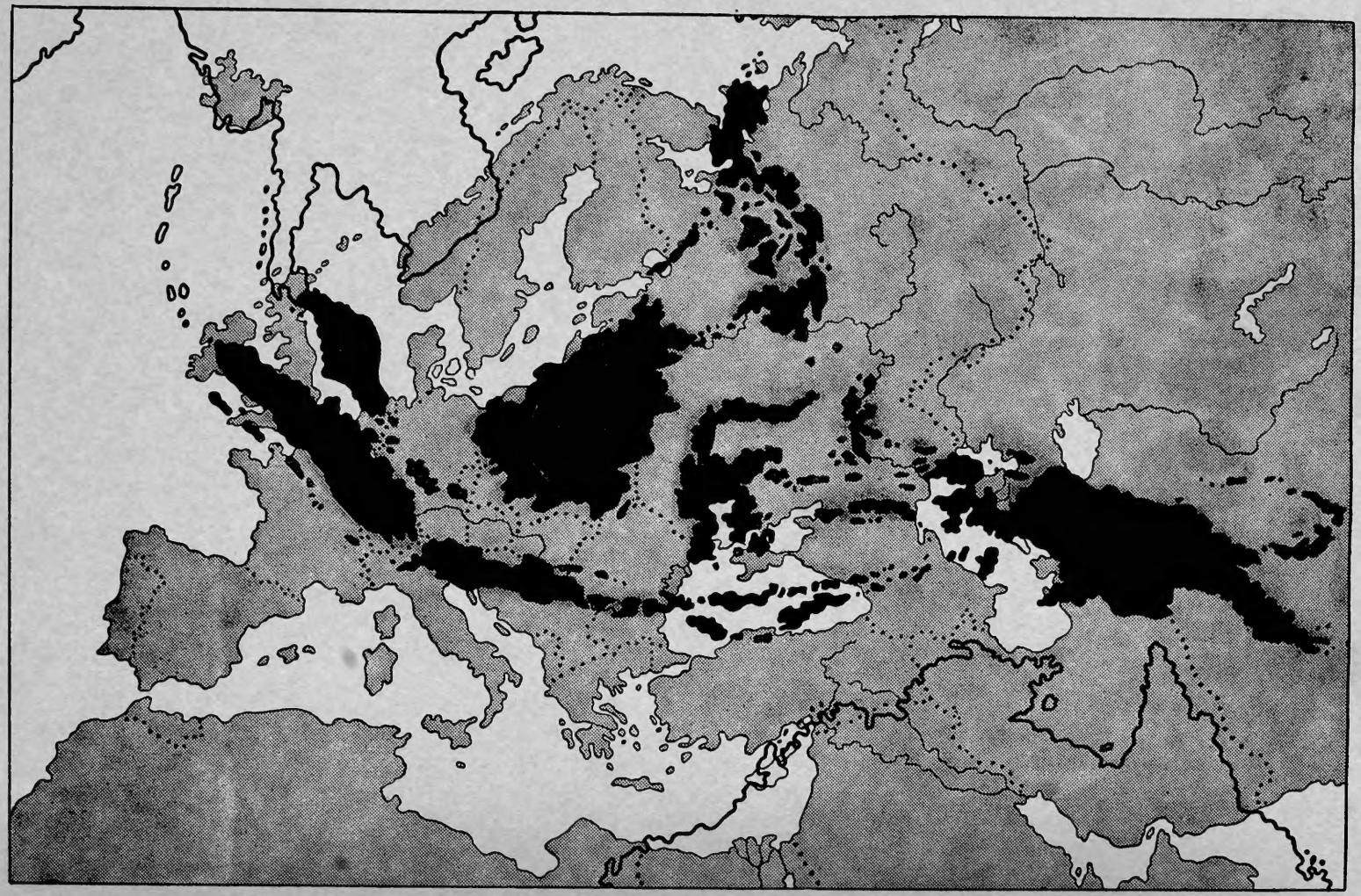
# FLORA MALESIANA

UNDER THE AUSPICES OF
THE BOTANIC GARDENS OF INDONESIA, BOGOR,
AND THE RIJKSHERBARIUM, LEYDEN



# CELASTRACEAE—II[1] (Ding Hou, Leyden)

The family *Hippocrateaceae* was established by A. L. DE JUSSIEU (Ann. Mus. Hist. Nat. Paris 18, 1811, 486, as *Hippocraticeae*) and three years later R. BROWN created the family *Celastraceae* (in Flinders, Voy. Terra Austr. 2, 1814, 554, as *Celastrineae*). BROWN was well aware that his new 'order' (family in our sense) closely approached *Hippocrateaceae* and hinted at the possibility that they might be fused later.

This was indeed effected by HOOKER *f.* (in B. & H. Gen. Pl. 1, 1862, 358), who reduced *Hippocrateaceae* to a tribe of the *Celastraceae*. Still up till the present there has been no unanimity of opinion on this question. Disagreement with HOOKER's vision started with MIERS (Trans. Linn. Soc. 38, 1873, 319–330) in his elaboration of the South American *Hippocrateaceae;* he reviewed the history of the two families and ably summarized their general characters. Basing himself on literature and new observations he put forward eleven points of difference for their distinction. However, many new genera and species have been described since 1873 which have obliterated many of MIERS's arguments, and recent specialists agree that, if any, only few characters do hold.

LOESENER, who kept the two families apart (in E. & P. Pfl. Fam. 3, 5, 1892, 189–230; *ibid.* ed. 2, 20b, 1942, 87–231), in discussing the African genus *Campylostemon* WELW. (Notizbl. Berl.–Dahl. 13, 1937, 563–577) remarked that the chief difference between the families would be: isomerous flowers in *Celastraceae* and anisomerous flowers in *Hippocrateaceae*. In passing it may be noted here that, in absence of fruit, he referred *Campylostemon*, which possesses 5 stamens, to the *Celastraceae*.

In his comprehensive work on the American *Hippocrateaceae* (Brittonia 3, 1940, 341–555) A. C. SMITH found the isomery obviously not an absolutely discriminating character as he reduced *Kippistia* MIERS (3 stamens) to *Cheiloclinium* MIERS (with 5 stamens), stating that the combined genus is a very coherent one. In his opinion the most important characters separating *Hippocrateaceae* from *Celastraceae* would be: (*i*) stamens inserted within the disk (not outside it or fused with it), (*ii*) stamens 3, except in two species of *Cheiloclinium* (not 5 or 4), and (*iii*) anthers dehiscing by lateral, apical, or extrorse clefts (never introrse).

In 1941, in connection with the publication of the new Hippocrateaceous genus *Brassiantha* A.C.SM. from New Guinea, I. W. BAILEY & A. C. SMITH (J. Arn. Arb. 22, 389–394, t. 1) stated that properly the only differential character left seemed to be the place of insertion of the stamens and they added that if that were so, the separation of the two families should be considered artificial.

In this respect it is very interesting to note that the Indo-Malesian genus *Kokoona* THW. was originally classified in *Hippocrateaceae* on account of its stamens which are inserted within the disk, and this was admitted also later by MIERS, *l.c.* Later authors have arranged it, however, unanimously with the *Celastraceae*, because of its arboreous habit, capsular fruit, and isomerous stamens. Properly it should be marked as a transitional link.

The African genus *Campylostemon* has also proved to be such a link, since LAWALRÉE has described the structure of its fruit (Bull. Jard. Bot. Brux. 18, 1947, 250–254). Its flowers fit *Celastraceae* and are isomerous, but its capsular fruit is similar to that of the *Hippocratea* group. LAWALRÉE found the fruit characters more important than the isomerous stamens and preferred to arrange *Campylostemon* with *Hippocrateaceae* of which he broadened and redefined the family concept. He was aware, however, that all the differences listed in his diagnosis are only quantitative and needed further study.

From this succinct review it appears that *Celastraceae* and *Hippocrateaceae* are connected by several intermediate genera and species which obscure a sharp distinction. This is corroborated by the data which emerge from auxiliary data derived from palynological, anatomical, and chemotaxonomical observations.

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(1) Part I was published in vol. 6 (1963) 227–291.

ERDTMAN stated that pollen grains ± similar to those of *Hippocrateaceae* occur in *Celastraceae* (Pollen Morph. Pl. Tax. Angiosp. 1952, 105, fig. 52A and 204, fig. 121B).

METCALFE & CHALK found the anatomical characters of *Hippocrateaceae* very similar to those of *Celastraceae* and concluded that the two families are very closely related (Anat. Dicot. 1, 1950, 387–404).

HEGNAUER concluded that as far as phytochemical characters are known the separation of *Celastraceae* and *Hippocrateaceae* seems hardly justified from that point of view (this vol., p. 230).

Summarizing, it appears that the overwhelming evidence is in favour of accepting one natural family, *Celastraceae*, a name which has been proposed for conservation by BULLOCK (Taxon 7, 1958, 10, 18).

