZ, For. Fl. Burm. 1 (1877) 465.—*Embryogonia latifolia* BL. Mus. Bot. Lugd. Bat. 2 (1852) 122.—*Embryogonia acuminata* BL. *l.c.* (1852) 123.—*C. wallichii* (non DC.) HASSK. Tijd. Nat. Gesch. 10 (1843) 145; Flora 27 (1844) 606; MIQ. Fl. Ind. Bat. 1 (1855) 608.—*C. neurophyllum* MIQ. *l.c.*.—*C. stenopetalum* HEURCK & MÜLL. ARG. in HEURCK, Obs. Bot. (1870) 225.—*C. vanheurckii* MÜLL. ARG. *op. cit.* (1870)

227.—*Terminalia borneensis* RIDL. Kew Bull. (1938) 283, *non T. borneensis* SLOOT.—**Fig. 2c.**

Scandent shrub. Young branchlets densely ferrugineous-scaly and sometimes at first minutely puberulous, soon becoming glabrous. *Leaves* opposite, chartaceous or subcoriaceous, elliptic, oblong-elliptic, broadly lanceolate or sometimes oblanceolate, densely scaly but individual scales contiguous and not very conspicuous, nearly glabrous except for occasional hairs on the veins of the lower surface, 10–21 by 4–11 cm, usually acuminate at the apex with acumen up to 1½ cm long, cuneate, obtuse or rounded at the base; petiole scaly when young, 5–12 mm. *Inflorescence* of unbranched axillary spikes up to 10 cm long or occasionally of terminal panicles of spikes, ferrugineous-scaly and pubescent or nearly glabrous. Bracts very small, soon deciduous. *Flowers* yellowish, 4-merous, sessile. *Lower receptacle* (ovary) densely scaly, otherwise glabrous, 1–1½ mm long. Upper receptacle campanulate, scaly, outside glabrous, 2–3 mm long, inside pubescent, terminating in 4 deltoid *calyx*-lobes about 1 mm long. *Petals* 4, yellow, narrowly elliptic, very small, often less than ½ mm long, occasionally up to 1½ mm long. Stamens 8, exserted, 5–7 mm long. Disk cupular, about 0.8 mm deep, glabrous, hairy on the margin. Style 5½ mm long. *Fruit* densely scaly, especially when young, tomentellous or puberulous, eventually glabrescent, 3½–6½ by 1–2 cm, usually slightly narrowed at each end with 4 (rarely 5) longitudinal, rounded (occasionally sharp) ridges.

Distr. India, Ceylon, Burma, Indo-China and in *Malaysia:* Malay Peninsula, W. Java (incl. Christmas Isl.), Borneo, Philippines, SW. Celebes, Moluccas and northern New Guinea.

Ecol. Along the coast in low-lying frequently flooded areas, along rivers and in secondary forests at low altitudes.

Uses. A decoction of the leaves is used medicinally for tape-worm.

Vern. *Areuj balingbing, areuj tukul takal minjak,* S, *kalenleng didi,* SW. Celebes.

Note. Fruits probably water-borne (see note under *C. trifoliatum*).

FORBES 3250, from Sumatra, identified by E. G. BAKER as this species (J. Bot. 52, Suppl., 1924, 35), is *Lophopetalum oblongifolium* KING.

5. Combretum punctatum BL. Bijdr. (1825) 640.

Climbing shrub or liana. Young branchlets densely ferrugineous- or cinereous-scaly, individual scales usually very conspicuous. *Leaves* opposite, subcoriaceous, densely scaly on both surfaces, individual scales usually conspicuous, lanceolate, ovate-lanceolate, narrowly elliptic or broadly elliptic to almost suborbicular, occasionally narrowly elliptic, usually about 7–10 by 4–7 cm (up to 18 by 11 cm in specimens from Burma) usually abruptly acuminate at the apex and rounded at the base; petiole 5–12 mm. *Inflorescence* a terminal panicle of elongated or pseudo-capitate spikes, the latter up to 7 cm long; rhachis densely cinereous- or ferrugineous-scaly. *Flowers* yellowish, fragrant, sessile, 4-merous. *Lower receptacle* (ovary) 1½–2 mm long, densely ferrugineous-scaly otherwise glabrous. Upper receptacle 3–5 mm long measuring to the tips of the calyx-lobes, densely ferrugineous-scaly, lower part, containing the disk, infundibuliform, upper part cupuliform, terminating in 4 deltoid *calyx*-lobes less than 1 mm long. *Petals* 4, obovate, narrowly elliptic or oblanceolate, unguiculate, about 1½ mm long, glabrous. Disk infundibuliform, margin free for about 1 mm, barbate. Stamens 8, filaments 3½ mm long, anthers 0.6 mm long. *Fruit* usually suborbicular, sometimes obpyriform in outline, very variable in size and shape, sparsely scaly (densely when young), 1.2–2½ by 1½–2½ cm, with 4 thin, flexible wings, up to 1 cm broad.

Distr. India, Burma, Siam, Indo-China, and *Malaysia:* SW. Sumatra, Malay Peninsula, Java (W. half), Billiton, Borneo (SE. and Sarawak), and Philippines. Fig. 4.

subsp. **punctatum.**—*Combretum punctatum* BL. Bijdr. (1825) 640; MIQ. Fl. Ind. Bat. 1, 1 (1855) 607; KOORD. Exk. Fl. 2 (1912) 670 *excl. syn. C. sundaicum* MIQ.; SLOOT. Bijdr. Combr. (1919) 35; MERR. En. Born. (1921) 422; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 58; MEEUSE in Back. Fl. Java (em. ed.) 4, fam. 101 (1944) 3.—*C. squamosum* (*non* ROXB. *ex* DON) MERR. En. Born. (1921) 423.—**Fig. 2e.**

Leaves lanceolate, ovate-lanceolate or narrowly elliptic. Inflorescence a terminal panicle of pseudo-capitate spikes. Petals obovate, unguiculate.

Distr. *Malaysia:* SW. Sumatra (Bencoolen), Java (W. half), and SE. Borneo.

Ecol. In submontane forest and bush, usually 1000–1600 m.

Vern. *Areuj mĕngander, ki konèng, ojod djaha,* S, *marambat,* Bencoolen.

Note. This subspecies, nomenclaturally the typical one, is a submontane subspecies clearly separated altitudinally from the more widespread, lowland *subsp. squamosum.*

subsp. **squamosum** (ROXB. *ex* DON) EXELL, *comb. nov.*—*Combretum squamosum* ROXB. [Hort. Beng. (1814) 88 *nom. nud.*] *ex* DON, Trans. Linn. Soc. Lond. 15 (1827) 419, 438; Fl. Ind. 2 (1832) 231; MIQ. Fl. Ind. Bat. 1, 1 (1855) 607; KURZ, For. Fl. Burm. 1 (1877) 463; CLARKE in HOOK. *f.* Fl. Brit. Ind. 2 (1878) 456; KING, J. As. Soc. Beng. 66, 2 (1897) 339; MERR. Philip. J. Sc. C. Bot. 4 (1909) 649; SLOOT. Bijdr. Combr. (1919) 43; GAGNEP. Fl. Gén. I.-C. 2 (1920) 739; RIDL. Fl. Mal. Pen. 1 (1922) 709; MERR. En. Philip. 3 (1923) 148; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 58; CRAIB, Fl. Siam. En. 1 (1931) 620.—*C. distillatorium* BLANCO, Fl. Filip. (1837) 295.—*Poivrea squamosa* (ROXB. *ex* DON) WALP. Rep. 2 (1843) 64.—*C. lepidotum* PRESL, Bot. Bemerk. (1844) 142.—*C. laxum* (*non* JACQ. *nec* AUBL.) BLANCO, Fl. Filip. ed. 2 (1845) 206.—*C. squamosum var. luzonicum* PRESL, Abh. Kön. Böhm. Ges. Wiss. V, 6 (1851) 576.—*C. squamosum var. dissitum* CRAIB, Fl. Siam. En. 1 (1931) 620.—**Fig. 2d.**

Leaves broadly elliptic to almost suborbicular, occasionally narrowly elliptic. Inflorescence a terminal panicle of elongated spikes. Petals narrowly elliptic or lanceolate, unguiculate.

Distr. India, Burma, Siam, Indo-China, and *Malaysia:* Malay Peninsula, Billiton, Borneo (Sarawak), and Philippines.

Ecol. Woody climber in bush and secondary forest at low altitudes.

Vern. Philippines: *Libang-libang*, Mbo, *pamulaklakin, malakadog*, Ilk., *malatumbága, tagarau*, Tag., *muli*, Sub.

6. Combretum porterianum (CLARKE) WALL. *ex* CRAIB, Fl. Siam. En. 1 (1931) 618.—*C. chinense* ROXB. *ex* DON, Trans. Linn. Soc. Lond. 15 (1827) 417, 432 *pro parte*?.—*C. chinense var. porterianum* CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 457; KING, J. As. Soc. Beng. 66, 2 (1897) 338; RIDL. Fl. Mal. Pen. 1 (1922) 709.

Scandent shrub. Young branchlets at first tomentellous, soon glabrescent. *Leaves* opposite, chartaceous, elliptic or narrowly elliptic, sparsely pubescent or glabrous, densely uniformly scaly and also usually with whitish rather sparse individually conspicuous scales or rather faintly visible scales on both surfaces, up to 14 by 7 cm, usually acuminate; petiole tomentellous or sparsely scaly, 1/2–1 cm. *Inflorescence* of axillary spikes *c.* 5 cm long or a terminal panicle of spikes *c.* 20 cm long; rhachides tomentellous or densely puberulous, sparsely and rather inconspicuously scaly. Bracts 1 1/2 mm long. *Flowers* probably yellowish-white, sessile. *Lower receptacle* (ovary) densely ferrugineous-scaly, 1 1/4 mm long, somewhat constricted at the top. Upper receptacle 2 1/2 mm long to the tips of the calyx-lobes, cupuliform at the top, terminating in the deltoid *calyx*-lobes, 1/2 mm long, with an infundibuliform basal part containing the disk, rather densely ferrugineous lepidote, otherwise nearly glabrous. *Petals* 4, yellow, obovate, 3/4 mm long, emarginate at the apex, glabrous. Stamens 8; filaments 3 mm long; anthers 1/2 mm long. Disk infundibuliform, margin free for about 0.3 mm, glabrous inside, bearded on the margin. Style 2 mm. *Fruit* suborbicular in outline, 2–2 1/2 cm diam., shortly stipitate, densely scaly on the body and sparsely so on the 4, thin, flexible wings, 5–7 mm broad.

Distr. Siam? and *Malaysia:* Malay Peninsula (Penang and Pahang). Fig. 4.

Ecol. Edges of forests and limestone cliffs.

Note. The type, G. PORTER in WALLICH 4000, from Penang, is in fruit. I have taken RIDLEY 5355, from Penang as representing the flowering stage and drawn up the description of the flowers from it.

For a note on the name '*C. chinense*' see under 7. *C. yunnanense*.

7. Combretum yunnanense EXELL, Sunyatsenia 1 (1938) 88, t. 21, f. F, t. 23.—*C. chinense* (*an* ROXB.?) SLOOT. Bijdr. Combr. (1919) 43; Bull. Jard. Bot. Btzg III, 6 (1924) 58.—*C. chinense var. pubescens* KING, J. As. Soc. Beng. 66, 2 (1897) 339; RIDL. Fl. Mal. Pen. 1 (1922) 709.

Scandent shrub or large climber. Young branchlets ferrugineous-scaly, otherwise glabrous in the Malaysian specimens seen but pubescent at first in Chinese specimens. *Leaves* opposite or subopposite, rarely ternate, elliptic, oblong-elliptic or ovate-elliptic, rarely obovate, acuminate at the apex (rounded in some Assamese specimens) and rounded or cuneate at the base, with rather sparse, individually conspicuous usually golden or reddish scales on both surfaces, pubescent or glabrous, 4–12 by 3–6 1/2 cm (up to 18 by 7 cm in Chinese specimens); nerves 6–9 pairs; petiole at first tomentose or pubescent later glabrescent, scaly, 3–10 mm. *Inflorescences* of axillary spikes up to 10 cm long and terminal panicles of spikes; rhachis ferrugineous-scaly, tomentellous, finely pubescent or glabrous apart from the scales. *Flowers* sessile, 4-merous, white or yellowish. *Lower receptacle* (ovary) densely ferrugineous-scaly, sometimes puberulous, 1–2 mm long. Upper receptacle infundibuliform at the base, cupuliform at the apex, 3 by 2 1/2 mm, densely ferrugineous-scaly, puberulous or glabrous (apart from the scales). *Calyx*-lobes triangular, 1/2 mm long. *Petals* 4, obovate or broadly elliptic, unguiculate, glabrous, 2 by 1 1/2 mm. Stamens 8, filaments 3–4 mm long. Disk well-developed, densely pilose on the margin. Style 6–6 1/2 mm long. *Fruit* suborbicular in outline, 2 1/2–3 1/2 by 2 1/2–3 1/2 cm, ferrugineous-scaly with 4 flexible wings 1 cm broad.

Distr. Bengal?, Assam?, Yunnan, and *Malaysia:* Sumatra, Malay Peninsula, and NW. Borneo.

Ecol. Little known. It grows up to 1600 m in Yunnan and may be a submontane species in Malaysia.

Note. The name *C. chinense* ROXB. *ex* DON has to be typified by a specimen in Herb. Lambert, collector unspecified, cited by DON and the conception given to the species by DON seems to differ in important respects from the original *C. chinense* ROXB. *nom. nud.* As I am uncertain whether *C. chinense* ROXB. *ex* DON applies to the species here described, to *C. porterianum* WALL. *ex* CRAIB. or possibly to a species not represented in Malaysia, I have had to treat the name, at least for the present, as a *nomen obscurum*.

8. Combretum borneense EXELL, J. Bot. 69 (1931) 265.

Woody climber. Young branchlets tomentellous, soon glabrescent. *Leaves* opposite, coriaceous, elliptic, narrowly elliptic, ovate-elliptic or suborbicular, somewhat shiny above, distinctly scaly above, scales spaced, not marginally contiguous, densely scaly below but scales not individually conspicuous, otherwise glabrous, 10–15 by 4–7 cm, abruptly acuminate at the apex, rounded or subcordate at the base; petiole 5–7 mm, at first pubescent, glabrescent. *Inflorescence* an ample terminal or axillary panicle up to 20 cm long, ultimate spikes 3–4 cm long. Bracts filiform, 2 mm long. Rhachis fulvous-pubescent. *Flowers* sessile, 4-merous. *Lower receptacle* (ovary) 2–3 mm long, densely scaly, scales marginally contiguous, otherwise glabrous. Upper receptacle shortly in-

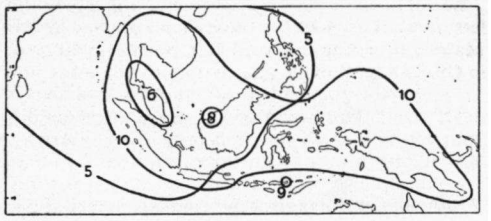

Fig. 4. Distribution of *Combretum*: 5. *punctatum*, 6. *porterianum*, 8. *borneense*, 9. *tetralophoides*, 10. *tetralophum*.

fundibuliform at the base, cupuliform at the apex with 4 acute, broadly triangular *calyx*-lobes, rather densely and conspicuously scaly, otherwise glabrous, 2½–3 by 2.2 mm measuring to the tips of the calyx-lobes. *Petals* 4 oblanceolate, shortly clawed, glabrous, 1¾ by ¾ mm. Stamens 8, exserted, filaments 3½–4.2 mm. Disk pilose with a shallow free margin. Style 5 mm. *Fruit* unknown.

Distr. *Malaysia:* Borneo (Sarawak). Fig. 4.

Note. Probably related to *C. tetralophum* CLARKE but only 3 collections are known and no fruits have yet been collected.

9. Combretum tetralophoides SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 55.

Climbing shrub. Branchlets at first fulvous-tomentellous, later glabrescent. *Leaves* papyraceous, opposite, elliptic or oblong-elliptic, sparsely pubescent above, densely pubescent or almost tomentose beneath and densely scaly but individual scales not conspicuous, 6–11 by 4–5 cm, bluntly acuminate at the apex, cuneate at the base; nerves 5–8 pairs; petiole 3–5 mm, tomentellous. *Inflorescence* fulvo-tomentellous, a terminal or axillary panicle of spikes. Bracts linear, pubescent, 2 mm long, soon deciduous. *Flowers* sessile, 4-merous. *Lower receptacle* (ovary) densely ferrugineous-scaly, 2 mm long, somewhat constricted above the ovary. Upper receptacle densely ferrugineous-scaly, shortly and broadly infundibuliform at the base, *c.* 1 mm long, cupuliform at the apex and terminating in 4 broadly triangular *calyx*-lobes. *Petals* 4, linear-lanceolate, glabrous, 1–1½ mm long. Stamens 8, exserted. Disk small, densely pilose. *Fruit* broadly elliptic to obovate in outline, scaly but scales not very conspicuous, retuse at the apex and with a short, 1½ mm long stipe at the base; wings 4 thin, flexible *c.* 1 cm broad.

Distr. *Malaysia:* Lesser Sunda Islands (Flores: Larantuka), once collected. Fig. 4.

10. Combretum tetralophum CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 454; KING, J. As. Soc. Beng, 66, 2 (1897) 336; SLOOT. Bijdr. Combr. (1919) 34; Bull. Jard. Bot. Btzg III, 6 (1924) 54; GAGNEP. Fl. Gén. I.-C. 2 (1920) 738; MERR. En. Born. (1921) 423; RIDL. Fl. Mal. Pen. 1 (1922) 708; HEYNE, Nutt. Pl. (1927) 1173; CRAIB, Fl. Siam. En. 1 (1931) 621; BURK. Dict. (1935) 645; MEEUSE in BACK. Fl. Java (em. ed.) 4, fam. 101 (1944) 4.—*C. acuminatum* (*non* ROXB.) K. SCHUM. & HOLLR. Fl. Kais. Wilh.-Land (1889) 84; LAUT. Nova Guinea 8 (1910) 317; (1912) 847; DIELS, Bot. Jahrb. 57 (1912) 427, *quoad specim.* LEDERM. 7307.—*C. wrayi* KING, J. As. Soc. Beng. 66, 2 (1897) 339.—*C. tetragonocarpum* (*non* KURZ) KOORD. Minah. (1898) 453; KOORD.-SCHUM. Syst. Verz. 3, 1 (1914) 93.—*C. neurophyllum* (*non* MIQ.) BACKER, Bull. Jard. Bot. Btzg II, *no* 12 (1913) 12.—**Fig. 2f.**

Liana climbing to a considerable height or scandent shrub. Young branchlets ferrugineous-scaly, soon glabrescent. *Leaves* opposite, papyraceous to chartaceous, elliptic, often shiny above, densely scaly but scales not individually conspicuous, otherwise nearly glabrous except for some pubescence, nearly always present, on the midrib at the base of the lower surface of the leaf, 6–15 (–20) by 3–6(–11) cm, usually slightly or distinctly acuminate at the apex and cuneate or rounded at the base; nerves 6–8 pairs; petiole 3–10 mm long, scaly and often somewhat pubescent. *Inflorescences* scaly and pubescent, of lateral spikes and terminal panicles of spikes, spikes rarely more than 2–3 cm long and often subcapituliform. *Flowers* 4-merous, sessile, yellow, greenish yellow or greenish white, sweet-scented, 4½–7½ mm long measuring to the tips of the calyx-lobes. *Lower receptacle* (ovary) 2–2½ mm long, densely ferrugineous-scaly, otherwise glabrous, constricted at the apex; upper receptacle cupuliform at the apex, 1 by 3 mm, with 4 triangular acute *calyx*-lobes, basal portion containing the disk broadly infundibuliform, 1½ by 1 mm, densely ferrugineous-scaly, otherwise usually glabrous. *Petals* 4, glabrous, oblanceolate, 2½–3 by 0.8 mm. Stamens 8; filaments 4–4½ mm long; anthers ½ mm long. Disk well-developed with a short free margin, densely pilose so that the flowers appear barbate within. Style 6 mm long. *Fruit* ovoid or ovoid-ellipsoid in outline, densely scaly, 2½–3.8 by 1.2–1.8 cm with 4 stiff, narrow, sharp-edged wings or ridges, along which it eventually dehisces.

Distr. Indo-China, Siam, Caroline Islands, in *Malaysia:* Sumatra, Malay Peninsula, Java, Borneo, Celebes, New Guinea; not recorded from Philippines. Fig. 4.

Ecol. In mangrove swamps and in fringing forests along banks of rivers in lowland regions. Fruit probably dispersed by water.

Uses. The fruits are used as a vermifuge but perhaps by confusion with those of *C. trifoliatum* or *Quisqualis indica*.

Vern. *Akar aru*, E. Borneo, *songsong harus*, *susong harus*, M, *tingting*, Celebes.

Notes. One specimen, EVANGELISTA 897 (A), from Br. N. Borneo, Labuan River, has much shorter and broader calyx-lobes, so that the flowers resemble those of *C. yunnanense*, but the leaves are undoubtedly those of *C. tetralophum*. Leaf-galls caused by a gall-mite are described by DOCTERS VAN LEEUWEN (Zoocecid. Neth. E. I. 1926, 402, f. 749).

11. Combretum latifolium BL. Bijdr. (1825) 641, *non C. latifolium* DON (1827); MIQ. Fl. Ind. Bat. 1, 1 (1855) 609; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 52; MEEUSE in BACK. Fl. Java (em. ed.) 4, fam. 101 (1944) 4.—*C. extensum* ROXB. [Hort. Beng. (1814) 28 *nom. nud.*] *ex* DON, Trans. Linn. Soc. Lond. 15 (1827) 414, 422; KURZ, For. Fl. Burma 1 (1877) 463; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 458; KING, J. As. Soc. Beng. 66, 2 (1897) 337; MERR. Philip. J. Sc. C. Bot. 4 (1909) 649; BACK. Schoolfl. Java (1911) 493; KOORD. Exk. Fl. 2 (1912) 670; SLOOT. Bijdr. Combr. (1919) 36; GAGNEP. Fl. Gén. Indo-Ch. 2 (1920) 737; MERR. En. Born. (1921) 422; En. Philip. 3 (1923) 148; RIDL. Fl. Mal. Pen. 1 (1922) 709; CRAIB, Fl. Siam. En. 1 (1931) 615.—*C. rotundifolium* ROXB. [Hort. Beng. (1814) 88 *nom. nud.*] Fl. Ind. 2 (1832) 226, *non* RICH. (1792).—*C. cyclophyllum* STEUD. Nom. ed. II, 1 (1841) 400.— *C. formosum* GRIFF. Not. Pl. As. 4 (1854) 682, *non* DON (1827).—*C. horsfieldii* MIQ. Fl. Ind. Bat. 1 (1855) 609.—*C. micropetalum* LLANOS, Mem. Acad. Cienc. Madr. 4 (1856) 502, *non* DC. (1828).—*C. leucanthemum* HEURCK & MÜLL. ARG. in HEURCK, Obs. Bot. (1870) 240.—*C. platyphyllum* HEURCK & MÜLL. ARG. *op. cit.* (1870) 242.—**Fig. 1a, 1c.**

Liana. Young branchlets scaly when very young, otherwise usually glabrous often reddish in colour. *Leaves* opposite, chartaceous to subcoriaceous, usually broadly elliptic or ovate-elliptic, sometimes suborbicular or elliptic, rarely narrowly elliptic (sucker shoots?) rather sparsely conspicuously scaly when young, when mature densely lepidote (under high magnification) but individual scales not conspicuous, otherwise glabrous, domatia often present but not hairy, 8–20 by 4–13 cm, often acuminate at the apex, acumen up to 1 cm long, cuneate or rounded at the base; petiole scaly when young, soon glabrescent, 7–20 mm long. *Inflorescence* a terminal or axillary panicle up to 20 cm long, of elongated 5–8 cm long spikes or occasionally an unbranched lateral spike, densely and finely velutinous. Bracts very small and soon caducous. *Flowers* greenish-white (occasionally pink?), 4-merous, subsessile. *Lower receptacle* (ovary) finely velutinous, 2½–3½ mm long. Upper receptacle finely velutinous narrowly tubular, 5–6 mm long, somewhat expanded at the apex and terminating in 4 narrowly triangular acute *calyx*-lobes 3 by 2 mm. *Petals* 4 suborbicular, glabrous, 2 by 2 mm, slightly emarginate at the apex and very shortly unguiculate at the base. Stamens 8 inserted at the margin of the disk; filaments 3½ mm long; anthers 0.8 mm long. Disk narrowly infundibuliform, margin thickened, free for about ½ mm, pilose. Style 8–8½ mm, rather stout. *Fruit* suborbicular (rarely obovate) in outline, 2–3 cm diam., with 4 thin, flexible wings, viscid-glandular especially on the body less so on the wings, shortly stipitate; stipe *c.* 2 mm long.

Distr. India, Ceylon, Burma, Indo-China, Siam, throughout *Malaysia*, the Moluccas and New Guinea excepted. Fig. 5.

Ecol. Widespread along margins of forest and in secondary forest, from sea-level up to 1000 m (fide BACKER), but most records are below 500 m.

Vern. *Areuj munding djalo, areuj tjikupa,* S, *londo, klundo, klondo, ojod klondo, ojod lundo,* J, *balimbing balimbing,* Bajau, *lamutagi,* SW. Celebes; Philippines: *suksukung,* Tagb., *dalipog.*

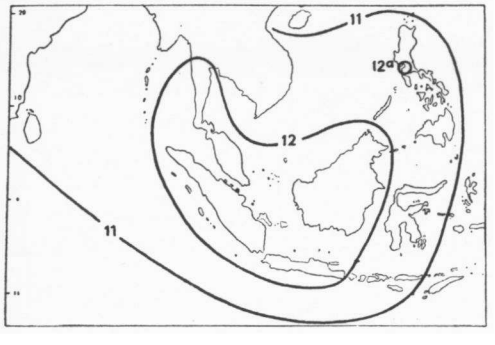

Fig. 5. Distribution of *Combretum*: 11. *latifolium*, 12. *sundaicum*, 12a. *confusum*.

12. Combretum sundaicum MIQ. Fl. Ind. Bat. Suppl. (1860) 327; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 458; KING, J. As. Soc. Beng. 66, 2 (1897) 337 ('*sundiacum*'); BACK. Schoolfl. Java (1911) 493; SLOOT. Bijdr. Combr. (1919) 38; Bull. Jard. Bot. Btzg III, 6 (1924) 54; RIDL. Fl. Mal. Pen. 1 (1922) 708; MERR. En. Philip. 3 (1923) 149; HEYNE, Nutt. Pl. (1927) 1173; CRAIB, Fl. Siam. En. 1 (1931) 620; BURK. Dict. (1935) 644; MEEUSE, in BACK. Fl. Java (em. ed.) 4, fam. 101 (1944) 5.—**Fig. 2g, 6.**

Scandent shrub or liana up to 30 m. Young branchlets usually densely ferrugineous-scaly, otherwise glabrous or nearly so. *Leaves* opposite, chartaceous or papyraceous, usually broadly elliptic, sometimes nearly suborbicular, densely scaly but individual scales usually not very conspicuous in dried specimens (but occasionally conspicuous), often minutely verruculose on the upper surface, up to 15 by 10 cm (usually *c.* 11 by 7 cm *in herb.*), acuminate at the apex (rarely rounded, rarely caudate), rounded or obtuse at the base; petiole up to 2 cm long, often rather slender, usually densely (sometimes sparsely) ferrugineous-scaly, glabrescent. *Inflorescence* a terminal panicle of capituliform spikes or racemes, rhachis densely covered with reddish, golden-brown or greyish scales, otherwise usually glabrous. Bracts subtending the flowers, filiform, 1–2 mm long, soon caducous. *Flowers* greenish-white, 4-merous, subsessile. *Lower receptacle* (ovary) densely scaly otherwise glabrous, 3 mm long. Upper receptacle densely scaly otherwise glabrous or nearly glabrous, narrowly tubular, 5 mm long, somewhat expanded at the apex and terminating in 4 triangular acute *calyx*-lobes 2½ by 1½ mm, often reflexed in mature flowers. *Petals* 4 obovate to suborbicular, glabrous, 1½–2 by 1–2 mm, shortly unguiculate. Stamens 8 inserted at the margin of the disk; filaments 3 mm; anthers 0.8 mm long. Disk narrowly infundibuliform, margin

Fig. 6. *Combretum sundaicum* MIQ. *a.* Flowering twig, × 2/3, *b.* flower, × 5 (BARTLETT & DE LA RUE 45), *c.* fruit, nat. size (LÖRZING 1057).

free for about 1/2 mm, rather densely pilose. Style 8 mm. *Fruit* suborbicular in outline, somewhat glutinous, especially when young, with 4 thin flexible wings up to 1 1/2 cm broad, not conspicuously lepidote; stipe 2–3 mm.

Distr. Siam and *Malaysia:* Sumatra, Malay Peninsula, Java, Borneo. Fig. 5.

Ecol. Climbing shrub or liana of open bush and edges of forest from sea-level to *c.* 250 m.

Uses. It has been used as a cure for opium-craving but is probably of little real value, the supposed effect now being considered mainly psychological.

Vern. *Akar gambir, akar gĕgambir, kait-kait, pugar tanar,* M, *bajit djaha,* Lampong, *sung-sung ajĕr,* Borneo.

Note. This species is very close to *C. latifolium* differing mainly in the capituliform spikes and in the scaly but otherwise glabrous inflorescences. The relationship between these species parallels that between *C. punctatum* and *C. squamosum* but is somewhat less close, as a

difference in the form of the inflorescence is correlated with a difference in indumentum (except for a few specimens which may be hybrids: see *C. confusum*). Hence *C. latifolium* and *C. sundaicum* have been maintained as separate species while *C. squamosum* and *C. punctatum* are considered to be only subspecifically distinct.

12a. Combretum confusum MERR. & ROLFE, Philip. J. Sc. C. Bot. 3 (1908) 116 (= *C. latifolium* × *C. sundaicum*?).—*C. sexalatum* MERR. Philip. J. Sc. 1, Suppl. 3 (1906) 212 *pro parte quoad fl.*

Similar to the last species in leaf characters but with inflorescences intermediate between those of *C. latifolium* and *C. sundaicum*, the ultimate spikes being slightly more elongated than in the latter species. The flowers are scaly like those of *C. sundaicum* but the rhachides and peduncles of the inflorescence are densely pubescent or tomentellous, much as in *C. latifolium*.

Distr. *Malaysia:* Philippines (Luzon). Fig. 5.

Note. The three gatherings known are all from Luzon and may represent a hybrid between *C. latifolium* and *C. sundaicum*. Neither supposed parent is now known in Luzon but *C. latifolium* occurs in Palawan and *C. sundaicum* in Sarawak.

Cultivated species

The following species are in cultivation in various Malaysian gardens: **C. assimile** EICHL., **C. coccineum** (SONN.) LAMK (*C. purpureum* VAHL), **C. flagrocarpum** CLARKE, **C. grandiflorum** DON, **C. paniculatum** VENT. (*C. pincianum* HOOK.), **C. pilosum** ROXB., **C. quadrangulare** KURZ, and **C. roxburghii** SPRENG. (*C. decandrum* ROXB.).

Of these the more attractive and widely grown species are: *C. coccineum*, *C. grandiflorum* and *C. paniculatum*. *C. grandiflorum* has occasionally established itself as an escape from cultivation in Penang.

Excluded species

Combretum flavo-virens LAUT. Nova Guinea 8 (1912) 847 = *Pygeum dolichobotrys* K. SCHUM. & LAUT. (see DIELS, Bot. Jahrb. 57, 1922, 427) (*Rosac.*).

Combretum sexalatum MERR. Philip. J. Sc. 1 Suppl. 3 (1906) 212 *pro parte quoad fruct.* = *Aspidopteris elliptica* JUSS. (*Malpigh.*).

2. QUISQUALIS

LINNÉ, Sp. Pl. ed. 2, 1 (1762) 556; SLOOT. Bijdr. Combr. (1919) 45; Bull. Jard. Bot. Btzg III, 6 (1924) 59; EXELL, J. Bot. 69 (1931) 117.—*Quis qualis* RUMPH. Herb. Amb. 5 (1747) 71, t. 38.—*Kleinia* CRANTZ, Inst. (1766) 488, *non* JACQ. (1763).—*Sphalanthus* JACK in Mal. Misc. 2, *no* 7 (1822) 55.

Woody climbers. *Leaves* opposite or subopposite, entire, glabrous or hairy; petioles partly persisting after the fall of the leaf, their bases forming thorns. *Flowers* ♀, actinomorphic or slightly zygomorphic, 5-merous, in elongated, terminal or axillary bracteate (occasionally branched) spikes. *Receptacle* (*calyx*-tube) hairy or nearly glabrous, divided into a lower part (lower receptacle) surrounding and adnate to the ovary and a tubular to narrowly tubular upper part (upper receptacle) terminating in the calyx-lobes, the latter part caducous. *Calyx*-lobes 5, triangular, sometimes with filiform tips. *Petals* 5, rather large for the family and much exceeding the calyx-lobes, enlarging during anthesis. Stamens 10, biseriate, inserted inside and near the mouth of the upper receptacle. Anthers versatile. Disk narrowly tubular or absent. Style adnate for part of its length to the inner wall of the upper receptacle. Ovules 2–4; funicles sometimes papillose. *Fruit* dry, oblong, narrowed at both ends, deeply 5-sulcate between the longitudinal wings. Seed 1, longitudinally sulcate.

Distr. About 17 *spp.* of which 8 occur in tropical and South Africa, 8 in tropical Indo-Malaysia and 1, *Q. indica*, cultivated throughout the tropics, is probably indigenous both in tropical Africa and tropical Indo-Malaysia.

