

PITTIOSPORACEAE (K. Bakker & C. G. G. J. van Steenis, Leyden)

Mostly evergreen trees or shrubs (outside Mal. some woody climbers), often aromatic (in leaves and fruit), bark of the stem (and roots) containing a circle of schizogenous resin ducts outside the phloem; twigs sometimes ending in a thorny tip; indument if present consisting of simple (exceptionally 2-armed or capitate-glandular) hairs. *Leaves* simple, penninerved, spirally arranged, frequently crowded towards the twig ends, mostly entire. Stipules 0. *Flowers* actinomorphic, mostly 5-merous, bisexual or functionally unisexual or \pm polygamous, solitary or in few- to many-flowered, axillary or terminal, bracteate corymbs or thyrses. Bracteoles often 2. *Sepals* imbricate, free or more rarely connate below. *Petals* imbricate, their lower portion often narrow and loosely cohering in a tube, caducous. *Stamens* 5, episepalous, erect, free, or slightly connivent below; anthers 2-celled, introrse, basifixed, dehiscing lengthwise (or by pores). Disk absent (but cf. *Citriobatus*). *Ovary* superior, sessile or short-stipitate, mostly 1-celled, sometimes completely or incompletely 2-celled, placentas 2-5(-6), parietal or basal, (rarely sometimes axile in celled ovaries); style simple; stigma thickened or lobed. *Ovules* mostly ∞ , anatropous, with 1 integument. *Fruit* a berry or non-dehiscent, or a loculicidal capsule. *Seeds* mostly ∞ , often immersed in a viscid pulp, rarely winged; testa thin, smooth; albumen copious, hard; embryo small, close to the hilum; cotyledons small, 2-5.

Distribution. Only in the Old World, 9 (mostly small) genera of which 6 are entirely confined to Australia, 2 occur in Australia and E. Malaysia, and 1, viz *Pittosporum*, is widely distributed from West Africa (also in Teneriffe & Madeira) and Madagascar through Asia, Malaysia, and Australia to Polynesia. The general character of distribution shows a remarkable similarity to that of *Goodeniaceae*.

Ecology. The family shows capacity for a wide range of tolerance; representatives grow in tropical to warm-temperate countries (apparently none being frost resistant), and under everwet to arid conditions (Central Australia, not in the arid portions of Africa and Asia).

In Malaysia *Citriobatus* grows exclusively under seasonally dry lowland conditions, *Hymenosporum* belongs to the montane rain-forest, *Pittosporums* are found from the lowland to the montane zone, some even penetrating into the lower portion of the subalpine belt. Some species of *Pittosporum* are found apparently as occasional epiphytes (or hemi-epiphytes).

Wood anatomy. See under *Pittosporum*.

Uses. Some species are grown as ornamentals, a few *Pittosporums* might be used for re-afforestation of bare lands.

Notes. The family is subdivided into two tribes *Pittosporaeae* with capsular fruits (in Mal. *Pittosporum* and *Hymenosporum*) and *Billardiareae* with non-capsular fruits (in Mal. *Citriobatus*).

The revision of *Pittosporum* is by Mr K. BAKKER.

KEY TO THE GENERA

1. Unarmed. Flowers mostly in cymes or corymbs. Capsules dehiscent.
2. Corolla at most 1½ cm long, cream, pink, white, or purple-red. Seeds not winged. 1. *Pittosporum*
2. Corolla c. 3-4 cm long, yellow. Seeds winged 2. *Hymenosporum*
1. Most twigs ending in a thorn and/or provided with lateral thorns. Fruit indehiscent. Flowers small, solitary, axillary, on minute short-shoots. 3. *Citriobatus*

1. PITTIOSPORUM

BANKS ex GAERTNER, Fruct. 1 (1788) 286, t. 59; PUTTERLICK, Syn. Pitt. (1839); BLUME, Mus. Bot. 1 (1850) 158; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 273; GOWDA, J. Arn. Arb. 32 (1951) 263; COOPER, Ann. Mo. Bot. Gard. 43 (1956) 87.—*Senacia* LAMK, Tabl. Bot. 2 (1793) 95, p.p., *typus S. undulata*; DC. Prod. 1 (1824) 347.—*Pseuditea* HASSK. Flora 25, 2 (1842) Beibl. 30.—*Glyaspermum* ZOLL. & MOR. Nat. Geneesk. Arch. N.I. 2 (1845) 11.

Evergreen, erect, aromatic, shrubs or trees, sometimes epiphytic. Growth in flushes, terminal bud protected by cataphylls (and/or bud scales?). *Leaves* exstipulate, spirally arranged, often crowded in pseudo-whorls, specially towards the ends of the twigs, petioled or seldom sessile, entire (often sinuate in *1. P. sinuatum*), generally more or less acuminate, penninerved, young leaves often pubescent. *Inflorescences* terminal or axillary, in some *spp.* mainly ramiflorous, few to many-flowered, in fascicles, thyrsoïd, or in more or less condensed racemes, rarely solitary, essentially cymose. *Flowers* bisexual or functionally unisexual apparently to various degree, generally white or pale yellow, except in *5. P. berberidoides*, fragrant. *Sepals* 5, free or connate to various degree. *Petals* 5, generally ligulate, free or coherent in the lower part, free segments spreading or recurved. *Stamens* 5, free or occasionally coherent with the corolla tube; filaments in more ♂ flowers slender, in more ♀ flowers somewhat shorter and slightly broadened at the base; anthers dorsifix, introrse, in more ♂ flowers generally oblong, in more ♀ flowers sagittate, and smaller. *Pistil* sessile or stipitate, stipe thick, 5-furrowed, generally passing into the ellipsoid ovary; *ovary* glabrous or pubescent, 1-celled, in more ♂ flowers slender or cuneiform, in more ♀ flowers plumper and thicker; *placentas* 2(-5), (in one case 6!), parietal or basal, with a varying number of ovules; style glabrous, in more ♂ flowers somewhat longer than in more ♀ flowers; stigma in more ♂ flowers hardly thickened, in more ♀ flowers capitate, 2-5-lobed. *Capsule* globose, ellipsoid or ovoid, 1-celled, loculicidally lengthwise 2(-5)-valved, in Mal. *spp.* glabrous, mostly orange when mature, often mucronate by the remains of the style; valves of varying thickness, woody or coriaceous, occasionally with resiniferous cavities, chambers of ducts, inside generally transversely ribbed or pinnately striated; funicles along the median longitudinal placenta or basal. *Seeds* 1-∞, generally compressed against each other and irregularly angular and wrinkled, variably in size and shape, reddish or blackish, coated by a resinous, viscid fluid. Endosperm horny, large; embryo minute; cotyledons 2-5; germination epigeous.

Distr. About 100 *spp.* in Africa (10), South and East Asia to Korea and Japan, Malaysia, Australia, New Zealand, and the Pacific: Bonin Isl., Micronesia (Ponape, Kusaie), Melanesia, Polynesia (Fiji, Tonga, Hawaii), mostly confined to the tropical, subtropical, and warm-temperate regions.

The density of species per island or island group in Malaysia has been indicated in fig. 1, from which it appears that *Pittosporum* is comparatively richest developed in E. Malaysia: New Guinea, the Philippines, and Celebes.

Only one species occurs from Asia to Australia *viz 10. P. ferrugineum*; one is obviously essentially a continental-Asiatic species which is also found in the Malay Peninsula (*7. P. reticosum*), and finally two species occur in Malaysia and Formosa (*9. P. pentandrum*, *11. P. moluccanum*). It is possible that the latter two are also racially represented in China, but the far too fine specific delimitation applied by Gowda, makes it difficult to correlate them satisfactorily with Asiatic species without a complete new study which goes beyond the scope of the present work. I have the impression that also in New Caledonia too many species have been distinguished on unreliable characters.

Ecol. Malaysian *Pittosporums* are generally small to at most medium-sized shrubs or trees from the substage of the rain-forest. They do not tend to be social or gregarious but none of them seems to be rare. Only two species are found in forests which are subject to a distinct dry season and that apparently only in part of their area, *viz P. moluccanum* in the mountain areas of Central and East Java and the Lesser Sunda Islands and *P. ferrugineum* which is also widely distributed and is the only species occurring in Javanese teak-forests. Both of them may be pioneering in open, grassy mountain forest; *P. ferrugineum* is, according to VAN DER PIJL (Ann. Jard. Bot. Btzg 48, 1938, 136, 138), a common pioneer on the lavas of Mt Guntur (W. Java); it has also been employed in re-afforestation work, according to KOORDERS. A similar position is occupied in the Philippines by *P. pentandrum* which is frequent in parang vegetation.

As to altitude many species are rather tolerant; *P. sinuatum* and *P. ramiflorum*, for example, range from sea-level through the tropical and montane zones to the lower part of the subalpine zone up to respectively 2700 and 3200 m altitude. There are only two true mountain species, both endemic in New Guinea, *viz 6. P. pullifolium* (600-)1200-3800 m and *5. P. berberidoides* 3000-3900 m. The former species

exhibits in its leaves a certain vegetative adaptation towards high altitudes in getting thicker and smaller with recurring leaf margins and condensed habit in proportion to altitude. A similar behaviour is observed in *P. ferrugineum*, the high-altitude form of which was described as *P. versteeghii*.

Several species have been observed to grow as epiphytes or hemi-epiphytes in tall forest but are also recorded as terrestrial shrubs in more exposed spots.

The same species have occasionally been mentioned to be medium-sized trees. There is a possibility that these records are erroneous and that the epiphytic habit was overlooked, the size taken from that of the host tree. Collectors should check this in the field (*cf. P. pullifolium*).

Pollination. It is certain that the sweet-scented, white or cream-coloured, rarely reddish flowers (*P. berberidoides*) attract insects, but we have no data on pollinators. Flowers are functionally often unisexual.

Dispersal. In fruit Malaysian *Pittosporum* represents a most attractive, lively coloured picture with orange or orange-red valves, inside and outside, against which the sticky seeds, black or black-red give a marked contrast. The open fruit has a distinct aromatic smell. It is astonishing that nothing has been reported on dispersal of these seeds or fruits, save for RIDLEY's casual note (Disp. p. 382) that opossums introduced in New Zealand were observed to feed on the fruit of New Zealand species. Both the epiphytic habit of several species in New Guinea and the Philippines and the frequent occurrence of *Pittosporum* on oceanic islands would point to dispersal by birds.

Morph. KIRK (1872) has apparently been the first to observe sexual dimorphism in some New Zealand species; this was also observed in *P. ferrugineum* in Java by VALETON (1896), in Hawaiian species by ROCK (1913), in Asian & Chinese species by GOWDA (1951), in African species by CUFODONTIS (1951), and in Australasian species by COOPER (1956). The tendency for the separation of sexes seems therefore universal in the genus. On one tree both types of flowers are found in addition to the hermaphrodites!; some appear to be more ♀ or at least functionally ♀, others more ♂ or at least functionally so. The female or maleness seems to be often a matter of degree. In more ♂ flowers the ovary is narrow-lanceolate and sterile and anthers are larger and often longer than in ♀ flowers where the ovary is more plump and stamens and anthers are narrow-sagittate, often sterile or nearly so and reduced to various degree, sometimes even to small staminodes.

In the descriptions of this revision the sizes of sexual flower parts of more ♂ or ♀ flowers have generally been merged except in species 5, 9, 10, and 11, in which the differences were too large and distinct to allow for this practice.

Wood anat. DEN BERGER, Determinatietabel Malesië, Veenman, Wageningen (1949) 42 (hand lens). METCALFE & CHALK, Anat. Dic. 1 (1950) 129 (*Pittosporum*, *Citriobatus*, *Hymenosporum*); MOLL & JANS. Mikr. 1 (1906) 226-232. JANSSONIUS, Blumea 6 (1950) 435 does not suggest any relationship, CHALK in METCALFE & CHALK *l.c.* mentions a possible relationship with *Araliaceae* (septate fibres and scanty paratracheal parenchyma); see also JANSSONIUS, Key to Jav. woods, Brill, Leiden (1952) 62.C.A.R.-G.

Uses. Several *Pittosporums* are well known to gardeners because of the modest size of the shrubs or small trees, their attractive-scented flowers and orange fruits. Of the Malaysian species the timber is not available in large sizes or quantities and besides does not seem to be durable. The fruits of some species are here and there employed for medicinal purpose against a multitude of illnesses, *e.g.* 3. *P. resiniferum*. Fruits may contain resin and aromatic oil in such quantity that they are inflammable (*petroleum nut*), for example of 3. *P. resiniferum*. Leaves and fruits are used for fish poisoning, their bitter substances are obviously due to saponins.