**Taxonomic position of the genus Siphonodon**

There is controversial opinion about the inclusion of *Siphonodon* in the family, largely because of the interpretation of the flower, and more in particular about the question whether the central appendage found in the apically hollow pistil represents the style which HOOKER doubted because of it being covered by a cuticle. On this question I have recently given a survey (Blumea 12, 1963, 36–37). CROIZAT raised it to the rank of subfamily (Lilloa 13, 1947, 41, 43) and GAGNEPAIN & TARDIEU–BLOT to family rank (Nat. Syst. 14, 1951, 102). But this change of rank does not involve its exclusion from the *Celastrales*. In fact, HUTCHINSON retained it in close proximity to the *Hippocrateaceae*. Wood-anatomical data do not provide specific clues as this anatomy is rather heterogenous in *Celastraceae*. Palynologically, ERDTMAN is inclined to support the creation of a new family, but it may be doubted whether sufficient data are available. It would seem to me that a consideration on the taxonomic position of *Siphonodon* cannot be divorced from a consideration of the Papuan *Brassiantha* and the Australian genus *Hedraianthera* which also possess an apically hollow pistil. An apically hollow pistil occurs also in unrelated plants, *e.g.* in *Erycibe* (*Convolvulaceae*).

**Emendation of family circumscription**

In consequence of the considerations given above the provisional family description needs a few emendations, *viz*: add to the characters of the calyx:—'in some *Salacias* slightly, irregularly 3–5-lobed in the apical part and then circumscissile at the base, or lengthwise splitting, or not lobed'; and add to the characters of the cotyledons:—'or massive (*Salacia*), free or united'.

Germination. N. HALLÉ (Mém. Inst. Franç. Afr. Noire *n.* 64, 1962, 38–40, f. 22–24) made observations on seed germination of some species of the former *Hippocrateaceae*. He found that species with wingless seed and massive cotyledons, or winged seed with united cotyledons and a thickened marginal 'nerve' have hypogeal germination; he found this in *Salacia* (2 *spp.* observed), *Cuervea* (1 *sp.*), *Simirestis* (1 *sp.*) and *Loeseneriella* (1 *sp.*). Species with winged seed with a thin marginal 'nerve' and free cotyledons are epigeal: *Reissantia* (1 *sp.*), *Apodostigma* (1 *sp.*) and *Campylostemon* (1 *sp.*). The data of seed germination in the *Celastraceae* are still inadequate to be evaluated taxonomically at present.

Generic delimitation in '*Hippocrateaceae*' as accepted here I have discussed in detail in a precursory paper (Blumea 12, 1963, 31–38).

NEW KEY TO THE GENERA
(*based on flowering material*)

1. Stamens 5 or 4.
 2. Pistil not hollow in the apical part.
  3. Leaves spirally arranged or alternate.
   4. Leaves with cross-bar veins between the nerves. Petiole thickened at the apex beneath. Petals contorted. Styles 2, free or slightly united at the base. See vol. 6, p. 280 . . . **9.**[1] **Bhesa**
   4. Venation reticulate. Petiole not thickened at the apex beneath. Petals usually imbricate, rarely valvate (*Perrottetia*). Style simple.

(1) The numbering of the genera in the key in part I, *l.c.* 231–232, was, unfortunately, erroneous.

5. Petals always larger than the calyx lobes and usually different in shape, imbricate. Overy 3–4-celled (2-celled in *Maytenus diversifolia*).
6. Ovary (2–)3-celled, each cell with two collateral ovules.
7. Ovary free from the disk. Ovules with a cup-shaped aril at the base. Scandent shrubs, always unarmed. See vol. 6, p. 233 . . . . . **1. Celastrus**
7. Ovary usually partly immersed in the disk. Ovules without arillar cup at the base, though the seeds are arillate. Erect (sometimes scandent?) shrubs or small trees, sometimes spinous. See vol. 6, p. 238 . . . . . **2. Maytenus**
6. Ovary 4-celled, each cell with *c.* 10 ovules arranged in two series. See vol. 6, p. 243. **3. Xylonymus**
5. Petals usually similar to calyx lobes both in size and shape, usually valvate. Ovary 2-celled. See vol. 6, p. 288 . . . . . **12. Perrottetia**

3. Leaves decussate or opposite.
8. Petals slightly united at the base (very rarely free, *e.g.* in *Microtropis filiformis*). Disk proper absent, filaments united at the base into a ring or short tube, by some interpreted to represent a disk, usually united with the petals. See vol. 6, p. 272 . . . . . **8. Microtropis**
8. Petals free. Disk conspicuous, fleshy, cupular or flat (covering the ovary and coherent with it in *Glyptopetalum sp.*), free from the petals.
9. Ovary 3-, or 4–5-celled. Ovules 1–18 in each cell.
10. Ovary 4–5-celled.
11. Ovules 2 in each cell. See vol. 6, p. 245 . . . . . **4. Euonymus**
11. Ovule 1 in each cell. See vol. 6, p. 254 . . . . . **5. Glyptopetalum**
10. Ovary 3-celled. Ovules (4–6–)8–18 in each cell.
12. Petals contorted, without appendage. See vol. 6, p. 258 . . . . . **6. Kokoona**
12. Petals imbricate, usually with appendages on the inner side, very rarely naked. See vol.6, p. 262 . . . . . **7. Lophopetalum**
9. Ovary 2-celled, or 1-celled by abortion (*Pleurostylia*). Ovules 2 in each cell.
13. Disk more or less flat. Anthers subglobose and rounded at the apex, connective invisible on the dorsal side. See vol. 6, p. 284 . . . . . **10. Cassine**
13. Disk cupular. Anthers ovoid and short-apiculate, connective distinct and broad on the dorsal side. See vol. 6, p. 287 . . . . . **11. Pleurostylia**

2. Pistil hollow in the apical part (best observed in a longitudinal section of the flower).
14. Cavity of the pistil without a style-like appendage. Petals valvate. Disk composed of 5 pulvinate glands contiguous at the ends to form a pseudocontinuous annulus. Stamens inserted inside the disk . . . . . **13. Brassiantha**
14. The hollow cavity with a cylindric, style-like appendage arising from the bottom. Petals imbricate. Disk united with the ovary. Stamens inserted outside the disk . . . . . **14. Siphonodon**

1. Stamens 3, rarely 2.
15. Calyx distinctly 5-lobed even at very young stage, spreading at anthesis.
16. Flowers in axillary fascicles . . . . . **17. Salacia**
16. Flowers in axillary cymes, or terminal thyrses, or panicles.
17. Inflorescences with short, supplementary branchlets in the dichotomies or in the axils of branches. Disk inconspicuous . . . . . **16. Reissantia**
17. Inflorescences without short, supplementary branchlets as above. Disk conspicuous.
18. Petals subcoriaceous when dry, densely puberulous outside, subvalvate or the margins slightly overlapping . . . . . **15. Loeseneriella**
18. Petals thin, rarely slightly fleshy, glabrous, imbricate, the margins much overlapping. **17. Salacia**

15. Calyx almost unlobed or slightly, irregularly lobed at the apex, during anthesis breaking transversely along an irregular line near its base, sometimes irregularly splitting lengthwise, rarely the whole calyx unlobed, saucer-shaped and persistent . . . . . **17. Salacia**

## NEW KEY TO THE GENERA

*(based on fruiting material)*

1. Fruits capsular, dehiscent.
2. Fruits with 3 divergent, follicle-like parts. Seed with a basal wing.
3. Cotyledons united, at least partly so . . . . . **15. Loeseneriella**
3. Cotyledons free . . . . . **16. Reissantia**
2. Fruits otherwise. Seed wingless, or with an apical wing (*Kokoona*), or the wing surrounding the seed proper (*Lophopetalum*).
4. Leaves with crossbar-like veins between the nerves; petiole thickened at the apex beneath. See vol. 6, p. 280 . . . . . **9. Bhesa**
4. Leaves with reticulate veins; petiole not thickened at the apex beneath.
5. Leaves spirally arranged or alternate.
6. Fruits less than 1¾ cm long, 3-celled (very rarely 2-celled).