The Malaysian species belong to the following sections:
sect. *Sphalanthus* (JACK) EXELL (*Q. conferta* and *Q. parvifolia*), and
sect. *Euquisqualis* EXELL (*Q. indica* and *Q. sulcata*).

Ecol. Woody climbers along river-banks and margins of forests, mostly at low altitudes.

Uses. *Q. indica* is cultivated as an ornamental climber and the fruits are used as a vermifuge.

Notes. The genus as here delimited is separated from *Combretum* by the adnation of the style to the upper receptacle tube. For a full account of this question see EXELL, *l.c.*

KEY TO THE SPECIES

1. Petals less than 5 mm long. Upper receptacle (calyx-tube) not more than 2–5 cm long.
2. Upper receptacle (calyx-tube) 18–25 mm long. Branchlets tomentellous or pubescent. **1. Q. conferta**
2. Upper receptacle (calyx-tube) about 10 mm long. Branchlets glabrous or nearly glabrous. **2. Q. parvifolia**
1. Petals 7 mm long or longer in mature flowers (up to *c.* 20 mm). Upper receptacle (calyx-tube) 4–8 cm long.
3. Upper receptacle (calyx-tube) 4 cm long in mature flowers. Branchlets glabrous. Ovules 1–2. **3. Q. sulcata**
3. Upper receptacle (calyx-tube) up to 8 cm long. Indumentum very variable but branchlets never quite glabrous. Ovules 3–4 . . . . . **4. Q. indica**

1. Quisqualis conferta (JACK) EXELL, J. Bot. 69 (1931) 122.—*Sphalanthus confertus* JACK, Mal. Misc. 2, *no* 7 (1822) 55.—*Q. densiflora* WALL. [Cat. (1831) 4011 *nomen nudum*] *ex* MIQ. Fl. Ind. Bat. 1, 1 (1855) 611; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 460 *pro parte excl. spec. Moulm.*; KING, J. As. Soc. Beng. 66, 2 (1897) 341; GAGNEP. Fl. Gén. I.-C. 2 (1920) 773; RIDL. Fl. Mal. Pen. 1 (1922) 711; CRAIB, Fl. Siam. En. 1 (1931) 622.—*Sphalanthus ovatifolius* JACK *ex* STEUD. Nom. ed. 2, 2 (1841) 621, *nomen nudum.*

Young branchlets appressed-pubescent or tomentellous. *Leaves* opposite, papyraceous, elliptic, oblong-elliptic or obovate-oblong, glabrous except for domatia on the undersurface and a few hairs on the midrib, minutely verruculose above and beneath, 8–16 by 3½–6 cm, acuminate at the apex and rounded (or sometimes very slightly cordate) at the base; nerves 5–6 pairs; petiole tomentellous, more or less glabrescent, 7–9 mm. Spikes terminal and axillary (occasionally branched), 6–12 cm long. Bracts narrowly elliptic, acuminate appressed-pubescent, 5–8 by 1½–2 mm. *Flowers* red or white (? turning colour during the day as in *Q. indica*), sessile, actinomorphic or slightly zygomorphic. *Lower receptacle* (ovary) sericeous, 3½–4 mm long; upper receptacle narrowly tubular, pubescent, 18–25 mm long, slightly expanded at the apex, basal part slightly swollen at one side. *Calyx*-lobes with recurved filiform tips, 2–3 mm long. *Petals* oblong or elliptic, pubescent, 4 by 1.8 mm (about 2½ mm long in dried specimens). Longer stamens opposite the calyx-lobes with filaments 3½ mm long, shorter ones inserted higher in the upper receptacle opposite the petals with filaments 2 mm long; anthers 0.8 mm long. Disk narrowly tubular, slightly zygomorphic, glabrous, 10 by 1½ mm without free margin and not very clearly differentiated.

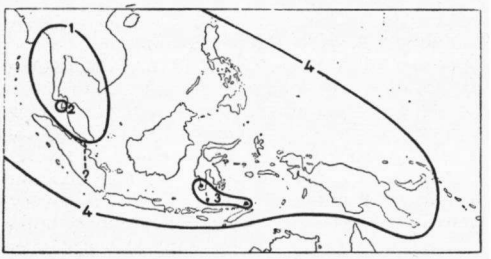

Fig. 7. Distribution of *Quisqualis*: 1. *conferta*, 2. *parviflora*, 3. *sulcata* (localities indicated by dots), 4. *indica*.

Style adnate to the upper receptacle for 20 mm, upper part free, 6 mm. Ovules 3. *Fruit* elliptic to ovate-elliptic in outline, 2–2½ by 1.8 cm with 5 thin, but rather stiff wings 6–7 mm broad, shortly stipitate, sparsely pubescent, somewhat viscid.

Distr. Indo-China, Siam, in *Malaysia:* Malay Peninsula (and Sumatra?, *cf.* JACK). Fig. 7.

Ecol. Presumably a forest-climber.

Uses. Apparently used indifferently with *Q. indica* as a vermifuge according to BURKILL (Dict. 1860); leaves or roots are used.

Vern. *Kayu sumang, sĕlimpas, sumang, akar dani, rĕdani*, Mal. Pen.

Notes. This species is said to have been collected by WILLIAM JACK in Sumatra and a specimen, without precise locality, is in the DELESSERT Herbarium at Geneva and must be considered as the type. The species has never been collected again in Sumatra.

The 'disk' mentioned in this and the following species is not such an obviously independent structure as in most species of *Combretum* and *Terminalia* but rather a thickened portion of the basal part of the upper receptacle presumably secretory in function.

2. Quisqualis parvifolia (RIDL.) EXELL, J. Bot. 69 (1931) 123.—*Q. densiflora var. parvifolia* RIDL. Fl. Mal. Pen. 1 (1922) 711; CRAIB, Fl. Siam. En. 1 (1931) 623.

Branchlets very slender, glabrous or nearly so. *Leaves* minutely verruculose above, glabrous except for domatia and some pubescence on the midrib beneath, ovate-oblong, ovate-elliptic or elliptic, acuminate at the apex, rounded or subcordate at the base, 3–10 by 1½–5 cm; nerves 3–4 pairs, rather prominent beneath; petioles 4–6 mm, glabrous. Spikes short, terminal or lateral with rhachides 6–10 mm long. *Flowers* 'dirty mauve'. *Lower receptacle* (ovary) appressed-pubescent 2 mm long; upper receptacle tubular, 10 by 2½ mm, slightly swollen at one side in the basal part containing the disk, appressed-pubescent outside, glabrous inside. *Calyx*-lobes triangular, acute, 2 by 0.8 mm, tips ± filiform but only ½–1 mm long. *Petals* ovate, appressed-pubescent, 2 by 1½ mm. Filaments of longer stamens 2 mm, shorter ones 1½ mm; anthers ½ mm long. Disk infundibuliform, *c.* 2 mm long, not very clearly differentiated. Style adnate for 8 mm to the upper receptacle; free part 2½ mm. Ovules 2. *Fruit* not known.

Distr. *Malaysia:* NW. Malay Peninsula (Langkawi Islands). Fig. 7.

Fig. 8. *Quisqualis indica* L. with flowers and fruits, × 2/3.

Notes. Clearly closely related to the preceding species but smaller in all its parts and with only 2 ovules in the ovaries of the few flowers available for dissection. The relation between this species and *Q. conferta* is almost the same as that between *Q. sulcata* and *Q. indica*.

3. Quisqualis sulcata SLOOT. Bijdr. Combr. (1919) 49; Bull. Jard. Bot. Btzg III, 6 (1924) 61; EXELL, J. Bot. 69 (1931) 123.—*Q. sulcata var. subcordata* SLOOT. *l.c.* (1919) *et* (1924) 62; EXELL, *l.c.*—*Q. indica* (*non* L.) SLOOT. *l.c.* (1924) 61, *quoad spec.* TEYSMANN 12837.

Young branchlets reddish, glabrous. *Leaves* opposite, obovate or elliptic shortly acuminate at the apex, subcordate or rounded at the base, nearly glabrous, except for domatia on undersurface, minutely verruculose above, 10–19 by 4½–8 cm; petiole 1.2–2 cm, glabrous, sulcate. Spikes shortly and densely hairy, terminal and axillary, 7–9 cm long. *Lower receptacle* (ovary) densely appressed-pubescent, 5–6 mm long; upper receptacle narrowly tubular, somewhat expanded at the apex with short appressed-pubescence on the outside and longer patent hairs within. *Calyx*-lobes broadly ovate, 1½ mm long. *Petals* oblong,

puberulous, rounded at the apex and rounded or slightly cuneate at the base, 12 by 6 mm. Filaments of longer stamens 9 mm, inserted opposite the calyx-lobes in the upper part of the upper receptacle, filaments of shorter ones 8 mm, inserted near the base of the petals *c.* 2 mm higher in the tube of the upper receptacle than the longer series; anthers 0.8 mm long. Style attached to the inside of the tube of the upper receptacle to within 2 mm of the attachment of the longer stamens at which it becomes free, free part 13 mm. Ovules 2. *Fruit* ellipsoid in outline, 3–3 1/2 by 1.2–1.4 cm with 5 narrow stiff wings, at first appressed-pubescent, later glabrescent.

Distr. *Malaysia:* Lesser Sunda Islands (P. Wetar), Saleyer group (P. Kalao Toa, halfway Flores-SW.Celebes), and SW.Celebes (Maros). Fig. 7.

Ecol. Possibly on coral limestone, in Wetar in Eucalypt savannah, 0–50 m, *fl.* March–May.

Notes. Owing to lack of material I have not been able to verify VAN SLOOTEN's statement that this species has only 2 ovules, compared with 3 to 4 in *Q. indica.* If this distinction is true, in combination with the glabrousness of the twigs and the rather shorter upper receptacle it should be sufficient to maintain *Q. sulcata* as a good species. The difference given by VAN SLOOTEN in the shape of the petals proves on examination to be scarcely significant. Moreover, *Q. indica* is so variable as regards indumentum that the glabrous twigs in *Q. sulcata* could be regarded as no more than the end-point of a series of diminishing hairiness.

4. Quisqualis indica LINNÉ, Sp. Pl. ed. 2, 1 (1762) 556; SIMS in CURT. Bot. Mag. t. 2033 (1819); BL. Bijdr. (1825) 642; BLANCO, Fl. Filip. (1837) 361; HASSK. Flora 27 (1844) 607; MIQ. Fl. Ind. Bat. 1, 1 (1855) 610; KURZ, For. Fl. Burma 1 (1877) 467; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 459; F.-VILL. Novis. App. (1880) 81; VIDAL, Sinops. Atl. (1883) 26, t. 48, f. D; Phan. Cuming. Philip. (1885) 112; Rev. Vasc. Fl. Filip. (1886) 128; K. SCHUM. in K. SCHUM. & HOLLR. Fl. Kais. Wilh. Land (1889) 85; KING, J. As. Soc. Beng. 66, 2 (1897) 342; MERR. Philip. J. Sc. C. Bot. 4 (1909) 649; En. Born. (1921) 423; En. Philip. 3 (1923) 154; BACK. Schoolfl. Jav. (1911) 494; KOORD. Exk. Fl. 2 (1912) 670; SLOOT. Bijdr. Combr. (1919) 46; GAGNEP. Fl. Gén. I.-C. 2 (1920) 776; RIDL. Fl. Mal. Pen. 1 (1922) 711; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 59; HEYNE, Nutt. Pl. N.I. (1927) 1173; CRAIB, Fl. Siam. En. 1 (1931) 623; EXELL, J. Bot. 69 (1931) 124; BURK. Dict. (1935) 1860; MEEUSE in BACK. Fl. Java (em. ed.) 4, fam. 101 (1944) 5.—*Quis qualis* RUMPH. Herb. Amb. 5 (1747) 71, t. 38.—*Kleinia quadricolor* CRANTZ, Inst. 2 (1766) 488.—*Q. pubescens* BURM. *f.* Fl. Ind. (1768) 104, t. 35, *f.* 2.—*Q. glabra* BURM. *f. op. cit.* 104, t. 28, f. 2.—*Q. spinosa* BLANCO, Fl. Filip. ed. 2 (1845) 254.—*Q. densiflora* (*non* WALL. *ex* MIQ.) F.-VILL. Novis. App. (1880) 81.—**Fig. 1d, 8, 9.**

Climbing to the left (MEEUSE). Young branchlets tomentose, villous, pilose, appressed-pubescent or sparsely pubescent, rarely sparsely glandular. *Leaves* opposite or subopposite (said to be sometimes partly alternate, spiral or ± whorled—see SIMS and MEEUSE, *ll.cc.*), papyraceous, elliptic or elliptic-oblong, varying from tomentose to nearly glabrous, with domatia sometimes present, minutely verruculose on the upper surface, 5–18 1/2 by 2 1/2–9 cm, acuminate or sometimes subcaudate at the apex, rounded or subcordate at the base; nerves 5–6 pairs; petiole varying from tomentose to nearly glabrous, 1/2–2 cm; petiolar thorns sometimes up to 1 1/2 cm. *Spikes* terminal and axillary, 2–10 cm long, sometimes forming a leafy panicle. Bracts lanceolate-acuminate or elliptic, 6–10 by 2–3 mm. *Flowers* pleasantly scented. *Lower receptacle* sericeous, 3–4 mm long; upper receptacle narrowly tubular, slightly expanded at the apex, outside varying from tomentose to nearly glabrous. *Calyx*-lobes deltoid or shortly triangular, 1–2 mm long, tips acute but scarcely filiform. *Petals* oblong, white, 6–8 mm, finally turning dark red, 10–20 by 3–6 mm, somewhat rounded and very shortly unguiculate at the base, imbricate in bud, sparsely pubescent. Filaments 7–7 1/2 mm long, longer ones attached *c.* 1 1/2 mm lower in the receptacle-tube than the shorter ones. Style adnate to the inner wall of the upper receptacle, upper part free for 15 mm. Ovules 3–4. *Fruit* dark-brown, ovate-elliptic in outline, usually appressed-pubescent, 2 1/2–4 by 3/4–1 1/4 cm with 5 rather stiff wings.

Distr. Widespread in the tropics of the Old World and widely planted in many tropical countries, throughout *Malaysia.* Fig. 7.

Ecol. A large climber along margins of primary forest, along river-banks, in thickets and in secondary forest; from sea-level to *c.* 100 (–300) m. Specimens maintain themselves by root-suckers and stooling.

Uses. Much grown as an ornamental climber in tropical gardens. In India and Malaysia fruits are often used as vermifuge; for this purpose they are picked half-ripe, when they are bitter, pulped in water and the liquid drunk. Seeds from ripe fruits may also be used. When ripe they taste like coconut (BURK. Dict. 1860). In Java the root is used as a vermifuge, or in E. Malaysia an extract from the mature leaves. Though many experiments have been carried out it is surprising that no active chemical substance has yet been isolated (*cf.* QUISUMBING, Medic. Pl. Philip. 1951, 654).

Very young shoots are used as a vegetable in Java (OCHSE, Veg. D. E. I. 1931, 106).

Vern. *Rangoon creeper, Burma creeper, Chinese honeysuckle,* E, *dani, udani, urdani, ara dani, akar dani, rědani, wudani, sělimpas, akar suloh,* M, *akar puntianak,* Mal. Pen., *bidani,* S, *katěkluk katjěkluk, tjěguk, tjěkluk,* J, *rabět dani, kunji rabět, rabět bĕsi,* Md, *saradèngan,* Kangean, *tikao,* Bugin.; Philippines: *niog-niógan* (standard Tagalog name), *balitadham, pinion, piñones,* Bis., *bonor,* P. Bis., *kasunbal, tanglón, tañgúlo,* Bik., *agúlo, tañgólo, totoraok, tagarau,* Tag., *talólong,* Tag., Ilk., *tatúlong,* Ibn., *taúñgon,* Mbo, *tartaraok, tartarau,* Ilk.

Fig. 9. *Quisqualis indica* L. Botanic Gardens, Singapore, June 1950 (HENDERSON).

Notes. *Q. indica* varies very greatly as regards its form of growth and indumentum. This led RUMPHIUS to observe (*op. cit.* 72) 'Haec planta mihi Latine Quis qualis vocatur, acsi juxta Belgicum *Hoedanig* denominata esset, atque hoc nomen ipsi inposui ob multiplices, quas subit, mutationes, & variabilem formam' (See also SIMS, *l.c.*).

The petals are white when the flowers open in the early morning and gradually turn red as the day advances. The flowers are adapted for pollination by only very long-tongued insects; fruiting specimens are rare from many localities.

A leaf-gall due to the gall-mite *Eriophyses quisqualis* NOL. has been recorded on the species (DOCTERS VAN LEEUWEN, Zoocec. N. I. 1926, 403).

Several experienced collectors have expressed the opinion that *Q. indica* is indigenous in tropical Africa and not merely an escape from cultivation.

3. TERMINALIA

LINNÉ, Syst. Nat. ed. 12, 2 (1767) 674 (*err.* 638) & Mant. Pl. (1767) 21 *nom. cons.*; SLOOT. Bijdr. Combret. (1919) 6; Bull. Jard. Bot. Btzg III, 6 (1924) 12.—*Adamaram* ADANS. Fam. 2 (1763) 445 *excl.* Hort. Malab. 4, t. 5.—*Myrobalanus* GAERTN. Fruct. 2 (1791) 90. t. 97, fig. 2.—*Gimbernatea* R. & P. Prod. Fl. Peru (1794) 138, t. 36.—*Pentaptera* ROXB. [Hort. Beng. (1814) 34, *nomen nudum*] Fl. Ind. ed. CAREY 2 (1832) 437.

Trees, often of great stature, frequently buttressed. Branching often sympodial. *Leaves* usually spirally arranged, often crowded in pseudo-whorls at the ends of the branchlets, usually petiolate, entire, glabrous or hairy, often minutely verruculose and pellucid-punctate due to aggregations of calcium oxalate crystals, rarely with canal-like mucilaginous cavities, often with domatia, frequently with 2 or more glands at or near the base of the lamina or on the petiole. *Flowers* actino-

morphic 5-merous (rarely 4-merous) usually in axillary spikes with ♂ flowers towards the apex and ♀ *flowers* towards the base, more rarely in terminal or terminal and axillary panicles; ♂ *flowers* stalked, stalks resembling pedicels but corresponding to the lower receptacle with abortion of the ovary; ♀ sessile. *Receptacle* (calyx-tube) glabrous or hairy, divided into a lower part (lower receptacle) surrounding and adnate to the ovary and often narrowed above it and an upper part, often scarcely developed, expanding into a shallow cup terminating in the calyx-lobes. *Calyx-lobes* deltoid, ovate or triangular. *Petals* absent. Stamens usually 10, exserted; anthers dorsifixed, versatile. Disk intrastaminal, usually barbate or densely pilose, occasionally glabrous or nearly glabrous, rarely little developed. Style simple, free, exserted. *Ovary* completely inferior, unilocular with 2 (rarely 3 or 4) pendulous ovules. *Fruit* (pseudocarp) very variable in size and shape, often fleshy and drupe-like, sometimes dry and leathery or corky, often 2–5-winged, usually with an at least partially sclerenchymatous endocarp (thus distinguishing it from the fruit of *Combretum*).

Distr. About 200 *spp.* throughout the tropics fairly equally distributed between tropical Asia, extending to northern Australia and Polynesia, tropical Africa and tropical America.

Ecol. The Malaysian species are mainly large evergreen or semideciduous trees of rain-forests, teak-forests, swamp forests and riverine forests. Some species are littoral and most occur at low altitudes, a few reaching 1600–2000 m. A number of species have fruits which are corky or contain air-chambers adapting them for distribution by water.

Wood anat. See under the species.

There is a marked tendency in Malaysian *Terminalia spp.* towards a crown habit, described and figured by CORNER as *pagoda trees.* CORNER says (Wayside Trees of Malaya p. 30):—'Their striking shape depends not only on the spacing of the limbs on the trunk but on their own peculiar branching whereby the leaves are set together in upturned posses to form mats of foliage, there being one such mat for each tier of the crown: and, because this branching is typical of the genus of the *kĕtapang*, we have called it *Terminalia-branching.*' This is caused by sympodial growth. The pagoda habit is most conspicuous in saplings (fig. 18) and often disappears in the older trees as the branches droop at the ends and the crown is filled out. It has, however, often been mentioned in field notes as characteristic, for example in the following species: *T. archboldiana*, *T. calamansanai*, *T. hypargyrea*, *T. solomonensis*, and *T. subspathulata.*

As to bark characters only one species is remarkable, *viz T. brassii* in which the bark comes off in long, loose strips, so that the general appearance is reminiscent of some species of *Eucalyptus* and *Tristania.*

Most species possess a 'normal' leaf-size, some have large leaves, *viz T. adenopoda*, *T. catappa*, *T. darlingii*, *T. kaernbachii*, *T. zollingeri*, the largest-leaved of all being *T. copelandii* (up to 40 by 18 cm).

Most species occur in rain-forest, a few are apparently confined to semi-arid conditions, *e.g. T. crassifolia*, *T. microcarpa*, and *T. insularis.*

Deciduous species are, as far as known: *T. bellirica*, *T. calamansanai*, *T. canaliculata*, *T. catappa*, and *T. papuana.* This character is not correlated with occurrence in a monsoon climate.

CORNER (*l.c.* p. 192) says that species in the Malay Peninsula seem to be deciduous and flower after the new leaves have developed, but both the frequency with which they shed their leaves and the season differ markedly.

Uses. A considerable number of species provide useful timber. The fruits of some are edible and those of others are used for tanning and dyeing, especially the various species known collectively as Myrobalans.

Notes. The sections proposed in the genus are not entirely satisfactory and no useful purpose would be served by trying to fit the Malaysian species into them without a worldwide revision.

Apart from small differences in size and indumentum, the flowers of *Terminalia* are remarkably uniform in structure and offer few features of diagnostic value. The fruits, on the other hand are extremely variable and it is essential to use them for the making of keys. As the latter, and in the main the descriptions of the species, have perforce to be drawn up from dried material, the shapes and dimensions must necessarily be misleading to those who use the Flora with living specimens. Fleshy pericarps shrivel to a mere skin and except where information has been available from collectors' notes, the object described and measured is often merely the *endocarp* or *stone* of the fruit.

Too much attention should not be paid to the length of the lower receptacle in the descriptions for it begins to swell and to lengthen as the fertilized ovum developes. Only descriptions made from material at comparable stages of development would have diagnostic validity.

In comparing flowering and fruiting specimens and matching them up, a process not yet fully com-

pleted in this genus, it is perhaps superfluous to point out that when the lower receptacle is glabrous in the flowering stage a hairy fruit cannot result from it; but when the lower receptacle is sericeous the fruit, after swelling, will be at first appressed-pubescent. This indumentum may wear off as the fruit matures though traces of it can often be seen in furrows or near the base.

Some explanation of the 'pellucid punctuation' of the leaves is advisable. Aggregations of crystals of calcium oxalate cause minute warts usually on the upper and occasionally on the lower surface of the leaf. When held up to the light the leaf appears more or less pellucid-punctate. In very young, thin leaves these characters will not have developed; while as the leaf thickens with age they frequently disappear so that their diagnostic value is limited and their presence or absence in a description may be misleading and too much importance should not be attached to them.

A number of species, especially from Sumatra, Borneo, Celebes and New Guinea are still very insufficiently known. Sterile or imperfect material in herbaria shows that there are a number of new ones yet to be described; while several of those here enumerated may eventually be united when more collections have been made.

Finally, several species are very variable and have had to be inserted in more than one place in the key; so that when it seems uncertain which way to go it is possible to hope that either road will lead to the desired destination.

SYNOPSIS OF THE SPECIES

in an attempted natural classification

Series A.—Flowers in terminal panicles probably all ♂. Leaves with a tendency to be opposite or subopposite. Species mainly of Indo-Malaysian distribution or affinity, approaching most nearly the genus *Combretum*.

Subseries (*a*). Fruits winged.

Fruit small, 2-winged, wings broader than long . . . . . **1. T. myriocarpa**
Fruit 2-winged, wings longer than broad . . . . . **2. T. brassii**
Fruit usually 3-winged . . . . . **3. T. triptera**
Fruit usually 4-winged . . . . . **4. T. polyantha**

Subseries (*b*). Fruits not winged. 'Myrobalans'.

Fruit ellipsoid (fig. 14) . . . . . **5. T. citrina**
(Fruit unknown) . . . . . **6. T. creaghii**
The introduced species **T. chebula** also comes here.

All succeeding series have spirally arranged leaves and all except series L have flowers in axillary spikes usually ♂ towards the apex and ♀ towards the base.

Series B.—Fruit 2-winged, broader than long (*i.e.* wings extended laterally). Species of Indo-Malaysian affinity.

Fruit pubescent . . . . . **7. T. calamansanai**
Fruit glabrous . . . . . **8. T. subspathulata**

Series C.—Fruit laterally compressed usually longitudinally circumalate or circum-ridged. Mainly endemic species confined to East Malaysia.

Subseries (*a*). Leaves spathulate to obovate, coriaceous. Species from the Philippines, Celebes, and New Guinea.

9. T. kjellbergii, 10. T. surigaensis, 11. T. darlingii, 12. T. slooteniana, 13. T. supitiana, 14. T. clemensae (fig. 14), **15. T. steenisiana** (fig. 14).

Subseries (*b*). Leaves narrowly elliptic to obovate, often silvery or rufous-sericeous especially when young. Endemic New Guinea species, except *no* 19 which is widespread in the Archipelago and *no* 20 which extends to the Solomon Islands.

16. T. oreadum, 17. T. sepicana (fig. 14), **18. T. rubiginosa, 19. T. microcarpa** (fig. 14), **20. T. complanata** (fig. 14), **21. T. hypargyrea** (fig. 14), **22. T. sogerensis, 23. T. longespicata** (fig. 14, 16).

Series D.—Leaves obovate, subcordate at the base. Fruit usually compressed, circumalate or circum-ridged. Littoral species of Tropical Asia-N.Australia-Polynesia distribution . . . . **24. T. catappa**

Series E.—Leaves obovate, usually coriaceous, not subcordate at the base. Fruit relatively small, ± laterally compressed. Littoral species of Polynesian affinity.

Fruit considerably compressed, *c.* 2 cm long (fig. 14) . . . . . **25. T. samoensis**
Fruit little compressed, *c.* 1½ cm long. Leaves sparsely appressed-pubescent . **26. T. crassifolia**
Fruit little compressed, 1½–2 cm long. Leaves densely, softly pubescent at time of flowering. **27. T. insularis**

Series F.—Leaves typically broadly elliptic to suborbicular, sometimes with petioles nearly as long as the lamina. Fruit subglobose to broadly ellipsoid, little compressed, often 5-ridged, tomentellous. Species of Indo-Malaysian distribution, also known as a 'Myrobalan' (fig. 14). . . **28. T. bellirica**

Series G.—A probably heterogeneous group of species with ellipsoid (not compressed) fruits with sclerenchymatous endocarp, about 2½–7 cm long. Leaves rarely more than 25 cm long, usually not exceeding 20 cm. Species mostly endemic to Malaysia.

29. T. macadamii (fig. 14), **30. T. solomonensis**, **31. T. kangeanensis** (fig. 14), **32. T. celebica** (fig. 14), **33. T. beccarii**, **34. T. soembawana** (fig. 14), **35. T. nitens** (fig. 22), **36. T. lundquistii** (fig. 22), **37. T. plagata** (fig. 22), **38. T. pellucida** (fig. 22), **39. T. papuana** (fig. 22), **40. T. zollingeri** (fig. 24).

Series H.—Fruit subglobose or ellipsoid with a spongy, fibrous or corky pericarp. Leaves not more than 20 cm long. Sumatra, Malay Peninsula, Borneo and Philippines. Species of Indo-Malaysian affinities.

Fruit 3½–5 cm long. Leaves up to 19 cm long (fig. 22, 25) . . . . . **41. T. foetidissima**
Fruit 3½ cm in diam. subglobose. Leaves up to 7 cm long (fig. 22) . . . . . **42. T. molii**
Fruit 6–7 by 4½ cm. Leaves up to 8 cm long (fig. 22) . . . . . **43. T. phellocarpa**

Series I.—Leaves often very large, up to 40 cm long, lateral nerves often numerous and prominent. Fruit up to 17½ cm long (*T. kaernbachii*). Malaysian-Melanesian species.

Fruit 3½–6 cm long. Lateral nerves 15–40 pairs (fig. 29) . . . . . **44. T. copelandii**
Fruit up to 8–17½ cm long. Lateral nerves 10–18 pairs (fig. 29) . . . . . **45. T. kaernbachii**
(Fruit unknown, perhaps belongs here) . . . . . **46. T. adenopoda**

Series J.—Leaves manifestly canaliculate showing distinct striae on the supper surface when viewed with a lens. The affinity may be with series G . . . . . **47. T. canaliculata**

Series K.—Leaves small, obovate, coriaceous, 3–7 cm long. Fruits small, 8 by 7 mm (perhaps immature). A New Guinean species of doubtful affinity . . . . . **48. T. archboldiana**

Series L.—Flowers in pseudo-capitulae. Species endemic to New Guinea . . . . **49. T. capitulata**

Unplaced.—Known only from leaves . . . . . **50. T. oxyphylla**

KEY TO THE SPECIES

1. Leaves without linear translucent mucilage canals clearly visible on the upper surface of the leaves, though sometimes pellucid-punctate.
2. Flowers in axillary spikes or terminal panicles (not pseudo-capitulae).
3. Fruit (including wings) broader than long.
4. Fruit (including wings) usually *c.* 1 cm broad (occasionally up to 1.6 cm). Flowers in terminal panicles . . . . . **1. T. myriocarpa**
4. Fruit (including wings) at least 2 cm broad. Flowers in axillary spikes or, more rarely, in terminal panicles.
5. Fruit finely pubescent or tomentellous, especially on the body, less so on the wings **7. T. calamansanai**
5. Fruit glabrous when mature. Leaves glaucous beneath . . . . . **8. T. subspathulata**
3. Fruit orbicular or ovate in outline, or longer than broad, variously winged or ridged, or not winged, terete or flattened.
6. Upper receptacle and calyx remaining attached to the apex of the developing fruit. Leaves usually oblong, rounded at the base with 20–35 pairs of lateral nerves. Flowers in terminal and axillary panicles . . . . . **2. T. brassii**
6. Upper receptacle and calyx early deciduous.
7. Fruit 3–5-winged (not merely at the apex). Flowers in panicles.
8. Fruit 3-winged, 1½–2 cm long. Flowers 1–1½ mm in diameter . . . . . **3. T. triptera**
8. Fruit 4–5-winged (exceptionally 3-winged), 1½ cm long. Flowers 1½–2 mm in diameter. **4. T. polyantha**
7. Fruit not 3–5-winged (except occasionally at the apex only), either circumalate, with 2 wings generally confluent at the apex and usually also at the base or without wings (though sometimes ridged or angled).
9. Fruit longitudinally circumalate (sometimes not completely so at the base or apex) usually laterally compressed. Wing sometimes as narrow as 2–3 mm but clearly more than a mere ridge or angle (border-line cases will be found in both halves of the key). Two or three additional longitudinal ridges sometimes present.
10. Leaves not subcordate at the base.
11. Fruit not (or very rarely) more than 2½ cm long (up to 2.7 cm in *T. microcarpa*).
12. Fruit glabrous when mature.
13. Fruit ovate in outline . . . . . **9. T. kjellbergii**
13. Fruit suborbicular in outline, emarginate at the apex . . . . . **10. T. surigaensis**
12. Fruit pubescent.