Taxon. From the work by COOPER, *l.c.* who in his revision of the Australasian representatives reduced a considerable number of species to synonymy, it is clear that the genus as a whole contains too many 'paper species' and that specific delimitation is rather chaotic, which is in part due to the absence of a prior, firm attempt towards correlation in a monographic treatment. For the Malaysian area up till the present 46 specific names were recognized. PRITZEL (1930) indicated already that a number of these did not deserve specific rank. I have been compelled to accept only 10 species, adding one obviously new species. The impression is that in Malaysia only very few novelties can be expected.

There have been several attempts to subdivide the genus into infrageneric taxa. PUTTERLICK (*l.c.* 6-18) divided the genus into three subgenera based on the structure and position of the inflorescences and the shape of the capsules, but it appears that these characters are very plastic. GOWDA (*l.c.* 234) is of opinion that no subgenera and sections can be distinguished in the solid mass of species; however, he distinguished two 'groups' *Trivalvae* and *Bivalvae*—raised by COOPER (*l.c.* 121) to the rank of series—which he mainly based on the number of carpels in the ovary, corresponding with the number of valves in the fruit. It appears doubtful to me whether these two groups or series represent natural affinities indeed, though the number of carpels may serve for the purpose of starting an artificial key. GOWDA noted already that the number of valves is not strictly constant, as in several bivalvate species occasionally 3-valved capsules are found; the same has been observed by COOPER. In the New Guinean 1. *P. sinuatum* there is an astonishing range of variability in the number of valves varying between 2 and 5(-6). A similar variability has been recorded by COOPER from the New Zealand *P. tenuifolium*.

PRITZEL (*l.c.* 273-281) did not reach a satisfactory subdivision of the genus and summarized for convenience species with brief keys according to geographical regions, menacing their synthetic correlation.

In my opinion the division into *Bivalvae* and *Trivalvae* is more of a practical value than serving in all cases to indicate affinity.

Notes. Field collectors are invited to make observations on dispersal and pollination. Furthermore they should try to secure both flowering material and ripe fruits which are indispensable for a correct identification.

KEY TO THE SPECIES

(flowering material)

- 1. Leaves entire or sinuate, papyraceous. Ovary with 2-5 placentas 1. *P. sinuatum*
- 1. Leaves entire, mostly chartaceous. Ovary with 2 placentas.
- 2. Inflorescences mainly on the bare branches, below the leaves, seldom between the leaves.
 - 3. Flowers small, c. 4-7 mm.
 - 4. Leaves generally small, c. 4-7 by 1½-3 cm, narrowly obovate or narrowly elliptic. 4. *P. ramosilii*
 - 4. Leaves generally larger, c. 5-18 by 2½-6 cm, elliptic or narrowly elliptic 2. *P. ramiflorum*
 - 3. Flowers large, c. 9-12 mm. Leaves narrowly obovate or oblanceolate, c. 8-15 by 3½-5½ cm. 3. *P. resiniferum*
- 2. Inflorescences terminal or axillary, all between or near the leaves.
 - 5. Flowers always solitary, axillary. Leaves small, obovate, c. 2-4 by 1-3 cm, abruptly shortly acute acuminate. Reticulation conspicuous, prominent on *both* sides. Ovary glabrous. 5. *P. berberidoides*
 - 5. Inflorescence with a varying number of flowers. Leaves generally larger. Reticulation not prominent on *both* sides.
 - 6. Leaves generally bullate or at least nervation impressed above. Flowers always in (pseudo-) terminal condensed, shortly pedunculate racemes. Petals large, c. 9-15 by 2-5 mm. 6. *P. pullifolium*
 - 6. Leaves not bullate. Inflorescences various. Petals c. 1-2½ mm broad.
 - 7. Ovary glabrous or only pubescent at the base.
 - 8. Leaves very narrowly elliptic. Nerves not very conspicuous. Sepals obtuse. 9. *P. pentandrum*
 - 8. Leaves elliptic or narrowly elliptic. Nerves conspicuous. Sepals obtuse or acute.
 - 9. Nerves distinctly impressed above, c. 5-7 pairs. Sepals free. Ovules 4, basal. 7. *P. reticosum*
 - 9. Nerves conspicuous, but generally not impressed above. Sepals united to varying degree or nearly free. Ovules more than 4, parietal. 11. *P. moluccanum*
 - 7. Ovary pubescent.
 - 10. Sepals longer than 5 mm, free and acute 8. *P. longisepalum*
 - 10. Sepals shorter than 5 mm, free or united, acute or obtuse.
 - 11. Leaves attenuate acuminate; lower surface often with a ferruginous pubescence. Sepals always free and acute 10. *P. ferrugineum*
 - 11. Leaves acute or slightly acuminate, occasionally rounded. Young leaves sometimes with a ferruginous pubescence, generally not persisting on older leaves. Sepals united or nearly free, obtuse or acute 11. *P. moluccanum*

KEY TO THE SPECIES

(dry fruiting material)

- 1. Leaves entire or sinuate, papyraceous. Fruit 2-5-valved. Funicles long, ribbon-like. 1. *P. sinuatum*
- 1. Leaves entire, mostly chartaceous. Fruit 2-valved. Funicles short.
- 2. Infructescences mainly on the bare branches, below the leaves, seldom between the leaves.
 - 3. Valves hard, rugose, and woody.
 - 4. Fruits globose, compressed, c. 0.7-1.5 cm diam. Leaves generally elliptic or narrowly elliptic, base broadly attenuate 2. *P. ramiflorum*
 - 4. Fruits ovoid or broadly ellipsoid, compressed; base sometimes emarginate, c. 2½-4 by 2-3 cm. Leaves generally narrowly obovate or oblanceolate, base decurrent 3. *P. resiniferum*
 - 3. Valves not hard, smooth, coriaceous and pellucid 4. *P. ramosilii*
- 2. Infructescences terminal or axillary, all between or near the leaves.
 - 5. Leaves small, obovate, c. 2-4 by 1-3 cm, abruptly shortly acute acuminate. Reticulation conspicuous, prominent on *both* sides. Fruits solitary, ellipsoid 5. *P. berberidoides*
 - 5. Leaves larger, if small, reticulation impressed above.
 - 6. Fruits longer than broad (not including the stipe and the apical mucro).
 - 7. Leaves generally bullate. Fruit valves not strongly recurving when ripe, margins straight. Placenta not raised. 6. *P. pullifolium*
 - 7. Leaves generally not bullate. Fruit valves often strongly recurving when ripe, margins wavy. Placenta raised 11. *P. moluccanum*
 - 6. Fruits as long as broad or slightly broader than long (not including the stipe and the apical mucro).
 - 8. Fruit valves rather thick 11. *P. moluccanum*
 - 8. Fruit valves rather thin.

- 9. Funicles inserted up to halfway the valves. Leaves elliptic or narrowly ovate, top attenuate acuminate. Nerves c. 5-7 pairs 10. *P. ferrugineum*
- 9. Funicles inserted close to the base of the valves.
 - 10. Seeds few, c. 1-4. Nervation conspicuously impressed above. Leaves elliptic or narrowly elliptic.
 - 11. Seeds large, c. 5 mm or more 7. *P. reticosum*
 - 11. Seeds smaller, up to c. 4 mm 8. *P. longisepalum*
- 10. Seeds generally more than 4. Nervation inconspicuous. Leaves very narrowly elliptic.
 - 9. *P. pentandrum*

1. *Pittosporum sinuatum* BLUME, Mus. Bot. 1 (1850) 161; MIQ. Fl. Ind. Bat. 1, 2 (1858) 123; MIQ. Illustr. 1 (1870) 77, t. 35; VAL. Bull. Dép. Agr. Ind. Néerl. 10 (1907) 15; PULLE, Nova Guinea 8 (1910) 365; RIDL. Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 19; PRITZEL, Bot. Jahrb. 62 (1929) 340; E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; MERR. & PERRY, J. Arn. Arb. 21 (1940) 178.—*P. chelidospermum* BL. Mus. Bot. 1 (1850) 161, fig. 33; MIQ. Fl. Ind. Bat. 1, 2 (1858) 123; Illustr. 1 (1870) 77, t. 34.—*P. rumphii* (non PUTT.) BL. Mus. Bot. 1 (1850) 160.—*P. novoguineense* MIQ. Illustr. 1 (1870) 79.—*P. galai* K.SCH. in K.Sch. & Hollr. Fl. Kais. Wilh. Land (1889) 71; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 337; Nachtr. (1905) 272.—*P. quinquevalvatum* WARB. Bot. Jahrb. 13 (1891) 320; K.SCH. & LAUT. Nachtr. (1905) 271.—*P. brassii* MERR. & PERRY, J. Arn. Arb. 21 (1940) 178.

Shrub or small tree, c. 1-2(-4) m; twigs glabrous, young shoots puberulous, with scattered caducous, minute, bract-like leaves (cataphylls) below the leaves of the apical flush. Leaves mostly c. 3-5 subverticillate or scattered, papyraceous, very variable in size and shape, elliptic, narrowly elliptic or narrowly obovate, c. (6-)12-22(-30) by (3-)4-7(-9) cm; base cuneate, margin entire or more or less deeply irregularly sinuate, top c. 1-2½ cm gradually acute-acuminate; nerves c. 5-10 pairs, prominent beneath, forming distinct intramarginal loops; reticulation lax; petiole c. 0-1 cm. Inflorescences one or more (pseudo-)terminal pseudo-umbels or condensed corymbs; peduncle c. ½-1 cm, sometimes longer, ferruginous-pubescent as are the bracts and pedicels. Bracts narrowly oblong, boat-shaped, c. 4-5 mm. Pedicels c. 2-6 mm. Flowers yellowish-white or pink. Sepals free, lanceolate, c. 3-6 by 1 mm, top acute, rarely blunt, margin ciliate. Petals ligulate, c. 10-15 mm, tip rounded. Filaments c. 2-8 mm, anthers c. 1-2 mm. Ovary subsessile or up to c. 3 mm stipitate, elliptic, c. 2-3 by 1 mm, ferruginous-pubescent; ovules ∞, on 2-5 parietal placentas; style 2-6 mm. Fruits c. 1-3, on woody pedicels of c. ½-1 cm, subglobose, obovoid or club-shaped when young, more or less ovoid or ellipsoid when ripe, sometimes angled, c. 2-4½ by 1-2 cm when dry, 2-5-valved, valves coriaceous, yellow or orange at both sides also when dry, inside not distinctly transversely ribbed; funicles long, ribbon-like, orange. Seeds ∞, subreniform, c. 5-8 mm.

Distr. Malaysia: New Guinea (incl. also Aru Isl.). Ecol. More or less common in the undergrowth of poorly drained rain-forest, in mossy forests or swamp forest, 50-2700 m.

Uses. A decoction of the roots is locally applied for belly-ache of children.

Vern. *Galai, talli-wal*.

Notes. In spite of its variability in leaf-shape and number of fruit valves, this species is very easy to recognize by its very thin, light green, often sinuate leaves and the structure of its fruit. Of a total of 69 fruits examined I obtained the following figures: 17 had 2 valves, 11 had 3 valves, 22 had 4 valves, 18 had 5 valves, and 1 had 6 valves. Of specimens of which at least 2 fruits were available, the figures were: 4 had strictly 2 valves, 1 had 3 valves, 2 had 4 valves, 3 had 5 valves, and 8 possessed a variable number of valves. The number of valves tends therefore to be more or less constant in one specimen.

Sinuate and entire leaves may be present in one specimen. WARBURG (1891) already hinted at the possibility that *P. chelidospermum*, *P. novoguineense*, *P. galai*, and *P. sinuatum* might appear to be conspecific with his *P. quinquevalvatum* (of which I saw a 'rubbing' from the Wroclaw Herbarium). These reductions have been accepted by PRITZEL and after a thorough examination of abundant material and the types I fully agree; I have also included *P. brassii*.

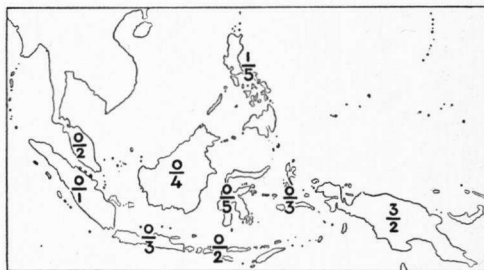


Fig. 1. Distribution of *Pittosporum* in Malaysia. The figure above the hyphen indicates the number of endemic species in each district, the figure below the hyphen the number of non-endemic species.