7. Seeds completely enveloped by the aril. Scandent shrubs. See vol. 6, p. 233 . **1. Celastrus**
7. Seeds only at the lower half or at the base enveloped by the aril. Erect (sometimes scandent?) shrubs or small trees. See vol. 6, p. 238 . . . . . **2. Maytenus**
6. Fruits 2½–6½ cm long, 4- or 5-celled.
8. Fruits subglobose, 5-sulcate, 5-celled. Seeds usually 2–4 in each cell . . **13. Brassiantha**
8. Fruits oblong, 4-angular, 4-celled. Seeds *c.* 10 in each cell. See vol. 6, p. 243 . . **3. Xylonymus**
5. Leaves decussate or opposite.
9. Fruits 3–5-celled, loculicidally dehiscent, usually 3–5-valved, 3–∞-seeded.
10. Fruits usually 4–5-angular or -lobed, 4–5-celled, occasionally 1–3-celled by abortion, each cell 1- or 2-seeded. Seeds not winged, completely or incompletely enveloped by aril.
11. When the fruit dehisces its axis splitting completely together with the valves, leaving no columella. Seeds usually 2 in each cell, attached to the top or base at the inner angle; raphe not branched. See vol. 6, p. 245 . . . . . **4. Euonymus**
11. When the fruit dehisces its axis splitting or not, but remains free from the valves. Seeds only 1 in each cell, hanging from the top of the persistent axis; raphe branched usually at the morphological base of the seed, the bands ascending on the other side towards the hilum. See vol. 6, p. 254 . . . . . **5. Glyptopetalum**
10. Fruits 3-angular, -lobed, or ± winged, 3-celled, each cell usually 4–12-seeded. Seeds winged; no aril.
12. Seeds attached at their base, wing at the apical end. See vol. 6, p. 258 . **6. Kokoona**
12. Seeds surrounded by a wing, attached laterally at the ± centre. See vol. 6, p. 262. **7. Lophopetalum**
9. Fruits usually 1-celled, splitting on one side, usually 1-seeded. See vol. 6, p. 272. **8. Microtropis**
1. Fruits drupaceous or berry-like, indehiscent.
13. Fruits with a lateral, persistent style. See vol. 6, p. 287 . . . . . **11. Pleurostylia**
13. Fruits with a terminal persistent style or its scar, or with a depressed cavity at the upper end (*Siphonodon*).
14. Leaves alternate; twigs zigzag. Fruit a small, globular berry. Seeds muricate-foveolate or tuberculate. See vol. 6, p. 288 . . . . . **12. Perrottetia**
14. Leaves decussate, opposite, or spiral; twigs not zigzag. Fruit otherwise, always larger. Seeds smooth.
15. Fruits obovoid-oblong or broad-ellipsoid, 1–2-seeded. See vol. 6, p. 284 . . . **10. Cassine**
15. Fruits subglobose, few- to many-seeded, sometimes 1-seeded in *Salacia*.
16. Leaves decussate or opposite (except in *S. vimeria* and sometimes in *S. chinensis*). Stamens 2 or 3, persistent or leaving distinct scars at the base of the fruit. Climbers, shrubs or rarely small trees . . . . . **17. Salacia**
16. Leaves spiral. Stamens 5, caducous, and their scars usually not distinct at the base of the fruit. Tall trees . . . . . **14. Siphonodon**

## 13. BRASSIANTHA

A. C. SMITH, J. Arn. Arb. 22 (1941) 389.—**Fig. 23.**

Small tree. Stipules small, deltoid or ovate, caducous. *Leaves* alternate or spiral. *Inflorescences* axillary, paniculate, rarely cymose, few-flowered. *Flowers* 5-merous. *Calyx* lobes imbricate. *Petals* valvate. *Disk* extrastaminal, fleshy, annular-pulvinate or slightly cupular, composed of 5 pulvinate glands contiguous at the ends. *Stamens* 5, erect, inserted at the inner side of the notches of disk; anthers basifixed, dehiscing by a transverse slit, ± extrorse. *Pistil* hollow in the upper ⅓, apex truncate. *Ovary* 5-celled, short-conical, base confluent with the disk; style none; stigma inconspicuous. *Ovules* 2–5 in each cell, superposed or biseriate. *Fruit* capsular, subglobose, loculicidal, after dehiscing leaving a conspicuous, club-shaped columella. *Seeds* (1–)2–4(–5) in each cell, completely enveloped by an aril when young, leaving an opening on one side when ripe; albuminous; cotyledons flat, foliaceous.

Distr. Monotypic; *Malesia*: New Guinea.
Ecol. In lowland forests, sometimes found at 1800–1900 m.
Notes. A. C. SMITH & I. W. BAILEY (J. Arn. Arb. 22, 1941, 389–394) gave a full account of the mor-

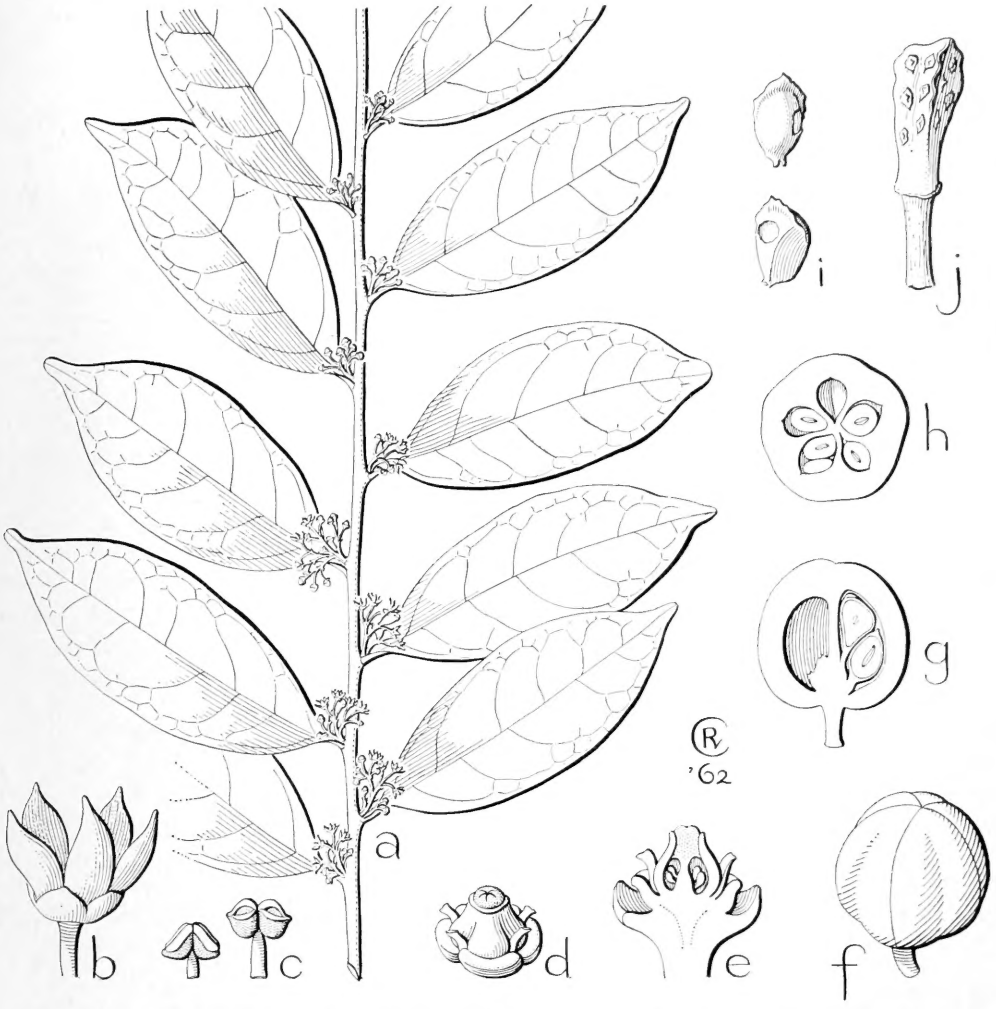



Fig. 23. *Brassiantha pentamera* A. C. SMITH. *a.* Habit, × ⅔, *b.* flower, × 8, *c.* young and mature stamens, × 16, *d.* flower, calyx lobes, petals, and anthers removed, × 16, *e. ditto*, in section, × 16, *f.* fruit, × ⅔, *g–h. ditto*, longitudinal and cross-sections, × ⅔, *i.* seeds, × ⅔, *j.* columella, × ⅔ (*a–b*, *d–e* BRASS 8954, *c* BRASS 8889, *f–i* BW 5513, *j* NGF 9587).

phological and anatomical characters and of the taxonomical affinities of this interesting genus. I can add that *Brassiantha* must be quite closely allied to the monotypic Australian genus *Hedraianthera* F. v. M. (Fragm. 5, 1865, 58) by the alternate or spirally arranged leaves, few-flowered, paniculate inflorescences, divaricate anther-cells, pistil hollow in the apical end, a 5-celled ovary of which each cell contains several ascendent, superposed ovules, the sessile stigma, and capsular fruit which has evidently a columella after dehiscing. The chief difference between these two genera is, as far as I know, found in the disk, the insertion of the stamens, and in the seed: in *Brassiantha* the disk is fleshy, composed of five pulvinate glands contiguous at the ends, the stamens are inserted at its inner side before the notches of the disk, and the seed is more or less completely enclosed by an aril; in *Hedraianthera* the disk is rather thin, annular, 5-notched, the stamens are inserted just beneath the outer margin of the disk, and the seed has a caterpillar-like aril attached on one side.

The type of *Hedraianthera porphyropetala* F. v. M. (Fragm. 5, 1865, 59; F. M. BAILEY, Queensl. Fl. 1, 1899, 256; Compr. Cat. Queensl. Pl. 1913, f. 77) was collected by J. DALLACHY (*s.n.*, type in MEL, isotypes in L & K) at Rockingham Bay, Queensland. I am very grateful to Messrs J. H. WILLIS and S. L. EVERIST, Australia, for kindly sending us the material of type and later collections together with valuable data of *Hedraianthera*. In a letter addressed to Dr VAN STEENIS, dated December 5th, 1963,

Mr EVERIST stated that Mr L. S. SMITH after making a more detailed examination of the material of *Hedraianthera* and *Brassiantha* in Brisbane agrees that these two genera are distinct.

As to the fruit of *Hedraianthera*, VON MUELLER described it, from immature material, as smooth; however, it is corrugate outside. The mature seeds, from a detached open fruit of a subsequent collection made in the type locality, sent by Mr WILLIS, have along the raphe a most peculiar caterpillar-like thickening which is obviously the aril as described by LOESENER (in E. & P. Pfl. Fam. ed. 2, 20b, 1942, 125); they match with those of a young detached fruit of the type and are albuminous with two foliaceous cotyledons. This rather surprising kind of aril is, so far, not known in any other species of the *Celastraceae*.