14. Fruit suborbicular in outline, somewhat emarginate at the apex. Leaves up to 26 cm long, much narrowed at the base . . . . . **11. T. darlingii**
14. Fruit flattened ellipsoid. Leaves *c.* 12 cm long (fig. 14) . . . . **19. T. microcarpa**
11. Fruit 3 cm long or longer.
15. Fruit suborbicular or very broadly elliptic in outline.
16. Fruit not more than 3 cm long . . . . . **11. T. darlingii**
16. Fruit 7½ by 6 by 3 cm, resembling a diminutive tortoise in shape . **12. T. slooteniana**
15. Fruit elliptic or ovate in outline.
17. Mature fruit glabrous.
18. Fruit elliptic or narrowly elliptic in outline.
19. Wings of fruit 5–7 mm broad. Leaves narrowly obovate or spathulate. **13. T. supitiana**
19. Wings of fruit 1–3 mm broad, sometimes scarcely developed.
20. Fruit 3½ cm long. Receptacle sericeous. Leaves up to 10 cm long (fig. 14). **16. T. oreadum**
20. Fruit 5½–7 cm long. Leaves up to 20 cm long (fig. 14) . . . . **14. T. clemensae**
18. Fruit ovate to broadly elliptic in outline, up to 3½ cm long. Receptacle glabrous. Leaves elliptic or obovate-elliptic, usually shiny above (fig. 14) . . . . **15. T. steenisiana**
17. Mature fruit pubescent or tomentellous.
21. Leaves fulvous-pubescent on the nerves beneath (fig. 14) . . . . **17. T. sepicana**
21. Leaves rufous-tomentellous on the nerves beneath . . . . . **18. T. rubiginosa**
10. Leaves usually subcordate at the base, obovate, with a short, thick petiole; deciduous. **24. T. catappa**
9. Fruit not winged, sometimes with 2–5 longitudinal ridges.
22. Fruit laterally compressed so that, in dried specimens the longer axis of the transverse section is at least 1½ times the shorter axis. (In fresh specimens the endocarp or 'stone' should be measured.)
23. Fruit 1–2 cm long (occasional fruits reaching 2½ cm).
24. Fruit glabrous, the sclerenchymatous endocarp containing many small air-spaces. Leaves obovate or broadly obovate (fig. 14) . . . . . **25. T. samoensis**
24. Fruit pubescent or sericeous (if pubescent with traces of indumentum remaining). Leaves elliptic to obovate-elliptic.
25. Endocarp of fruit densely sclerenchymatous without air-chambers . **19. T. microcarpa**
25. Endocarp of fruit with radial plates of sclerenchyma separated by large air spaces.
26. Leaves with up to 12 pairs of lateral nerves, typically elliptic (fig. 14). **20. T. complanata**
26. Leaves with up to 16 pairs of lateral nerves, typically obovate-elliptic. **23. T. longespicata**
23. Fruits more than 2 cm long.
27. Leaves not subcordate at the base. Fruit 2–4 cm long.
28. Leaves obovate or narrowly obovate.
29. Young parts rufous-tomentose, sometimes glaucous beneath . . **41. T. foetidissima**
29. Young parts silvery or rufous-sericeous. Leaves not glaucous beneath (fig. 14). **21. T. hypargyrea**
28. Leaves oblong, elliptic or oblanceolate.
30. Leaves with up to 16 pairs of lateral nerves, rufous-tomentose, -tomentellous or -pubescent (fig. 14, 16) . . . . . **23. T. longespicata**
30. Leaves with 6–12 pairs of lateral nerves.
31. Fruit suborbicular in outline, sometimes beaked.
32. Leaves appressed-pubescent beneath. Lateral veins regularly parallel, sharply ascending and usually about 4–8 mm apart . . . . . **20. T. complanata**
32. Leaves with a dense, silky, red, silvery or golden indumentum (sometimes glabrescent when mature). Lateral nerves less regularly parallel than in the preceding species.
33. Bracts of inflorescence 2–3 mm long. Indumentum of leaves and inflorescences silvery or golden (in dried specimens). Leaves obovate to elliptic . . **21. T. hypargyrea**
33. Bracts of inflorescence 4–6 mm long. Indumentum of leaves and inflorescences golden-red to red (in dried specimens). Leaves narrowly elliptic or narrowly obovate-elliptic . . . . . **22. T. sogerensis**
31. Fruit elliptic in outline . . . . . **16. T. oreadum**
27. Leaves usually subcordate at the base. Fruit usually more than 4 cm long. **24. T. catappa**
22. Fruit terete or nearly terete in transverse section or if somewhat laterally compressed then the longer axis of the transverse section less than 1½ times the shorter axis.
34. Flowers in panicles. Leaves often opposite or subopposite.
35. Leaves coriaceous shiny, with numerous conspicuous parallel tertiary veins on lower surface. (Fruit unknown.) . . . . . **6. T. creaghii**
35. Leaves without conspicuous parallel tertiary veins on the lower surface (fig. 14). **5. T. citrina**
34. Flowers in axillary spikes.
36. Fruit not more than 5 cm long.

37. Fruit not more than 1 1/2 cm long.
38. Leaves softly and densely pubescent at time of flowering, 8–17 cm long. **27. T. insularis**
38. Leaves sparsely appressed-pubescent or glabrous.
39. Leaves 6–13 cm long. Fruit 1–1 1/2 cm long. Branchlets rather stout. **26. T. crassifolia**
39. Leaves 3–9 cm long. Fruit 1 cm long. Branchlets slender . . . **48. T. archboldiana**
37. Fruit 2–5 cm long.
40. Leaves usually subcordate at the base.
41. Lateral nerves 8–13 pairs. Inflorescences 8–20 cm long . . . . . **24. T. catappa**
41. Lateral nerves 18–30 pairs. Inflorescences often more than 30 cm long. **44. T. copelandii**
40. Leaves not subcordate at the base.
42. Fruit tomentellous. Petioles 3–6 cm long (fig. 14) . . . . . **28. T. bellirica**
42. Fruit glabrous or sparsely hairy.
43. Mature leaves fulvous or rufous-tomentose at least on the nerves below.
44. Fruit over 4 cm long. Leaves narrowly obovate or narrowly obovate-elliptic. **40. T. zollingeri**
44. Fruit 2 1/2–3 cm long. Leaves elliptic or broadly elliptic (fig. 14). **29. T. macadamii**
43. Mature leaves not tomentose beneath (except sometimes on the petioles when young).
45. Leaves elliptic or obovate-elliptic, greatest breadth usually between 1/2 and 2/3 of distance from base to apex.
46. Flowers sericeous outside.
47. Fruit subglobose 3 1/2 by 3 cm (fig. 22) . . . . . **42. R. molii**
47. Fruit ellipsoid.
48. Fruit 1 1/2–2 times as long as broad.
49. Petioles 3 1/2–5 cm long, usually with 2 glands near the centre. Fruit 3 1/2–4 cm long (New Guinea and Solomon Isl.). . . . . **30. T. solomonensis**
49. Petioles 2–3 cm long; glands obsolete or rather inconspicuous at the base of the lamina. Fruit 2 1/2–3 1/2 cm long (Java, Kangean Arch.) (fig. 14). **31. T. kangeanensis**
48. Fruit 2 1/2–3 times as long as broad, sclerenchyma of endocarp stellate in transverse section (fig. 14) . . . . . **32. T. celebica**
46. Flowers glabrous outside.
50. Petiole 2 1/2 cm long. Leaves not shiny above, up to 14 by 7 1/2 cm. (Fruit unknown; position perhaps here). . . . . **33. T. beccarii**
50. Petiole not more than 2 cm long. Leaves ± shiny above.
51. Fruit 3–3 1/2 cm long. Leaves up to 20 by 11 cm, somewhat shiny above (fig. 14). **34. T. soembawana**
51. Fruit up to 5 cm long. Leaves up to 15 by 9 cm.
52. Fruit not verrucose. Leaves very shiny above . . . . . **35. T. nitens**
52. Fruit verrucose. Leaves not very shiny above, glutinous beneath (fig. 22). **36. T. lundquistii**
45. Leaves narrowly obovate to obovate or oblanceolate, usually rounded at the apex (though often also apiculate), greatest breadth within the apical third of the leaf.
53. Flower-buds glabrous (calyx-teeth, upper receptacle and lower receptacle glabrous on the outside).
54. Leaves not minutely verruculose on the upper surface, usually intensely shiny above and drying (in the specimens seen) a dark chocolate brown (fig. 22). **35. T. nitens**
54. Leaves usually minutely verruculose on the upper surface when adult; upper surface of leaf (when dried) dull or somewhat shiny.
55. Leaves up to 20 by 11 cm. Lateral nerves 9–13 pairs. . . **34. T. soembawana**
55. Leaves rarely more than 12 cm long (occasionally up to 17 by 9 cm). Lateral nerves 5–10 pairs.
56. Petiole sericeous. Reticulation prominent on the upper surface of the leaf (fig. 22) . . . . . **37. T. plagata**
56. Petiole glabrous. Reticulation not very prominent on the upper surface of the leaf (fig. 22) . . . . . **38. T. pellucida**
53. Flower-buds hairy, especially on the lower receptacle (fig. 22, 25). **41. T. foetidissima**
36. Fruit more than 5 cm long.
57. Leaves subcordate at the base.
58. Lateral nerves 8–13 pairs. Inflorescences 8–20 cm long . . . . . **24. T. catappa**
58. Lateral nerves 18–30 pairs. Inflorescences up to 30 cm long (fig. 29) . **44. T. copelandii**
57. Leaves not subcordate at the base.
59. Mature leaves rufous-tomentose on the nerves beneath, up to 30 cm long.
60. Petiole about 5 mm long. Fruit 4 1/2–7 1/2 cm long (fig. 24) . . . . **40. T. zollingeri**
60. Petiole usually 15–30 mm long. Fruit 8–17 cm long (fig. 29) . . **45. T. kaernbachii**
59. Mature leaves nearly glabrous.

61. Leaves up to 8 cm long. Fruit 6–7 cm long; pericarp corky (fig. 22). **43. T. phellocarpa**
61. Leaves up to 17 cm long. Fruit 5–6 cm long; pericarp not corky (fig. 22). **39. T. papuana**
2. Flowers in pseudo-capitulae . . . . . **49. T. capitulata**
1. Leaves with linear translucent mucilage canals clearly visible (especially with a lens) on the upper surface . . . . . **47. T. canaliculata**

Flowers and fruits unknown (Sumatra)

Leaves nearly glabrous up to 35 by 12 cm. Lateral nerves 14–17 pairs . . . . **46. T. adenopoda**
Leaves glabrous, crowded at the ends of the branches, narrowly elliptic up to 20 by 6½ cm. **50. T. oxyphylla**

1. Terminalia myriocarpa HEURCK & MÜLL. ARG. Obs. Bot. (1870) 215; KURZ, For. Fl. Burm. 1 (1877) 457; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 448; GAGNEP. Fl. Gén. I.-C. 2 (1920) 760.— *Myrobalanus myriocarpa* KUNTZE, Rev. Gen. Pl. (1891) 237.

Large, evergreen tree. Young branchlets tomentellous sometimes rapidly glabrescent. *Leaves* subopposite, at first tomentellous or appressed-pubescent, often glabrescent when mature, oblong, oblong-elliptic or oblong-lanceolate, 8–20 by 2–8 cm, pointed at the apex, rounded or subcordate at the base; nerves up to 20–30 pairs; petiole tomentellous often glabrescent, relatively short and thick, 3–4(–7) mm, often 1 or 2 conspicuous glands (sometimes stalked) at the apex of the petiole or at the base of the lamina. *Flowers* small, sessile, numerous, ♂, protogynous, in large terminal fulvous-tomentellous panicles; bud subglobose, nearly glabrous towards the apex. *Lower receptacle* (ovary) sericeous, ¾–1 mm long; upper receptacle nearly glabrous, cupuliform, 0.8 by 0.8 mm. *Calyx*-lobes deltoid, ½ mm long. Filaments glabrous, 1½ mm; anthers ½ mm long. Disk poorly developed. Style glabrous, 2 mm. *Fruit* fulvous-sericeous, body compressed-ellipsoid or obscurely trigonal, 3–4 by 1–1½ mm, expanded laterally into 2 thin pubescent transversely oblong wings, 2–4 by 5–6 mm, with occasional rudimentary development of a third wing.

Distr. India (Sikkim, Assam), Upper Burma, China (Yunnan), Indo-China, in *Malaysia:* N. Sumatra. Fig. 10.

Ecol. Primary forests, 1000–2000 m.

Wood anat. PEARSON & BROWN, Comm. Timb. 1 (1932) 530.

Uses. The timber is said to be excellent, the wood being white and hard.

Vern. *Sĕntalon*, Gajo.

Note. GRIFFITH 407 (BM) has a printed label 'Malacca' but a specimen in Herb. VAN HEURCK, which may well be the same collection, is labelled 'Khasiya'. The species is not recorded in botanical works on the Malay Peninsula. The fruits are smaller than those of *T. paniculata* ROTH with which it can easily be confused.

2. Terminalia brassii EXELL, J. Bot. 73 (1935) 134.

Large, flange-buttressed tree, up to 50 m. Bark scaly brown. Young branchlets tomentose or nearly glabrous. *Leaves* alternate or sometimes subopposite, subcoriaceous, varying from tomentose to nearly glabrous, narrowly oblong, narrowly oblong-elliptic, oblong-elliptic or elliptic 5–9 by 3–6 cm, usually gradually narrowed and pointed at the apex (sometimes rounded) rounded or subcordate at the base; nerves 20–35 pairs; petiole tomentose-pubescent or glabrous 5–10 mm, with 2 conspicuous, glabrous suborbicular glands at or near the apex. *Flowers* pale green sessile in terminal and axillary panicles 8–13 cm long; rhachis tomentose. *Lower receptacle* (ovary) tomentose 1½–2 mm long elongating to 5–8 mm before the wings develop; upper receptacle cupuliform 1 by 1–2 mm, persistent; *calyx*-lobes scarcely developed. Filaments 2½–3½ mm; anthers 0.3 mm long. Disk rather fleshy, pilosulose. Style glabrous, 2½ mm. *Fruit* pubescent suborbicular, obovate or ovate in outline, 1–1½ by 0.8–1.3 cm, with 2 well-developed thin flexible wings and 3 rudimentary ones, crowned at the apex by the remains of the persistent calyx.

Distr. Solomon Islands (Ysabel, San Christobal, Bougainville) and New Britain. Fig. 10.

Ecol. A large tree of lowland and riverine rain-forest.

Uses. The sapwood is pale brownish-yellow, porous, straight-grained, somewhat stringy and of medium weight (according to E. P. HOLMES). It is probably not in commercial use.

Notes. The bark comes off in long, loose strips so that the general appearance is reminiscent of some species of *Eucalyptus* or *Tristania*. Young trees often send out stiff, horizontal adventitious roots high above the ground.

3. Terminalia triptera STAPF, Kew Bull. (1895) 103; RIDL. Fl. Mal. Pen. 1 (1922) 706; CRAIB, Fl. Siam. En. 1 (1931) 608.

Small tree, 3–10 m. Young branchlets sometimes pubescent at first, soon becoming glabrous. *Leaves* alternate or subopposite, chartaceous or papyraceous sparsely pubescent beneath or glabrous, rather obscurely minutely verruculose on the upper surface and obscurely pellucid-punctate, ovate, ovate-elliptic, elliptic or obovate, usually slightly acuminate, acute or blunt at the apex, rounded or cuneate at the base, 3–8 by 1½–3½ cm; petiole pubescent often glabrescent, slender, 5–10 mm. *Flowers* cream, protogynous, apparently all ♂, in terminal and axillary panicles 2½–4 cm long; rhachides densely pubescent. Bracts pubescent, filiform, 1 mm. *Lower receptacle* (ovary) glabrous, 0.8 mm long, upper receptacle shallowly cupuliform glabrous, ½ by 1 mm, with broadly ovate *calyx*-lobes *c.* 0.6 mm long. Filaments glabrous, 3 mm; anthers 0.3 mm long. Disk densely pilose. Style glabrous, 2½ mm. *Fruits* 3-winged, 10–20 by

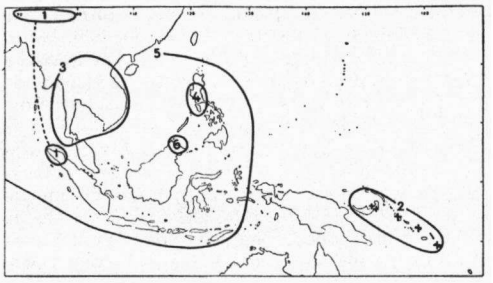

Fig. 10. Distribution of *Terminalia* series A: 1. *myriocarpa*, 2. *brassii* (localities indicated) 3. *triptera*, 4. *polyantha*, 5. *citrina*, 6. *creaghii*.

6–12 mm, glabrous or nearly glabrous, often somewhat oblique.

Distr. Siam, Indo-China, in *Malaysia:* NW. Malay Peninsula (N. Kedah: Langkawi Islands and Alor Star). Fig. 10.

Ecol. A small tree common on limestone in the Langkawi Islands, also on quartzite and shale, up to 100 m.

Vern. *Tan, tau, titau.*

Notes. This species is closely related to *T. polyantha* PRESL. The fruits of the latter are usually 4–5-winged but one specimen (SULIT PNH 7444 from Luzon) has all the fruits 3-winged and approaches *T. triptera* very closely. The differences between the two species as far as can be ascertained from the material available are:

T. polyantha:—Fruit usually 4-winged, rarely 2-winged, 3-winged or 5-winged, 0.8–1½ cm long, symmetrical. Flowers 1½–2 mm in diam.

T. triptera:—Fruits always 3-winged, 1–2 cm long, usually somewhat asymmetrical. Flowers 1.3–1½ mm in diam.

T. obliqua CRAIB from Siam is also closely related and scarcely specifically distinct from *T. triptera.*

4. Terminalia polyantha PRESL, Abh. Kön. Böhm. Ges. Wiss. V, 6 (1851) 574; MERR. Philip. J. Sc. C. Bot. 4 (1909) 646; En. Philip. 3 (1923) 152.—*Gnidia oppositifolia* BLANCO, Fl. Filip. (1837) 299, *non* LINNÉ (1753).—*T. parviflora* PRESL, *l.c.*; GAGNEP. Fl. Gén. I.-C. 2 (1920) 754.—*Gnidia? philippinensis* MEISN. in DC. Prod. 14 (1857) 592.—*T. montalbanica* ELM. *ex* MERR. En. Philip. 3 (1923) 153, *nom. nud.*

Small tree. Young branchlets slender, at first pubescent, soon glabrescent. *Leaves* alternate or subopposite, chartaceous or papyraceous, sometimes tomentose when very young, usually sparsely pubescent or glabrous, sometimes tomentose on the midrib and principal nerves beneath, minutely verruculose above, rather obscurely pellucid-punctate, ovate, ovate-elliptic, elliptic or suborbicular, 3–8 by 1½–5 cm, usually somewhat acuminate and acute at the apex, cuneate to rounded at the base; nerves 6–8 pairs; petiole tomentose or pubescent, 5–10 mm. *Flowers* sessile, probably all ♂, in terminal and axillary panicles 3–10 cm long; rhachides densely patent or appressed pubescent. Bracts minute, caducous. *Lower receptacle* (ovary) viscid, glabrous, 1–2 mm long; upper receptacle cupuliform glabrous or nearly glabrous outside, pubescent inside, 1–1½ by 1½–2 mm. *Calyx*-lobes very short, pubescent on the margins. Filaments glabrous 3 mm; anthers 0.4–0.5 mm long. Disk pilose. Style glabrous, 3 mm. *Fruit* usually glabrous, generally 4-winged (rarely 2-, 3- or 5-winged), elliptical or suborbicular in outline, 8–15 by 7–12 mm (incl. wings).

Distr. Indo-China, in *Malaysia:* Philippines (Luzon, Mindoro). Fig. 10.

Ecol. A small tree of dry thickets and secondary forests at low and medium altitudes.

Wood anat. REYES, Commonw. Philip. Dept Agr. Techn. Bull. 7 (1938) 367. Brief comments.

Uses. Wood employed for general house construction and for parts protected from the weather. Relatively rare (REYES l.c.).

Vern. *Anagap*, Tag., Sbl., *bangles*, Ilk.

Notes. *T. montalbanica* was a manuscript name distributed with ELMER 17420 from Montalban, Luzon. It has rather larger flowers than typical *T. polyantha* and a pubescent upper receptacle. There is only the single gathering cited.

5. Terminalia citrina (GAERTN.) ROXB. *ex* FLEM. in As. Res. 11 (1810) 183; KURZ, For. Fl. Burm. 1 (1877) 456; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 446; KING, J. As. Soc. Beng. 66, 2 (1897) 328; RIDL. Fl. Mal. Pen. 1 (1922) 704; CRAIB, Fl. Siam. En. 1 (1931) 602; BURK. Dict. (1935) 2140.—*Myrobalanus citrina* GAERTN. Fruct. 2 (1791) 91, t. 97, fig. n–s.—*T. chebula* (*non* RETZ.) BL. Bijdr. (1825) 643.—*Bucida comintana* BLANCO, Fl. Filip. (1837) 856.— *T. chebula* (*non* WILLD.) MIQ. Fl. Ind. Bat. 1, 1 (1855) 601; FERN.-VILL. Novis. App. (1880) 80.—*Embryogonia arborea* T. & B. in MIQ. J. Bot. Néerl. 1 (1861) 365; MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1868–69) 115.—*Combretum arboreum* MIQ. *l.c.*—*T. citrina var. malayana* CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 447; KING, J. As. Soc. Beng. 66, 2 (1897) 447; RIDL. Fl. Mal. Pen. 1 (1922) 704.—*T. teysmannii* K. & V. Bijdr. Booms. 9 (1903) 20.—*T. arborea* K. & V. Bijdr. Booms. 9 (1903) 22; BACK. Schoolfl. Jav. (1911) 488; KOORD. Atl. Baumart. Jav. (1913) 72; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 24; HEYNE, Nutt. Pl. N.I. (1927) 1174; BURK. Dict. (1935) 2135; MEEUSE in BACK. Fl. Jav. em. ed. 4, fam. 101 (1944) 7.—*T. multiflora* MERR. Govt Lab. Publ. Philip. 27 (1904) 34.—*T. comintana* MERR. Philip. J. Sc. C. Bot. 4 (1909) 300; En. Born. (1921) 423: En. Philip. 3 (1923) 150; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 26.—*T. curtisii* RIDL. Kew Bull. (1931) 449.—**Fig. 14.**

Tree 20–30 m by about 70 cm. Young branchlets rufous-pubescent or rufous-villous (especially in seedlings), glabrescent or retaining their indumentum for a considerable time. *Leaves* papyraceous or chartaceous, opposite, subopposite or alternate, rufous-sericeous or rufous-pubescent to almost glabrous, sometimes pellucid-punctate, elliptic, narrowly elliptic or oblong-elliptic, 3–14 by 1.8–

6½ cm, usually acutely acuminate at the apex and rounded or broadly cuneate at the base; nerves 9–12 pairs usually rather closely spaced; domatia absent or inconspicuous; petiole appressed-pubescent or glabrous, 5–20 mm, 2 glands often present at or near the apex. *Flowers* sessile, yellow, all ♀, in terminal panicles; rhachides rufous-tomentose or pubescent. Bracts filiform, 2 mm long, very caducous. *Lower receptacle* (ovary) 1–1½ mm long, sericeous or shiny and almost glabrous; upper receptacle shallow-cupuliform, ½ by 2 mm, nearly glabrous. Filaments glabrous, 2½–3 mm; anthers 0.3 mm long. Disk barbate. Style glabrous 1½–2½ mm long. *Fruit* ellipsoid to subglobose, 5-angled, glabrous, 20–30 by 8–20 mm (when dried), endocarp shaped like a 5-pointed star in cross-section.

Distr. India, Burma, Indo-China, Siam throughout *Malaysia*, New Guinea possibly excepted. Fig. 10.

Ecol. Forests at low and medium altitudes, in the Malay Peninsula and the Philippines often along the seashore, often planted inland.

Wood anat. (*T. teysmannii* K. & Val.) MOLL & JANSSONIUS, Mikr. Holzes 3 (1914) 377; [*T. comintana* (Blanco) Merr.] REYES, Commonw. Philip. Dept Agr. Techn. Bull. 7 (1938) 369.

Uses. The wood is used for door-posts, beams and planks, boats and masts. In Indo-China beautiful furniture is said to be made from it. Tannin is extracted from the fruits and the bark gives a blue dye. The fruits are similar to and often mistaken for the commercial myrobalans (*T. chebula* RETZ.).

Vern. Malay Peninsula: *Antoi, antoi puteh, bĕlang rimau, bĕlawan, kayu rajah, galumit, blabah*, J, *djèrèt, tèngèh tjaäh*, S, *mĕrtaki, pĕlawai, rĕntaki*, Palemb.; Philippines: *apunga, bangias, hinabuad, hinabuan, hinabusi, laknab, maghubo, nanghubo, paghubo, palanag, rubian, saplungan*, Tag., *agaru, magtalopoi*, Pang., *bangles, lasilak*, Ilk., *bingas*, Sbl., *bongas, bungas*, S.L.Bis., *bunglas*, P. Bis., *bungras*, Bik., *lasila, lasilak, lasilan, lasilat*, Ibn., *luno-luno*, Bag., *lununu*, C.Bis., *malatagum*, Sulu, *maupat*, Tagb., *tangisan*, Pamp., *yunu-yunu*, Mbo.

Notes. I have treated this as a widespread variable species for there are numerous intermediates between the small-leaved, small-fruited Philippine specimens ('*T. comintana*') and the large-leaved, larger-fruited specimens from Sikkim and Bengal.

BRASS & VERSTEEGH 14019 (A, BM), a sterile specimen from Bernhard Camp (Idenburg River in Netherlands New Guinea) may be this species. Otherwise there is no record from New Guinea.

This is a very *Combretum*-like species of *Terminalia* and if the records from the Malay Peninsula (BURK. *l.c.* 2140–2141) are correct it is sometimes a sprawler or semi-climber.

6. Terminalia creaghii RIDL. Kew Bull. (1934) 493.

Tree or (?) climber. Young branchlets minutely, densely pubescent and viscid. *Leaves* subcoriaceous opposite and decussate, shining, glabrous, narrowly elliptic or elliptic-oblong, 6–14 by 2½–6 cm, acuminate at the apex, cuneate or somewhat rounded at the base; nerves 5–8 pairs; domatia absent or inconspicuous; numerous conspicuous parallel tertiary veins on the lower surface; petiole glabrous, viscid, 6–8 mm. *Flowers* sessile in terminal panicles, rhachides pubescent. Bracts pubescent, 1½ mm long. *Lower receptacle* (ovary) glabrous, viscid 1½ mm long; upper receptacle cupuliform 1½ by 3½ mm, glabrous. *Calyx*-lobes scarcely developed. Stamens 10–12; filaments glabrous, 3–4 mm; anthers 0.8 mm long. Disk pilose. Style glabrous, 5 mm. *Fruit* unknown.

Distr. *Malaysia:* NE. Borneo. Fig. 10.

Note. This species, described from a single collection made by Governor Creagh in British North Borneo, is a puzzle. In general appearance the plant is more like a *Combretum* than a *Terminalia* but I cannot identify it with any known species of the former genus. There are certainly no petals but the flowers are abnormal (several have an extra number of stamens) and appear to have suffered from an insect attack. The leaves seem to be truly opposite as in *Combretum*. The ovary is quite inferior, 1-locular with usually 4 pendulous ovules so there is little doubt that the species is at least in the right family. Discovery of the fruit would show whether it is a true *Terminalia*, perhaps near *T. citrina* or an apetalous *Combretum*, near *C. acuminatum* or *C. borneense*. The absence of any trace of scales inclines me to think that the balance of evidence is for *Terminalia*.

7. Terminalia calamansanai (BLANCO) ROLFE, J. Linn. Soc. Bot. 21 (1884) 310; MERR. Philip. J. Sc. C. Bot. 4 (1909) 646; En. Philip. 3 (1923) 149.—*Gimbernatea calamansanai* BLANCO, Fl. Filip. ed. 2 (1845) 266.—*Pentaptera pyrifolia* PRESL, Abh. Kön. Böhm. Ges. Wiss. 6 (1851) 575.—*T. pyrifolia* KURZ, Prelim. Rep. For. Veg. Pegu App. A (1875) 59; For. Fl. Burm. 1 (1877) 457; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 448; CRAIB, Fl. Siam. En. 1 (1931) 607; CORNER, Wayside Trees (1940) 194, t. 46.—*T. papilio* HANCE, J. Bot 15 (1877) 333.—*T. bialata* (*non* KURZ) FERN.-VILL. Novis. App. Fl. Philip. (1880) 80 *pro parte quoad syn. cit.* '*Gimbernatia Calamansanay*'.—*Myrobalanus pyrifolia* KUNTZE, Rev. Gen. Pl. (1891) 237.—*T. bialata* (*non* STEUD.) KING, J. As. Soc. Beng. 66, 2 (1897) 332; RIDL. Fl. Mal. Pen. 1 (1922) 705; BURK. Dict. (1935) 2137.— *T. mollis* MERR. Govt Lab. Publ. (Philip.) 17 (1904) 34 *non T. mollis* LAWS. (1871) *nec* ROLFE (1885).—*T. blancoi* MERR. Philip. J. Sc. C. Bot. 4 (1909) 645.—*T. calamansanai var. acuminata* MERR. *tom. cit.* (1909) 646 *et var. platypteris* MERR. *l.c.*—*T. latialata* C. T. WHITE, J. Arn. Arb. 10 (1929) 249.—**Fig. 11.**

A medium-sized or large, deciduous tree, 8–30 m or more. Young branchlets tomentellous, appressed-pubescent or nearly glabrous. *Leaves* spirally arranged and somewhat crowded towards the ends of the twigs, subcoriaceous or chartaceous, usually subtomentose or pubescent, especially on the lower surface when young, frequently becoming glabrous when mature but often retain-

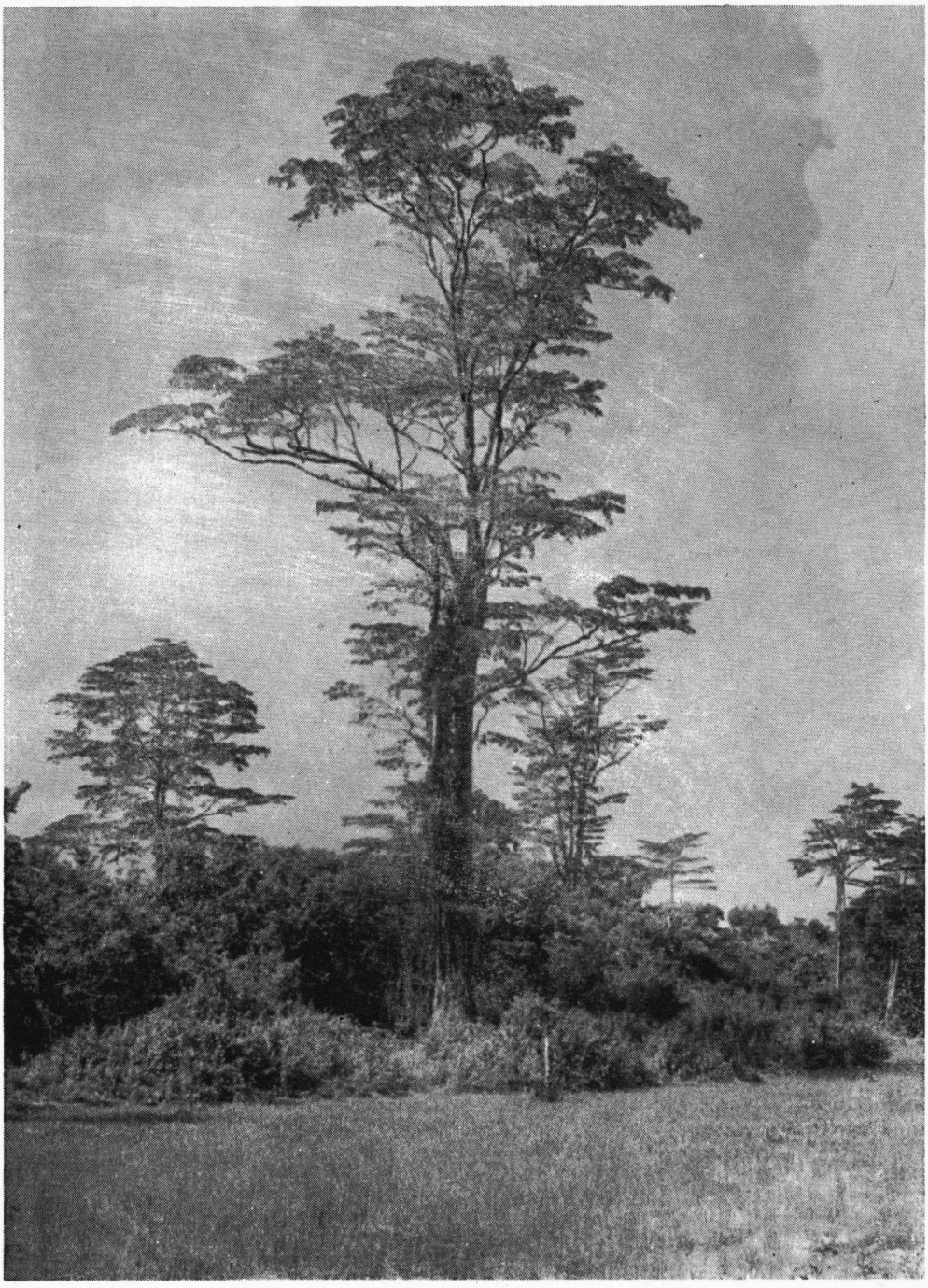

Fig. 11. *Terminalia calamansanai* (BLANCO) ROLFE. Six trees by the road from Kodiang to Changlun, Kedah (CORNER). *Courtesy Government Printer Singapore.*

ing some pubescence beneath, usually somewhat shiny above, narrowly to broadly elliptic or occasionally obovate, 9–20 by 3–9 cm, usually acuminate rarely rounded at the apex, cuneate at the base, usually minutely verruculose on both surfaces, sometimes manifestly pellucid-punctate but usually only very obscurely so; nerves 4–7 pairs, rather widely spaced, reticulation clearly visible and sometimes rather prominent below; petiole tomentose, appressed-pubescent or glabrous, 1–4 cm, often with 2 glands varying in position from the middle to near the apex. *Flowers* cream or greenish-yellow, buds globular, protogynous, sessile in axillary spikes 6–20 cm long; rhachis tomentose or tomentellous. Bracts 1½–2 mm long, soon deciduous. *Lower receptacle* (ovary) 1–2 mm long, tomentose or sericeous; upper receptacle shallow-cupuliform 1 by 2½ mm, sericeous. *Calyx*-lobes deltoid, 1 mm long, tomentose outside and rather less densely so within. Filaments glabrous, 2–2½ mm; anthers ½ mm long. Disk, barbate. Style glabrous, 1½ mm. *Fruit* with 2 broad wings, very variable in size and shape, overall dimensions 1–3 by 2–10 cm, fruit-body trigonal, pubescent, velutinous or tomentose, wings pubescent 1–2 by 2–4 cm.

Distr. Burma, Indo-China, Siam, in *Malaysia:* N. Malay Peninsula (from Alor Star northwards and in Langkawi Islands), Borneo? (sterile material only), Philippines, SW. Celebes (Pangkadjene), and New Guinea (Papua). Fig. 12.