2. *Pittosporum ramiflorum* (ZOLL. & MOR.) ZOLL. ex MIQ. Fl. Ind. Bat. 1, 2 (1858) 122; Illustr. 1 (1870) 82, t. 37; K. & V. Bijdr. 4 (1896) 56; BOERL. Cat. Hort. Bog. 1 (1899) 57; MERR. Philip. J. Sc. 5 (1910) Bot. 180; BACK. Schoolfl. (1911) 74; KOORD. Exk. Fl. Java 2 (1912) 309; BREMER, Ann. Jard. Bot. Btzg 29 (1916) 161 (embryology); MERR. Philip. J. Sc. 11 (1917) Bot. 274; En. Philip. 2 (1923) 223; KOORD. Fl. Tjib. 2 (1923) 96; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274;

MERR. & PERRY, J. Agr. Arb. 21 (1940) 176, *incl.* var. *parvifolium*; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) Fam. 81, p. 2.—*Glyaspernum ramiflorum* ZOLL. & MOR. Nat. Geneesk. Arch. N.I. 2 (1845) 11.—*P. floribundum* (non W. & A.) HASSK. Pl. Jav. Rar. (1848) 228.—*P. ramiflorum* var. *parviflorum* K.SCH. in K.Sch. & Hollr. Fl. Kais. Wilh. Land (1889) 70; PRITZEL, Bot. Jahrb. 62 (1929) 340.—*P. comptum* K.SCH. & LAUT. Fl. Schutzgeb. (1900) 338.—*P. clementis* MERR. Philip. J. Sc. 3 (1908) Bot. 137.—Fig. 2.

Shrub or tree, (3-)5-20(-30) m, occasionally epiphytic. *Leaves* spirally arranged or in pseudo-whorls of 3-6, elliptic to narrowly elliptic, c. 5-18 by 2½-6 cm, subcoriaceous; base broadly cuneate, margin slightly recurved, top c. ½-1½ cm rather abruptly acuminate, nerves c. 5-8 pairs, reticulations fine, tessellate; petiole c. 1½-2½ cm. *Inflorescences* generally on the bare branches below the leaves, variously densely branched and flowered; peduncles pubescent, occasionally up to

c. 3 cm. Bracts ovate, c. 1½-1 mm, caducous. Pedicels up to c. 6 mm. *Sepals* united at their base in a shallow cup c. 1½-2 mm high, short free lobes rounded at the top. *Petals* (4-)5-6(-7) by (1-)2(-3) mm, narrowly elliptic, rounded. Stamens c. 4-5 mm, filaments c. 3-5 by ⅓ mm, anthers oblong, ¾-2 mm. *Ovary* subsessile, ellipsoid or obovoid, c. 2-3 by 1-1½ mm, brownish pubescent; style 1-3 mm, stigma 2-lobed. *Fruits* varying in number, on woody pedicels, compressed globose, c. (7-)10-12(-15) mm diam., 2-valved, mucronate, valves hard, c. 1-2 mm thick, wrinkled, placentas up to near the top. *Seeds* numerous, very irregular-roundish, flat, c. 2-3 mm diam.

Distr. Solomon Isl., in *Malaysia*: Java, Celebes, N. Borneo (Mt Kinabalu), southern Philippines, (Negros, Cebu, Mindanao, Bohol), Moluccas (Ambon, Buru, Ceram), and New Guinea.

Ecol. Substage tree in rain-forests and on banks of forest streams, occasionally in mountain forests



Fig. 2. *Pittosporum ramiflorum* (Z. & M.) ZOLL. *ex* MIQ. Flowering twig, $\times \frac{1}{4}$, from a tree cultivated in Kebun Raya Indonesia (Photogr. F. HUYSMANS).

and in mossy oak forests, 0-3200 m, mostly above 1000 m.

Vern. Java: *Wuru*, (w.) *tjombangan*, J. Philippines: *duong*, *malagus*, Bag., *kolinus-hamolaon*, C. Bis., *riin*, Lan. Celebes: *karangkang-banti*, *mawuring*, Tombulu. New Guinea: *aratna*, Aiyura dial.

Note. In my opinion size of flowers or leaves give no reason for distinguishing varieties within this species.

A specimen collected by KOSTERMANS (2408) has remarkably large flowers (c. 10 mm) and fruits (c. 2½ mm diam.). It was collected together with

another specimen (KOSTERMANS 2407) which doubtless represents *P. ramiflorum* and has average-sized flowers and fruit. As the large-fruited specimen further agrees entirely (!) with *P. ramiflorum*, I distinguish this deviation for the present as *P. ramiflorum* f. *macrocarpum*.

3. *Pittosporum resiniferum* HEMSL. Kew Bull. (1894) 344; MERR. Publ. Gov. Lab. Philip. no 35 (1906) 17, incl. var. *orbiculatum*; Philip. J. Sc. 1 (1906) Suppl. 60; op. cit. 2 (1907) Bot. 275; op. cit. 5 (1910) Bot. 352; BROWN, Min. Prod. Philip. For. 2 (1921) 106, t. 38; MERR. En. Philip. 2 (1923) 224;

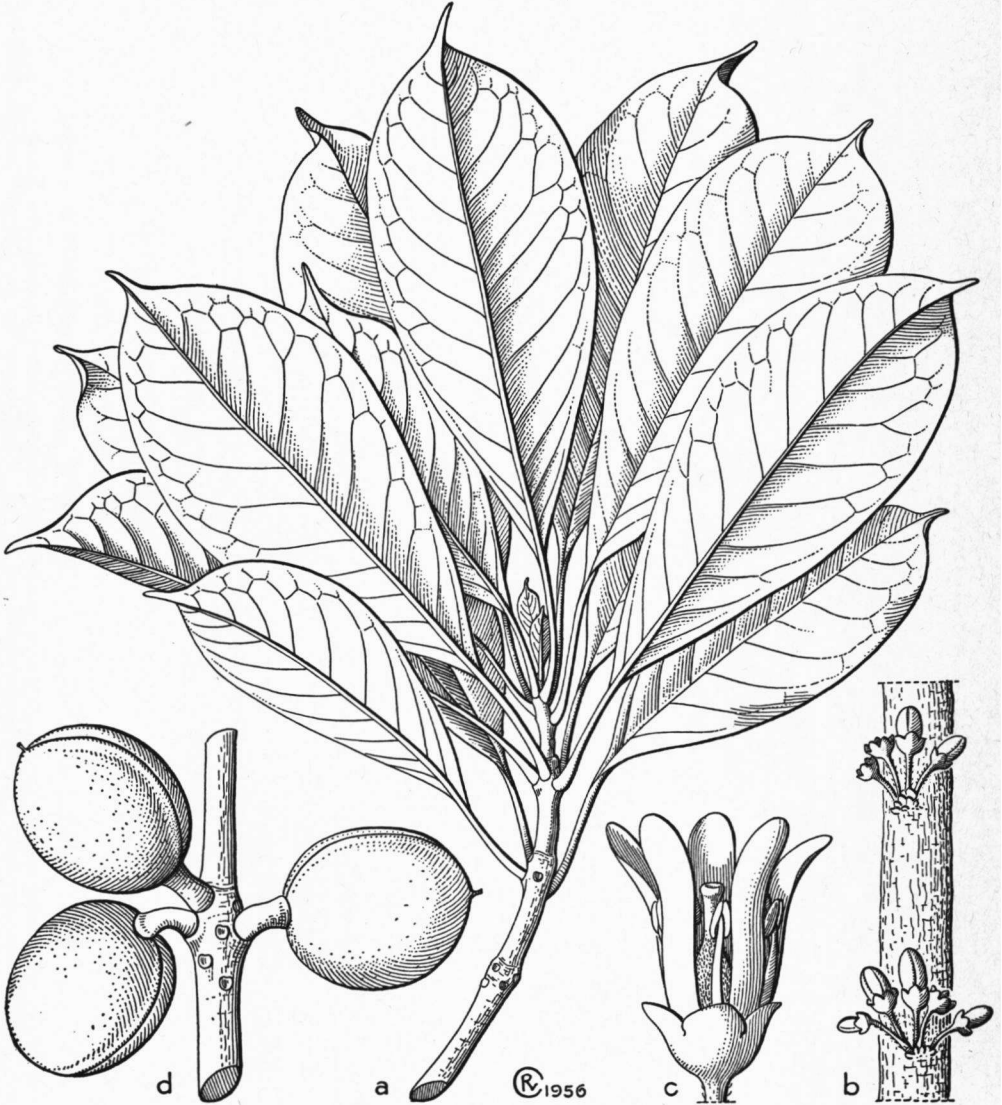


Fig. 3. *Pittosporum resiniferum* HEMSL. a. Twig, $\times \frac{2}{3}$, b. ramiflorous inflorescences, $\times \frac{2}{3}$, c. flower, $\times 3$, d. infructescence, $\times \frac{2}{3}$ (a after ELMER 9232, b-c RAMOS BS40750, d RAMOS BS1501).

PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; BROWN, Useful Pl. Philip. 2 (1950) 62, f. 23-24; QUIS. Med. Pl. Philip. (1951) 353.—*P. epiphyticum* MERR. Philip. J. Sc. 3 (1908) Bot. 138; En. Philip. 2 (1923) 222; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. acuminatissimum* MERR. Philip. J. Sc. 14 (1919) 402; En. Philip. 2 (1923) 221.—Fig. 3.

Small tree or shrub, often epiphytic, c. 2-5 m, occasionally c. 15 m; twigs glabrous. *Leaves* spirally arranged or slightly crowded in pseudo-whorls, stiff-coriaceous, narrowly obovate or oblanceolate, c. (6-)8-15(-21) by (2½-3)½-5½ (-6)½ cm, glabrous, the very young ones pubescent; base cuneate, decurrent, top rather abruptly c. ½-1 cm acuminate; nerves 7-10 pairs, prominent beneath, reticulations very fine; petiole c. 2-4 cm. *Inflorescences* almost always on the bare branches below the leaves, fascicles or shortly peduncled pseudo-umbels. Bracts ovate, c. 2 by 1½ mm, pubescent. Pedicels c. 2-6(-10) mm, pubescent or glabrescent. *Sepals* in their lower half united into a shallow cup c. 1-2 mm high, free lobes rounded at the top, c. 1-2 mm long. *Petals* narrowly oblong, c. 9-12 by 1½-2 mm. Filaments slender c. 6-7 mm, anthers c. 1½-2 mm, oblong. *Ovary* sessile, ellipsoid, c. 4-5 by 1½-2 mm, densely pubescent; style c. 2-2½ mm, stigma thickened. *Fruits* 1-6, on woody pedicels, globose, ellipsoid or ovoid, compressed, c. 2½-4 by 2-3½ cm, 2-valved; valves very hard, c. 4-5 mm thick, with large resiniferous cavities, cordate at the base, rugose; funicles inserted up to near the top. *Seeds* many, irregular in shape, c. 4 mm.

Distr. *Malaysia*: North Borneo (Mt Kinabalu) and Philippines (Luzon, Mindoro, Panay, Catanduanes, Leyte, and Mindanao).

Ecol. Common in mountain forests (mossy forests) on exposed ridges as a small tree or epiphyte, (400-)1000-2200(-3000) m, in the lower localities at 400 and 600 m apparently exclusively epiphytic.

Uses. The fruit is called 'petroleum nut' in the Philippines. It contains a considerable amount of pleasant-smelling oil, composed of dihydroterpene and normal heptane. It burns readily and is therefore used for illuminating purposes. Further it is considered as a universal medicine, cf. QUSUMBING *l.c.*

Vern. *Petroleum nut*, E, *abkél, abkól, apisang, botiak, daél, diñgo, kabilan, kiligto, lañgis, obkol*, Ig., *amimit, bualau, tago-ngirit*, Bik., *balicbican*, Tag., *kalapakab, pilai*, Bon., *sagága*, Ting.

Note. The only specimen from Mindanao (CLEMENS 1040) is the type specimen of *P. epiphyticum*. The two specimens from Leyte (WENZEL 807 and RAMOS B.S.15225) have formerly also been identified as *P. epiphyticum*. As the specimens from outside Luzon differ all more or less from the bulk of the Luzon material, it seems to me, that this species must be reduced to *P. resiniferum*, from which it only differs in the size of the leaves. The same can be said of *P. acuminatissimum*.