**1. Brassiantha pentamera** A. C. SMITH, J. Arn. Arb. 22 (1941) 390, t. 1.—**Fig. 23a-j.**

Small tree or shrub up to 10 m by 20 cm ø. Branchlets terete, light to reddish brown. *Leaves* chartaceous to subcoriaceous, elliptic to elliptic-lanceolate, ovate, or obovate-oblong, 4–12 by 1½–5 cm; base cuneate to attenuate; apex acuminate; margin entire; nerves 4–9 pairs; petiole 3–10 mm. *Inflorescences* usually in many leaf axils, ½–2 cm long; rachises, peduncles and pedicels with elastic threads shown on breaking. Peduncle 0–1 cm. Bracts triangular, 1–1¼ mm long. Pedicels 5–8 mm. *Flowers* red or purplish red. *Calyx* lobes triangular, ½–¾ mm long. *Petals* ovate, 1¾–2½ by ¾–1⅓ mm, short-acuminate. *Disk* ¾–1½ mm ø. *Stamens* very short; anthers ± triangular, cells separated by a conspicuous connective, slightly oblique when young. *Ovary* ½–1 mm long. *Fruit* subglobose, 2½–3½ cm ø, 5-sulcate, red. *Seeds* slightly falcate, or ± ellipsoid, sometimes slightly planoconvex, 12–15 by 7–10 mm; aril orange; hilum very long, along the whole length of the seed on the outer side.

Distr. *Malesia:* New Guinea (Hollandia and vicinity, and NE. New Guinea).

Ecol. In primary and secondary forests, in West New Guinea in lowland up to 100 m, in NE. New Guinea at 1800–1950 m.

## 14. SIPHONODON

GRIFF. Calc. J. Nat. Hist. 4 (1844) 246, t. 14; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 195; DING HOU, Blumea 12 (1963) 36.—*Capusia* LECOMTE, Bull. Mus. Hist. Nat. Paris 32 (1926) 95, f. 1–2.—**Fig. 24.**

Trees. Stipules minute. *Leaves* spiral or alternate. *Inflorescences* axillary, cymose, sometimes only one-flowered. Peduncles present or 0. *Flowers* 5-merous. *Calyx* lobes imbricate. *Petals* imbricate. *Stamens* 5, sometimes alternating with 5 staminodes; anthers latrorse, connective distinct and broad, separating the cells. *Pistil* half-immersed, adnate to the disk, the upper half hollow and with a style-like column rising from the bottom. *Ovary* many-celled, cells irregularly superposed. *Ovules* 1 in each cell, anatropous, attached towards the inner angle, oblique or pendulous. *Fruit* drupaceous, hard, with numerous bony, 1-seeded stones. *Seeds* flat, albuminous; testa membranous; cotyledons flat, free.

Distr. Species *c.* 7, distributed from SE. Asia through Malesia to Australia. Fig. 26.

Ecol. In forests from lowland up to 1375 m.

### KEY TO THE SPECIES

1. Central column of the pistil obtuse at the top. Calyx lobes smaller than petals. Stamens with filaments united at the lower half or at the base . . . . . **1. S. celastrineus**
1. Central column of the pistil peltate at the top and covering the tips of the anthers. Calyx lobes larger than the petals. Stamens usually free . . . . . **2. S. peltatus**

**1. Siphonodon celastrineus** GRIFF. Calc. J. Nat. Hist. 4 (1844) 247, t. 14; HOOK. *f.* Trans. Linn. Soc. 22 (1844) 133, t. 26; HASSK. Nat. Tijd. N.I. 10 (1856) 150; MIQ. Fl. Ind. Bat. 1, 2 (1859) 592 ('*Sophonodon*'); LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 629; KURZ, For. Fl. Burma 1 (1877) 254; PIERRE, Fl. For. Coch. 19 (1894) *sub* t. 312A, in text, *p.p.*; KOORD. Minah. (1898) 396; MERR. Philip. J. Sc. 3 (1908) Bot. 239; KOORD. in Junghuhn Gedenkboek (1910) 175; BACK. Schoolfl. (1911) 238; KOORD.–SCHUM. Syst. Verz. (1911) Fam. 158, 5; KOORD. Exk. Fl. Java 2 (1912) 526; MERR. Fl. Manila (1912) 302; PITARD, Fl. Gén. I.-C. 1 (1912) 906, f. 114, 9–11, *p.p.*; MERR. En.

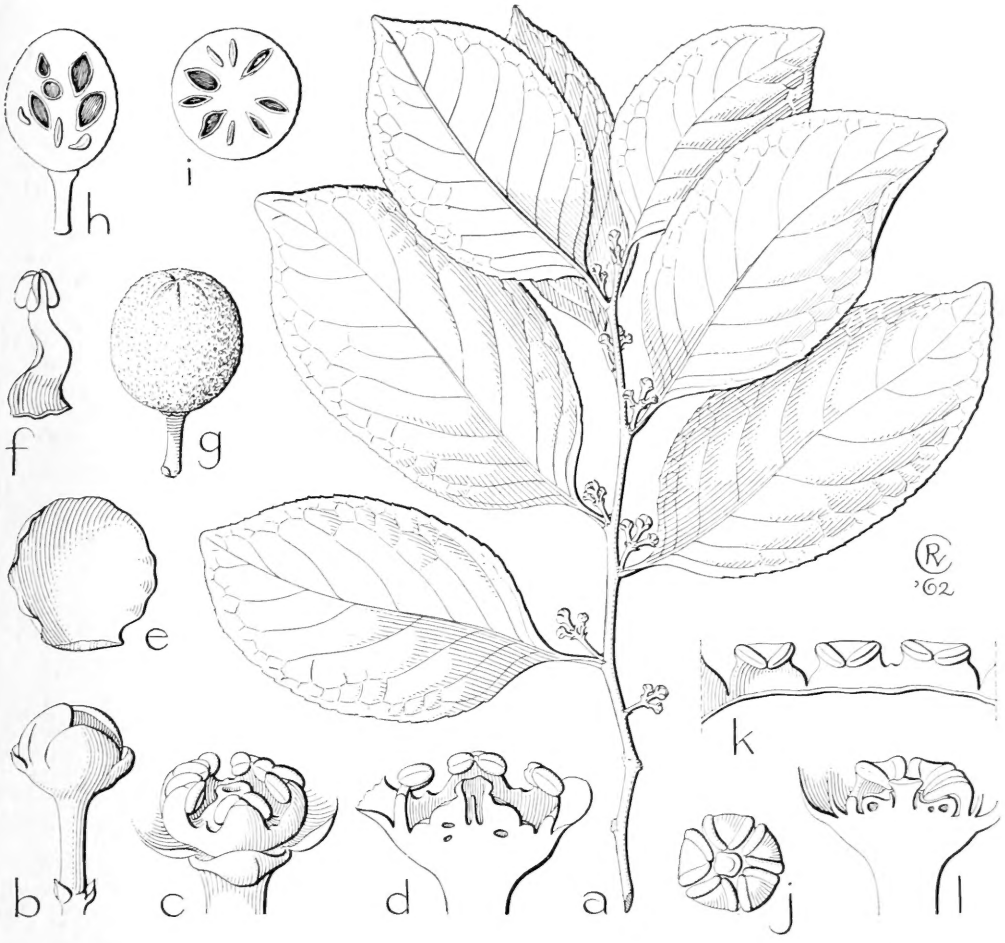



Fig. 24. *Siphonodon celastrineus* GRIFF. *a*. Habit, × ⅔, *b*. opening bud, × 4, *c*. young flower, with petals removed, × 8, *d. ditto*, section, × 8, *e*. petal, × 8, *f*. stamen, × 8, *g*. fruit, × ⅔, *h–i. ditto*, longitudinal and cross-sections, × ⅔.—*S. peltatus* DING HOU. *j*. Flower seen from the top, calyx lobes and petals removed, × 8, *k*. stamens, × 8, *l*. flower, in section, × 8 (*a–f* SAN 18729, *g–i* KOSTERMANS 5860, *j–l* CARR 13908).

Philip. 2 (1923) 485, *incl. var. acuminatissima* MERR. *et var. subglobosa* MERR.; CRAIB, Fl. Siam. En. 1 (1926) 293; REHDER, J. Arn. Arb. 14 (1933) 63; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 196; TARDIEU, Suppl. Fl. Gén. I.–C. (1948) 824, *p.p.*—*S. pyriformis* MERR. Philip. J. Sc. 3 (1908) Bot. 240; En. Philip. 2 (1923) 485; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 196.—*Xanthophyllum subglobosum* ELM. Leafl. Philip. Bot. 5 (1913) 1676, *incl. var. longifolium* ELM.—*S. pyriformis var. parvifolius* MERR. Philip. J. Sc. 27 (1925) 33. —**Fig. 24a-i, 25.**

Tree up to 35 m by 90 cm ø, very rarely with buttresses up to 1–1½ m high (*fide* KOSTERMANS 13472 & 13487). *Leaves* chartaceous to subcoriaceous, sometimes coriaceous, olivaceous or grey-greenish when dry, ovate-oblong or elliptic-oblong to -lanceolate, 4–23 by 3½–9½ cm; base cuneate or round; apex acute to acuminate; margin usually crenate, sometimes remotely or obscurely crenulate, rarely entire; nerves 6–10 pairs; petiole ½–2 cm. *Inflorescences* cymose or umbelliform, (1–)few(–∞)-flowered. Peduncle ½–1½ cm. Pedicels 5–11 mm. *Flowers* cream-white; calyx and petals sometimes containing reddish brown cells or spots in the tissue. *Calyx* lobes reniform or subrotund, 1–2 mm long. *Petals* ovate, 2¼–3½ by 1¾–2½ mm, obtuse. *Stamens c.* 1 mm; filaments flat, united at the lower ½ or near the base; anthers usually perpendicularly bent inward in bud. Pistillar body usually ± semi-globose, sometimes ± short conical, occasionally with 5

Fig. 25. *Siphonodon celastrineus* GRIFF., Bulolo logging area, New Guinea, 900 m alt. (NGF 15080; photogr. P. VAN ROYEN, 1962).

radiating ridges on the upper surface. *Fruit* green or yellowish green, broad-ellipsoid, globose, sometimes slightly obovoid or ± pyriform, 3–6½ by 2–6 cm.