Ecol. A medium-sized tree (described as a tall tree in Papua) shedding its leaves towards the end of the year and growing on limestone cliffs (Langkawi Isl.), in lowland forest and by roads and ricefields in Kedah and Perlis where it is one of the commonest trees. *Fl.* Aug.–Dec. in the rainy season, *fr.* Dec.–April during the dry season, easily recognizable from its rather small-leaved, flat-topped crown, sparsely decked with the bright yellow withered leaves (CORNER, *l.c.*). In the Philippines it is also abundant in primary forests. Apparently a species confined to areas subject to a dry season.

Wood anat. (*T. pyrifolia* KURZ) PEARSON & BROWN, Comm. Timb. 1 (1932) 528; REYES, Commonw. Philip. Dept Agr. Techn. Bull. 7 (1938) 367.

Uses. The wood is employed for foundation piles; seldom sawn into lumber or used for construction as it is not durable (REYES *l.c.*).

Vern. Malay Peninsula: *Mĕntalun batu, mĕdang mĕrapoh, batalong,* M.; Philippines: *kalamansanai* (Tag. standard), *anarep, bagabo pangalusiten, saket,* Ilk., *bangkalauan, bunlos malakalumpit, sakat, kalamansakat, subo-subo,* Tag., *bangkalauag,* Bis., *bisal, busili,* Pang., *burauis,* Kuy., *dikang,* Pamp., *kabangasbangas,* Bag., *kalamansali,* Sbl., *langkog, yankug,* Mbo., *langtug, lumanog saplid,* C. Bis., *magtalisai,* P Bis., *saget,* Ig., *salisai,* Lan.

Notes. The Asiatic Terminalias with two laterally extended wings to the fruit have caused no little difficulty in classification, as will be seen from the complicated synonymy. I found no clear-cut distinctions in the shape of the fruit and decided finally to recognize only two Malaysian species: a 'northern' species (*T. calamansanai*) with pubescent fruits, extending from Burma and Indo-China down to the North of the Malay Peninsula and through the more northerly islands as far as Papua; and a 'southern' species (*T. subspathulata*) with glabrous fruits and glaucous leaves extending from the Malay Peninsula to Sumatra, Java and Borneo. Both species may occur in Borneo.

8. Terminalia subspathulata KING, J. As. Soc. Beng. 66, 2 (1897) 332; RIDL. Fl. Mal. Pen. 1 (1922) 705; BURK. Dict. (1935) 2141; CORNER, Wayside Trees (1940) 195, fig. 50.—*T. bialata* (*non* KURZ) K. & V. Bijdr. Booms. 9 (1903) 28; KOORD. Atl. Baumart. 1 (1913) t. 73; BACK. Schoolfl. Java (1911) 490; KOORD. Exk. Fl. 2 (1912) 671 (*err.* '*alata*'); MEEUSE in BACK. Fl. Jav. (em. ed.) 4, fam. 101 (1944) 8.

A large tree up to 45 m, with tall spreading branches. Young branchlets at first rufous-appressed-pubescent soon becoming glabrous. *Leaves* spirally arranged and somewhat crowded towards the ends of the twigs, coriaceous or subcoriaceous, glossy green above, glaucous underneath, glabrous, oblanceolate or subspathulate, 4–14 by 1½–5 cm, rounded and shortly acuminate, acute or obtuse at the apex, narrowly cuneate at the base; nerves 8–10 pairs, reticulation rather prominent; petiole glabrous 2–3½ (–5) cm, glands absent or inconspicuous. *Flowers* greenish or yellow, buds globular, sessile, in axillary spikes 6–20 cm long, rhachis densely rufous-appressed-pubescent. Bracts absent or very early caducous. *Lower receptacle* (ovary) 2 mm long, rufo-sericeous; upper receptacle shallow-cupuliform, sericeous, 1 by 2 mm. *Calyx*-lobes deltoid 0.8 mm long, densely appressed-pubescent. Filaments glabrous, 2½ mm; anthers 0.4 mm long. Disk barbate. Style 3 mm, pilosulose. *Fruit* broadly 2-winged, light yellow, pubescent when very young but soon becoming glabrous, overall dimensions 2–3.3 by 3½–5½ cm, wings usually confluent at apex and base so that the fruit is circumalate.

Distr. *Malaysia:* Sumatra, Malay Peninsula

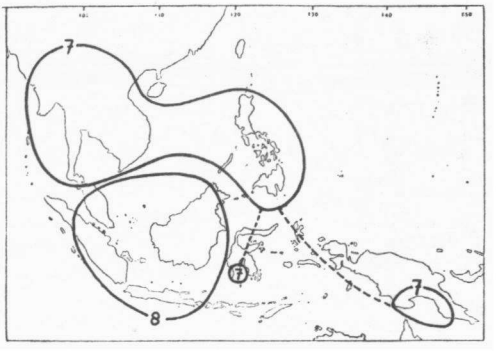

Fig. 12 Distribution of *Terminalia* series B: 7. *calamansanai*, 8. *subspathulata*.

(scarce, from Perak southward), Java, and Borneo (Balikpapan, Pleihari, Sarawak). Fig. 12.

Ecol. Up to 1350 m in Java.

Wood anat. (*T. bialata*) MOLL & JANSSONIUS, Mikr. Holzes 3 (1914) 377.

Uses. Quality of timber unknown.

Vern. *Jĕlawai, pĕlawei, mĕdang salak*, Mal. Pen.

9. Terminalia kjellbergii EXELL, Blumea 7 (1953) 322.

Tree, 15 m. Young branchlets rather thick, 4–5-angled near the apex, at first fulvous-sericeous-tomentose but very soon becoming glabrous, growth sympodial. *Leaves* coriaceous, spirally crowded at the ends of the branchlets, sparsely sericeous-pilose when young, soon becoming shiny and glabrous, minutely verruculose above, narrowly obovate-spathulate, obovate-elliptic or narrowly elliptic, 5–20 by 2–7½ cm rounded or obtuse at the apex, rounded or subcordate and 2-glandular at the base; nerves 11–12 pairs; petiole thick, 3–5 mm, at first fulvous-tomentose soon glabrescent. *Flowers* sessile in axillary spikes up to 17 cm long; rhachis rather stout, minutely appressed-pubescent or almost glabrous. Bracts filiform, 1½ mm long. *Lower receptacle* (ovary) fulvo-sericeous 3½–4 mm long; upper receptacle cupuliform, 3–3½ by 5–5½ mm, outside viscid almost glabrous, inside sericeous-pilose with glabrous ovate-acuminate *calyx*-lobes about 3 mm long. Filaments glabrous 12–13 mm; anthers 1 mm long. Disk almost glabrous. Style glabrous, 11 mm. *Fruit* ovate in outline, glabrous, 2½ by 1.7 cm, 2-winged, wings 5 mm broad.

Distr. *Malaysia:* Central Celebes (Malili, Towuti Lake).

Ecol. Medium-sized tree in swamps, 300–400 m.

10. Terminalia surigaensis MERR. Philip. J. Sc. 17 (1921) 295; En. Philip. 3 (1923) 153.

Tree. Young branchlets very thick, at first sparsely appressed-pubescent soon glabrous. *Leaves* subcoriaceous, spirally arranged, crowded at the end of the branchlets, glabrous, narrowly spathulate or narrowly obovate-elliptic, 10–13 by 3½–4½ cm, rounded at the apex, cuneate at the base, somewhat shiny above; petiole 5–7 mm, with 2 conspicuous glands at or near the apex. *Flowers* sessile in axillary spikes about 10 cm long; rhachis glabrous. Bracts (not seen) caducous. *Lower receptacle* (ovary) 4–5 mm long, glabrous; upper receptacle cupuliform glabrous 3–4 by 4–6 mm. *Calyx*-lobes glabrous, deltoid, 2 mm long. Filaments glabrous, 10–12 mm long; anthers 0.8 mm long. Disk glabrous or nearly glabrous. Style glabrous, 11–12 mm. *Fruit* glabrous, suborbicular in outline, 1.6–2 cm in diameter, circumalate, usually emarginate at the base and apex.

Distr. *Malaysia:* Philippines (Mindanao).

Ecol. Along streams at low altitudes.

11. Terminalia darlingii MERR. Philip. J. Sc. C. Bot. 5 (1910) 202; En. Philip 3 (1923) 151.

Tree. Young branchlets very thick, sparsely pubescent or glabrous. *Leaves* subcoriaceous or chartaceous, spirally arranged in dense clusters at the ends of the branchlets, subsessile or shortly petiolate, shining, glabrous or appressed-pubescent mainly on the midrib and principal veins and sometimes on the lamina, minutely verruculose above, obscurely pellucid-punctate, spathulate, 15–26 by 6–9½ cm, rounded at the apex, narrowly cuneate at the base and decurrent into the short thick petiole; petiole 5–7 mm, or sometimes scarcely developed, with two large subopposite glands at the apex or at the base of the lamina. *Flowers* large for the genus in axillary spikes *c.* 12 cm long; rhachis appressed-pubescent. Bracts narrowly elliptic, 10–15 mm long, fulvo-sericeous, persistent. *Lower receptacle* (ovary) *c.* 2 mm long, fulvo-sericeous; upper receptacle cupuliform, about 5 by 7 mm, nearly glabrous. *Calyx*-lobes deltoid about 2 mm long. Filaments glabrous, 15 mm; anthers 0.3–0.4 mm long. Disk sparsely pilose or nearly glabrous. Style 17 mm, glabrous. *Fruit* circumalate suborbicular or broadly obovate in outline, 1.7–3 by 1.7–2½ cm, tomentellous or appressed-pubescent.

Distr. *Malaysia:* Philippines (Luzon, Samar). Fig. 13.

Ecol. Primary forests at low altitudes.

Wood anat. REYES, Commonw. Philip. Dept Agr. Techn. Bull. 7 (1938) 367. Brief comments.

Uses. The wood is used for house posts, beams, joists, and general framing work. Not plentiful (REYES *l.c.*).

Vern. *Pagat-págat*, Neg.

Note. This differs from *T. surigaensis* in the fulvo-sericeous lower receptacle (ovary), rhachis and fruit.

12. Terminalia slooteniana EXELL, Blumea 7 (1953) 323.

Tree, 25 m. Young branchlets thick, glabrous, sympodial. *Leaves* coriaceous spirally arranged and crowded at the ends of the branchlets, glabrous, shiny above, minutely verruculose above and below, spathulate, oblanceolate or narrowly obovate-elliptic, 10–20 by 4–8 cm, rounded at the apex, narrowly cuneate at the base and decurrent into the petiole; nerves 9–12 pairs; petiole glabrous, 1–2 cm, with two glands (sometimes inconspicu-

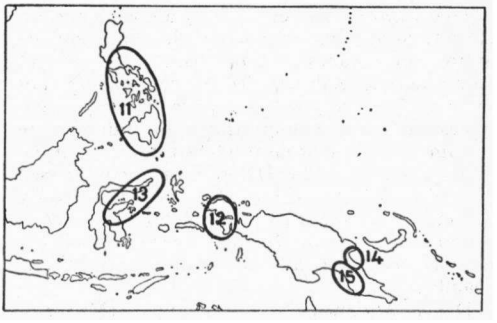

Fig. 13. Distribution of *Terminalia* series C(a): 11. *darlingii*, 12. *slooteniana*, 13. *supitiana*, 14. *clemensae*, 15. *steenisiana*.

ous) at or near the apex. *Flowers* not known. *Fruit* glabrous, suborbicular to broadly elliptic in outline, 7½ by 6 by *c.* 3 cm, circumalate with a stiff narrow wing 2–4 mm broad, closely resembling a small tortoise in shape.

Distr. *Malaysia:* West New Guinea (Rauna and Fakfak). Fig. 13.

Ecol. Large tree in primary forest at low altitudes.

Vern. *Gufasa catu, sawar.*

Notes. Named after Dr D. F. VAN SLOOTEN, who first recognized it as new, and in commemoration of his excellent work on the *Combretaceae* of the East Indies.

13. Terminalia supitiana KOORD. Minah. (1898) 454, 623; Fl. N.O. Celebes Suppl. 2 (1922) f. 99; Suppl. 3 (1922) 48; SLOOT. Bijdr. Combret. (1919) 23; Bull. Jard. Bot. Btzg III, 6 (1924) 39.

Large tree 20–50 m. Young branchlets sympodial, glabrous or nearly glabrous. *Leaves* subcoriaceous, spirally arranged and rather crowded at the ends of the branchlets, glabrous or sparsely minutely appressed-pubescent, rather inconspicuously minutely verruculose above, narrowly elliptic, 3–15 by 1.2–5 cm, blunt or pointed at the apex, cuneate at the base and decurrent into the petiole, nerves 9–11 pairs; petiole 5–10 mm, glabrous, with 2 glands (sometimes inconspicuous) near the apex. *Flowers* white, sessile, in short axillary spikes, 3–5 cm long; rhachis glabrous. Bracts filiform, 1 mm. *Lower receptacle* (ovary) glabrous, 5 mm long, narrowed at base and apex; upper receptacle shallow-cupuliform, glabrous, 1 by 2 mm. *Calyx*-lobes glabrous, broadly ovate, 1 mm long. Filaments glabrous, 2½–3 mm; anthers ½ mm long. Disk densely pilose. Style glabrous, 2 mm. *Fruit* glabrous, elliptical in outline 4–5½ by 2–2½ cm, 2-winged, wings confluent at base and apex (circumalate), 7–10 mm broad.

Distr. *Malaysia:* North and Central Celebes (Menado and Malili). Fig. 13.

Ecol. Primary forests, 0–500 m.

Vern. *Anjurung, kanjuruang cata, tĕluse.*

14. Terminalia clemensae EXELL, Blumea 7 (1953) 324.—**Fig. 14.**

Tree. *Leaves* coriaceous, shiny above, glabrous, elliptic, 20 by 8 cm, rounded or shortly acuminate at the apex, cuneate at the base; nerves 12–14 pairs; petiole glabrous, 1½–2 cm. *Flowers* not known. *Fruit* very woody, probably appressed-pubescent when young (traces of indumentum remain) almost glabrous or glabrous when mature, compressed ovoid-ellipsoid or compressed ellipsoid, 6–7 by 3–4 by 1½–1.8 cm, narrowly circumalate, wing rigid, 4 mm broad, showing in cross-section an irregular mass of sclerenchyma enclosing a few small scattered air-chambers.

Distr. *Malaysia:* NE. New Guinea (Morobe). Fig. 13.

Ecol. In forests, 650–950 m.

Note. Nothing more is known of this species, which was collected from a fallen branch. Judging from the fruits it appears to be a very distinct species.

15. Terminalia steenisiana EXELL, Blumea 7 (1953) 327.—*T. cf. 'foveolata'* EXELL, Brittonia 2 (1936) 138.—**Fig. 14.**

Tree 10–15 m. Bark grey-brown. Wood hard, brown. Young branchlets at first appressed-rufo-pubescent, soon becoming glabrous, sympodial in growth. *Leaves* subcoriaceous, crowded at the slightly thickened apices of the branchlets, shiny and glabrous above, only very obscurely verruculose, opaque, elliptic, obovate-elliptic, obovate or oblanceolate, 8–13 by 2½–6 cm, rounded, obtuse or shortly acuminate at the apex, cuneate at the base; nerves 6–10 pairs, domatia rather inconspicuous, occasionally with a few hairs; petiole glabrous in mature leaves, 1–2 cm. *Flowers* white, in axillary spikes 6–8 cm long; rhachis glabrous when mature. Bracts filiform, 1 mm, glabrous, early caducous. *Lower receptacle* (ovary) glabrous, 2½ mm long; upper receptacle glabrous shallow-cupuliform, 1 by 3 mm. *Calyx*-lobes deltoid, 1½ mm long. Filaments glabrous, 2½ mm; anthers ½ mm long. Disk densely pilose. *Fruit* red when ripe, glabrous, when dried compressed-ellipsoid, 2½–3½ by 1½–2.6 by 0.8–1.2 cm, longitudinally circumalate with a rigid wing 2–3 mm broad, sometimes with 2–3 additional longitudinal ridges, sometimes flat on one face and convex on the other, showing in cross-section a rather thick, irregularly elliptical band of sclerenchymatous tissue and little or no alveolar tissue.

Distr. *Malaysia:* New Guinea (Papua: Nakeo District and Kanosia). Fig. 13.

Ecol. A common tree in lowland rain-forest.

Note. The fruit is said to be fleshy when ripe.

16. Terminalia oreadum DIELS, Bot. Jahrb. 57 (1922) 429.—**Fig. 14.**

Large tree, up to 40–50 m, buttressed to 2 m. Bark pale brown, wood pale yellow. Young branchlets fulvous-sericeous, later glabrescent. *Leaves* subcoriaceous, spirally arranged along the branchlets, minutely appressed-pubescent, later glabrescent, broadly to narrowly elliptic, 3–9 by 1–4 cm, slightly acuminate or blunt at the apex, cuneate at the base; nerves 5–8 pairs with glabrous domatia in their axils; petiole at first appressed-pubescent eventually glabrescent, 5–12 mm. *Flowers* (only immature ones seen) sessile, ellipsoid in bud, in axillary spikes *c.* 5 cm long; rhachis fulvous-sericeous. Bracts hairy, filiform, 2½ mm, soon caducous. *Lower receptacle* (ovary) 1½ mm long, fulvous-sericeous, upper receptacle fulvo-sericeous, cupuliform, 1 by 1½ mm. *Calyx*-lobes triangular, *c.* 1 mm long. *Fruit* very sclerenchymatous, with a few scattered air-spaces, sericeous when young, glabrescent, flattened-ellipsoid, 3½ by 1½-2 cm, narrowly circumalate, wing *c.* 1 mm broad, sometimes with 2 additional ridges near the apex.

Distr. *Malaysia:* East New Guinea. Fig. 15.

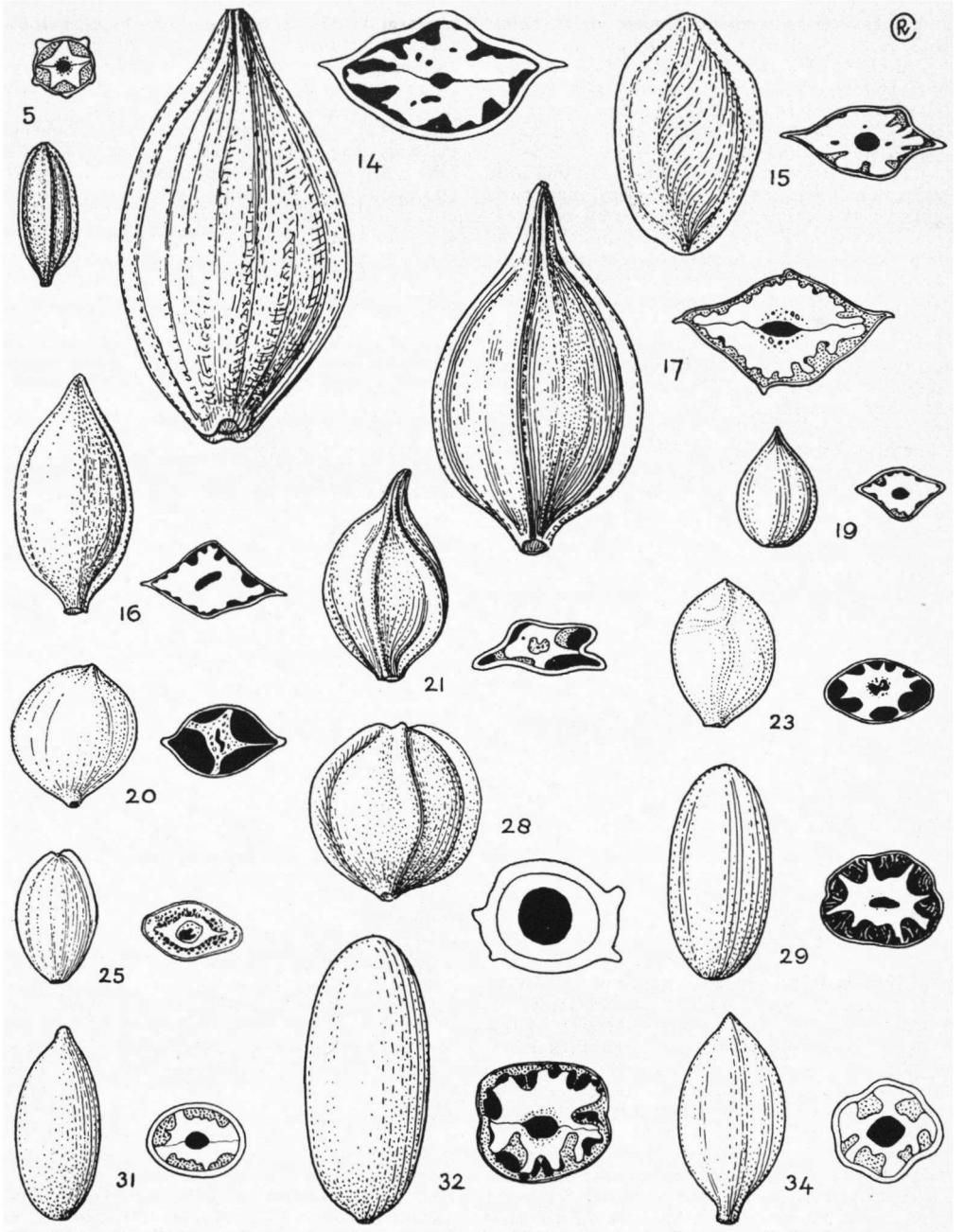

Fig. 14. Fruits of *Terminalia* numbered to correspond with the species in the text; a fruit of each species and its cross-section; all from herbarium material; loculus and hollows black, sclerenchyma white, alveolar tissue dotted; nat. size.—5. *T. citrina* (BARROS FB 24842), 14. *T. clemensae* (CLEMENS 3087), 15. *T. steenisiana* (BRASS 3759), 16. *T. oreadum* (SMITH NGF 1039), 17. *T. sepicana* (NGF 3179), 19. *T. microcarpa* (MANEJA FB 23982), 20. *T. complanata* (BRASS 6433), 21. *T. hypargyrea* (BRASS 8551), 23. *T. longespicata* (LEDERMANN 8068), 25. *T. samoensis* (BRASS 3095), 28. *T. bellirica* (KOORDERS 30944), 29. *T. macadamii* (MCADAM 8), 31. *T. kangeanensis* (BACKER 27306), 32. *T. celebica* (WATURANDANG 26), 34. *T. soembawana* (DOMMERS *s.n.*).

Ecol. Montane and submontane forest, 1200–2000 m.

Vern. *Marori, suba, tuba.*

17. Terminalia sepicana DIELS, Bot. Jahrb. 57 (1922) 429; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 40.—**Fig. 14.**

Tree up to 50 m, buttressed to 2½ m, with spreading crown. Bark brown or grey, inner bark pink or brownish-red, sapwood straw-coloured, inner wood light brown. Young branchlets at first densely appressed-pubescent or appressed-pilose later glabrescent. *Leaves* spirally arranged along the branchlets, chartaceous or subcoriaceous, at first densely appressed-pubescent, later glabrescent, obscurely pellucid-punctate when young, opaque when older, elliptic, obovate-elliptic or oblong-elliptic, 6–15 by 3–7½ cm, blunt or rounded, sometimes shortly acuminate or apiculate at the apex, cuneate at the base; nerves 7–9 pairs; domatia present, sometimes hairy; petiole at first tomentellous or appressed-pubescent, later glabrescent, 8–14 mm. *Flowers* sessile in axillary spikes up to 4 cm long; rhachis densely sericeous. Bracts hairy, filiform, 1 mm, early caducous. *Lower receptacle* (ovary) sericeous, 1 mm long; upper receptacle scarcely developed. *Calyx*-lobes triangular, 0.8 mm long. Filaments glabrous, 1½–2 mm; anthers 0.3 mm long. Disk barbate. Style glabrous, 1½ mm. *Fruit* reddish-purple, densely appressed-pubescent when young and retaining at least some indumentum when old, compressed ellipsoid, pointed at the apex, circumalate with a narrow wing or ridge 1–2 mm broad and 2 or 3 accessory ridges also developed, especially towards the apex, 4–5 by 2½–3 by 1½–2 cm when dried; endocarp hard and very sclerenchymatous in cros-ssection, air-spaces poorly developed in a ring round the loculus.

Distr. *Malaysia:* NE. New Guinea (Sepik and Morobe District) and New Britain. Fig. 15.

Ecol. Rain-forest at low and medium altitudes.

Uses. The wood is said to be very soft. The fruit is said to be edible and to exude a red dye.

18. Terminalia rubiginosa K. SCHUM. in K. SCHUM. & HOLLR. Fl. Kais. Wilh. Land (1889) 84; K. SCHUM. & LAUT. Fl. Deut. Schutzgeb. Südsee (1901) 466; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 30, *pro parte excl.* FORBES 636.

Large tree up to 35 m high. Young branchlets rufous-tomentose or rufous-appressed-pubescent, becoming glabrous, somewhat sympodial in growth but not always markedly so. *Leaves* spirally arranged and crowded at the apices of the branchlets, rufous- or fulvous-tomentellous when young and remaining so on the nerves below and sometimes also on both surfaces of the leaf-blade, sometimes rather inconspicuously minutely verruculose on the upper surface, obovate obovate-elliptic or narrowly obovate-elliptic, 5–10 by 2½–5½ cm, usually rounded at the apex and cuneate at the base; nerves 9–13 pairs, rather closely spaced; petiole rufous or fulvous-tomentose 4–13 mm. *Flowers* yellow, sessile, buds globose, in axillary spikes 4–9 cm long; rhachis rufous-tomentose. Bracts filiform fulvous-pubescent, 1½–2½ mm. *Lower receptacle* (ovary) rufous-tomentose, 1–2 mm long; upper receptacle densely pubescent, shallow-cupuliform ½ by 1 mm. *Calyx*-lobes ovate, 1 mm long. Filaments glabrous 2½ mm; anthers 0.3–½ mm long. Disk pilose. Style glabrous 3–4 mm long. *Fruit* densely appressed-pubescent somewhat glabrescent when old, broadly elliptic in outline, 5 by 3½ cm, laterally compressed, surrounded by a thick narrow wing 2 mm broad, with 3 additional ridges developed especially towards the apex where the fruit appears sub-5-winged.

Distr. *Malaysia:* Moluccas (N. Halmaheira: Tobelo, and Aru Islands), New Guinea. Fig. 15.

Ecol. Fairly common in primary forest at low altitudes.

Vern. *Karou, mambang.*

19. Terminalia microcarpa DECNE, Nouv. Ann. Mus. Par. 3 (1834) 457; Herb. Timor. Descr. (1835) 129; SPAN. Linnaea 15 (1841) 203; MIQ. Fl. Ind. Bat. 1, 1 (1855) 602; SLOOT. Bijdr. Combr. (1919) 17; Bull. Jard. Bot. Btzg III, 6 (1924) 20.—*T. intermedia* SPAN. in HOOK. Comp. Bot. Mag. 1 (1836) 347, *nom. nud.*; Linnaea 15 (1841) 203, *in syn., non T. intermedia* BERT. & SPRENG. (1825).—*T. angustifolia* BLANCO, Fl. Filip. (1837) 377, *non T. angustifolia* JACQ. (1776).—*T. edulis* BLANCO, Fl. Filip. ed. 2 (1845) 265; MERR. Philip. J. Sc. C. Bot. 4 (1909) 643; En. Philip. 3 (1923) 151; W. H. BROWN, Minor Prod. Philip. For. 2 (1921) 354, fig. 71; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 18; HEYNE, Nutt. Pl. N. I. (1927) 1177; BURK. Dict. (1935) 2141; MEEUSE in BACK. Fl. Jav. (em. ed.) 4, fam. 101 (1944) 7.—*Pentaptera mollis* PRESL, Abh. Kön. Böhm. Ges. Wiss. V, 6 (1850) 574.—*T. javanica* MIQ. Fl. Ind. Bat. 1, 1 (1855) 602; KOORD. & VAL. Bijdr. Booms. Jav. 9 (1903) 23; Atlas Baumart. (1913) t. 74; BACK. Schoolfl. Jav. (1911) 489; KOORD. Exk. Fl. Jav. 2 (1912) 671; SLOOT. Bijdr. Combr. (1919) 18.—*T. belerica* (*non* ROXB.) FERN.-VILL. Novis. App. (1880) 80.—*T. mollis* (PRESL) ROLFE, J. Bot. 23 (1885) 212, *non T. mollis* LAWS. (1871).—*Myrobalanus microcarpa* KUNTZE, Rev. Gen. Pl. (1891) 237.—*Myrobalanus javanica* KUNTZE, *l.c.*—*T. foveolata* WHITE & FRANCIS *ex* LANE-POOLE, For. Res. Papua & N. Guin. (1925) 123 (*sphalm.* '*faveolata*'); Proc. R. Soc. Queensl. 38 (1927) 248, f. 12.—**Fig. 14.**

Tree 10–40 by 2 m. Young branchlets at first fulvous-sericeous soon glabrescent, usually not markedly sympodial. *Leaves* papyraceous or chartaceous spirally arranged along the branchlets usually not markedly crowded at the apices, at first densely sericeous-pilose some appressed hairs usually remaining on both surfaces in old age but sometimes becoming glabrous, minutely verruculose above and below, usually pellucid-punctate at time of flowering later becoming opaque, elliptic, oblong-elliptic, or broadly elliptic or sometimes very narrowly elliptic on sterile shoots, 6–15(–32) by 2–7(–11) cm, acuminate or

apiculate at the apex, cuneate at the base; nerves 7–13 pairs; domatia usually present but not hairy; two rather inconspicuous glands usually present near the base of the leaf-blade; petiole appressed-pubescent or appressed-pilose, sometime glabrescent, usually relatively long and slender, 1½–3½ cm. *Flowers* sessile, in axillary spikes 6–12 cm long, rhachis fulvous-tomentose. Bracts hairy, filiform, 2–3 mm. *Lower receptacle* (ovary) densely sericeous, 1½–2 mm long; upper receptacle very shallow, scarcely developed. *Calyx*-lobes pubescent, ovate-triangular, 1–1½ mm long. Filaments glabrous, 2 mm; anthers 0.3–0.4 mm long. Disk barbate. Style glabrous, 1½ mm. *Fruit* plum-like, smooth, dark red, fleshy, edible, drupaceous, somewhat acid, up to 27 by 15 mm, when dried appressed-pubescent, flattened-ellipsoid, 10–20(–25) by 6–12 mm, often verrucose, usually apiculate at the apex and narrowly (sometimes obscurely) circumalate, endocarp very sclerenchymatous.

Distr. *Malaysia:* throughout the area but apparently absent from the Malay Peninsula, perhaps in Sumatra (record based on sterile material only). Fig. 15.

Ecol. A usually tall tree common in both primary evergreen and in seasonal deciduous forests (*e.g.* teak-forest in Java), up to 800 m.

Wood anat. (*T. javanica* MIQ.) MOLL & JANSSONIUS, Mikr. Holzes 3 (1914) 374; (*T. edulis* BLANCO) REYES, Commonw. Philip. Dept Agr. Techn. Bull. 7 (1938) 371.

Uses. The fruits (fleshy pericarp) are edible and are also used in lotions for the eye and skin. The wood is light brown and not very durable when exposed to the weather or in contact with the ground. A durable wood for interior work. Used for furniture and cabinet making; a good wood for ship planking (REYES *l.c.* & p. 372).

Vern. *Djaha bĕnti, gamprit, klumpit, klumprit, sĕlumprit,* J, *klompèk,* Md, *kadju tandu, kalumpit,* Kangean, *kunjit-kunjit,* Bali, *lĕka sĕla, tawa im bolai, kanalo,* Minahassa; Philippines: *kalumpit,* standard, *alupi, kalurig, kalusit,* Ibn., *anagep, kalautit,* Ilk., *baho, baraus, kamaris,* Tagb., *balisáyin, basal, dalinson, kalamai,* Tag., *bango,* Mbo., *gisit, basi,* Itn., *bisi, disi, kalaotit,* Gad., *buluang,*

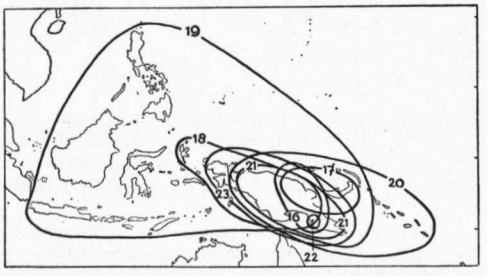

Fig. 15. Distribution of *Terminalia* series C(b): 16. *oreadum,* 17. *sepicana,* 18. *rubiginosa,* 19. *microcarpa,* 20. *complanata,* 21. *hypargyrea,* 22. *sogerensis,* 23. *longespicata.*

Bis., *gayumayen,* Sbl., *kalomagon, kalumagon, kalumangog, kotmok,* Bik., *kalomaog, kalumanog, magtalisai, taya-táya,* P. Bis., *kalupi, kalupit,* Neg., *lumangog,* S. L. Bis.

Notes. From duplicates distributed from Paris there is little doubt that *T. microcarpa* is the oldest name for the well-known species usually known as *T. edulis* BLANCO.