4. *Pittosporum ramosii* MERR. Philip. J. Sc. 5 (1910) Bot. 180; En. Philip. 2 (1923) 223; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.

Tree or shrub, c. 3-6 m. *Leaves* spirally arranged, sometimes somewhat crowded apically, elliptic, narrowly elliptic or narrowly obovate, c. 4-7 by 1½-3 cm; base decurrent, top abruptly c. ¾-1 cm acuminate; nerves c. 5-6 pairs, separated by a distinct intermediary secondary nerve, reticulations fine; petiole c. 1-1½ cm. *Inflorescences* mainly on the bare branches, below the leaves, but also axillary, fascicles or shortly peduncled pseudo-umbels. Bracts triangular, acute, c. 1 mm. Pedicels slender, c. 1 cm, glabrous. *Sepals* united at the base, elliptic, c. 1 mm long. *Petals* (immature) ligulate, c. 7 by 1½ mm. Filaments c. 4½ mm, anthers oblong, c. 1½ mm, cordate. *Ovary* c. 2 mm stipitate, ellipsoid, c. 2 by 1 mm, pubescent; style c. 2-2½ mm; stigma capitate. *Fruits* c. 1 cm stalked, c. 2 mm stipitate, subglobose, c. 8-10 mm diam., 2-valved, mucronate; valves coriaceous, pellucid, with large resiniferous cavities, smooth, inside faintly transversely ribbed; funicles inserted up to halfway the valves. *Seeds* c. 8-10, irregularly angled, c. 4 mm.

Distr. *Malaysia*: Philippines (Luzon).

Ecol. In forests, c. 1500 m.

Vern. *Albon*, Ig., *tungtuñga*, Bon.

Note. Obviously closely allied to *P. ramiflorum*, and hardly distinguishable from it in flower, but different in fruit by its coriaceous, pellucid, strongly resiniferous valves. It might possibly represent a subspecies (geographical race) of *P. ramiflorum* which it excludes geographically.



Fig. 4. *Pittosporum berberidoides* BURKILL, nat. size (BRASS 4399).

5. *Pittosporum berberidoides* BURKILL, Kew Bull. (1899) 96; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 276; MERR. & PERRY, J. Arn. Arb. 21 (1940) 175.—Fig. 4.

Slender tree, 3–6 m; young shoots purple-red. *Leaves* coriaceous, obovate, c. 2–4 by 1–3 cm; base cuneate, top abruptly and very short (c. 3 mm) acuminate; upper surface greyish-olive green, midrib impressed, c. 10–15 pairs of nerves, prominent, reticulations not fine; lower surface brownish-olive, midrib, nerves and reticulations yellowish, prominent; petiole c. 1 cm, purple-red. *Flowers* solitary, in the axils of often small leaves. Pedicels c. 1–2 cm. *Sepals* free, ovate or narrowly ovate, c. 3–3½ by 1½–2 mm, deep purple-red, margins ciliate, top acute. *Petals* ligulate, c. 12 by 2–2½ mm, deep purple-red, 3-nerved, apex rounded. Filaments c. 6 mm, slightly thickened towards the base; anthers narrowly ovate, c. 2 by 1 mm, base cordate. *Ovary* subsessile, ellipsoid, c. 3 mm long, glabrous, with c. 10–12 ovules; style c. 2–2½ mm, stigma not thickened. *Fruit* ellipsoid, c. 12 by 8 mm, purple-black in herb., 2-valved, mucronate; valves hard, rather thin, funicles inserted on the lower half, c. 1–2 mm long. *Seeds* c. 6, irregular, c. 3–4 mm long.

Distr. *Malaysia*: New Guinea (Central Division: Mts Scratchley & Albert Edward).

Ecol. Apparently only in subalpine mountain forests, 3000–3960 m, according to BRASS rather common on Mt Albert Edward.

6. *Pittosporum pullifolium* BURKILL, Kew Bull. (1899) 96; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 276; MERR. & PERRY, J. Arn. Arb. 21 (1940) 176.—*P. nubigenum* RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 18; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 276.—*P. batavorum* PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 276, in clav.—*P. ledermannii* PRITZEL, Bot. Jahrb. 62 (1929) 338; E. & P. Pfl. Fam. ed. 2, 18a (1930) 274, t. 157.—Fig. 5.

Small tree or shrub, c. 1–5 m, at lower altitudes hemi-epiphytic, said occasionally to be a medium-sized tree, c. 15–20(–36) m, young shoots yellowish brown pubescent. *Leaves* more or less in pseudo-whorls, stiffly coriaceous, elliptic, narrowly elliptic or narrowly obovate, c. 2½–25 by 1½–9 cm, pubescent when young, pubescence occasionally persisting beneath; base attenuate, margin slightly recurved or distinctly revolute, top rounded or abruptly c. ½–1 cm acuminate; midrib, 5–10 pairs of nerves, and the lax reticulations impressed above, midrib and nerves prominent beneath; petiole ½–3½ cm. *Inflorescences* terminal or pseudo-terminal, condensed racemes, exceptionally solitary axillary; peduncle firm, c. (0–)1–1½ cm, pubescent; rachis c. ½ cm, pubescent. Bracts triangular or narrowly oblong, c. 3–10 by 2–3 mm, acute. Pedicels 0–10 mm. *Flowers* large. *Sepals* free, narrowly elliptic to broadly elliptic, c. 4–6 by 2–3½ mm, yellow or purple, ciliate. *Petals* ligulate, c. 9–15 by 2–5 mm, top rounded. *Stamens* in ♂ flowers c. 9–12 mm, in ♀ flowers 4–4½ mm; filaments in ♂ flowers, c. 6–9 mm, in ♀ flowers c. 3 mm; anthers in ♂ flowers oblong, c. 2–3 mm,

in ♀ flowers small, c. 1–1½ mm. *Ovary* sessile, in ♂ flowers reduced, cuneiform. c. 1 mm, pubescent, in ♀ flowers ellipsoid, c. 4–6 by 2½ mm, style in ♂ flowers c. 3 mm, in ♀ flowers slightly shorter. *Fruits* up to 20, on woody pedicels of c. 1–2(–3) cm, ellipsoid to broadly ellipsoid, some-

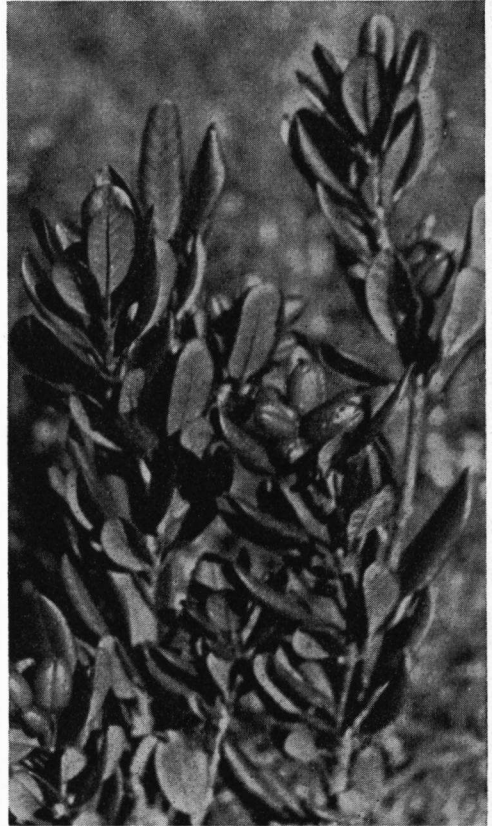


Fig. 5. *Pittosporum pullifolium* BURKILL near Lake Habbema (W. New Guinea), 3225 m alt., fruiting branches with typical convex leaves (Photogr. BRASS no 9087A).

times compressed, c. 1½–3½ by 1–2 cm, 2- or occasionally 3-valved, mucronate; valves rugose, slightly recurved when mature, c. 1–2 mm thick at the straight margins, in the median line up to 4 mm diam., funicles inserted up to the top of the valves. *Seeds* numerous, irregular, flattened, c. 5 mm.

Distr. *Malaysia*: New Guinea.

Ecol. The mountain form is a common small tree or shrub in edges of subalpine forests (3200–3800 m), the specimens from lower altitude are hemi-epiphytic shrubs or small trees in rain-forests or mossy forests (1200–2100 m, once at 600 and 100 m).

Note. The type of *P. pullifolium* represents the mountain form, which has small, thick leaves

with revolute margins and short petioles. In specimens from lower altitudes which have been referred to as *P. ledermanni*, leaf characters show a complete range from large and rather thin to rather small and thick. An authentic specimen of *P. batavorum* entirely agrees with *P. pullifolium*. The fragmentary type specimen of *P. nubigenum* has only immature flowers; it differs from *P. pullifolium* by its smaller flower parts and by its few, axillary flowers. *P. ledermanni* was considered to be an epiphytic shrub developing later into a tree. On the labels of the collectors one finds mostly 'epiphytic shrub' or 'small tree'.

7. *Pittosporum reticosum* RIDL. Fl. Mal. Pen. 1 (1922) 137.—*P. kerrii* CRAIB, Kew Bull. (1925) 16; Fl. Siam. En. 1 (1931) 98.

Small tree or shrub, c. 3–5 m high. Leaves spirally arranged and crowded towards the ends of the twigs, coriaceous, elliptic or narrowly elliptic, c. 4–15 by 2–4½ cm; base attenuate to decurrent, margin often wavy; top acute and generally c. ½–1 cm acuminate; midrib, c. 5–7 pairs of nerves and the fine reticulations more or less finely impressed above, prominent below; innovations yellowish or ferruginous-pubescent; petiole c. ½–1 cm. *Inflorescences* terminal, thyrsoid panicles, all parts ferruginous-pubescent; peduncle c. ½ cm, rhachis c. 1½–3 cm, lower branchlets 3-flowered. Bracts c. 4–5 mm long, caducous. Pedicels c. 2–3 mm. *Sepals* free, broadly elliptic, c. 2–2¼ by 1½ mm, rounded or acute, membranous towards the irregular margins. *Petals* narrowly elliptic, rounded c. 6 by 2½ mm. Filaments c. 3½ mm, anthers ovate, c. 1½ mm long, cordate at the base. *Ovary* subsessile, including the 5-furrowed stipe c. 2½ by 1¼ mm, pubescent at the base, apically nearly glabrous; style c. 2 mm, stigma not capitate. *Ovules* 4, basal. *Fruits* subglobose or broader than long, 2-valved, c. 1–2 cm pedicelled, c. 8–12 by 10–14 mm, mucronate; valves thin, slightly notched at the apex. *Seeds* 4 or less, inserted near the base, large, c. 4–6 mm, black, smooth.

Distr. S. China (Yunnan), Indo-China, Burma, Siam, and *Malaysia*: Malay Peninsula.

Ecol. In forests 1000–1800 m.

Note. As from the Malay Peninsula only fruiting specimens were available, the flowers have been described from a specimen from Siam (KERR 5559, the type of *P. kerrii*) which is obviously conspecific with *P. reticosum*. The type specimen of *P. reticosum* (WRAY & ROBINSON 5444), has somewhat longer and more slender fruit pedicels than the rest of the material (c. 1½–2 cm).

8. *Pittosporum longisepalum* BAKKER, *nov. sp.*—Fig. 6.

Habitu P. ferrugineo, sed differt sepalis eis duplo longioribus et alabastrum maturam conspicue excedentibus, seminibus 1–4, ad valvarum basin insertis. *Typus Clemens* 35096.

Treelet (or occasionally an epiphytic shrub?), c. 6 m; innovations pubescent. *Leaves* in pseudo-whorls, narrowly elliptic, c. 4–6 by 1½–2 cm;

base cuneate, decurrent, margin recurved, top acute and c. ½–¾ cm acuminate; midrib, c. 5–7 pairs of nerves and the fine reticulations finely impressed above; more or less pubescent beneath; petiole c. ½ cm. *Inflorescences* a small number of apical, 3-flowered cymes; peduncle terete, c. 2–3 cm, pubescent. Bracts linear, c. 5–6 mm, pubescent; pedicels ½–1½ cm. *Sepals* free, linear-lanceolate, c. 6–7 by 1–1½ mm, pubescent, acute, exceeding the petals in bud. *Petals* narrowly oblanceolate, c. 8 by 1–2 mm, acute, 3-nerved. Filaments c. 3 mm; anthers oblong, c. 2 mm, apiculate. *Ovary* subsessile, ellipsoid, densely pubescent on a c. 1 mm long, 5-furrowed stipe, c. 2 by 1–1½ mm, ovules 6–8; style c. 1½ mm, stigma capitate. *Fruit* subglobose, c. 7 mm diam., mucronate, 2-valved; valves thin, rugose; funicles inserted close to the base. *Seeds* 1–4, c. 4 by 3 mm.