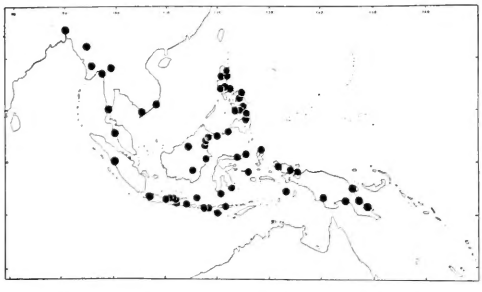


Fig. 26. Distribution of *Siphonodon celastrineus* GRIFF.

Distr. Widely distributed but scattered in India, Burma, Thailand, Indo-China, and throughout *Malesia*. Fig. 26.

Ecol. In forests, from the lowland up to 1375 m; found on limestone in E. Kutai and Java, also collected on level clay soil in W. New Guinea.

In Sula Sanana I. (West Moluccas) it occurs on limestone slopes along the Wai Bussa near Fowata between 40–90 m as a dominant in forest, associated with *Vitex cofassus*, *Pangium edule*, *Intsia* (scattered), *Pometia*, *Ficus*, and *Nauclea* (BLOEMBERGEN, 1939).

Vern. Java: *danoklot kĕpu*, *karangasĕm*, *tèdjo*, *wanitan*, *wĕlaham*, J, *ki putri*, *ki singuguh kaju*, S, *langghadeung*, Md; Lesser Sunda Is., Flores: *oëkapa*, Endeh I.; Borneo: *kalantaid*, North Borneo, *tulang*, Dajak; Celebes: *indohe hapoeté*, Muna, *kalawalan*, Menado, *kapupukina*, Muna; Moluccas: *tua*, Sula Is.; New Guinea: *aruai*, Japen, *mobiek*, *pieh*, Kèbar lang., *uwoga*, Orokaiva lang.

Notes. The shape and size of leaves and fruits are very variable, even in the same collection. In the herbarium fruits are, in most cases, detached; some very large fruits show holes and are deformed by insects. Only few flowering specimens available; it seems that the flowers fall off easily after drying. It is desirable to have them in different stages of development, preserved in liquid for further study of their variability.

There are three specimens cited in the original description of *S. pyriformis* MERR., *i.e.* ELMER 5985 (lectotype, US), FB 5141 (not seen), and BS 2875 (US). According to MERRILL, it would differ from *S. celastrineus* by its pyriform fruit. However,

I have seen pyriform fruits in several specimens of *S. celastrineus*, *e.g.* KOORDERS 1122β (BO) from Java. My hesitation to reduce *S. pyriformis* to *S. celastrineus* was overcome by the examination of two flowers on ELMER 5985 which showed that the floral characters are exactly similar.

**2. Siphonodon peltatus** DING HOU, Blumea 12 (1963) 38.—**Fig. 24j-l.**

Tree *c.* 27 m. *Leaves* chartaceous, olivaceous or light brown above, light brown beneath, oblong-ovate, 11–14½ by 5–6½ cm; base round or acute; apex (all damaged) probable acute; margin entire; nerves 6–8 pairs; petiole ½–1 cm. *Inflorescences* condensed. Peduncle very short or obscure, sometimes up to *c.* 5 mm. Pedicels *c.* 2 mm. *Flowers* cream-coloured. *Calyx* lobes very broad-ovate or suborbicular, *c.* 4 mm ø, ± entire, with 3 faint, slightly branched veins. *Petals* suborbicular, *c.* 3 mm ø, rather fleshy, the marginal part thin and transparent (when dry), wavy. *Stamens* ± free, or some of them slightly united at the base; filaments flat, broad-oblong, *c.* 1 mm long; anthers deltoid, perpendicularly bent inward, the tips under the peltate apex of the central column. *Pistil* flat, round, slightly concave near the center, the central column peltate at the apex. *Ovules* arranged on one level (?). *Fruit* unknown.

Distr. *Malesia*: SE. New Guinea (Lala River), once collected.

Ecol. In forest at *c.* 1650 m.

## 15. LOESENERIELLA

A. C. SMITH, Am. J. Bot. 28 (1941) 438; WILCZEK, Fl. Congo Belge 9 (1960) 148; HALLÉ, Mém. Inst. Fr. Afr. Noire *n.* 64 (1962) 103.—*Hippocratea auct., p.p., typ. excl.*—**Fig. 28.**

Liana, or scandent rarely erect shrubs. Stipules interpetiolar or sometimes ± intrapetiolar. *Leaves* decussate. *Inflorescences* axillary, dichotomously cymose. *Calyx* deeply 5-lobed. *Petals* 5, usually rather thick, subcoriaceous to coriaceous when dry, subvalvate or the margins slightly overlapping, usually acuminate, entire, puberulous on the outer surface, sometimes glabrescent. *Disk* extrastaminal, fleshy, simple and annular-pulvinate, rarely double with the outer part cupular and the inner part forming a kind of receptacular androgynophore (in extra-Mal. *spp.*). *Stamens* 3, inserted at the base of the free part of the pistil; filaments linear, reflexed at anthesis; anthers transversely dehiscent, extrorse. *Ovary* half-immersed, sometimes superior, 3-celled; style distinct, slender; stigma obscure. *Ovules* 4–12 in each cell. *Fruit* capsular, consisting of 3 separate, divergent, dorsoventrally flattened 'follicles' each dehiscing along an inconspicuous median suture into 2 navicular valves. *Seeds* usually with a basal wing, the wing usually membranous, with 1 submedian (raphe) and 1 marginal 'nerve'; endosperm 0; cotyledons completely, sometimes only partly united.

Distr. About 26 *spp.*, in tropical Africa, Asia and Malesia, southeastward as far as the New Hebrides; in Malesia 4 *spp.*

Ecol. In forests, in Malesia from the lowland up to *c.* 850 m.

### KEY TO THE SPECIES

1. The upper ½–⅔ of the petals on the inner surface and disk at the top distinctly pilose.
   2. Pericarp usually thin-leathery, after dehiscence the sutural margins slightly reflexed. Seed proper very narrowly oblong-ellipsoid, 3–4½ by ½–¾ cm; most part of the wing unilateral, 3–5½ by ⅓–¾ cm, rather thick and not transparent when dry, the submedian and marginal nerves inconspicuous. **1. L. macrantha**
   2. Pericarp rather woody, after dehiscence the sutural margins not reflexed. Seed proper very broad-ellipsoid, 1–1⅓ by ¾ cm; wing ± at one end of the seed, *c.* 3 by 1½ cm, membranous and ± transparent, the submedian and marginal nerves conspicuous.
      3. Leaves usually elliptic-oblong or -lanceolate; apex acuminate. Anthers and filaments glabrous. **2. L. sogerensis**
      3. Leaves broad-elliptic to rounded; apex obtuse or rounded. Inner surface of both the filaments at the apical part and the base of the anthers papillose or puberulous . . . . . **3. L. cumingii**

1. Inner surface of the petals and disk glabrous. (Pericarp thin-leathery, after dehiscence the sutural margins slightly spreading. Seed proper elliptic- or ovate-oblong, 1–2 by ½–¾ cm; wing at one end, membranous, ovate to ovate-oblong, or elliptic, 2–4 by 1¼–2 cm, with conspicuous submedian and marginal nerves.) . . . . . **4. L. pauciflora**

**1. Loeseneriella macrantha** (KORTH.) A. C. SMITH, Am. J. Bot. 28 (1941) 439.—*Hippocratea macrantha* KORTH. Kruidk. (1842) 187, t. 39; MIQ. Fl. Ind. Bat. 1, 2 (1859) 599; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 153; ROLFE, Kew Bull. (1918) 47, *excl. syn.*; RIDL. Fl. Mal. Pen. 1 (1922) 455, *excl. syn.*; MERR. En. Philip. 2 (1923) 486; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 213; AMSHOFF, Blumea 5 (1945) 486.—*Hippocratea hasseltiana* MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 154; BACK. Schoolfl. (1911) 236.—*Hippocratea trilobulata* RIDL. Kew Bull. (1938) 241.