20. Terminalia complanata K. SCHUM: in K. SCHUM. & HOLLR. Fl. Kais. Wilh. Land (1889) 83; K. SCHUM. & LAUT. Fl. Deut. Schutzgeb. Südsee (1901) 466.—**Fig. 14.**

Large buttressed tree with spreading crown, up to 50 m. Bark grey, yellow-brown or reddish-brown (according to different collectors), wood yellow. Young branchlets slender, at first rufous-sericeous, eventually glabrescent. *Leaves* chartaceous to subcoriaceous, spirally arranged, dispersed along the branchlets, at first rufous- or golden-appressed-pubescent, usually glabrescent, shiny above, minutely verruculose above and below, usually markedly pellucid-punctate, typically elliptic or narrowly elliptic, sometimes oblong-elliptic, rarely obovate, 5–10 by 2–4 cm, acuminate or shortly acuminate at the apex, cuneate at the base; nerves 9–12 pairs (occasionally more), rather prominent and somewhat closely spaced; petiole slender, at first appressed-pubescent, soon glabrescent, 1–1½ cm, usually with two glands near the centre or towards the apex. *Flowers* sessile, pale green, in lateral spikes 3–10 cm long; rhachis rufous- or fulvous-tomentose. Bracts hairy, filiform, recurved, 2 mm, soon caducous. *Lower receptacle* (ovary) sericeous, 1½ mm long; upper receptacle scarcely evident. *Calyx*-lobes triangular, 1½ mm long. Filaments very slender, glabrous, 2½–3 mm; anthers 0.2 mm long. Disk barbate. Style glabrous, 3 mm. *Fruit* dull purple, suborbicular in outline and laterally compressed or broadly flattened-ellipsoid, sericeous at first and usually retaining some traces of indumentum, 1.8–2.2 by 1.4 by 1.7 cm, very narrowly circumalate, often apiculate at the apex, in cross-section showing a few radial plates of sclerenchyma separated by large air-spaces.

Distr. *Malaysia:* New Guinea, New Britain, and Solomon Islands (Guadalcanal). Fig. 15.

Ecol. In rain-forests up to 1400 m, sometimes dominant in riverine swamp-forest, fairly widespread in New Guinea.

Uses. The wood is said to be tough and fibrous and to contain a yellow dye.

Vern. *Naroongap,* Papua (Yalu), *doana,* Papua, *kwisik,* Sepik.

21. Terminalia hypargyrea K. SCHUM. & LAUT. Fl. Deut. Schutzgeb. Südsee (1901) 467; SLOOT. Bijdr. Combr. (1919) 20; Bull. Jard. Bot. Btzg III, 6 (1924) 24; DIELS, Bot. Jahrb. 57 (1922) 428.—**Fig. 14.**

Large spur-buttressed tree; wood pale yellow. Young branchlets silvery- or golden-reddish-sericeous, retaining some indumentum for a considerable time. *Leaves* chartaceous to coriaceous,

spirally arranged along the branchlets, at first sericeous becoming nearly glabrous above or more frequently retaining some appressed hairs especially near the base of the midrib, densely appressed-pilose or appressed-pubescent beneath, often minutely verruculose above and pellucid-punctate, sometimes opaque, broadly obovate, obovate, obovate-elliptic or narrowly elliptic, 5–12 by 2½–5½ cm, apex very variable, cuneate at the base; nerves 7–13 pairs often rather closely spaced; petiole appressed-pubescent or appressed-pilose, 1–2 cm. *Flowers* sessile, white, in axillary spikes, 7–13 cm long, rhachis sericeous. Bracts pilose to nearly glabrous, filiform, 2–2½ mm. *Lower receptacle* sericeous, 1½–2 mm long (3–3½ mm in some older flowers but the fruit may have started to grow); upper receptacle scarcely developed. *Calyx*-lobes sericeous or sparsely appressed-pubescent outside, nearly glabrous inside, ovate-triangular, 1½ by 1 mm. Filaments glabrous, 3–4 mm; anthers ½ mm long. Disk pilose. Style glabrous, 5 mm. *Fruit* red or pink, at first sericeous eventually sparsely appressed-pubescent, elliptic to suborbicular in outline, much flattened, 2–3 by 2–2½ cm, usually beaked, rather obscurely longitudinally circumalate, showing in cross-section a very irregular mass of sclerenchyma surrounded by large, irregular air-spaces.

Distr. *Malaysia:* New Guinea. Fig. 15.

Ecol. In rain-forest throughout the island up to 1350 m.

Note. Collectors' notes are conflicting as this species is described as a 'tall forest tree' and also as a 'tree of 10–12 m with horizontal branches in gallery extensions of rain-forest' and notes on the bark, *etc.*, are also at variance. The corresponding specimens all seem to be conspecific as far as can be ascertained by studying the herbarium material.

22. Terminalia sogerensis BAK. *f.* J. Bot. 61, Suppl. (1923) 14.—*T. rubiginosa* (*non* K. SCHUM.) SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 30 *pro parte quoad specim.* FORBES 636.

Tree 20–25 m. Young branchlets somewhat thickened, densely rufous-sericeous, indumentum persisting for some time, with a tendency towards sympodial branching. *Leaves* at first membranaceous later subcoriaceous, spirally arranged, somewhat crowded at the tips of the branchlets, at first densely rufous-sericeous and undersurface remaining rufous-tomentose while the upper surface is more or less glabrescent with the exception of the midrib, minutely verruculose and pellucid-punctate at one stage but these characters disappear as the leaf-blade becomes older and thicker, elliptic, narrowly elliptic or obovate-elliptic, 6–12 by 2½–6 cm, shortly and bluntly acuminate at the apex, cuneate at the base; nerves 10–13 pairs, often rather closely spaced; domatia not conspicuous; petiole rufous-tomentose, 8–15 mm, glands not conspicuous. *Flowers* pale yellow, in axillary spikes 5–7 cm long; rhachis rufous-tomentose. Bracts pilose, filiform, 3–6 mm. *Lower receptacle* (ovary) densely sericeous, 1 mm long; upper receptacle scarcely developed. *Calyx*-lobes ovate, glabrous 0.8 mm long. Filaments glabrous, 2 mm; anthers 0.2–0.3 mm long. Disk barbate. Style glabrous, 1½ mm. *Fruit* appressed-pubescent broadly compressed-ellipsoid 20–28 by 12–19 by 6 mm when dried, very narrowly circumalate, beaked at the apex, showing large air-spaces in cross-section.

Distr. *Malaysia:* E. New Guinea (Papua: Sogeri Region and Kanosia). Fig. 15.

Ecol. Swamp forests at low altitude. Fruits adapted to water-dispersal.

Note. This may prove to be conspecific with *T. hypargyrea* K. SCHUM. & LAUT. but with the small amount of material at present available it seems advisable to maintain it as a distinct species.

23. Terminalia longespicata SLOOT. Bijdr. Combr. (1919) 19, t. 1, f. 1–5; Bull. Jard. Bot. Btzg III, 6 (1924) 29.—*T. phaeoneura* DIELS, Bot. Jahrb. 57 (1922) 419.—**Fig. 14, 16.**

Tree 15–35 m, buttressed. Bark grey-green to brown, resinous; wood straw-yellow or dark yellow. Young branchlets rufous-tomentose or rufous-tomentellous, retaining some indumentum for a considerable period. *Leaves* chartaceous, spirally arranged along the branchlets, at first rufous- or golden-sericeous later glabrescent above except for the midrib but remaining rufous-tomentose or rufous-tomentellous beneath, especially on the nerves, not conspicuously verruculose or pellucid-punctate, elliptic, narrowly elliptic, obovate-elliptic, narrowly obovate-elliptic or oblanceolate, 5–12 by 2½–6 cm, usually acuminate rarely rounded at the apex, cuneate to rounded at the base, sometimes with 2 rather inconspicuous glands; nerves 8–16 pairs, rather closely spaced and prominent beneath; domatia not conspicuous; petiole rufous-tomentose later glabrescent, 7–15 mm. *Flowers* sessile in axillary spikes 5–17 cm long; rhachis rufous-tomentose. Bracts hairy, filiform, recurved, 2½ mm. *Lower receptacle* (ovary) rufous-tomentose, 2 mm long, somewhat narrowed at the apex; upper receptacle rufous-tomentose, shallow-cupuliform, 1 by 1½ mm. *Calyx*-lobes tomentose or pubescent, ovate, 1 mm long. Filaments glabrous, 3 mm; anthers 0.2 mm long. Disk pilose. Style glabrous, 3½–4 mm. *Fruit* red, pubescent when young, glabrous when mature, suborbicular to elliptic in outline, laterally compressed, 20–23 by 13–18 by 8–12 mm (when dried), apiculate at the apex, showing in cross-section a band of sclerenchymatous tissue surrounding the loculus with radial, spoke-like projections alternating with large air-chambers.

Distr. *Malaysia:* New Guinea (fairly widespread). Fig. 15.

Ecol. A large tree, sometimes dominant, in riverine lowland, swamp forest. The fruits are clearly adapted to water-dispersal.

Uses. The timber appears to be of little use. The fleshy part of the fruit is eaten by the natives.

Vern. *Karija, karo, kihim.*

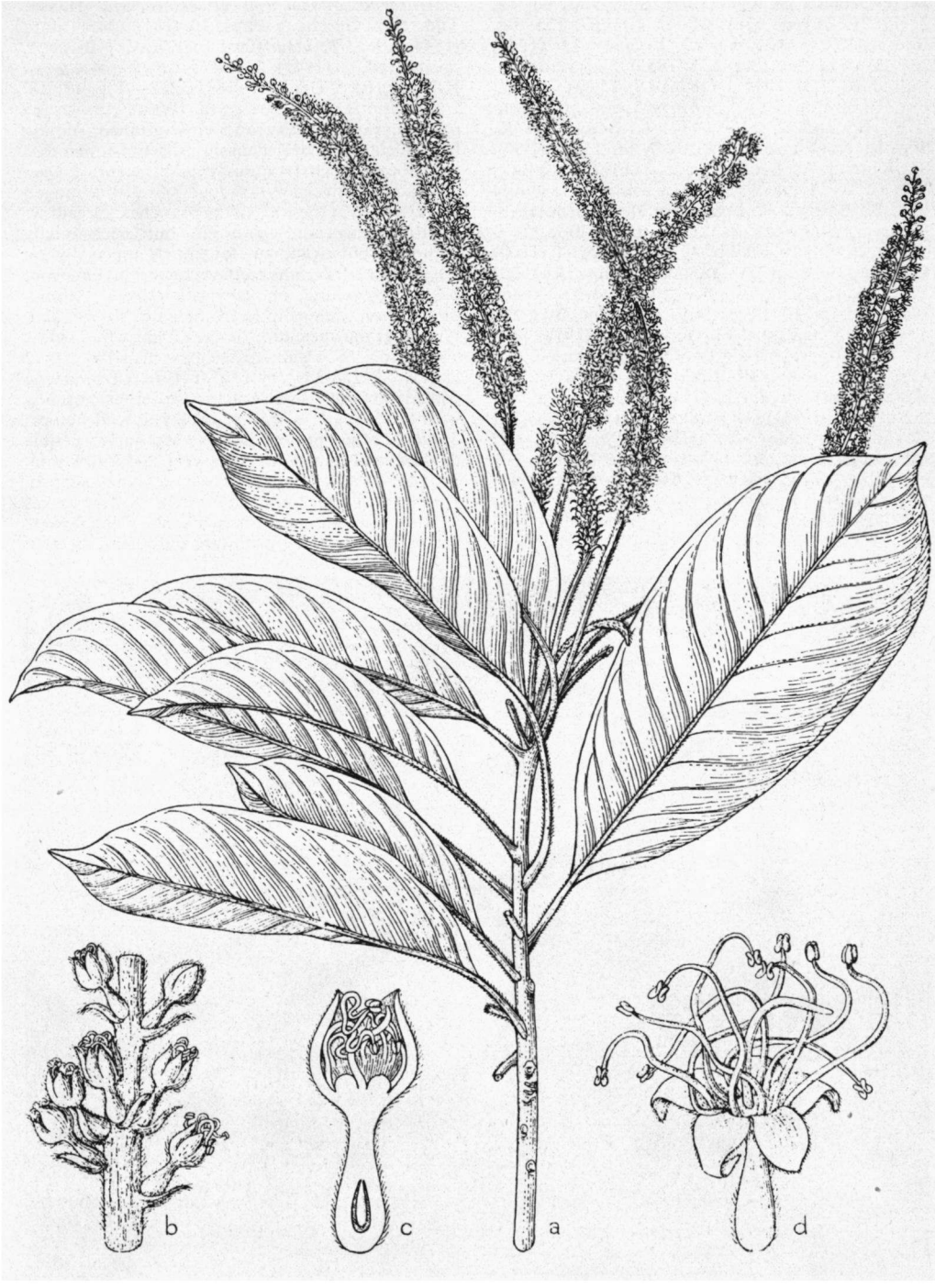

Fig. 16. *Terminalia longespicata* SLOOT. *a*. Flowering branch, × 2/3, *b*. part of spike, × 8, *c*. bud in section. × 20, *d*. flower, × 12 (after VAN SLOOTEN).

24. Terminalia catappa LINNÉ, Syst. Nat. ed. 12, 2 (1767) 674 (*err.* 638); MANT. 1 (1767) 128; BL. Bijdr. (1825) 642, SPAN. Linnaea 15 (1841) 203; MIQ. Fl. Ind. Bat. 1, 1 (1855) 599; SCHEFFER, Bull. Jard. Bot. Btzg 1 (1876) 69, 73, 94; KURZ, For. Fl. Burm. 1 (1877) 454; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 444; K. SCHUM. in K. SCHUM. & HOLLR. Fl. Kais. Wilh. Land (1889) 83; KING, J. As. Soc. Beng. 66, 2 (1897) 331; BAK. *f.* in C. W. ANDREWS, Mon. Christm. Isl. (1900) 177; K. SCHUM. & LAUT. Fl. Deut. Schutzgeb. Südsee (1901) 465; K. & V. Bijdr. Booms. 9 (1903) 26; MERR. Philip. J. Sc. C. Bot. 4 (1909) 642; En. Born. (1921) 423; En. Philip. 3 (1923) 150; BACK. Schoolfl. Jav. (1911) 489; SLOOT. Bijdr. Combr. (1919) 8; Bull. Jard. Bot. Btzg III, 6 (1924) 14; GAGNEP. Fl. Gén. I.-C. 2 (1920) 743; W. H. BROWN, Minor Prod. Philip. For. (1921) 162, f. 55; RIDL. Fl. Mal. Pen. 1 (1922) 705; HEYNE, Nutt. Pl. N. I. (1927) 1176; CRAIB, Fl. Siam. En. 1 (1931) 621; BURK. Dict. (1935) 2137; CORNER, Wayside Trees (1940) 193, t. 44, 45; MEEUSE in BACK. Fl. Java (em. ed.) 4, fam. 101 (1944) 7.—*Catappa* RUMPH. Herb. Amb. 1 (1741) 174, t. 68.—*T. moluccana* LAMK, Encycl. 1 (1783) 349.—*T. latifolia* BLANCO, Fl. Filip. (1837) 376, *non T. latifolia* SW. (1788).—*T. catappa var. macrocarpa, rhodocarpa et chlorocarpa* HASSK. Tijd. Nat. Gesch. & Phys. 10 (1843) 145; Flora (1844) 606.—*T. mauritiana* (*non* LAMK) BLANCO, *op. cit.* ed. 2 (1845) 264.—*Myrobalanus catappa* KUNTZE, Rev. Gen. Pl. (1891) 237.—**Fig. 17, 18.**

Deciduous tree, 10–35 m. Wood brown or reddish, rather heavy and close-grained. Young branchlets thickened, densely sericeous-tomentose or pubescent fairly quickly glabrescent. *Leaves* chartaceous or papyraceous, spirally arranged and crowded at the ends of the branches, spreading, usually shiny and glabrous but occasionally appressed-pubescent or tomentose especially on the lower surface, minutely verruculose above and below, typically obovate sometimes elliptic-obovate or even elliptic, rounded or shortly acuminate at the apex and somewhat narrowed below the middle to a subcordate base usually with 2 glands, 8–25(–38) by 5–14(–19) cm, varying considerably in size and shape (see notes); usually with *c.* 6–9 pairs of rather widely spaced nerves; domatia often present, some mes hairy; petiole thick, usually sericeous-pubescent, 5–15(–20) mm. Seed-leaves transversely elliptic or kidney-shaped. *Flowers* white or whitish, sessile in axillary spikes 8–16 cm long, in which the majority of the flowers are usually ♂, a few ♀ flowers only being present

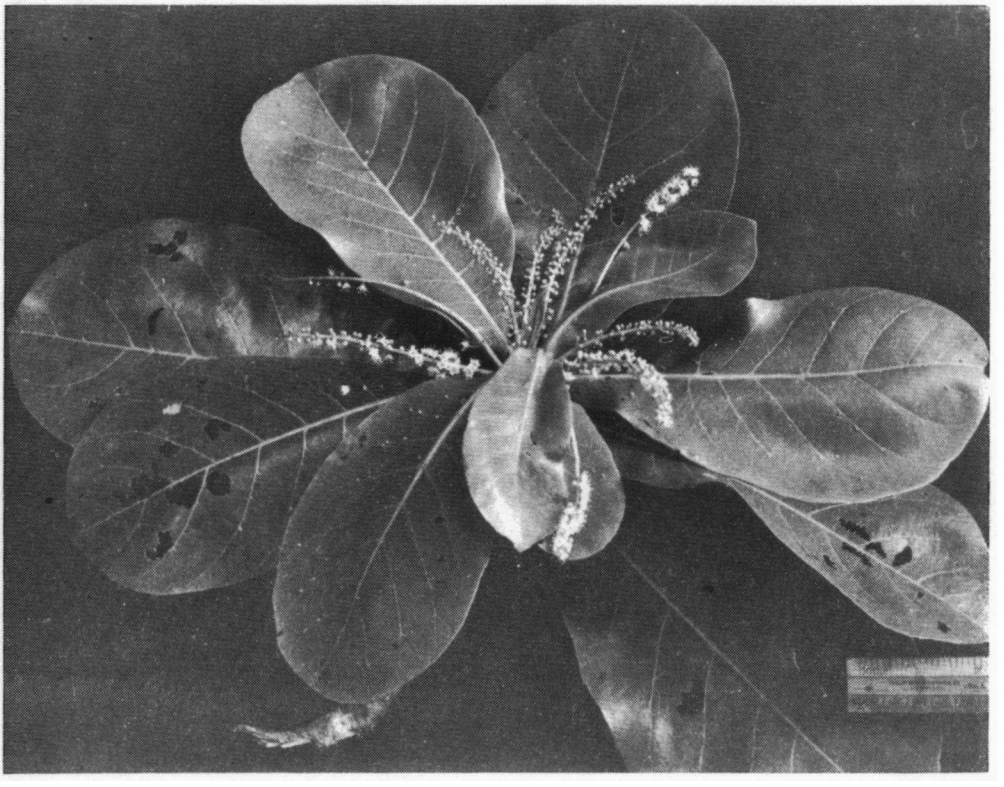

Fig. 17. *Terminalia catappa* L. Tuft of leaves with inflorescences (CORNER). *Courtesy Government Printer Singapore.*

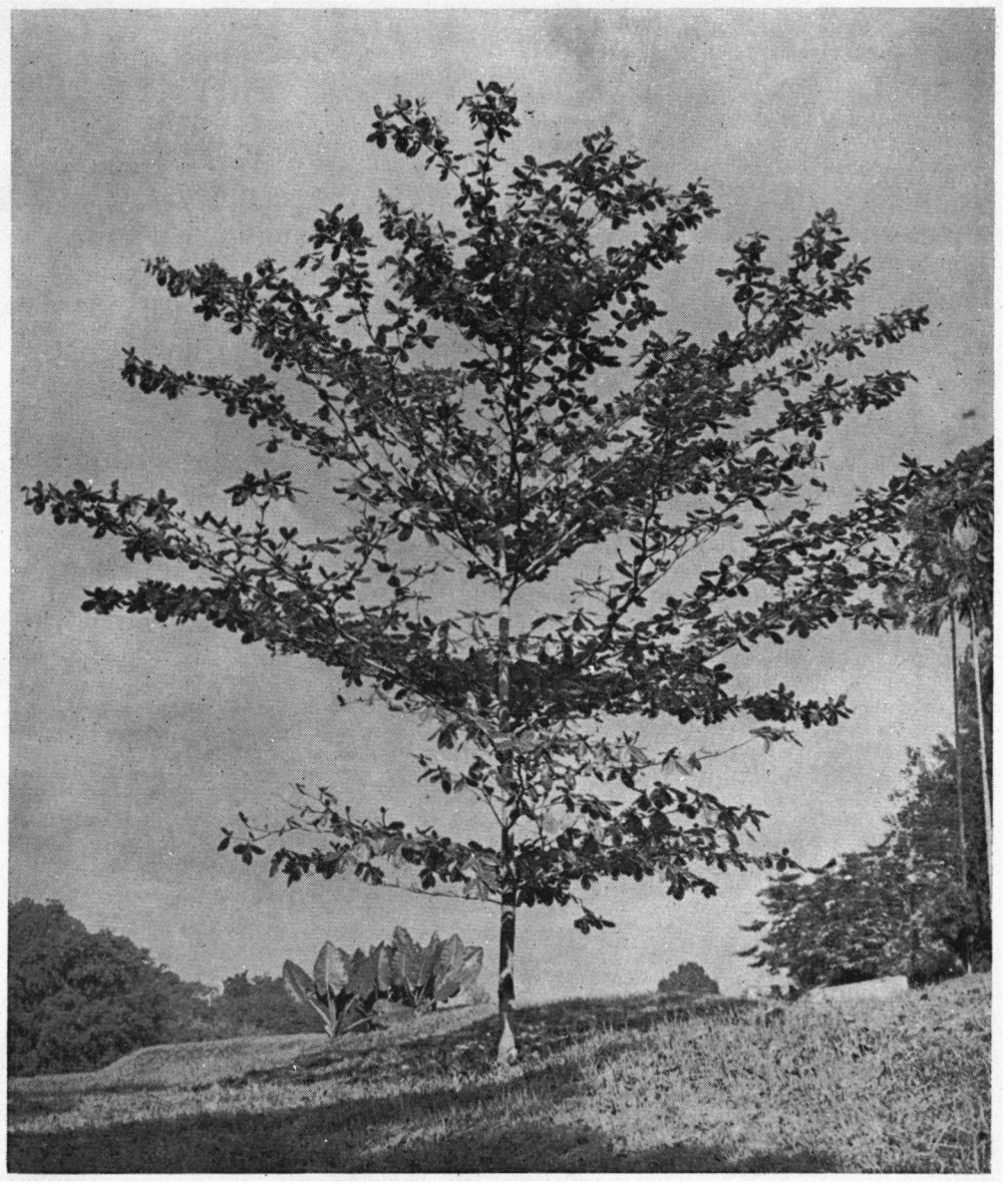

Fig. 18. *Terminalia catappa* L. Young tree near Tanglin Corner, Singapore (CORNER). *Courtesy Government Printer Singapore.*

towards the base; rhachis usually appressed-pubescent, sometimes glabrous. Bracts *c.* 1 mm long, early caducous. *Lower receptacle* (ovary) sericeous or glabrous, usually 2–4 mm long, occasionally up to 7 mm long; upper receptacle usually nearly glabrous, shallow-cupuliform, 1½ by 3 mm. *Calyx*-lobes ovate-triangular, 1–1½ mm long. Filaments glabrous, 2 mm; anthers ½ mm long. Disk barbate. Style glabrous, 2 mm. *Fruit* a usually glabrous, reddish, yellowish or greenish drupe, ovoid or ellipsoid, more or less laterally compressed or scarcely compressed, circumalate with a stiff rigid wing *c.* 2 mm broad or wing obsolete and scarcely conspicuous, very variable in size, 3½–7 by 2–5½ cm, cultivated races often having conspicuously larger fruits than the wild plants.

Distr. Tropical Asia, N. Australia and Poly-

nesia, commonly planted in the tropics, in *Malaysia:* throughout the area although apparently rather rare on the mainland of Sumatra and in Borneo.

Ecol. Sandy or rocky beaches 0–5 m altitude, a typical constituent of the *Barringtonia* formation. VAN DER PIJL (Trop. Nat., Jub. *no*, 1936, 97–99) observed regular dispersal of *kĕtapang* fruits through fructivorous bats all over Meeuwen Island (SW. Java) and elsewhere and found chewed kernels under trees where they devour their fruits. He concludes that they are distinctly diplochorous, *viz* dispersed both by sea-water and by bats. This is confirmed by DOCTERS VAN LEEUWEN for Krakatau Island. *T. catappa* was also found in the beach-forest of the newly formed Anak Krakatau (*cf.* VAN BORSSUM WAALKES, Trop. Nat. 32, 1950, 42–43).

Wood anat. MOLL & JANSSONIUS, Mikr. Holzes 3 (1914) 375; PEARSON & BROWN, Comm. Timb. 1 (1932) 501; REYES, Commonw. Philip. Dept Agr. Techn. Bull. 7 (1938) 368.

Uses. Often planted in avenues as a shade-tree, for which it is suitable because of its very regular shape. The timber is reddish and of good quality and is used for house- and boat-building, carts, planks, *etc.* The kernel of the fruit is edible and contains a colourless, fatty oil similar to almond oil. The bark contains tannin used as an astringent in dysentery and thrush. The leaves act as a sudorific and are applied to rheumatic joints. Bark and leaves are used for tanning leather.

Vern. *Amendoeira da India*, Portug., *Badamier*, Fr., *Etagenbaum*, Germ., *Indian* or *Singapore Almond*, E., *kĕtapang*, standard-Mal., Jav. Sund., *lingtak*, Mal. Pen.; Sumatra: *bèowa*, *kilaula*, Enggano, *gĕntapang*, Atjeh, *katapang*, Toba-Batak, *lapahang*, Simalur, *katapieng*, Minangk., *katafa*, Nias; Lesser Sunda Isl.: *kĕtapas*, Timor, *klihi*, Pantar, *lisa*, Roti, *wewa*, Tenimber; Celebes: *sabrisé*, Sangir, *aarisei*, *talisei*, *dumpajang*, *lumpoyang*, Alf. Cel., *atapang*, Bug; Moluccas: *sadina*, *sarisa*, W. Ceram, *sertalo*, S. Ceram, *kajané*, *sarisalo*, Saparua, *sĕrisa*, Sepa, *sarasa*, Haruku, *sirisal*, Nusa-laut, *lisa*, Buru, *tasi*, Sula, *klis*, Weda, *gnusa*, Ternate, Tidore, Galela, *tiliho*, Tobelo, *tiliso*, Loda, *wéw*, Key; Philippines: *talisai* (standard), *almendras*, *almendro*, Span., *banilak*, *dalasa*, *kalisai*, *hitam*, Pamp., *dalinsi*, Bik., *dalisai*, Ibn., *logo*, *lugo*, Ilk., *savidug*, Iv., *saluisai*, Ig., *salisai*, Sbl., *taisai*, Sulu, *talisi*, Yak., *valisai*, Tag.; W. New Guinea: *kalis*, *kris*, *ruge*.

Notes. This very well-known tree is a characteristic feature of the tropical urban landscape for it is one of the commonest avenue trees. The branches come off in regular tiers giving the species a curiously regular appearance.

The tree sheds its leaves all at once, quite suddenly, usually twice a year (January or February and July or August). Unlike most tropical trees, the leaves turn first yellow, then vivid red before falling giving a well-marked 'autumn colour'.

As is perhaps to be expected in a frequently planted species with an edible kernel, the fruits show great variation in size, colour and shape and there has apparently been some selection in cultivating large-fruited races. This variation has made it difficult to place the species in the key, where it has to appear several times and it is still possible that atypical specimens may escape correct identification. It has been necessary to use as a determining character the subcordate base to the leaf which is clear enough in the great majority of specimens. In young plants, however, and probably on branches of rapid growth leaves with a cuneate base and petioles longer than normal can be found and closely simulate leaves of other species of the genus. Specimens from Timor and neighbouring islands seem to be particularly atypical in this respect and in the absence of fruits their determination is doubtful. A normal leaf-specimen, even in the absence of fruits, can be distinguished from nearly all other species of *Terminalia* by the obovate leaves, with comparatively few lateral nerves, considerably narrowed towards the base, where the lamina is clearly subcordate and not decurrent into the rather short, thick petiole.

25. Terminalia samoensis RECHINGER, in FEDDE, Rep. 4 (1907) 229.—**Fig. 14.**

Tree. Bark hard, grey, scaly. Young branchlets fairly thick, fulvous-tomentose eventually glabrescent with sympodial growth. *Leaves* chartaceous, papyraceous or membranaceous, spirally arranged and somewhat crowded towards the ends of the branchlets, pubescent above, more densely so on the midrib, pubescent to tomentose beneath, obovate, broadly obovate, broadly elliptic or suborbicular, 6–20 by 4½–12½ cm, rounded at the apex and usually at the base, usually (but sometimes obscurely) minutely verruculose above, manifestly, though not very conspicuously, pellucid-punctate; nerves 7–10 pairs; petiole fulvous-tomentose, 1–3½ cm. *Flowers* greenish-white, sessile, in axillary spikes 6–11 cm long; rhachis fulvous-tomentellous or pubescent. Bracts pubescent, filiform, 1 mm, early caducous. *Lower receptacle* (ovary) glabrous or sparsely pubescent, 4–5 mm long, much constricted above the ovary; upper receptacle glabrous, shallow-cupuliform 1½ by 4 mm. *Calyx*-lobes glabrous, ovate-triangular, 1½ mm long. Filaments glabrous, 3 mm; anthers 0.4 mm long. Disk pilose. Style glabrous, 2 mm. *Fruit* glabrous, fleshy and red when ripe, compressed-ellipsoid or compressed-ovoid, 1.7–2.2 by 1–1.3 cm; pericarp of dried fruit showing in cross-section an inner sclerenchymatous layer *c.* 0.7 mm thick, surrounded by a middle layer *c.* 1–2 mm thick with many small air-spaces, followed by an outer layer of corky consistency.

Distr. Polynesia (Samoa, Gilbert Isl., Ellice Isl., Marshall Isl.), Melanesia (Solomon Islands: Owa Raha), in *Malaysia:* New Ireland (Kavieng) and Celebes (Miangas Island). Fig. 19.

Ecol. A littoral species growing on coral limestone in Miangas Isl. The fruits are probably water-borne.

Vern. *Salise.*

Notes. *T. saffordii* MERR. from Guam with

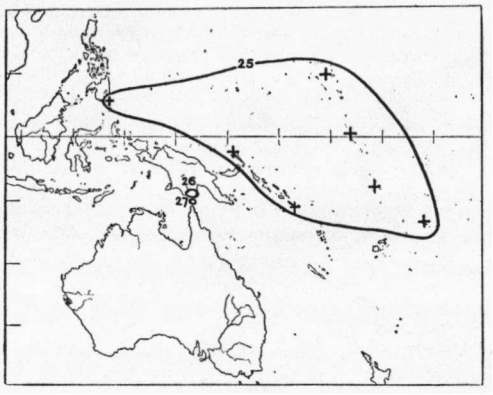

Fig. 19. Distribution of *Terminalia* series E: 25. *samoensis*, 26. *crassifolia*, 27. *insularis*.

glabrous inflorescence, slightly smaller fruits and shorter petioles may prove to be the same species when more material is available, but the name *T. samoensis* has priority.

26. Terminalia crassifolia EXELL, J. Arn. Arb. 20 (1939) 319.

Small tree, 6–8 m. Young branchlets rather thick, appressed-pubescent, later glabrescent, growth sympodial. *Leaves* subcoriaceous to coriaceous, spirally arranged and crowded at the ends of the branchlets, glabrous above, rather obscurely verruculose, sparsely appressed-pubescent beneath, especially towards the base of the midrib, obovate, 6–11 by 3½–7½ cm, rounded and often shortly apiculate at the apex, cuneate at the base with 2 glands near the base of the midrib; nerves 5–8 pairs, rather widely spaced except at the base; domatia often present, usually hairy; petiole appressed-pubescent, fairly stout, 5–18 mm. *Flowers* sessile in axillary spikes 9–11 cm long; rhachis appressed-pubescent. Bracts not seen, presumably early caducous. *Lower receptacle* (ovary) densely sericeous, 1½ mm long; upper receptacle sparsely appressed-pubescent, shallow-cupuliform, 3 by 1 mm. *Calyx*-lobes deltoid, 1½ mm long. Filaments glabrous, 3–3½ mm; anthers 0.7–0.8 mm long. Disk barbate. Style glabrous, 2 mm. *Fruit* appressed-puberulous, when mature only very sparsely so, when ripe 'dark purple, somewhat compressed, 1½ by 1 cm' when dried slightly compressed ellipsoid, apiculate, 12–13 by 7–8 mm, endocarp showing in cross-section a central sclerenchymatous zone surrounded by a zone honey-combed with air-spaces.

Distr. *Malaysia:* South New Guinea (Papua: Mabaduan). Fig. 19.

Ecol. Common in savannah-forest substage and in light rain-forest on granite slopes, apparently under semi-arid climatic conditions.

Note. The fruits are among the smallest known of the drupaceous type in Malaysia.

27. Terminalia insularis C. T. WHITE, Proc. R. Soc. Queensl. 55 (1944) 64.

Tree. Branchlets stout, somewhat swollen at the tips. *Leaves* spirally arranged, ± crowded at the apices of the branchlets, fairly densely pubescent above, densely and softly pubescent beneath at time of flowering, losing most of their indumentum in old age, not verruculose or punctate, obovate or obovate-cuneate, 8–17 by 4½–9 cm, usually rather abruptly acuminate at the apex and cuneate at the base, nerves 6–9 pairs; petiole at first pubescent later glabrescent, 3½–4½ cm. *Flowers* (*ex descr.*) in densely flowered spikes 8–17 cm long. *Lower receptacle* (ovary) densely sericeous 2 mm long. *Calyx*-lobes sparsely pilose outside, deltoid. Filaments 5 mm. Disk barbate. *Fruit* sparsely pubescent, ellipsoid or ovoid, scarcely compressed, 1½–2 by 0.9–1 cm.

Distr. Thursday Island, expected to occur in South New Guinea. Fig. 19.