Distr. *Malaysia*: North Borneo (Mt Kinabalu) and Central Celebes (*P. VAN DER GOOT* 1).

Ecol. Mountain rain-forests, 1200–1500 m.

Vern. Central Celebes: *Patjijala*, Toradja.

Note. This species seems to be related to *P. ferrugineum* AIT., but differs distinctly in having sepals about twice as long and a fruit with funicles inserted close to the base of the valves and containing much less seeds.



Fig. 6. *Pittosporum longisepalum* BAKKER. a. Twig with buds, × 2/3, b. bud, × 4, c. flower, × 4, d. fruit, nat. size, e. ditto, open, nat. size, f. seeds, nat. size (a after CLEMENS 33025, b–c, e–f CLEMENS 35096, d CLEMENS 31270).

9. *Pittosporum pentandrum* (BLANCO) MERR. Publ. Gov. Lab. Philip. no 27 (1905) 19; *op. cit.* no 35 (1906) 16; Philip. J. Sc. 1 (1906) Suppl. 57; BACON, Philip. J. Sc. sect. A, 4 (1909) 118; MERR. Philip. J. Sc. 5 (1910) Bot. 352; Sp. Blanc. (1918) 162; BROWN, Min. Prod. Philip. For. 2 (1921) 105; MERR. En. Philip. 2 (1923) 222; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; BROWN, Useful Pl. Philip. 2 (1950) 61; LI, J. Wash. Ac. Sc. 43 (1953) 45; QUISUMBING, Med. Pl. Philip. (1951) 352.—*Aquilaria pentandra* BLANCO, Fl. Filip. ed. 1 (1837) 373; MEISN. in DC. Prod. 14 (1857) 602.—*Limonea laureola* (non DC.) BLANCO, Fl. Filip. ed. 2 (1845) 251; NAVES in Blanco, Fl. Filip. ed. 3, 2 (1878) 101, t. 128.—*Bursaria inermis* AZAOLA in Blanco, Fl. Filip. ed. 2 (1845) 124; ed. 3, 1 (1877) 222.—*P. brachysepalum* TURCZ. Bull. Soc. (Imp.) Nat. Mosc. 27, 2 (1854) 366; ROLFE, J. Bot. 23 (1885) 210; VIDAL, Phan. Cuming. (1885) 95; Rev. Pl. Vasc. Filip. (1886) 50; CERON, Cat. Pl. Herb. Manila (1892) 18.—*P. ferrugineum* (non ART.) F.-VILL. Nov. App. (1880) 13.—*P. floribundum* (non W. et A.) F.-VILL. Nov. App. (1880) 13.—*P. fernandezii* F.-VILL. Nov. App. (1880) 13; VIDAL, Cat. Pl. Prov. Manila (1880) 17; Sinopsis Atl. (1883) 13, t. 8, f. A; Rev. Pl. Vasc. Filip. (1886) 50; CERON, Cat. Pl. Herb. Manila (1892) 18.—*P. pseudostipitatum* MERR. Philip. J. Sc. 14 (1919) 401; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.

Tree, c. 3–10(–17) m high, (2–)10–20(–30) cm diam. Leaves spirally arranged or subverticillate, very narrowly to narrowly elliptic or oblanceolate, c. (4–)6–10(–12) by 1–3 cm; base decurrent, margin often slightly undulate, top acute or very seldom rounded, generally slightly and gradually acuminate; midrib prominent, nerves not very conspicuous, c. 10–14 pairs the almost equally strong secondary ones included, reticulations very fine; petiole c. 1–1½ cm. Inflorescences terminal or axillary, many-flowered, thyrsoïd c. 3–4 cm diam.; peduncle c. 2–4 cm, pubescent; rachis c. 1–4½ cm, pubescent; lower branches c. 2 cm, upper ones c. ½ cm, all pubescent. Bracts narrowly ovate, boat-shaped, c. 3 by 1 mm, slightly ciliate; pedicels 0–5 mm. Sepals nearly free, coherent at the base, elliptic, rounded, c. 1–2 by 2/3–1 mm, ciliate. Petals almost ligulate, c. 6–8 by 1 mm, 3-nerved, top almost truncate. Stamens in ♂ flowers c. 4–5 mm, in ♀ flowers shorter; anthers in ♂ flowers oblong, c. 1½–2 by ½ mm, apiculate, in ♀ flowers sagittiform, c. ½–1 mm. Ovary c. 1 mm stipitate, glabrous, in ♂ flowers hardly thickened, c. 1½ by 1 mm; ovules c. 6–8; style c. 2–2½ mm, stigma not thickened; stipe in ♀ flowers thicker; ovary ovoid, compressed, c. 1½–2 by 1½–1½ mm, glabrous; ovules c. 8–10; style c. 1½ mm, stigma thickened. Fruits globose, compressed, mucronate, c. 7 mm diam., often with a stipe of variable (c. 1–3 mm) length; valves 2, thin, rugose; funicles inserted at the base of the valves, knob-like. Seeds c. 6–8, subreniform, c. 3 by 2 mm.

Distr. Formosa and Malaysia: Philippines (throughout) and N. Celebes.

Ecol. Characteristic for 'parang', i.e. thickets left of former forests from which the valuable timber trees have been removed (selective cutting), occasionally in rain-forest, common at low and medium altitudes up to 2300 m.

Uses. The fruits are used for medicinal purpose; they contain the so-called 'mamalis oil', cf. QUISUMBING, l.c.

Vern. *Abuagan, lamayen, lasult, pasgik, Ig., balinkauayan, bolonkoyan, saboagan*, P. Bis., *basult, oplai, uplai*, Ilk., *buyobuyo*, Vis., *darayau, mamali, marabiaga*, Tag., *dili, Gad., mamalis*, Pang., Tag., *panagusipsip*, Malaghi, *pañgantóan, pañgatóan, antoan*, C.Bis. *pasik*, Bon., *taliú*, Sbl., *parabiaga*, Tagb.

Note. The type specimen of *P. pseudostipitatum* differs only from the bulk of the material in having a slightly longer fruit stipe.

10. *Pittosporum ferrugineum* ART. Hort. Kew ed. 2, 2 (1811) 27; Bot. Mag. 46 (1819) t. 2075; DC. Prod. 1 (1824) 246, *excl. var. β ?filarium*; PUTTERL. Syn. Pitt. (1839) 8; BENTH. Fl. Austr. 1 (1863) 112; MIQ. Illustr. 1 (1870) 77; HOOK. f. & TH. Fl. Br. Ind. 1 (1872) 199; K.SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 71; KING & GAMBLE, J. As. Soc. Beng. 59, ii (1890) 128; K. & V. Bijdr. 4 (1896) 53; BAILEY, Queensl. Fl. 1 (1899) 70; BOERL. Cat. Hort. Bog. 1 (1899) 56 *incl. var. javanicum, var. moluccanum (pro specim.)*; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 337; MERR. Publ. Gov. Lab. Philip. no 35 (1906) 18; BACK. Schooffl. (1911) 74; KOORD. Exk. Fl. Java 2 (1912) 309; KOORD.-SCHUM. Syst. Verz. 1 § 1 (1912) Fam. 118; KOORD. Atlas 1 (1913) t. 136; GIBBS, J. Linn. Soc. Bot. 42 (1914) 58; HALLIER f. Med. Rijksherb. 37 (1918) 5; MERR. En. Born. (1921) 287; RIDL. Fl. Mal. Pen. 1 (1922) 136; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; CRAIB, Fl. Siam. En. 1 (1931) 98; BURK. Dict. (1935) 1763; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 81, p. 2; HEYNE, Nutt. Pl. (1950) 688; GOWDA, J. Arn. Arb. 32 (1951) 321; CORNER, Ways. Trees (1952) 517; COOPER, Ann. Mo. Bot. Gard. 43 (1956) 177.—*Itea javanica* BL. Bijdr. (1826) 863.—*Pseuditea javanica* HASSK. Flora 25, 2 (1842) Beibl. 30; Cat. Hort. Bog. (1844) 160.—*P. densiflorum* (non PUTT.) MOR. Syst. Verz. (1846) 21; MIQ. Fl. Ind. Bat. 1, 2 (1859) 122; Suppl. (1860) 392.—*P. floribundum* (non W. et A.) HASSK. Pl. Jav. Rar. (1848) 228, *excl. syn. Glycerium ramiflorum* ZOLL.—*P. javanicum* BL. Mus. Bot. 1 (1850) 159; MIQ. Illustr. 1 (1870) 75.—*P. rufescens* TURCZ. Bull. Soc. (Imp.) Nat. Mosc. 27, 2 (1854) 367; KOORD. Exk. Fl. Java 2 (1912) 310.—*P. moluccanum* (non (LAMK) MIQ. Illustr. 1 (1870) 76, *pro specim.*—*P. nativitatis* BAKER in Andrews, Monogr. Christm. Isl. (1900) 171; RIDL. J. Str. Br. R. As. Soc. no 45 (1906) 172.—*P. versteeghii* MERR. & PERRY, J. Arn. Arb. 21 (1940) 177.

Tree or shrub, c. (1½–)3–15(–22) m high. Leaves spirally arranged or slightly crowded in pseudowhorls, elliptic or narrowly elliptic, rarely narrowly ovate, c. 5–15 by 1½–5 cm; base cuneate or slightly decurrent, margin slightly wavy, top

acute and *c.* 1½–2 cm attenuate-acuminate; nerves *c.* (4)–5–8(–11) pairs, sometimes prominent beneath, reticulations fine; young leaves entirely ferruginous-pubescent, older leaves glabrescent to various degree, pubescence often persisting beneath; petiole *c.* 1 cm. *Inflorescences* terminal or less frequently axillary, thyrsoid, many-flowered; peduncle pubescent, *c.* 1–5 cm. Buds distinctly acute. *Sepals* free, lanceolate or narrowly lanceolate, *c.* 2–3(–4) by ¾–1 mm, acute and often acuminate, generally ferruginous-pubescent. *Petals* ligulate, *c.* 6–8 by 1 mm, acute, 3-nerved. *Stamens* *c.* 3–4 mm; filaments *c.* 2½–3½ mm; anthers oblong, in more ♂ flowers *c.* 1 by ⅔ mm, in more ♀ flowers *c.* ½ by ⅓ mm. *Ovary* inconspicuously (*c.* 1 mm) stipitate, ellipsoid or cylindrical, *c.* 2–2½ by 1–1½ mm, densely ferruginous-pubescent; style *c.* 1–1½ mm; stigma hardly capitate in ♂ flowers, in more ♀ flowers 2-lobed. *Fruits* 1–16, 2-valved; valves often broader than long, *c.* 7–10 by 9–12 mm, generally notched and mucronate at the top, narrowed towards the often pubescent base, rather thin, *c.* 1 mm, seldom 2 mm across, rugose; funicles inserted up to halfway the valves. *Seeds* *c.* 8–24, *c.* 3–4 mm.

Distr. SE. Asia to Australia, and Melanesia (Bismarck & Solomon Isl.), throughout *Malaysia*, also from the SW. Philippines (Palawan: SULIT PNH 12442).

Ecol. Common small tree or shrub in the tropical and montane zones, near the seashore (edge of swamps, rocks, etc.), along rivers, in dry bushes, on steppes and in open savannah land, sometimes as undergrowth in rain-forests or in secondary forests from the lowland up to 1800 m, in New Guinea once at 2800 m.

Uses. Bruised leaves and fruits are used as a fish poison, leaves and roots are used medicinally in Malaya.