Liana. Stipules ± intrapetiolar, lanceolate, ⅔–1 mm long, the scars united in a ring on the older branchlets. *Leaves* chartaceous to thin-coriaceous, sometimes shining above, elliptic to elliptic-lanceolate, ovate-oblong to lanceolate, sometimes broad-elliptic or -ovate, rarely obovate, (5½–)10–20½ by (3–)5–8 cm; base obtuse, cuneate; apex acute, short-acuminate to acuminate; margin subentire rarely slightly crenulate; nerves 6–8 pairs; petiole ½–1 cm. *Inflorescences* sometimes ramiflorous, 1–6 cm long, up to 5 times branched, usually glabrous rarely sparsely light yellowish puberulous; sometimes flowers on a young, axillary short-shoot with bracts or reduced leaves and such shoot resembling a thyrsiform inflorescence. Peduncle ⅓–3 cm. Bracts deltoid, *c.* 1½ mm long. Pedicels 5–7 mm, the central one usually longer, up to 10 mm, sometimes with elastic threads shown on breaking. *Flowers* green or yellowish green, rarely yellowish. *Calyx* lobes deltoid, 1–1¼ mm long, puberulous outside. *Petals* ovate-oblong, 4½–6½ by 1¾–2½ mm, densely pilose (uniseriate hairs) on the upper half or ⅔ inside and on the margins. *Disk* annular-pulvinate, 1⅓–3 mm ø, ⅓–2½ mm high, the basal part before the calyx lobes slightly extended obliquely outward and downward, pilose (uniseriate hairs) at the top, very rarely glabrous when young. *Stamens c.* 2 mm. *Pistil* 1–2 mm emerging from the disk. *Ovules* 4–6 in each cell. *Follicles* ovate- or elliptic-oblong, obtuse at the apex, 5–8 by 2–3½ cm. *Seeds* (*incl.* wing) obovate-oblong, 3½–6 by ½–1 cm.

Distr. From New Ireland (W. coast), the Solomon Is. (New Georgia group), and the New Hebrides (Santa Cruz group) to Ceylon; in *Malesia:* Sumatra (Indragiri, Palembang), Riouw (P. Durian), Malay Peninsula (Perak, Selangor, Pahang, Johore, Singapore), Banka, Central Java (Kediri and Kinderzee), Borneo (North Borneo, Banjermasin, and Sarawak), SE. and Central Celebes (Kendari and Latoöe), Moluccas (Sula Is.) and New Guinea (throughout but scattered). Fig. 27.

Ecol. In lowland forests up to 400 m, also found in river flood plain, riverside, and mangrove swamp forests.

Galls. Insects galls on leaves (BRASS 13920).

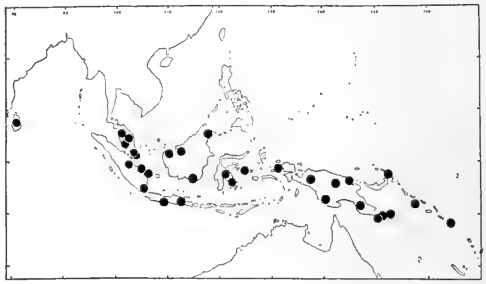


Fig. 27. Distribution of *Loeseneriella macrantha* (KORTH.) A. C. SMITH

Vern. Malay Peninsula: *akar bintong, akar china, akar mata pĕlandok, gambir ayĕr,* M; North Borneo: *bohan kutongan,* Bajao Sporna.

**2. Loeseneriella sogerensis** (BAK. *f.*) A. C. SMITH, Am. J. Bot. 28 (1941) 439.—*Hippocratea sogerensis* BAK. *f.* J. Bot. 61 (1923) Suppl. 10.

Liana. Stipules triangular or deltoid, *c.* 1 mm long, ± intrapetiolar, the scars forming ± a ring on the older branches. *Leaves* subcoriaceous to coriaceous, elliptic, elliptic-oblong or -lanceolate, rarely ovate-oblong, 5½–11 by 2½–4½ cm; base cuneate; apex acuminate; margin crenulate; nerves 5–9 pairs; petiole ½–1 cm. *Inflorescences* 3 or 4 times branched, 1½–2½ cm long, densely puberulous, ferrugineous. Peduncle 1–2 cm. Bracts triangular, 1–1¼ mm long. Pedicels 1–3 mm. *Flowers* yellowish. *Calyx* lobes semiorbicular or triangular, ¾–1 mm long, puberulous on the outside. *Petals* ovate-oblong to lanceolate, 4–5 by 1½–1¾ mm, pilose on the upper ½–⅓ inside and on the margins. *Disk* annular-pulvinate, 1¼–1½ mm high, 1½–2 mm ø, short-pilose at the top, in the basal part before to the calyx lobes slightly extended outward and downward. *Stamens* 1½–2 mm. *Pistil* 1–1½ mm emerging from the disk. *Ovules* 6–10 in each cell. *Follicles* obovate, *c.* 4½ by 2½ cm, pericarp woody. *Seeds* (*incl.* wing) ovate-oblong or lanceolate, 3¼–4 by 1⅓ cm.

Distr. *Malesia:* New Guinea (Sogere, Kanosia, Lower Fly R., and Milne Bay Distr.).

Ecol. In lowland forests and along mangrove swamp.

Notes. The type of *L. sogerensis* is FORBES 440 (BM, L); its flowers are quite similar to those of *L. macrantha.* BAKER stated it to differ from the latter by the shape of the leaves and the colour of the flowers. Besides, the leaves are usually smaller and distinctly crenulate, the inflorescences are densely rusty puberulous, the pericarp rather woody, and the seeds possess a prominent membranous wing attached at one end.

The number of ovules per cell is quite variable in this species and is sometimes found to vary in

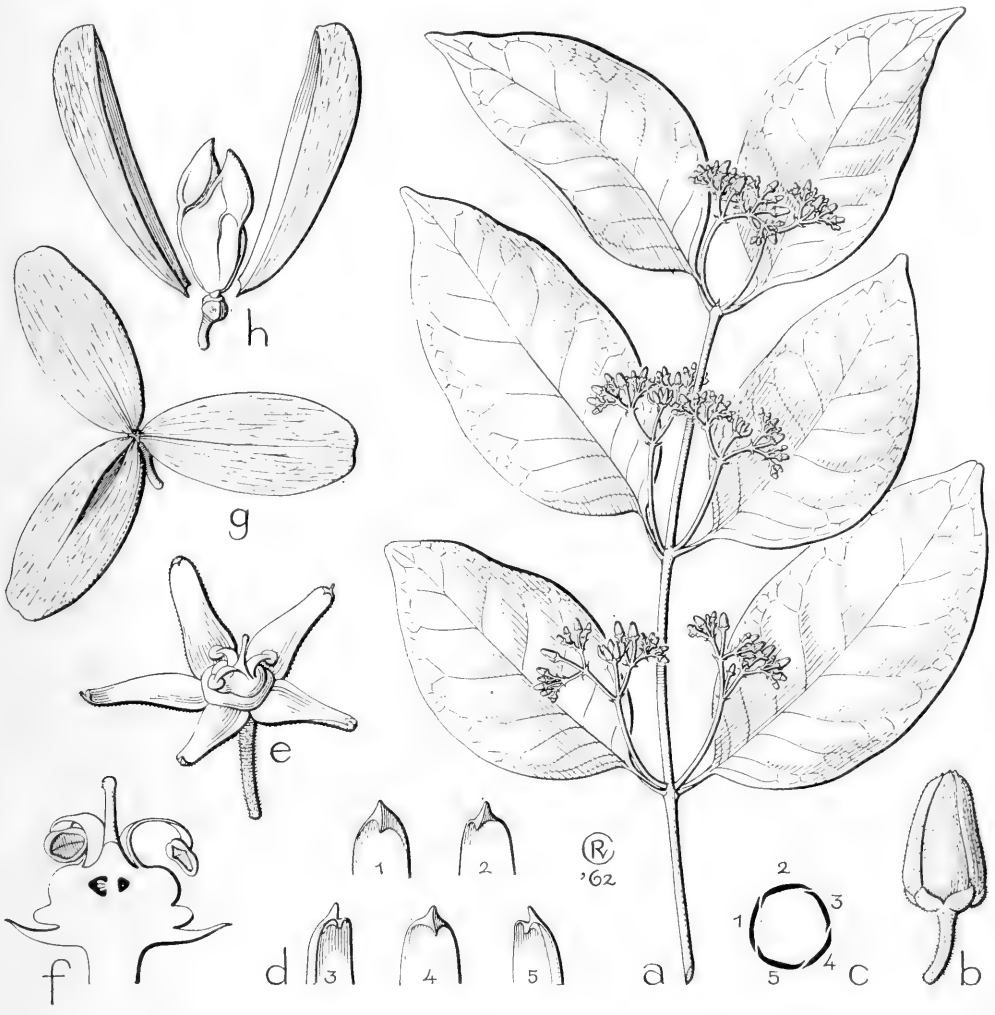



Fig. 28. *Loeseneriella pauciflora* (DC.) A. C. SMITH. *a.* Habit, × ⅔, *b.* bud, × 4, *c.* diagram showing arrangement of petals, *d.* tips of petals, × 8, *e.* open flower, × 4, *f.* flower in section, petals removed, × 12, *g.* fruit, × ⅔, *h.* dehiscent follicle, immature, in centre adhering seeds with basal wing, × ⅔ (*a–f*, *h* SPANOGHE *s.n.*, *g* SOEGENG REKSODIHARDJO 146).

one specimen, or even in one flower.