Note. I have not seen the type but two fragments in the British Museum Herbarium, E. COWLEY 30 and an unnamed collector, both from Thursday Island, must be this species. The only discrepancy is in the length of the petioles, which is 3½ to 4½ cm in the specimens seen while they are 1–2½ cm long in the original description. The length I have given fits in much better with C. T. WHITE's key character 'leaves three or four times as long as the petiole'.

28. Terminalia bellirica (GAERTN.) ROXB. Pl. Corom. 2 (1805) 54, t. 198 ('*bellerica*'); MIQ. Fl. Ind. Bat. 1, 1 (1855) 600; KURZ, For. Fl. Burm. 1 (1877) 455; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 445; KING, J. As. Soc. Beng. 66, 2 (1897) 329; KOORD. Exk. Fl. 2 (1912) 671; SLOOT. Bijdr. Combr. (1919) 15; Bull. Jard. Bot. Btzg III, 6 (1924) 22; GAGNEP. Fl. Gén. I.-C. 2 (1920) 749; RIDL. Fl. Mal. Pen. 1 (1922) 704; HEYNE, Nutt. Pl. N. I. (1927) 1175; CRAIB, Fl. Siam. En. 1 (1931) 601; BURK. Dict. (1935) 2136; JAPING & OEY DJOEN SING, Tectona 29 (1936) 675; CORNER, Wayside Trees (1940) 193; MEEUSE in BACK. Fl. Java (em. ed.) 4, fam. 101 (1944) 7.— *Myrobalanus bellirica* GAERTN. Fruct. 2 (1791) 90, t. 97, f. a–d ('*bellirina*').—*T. punctata* ROTH, Nov. Sp. (1821) 381.— *T. laurinoides* T. & B. *ex* MIQ. *l.c.*— *T. lauriformis* T. & B. [Cat. Hort. Bog. 1855, 252, *ined.*] *ex* SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 22.—*T. moluccana* (*non* LAMK) MIQ. *tom. cit.* (1855) 601; K. SCHUM. in K. SCHUM. & HOLLR. Fl. Kais. Wilh. Land (1889) 84.—*T. belerica var. laurinoides* CLARKE, *l.c.*; BACK. Schoolfl. Java (1911) 490; KOORD. Atl. Baumart. 1 (1913) t. 75.—*Myrobalanus laurinoides* KUNTZE, Rev. Gen. Pl. (1891) 237. —**Fig. 14, 20.**

A deciduous tree, 25–50 by 2 m, with large buttresses. Young branchlets thick, at first densely, later sparsely, rufous-appressed-pubescent. *Leaves* at first papyraceous later subcoriaceous or coriaceous, spirally arranged along the branchlets or crowded at the ends of the branchlets, sometimes whorled, rufous-sericeous when very young, soon becoming glabrous or almost glabrous, usually

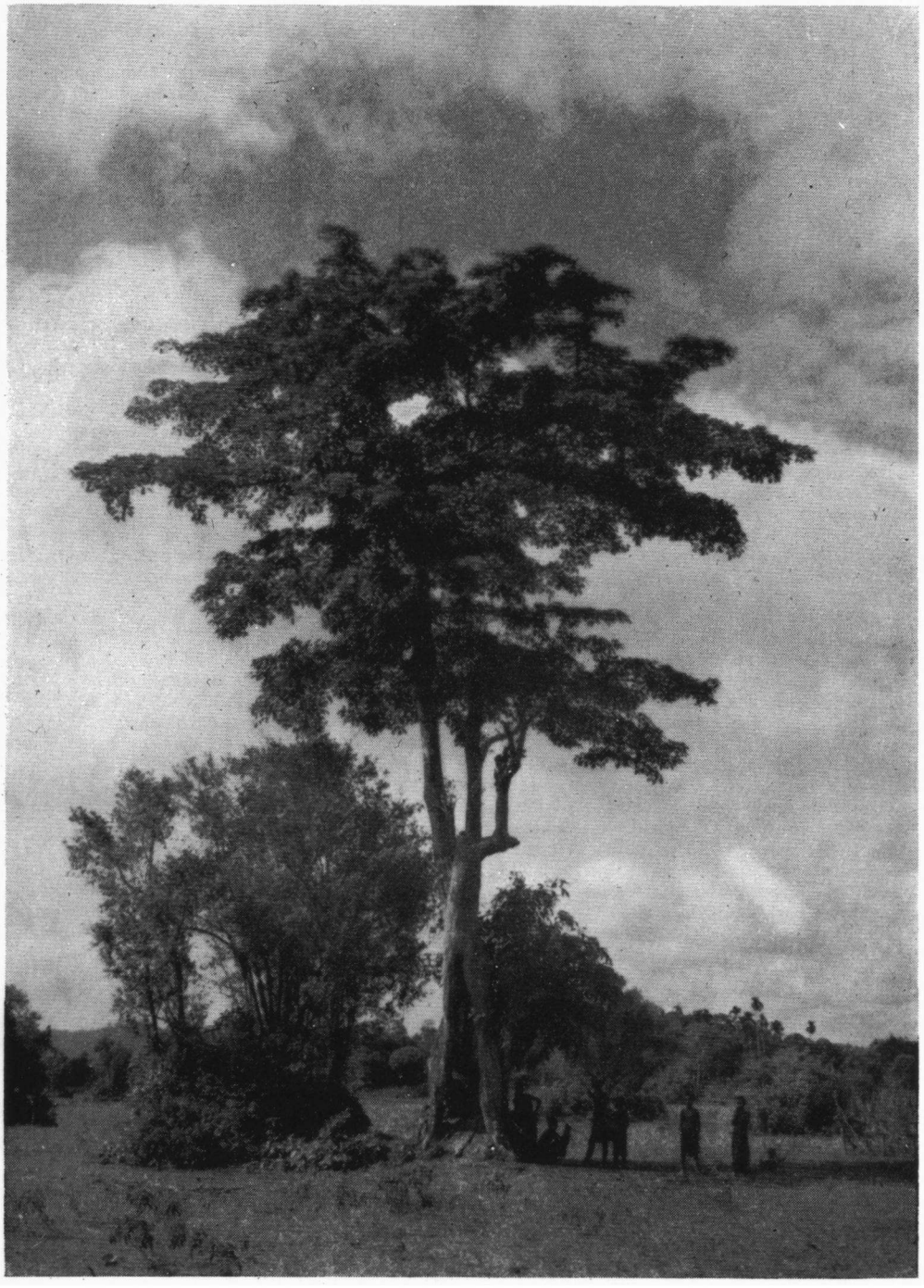

Fig. 20. *Terminalia bellirica* (GAERTN.) ROXB. Tree near Kuala Trengganu, Malaya (CORNER 1937).

conspicuously minutely verruculose above and less conspicuously so beneath, pellucid-punctate for a time but eventually opaque, typically broadly elliptic or obovate-elliptic, sometimes elliptic and narrowly oblanceolate in seedlings, 4–18 by 2–11 cm, rounded or obtuse or sometimes acuminate at the apex, rounded, obtuse or cuneate at the base; nerves usually 6–8 pairs, rather widely spaced; domatia usually absent or inconspicuous; petiole at first pubescent soon glabrescent, generally long in relation to the lamina, usually *c.* 3 cm but sometimes up to 9 cm. *Flowers* sessile, yellowish, buds subglobose, in axillary spikes 3–15 cm long; rhachis rufous- or fulvous-appressed-pubescent. Bracts absent or very early caducous. *Lower receptacle* (ovary) densely sericeous or tomentellous, 1½–2 mm long; upper receptacle shallow-cupuliform, 1 by 4 mm, sericeous. *Calyx*-lobes recurved, deltoid, 1½ mm long. Filaments glabrous, 3 mm; anthers 0.8 mm long. Disk rufous- or fulvous-barbate. Style glabrous, 4 mm. *Fruit* densely and finely velutinous or sericeous, subglobose to broadly ellipsoid when dried, 2–2.8 by 1.8–2.2 cm, usually with 5 well-marked longitudinal ridges, endocarp densely sclerenchymatous, with no trace of air-spaces; exocarp hard, 1–2½ mm thick when dried, dark in section.

Distr. Ceylon, India, Burma, Indo-China, Siam, in *Malaysia:* Malay Peninsula, Sumatra (Eastcoast Res., Palembang, Lampongs), Java, N. Borneo (Sandakan), Lesser Sunda Islands (Bali, Wetar), Central Celebes (Wataipi) and Moluccas (Ambon & Key Islands). Fig. 21.

Ecol. A deciduous tree, remaining leafless, however, for only a short period, on periodically dry soils in deciduous monsoon forest, also in rain-forests on red soil. In Java mainly in Central and East Javan teak-forests, mostly at low altitudes but up to 600 m in Java.

Wood anat. (*T. bellerica var. laurinoides* CLARKE) MOLL & JANSSONIUS, Mikr. Holzes 3 (1914) 367; (*T. belerica* ROXB.) PEARSON & BROWN, Comm. Timb. 1 (1932) 506.

Uses. There are conflicting accounts as to the durability of the timber but in Malaysia it is not considered of much value, although said to be good for firewood and charcoal. In Indo-China, however, it is used for making wheels and its durability is said to be improved by immersion in water. The fruit is one of the commercial myrobalans used for tanning leather, for a black dye (together with sulphate of iron), to economize in the use of indigo and for making ink. The unripe fruit is purgative and the ripe fruit astringent, being extensively used in India for dropsy, haemorrhoids and diarrhoea. In Java the fruits are sold with the seeds removed as 'djalawé' in native pharmacies. The kernels can be eaten but are somewhat dangerous as they produce a narcotic effect. The tree also yields an insoluble gum in considerable quantity. For further details see BURKILL (*l.c.*), HEYNE (*l.c.*), and PEARSON & BROWN (*l.c.*).

Vern. *Djeuheu, djoho, djaha, gamprit,* J, Md, *dj. kĕbo, dj. kĕling, dj. sapi,* J, *djĕlawai, mĕntalun, uji,* Mal.Pen., *simar kulihap,* Sumatra, *ulu bĕlu,* Lampongs, *tietiemalong,* Ambon, *koenfit, niesmetan.*

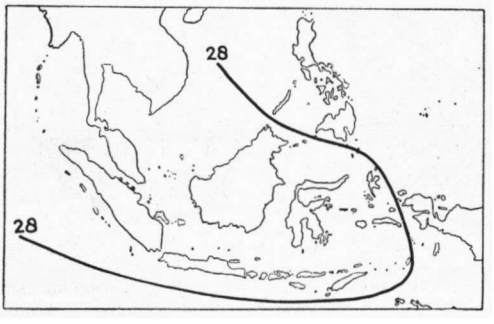

Fig. 21. Distribution of *Terminalia* series F: 28. *bellirica.*

29. Terminalia macadamii EXELL, Blumea 7 (1953) 324.—**Fig. 14.**

Tree *c.* 40 m by 80 cm. Bark green. Wood creamy, porous. Young branchlets rufous-tomentellous and retaining their indumentum for a considerable time. *Leaves* spirally arranged along the branches, chartaceous, at first densely rufous-tomentellous, later glabrescent above but retaining their indumentum especially on the nerves and reticulation beneath, rather obscurely minutely verruculose above, pellucid-punctate, elliptic or more rarely obovate-elliptic, 8½–18 by 3½–9 cm, usually somewhat acuminate at both apex and base; nerves 9–12 pairs, domatia not conspicuous; petiole rufous-tomentellous, 1–3 cm. *Flowers* unknown. *Fruit* tomentellous when young becoming glabrous when mature, oblong-ellipsoid, usually scarcely compressed, 2½–3½ by 1.3–1½ cm, rather obscurely longitudinally ridged, showing in cross-section a sclerenchymatous inner layer extended radially in spoke-like projections.

Distr. *Malaysia:* New Guinea (Papua: Milne Bay). Fig. 23.

Ecol. Rain-forest at low altitude.

Uses. The wood is described as 'creamy and porous'.

Vern. *Muru muru widi.*

30. Terminalia solomonensis EXELL, J. Bot. 73 (1935) 132.

Buttressed tree, 15–30 m, with flatly spreading, whorled branches. Bark brown, wood yellow. Young branchlets rather stout and very early glabrescent although the terminal buds are sericeous. *Leaves* papyraceous, spirally arranged along the branchlets or sometimes whorled, glabrous somewhat shiny and rather conspicuously minutely verruculose on both surfaces, manifestly pellucid-punctate, elliptic, narrowly elliptic, obovate-elliptic or oblong-elliptic, 12–24 by 6½–9 cm, acuminate at the apex, cuneate at the base; nerves 9–14 pairs; domatia absent or inconspicuous; petiole glabrous, 3½–5 cm, usually with 2 glands near the centre. *Flowers* sessile, cream, brown or yellow, in axillary spikes 7–14 cm long; rhachis appressed-

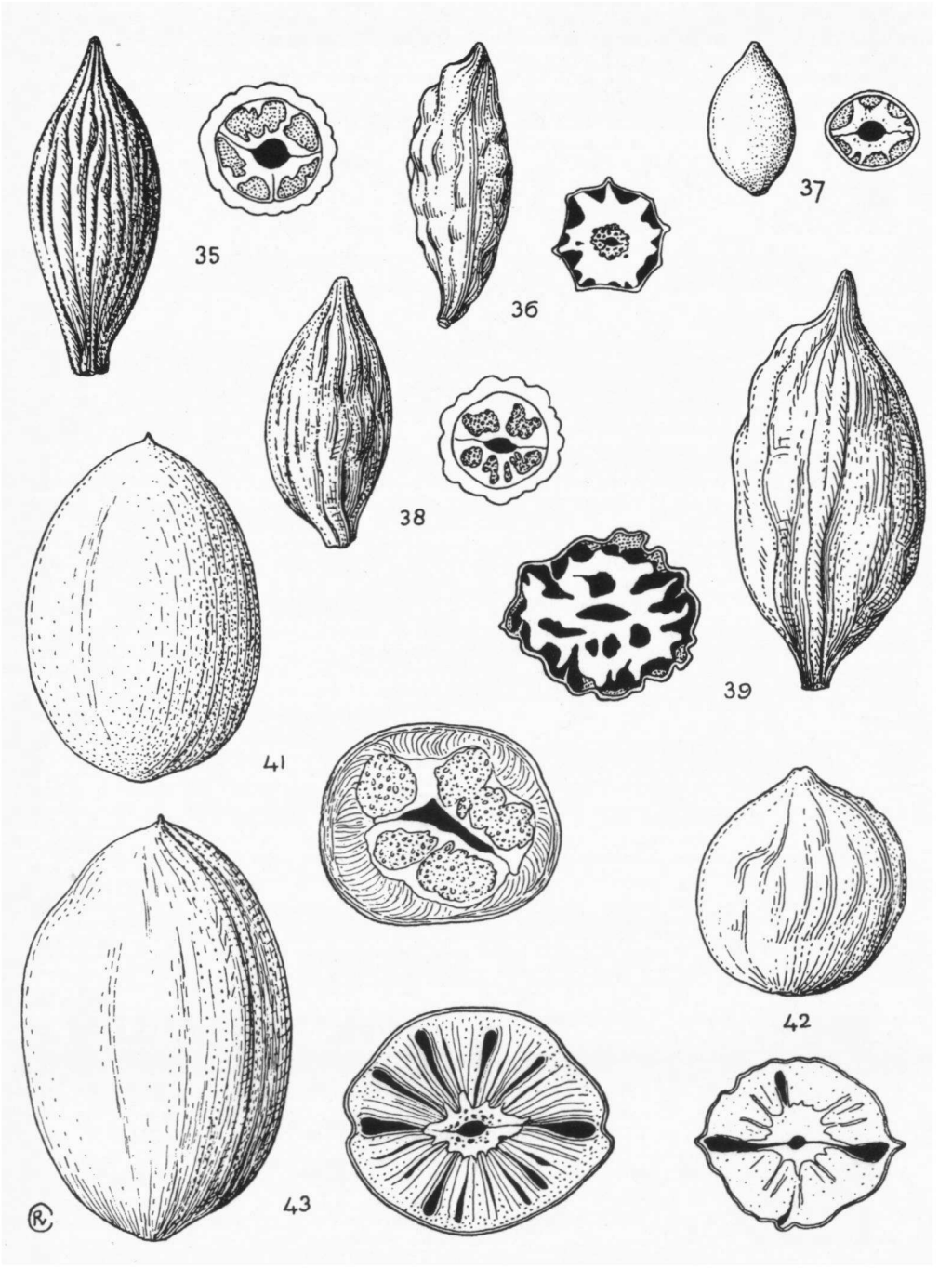

Fig. 22. Fruits of *Terminalia* numbered to correspond with the species in the text; a fruit of each species and its cross-section; all from herbarium material; loculus and hollows black, sclerenchyma white, alveolar tissue dotted; nat. size.—35. *T. nitens* (ELMER 18410), 36. *T. lundquistii* (LUNDQUIST 105), 37. *T. plagata* (RAMOS & EDAÑO 44338), 38. *T. pellucida* (ELMER 13241), 39. *T. papuana* (BRASS & VERSTEEGH 12542), 41. *T. foetidissima* (ELMER 18058), 42. *T. molii* (MOL 207), 43. *T. phellocarpa* (NGADIMAN SF 34743).

pubescent. Bracts pubescent, filiform, 2½ mm. *Lower receptacle* (ovary) densely tomentose or sericeous, 1½–3 mm; upper receptacle sericeous, shallow-cupuliform, 1 by 2½ mm. *Calyx*-lobes hairy outside glabrous within, ovate-triangular, often recurved, 2–2½ by 1½ mm. Filaments glabrous, 3½ mm; anthers 0.7 mm long. Disk barbate. Style glabrous 3½–5 mm. *Fruit* black when ripe, appressed-pubescent when young, glabrous when mature, ellipsoid, slightly compressed, 3½–4 by 2–2½ by 1.8 cm, apiculate, showing in cross-section a thick sclerenchymatous band with rather irregular spoke-like projections and included in the sclerenchyma a layer near the centre containing dispersed air-chambers.

Distr. Solomon Islands (Guadalcanar, Malaita and Isabel Islands), in *Malaysia:* E. New Guinea (Papua: Lower Fly River; Morobe and Budatobara). Fig. 23.

Ecol. Rain-forest, also in secondary grassland, from sea-level to 300 m.

Uses. The fruit is said to be eaten by the natives.

31. Terminalia kangeanensis SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 35, fig. 4.—**Fig. 14.**

Medium-sized tree. Young branchlets fairly stout at first with appressed fulvous or golden pubescence, later glabrescent. *Leaves* papyraceous or chartaceous, spirally arranged and crowded at the ends of the branchlets, appressed-pubescent when young, soon glabrescent, usually conspicuously minutely verruculose above and manifestly pellucid-punctate, sometimes (or perhaps more correctly at some stages) not verruculose and opaque, obovate, obovate-elliptic or elliptic, 10–17 by 5–9½ cm, rounded, obtuse or shortly acuminate at the apex, cuneate at the base; nerves 8–12 pairs, with glabrous or only slightly hairy domatia in their axils; petiole at first appressed-pubescent, eventually glabrescent, 2–3 cm. *Flowers* sessile, in axillary spikes 8–12 cm long; rhachis appressed-pubescent. Bracts not seen. *Lower receptacle* (ovary) densely sericeous 2½ mm long, narrowed at the apex then expanding into the shallow-cupuliform appressed-pubescent upper receptacle, 1 by 3 mm. *Calyx*-lobes ovate, triangular appressed-pubescent outside, glabrous inside, 2 by 2 mm. Filaments glabrous, 4 mm; anthers 0.4 mm long. Disk pilose. Style glabrous, 4 mm. *Fruit* glabrous when mature, ellipsoid, only slightly compressed, 2½–3½ by 1.3–1½ cm, rather obscurely longitudinally ridged, showing in cross-section a band of sclerenchymatous tissue round the loculus with about 5 spoke-like projections with rather large honey-combed air-chambers lying between them.

Distr. *Malaysia:* Java (Karimondjawa Islands?, N of Semarang), Kangean Arch. (N of Bali–Lombok). Fig. 23.

Ecol. Tree growing along the shore in the *Barringtonia* association and in mixed rain-forest on limestone at 50 m. The fruit appears adapted for water-distribution.

Notes. The fruits are less flattened than those of *T. microcarpa* and are somewhat smaller than those of *T. solomonensis*. The Karimondjawa specimen, KOORDERS 188 (BO), is sterile.

32. Terminalia celebica EXELL, Blumea 7 (1953) 325.—**Fig. 14.**

Tree, 20 m. Young branchlets glabrous and even the terminal bud has only a few hairs, growth sympodial. *Leaves* chartaceous, spirally arranged and ± crowded at the ends of the branchlets, glabrous, densely minutely verruculose above, obscurely pellucid-punctate or opaque, elliptic or narrowly elliptic, 7–15 by 3½–7 cm, acuminate at the apex, narrowly cuneate at the base; nerves 9–12 pairs; domatia scarcely conspicuous, glabrous; petiole glabrous, 1½–3 cm. *Flowers* yellowish, honey-scented, sessile, in axillary spikes 6–13 cm long; rhachis fulvous-tomentellous. Bracts at first conspicuous, glabrous, filiform, 3–9 mm, soon caducous, ♂ flowers very numerous and rather densely arranged at the upper end of the spike, with stalks 1½–3 mm long, ♀ flowers towards the base of the spike, less numerous. *Lower receptacle* (ovary) narrowed at the apex, sericeous, 2–2½ mm long, upper receptacle shallow-cupuliform, 1 by 2 mm, sparsely pubescent or nearly glabrous. *Calyx*-lobes almost glabrous, triangular, 2 by 1.2 mm. Filaments glabrous, 4–5 mm; anthers ½ mm long. Disk barbate. Style glabrous, 4 mm. *Fruit* glabrous, oblong-ellipsoid, somewhat laterally compressed, when dry 4–4½ by 1.8–2 by 1.4–1.6 cm, apiculate at the apex, showing in cross-section a band of sclerenchymatous tissue 3–4 mm thick, including in it some isolated air-chambers, especially in a ring round the loculus, and radially extended into 9–10 spoke-like projections with further air-chambers between them.

Distr. *Malaysia:* Central Celebes (Malili). Fig. 23.

Ecol. Primary forest, 250 m.

Vern. *Tolihe poete.*

Note. The structure of the fruit is very similar to that of *T. solomonensis* but it is longer and relatively narrower in shape and rather more compressed.

33. Terminalia beccarii EXELL, Blumea 7 (1953) 325.

Tree. Young branchlets sparsely appressed-pubescent at first, very soon becoming glabrous. *Leaves* chartaceous, spirally arranged along the branches, sparsely appressed-pubescent on the nerves otherwise glabrous, very obscurely verruculose, opaque, elliptic or obovate-elliptic, 7–14 by 4–7½ cm, acuminate at the apex, obtuse at the base, with 2 or more rather conspicuous glands, black when dried, near the base of the midrib and each extending along, or in the direction of, a lateral nerve; nerves 8–9 pairs, somewhat impressed above and prominent beneath; petiole sparsely appressed-pubescent or almost glabrous, 2–4 cm. *Flowers* (♂ not seen) in axillary spikes up to 18 cm long; rhachis glabrous or almost glabrous. Bracts not seen. *Lower receptacle* (ovary) glabrous 2 mm long; upper receptacle scarcely developed. *Calyx*-lobes ovate acute, 2 by

1½ mm, glabrous outside, pilose inside, recurved at the apex. Filaments glabrous, 4 mm; anthers ½ mm long. Disk barbate. Style glabrous, 4 mm. *Fruit* unknown.

Distr. *Malaysia:* New Guinea (Mt Arfak). Fig. 23.

Notes. For some remarks on the glands see EXELL (*l.c.*).

34. Terminalia soembawana SLOOT. Bijdr. Combr. (1919) 11; Bull. Jard. Bot. Btzg III, 6 (1924) 21 ('*sumbawana*').—*T. trivialis* SLOOT. *tom. cit.* (1924) 38, f. 5.—**Fig. 14.**

Tree 15 m. Young branchlets rather stout, at first golden or fulvous-sericeous, later appressed-pubescent, finally glabrous. *Leaves* papyraceous or chartaceous, spirally arranged at the ends of the branchlets, sparsely appressed-pilose or almost glabrous, manifestly minutely verruculose above, rather obscurely pellucid-punctate, obovate or obovate-elliptic, 7–20 by 4–8½ cm, rounded and usually acuminate or obtuse at the apex, cuneate at the base, usually with 2 black (when dried) glands on each side of the midrib about 5–10 mm from the base; nerves 10–16 pairs, domatia usually present but not hairy; petiole sericeous, eventually sparsely sericeous or nearly glabrous, 1–2 cm. *Flowers* in axillary spikes 5–10 cm long; rhachis appressed-pubescent. Bracts hairy, filiform, 1–2 mm, soon caducous. *Lower receptacle* (ovary) glabrous or nearly so, sometimes with a few appressed hairs, 1½–2½ mm long; upper receptacle glabrous, shallow-cupuliform, 1 by 2½–3 mm. *Calyx*-lobes deltoid or ovate, 1 by 1 mm, glabrous outside, hairy within. Filaments glabrous, 3–4 mm; anthers 0.6–0.7 mm long. Disk barbate. Style glabrous, 3½–4 mm. *Fruit* glabrous, ellipsoid, at both ends, 3–3½ by 1.3–1½ cm when dried, showing in cross-section a circular band of sclerenchymatous tissue surrounding the loculus extended into 4–6 very irregular, radial projections partially enclosing honey-combed air-chambers between them.

Distr. *Malaysia:* Lesser Sunda Islands (Kangean Arch., Sumbawa, and Timor). Fig. 23.

Ecol. Mixed forest, 70–240 m.

Vern. *Kětapang gunung*, Kangean.

Notes. In his note *sub T. trivialis* VAN SLOOTEN (*l.c.*) says '... it agrees with *T. edulis* (BLANCO) MERR., but it differs by its compressed, pilose, in sicco rugose fruit', a statement which may cause confusion. He certainly intended 'but *the latter* differs *etc.*' instead of 'but it differs' for the cited description of the fruit applies to that of *T. edulis* not *T. trivialis*.

35. Terminalia nitens PRESL, Abh. Kön. Böhm. Ges. Wiss. V, 6 (1851) 574; MERR. Philip. J. Sc. C. Bot. 4 (1909) 645; En. Philip. 3 (1923) 152.—*T. belerica var. laurinoides* (*non* CLARKE) FERN.-VILL. Novis. App. (1880) 80.—*T. merrillii* ELM. Leafl. Philip. Bot. 7 (1915) 2581.—**Fig. 22.**

Young branchlets at first sericeous appressed-pubescent, soon glabrescent. *Leaves* chartaceous, spirally arranged along the branchlets, sometimes somewhat crowded towards their tips, sometimes pseudo-whorled, usually glabrous or nearly so, occasionally pubescent on the nerves below, shining above, not verruculose, sometimes rather obscurely verruculose below, obovate, obovate-elliptic or narrowly obovate, 7–12 by 3½–6½ cm, rounded and sometimes acuminate at the apex, cuneate at the base; nerves 6–9 pairs; domatia present but usually not hairy; petiole glabrous or sparsely pubescent, 1–1½ cm, with 2 glands near the apex. *Flowers* sessile, in axillary spikes 7–10 cm long; rhachis golden-appressed-pubescent. Bracts glabrous or nearly so, filiform, 3–4 mm. *Lower receptacle* (ovary) usually glabrous rarely sparsely appressed-pubescent, 3–4 mm long; upper receptacle glabrous, shallow-cupuliform, 1 by 3–3½ mm. *Calyx*-lobes glabrous outside, hairy inside, broadly ovate or deltoid, 2 by 2 mm. Filaments glabrous, 4 mm; anthers 0.8 mm long. Disk barbate. Style glabrous, 4–5 mm. *Fruit* glabrous ellipsoid, attenuated at each end, often beaked at the apex, 3–5 by 1.8–2 cm, showing in cross-section a ring of sclerenchymatous tissue round the loculus extended radially into 5–6 spoke-like projections with relatively large air-chambers filled with alveolar tissue between them; exocarp rather thick and hard when dried.

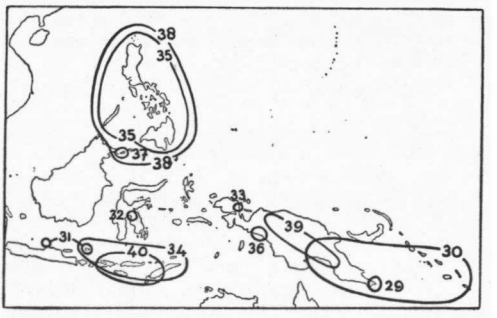

Fig. 23. Distribution of *Terminalia* series G: 29. *macadamii*, 30. *solomonensis*, 31. *kangeanensis*, 32. *celebica*, 33. *beccarii*, 34. *soembawana*, 35. *nitens*, 36. *lundquistii*, 37. *plagata*, 38. *pellucida*, 39. *papuana*, 40. *zollingeri*.

Distr. *Malaysia:* throughout the Philippines. Fig. 23.

Ecol. Primary forests at low and medium altitudes.

Wood anat. REYES, Commonw. Philip. Dept Agr. Techn. Bull. 7 (1938) 372.

Vern. *Anegep*, *arinbukal*, *kalautit*, *pongud*, Ilk., *bisal*, Pang., *dalinsi*, *daminsil*, *malagábi*, *pansaket*, Tag., *kalaotit*, Ig., *kalaupi*, Ibn., *kananaupong*, Mbo, *magatalishai* Bis., Mag., *magtalishai*, Bik., *mantalisi*, Sulu, *sakat*, Pamp., *samondo*, *tagit*, Tagb., *samuloko*, Bag., *tujongmanuk*, P. Bis.

36. Terminalia lundquistii EXELL, Blumea 7 (1953) 326.—**Fig. 22.**

Tree 21 m. Young branchlets rather stout, at

first rufous-sericeous, soon sparsely appressed-pubescent, at length glabrescent. *Leaves* subcoriaceous, spirally arranged, glabrous above, appearing resinous or glutinous beneath, almost glabrous or sometimes pubescent on the nerves, elliptic or obovate elliptic, 8–13 by 4½–8½ cm, somewhat acuminate at the apex, cuneate at the base; nerves 8–11 pairs with glabrous domatia; petiole at first rufous-sericeous, later sparsely appressed-pubescent or glabrous, 1½–2 cm. *Flowers* (not seen) in axillary spikes 14 cm long; rhachis almost glabrous. Bracts not seen. *Fruit* glabrous, ellipsoid, somewhat beaked at the apex, irregularly verrucose and also rather densely minutely verruculose, 4–5 by 1½–2 cm, showing in cross-section some honey-combed tissue around the loculus surrounded by a thick band of sclerenchyma with short radial spoke-like projections.

Distr. *Malaysia:* South New Guinea (Mimika). Fig. 23.

Ecol. Primary forest on sandy soil, 50 m.

Vern. *Keari.*

37. Terminalia plagata MERR. Philip. J. Sc. 30 (1926) 414.—**Fig. 22.**

Tree. Young branchlets densely fulvous-appressed-pubescent, later glabrescent. *Leaves* coriaceous or subcoriaceous, spirally arranged and somewhat crowded at the ends of the branchlets, shiny and glabrous above except for some appressed pubescence on the midrib, with close prominent reticulation, rather densely appressed-puberulous beneath, eventually nearly glabrous, spathulate or oblanceolate, 4–9 by 2–4 cm, rounded or blunt at the apex, cuneate at the base; nerves 7–10 pairs, with rather prominent domatia in their axils; petiole sericeous, 2–8 mm. *Flowers* unknown. *Fruits* at first sparsely appressed-pubescent, becoming glabrous, ellipsoid, 2–2.8 by 1.2–1½ cm, sometimes somewhat laterally compressed, beaked at the apex, showing in cross-section a stellate band of sclerenchymatous tissue about 2 mm thick round the loculus with some air-chambers included in it and with short radial projections and a relatively wide outer band of alveolar tissue.

Distr. *Malaysia:* Philippines: Sulu group (Tawi-Tawi Isl., close to NE. Borneo). Fig. 23.

38. Terminalia pellucida PRESL, Abh. Kön. Böhm. Ges. Wiss. V, 6 (1851) 574; MERR. Philip. J. Sc. C. Bot. 4 (1909) 644; En. Philip. 3 (1923) 152.—*T. sumatrana* (*non* MIQ.) NAVES in BLANCO, Fl. Filip. ed. 3 (1877–83) t. 200.—*T. iwahigensis* ELM. Leafl. Philip. Bot. 5 (1913) 1760.—**Fig. 22.**

Tree. Young branchlets considerably thickened at the tips, at first rufous-sericeous, soon glabrescent, growth sympodial. *Leaves* papyraceous to chartaceous or sometimes subcoriaceous, spirally arranged and crowded at the tips of the branchlets, sericeous when very young eventually glabrous or almost glabrous except for appressed pubescence on the midrib, conspicuously minutely verruculose above and pellucid-punctate at certain stages of development but these characters are not seen when the leaf is young and it becomes opaque as it grows old, obovate, narrowly obovate or obovate-spathulate, 5–12 by 2½–6½ cm, rounded at the apex, cuneate at the base; nerves 8–10 pairs, domatia present in their axils, sometimes hairy; petiole sericeous, eventually sparsely appressed-pubescent, or glabrous, ½–2 cm, usually with 2 glands at or above the middle. *Flowers* in axillary spikes 5–8 cm long; ♂ numerous, glabrous, 1½–2 mm stalked; ♀ sessile, fewer, towards the base of the spike, rhachis nearly glabrous. Bracts glabrous, filiform, 1 mm. *Lower receptacle* (ovary) glabrous, 1½–2 mm long; upper receptacle glabrous, shallow-cupuliform 1 by 2 mm. *Calyx*-lobes broadly deltoid, glabrous, 0.8 mm long. Filaments glabrous, 1½–2 mm (probably immature); anthers ½ mm long. Disk barbate. Style glabrous, 1½ mm. *Fruit* glabrous, ellipsoid, 2.2–4½ by 1.2–2 cm, often beaked and stipitate, showing in cross-section a complete ring of sclerenchymatous tissue 5–6 mm broad in which 5–6 irregular masses of alveolar tissue are embedded or the latter may be more developed at the expense of the sclerenchyma which is sometimes little more than a framework.