Vern. Malay Peninsula: *Akar bēlalang puak*, *bunga sapon*, *chabek hantu*, *chēmpērai ikan*, *geramong*, *kēpialu pajan*, *kēlat tupai*, *kēpilu*, *mēdang kēlēlawat*, *m. pasir*, *pokok lēsai*, *p. nasi-nasi*, *p. sēruras*, *pulai puak*, *sērangnok*. Banka: *lēting*. Sumatra: *kaju tappul salaon*, *M. makamkadé*, Atjeh, *kaju madan kado*, W. Coast, *djarum djarum*, *longgāhan*, *simarsihula*, E. Coast, *simar sihalah*, Toba-Batak. Java: *mēdang pasir*, *M. huru hon(d)jē*, *huru sērēh*, *kihon(d)jē*, *kiladja*, *S. bērasan*, *brasa*, *kētjombrangan*, *lēri*, *mangir*, *manisdjangan*, *mēntaas*, *ondjē-ondjēan*, *pētjari*, *pundungan*, *sapēn*, *sonko*, *tjombrangan*, *wuru gēlēr*, J. Borneo: *mēdang lilin*, *M. ara bukit*, Brunei, *bangkulit*, *nonok nonok*, *pētaling*, Dusun, *sibutu*, Bajau. Celebes: *milai*, *ririh*, *P. Muna*, *soté*, Bonthain, *poētjē*, *londji*, *marāe*. Talaud Isl.: *abólo'a*, *ribusdr'a*. Moluccas: *asi*, *kaiporo*, Noef, *guseeman*, *rarakai*, Aru Isl. New Guinea: *bagiha*, Orokaiva language, Mumuni, *giche*, Constantinhafen, *jetapa*, Miniafia language, Utukap, *kapuwimbu*, Rawa, *pehfor*, Bemhi, *salinki*, Kaigorin, *sehpír*, Madang, *tormuya*, Anona dial.

Note. This is the most widely distributed species in Malaysia. It is rather common and can always easily be recognized; its characters are

remarkably constant in comparison with those of e.g. *P. moluccanum*. *P. rufescens* was considered by KOORDERS as a doubtful species. The type specimen represents, however, without any doubt, *P. ferrugineum*. The specimens referred by MIQUEL to *P. moluccanum* (LAMK) MIQ. are rather glabrous specimens of *P. ferrugineum*. *P. nativitatís* from Christmas Isl. (Ind. Oc.) has been distinguished on account of its congested inflorescence, but the type material contains only young inflorescences and these are often condensed in *P. ferrugineum*. The leaves of other specimens (RIDLEY 32 and 32a) are somewhat larger and have up to 11 pairs of nerves. The top of the leaves is acute but not acuminate.

The type locality of *P. ferrugineum*, as given by AITON ('Guinea') is obviously an error, as has already been pointed out by HOOKER *f.*, *l.c.*

11. *Pittosporum moluccanum* (LAMK) MIQ. Illustr. 1 (1870)76, *excl. specim., syn. part.*; MERR. Int. Rumph. (1917) 243, *excl. syn. P. ferrugineum β filarium.*—*Cortex foetidus* RUMPH. Herb. Amb. 7 (1755) 12, t. 7.—*Anasser moluccana* LAMK, Tabl. Enc. Méth. Bot. 2 (1793) 40.—*Anassera moluccana* PERS. Syn. (1805) 265.—*Itea umbellata* ROXB. [Hort. Beng. 1814, 85, *nomen*] Fl. Ind. 2 (1824) 419.—*Senecia undulata* (*non* LAMK) DECAISNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 429.—*P. rumphii* PUTTERL. Syn. Pitt. (1839) 7, *excl. syn. P. ferrugineum β filarium*; BLUME, Mus. Bot. 1 (1850) 160, *excl. specim., excl. syn. ditto*; MIQ. Fl. Ind. Bat. 1, 2 (1858) 123, *ditto*.—*P. timorense* BL. Mus. Bot. 1 (1850) 160; MIQ. Fl. Ind. Bat. 1, 2 (1858) 122; Illustr. 1 (1870) 80, t. 36; BOERL. Cat. Hort. Bog. 1 (1899) 57, *incl. var. teysmannianum*; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. monticolum* MIQ. Illustr. 1 (1870) 83; K. & V. Bijdr. 4 (1896) 60; KOORD. Exk. Fl. Java 2 (1912) 309; KOORD.-SCHUM. Syst. Verz. 1, § 1 (1912) Fam. 118; KOORD. Atlas (1913) t. 137; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; STEEN. Bull. Jard. Bot. Btzg III, 13 (1933) 49; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 81, p. 2.—*P. fissicalyx* MIQ. Illustr. 1 (1870) 81; DAMMERMAN, Nat. Tijd. N.I. 86 (1926) 108; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. brackenridgei* (*an* A. GRAY?) MIQ. Illustr. 1 (1870) 83.—*P. glabratum* (*non* LINDL.) F.-VILL. Nov. App. (1880) 13; VIDAL, Sinopsis Atlas (1883) t. 8, f. B.—*P. microcalyx* K. & V. Bijdr. 4 (1896) 62; BACK. Schoolfl. (1911) 74.—*P. zollingerianum* BINN. *ex* K. & V. Bijdr. 4 (1896) 58, *incl. var. tenuinervis & var. argentea*; BOERL. Cat. Hort. Bog. (1899) 56; Ic. Bog. (1906) t. 138.—*P. odoratum* MERR. Publ. Gov. Lab. Philip. no 35 (1906) 16; Philip. J. Sc. 1 (1906) Suppl. 60; Philip. J. Sc. 2 (1907) Bot. 275; Philip. J. Sc. 3 (1908) Bot. 406; En. Philip. 2 (1923) 222; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. littorale* MERR. Philip. J. Sc. 5 (1910) Bot. 179; En. Philip. 2 (1923) 222; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; LI, J. Wash. Ac. Sc. 43, 2 (1953) 45.—*P. megacarpum* MERR. Philip. J. Sc. 5 (1910) Bot. 179; En. Philip. 2 (1923) 222; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930)

274.—*P. pulgarens* ELMER, Leaf. Philip. Bot. 5 (1913) 1825; MERR. En. Philip. 2 (1923) 223.—*P. subverticillatum* ELMER, Leaf. Philip. Bot. 8 (1915) 2795.—*P. glaberrimum* MERR. Philip. J. Sc. 14 (1919) 402; En. Philip. 2 (1923) 222; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. euphlebium* MERR. Philip. J. Sc. 17 (1920) 258; En. Philip. 2 (1923) 222; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. obscurinerve* MERR. Philip. J. Sc. 17 (1920) 257; En. Philip. 2 (1923) 222.—Fig. 7-8.

Shrub or tree, (2-)8-15(-20) m high; young shoots often ferruginous-pubescent. *Leaves* spirally arranged or crowded towards the ends of the twigs, subcoriaceous, very variable in shape and size, generally narrowly elliptic, narrowly obovate or oblanceolate, rarely narrowly ovate, c. 5-15(-23) by 2½-5½(-7) cm; base cuneate, generally

decurrent, margins generally undulate, top gradually or abruptly shortly acuminate, often also rounded; nerves c. 6-12 pairs, reticulations fine; petiole c. 1-2 cm. *Inflorescences* terminal or axillary subsessile or peduncled fascicles or panicles, peduncles up to c. 6 cm. Bracts linear, acute, pubescent, c. 3 mm long. Pedicels c. 1-6 mm. *Sepals* nearly free or united to varying degree, narrowly elliptic or lanceolate, sometimes the calyx split to the base at one side, c. 4 mm long, tops acute or rounded. *Petals* ligulate, (9-)10-12 (-15) by 2 mm. *Stamens* in ♂ flowers c. 8-12 mm, in ♀ flowers c. 4½-6 mm; anthers in ♂ flowers oblong, c. 1½-3 mm, apiculate, in ♀ flowers triangular or sagittiform, c. 1½-1½ mm. *Ovary* stipitate or almost sessile, in ♂ flowers c. 5 by 1 mm, in ♀ flowers ellipsoid, c. 3-5 by 1½-2 mm, glabrous or pubescent (the base, the lower half,



Fig. 7. *Pittosporum moluccanum* (LAMK) MIQ. a. Flowering twig, $\times 2/3$, b. bud, $\times 3$, c. section of flower, $\times 3$, d. reduced stamen of ♀ flower, $\times 6$, e. fruit, $\times 2/3$, f. ditto, dehiscent, $\times 2/3$ (after materials from East Java).

or entirely); style in ♂ flowers c. 4 mm, in ♀ flowers c. 2 mm; stigma in ♂ flowers not, in ♀ flowers distinctly thickened. *Fruits* solitary or few, ellipsoid, compressed-obovoid or -globose, mucronate, c. (1-)2-4(-5) by (1-)1½-2(-3) cm, 2-valved; valves thick-fleshy, in the median line c. 3-6 mm thick, recurving when dry, margins readily incurved when dry, undulate, rugose; funicles inserted up to near the top. *Seeds* many, of variable size.

Distr. Formosa, and *Malaysia*: Philippines (throughout), Celebes (incl. also Saleyer & Kabaena Isl.), Moluccas (Buru & Kei Isl.), Java (specially E. Java), Lesser Sunda Isl. (throughout).

Ecol. In light, rather dry woods, mixed monsoon-forest, tjemara forest, steep and bare slopes, occasionally near the sandy beach, on rocky shores, on sand, limestone or volcanic soil, in Java generally between 1000 and 2000 m, in the Philippines between 600 and 1500 m, but here as well as elsewhere also often at lower altitude.

Use. A decoction of the fruits is occasionally used for cleaning wounds.

Vern. Java: *Hondjè bodas*, *S*, *belatjan*, *ëndog-ëndogan*, *gédangan*, *kédutan*, *klapan*, *pèlong*, *polean*, *randu-basin*, *sēmutan*, *sēngir*, *suruan*, *wuru gédang*, *wuru ketek*, *J*, *adjon*, *kadju tjankrèng*, *kalang mangga*, *kheuleung-manggeuh*, *sawo alas radja*, Md. Sumbawa: *luha*. Sumba: *aikelihit*, *kalihi*. Flores: *maramike*. Timor: *natbona*, *nak bohna*. Celebes: *lassa darre*, Makass., *tikala*, Toradja. Philippines: *amomu*, P. Bis., *amomunpon*, Vis., P. Bis., *botúnis*, Ilk., *bulálang*, Tag., *camar-sutay*, *dail*, Bon., *kamidíng*, Ig., *labagáñgon*, *libagañgon*, *sagawan*, Buk., *tapotása*, *tumpagasog*, Bag., *tikala*, C. Bis.

Nomencl. The type (and sole base) of this species is the description and plate of *Cortex foetidus* of RUMPHIUS (Herb. Amb. 7, p. 12 t. 7), the Amboinese name of which is, according to R., *anasser*. On p. 13 RUMPHIUS described a second plant as *Cortex filarius* (without a plate). The interpretation of these two has caused much confusion as appears from the synonymy.

LAMARCK (Enc. Méth. Bot. 1, 1783, 747) entered *anasser* in his list limiting it to *Cortex foetidus* RUMPH. The fact that LAMARCK did not enter the name *anasser* in his 'Table des noms latins des genres de plantes contenus dans ce volume' proves that he did not accept this vernacular name as the scientific name of a genus, no more than when he entered '*appel*' (l.c. 216); scientific names in this work are printed in italics. JUSSIEU (Gen. Pl. 1789, 150) accepted the vernacular name *anasser* as the generic name of a new genus, basing his description, however, on a plant collected by COMMERSON in Bourbon, unfortunately suggesting that this species was '*subsímile plantae rumphianae 7, t. 7 forte congeneri & Anasser dictae*'. This latter assumption has proved to be erroneous as COMMERSON's plant has appeared to belong to *Geniostoma* (*Loganiaceae*).

LAMARCK in his Tabl. (Bot. 2, 1793, 40) accepted JUSSIEU's generic description of *Anasser*, distinguishing two species, *A. borbonica* and *A. moluc-*

cana (based on *Cortex foetidus*). The type species of *Anasser* JUSS. is obviously *A. borbonica*. The latter is also the only species accepted in *Anasser* by GMELIN (Syst. Veg. 1, 1796, 333). The generic name *Anasser* JUSS. is, therefore, a clear synonym of *Geniostoma*.

Why *Anasser moluccana* has been reduced to *Strychnos pseudoquina* in Ind. Kew. is obscure.