**3. Loeseneriella cumingii** (LAWS.) DING HOU, Blumea 12 (1963) 32.—*Hippocratea cumingii* LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 624; KING, J. As. Soc. Beng. 65, ii (1896) 358; F.-VILL. Nov. App. (1880) 47; VIDAL, Phan. Cuming. (1885) 103. —*Hippocratea macrantha* (*non* KORTH.) ROLFE, Kew Bull. (1918) 47; MERR. En. Philip. 2 (1923) 486, *pro* CUMING 1725.—*Hippocratea trichopetala* MERR. Philip. J. Sc. 13 (1918) Bot. 21; En. Philip. 2 (1923) 486.

Scandent shrub. Stipules triangular or lanceolate, ½–1 mm long, spacious. *Leaves* coriaceous, broad-elliptic or rotund, sometimes ovate, 3–11 by 2½–7¾ cm; base rounded, obtuse, rarely cuneate; apex obtuse, rounded, rarely emarginate; margin crenulate; nerves 5–8 pairs; petiole 3–4 mm. *Inflorescences* 2–4 times branched, ½–4 cm long, light brownish puberulous, sometimes glabrescent especially on the peduncles. Peduncle 1½–2½ cm. Bracts deltoid, *c.* 1 mm long. Pedicels 3½–4½ mm. *Flowers* greenish yellow, or green. *Calyx* lobes triangular, *c.* ½ mm long, puberulous outside. *Petals* lanceolate, 4½–5 by 1⅓–1½ mm, pilose on the upper ½–⅓ inside and on the margins. *Disk* annular-pulvinate, *c.* 1 mm high, 1½–2 mm ø, pilose at the apex, slightly 5-notched at the base. *Stamens c.* 2 mm, the inner surfaces of both the filament at the apical part and the base

of the anther papillose. *Pistil c.* 1 mm emerging from the disk, sparsely pilose towards the base. *Ovules* 8–10 in each cell. *Follicles* oblong, 6½ by 2½ cm. *Seeds* (*incl.* wing) lanceolate, 4½–5 by 1⅓–1½ cm.

Distr. *Malesia:* W. Sumatra (Batu I.), Malay Peninsula (Selangor and Malacca), and Philippines (Luzon, Samar and Panay).

Ecol. In lowland forests along streams and on limestone.

Notes. LAWSON in the original description of his new species *Hippocratea cumingii* cited only 'Malacca, GRIFFITH.—Distrib. Philippines'. This refers to GRIFFITH 906 (K) from Malacca and CUMING 1725 (K) from the Philippines, which I could examine at Kew. Since then, additional material has been available from the Malay Peninsula, Sumatra, and the Philippines.

The fruit characters are derived from a collection of BOERLAGE (*s.n.*, L), from the Hort. Bog. of unknown provenance; it bears both flowers and mature fruits. The flowers of this specimen are similar to those of other specimens.

**1. Loeseneriella pauciflora** (DC.) A. C. SMITH, Am. J. Bot. 28 (1941) 440.—*Hippocratea pauciflora* DC. Prod. 1 (1824) 569; MIQ. Fl. Ind. Bat. 1, 2 (1859) 600; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 154. *incl. f. minor* MIQ. *et f. novoguineensis* MIQ.; WARB. Bot. Jahrb. 13 (1891) 366; VALETON, Bull. Dép. Agric. Ind. Néerl. 10 (1907) 30.—*Salacia javanensis* BL. Bijdr. (1825) 219; MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 151, *excl. syn.*; KOORD. Exk. Fl. Java 2 (1912) 527.—*Hippocratea rigida* SPAN. Linnaea 15 (1841) 178, *non* HAMP. *ex* LAWS. 1875; MIQ. Fl. Ind. Bat. 1, 2 (1859) 600.—*Salacia griffithi* LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 628; KING, J. As. Soc. Beng. 65, ii (1896) 364; F.-VILL. Nov. App. (1880) 47, *pro nomen*; MERR. En. Philip. 2 (1923) 487.—*Hippocratea macrantha auct. non* KORTH.: KURZ, J. As. Soc. Beng. 44, ii (1875) 164; For. Fl. Burma 1 (1877) 257; KING, J. As. Soc. Beng. 65, ii (1896) 357.—*Salacia perakensis* KING, *l.c.* 364; RIDL. Fl. Mal. Pen. 1 (1922) 457.—*Hippocratea obtusifolia* (*non* ROXB.) KOORD.-SCHUM. Syst. Verz. (1911) Fam. 159, 2; KOORD. Exk. Fl. Java 2 (1912) 527; MERR. En. Philip. 2 (1923) 486; HOLTHUIS & LAM, Blumea 5 (1945) 205; AMSHOFF, *l.c.* 518.—*Hippocratea lawsonii* ELM. Leafl. Philip. Bot. 7 (1915) 2688; MERR. En. Philip. 2 (1923) 486, *excl. syn.*—*Hippocratea nigricaulis* RIDL. J. Str. Br. R. As. Soc. *n.* 75 (1917) 20, new name for *Hippocratea macrantha* (*non* KORTH.) KING; ROLFE, Kew Bull. (1918) 47; RIDL. Fl. Mal. Pen. 1 (1922) 455.—*Hippocratea brachystachys* RIDL. Kew Bull. (1938) 241.—**Fig. 28.**

Liana, or shrubby creeper. Stipules triangular, or a series of filaments, *c.* 1 mm long. *Leaves* subcoriaceous or chartaceous, ovate-oblong, ovate, broad-elliptic to elliptic-lanceolate, 3½–16 by 2–9 cm; base obtuse, cuneate; apex acute to acuminate, sometimes obtuse and slightly apiculate; margin crenate to subentire; nerves 5–8 pairs; petiole 3–7 mm. *Inflorescences* axillary and extra-axillary, 1–4 times branched, few-flowered, densely reddish brown puberulous, 1⅓–4 cm long, sometimes very short. Peduncle ⅔–2 cm. Bracts triangular, *c.* 1 mm long. Pedicels 2–5 mm. *Flowers* yellowish, or green. *Calyx* lobes semi-orbicular, or deltoid, ⅔–1 mm long, brownish puberulous outside. *Petals* ovate-oblong, 3–5 by 1⅓–2 mm. *Disk* annular-pulvinate, 1½–2½ mm ø, *c.* 1 mm high, sometimes the basal part slightly extended outwards or downward and slightly 5-angular. *Stamens* 1½–2 mm. *Pistil* ¾–2 mm emerging from the disk. *Ovules* (5–)6(–8) in each cell. *Follicles* obovate to obovate- or elliptic-oblong, 2½–7¾ by 1½–3 cm, emarginate or obtuse at the apex; pericarp thin-leathery, the margins of suture slightly spreading after dehiscence. *Seed* proper elliptic- or ovate-oblong, 1–2 by ½–¾ cm; wing ovate to ovate-oblong, or elliptic, 2–4 by 1¼–2 cm.

Distr. Thailand (scattered) and *Malesia:* NW. Sumatra (Simalur I.), Malay Peninsula (Perlis, Perak, Kelantan, Trengganu, Pahang, Selangor, and Penang), Java (Bantam, Preanger, Nusa Kembangan, Banjumas, and Kangean), Lesser Sunda Is. (Timor), Borneo (Sarawak), Philippines (Luzon, Sibuyan, and Masbate I.), Celebes (Gorontalo, P. Muna, and Pangkadjene), Moluccas (Talaud and Sula I.), and New Guinea (Aru, Vogelkop, Sorong, Wakoli, and Radjah Ampat I.).

Ecol. In forests from the lowland up to *c.* 840 m, sometimes found on limestone rocks.

Vern. Sumatra: *olor balijan dotan*, Simalur; Malay Peninsula: *akar china*; Borneo: *bohan kutongan*, Bajau E.C.; Moluccas: *poenclángi*, Nenusa.

## 16. REISSANTIA

HALLÉ, Bull. Mus. Hist. Nat. Paris 30 (1958) 466; Mém. Inst. Fr. Afr. Noire *n.* 64 (1962) 84.—*Hippocratea auct., p.p., excl. typ.*—**Fig. 29.**

Lianas, scandent or sometimes erect shrubs, rarely small trees. *Leaves* decussate very rarely associated with some subopposite ones. *Inflorescences* axillary, sometimes crowded on short shoots, dichotomously cymose, or rarely paniculate, usually with supplementary branchlets in the dichotomies or in the axils of branchlets. *Flowers* small. *Calyx* lobes 5, imbricate. *Petals* 5, imbricate, erect or

suberect at anthesis. *Disk* extrastaminal, inconspicuous, most of it usually united with the ovary, the uppermost part slightly extended outward ± like a rim. *Stamens* 3, inserted at the base of the free part of the pistil; anthers transverse-oblong, extrorse. *Ovary* 3-celled, its free part globose or obscurely 3-sulcate; style short; stigma obscure. *Ovules* usually 2, rarely 4–8 in each cell. *Fruit* capsular, consisting of 3 divergent, separate 'follicles' which dehisce along an inconspicuous median suture into 2 navicular valves. *Seeds* with a basal, ± transparent, membranous wing, the latter with a distinct submedian and a thick marginal 'nerve'; endosperm 0; cotyledons free (always?).