Distr. *Malaysia:* Philippine Islands (Luzon, Mindanao, Sulu Arch., and Palawan). Fig. 23.

Ecol. Forests at low altitudes.

Wood anat. REYES, Commonw. Philip. Dept Agr. Techn. Bull. 7 (1938) 367. Brief comments.

Vern. *Dalinsi*, *sobo-sobo*, Tag., *aritongtong*, *dulaoen*, Ilk., *hakit*, *sakut*, Sbl., *saket*, Pang., Sbl., *solo-solo*, Pamp., *aalisai-tandok*, Sulu, *upung-upung*, S. L. Bis.

Note. The specimens described as *T. iwahigensis* have rather larger fruits but there seems to be no difference in structure.

39. Terminalia papuana EXELL, Brittonia 2 (1936) 246.—*T. brassii* EXELL, *tom. cit.* (1936), *non T. brassii* EXELL (1935)—**Fig. 22.**

Large, deciduous tree, 20–30 m. Bark grey, grey-brown or black. Young branchlets stout, at first fulvous- or rufous-sericeous, later glabrescent. *Leaves* papyraceous, spirally arranged and crowded at the ends of the branchlets, very shiny above, sparsely pilosulose or glabrous, rather obscurely verruculose, appressed-pubescent below eventually glabrescent, manifestly but not very conspicuously pellucid-punctate, obovate to obovate elliptic, 10–20 by 5–13 cm, rounded and usually shortly acuminate at the apex, subcuneate or slightly cordate at the base; nerves 8–12 pairs, domatia usually present but without indumentum other than that covering the undersurface of the lamina; petiole appressed-pubescent, becoming nearly glabrous, 2–3 cm. *Flowers* white, sessile, in axillary spikes 5–10 cm long; rhachis appressed-pubescent. Bracts not seen. *Lower receptacle* (ovary) densely sericeous 2–3 mm long, upper receptacle scarcely developed. *Calyx*-lobes triangular, 1½ by 2 mm, subsericeous outside, nearly glabrous within. Filaments glabrous, 3 mm; anthers 0.8 mm long. Disk barbate. Style glabrous, 3 mm. *Fruit* glabrous when mature, ellipsoid, not laterally compressed, 5–6 by 2½–3 cm, beaked or apiculate at

the apex, shortly stipitate at the base, showing in cross-section an irregular mass of sclerenchymatous tissue enclosing pockets of alveolar tissue, which breaks down to form air-chambers.

Distr. *Malaysia:* New Guinea (Idenburg River, Bernhard Camp, and Mafulu). Fig. 23.

Ecol. Rain-forest, from the flood-plains up to 850–1200 m.

Note. The description of the fruit is taken from BRASS & VERSTEEGH 12542 (A) from Idenburg River, Bernhard Camp. It has been a puzzle which fruiting specimens to correlate with the flowering material described as *T. papuana*. It is to be hoped that the right choice has been made. Other as yet unindentified specimens from lower altitudes with much smaller fruits are also very similar in leaf.

40. Terminalia zollingeri EXELL, *nom. nov.*—*T. mollis* T. & B. [Cat. Hort. Bog. 1855, 252 *ined.*] *ex* SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 30, f. 2, *non T. mollis* OLIV. (1871).—*T. macrocarpa* SLOOT. *op. cit.* 4 (1922) 282, *nomen nudum*, *non T. macrocarpa* KURZ (1877), *nomen nudum*.—**Fig. 24.**

Tree, 30 m. Young branchlets fulvous-tomen-

Fig. 24. *Terminalia zollingeri* EXELL. *a.* Flowering branch, × 1/2, *b.* ♀ flower, × 3 1/2, *c.* ♂ flower, × 3 1/2, *d.* ♀ flower in longitudinal section, × 3 1/2, *e.* fruit, × 1/2, *f.* stone, × 1/2 (after VAN SLOOTEN).

tose, somewhat or considerably thickened. *Leaves* chartaceous to coriaceous, crowded at the ends of the branchlets, pubescent above, fulvous-tomentose or densely pubescent beneath, obovate, narrowly obovate or oblanceolate, 10–28 by 3½–11½ cm, rounded, acute or acuminate at the apex, cuneate at the base; nerves 10–20 pairs; domatia sometimes present but usually not very conspicuous; petiole fulvous-tomentose, rather stout, 3–30 mm. *Flowers* greenish, in axillary spikes 10–18 cm long; rhachis fuscous-tomentose. Bracts early caducous. *Lower receptacle* (ovary) appressed-pilose, 3–4 mm long; upper receptacle rather sparsely appressed-pubescent, shallow-cupuliform, 1 by 3 mm. *Calyx*-lobes outside hairy towards the base, inside glabrous, deltoid, 1½ by 1½ mm. Filaments glabrous, 4 mm; anthers ½ mm long. Disk barbate. Style glabrous, 3 mm. *Fruit* at first appressed-pubescent, glabrous when mature, oblong-ellipsoid, scarcely compressed, 4½–7½ by 2½–4 cm.

Distr. *Malaysia:* Lesser Sunda Islands (Sumbawa, West Timor). Fig. 23.

Ecol. From sea-level to 900 m.

Vern. *Nismeten, sarisedoro, sĕrisè*, Sumbawa, Timor.

Note. The name *Terminalia mollis* T. & B. first occurs in a catalogue of the Buitenzorg Botanic Garden printed in 1855 but the issue was deliberately suppressed and only 2 copies were kept for internal use in the curator's office at Bogor, and are now incorporated in the Bibliotheca Bogoriensis so that names in it cannot be considered as validly published in spite of VAN SLOOTEN's opinion (*l.c.*) to the contrary. For a fuller discussion see VAN STEENIS (Bull. Jard. Bot. Btzg III, 13, 1933, 117). This standpoint as regards Cat. Hort. Bog. (1855) allows the retention of *T. mollis* OLIV. for the African species.

41. Terminalia foetidissima GRIFF. Not. Pl. As. 4 (1854) 685; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 445; KING, J. As. Soc. Beng. 66, 2 (1897) 331; RIDL. Fl. Mal. Pen. 1 (1922) 704; CRAIB, Fl. Siam. En. 1 (1931) 621; BURK. Dict. (1935) 2141.—*T. sumatrana* MIQ. Fl. Ind. Bat. Suppl. (1860) 326; SLOOT. Bijdr. Combr. (1919) 18; Bull. Jard. Bot. Btzg III, 6 (1924) 27, f. 1.—*Myrobalanus foetidissima* KUNTZE, Rev. Gen. Pl. (1891) 237.—*T. oocarpa* MERR. Govt Lab. Publ. Philip. 17 (1904) 32 ('*ovocarpa*'); Philip. J. Sc. C. Bot. 4 (1909) 644; En. Philip. 3 (1923) 152.—*T. ellipsoidea* MERR. *tom. cit.* (1904) 33.—*T. borneensis* SLOOT. Bijdr. Combr. (1919) 14; Bull. Jard. Bot. Btzg III, 6 (1924) 27, *non T. borneensis* RIDL. (1938).—**Fig. 22, 25.**

Tree up to 30 m by 75 cm. Young branchlets rather stout, rufous- or silvery-tomentose or sericeous soon glabrescent. *Leaves* chartaceous to subcoriaceous, spirally arranged along the branchlets or often crowded towards their tips, appressed-pubescent when young, usually glabrous or nearly glabrous when mature, sometimes rufous-pubescent on the nerves beneath, sometimes rather sparsely or more densely minutely verruculose above and at times beneath, usually opaque or very obscurely pellucid-punctate, sometimes somewhat glaucous beneath, obovate, narrowly obovate or obovate-elliptic, 6–19 by 2½–10 cm, rounded, shortly acuminate or obtuse at the apex, narrowly cuneate at the base; nerves 6–8 pairs, rather widely spaced, domatia usually present, mostly glabrous; petiole usually glabrous sometimes sparsely appressed-pubescent, 1–2½ cm, usually with 2 glands at or near the middle. *Flowers* sessile, in axillary spikes 10–16 cm long, rhachis appressed-pubescent or glabrous. Bracts filiform, hairy, 2 mm. *Lower receptacle* (ovary) rufous-tomentose or sericeous 2–2½ mm long; upper receptacle scarcely developed. *Calyx*-lobes triangular pubescent or nearly glabrous, 2 by 1½ mm. Filaments glabrous, 3–4 mm; anthers ½ mm long. Disk barbate. Style glabrous 3–4 mm. *Fruit* hairy at first, glabrous when mature, subglobose or ovoid, slightly laterally compressed (sometimes appearing more flattened due to drying), 3½–5 by 3–4 cm, showing in cross-section thin irregular bands of sclerenchyma enclosing masses of alveolar tissue, the whole surrounded by a layer 3–5 mm thick of a spongy or fibrous nature.

Distr. Lower Burma (Mergui), Lower Siam (Puket), in *Malaysia:* Sumatra, Malay Peninsula, Borneo, Philippines. Fig. 26.

Ecol. Primary forests at low altitudes.

Wood anat. (*T. oocarpa* MERR.) REYES, Commonw. Philip. Dept Agr. Techn. Bull. 7 (1938) 373.

Vern. Mal. Pen.: *djĕlawai, pĕlawai, gĕlawai*, M; Sumatra: *djaha koling, kaju kunjit, k. ngtari, kĕtapang kantjil, k. talang*, Palemb., *djĕdjaho*, Lampongs, *marasĕsap*, E. Kutai, *kĕtapang gunung*, Pleihari, *semundo*, N. Born.; Philippines: *alilem, kalusit*, Ibn., *balinsil, paang-baliuis, talisai del monte, talisai gúbat*, Tag., *bangkaláuag, malagábi*, P. Bis., *dalinsi, dalinsoi*, Tag., Bik., *hakit*, Sbl., *kalutit, purukan*, Ilk., *magtalisai*, Bis., Mbo.

Uses. The timber is said to be not very durable. Bark is used in Palembang as a yellow or brown dye.

42. Terminalia molii EXELL, Blumea 7 (1953) 324.—**Fig. 22.**

Tree 30 m. Young branchlets slender, at first rufous or fulvous-tomentellous, later becoming glabrous. *Leaves* spirally arranged along the branchlets or somewhat crowded towards their tips, subcoriaceous, shiny and almost glabrous above, very obscurely verruculose, sparsely puberulous on the nerves below, opaque, obovate-elliptic, 2½–7 by 1½–3.2 cm, rounded at the apex, rounded to subcuneate at the base; nerves 5–6 pairs, rather widely spaced, with glabrous domatia in their axils; petiole puberulous, 8–15 mm, with 2 glands near the apex. *Flowers* not known. *Fruit* subglobose, 3½ by 3 cm when dried, shiny, glabrous, corky, showing in cross-section only a narrow band of sclerenchymatous tissue round the loculus surrounded by a broad corky layer.

Distr. *Malaysia:* Central Sumatra (Upper Indragiri, Tapanuli and Priaman). Fig. 26.

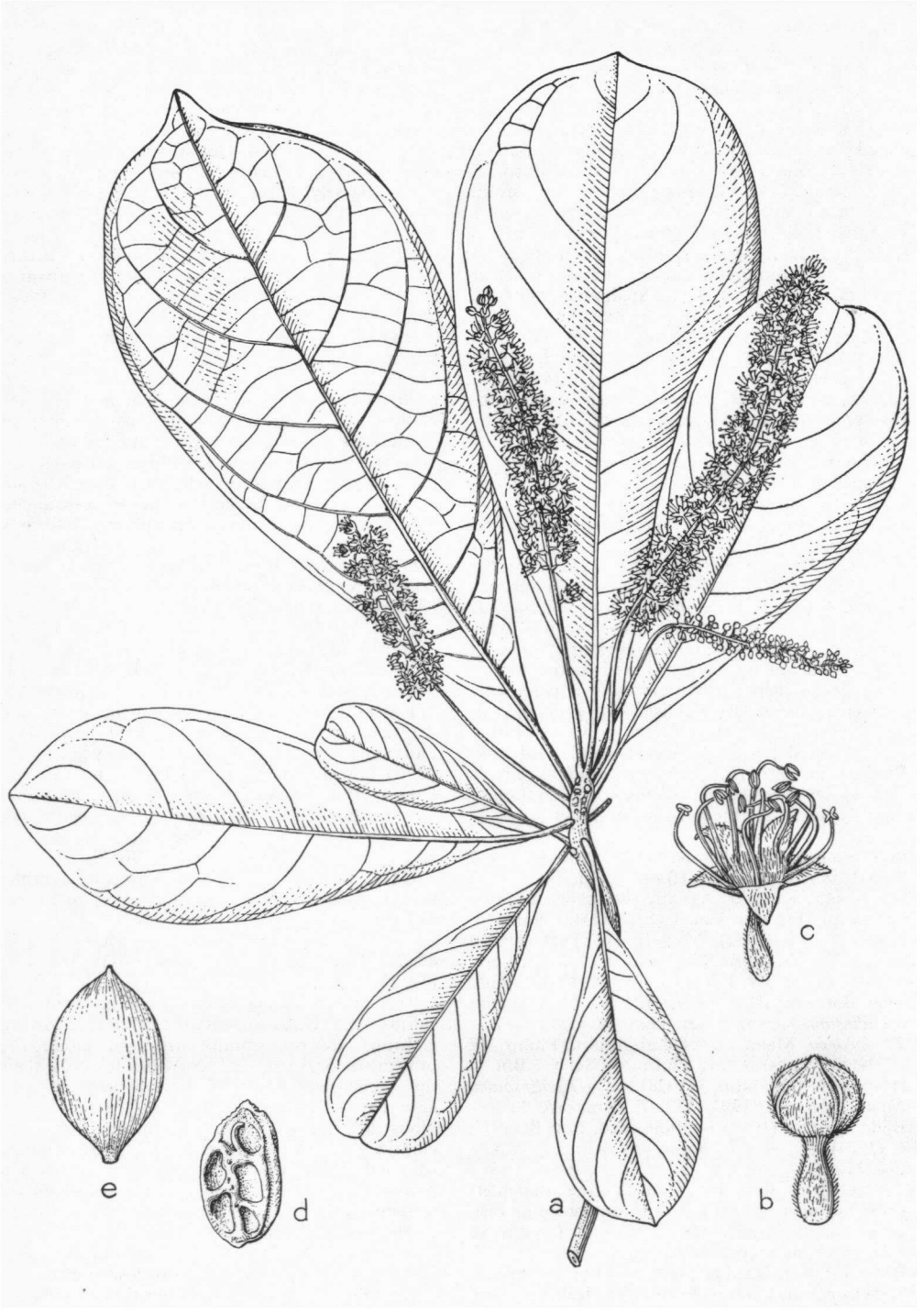

Fig. 25. *Terminalia foetidissima* GRIFF. *a.* Flowering branch, × 2/3, *b.* bud, × 6, *c.* flower, × 5, *d.* stone, × 2/3, *e.* fruit, × 2/3 (after VAN SLOOTEN).

Ecol. Primary forest from sea-level to 10 m.
Vern. *Katuko*, Pariaman, *simar kulihap*, Tapanuli.

43. Terminalia phellocarpa KING, J. As. Soc. Beng. 66, 2 (1897) 330; RIDL. Fl. Mal. Pen. 1 (1922) 705; BURK. Dict. (1935) 2141; CORNER, Wayside Trees (1940) 194.—**Fig. 22.**

Tree 12–20 m. Young branchlets rufous-appressed-pilose, slender. *Leaves* subcoriaceous, spirally arranged, somewhat crowded at the ends of the branchlets, at first appressed-pubescent especially on the nerves, later almost glabrous, rather shiny above, not verruculose, opaque, elliptic to obovate, 3½–8 by 1½–4½ cm, rounded at the apex, cuneate to rounded at the base; nerves 5–6 pairs with glabrous domatia; petiole at first appressed-pubescent later glabrescent, 8–18 mm, usually with 2 glands a little above the middle. *Flowers* sessile, in axillary spikes 3–4 cm long, rhachis appressed-pubescent. Bracts filiform, hairy, 2 mm. *Lower receptacle* (ovary) rufous-tomentellous, 1½ mm long; upper receptacle scarcely developed. *Calyx*-lobes hairy, ovate-triangular, 2 by 1 mm, reflexed at the tips. Filaments glabrous, 3 mm; anthers 0.8 mm long. Disk barbate. Style not seen (♂ flowers all immature). *Fruit* glabrous or nearly glabrous when mature, ellipsoid or suborbicular ± laterally compressed, 6–7 by 4–5 by 3–3½ cm, usually shortly beaked at the apex showing in cross-section a very narrow band of sclerenchyma round the loculus and a thick corky layer with radiating fibres.

Distr. *Malaysia:* Sumatra (Palembang) and Malay Peninsula (Kedah, Perak, Malacca, Selangor, Johore, Singapore). Fig. 26.

Ecol. Swamp forests at low altitudes.

Vern. *Jělawai, měmpělam babi* (pig's mango), *pauh kijang* (barking deer's mango, by confusion with *Irvingia*), *pělawai*; *tělisai*, Johore, *rěnjang*, Mal. Pen.

Notes. According to CORNER (*l.c.*) the fruits are distributed mainly by floodwater floating them through the forest. This seems to be the *Terminalia* species most completely adapted for water-distribution. The specimens from Sumatra have relatively broader, flatter fruits but material is insufficient to decide whether this difference is constant.

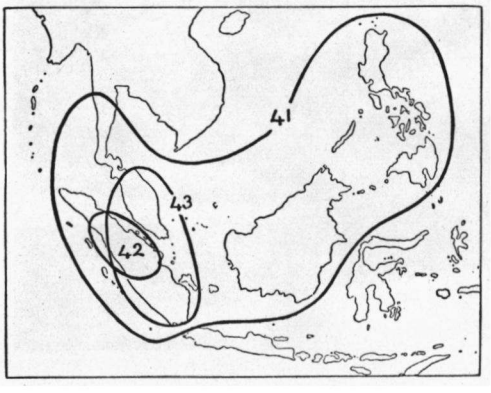

Fig. 26. Distribution of *Terminalia* series H: 41. *foetidissima*, 42. *molii*, 43. *phellocarpa*.

44. Terminalia copelandii ELMER, Leafl. Philip. Bot. 5 (1913) 1759; MERR. En. Philip. 3 (1923) 151.—*T. crassiramea* MERR. Philip. J. Sc. C. Bot. 12 (1917) 28; *l.c.* (1923).—*T. gigantea* SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 33, f. 3.—*T. catappoides* WHITE & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 249, f. 13.—**Fig. 27, 29.**

Large tree up to 40 m. Bark grey or brown; sapwood whitish. Young branchlets much thickened, rufous-sericeous, becoming glabrous. *Leaves* spirally arranged, crowded at the thickened ends of the branchlets, rufous-tomentose when young, later sparsely appressed-pubescent or nearly glabrous, shining above, rather sparsely appressed-pubescent and sometimes minutely verruculose beneath, usually opaque, obovate-cuneate, 15–40 by 4½–18 cm, rounded at the apex, narrowly cuneate below the middle and usually subcordate at the base; nerves 24–30 pairs, almost perpendicular to the midrib and rather closely spaced, domatia present but rather inconspicuous and not hairy; petiole thick, at first rufous-sericeous, becoming nearly glabrous, 5–10 mm. *Flowers* white, in axillary spikes 25–50 cm long; rhachis fulvous-tomentellous. Bracts filiform, 2 mm, soon caducous. ♂ Flowers numerous with appressed-pubescent stalks 3–5 mm long; ♀ flowers few, sessile towards the base of the spike. *Lower receptacle* (ovary) fulvous-sericeous, 3–6 mm long, narrowed at the apex into a slender stalk above the ovary; upper receptacle nearly glabrous, shallow-cupuliform, 1 by 3 mm. *Calyx*-lobes glabrous or nearly so, ovate-acuminate, 2 by 1½ mm. Filaments glabrous, 3½–4½ mm; anthers ½–0.6 mm long. Disk barbate. Style glabrous, 4 mm. *Fruit* sparsely appressed-pilose or nearly glabrous when mature, ovoid or ellipsoid, sometimes slightly laterally compressed, sometimes rather obscurely 5-lobed, often shortly beaked at the apex, 3½–6 by 2.2–3 cm, showing in cross-section very irregular and sinuate sclerenchymatous tissue partly enclosing and partly surrounded by alveolar tissue and a band of corky tissue 2–3 mm thick round the outside.

Distr. *Malaysia:* Sumatra (Simalur Isl., East and South coasts, Enggano, Krakatau), Borneo, Philippines, Lesser Sunda Islands (Flores), Celebes (Menado, Palopo, Buton Isl.), Moluccas (Talaud, Ternate, Sula, Ceram) and New Guinea. Fig. 28.

Ecol. Primary forests up to 500 m.

Wood anat. (*T. crassiramea* MERR.) REYES, Commonw. Philip. Dept Agr. Techn. Bull. 7 (1938) 366. Brief comments.

Uses. The timber is said to be similar to that of *T. catappa* L. The fruits are edible.

Vern. *Kětapang*, M, *kětapang darat, kědawang*, Bencoolen, *měrtapang, lahajang pajo*, Simalur, *katapang*, Karo; Philippines: *lanipáu*, S.L. Bis., C. Bis., Mbo., *nipon*, Bag., *talisai*, Tagb., *yanipó*, Mbo; *dalipo*, Palopo, *tusawara*, Sula.

Fig. 27. *Terminalia copelandii* ELMER. River bank of Kuala Bahewa, Karakelong Island (Talaud) (H. J. LAM).

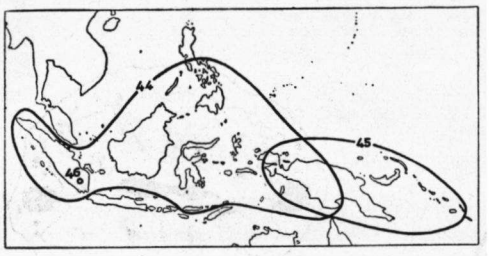

Fig. 28. Distribution of *Terminalia* series I: 44. *copelandii*, 45. *kaernbachii*, 46. *adenopoda*.

Notes. This is one of the largest leaved species of *Terminalia*. Sterile specimens may at times be confused with those of *T. catappa* owing to the fact that both species have obovate leaves with subcordate bases. The leaves of *T. copelandii* are relatively longer and narrower and have more numerous, more closely spaced lateral nerves. The inflorescences are usually longer and the fruits less compressed.

A sterile specimen collected at Endeh in Flores Island (FRI *bb.* 8923) may belong to this species.

45. Terminalia kaernbachii WARB. Bot. Jahrb. 18 (1893) 201; K. SCHUM. & LAUT. Fl. Deut. Schutzgeb. Südsee (1901) 466; DIELS, Bot. Jahrb. 57 (1912) 428; EXELL, J. Arn. Arb. 20 (1939) 318; C. T. WHITE, J. Arn. Arb. 31 (1950) 100.—*T. okari* C. T. WHITE, Proc. R. Soc. Queensl. 34 (1922) 46.—Fig. 29.

Buttressed tree, 35–45 m, with a large, spreading crown. Outer bark grey or grey-brown; inner purple or mauve, then brown against the cambium. Sapwood poorly defined, light with concentric wavy rings, sometimes almost porous. Young branchlets fulvous-tomentose, stout or very stout. *Leaves* coriaceous, spirally arranged along the branchlets, sometimes rather crowded in whorls towards the tips, finely reticulate above, somewhat shiny, remaining tomentose on the midrib and principal nerves, obscurely minutely verruculose, fulvous or rufous-tomentose below especially on the nerves, finally becoming nearly glabrous, rather obscurely pellucid-punctate at some stages of development, obovate-elliptic, narrowly obovate-elliptic or obovate-oblong, 12–35 by 5–12 cm, rounded and sometimes shortly acuminate or mucronate at the apex, cuneate or occasionally rounded at the base sometimes with 2 conspicuous black glands; nerves 10–18 pairs, domatia absent or inconspicuous; petiole fulvous- or rufous-tomentose or tomentellous, 1–2 cm, occasionally with 2 glands at or near the middle. *Flowers* sessile, rather large for the genus, in axillary spikes 10–12 cm long; rhachis fulvous- or rufous-tomentose. Bracts hairy, caducous, 1 mm long. *Lower receptacle* (ovary) fulvous-tomentellous, 5 mm long; upper receptacle shallow-cupuliform, fulvous-tomentellous, 2–2½ by 6–7 mm. *Calyx*-lobes fulvous-tomentellous, broadly ovate-deltoid, 2½ by 2½–3 mm. Filaments glabrous, 6–12 mm; anthers 0.8 mm long. Disk densely pilose. Style glabrous, 5–8 mm. *Fruit* red, fleshy, at first tomentose, nearly glabrous when ripe, ellipsoid, more or less laterally compressed, 6–17½ by 4–8 by 3½–6 cm, slightly beaked at the apex, the endocarp showing in cross-section a broad band of very hard sclerenchymatous tissue including in it some irregularly shaped and irregularly spaced air-chambers and a rather large loculus (up to 2½ by 2 cm in larger fruits) containing the edible kernel.

Distr. Solomon Islands (New Georgia), in *Malaysia:* New Guinea, S. Moluccas (Aru Islands). Fig. 28.

Ecol. Common in rain-forests and riverine forests up to 1000 m.

Uses. The wood is medium hard inclined to be brittle. The fruit, which is by far the largest known in the Combretaceae, is edible, the kernel being one of the best-flavoured tropical nuts and a favourite article of diet among the natives.

Vern. *Okari*, standard, *e mān*, Finschhafen.

46. Terminalia adenopoda MIQ. Fl. Ind. Bat. Suppl. (1860) 327; SLOOT. Bijdr. Combret. (1919) 21; Bull. Jard. Bot. Btzg III, 6 (1924) 40.

Tree. *Leaves* papyraceous, glabrous when old except for some reddish hairs on the midrib and on the principal veins below, narrowly obovate-cuneate or narrowly oblong-elliptic, 25–35 by 9–12 cm, obscurely pellucid-punctate, sometimes rather prominently sparsely verruculose above (? pathological); nerves 14–17 pairs, without domatia; petiole with remains of a fulvous tomentum, 1½–3½ cm, with 4 or more glands. *Flowers* and *fruits* unknown.

Distr. *Malaysia:* Sumatra (Palembang: Baturadja). Fig. 28.

Vern. *Kaju kèdjoh*, M.

Note. Only known from the inadequate original collection, TEYSMANN 3692 (BO, L, U) consisting of detached leaves and portions of branchlets. The material is in poor condition and both the rather sparse wart-like projections on the upper surface of leaf and the numerous 'glands' on the petiole may be pathological. In spite of the paucity of material there is enough to make it probable that the species is indeed a *Terminalia* and one not identifiable with any other known Sumatran species.

PELLA 12 from Celebes which VAN SLOOTEN (*l.c.* 1924) mentioned in a note *sub T. adenopoda*, though he rightly did not consider it to be the same, is probably *T. copelandii* ELM.

47. Terminalia canaliculata EXELL, Blumea 7 (1953) 327.

Semi-deciduous buttressed tree, 30 m. Bark brown or pale brown, flaky. Sapwood pale, heartwood red-brown. Young branchlets at first appressed-pubescent soon becoming sparsely pubescent or glabrous, growth sympodial. *Leaves* chartaceous, spirally arranged and somewhat crowded towards the ends of the branchlets, appressed-pubescent when young, soon glabrescent, obovate,

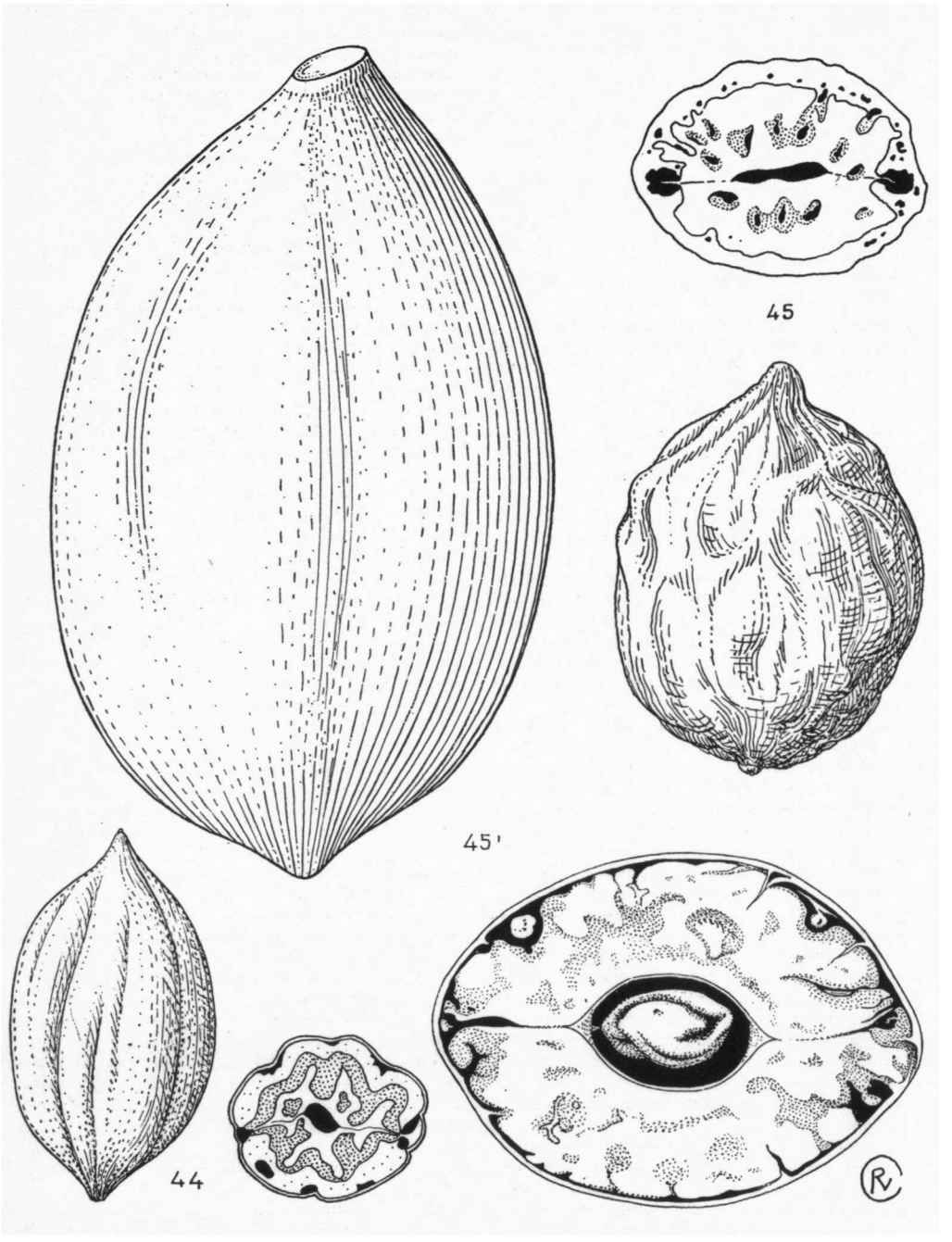

Fig. 29. Fruits of *Terminalia* numbered to correspond with the species in the text; of each species a fruit and its section; all from herbarium material; loculus and hollows black, sclerenchyma white, alveolar tissue dotted; nat. size.—44. *T. copelandii* (IDRIS 19), 45. *T. kaernbachii* (BRASS 6973) & 45'. *T. kaernbachii* (CARR 12239) (seed drawn in the section!) showing variation in size.

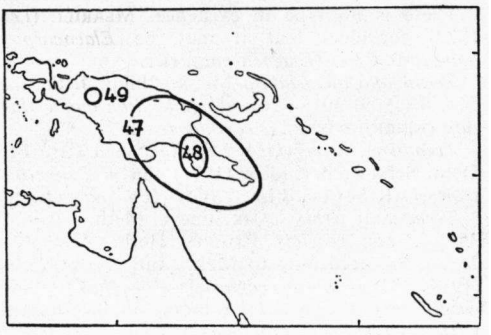

Fig. 30. Distribution of *Terminalia* series J, K, and L: 47. *canaliculata*, 48. *archboldiana*, 49. *capitulata*.

obovate-elliptic or elliptic, 8–15 by 4–7 cm, rounded and shortly acuminate at the apex, cuneate at the base, with numerous transverse canal-like mucilage cavities conspicuously visible with a lens on the upper surface and appearing translucent with transmitted light; nerves 9–13 pairs; domatia frequent, usually showing perforations of the lamina; petiole sparsely appressed-pubescent or glabrous, 1½–3 cm. *Flowers* white, in axillary spikes 10–13 cm long; rhachis appressed-pubescent. Bracts caducous. ♂ Flowers stalked; stalk appressed-pubescent, 1–1½ mm; ♀ fewer, at the base of the spike, sessile. *Lower receptacle* (ovary) sericeous, 2–2½ mm long; upper receptacle scarcely developed. *Calyx*-lobes sparsely pubescent outside, pilosulose inside, triangular 2½ by 1½ mm. Filaments glabrous, 3 mm; anthers ½ mm long. Disk barbate. Style unknown. *Fruit* unknown.

Distr. *Malaysia:* New Guinea (Papua: Palmer River, Oriomo River, and Milne Bay). Fig. 30.