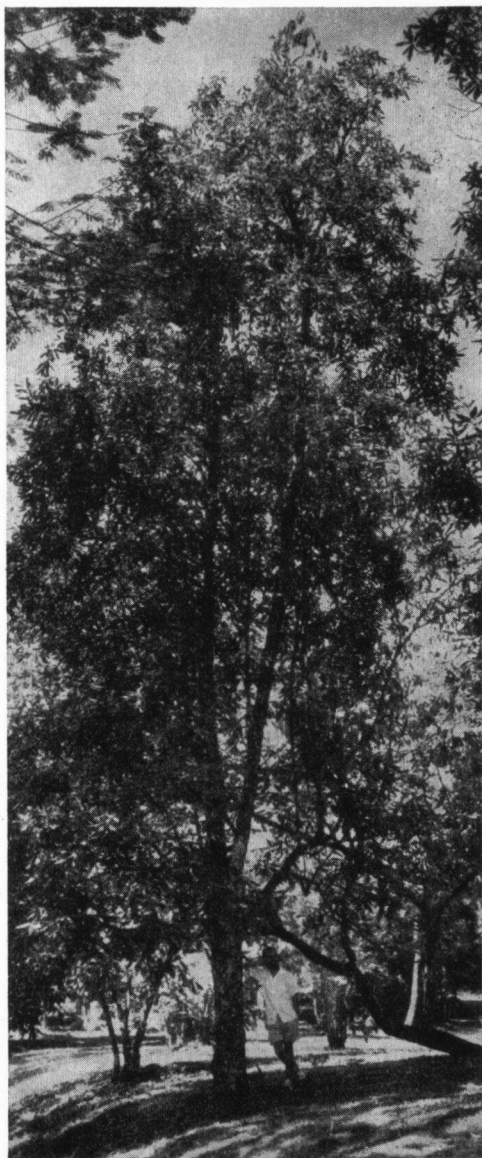


Fig. 8. *Pittosporum moluccanum* (LAMCK) MIQ. Tree grown in Kebun Raya Indonesia, Bogor (Photogr. F. HUYSMANS).

J. SMITH (in Rees, Cycl. 1814, under 4. *Pittosporum ferrugineum* AIT.) referred *Cortex filarius* RUMPH. to a plant collected by CHR. SMITH in the type locality (Oma Isl., Moluccas) associating it erroneously with RUMPH. Herb. Amb. 7, p. 13 t. 7 which table belongs to *Cortex foetidus*!. He already noted that he could find no trace of the bark fibres mentioned by RUMPHIUS for *Cortex filarius*. This error in mixing up the two Rumphian plants has been copied repeatedly by later authors and caused much confusion (e.g. DC. Prod. 1, 1829, 347 and DON, Gen. Hist. 1, 1831, 374 considered *Cortex filarius* a variety β ?*filarium* of *P. ferrugineum*).

PUTTERLICK l.c. was of opinion that the Rumphian plant was distinct from *P. ferrugineum* and based his *P. rumphii* on both *Cortex foetidus* and on *P. ferrugineum* β *filarium* SM. in REES (which in turn was based on *Cortex filarius* RUMPH.).

VALETON (in K. & V. Bijdr. 4, 1896, 52) was the first who suggested that *Cortex filarius* is not a *Pittosporum* and I agree with MERRILL (Int. Rumph. 1917, 380) that it is a *Gyrinopsis* (Thym.).

Cortex foetidus, however, is without any trace of doubt a *Pittosporum*. Superficially the plate suggests in the leaf *P. ferrugineum* which has misled some authors mentioned above. For a correct interpretation the major points in the description are:—leaves 15–22 by 5 cm, lanceolate, acute at both ends; buds in c. 2 cm long racemes; fruits solitary or 3–5 together, as large as a 'pigeon-egg' (i.e. c. 2½ cm), at last orange-red, with a thick-fleshy pericarp enclosing a cavity as large as a hazelnut; placenta reaching over halfway the valves; seeds numerous, black, shiny; on open places, often on coral limestone.

These characters agree excellently with plate 7, which is, judging from the sizes cited in the description, reduced to c. 2/5 of the natural size.

In trying to associate it with a Malaysian species of *Pittosporum* it appears that the only one in East Malaysia which agrees with its characters is what has been called hitherto *P. monticolum* = *P. timorensis*. *P. ramiflorum* and *P. resiniferum* are ramiflorous, *P. ferrugineum* has much smaller leaves and fruits, and the New Guinean species are equally out of question.

MIQUEL, following PUTTERLICK, was (1870) on the right track in distinguishing it from *P. ferrugineum*, but curiously his specimens of *P. moluccanum* (coll. ZIPPÉLIUS, and TEYSMANN) belong to *P. ferrugineum*; he possibly assumed t. 7 to be at natural size when he stated that RUMPHIUS's plate and description of *Cortex foetidus* represent two species.

Final evidence is furnished by the fact that *P. monticolum* = *P. timorensis* has actually been collected in BURU (leg. DE VRIESE & TEYSMANN, described as *P. fissicalyx* MIQ., and TOXOPEUS 303).

Though it is to be regretted that the well typified *P. timorensis* has to be reduced to a species merely based on a Rumphian description and

plate, the certainty achieved in identifying it leaves no other way out.

Note. *P. moluccanum* is a very variable species and has, therefore, given way to a vast synonymy. A careful analysis of a vast amount of herbarium material has shown the impossibility of splitting it up satisfactorily into distinct infraspecific taxa. The variability of the calyx lobes (degree of connation and shape of apex) is rather remarkable but is found in various places of the population. The Philippine specimens generally have nearly free sepals with acute tips, while the Java material shows generally connate sepals with rounded tips. These characters, however, are not constant and pass gradually into each other, as does the pubescence of the ovary, which is only present at the base in most Java specimens.

The type specimen of *Itea umbellata* ROXB. in the Brussels herbarium is mounted together with a specimen of *P. ferrugineum*. ROXBURGH's description of *I. umbellata*, however, can only refer to the left specimen on the sheet, which belongs doubtless to *P. moluccanum* (LAMK) MIQ.

In *P. fissicalyx* the leaves are very large and the sepals are almost entirely connate, while the calyx is split at one side, a character often encountered in this species. *P. megacarpum* has been distinguished by its large fruits, but the size of the fruits shows a wide (complete) range of variability; no other character could be found correlated with this large fruit size; flowers of *P. megacarpum* are not known. *P. obscurinerve* differs only from the majority of the sheets by rather thick leaves with an obscure nervation. *P. subverticillatum* has been distinguished by its longer petioles (c. 2 instead of 1 cm). *P. glaberrimum* has been proposed only on account of its solitary fruit which has a somewhat thinner pericarp (possibly immature?), as has the fruit of *P. euphlebioides*, which species has been distinguished because of a prominent nervation beneath. I have not seen material of *P. pulgarensis*, which species is said (ELMER l.c. 1913) to be closely related to *P. odoratum* (= *P. moluccanum*). MERRILL (l.c. 1923), however, stated, that *P. pulgarensis* is allied to *P. pentandrum*, rather than to *P. odoratum*. PRITZEL (l.c. 1930) assumed *P. pulgarensis* to deviate only little from *P. odoratum*. Judging from the description, the type specimen (which is apparently the only one known) seems to me a more φ plant of *P. moluccanum*.

P. moluccanum is among Malaysian species recognized by its fruits, which have a rather thick pericarp. The placenta bears funicles to near the top. In dried specimens the valves recurve strongly and have incurved margins.

Whether it occurs outside Malaysia, is not certain. MIQUEL (1870) identified a collection from Halmaheira (TEYSMANN HB 5646) with the Fijian *P. brackenridgei* A. GRAY which it strongly resembles in habit; further study with abundant material should reveal its relation to *P. moluccanum*.

In two specimens (ESCRITOR BS 21390 and SULTI PNH 10039), both from Mindanao, I found

abnormal flowers, in which the sepals were almost entirely connate into a cup with very small free lobes. In both specimens the flowers appeared to contain clumps of small globules which might be eggs laid into the bud by some insect. Stamens and pistil are absent.

Doubtful

Among the collections is one labelled 'GRIFFITH, Malacca', of which a specimen is preserved both in the Gray Herbarium and at Florence. It represents *P. floribundum* W. & A., but I doubt whether it is rightly localized.

Excluded

Pittosporum macrophyllum LAUT. & K.SCH. in K.Sch. & Laut. Fl. Schutzgeb. (1900) 338; RECHINGER, Denkschr. K. Ak. Wiss. M.-N. Kl. Wien 89 (1913) 556 = *Erythrospermum candidum* (BECC.) BECC. in Gibbs, Arfak (1917) 215; SLEUMER, Fl. Mal. I, 5 (1954) 7 (*Flacourtiaceae*).

Pittosporum ferrugineum β ?*filarium* DC. Prod. 1 (1824) 347, based on *Cortex filarius* RUMPH. Herb. Amb. 7 (1755) 13 (*excl. t. 7*) is according to MERRILL, Int. Rumph. (1917) 380 = *Gyrinopsis brachyantha* MERR. (*Thymelaeaceae*), a reduction with which HEYNE, Nutt. Pl. (1927) 1151 agrees.

2. HYMENOSPORUM

R.BR. *ex* F. v. MUELLER, Fragm. 2 (1860) 77.

Shrub or small tree. *Leaves* entire, often crowded towards the ends of the twigs. *Flowers* in often pseudo-umbellate, terminal corymbs, 5-merous. *Sepals* free, caducous. *Petals* loosely cohering in a tube to above the middle, more or less clawed, large. *Stamens* 5, exserted; filaments linear; anthers ovate-oblong, blunt, cells diverging sagittately at the base. *Ovary* linear, incompletely 2-celled; style short; stigma thickened \pm 2-lobed. *Ovules* ∞ . *Capsule* (not seen) broad-elliptic to orbicular, with 2 coriaceous valves each bearing a median placenta. *Seeds* (not seen) ∞ , flat, reniform, horizontally imbricate, surrounded by a membranous wing.

Distr. Monotypic, E. Australia and *Malaysia*: SE. New Guinea.

1. *Hymenosporum flavum* (HOOK.) F.v.M. Fragm. 2 (1860) 77; BENTH. Fl. Austr. 1 (1863) 114; F. M. BAILEY, Queensl. Fl. 1 (1901) 71; WHITE & FRANCIS, Proc. R. Soc. Queensl. 35 (1923) 63; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 281; WHITE, Contr. Arn. Arb. 4 (1933) 39; BAKH. f. & STEEN. Blumea 7 (1952) 292.—*Pittosporum flavum* HOOK. Bot. Mag. (1854) t. 4799.

Evergreen treelet, 6 m. *Leaves* obovate-oblong to oblanceolate, acute-acuminate, narrow cuneate-decurrent at the base, glabrescent, 7 $\frac{1}{2}$ –15 by 3–4 $\frac{1}{2}$ cm; petiole 1–1 $\frac{1}{2}$ cm. *Corymbs* few or many-flowered, tomentose-pubescent; peduncle 3–6 cm, c. 10(–20) by 10 cm. Bracts foliaceous, acute, oblong, 10–15 by 3 mm. Pedicels 3–4 cm. Bracteoles small, linear or lanceolate, acute, c. 10 by 1–2 mm. Flowers scented, yellow or cream tipped yellow, petals suffused with rose-violet inside at the base (CARR). *Sepals* oblong-rounded or acutish, 5–6 by 2 $\frac{1}{2}$ –3 mm, with a thin margin. *Petals*: claw-like base 2 $\frac{1}{2}$ cm, linear, erect, tomentose outside, the spreading lamina rhomboid-

ovate, c. 1–1 $\frac{1}{4}$ by $\frac{3}{4}$ cm, veined, puberulous outside. *Stamens* pubescent below, glabrous towards the apex; anthers oblong, c. 2 mm, cells at the base for $\frac{1}{4}$ mm free, divaricate. *Ovary* silky-tomentose, terete, c. 1 $\frac{3}{4}$ cm; style c. 4–5 mm. *Capsule* (not seen) stipitate, \pm orbicular, compressed, c. 2 $\frac{1}{2}$ –3 cm diam. *Seeds* (not seen) c. 4–6 mm long, wing 2–3 mm broad.

Distr. Australia (Queensland to New South Wales), in *Malaysia*: SE. New Guinea (Papua: Isuarava and Boridi).

Ecol. In Australia common in cleared rain-forest country, in Papua twice collected in secondary forest, c. 1200 m, fl. Nov.–Febr. (the rainy season).

Uses. A pretty ornamental, resembling a very large-flowered *Pittosporum*, grown with success in the Tjibodas Mountain Garden (W. Java) under everwet climatic conditions at c. 1400 m; also cultivated at Bogor, c. 250 m, but not flowering there; also in greenhouses in temperate regions.