Ecol. Canopy tree in forests on the lower ridges and swampy flats at low altitude.

Vern. *Kama*, Upper Waria, *gara*, Oriomo River.

Note. This species is remarkable for the linear markings on the upper surface of the leaf. These are translucent when the leaf is held up to the light. Dr C. A. REINDERS-GOUWENTAK describes them as canal-like cavities containing mucilage found above the xylem of the smaller veins and within the xylem of the larger and medium-sized veins.

48. Terminalia archboldiana EXELL, Brittonia 2 (1936) 137.

Tree up to 30 m, with flatly spreading branches. Bark pale brown, fissured, scaly; wood hard, yellow-brown. Young branchlets slender, minutely appressed-puberulous, buds sericeous. *Leaves* coriaceous or subcoriaceous, spirally arranged, sometimes whorled or crowded towards the ends of the branchlets, shiny and sparsely appressed-pubescent or glabrous above, appressed-pubescent eventually glabrescent beneath, not or rather obscurely verruculose, opaque, obovate or obovate-elliptic, 3–7 by 1½–3½ cm, rounded or blunt at the apex, cuneate at the base, 2 glands sometimes present on the midrib 5–10 mm from the base; nerves 5–6 pairs; domatia often present but usually not hairy; petiole appressed-pubescent, 2–4 mm. *Flowers* sessile, white, greenish or yellowish, buds pointed, in short, axillary, sometimes subcapitate spikes 2½–3 cm long; rhachis sericeous. Bracts sericeous, 1–2 mm, early caducous. *Lower receptacle* (ovary) 1½–2½ mm long, sericeous; upper receptacle scarcely developed. *Calyx*-lobes sericeous or almost glabrous, recurved, triangular, 2 by 1½ mm. Filaments glabrous, 2 mm; anthers 0.4 mm long. Disk barbate. Style glabrous, 3 mm. *Fruit* sericeous when young, later more sparsely appressed-pubescent, subglobose to ellipsoid, when dried 8 by 7 mm (perhaps immature).

Distr. *Malaysia:* E. New Guinea (Papua: Rona and Kanosia) Fig. 30.

Ecol. A common tree in hillside rain-forest at 450 m, found in open savannah at the same altitude; also recorded in forest at Kanosia at 15 m.

Note. L. J. BRASS describes this species as a common tree up to 30 m high growing in hillside forest at Rona, Laloki River and it was originally described from BRASS 3642 from this locality. C. E. CARR found it again in open savannah in the same district and at the same altitude but described it as a tree of 5 m. He also collected it in forest at Kanosia nearly at sea-level and again described it as a tree only 5 m high. I feel convinced that the material all belongs to the same species and it is of course possible that CARR's specimens came from young trees. The ecological data clearly need verification.

49. Terminalia capitulata EXELL, Blumea 7 (1953) 322.

Tree 17 m by 120 cm; crown wide-spreading. Bark thick, black, scaly, rough. Young branchlets rufous-sericeous. *Leaves* subcoriaceous, spirally arranged and more or less crowded towards the ends of the branchlets, at first densely rufous-sericeous becoming sparsely sericeous-pilose on both surfaces, conspicuously and rather densely minutely verruculose above, rather inconspicuously so beneath, pellucid-punctate, obovate, 1½–4½ by 0.7–2.6 cm, usually rounded at the apex and cuneate at the base; nerves 5–7 pairs, with domatia in their axils; petiole rufous-sericeous, 3–7 mm. *Flowers* white, sessile, in 3–6-flowered pseudo-capitulae with peduncle up to 4 cm long provided with 2–3 bracts, 2–3 mm long, at the apex. *Lower receptacle* (ovary) rufous-sericeous, 1½–2 mm long; upper receptacle scarcely developed. *Calyx*-lobes rufous-sericeous outside, glabrous inside, triangular or ovate-triangular, acute, 2 mm long. Filaments glabrous, 2 mm; anthers 0.3 mm long. Style glabrous, 2 mm. *Fruit* unknown.

Distr. *Malaysia:* W. New Guinea (Balim River). Fig. 30.

Ecol. Primary forest on river bank, 1600 m.

Note. The structure of the inflorescence is very unusual in *Terminalia*.

50. Terminalia oxyphylla MIQ. Fl. Ind. Bat. Suppl. (1860) 326; SLOOT. Bijdr. Combret. (1919) 21; Bull. Jard. Bot. Btzg III, 6 (1924) 41.

Tree. *Leaves* membranaceous (young) crowded at the ends of the branches, glabrous, not verruculose, narrowly elliptic, narrowly obovate-elliptic or oblanceolate, 8–20 by 3–6½ cm, acuminate at the apex, cuneate at the base; petiole 4 cm long, without glands. *Flowers* and *fruits* unknown.

Distr. *Malaysia:* Sumatra (W. Coast).

Note. Only known from the type gathering, TEYSMANN 850 (BO, L, U); leaves only.

Cultivated species

The following species are cultivated in various Malaysian gardens: *T. arjuna* (ROXB.) W. & A., *T. chebula* RETZ. and *T. fatraea* (POIR.) DC. The latter species, owing to mis-identification, is variously referred to in the literature as *Bucida buceras*, *Bucida nitida* and *T. nitida*.

Wood anat. *T. chebula* RETZ.: PEARSON & BROWN, Comm. Timb. 1 (1923) 509; (*T. arjuna* BEDD.) PEARSON & BR. p. 516.

Excluded species

Terminalia magarapali VIDAL, Sinops. Atl. (1883) 26, t. 48, f. c; MERR. Philip. J. Sc. C. Bot. 4 (1909) 643; En. Philip. 3 (1923) 151.

There is no type in existence. MERRILL (*l.c.* 1923) considers that it may be *Elaeocarpus monocera* CAV. (*Elaeocarpaceae*).

Terminalia quadrialata MERR. Philip. J. Sc. C. Bot. 4 (1909) 301 = *Combretodendron quadrialatum* (MERR.) MERR. (*Lecythidaceae*).

Terminalia trinervia K. SCHUM. & LAUT. Fl. Deut. Schutzgeb. Südsee (1901) 466 = *Bennettia trinervia* (K. SCHUM. & LAUT.) GILG (*Flacourtiaceae*).

Terminalia vernix LAMK, Encyc. Méth. 1 (1783) 350.—*Arbor vernicis* RUMPH. Herb. Amb. 2: 259, t. 86, according to MERR. Int. Herb. Amb. (1917) 331 = *Gluta renghas* L. ('*benghas*') (*Anacardiaceae*). *T. angustifolia* JACQ., an illegitimate name-change for *Croton bentzoe* L. (= *Terminalia bentzoe* (L.) L. *f.*), has been confused with this species (see MIQ. Fl. Ind. Bat. 1, 1, 1885, 599 and SLOOT. Bull. Jard. Bot. Btzg III, 6, 1924, 42).

Insufficiently known species

Terminalia amboinensis HORT. *ex* STEUD. Nomencl. ed. 2, 2 (1841) 668, *nomen nudum.*

Terminalia curranii MERR. *ex* E. E. SCHNEIDER, Bull. Bur. For. Philip. *no* 14 (1916) 197, *nomen nudum.* This is said 'to be known from one specimen from Laguna; no wood specimen present'. No type has been seen; it may represent possibly either *T. nitens* PRESL. or *T. foetidissima* GRIFF.

4. CALYCOPTERIS

LAMK, Ill. Gen. (1791–6) t. 357; Tabl. Enc. 2 (1819) 485.—*Getonia* ROXB. Pl. Corom. 1 (1798) 61, t. 87.

Scandent shrubs. *Leaves* opposite or subopposite. *Flowers* ♀, 5-merous, shortly pedicelled or subsessile in terminal leafy panicles. Receptacle (calyx-tube) divided into a lower part (*lower receptacle*) surrounding and adnate to the ovary and an upper campanulate part (*upper receptacle*) containing the disk and bearing the stamens. *Calyx*-lobes 5, accrescent. *Petals* 0. Stamens 10, biseriate, inserted within the upper receptacle above the margin of the disk; anthers versatile. Disk cupular without free margin. Style subulate. Ovary with 3 pendulous ovules of which one often aborts at an early stage and another aborts later. *Fruit* 5-gonous and 5-furrowed, crowned by the 5 spreading, accrescent calyx-lobes. Seed solitary.

Distr. Monotypic, India, Assam, Burma, Indo-China, Siam, and the Malay Peninsula.

Note. The question of priority between *Calycopteris* LAMK and *Getonia* ROXB. has long been a cause of instability in the nomenclature of this genus. LAMARCK's tab. 357 in his 'Illustrations des Genres' is still of uncertain date but was published not later than 1796 and probably about 1793–4. This plate seems to validate the genus although the corresponding text was not published until 1819. As long as ROXBURGH's *Getonia* appeared to have the firm date of 1795 it still seemed better to accept this name in view of the incertainty about the date of *Calycopteris*; but W. T. STEARN now assures me that he has conclusive evidence (*cf.* p. ccx) that ROXBURGH's 'Plants of the Coast of Coromandel' was published in parts and that *Getonia* did not appear until 1798, later than any possible date for *Calycopteris*.

1. Calycopteris floribunda (ROXB.) LAMK, Enc. Méth. Bot. Suppl. 2 (1811) 41; Tabl. Enc. 2 (1819) 485; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 449; KING, J. As. Soc. Beng, 66, 2 (1897) 333; GAGNEP. Fl. Gén. I.-C. 2 (1920) 769, f. 79; RIDL. Fl. Mal. Pen. 1 (1922) 706; CRAIB, Fl. Siam. En. 1 (1931) 610; BURK. Dict. (1935) 416.—*Getonia floribunda* ROXB. Pl. Corom. 1 (1798) 61, t. 87; EXELL, J. Bot. 69 (1931) 127.—*C. nutans* KURZ, J. As. Soc. Beng. 46 (1877) 59; For. Fl. Burm. 1 (1877) 368.—**Fig. 1e.**

Large scandent shrub. Young branchlets densely fulvous-tomentellous. *Leaves* chartaceous densely fulvous-pubescent above when young, somewhat glabrescent when older, densely fulvous-tomentel-

lous below, finely reticulate, ovate to narrowly elliptic 6–17 by 2–7 cm, usually acuminate or acute at the apex, cuneate, rounded or subcordate at the base; petiole 1/2–1 cm, fulvous-tomentellous. *Panicle* with reduced leaves at the points of branching and narrowly elliptical tomentellous leaf-like bracts, 10–11 by 4–4 1/2 mm, subtending the flowers. *Flowers* yellowish-green. Lower receptacle fulvous-villous, 4 1/2 by 2 mm. Upper receptacle fulvous-villous both within and without, 3 by 4 1/2 mm. *Calyx*-lobes narrowly elliptic or oblanceolate fulvous-sericeous-tomentellous 4 by 2 mm, in fruit reaching a length of 1–1 1/2 cm. Filaments 2 1/2 mm; anthers 0.6 mm long. Style 5 mm, pilose except at the apex. *Fruit* ellipsoid, densely villous, 7–8 by 2–3 mm.

Distr. SE. Asia, in *Malaysia:* Malay Peninsula (Penang & Langkawi Islands, Pahang); also in Lower Siam.

Ecol. A climber in mixed forests and along river-banks.

Uses. The flowers are used in Penang as a poultice for head-aches.

Vern. *Pĕlawas*, M.

5. LUMNITZERA

WILLD. Neue Schr. Ges. Naturf. Fr. Berl. 4 (1803) 186; SLOOT. Bijdr. Combr. (1919) 26; Trop. Natuur 11 (1922) 54, 65; Bull. Jard. Bot. Btzg III, 6 (1924) 43; Blumea Suppl. 1 (1937) 162; EXELL, J. Bot. 69 (1931) 128.—*Pyrrhanthus* JACK, Mal. Misc. 2, *no* 7 (1822) 57.

Small, evergreen, trees or shrubs. *Leaves* spirally arranged, sessile or almost sessile, fleshy-coriaceous, entire, glabrous when mature. *Flowers* ♀, 5-merous, actinomorphic, red, white, pink or yellow, in short terminal or axillary spikes or racemes. *Receptacle* (calyx-tube) not externally differentiated into an upper and a lower part but produced to form a tube beyond the ovary, bearing two adnate persistent bracteoles and terminating in a 5-lobed persistent *calyx*. *Petals* caducous. Stamens 5–10 borne on the inner wall of the receptacle tube; anthers versatile. Disk absent or inconspicuous. Ovules 2–5; style filiform, persistent, not adnate to the wall of the receptacle; stigma simple. *Fruit* (pseudocarp) compressed-ellipsoid, obtusely angled, more or less woody, crowned by the persistent calyx.

Distr. Species 2: one in E. Africa, Madagascar, tropical Asia, *Malaysia*, N. Australia, and Polynesia, the other in tropical Asia, *Malaysia*, N. Australia and Polynesia.

Ecol. Small trees or shrubs of mangrove swamps, tidal rivers, and estuaries, mostly on the land side of the mangrove, often above flood level.

VAN BODEGOM asserts (*in litt.*) that *Lumnitzera* forms a definite *tĕruntum* mangrove type (girdle) occupying the back-mangrove on solid, drier soils which are sandy or have a sandy subsoil. He observed

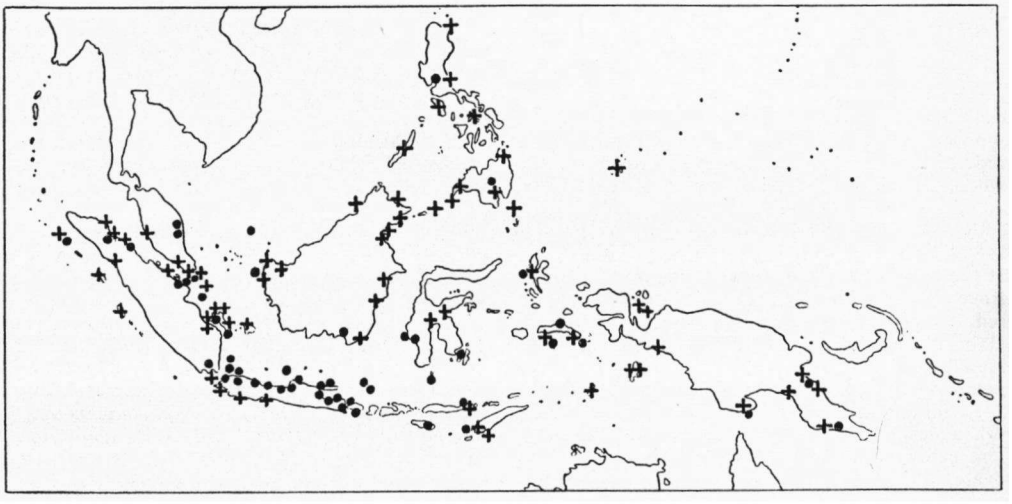

Fig. 31. Distribution of *Lumnitzera racemosa* WILLD. (●) and *L. littorea* (+) in Malaysia.

Lumnitzera to be frequent in the Riouw Islands but less so on the muddy shores of Bengkalis except on the more sandy northern shores of the islands, where they may form pure stands as *e.g* on the N. bank of Sg. Kembung. Similar observations were made by VAN DER ZWAAN (Het Bosch 2, 1934, 160) for Indragiri; exceptional trees may reach 40 m by 60–70 cm there. DE HAAN (Tect. 24, 1931, 51) found *Lumnitzera* in Tjilatjap (S. Java) forming part of his type 8 in girdle A4, characterized by solid shallow soils with local marlbanks below, inundated yearly only during very few days. Along Djakarta Bay *Lumnitzera racemosa* is locally gregarious in the back-mangrove. VAN DIJK (Boschbedrijf etc., 1939, 55) found *Lumnitzera* gregarious in the Island of Meos Noem (Geelvink Bay).

According to VAN SLOOTEN (Trop. Natuur 11, 1922, 54, 65, map; Bull. Jard. Bot. Btzg III, 6, 1924, 43–49, map; Blumea Suppl. 1, 1937, 162–175, map) the two species, though occurring throughout Malaysia where their areas overlap, practically exclude each other in habitat, and have never been collected in exactly the same stand. *L. littorea* appears to be entirely absent from the shores of the (muddy) Java Sea where in contrast *L. racemosa* has numerous stations. The exact cause of this different ecological behaviour is not yet known.

Wood anat. See under the species.

Uses. The timber is valuable; see under the species.

KEY TO THE SPECIES[1]

1. Flowers red, shortly pedicellate. Stamens twice as long as the petals. Inflorescences terminal. Knee-shaped pneumatophores usually present . . . . . **1. L. littorea**
1. Flowers white (occasionally pink?) or yellow (in *var. lutea*), sessile. Stamens equalling or only slightly exceeding the petals. Inflorescences axillary. Knee-shaped pneumatophores absent. **2. L. racemosa**

1. Lumnitzera littorea (JACK) VOIGT, Hort. Suburb. Calc. (1845) 39; KURZ, For. Fl. Burm. 1 (1877) 469; MERR. Philip. J. Sc. C. Bot. 4 (1909) 647; En. Born. (1921) 423; En. Philip. 3 (1923) 153; W. H. BROWN, Minor Prod. Philip. For. 1 (1920) 68, t. 30; SLOOT. Bull. Jard. Bot. Btzg III, 6 (1924) 43; HEYNE, Nutt. Pl. N.I. (1927) 1178; H. J. LAM, Miangas (1932) 29, 59; CORNER, Wayside Trees (1940) 191; MEEUSE in BACKER, Fl. Jav. (em. ed.) 4, fam. 101 (1944) 8.—*Pyrrhanthus littoreus* JACK, Mal. Misc. 2, *no* 7 (1822) 57.—*Laguncularia purpurea* GAUD. in FREYC. Voy. Bot. (1826) 481, t. 104.—*L. purpurea* PRESL, Rep. Bot. 1 (1834) 155.—*L. coccinea* W. & A. Prod. (1834) 316; MIQ. Fl. Ind. Bat. 1, 1 (1857) 606; CLARKE in HOOK. *f.* Fl. Brit. Ind. 2 (1878) 452; KING, J. As. Soc. Beng. 66, 2 (1897) 334; FERN.-VILL. Novis. App. (1880) 80; VIDAL, Rev. Pl. Vasc. Filip. (1886) 128; KOORD. Exk. Fl. 2 (1912) 672; RIDL. Fl. Mal. Pen. 1 (1922) 707; BURK. Dict. (1935) 1372.— **Fig. 32, 33.**

Tree up to *c.* 25 m by 50 cm, mostly smaller, not buttressed, with slender knee-shaped pneumatophores. Bark dark brown, fissured, inner bark reddish-brown, sapwood yellowish-brown, heartwood dark brown. Young branchlets reddish or grey, glabrous. *Leaves* usually crowded at the ends of the branchlets, narrowly obovate-elliptic, 2–8 by 1–2½ cm, rounded at the apex and cuneate at the base, with rather obscure marginal glands. Racemes short, terminal, *c.* 1½–3 cm long. *Flowers* red, shortly (1–1½ mm) pedicelled. *Receptacle* glabrous, tubular or narrowly infundibuliform, laterally compressed, slightly constricted just below the apex and then expanded into the calyx, 8–10 mm long, with two small, ovate, ciliolate bracteoles ½–⅘ mm long, adnate to it usually just below its middle. *Calyx*-lobes very broadly ovate, *c.* 1 mm long, slightly imbricate, margin ciliolate. *Petals* red, glabrous, oblong-elliptic, 4½ by 1½–2 mm. Stamens 5–10, *c.* 10 mm long, double the length of the petals. Style 10 mm, glabrous. *Fruit* glabrous, *c.* 10 by 4 mm longitudinally ribbed, somewhat corky in texture with a very thin inner layer of sclerenchyma and some strands of sclerenchymatous tissue dispersed throughout the pericarp.

Distr. Tropical Asia, northern Australia, and Polynesia, throughout *Malaysia* but apparently absent or very rare on the coasts of the Java Sea, where it is replaced by *L. racemosa*.

Ecol. Generally a small tree, mostly of the back-mangrove, sometimes gregarious, also above the tide level.

Wood anat. (*L. coccinea*) MOLL & JANSSONIUS, Mikr. Holzes 3 (1914) 378; REYES, Commonw. Philip. Dept Agr. Techn. Bull. 7 (1938) 365.

Uses. Wood dark grey; timber hard, durable, fine-grained, keeps its shape remarkably well; when first cut it has the scent of roses. Suitable for bridges, wharf-building, axles of carts, flooring, tool-handles, furniture, sleepers, ship-building, etc. but difficult to obtain in large pieces. Repeatedly recorded as sound for pier-posts standing seawater conditions, especially if the bark is not removed.

Vern. *Těruntum, těruntum merah*, M, *api-api uding*, Simalur, *gěriting*, W. Borneo, *randai*, E. Borneo, *riang laut*, Banka, *sěsop, sěsak*, Sum. E.C., *taruntung*, S, *duduk agung, duduk gědeh*, J, *wělompělong*, Bugin., *tènè*, Roti, Timor, *posi-posi ma gorago*, Ternate; Philippines: *tabau* (standard name), *agnáa, anilai, libato, kulasi, libatu-pulá, dalúru-babáe, papasil*, Tag., *aguia, kalapini*, Sbl., *bakting, banting, bating, panting-panting, santing*, Sul., *bulok-bulok, salasa*, P. Bis., *dulok-dúlok*, Bis., *sagasa, maoro*, C. Bis., *karifurog*, Neg., *linas*, Bag., *magalólo* Tagb., *supsupun*, Tagk., *talau*, Bik.

(1) See also the notes sub. *L. littorea*.

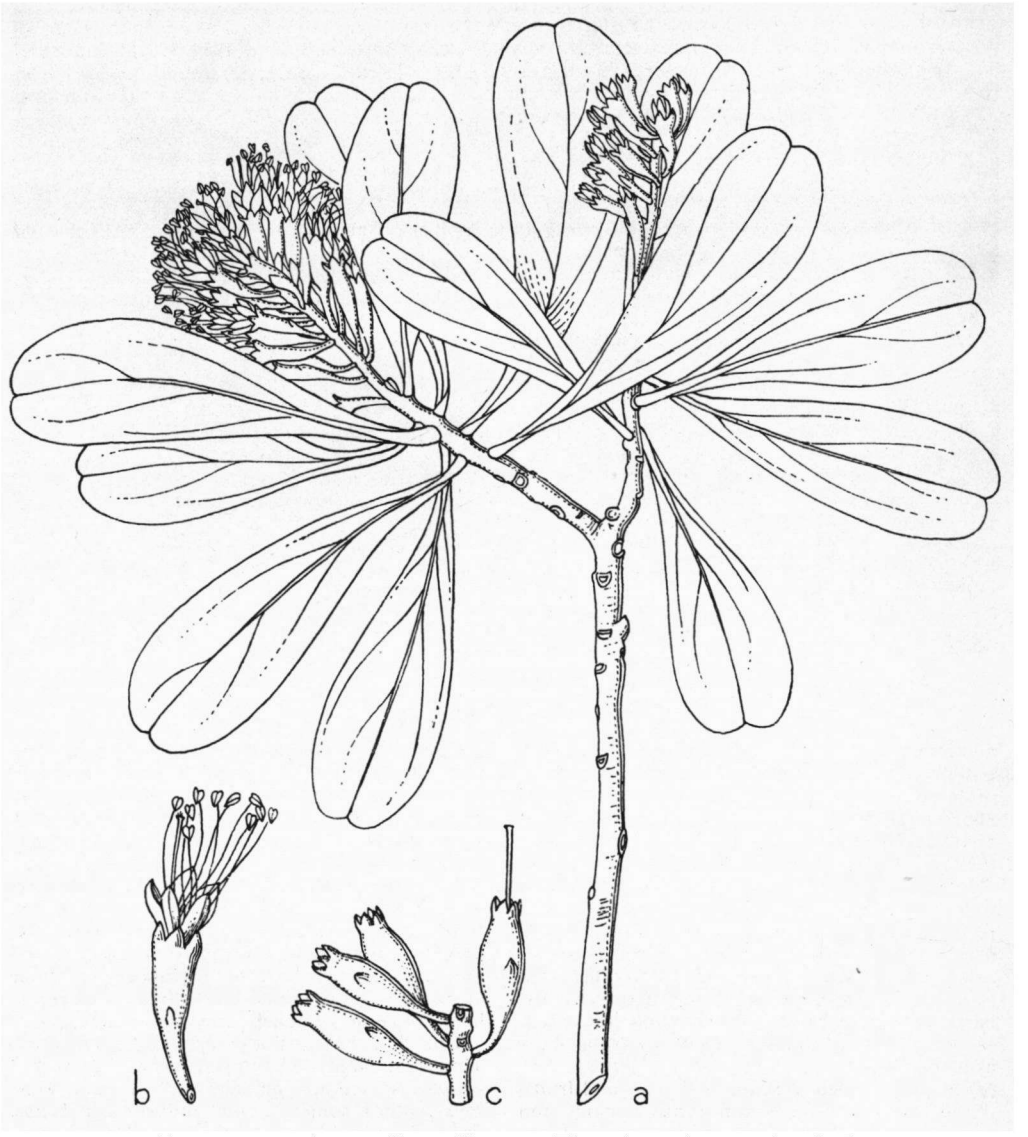

Fig. 32. *Lumnitzera littorea* (JACK) VOIGT. *a*. Flowering twig, nat. size, *b*. flower, × 2, *c*. rhachis with fruits, × 2.

Notes. It is not always easy to distinguish *L. littorea* from *L. racemosa* from deficient or disintegrated herbarium material. From leaves alone I doubt whether a confident determination can be given (at least without anatomical investigation). Attention to the following points will, however, enable most specimens to be named:
(*a*) When well preserved flowers are available there is no difficulty. Those of *L. littorea* are red with stamens twice as long as the petals: those of *L. racemosa* are white (rarely pink or yellow) with stamens approximately equalling the petals.
(*b*) With old flowers or young fruits two features should be noted: (i) the flowers are shortly pedicellate in *L. littorea* and sessile in *L. racemosa* (but it is not always easy to decide); (ii) in *L. littorea* the adnate bracteoles are merely very small appendages which do not interfere much with the general outline of the receptacle (calyx-tube). They are subopposite and usually attached somewhat below the middle of the receptacle. In *L. racemosa* the bracteoles are distinctly larger

Fig. 33. *Lumnitzera littorea* (JACK) VOIGT. Lukut Forest Reserve, Port Dickson, Malay Peninsula (WYATT-SMITH).

and interfere more fundamentally with the general outline of the receptacle (see fig. 1, b). They are often attached at different levels, sometimes one above and one below the middle of the receptacle.
(*c*) Older fruits, where characters mentioned in (*b*) become less evident, are said to be distinguishable in cross-section. In *L. racemosa* there is a well-developed inner layer of sclerenchyma with regular, radial, spoke-like projections. In *L. littorea* the pericarp looks more uniform and somewhat corky in structure with irregularly dispersed strands of sclerenchyma and only a very narrow band of sclerenchyma surrounding the seed-cavity. But this distinction is not always as clear as it sounds.
(*d*) In the complete absence of flowers and fruits, if the rhachis of the inflorescence remains and appears rather stout and clearly terminal the specimen is *L. littorea*.
(*e*) If the buds and very young branchlets are appressed-pubescent the specimen is *L. racemosa*, but a glabrous specimen is not necessarily *L. littorea*.
(*f*) Any trace of pubescence on the leaves also indicates *L. racemosa* but care must be taken not to be misled by mould.

2. Lumnitzera racemosa WILLD. Neue Schr. Ges. Naturf. Fr. Berl. 4 (1803) 187.—**Fig. 1, b.**

Small tree, up to *c.* 8 m by 30 cm, or shrub; knee-shaped pneumatophores absent. Bark rough, reddish-brown. Young branchlets reddish or grey, sometimes appressed-pubescent at first, soon glabrous. *Leaves* pubescent or glabrous, narrowly obovate, narrowly obovate-elliptic or narrowly elliptic, 2–9 by 1–2½ cm, blade cuneate to the subsessile base or sometimes narrowed 5–8 mm above the base thus appearing sub-petiolate. Spikes short, axillary, *c.* 2 cm long. *Flowers* white (rarely pink?) or yellow (in *var. lutea*), sessile. *Receptacle* tubular or narrowly urceolate, laterally compressed, glabrous or pubescent, 6–8 mm long, usually contracted just above the middle at the insertion of the two broadly ovate, 1½ mm long, sometimes ciliolate, opposite or subopposite adnate bracteoles. *Calyx*-lobes broadly ovate-acuminate often gland-tipped, sometimes with 3 glands, sometimes glandless, ⅘–1 mm long. *Petals* white (? sometimes pink) or yellow, glabrous, narrowly elliptic or oblanceolate, 4 by 1 mm. Stamens 10, equalling or slightly exceeding the petals. Style 6–7 mm long, glabrous. *Fruit* appressed-pubescent or glabrous, 10–12 by 3–5 mm; pericarp with a well-developed inner layer of sclerenchyma extended radially giving a spoke-like appearance in cross-section.

Distr. Eastern tropical Africa, Madagascar, tropical Asia, northern Australia and Polynesia, throughout *Malaysia* but almost absent from the shores facing the Indian Ocean.

Ecol. Small tree or shrub of mangrove swamps. According to HASSKARL (Nat. Tijd. N.I. 10, 1856, 170) and TEYSMANN (*op. cit.* 14, 1857, 368) it has been grown in occasionally (freshwater)-flooded

sandy soil in the Buitenzorg Botanical Garden, where it has flowered and fruited.

Wood anat. (*L. racemosa* & L. *racemosa var. pubescens*) MOLL & JANSSONIUS, Mikr. Holzes 3 (1914) 382 & 383.

Uses. The timber is similar in quality to that of the preceding species, but dimensions are generally even smaller. The bark is sometimes used for tanning purposes.

Vern. *Tĕruntum bunga puteh*, Mal. Pen., *api-api balah*, Simalur, *duduk laki-laki*, Lampongs, *api-api djambu*, S. Borneo, *duduk*, *t(ĕ)runtum*, J, *adu-adu*, Md, *knias*, Samau; Philippines: *kulási* (standard Tagalog name), *solási*, Tag,. *tabau*, P. Bis., Tag., *agnáya*, Sbl.

KEY TO THE VARIETIES

1. Flowers white (rarely pink?) *var.* **racemosa**
1. Flowers yellow (Timor) . . . *var.* **lutea**

var. **racemosa**.—*L. racemosa* WILLD. in Neue Schr. Ges. Naturf. Fr. Berl. 4 (1803) 187; SPANOGHE, Linnaea 15 (1841) 203; MIQ. Fl. Ind. Bat. 1, 1 (1855) 606; SCHEFFER, Ann. Jard. Bot. Btzg 1 (1876) 23; KURZ, For. Fl. Burma 1 (1877) 468; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1878) 452; KING, in J. As. Soc. Beng. 66, 2 (1897) 334; KOORD. & VAL. Bijdr. Booms. 9 (1903) 33; MERR. Philip. J. Sc. C. Bot. 4 (1909) 647; En. Born. (1921) 423; En. Philip. 3 (1923) 154; KOORD. Exk. Fl. 2 (1912) 672; SLOOT. Bijdr. Combr. (1919) 28; Bull. Jard. Bot. Btzg III, 6 (1924) 46; GAGNEP. Fl. Gén. I.-C. 2 (1920) 772; RIDL. Fl. Mal. Pen. 1 (1922) 707; HEYNE, Nutt. Pl. N.I. (1927) 1178; CRAIB, Fl. Siam. En. 1 (1931) 621; BURK. Dict. (1935) 1373; CORNER, Wayside Trees (1940) 191; MEEUSE in BACKER, Fl. Jav. (em. ed.) 4, fam. 101 (1944) 8.—*Laguncularia rosea* GAUD. in FREYC. Voy. Bot. (1826) 481, t. 105, f. 2.—*L. rosea* PRESL, Rep. Bot. 1 (1834) 155.—*Petaloma alba* BLANCO, Fl. Filip. (1837) 344.—*L. racemosa var. pubescens* KOORD. & VAL. Bijdr. Booms. 9 (1903) 34.

Distr. *etc.* As for the species.

Note. The typical variety with white flowers [perhaps occasionally pink—see *L. rosea* (GAUD.) PR.]. There is little doubt that *L. rosea* was described from the common combretaceous mangrove in Manila Bay, which is *L. racemosa*. I have seen no other reference to a pink-flowered form.

var. **lutea** (GAUD.) EXELL, *comb. nov.*—*Laguncularia lutea* GAUD. in FREYC. Voy. Bot. (1826) 481, t. 105, f. 1; DECNE in Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 458; MIQ. Fl. Ind. Bat. 1, 1 (1855) 606.—*L. lutea* PRESL, Rep. Bot. 1 (1834) 156; SLOOT. Bijdr. Combr. (1919) 30; Bull. Jard. Bot. Btzg III, 6 (1924) 49; Trop. Natuur 17 (1928) 136; Blumea Suppl. 1 (1937) 173.

Distr. *Malaysia:* Lesser Sunda Islands (Timor: Bay of Koepang between Kp. Oël Hendak and Pitais and near Kp. Babao; P. Alor: near Kp. Kakilai opposite Kalabahi).

Ecol. Small tree of the mangrove formation in tidal forest.

Note. A yellow-flowered variety with gland-tipped calyx-lobes. While it was thought that the yellow flower-colour and gland-tipped calyx-lobes in association were characters distinguishing *L. lutea* from *L. racemosa* there was justification for maintaining them as separate species; but gland-tipped calyx-lobes are to be found in the white-flowered variety, especially in New Guinea and the Philippines. *L. racemosa var. racemosa* has been recorded from Timor (although I cannot verify the flower-colour and the specimens are now without flowers) so that *var. lutea* is apparently not geographically isolated from the type variety.