3. CITRIOBATUS

CUNNINGHAM *ex* [LOUDON, Hort. Britt. Suppl. 1, 1835, 585, *nomen subnudum*] PUTTERLICK, Syn. Pitt. (1839) 4; F. M. BAILEY, Queensl. Agric. J. 30 (1913) 399, t. 64–68; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 285; C. T. WHITE, Proc. R. Soc. Queensl. 50 (1939) 67.—Fig. 9.

Stiff, erect, spiny shrubs; twigs mostly ending in a thorn or/and with lateral, partly axillary thorns, when young their surface normally provided with short, warty emergences which may be crowned by a few fine hairs. *Leaves* small,

partially in tufts on knob-like short-shoots. *Flowers* small, polygamo-dioecious if ♀ and ♂ or unisexual and dioecious if ♀ and ♂, 5-merous, white, solitary, axillary, mostly on knob-like very short, short-shoots provided with a number of minute, dry, imbricating scales, sessile, rarely pedicelled. *Sepals* 5, free or cohering at the base, slightly unequal, shortly fimbriate or ciliate. *Petals* 5, in their lower part coherent forming a tube, segments patent or recurved. *Filaments* coherent with the petals, anthers (slightly dorsi-) basifix, connective sometimes shortly and bluntly produced. *Ovary* sessile or short-stipitate, hairy, 1-celled, the stipe at the base sometimes with a ± lobed, disk-like, thickened ring; style glabrous, stigma thickened; placentas 2 or 5, parietal; ovules 10-∞. *Fruit* globular, not dehiscent, glabrous or glabrescent, with either a hard or a thin, finally orange pericarp. *Seeds* few to very numerous, immersed in a sticky resinous, aromatic pulp; cotyledons almost wholly connate, free at the apex; radicle very minute, conical.

Distr. Four *spp.* in Australia (Queensland to New South Wales), in *Malaysia* one species (SE. Java, Celebes, Philippines).

Ecol. Dry and wet rain-forests (Australia), in *Malaysia* a constituent of the lowland monsoon forest flora, often common in second growths.

Taxon. The status of the Australian species has gradually become clear; the opinion of BOERLAGE & KOORDERS (*l.c. vide infra*) that properly there would be only one species in Australia seems not justified. In framing a key for all species, it appeared impossible to separate the Malaysian species from the Australian *C. spinescens*, with which it shares an ovary with ± 5 placentas, a thick-walled, very many-seeded, large, hard-shelled fruit, entire, obovate leaves, and relatively large flowers. The form pictured by BAILEY *l.c.* as *var. kennyi* BAILEY exactly matches the Malaysian sheets. The Malaysian sheets have, averagely, somewhat larger leaves, but the variety just mentioned, sunk into the species by WHITE, occupies an intermediate position as to leaf-size.

As some of the Australian species may occur in the dry parts of southern New Guinea I have given a key to all species with the help of Mr L. S. SMITH (Brisbane).

Morph. The base of the ovary shows sometimes a ring-like thickening, indented slightly opposite the filaments, suggesting the presence of glandular disk-tissue. Axillary spines, lateral leaf-tufts, and flowers are borne on or represent short-shoots which are provided at the base with small, dry, imbricating scales. BAILEY mentions for *C. lancifolius* stamens opposite the petals; this is an error. This species is remarkable by its leaves being pellucid-dotted and flecked by glands which contain an orange-coloured (?resinous substance; according to C. T. WHITE fresh leaves of this species taste like carrots. In the other species pellucid dots are absent.

Mr L. S. SMITH (Brisbane), to whom I am obliged for vital information, has observed that all species have two kinds of flowers, one kind restricted to one specimen (and therefore to one plant?), similarly as in *Pittosporum*. Flowers with sterile anthers have the stamens only $\frac{1}{2}$ - $\frac{3}{4}$ of the length of the pistil; the anthers are stunted and the ovary obviously develops into a fruit. The other kind of flower has fertile anthers and its stamens are about as long as or a little longer than the pistil; the ovary is usually well developed and has the same number of ovules as the functionally ♀ flowers but is often more distinctly stipitate and its stigma is less expanded beyond the width of the style, but specimens available do not indicate whether fruit is set. It is therefore difficult to be certain whether the flowers are ♀ and ♂ (which they look like) or are functionally ♀ and ♂ (which they probably are).

Nomencl. In LOUDON'S First Additional Supplement, the cover of which bears the date 1835 in the Leyden copy, the generic name attributed to CUNNINGHAM, is technically a *nomen seminudum*, as a 'spiny shrub with citrus-like fruit' is hardly acceptable to me as a valid generic description. It is true, as Mr SMITH points out to me, that LOUDON by giving the genus a number 689a accepts it as pittosporaceous and arranges it following *Bursaria*, which is, however, also spiny. *Bursaria* fruits change rapidly from a pale greenish colour through pale yellow to dull brown (and when ripe they dry fairly quickly). Summarizing, the evidence for a 'description' as required by the Rules is therefore exceedingly meagre. This stands apart from the fact that the identification of LOUDON'S plants is obviously beyond doubt. And if by stating the fruit to be 'citrus-like' LOUDON meant that it was indehiscent it would be right to accept LOUDON'S as adequate. This is a border-line case; in my opinion we should accept the full description by PUTTERLICK (1839).

He mentioned the same two specific names *C. pauciflora* CUNN. and *C. multiflora* CUNN. as had been mentioned by LOUDON, but both are entirely *nomina nuda*. Although both species were grown in many greenhouses at that time, and in some tropical botanic gardens, where they flowered and fruited, the species remained undescribed until about 1860.

Unfortunately VON ETtingshausen (Blatt-Skelette Dikot. 1861, 147, t. 61, f. 6-8) has described and figured leaves under the name *C. pauciflorus* CUNN. which doubtless belong to *C. multiflorus* CUNN.

ex BTH. 1863 and unless an older description can be traced validating the latter name, the correct name for the latter species under the Rules is *C. pauciflorus* CUNN. ex ETTINGSH.

KEY TO THE SPECIES

1. Pericarp thick, hard, fruit c. ($1\frac{1}{4}$ -) $1\frac{1}{2}$ - $2\frac{1}{2}$ cm diam., densely hairy when young, glabrescent. Placentas c. 5. Ovules 80-100. Seeds c. 40-80. Corolla tube almost 6 mm high, segments c. 2-3 by $1\frac{1}{4}$ - $1\frac{3}{4}$ mm. Ovary c. $2\frac{1}{2}$ -3 or $3\frac{1}{4}$ - $4\frac{1}{2}$ mm; style $2\frac{1}{2}$ or 4-5 mm. Leaves distinctly obovate to obovate-oblong, entire, cuneate to the base 1. *C. spinescens*
1. Pericarp thin, fruit at most 1 cm diam., very sparsely hairy, even when young. Placentas 2. Ovules 10-20. Seeds c. 2-20. Corolla tube $2\frac{1}{2}$ -5 mm. Leaves either roundish or narrowly lanceolate to oblanceolate. Australian spp.
2. Leaves generally roundish, toothed or lobed and apiculate in the upper part (rarely some entire), $1\frac{1}{2}$ - $1\frac{1}{2}$ by $1\frac{1}{4}$ - $\frac{4}{5}$ cm. Corolla tube c. $2\frac{1}{2}$ - $3\frac{1}{2}$ mm high, lobes $1\frac{1}{2}$ -2 by 1 mm. Fertile anthers c. 1 mm. Ovary c. $1\frac{1}{2}$ - $2\frac{1}{4}$ mm long, style c. $1\frac{1}{4}$ mm (*C. multiflorus* CUNN. ex BTH. 1863).
C. *pauciflorus* CUNN. ex ETTINGSH.
2. Leaves lanceolate or linear to narrowly oblong, oblanceolate, rarely oblong, entire, mostly exceeding $1\frac{1}{2}$ cm. Corolla tube $3\frac{1}{2}$ -5 mm high. Fertile anthers c. $1\frac{1}{4}$ - $1\frac{1}{2}$ mm.
3. Leaves $1\frac{1}{2}$ - $3\frac{1}{2}$ by $1\frac{1}{4}$ - $\frac{3}{4}$ cm, not pellucid-punctate. Flowers 2-5 mm pedicelled. Sepals ovate-oblong, acute, $1\frac{1}{2}$ by $\frac{1}{2}$ - $\frac{3}{4}$ mm. Corolla tube c. $3\frac{1}{2}$ -5 mm high, segments $1\frac{1}{2}$ by $1\frac{1}{4}$ mm, erect or slightly spreading. (*C. multiflorus* CUNN. ex BTH. var. *linearis* & var. *intermedius* F. M. BAILEY).
C. *linearis* (F. M. BAILEY) C. T. WHITE
3. Leaves c. 2-6 by $\frac{3}{4}$ -2 cm, distinctly irregularly orange-pellucid-dotted or flecked. Flowers sessile. Sepals 3-5 mm long, spatulate, obtuse. (*C. lanceolatus* F. M. BAILEY, Compr. Cat. 1913, t. 45, *sphalma*?) C. *lanceolatus* F. M. BAILEY

1. *Citriobatus spinescens* (F.V.M.) DRUCE, Rep. Bot. Exch. Cl. Br. Isl. for 1916 (1917) 615; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 286.—*Ixiosporum spinescens* F.V.M. Fragm. Phyt. Austr. 2 (1860) 76.—*C. megacarpus* F.V.M., nomen in sched. et in syn. l.c.—*C. pauciflorus* CUNN. ex [LOUD. Hort. Britt. Suppl. 1, 1835, 585, nomen] BTH. Fl. Austr. 1 (1863) 122; F. M. BAILEY, Queensl. Fl. 1 (1899) 74; Queensl. Agric. J. 30 (1913) 402, t. 67-68, incl. var. *kennyi* F. M. BAILEY; WHITE, Proc. R. Soc. Queensl. 50 (1939) 67.—*C. javanicus* BOERL. & KOORD. Ic. Bog. 1 (1901) 5, t. 77; BACK. Schoolfl. (1911) 75; KOORD. Exk. Fl. Java 2 (1912) 310; MERR. Philip. J. Sc. 14 (1919) 401; En. Philip. 2 (1923) 224; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 81, p. 3.—Fig. 9.

Widely branched, 2-5 m, most twigs ending in a 1-3 cm long, straight thorn, besides lateral, ± straight thorns. Leaves obovate, cuneate to the base, apex rounded, truncate, notched or short-apiculate, 1-3 by $1\frac{1}{2}$ cm; nerves 2-3 pairs, ascending; petiole thin, short. Sepals $2\frac{1}{2}$ -3 by $1\frac{1}{4}$ - $1\frac{1}{2}$ mm, oblong, acute, margin finely fimbriate. Corolla tube c. 6 mm high, segments 3 by $1\frac{1}{2}$ - $1\frac{3}{4}$ mm. Stamens 5-7 mm, opened in bud, anthers $1\frac{1}{2}$ mm, linear-oblong. Ovary densely hairy, subsessile, c. 3 mm; ovules very numerous; style 4-5 mm. Fruit initially hairy, glabrescent, apiculate by the (mostly) persistent style-base, c. $1\frac{1}{2}$ cm diam. Seeds c. 40-50, c. 3-4 by 2 mm.

Distr. Queensland & New South Wales, in Malaysia: Philippines (W. Luzon: Batangas, Mt San Pedro; Mindanao: Davao Prov., Mati and Galintan), N. Celebes (Gorontalo: Molotabu), and SE. Java (Puger). To be expected in the Lesser Sunda Islands and South New Guinea.

Cultivated

Bursaria spinosa CAV. var. *incana* BTH., a small tree or shrub from Australia, grown in the Botanic Gardens, Bogor, is said to have been introduced as an ornamental in Java, according to BACKER (Bekn. Fl. Jav. (em. ed.) 4a, 1942, fam. 81, p. 3).



Fig. 9. *Citriobatus spinescens* (F.V.M.) DRUCE. a. Fruiting twig, $\times 2\frac{1}{3}$, b. flower on scaly brachyblast, $\times 3$, c. gynaecium, $\times 3$, d. seeds, $\times 2$ (a EDANAÑO 48871, b-d BACKER 18043).

Ecol. In dry forests, along forest borders, and in thickets, under seasonal climatic conditions, at Puger on limestone, at Gorontalo common on andesite rocks, 5-300 m. Fl. Dec.-Febr., fr. Jan.-Dec.

Vern. *Rukēm rukēman*, *J. molontio*, Gorontalo.