Distr. Species 7, in the Old World tropics of Central and West Africa, and Indo-Malesia; 4 of them in Malesia.

Ecol. In Malesia chiefly found in lowland forests, sometimes up to 700 m.

KEY TO THE SPECIES

1. Inflorescences dichotomous-cymose, usually with supplementary branchlets in the dichotomies.
 2. Flowers pedicelled (⅓–1 mm). Petals oblong, 1–1½ by ¼–½ mm. Stamens glabrous. Ovules 2 in each cell. Scars of stipules separated . . . . . **1. R. indica**
 2. Flowers almost sessile. Petals obovate, 2½–3 by 1–1½ mm. Stamens papillose. Ovules 4–8 in each cell. Scars of stipules ± fused in a ring on the older branches. . . . . **2. R. cassinoides**
1. Inflorescences thyrsiform or paniculate, occasionally with short, supplementary shoots in the axils of branchlets.
 3. Inflorescences and floral parts densely covered with rust-coloured papillae and uniseriate hairs. Petals spatulate (3–3½ mm long). Stipular scars ± fused in a ring on the older branches. **3. R. ferruginea**
 3. Inflorescences glabrous. Calyx and petals only papillose. Petals oblanceolate or obovate-oblong (2½–3 mm long). Scars of stipules separated . . . . . **4. R. grahamii**

**1. Reissantia indica** (WILLD.) HALLÉ [Bull. Mus. Hist. Nat. Paris 30 (1958) 466] Mém. Inst. Fr. Afr. Noire *n.* 64 (1962) 85; DING HOU, Blumea 12 (1963) 33.—*Hippocratea indica* WILLD. Sp. Pl. 1 (1797) 193; ROXB. Pl. Corom. 2 (1798) 16, t. 130; Fl. Ind. ed. Wall. 1 (1820) 169; DC. Prod. 1 (1824) 568; BL. Bijdr. (1825) 219, *incl. var. evonymoides* BL.; ROXB. Fl. Ind. ed. Carey 1 (1832) 165; W. & A. Prod. (1834) 104; KORTH. Kruidk. (1842) 185; Flora 31 (1848) 580; HASSK. Pl. Jav. Rar. (1848) 230; THWAITES, En. Pl. Zeyl. (1858) 52; MIQ. Fl. Ind. Bat. 1, 2 (1859) 599; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 152, *incl. f. timorensis* MIQ.; LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 624; KURZ, J. As. Soc. Beng. 44, ii (1875) 164; For. Fl. Burma 1 (1877) 256; VIDAL, Rev. Pl. Vasc. Filip. (1886) 89; PIERRE, For. Fl. Coch. 19 (1894) t. 302A; KING, J. As. Soc. Beng. 65, ii (1896) 359; MERR. Philip. J. Sc. 1 (1906) Suppl. 86; KOORD.-SCHUM. Syst. Verz. (1911) Fam. 159, 1; BACK. Schoolfl. (1911) 236; KOORD. Exk. Fl. Java 2 (1912) 526; PITARD, Fl. Gén. I.-C. 1 (1912) 898, *p.p.*; MERR. Sp. Blanc. (1918) 236; RIDL. Fl. Mal. Pen. 1 (1922) 455; MERR. En. Philip. 2 (1923) 485; RENDLE, J. Bot. 62 (1924) Suppl. 23; MERR. & CHUN, Sunyatsenia 5 (1940) 112.—*Hippocratea volubilis* (*non* LINNÉ) BLANCO, Fl. Filip. (1837) 27; ed. 2 (1845) 20; ed. 3, 1 (1877) 37.—*Pristimera indica* A. C. SMITH, Am. J. Bot. 28 (1941) 440; J. Arn. Arb. 26 (1945) 175; TARDIEU, Suppl. Fl. Gén. I.-C. 1 (1948) 817.

Liana, sometimes a small shrub or tree. Stipule triangular, *c.* ½ mm long, 3-lobed, laciniate or fimbriate, sometimes just a series of short filaments along the branchlet below the petiole. *Leaves* chartaceous, ovate, broad-ovate, elliptic to elliptic-oblong, rarely obovate, or broad-elliptic, 3½–13 by 2–6½ cm; base cuneate; apex acuminate, short-apiculate; margin crenulate; nerves 5–8 pairs; petiole 5–8 mm. *Inflorescences* cymose, 2–6 cm long, sometimes very short, usually with supplementary branchlets in the dichotomies. Peduncle very short, sometimes up to 3½ cm. Bracts triangular, *c.* ⅔ mm long, laciniate, sometimes fimbriate at the base. Pedicels ⅓–1 mm. *Flowers* light yellow or greenish yellow, small. *Calyx* thin, papillose on both surfaces, almost divided to the base, lobes triangular, ½–⅔ mm long, slightly erose. *Petals* ± oblong, 1–1½ by ¼–½ mm, papillose on both surfaces. *Disk* with the free part opposite the stamens slightly thicker. *Stamens* ½–1 mm. Free part of *pistil* flask-like, *c.* ½ mm long. *Ovules* 2 in each cell, inserted at the base. *Follicles* elliptic- or obovate-oblong, 3–5½ by 1¼–1½ cm; pericarp leathery, valves *c.* ⅓ mm thick, the sutural margins slightly spreading after dehiscence. *Seeds* (*incl.* wing) 2¾–3½ by 1 cm, seed proper broad-elliptic, or elliptic, 1–1⅓ by ½–⅔ cm.

Distr. Widely distributed but scattered in India, Ceylon, Burma, Thailand, Indochina, S. China (Yunnan and Hainan), and *Malesia:* Sumatra (Taliabu and Mangoli), Malay Peninsula (Perlis, Pahang, Penang, and Singapore), Java (throughout), Lesser Sunda Is. (Lombok, Sumbawa and Timor), Borneo (Bundu and Tarat),

Philippines (Luzon, Lubang I., San Mateo, and Mindanao), and Celebes (Gorontalo, Kendari, Pangkadjene, Bonthain, and Lelewao).

Ecol. In rain- and monsoon-forests, on ridges, in secondary forests, sometimes found on limestone, from the lowland up to 650 m.

Uses. According to HEYNE (Nutt. Pl. 1927, 985) the sap of the stem is drunk for treating fever. The leaves, slightly scorched and seasoned with sambal, are given to eat to women in childbed, and compounded with *adas-pulasari* (*Alyxia sp.*) are used for poultice in treating rheumatism.

Vern. Java: (*areuj*) *mangèndèr*, *hóëh tútung*, *ojot tju-tju-rian*, S; Borneo: *saripangil*, *tutok otik*, Dusun.

Notes. *Hippocratea volubilis* described by BLANCO was not a new species as MERRILL erroneously concluded, but merely the identification of a Philippine plant as *Hippocratea volubilis*, as indicated by the reference '*Lin. ibid.*' at the end of BLANCO's description (1845). MERRILL referred this record with doubt to *Hippocratea indica*, and though the inflorescences are described as racemose and the fruit as obliquely cordate I agree this is probably the best disposition of it.

Under the vernacular names of *Alor sta* (SF 10416) and *Serapat akar* (SF 13405), BURKILL & HANIFF (Gard. Bull. S.S. 6, 1930, 184) identified these two collections as *Hippocratea ?indica* and derived the information of medicinal uses. I examined the collection SF 13405 (SING) which is a sterile young shoot and may belong to *Rubiaceae*. The identity of the other specimen, SF 10416, which has not yet been found, is still doubtful.

**2. Reissantia cassinoides** (DC.) DING HOU, Blumea 12 (1963) 33.—*Hippocratea*? *cassinoides* DC. Prod. 1 (1824) 569; MIQ. Fl. Ind. Bat. 1, 2 (1859) 600.—*Hippocratea indica* (*non* WILLD.) SPAN. Linnaea 15 (1841) 179.—*Hippocratea glaga* KORTH. Kruidk. (1842) 186, t. 40; Flora 31 (1848) 580; WALP. Ann. 2 (1850–51) 193; MIQ. Fl. Ind. Bat. 1, 2 (1859) 599; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 153; BACK. Schoolfl. (1911) 236.—*Hippocratea beccarii* TUYN, Blumea 10 (1960) 139, f. 3.

Liana. Stipules ± intrapetiolar, triangular, 3-lobed, or laciniate, *c.* ⅔ mm long. Branchlets occasionally producing rootlets, sometimes with 2 buds in a leaf axil. *Leaves* chartaceous to subcoriaceous, elliptic- or ovate-oblong, sometimes broad-elliptic, 7–15 by 3–8 cm; base obtuse or cuneate; apex acuminate, sometimes apiculate; margin entire, or remotely, slightly crenulate; nerves 4–6 pairs; petiole 8–13 mm. *Inflorescences* dichotomous-cymose, 4½–8½ cm long, usually with short, supplementary branchlets in the dichotomies. Peduncle 3–4½ cm. Bracts triangular or deltoid, *c.* 1 mm long. *Flowers* pale yellow or yellowish green, almost sessile. *Calyx* fleshy, divided almost to the base, lobes deltoid, ½–1 mm long, slightly erose at the margin. *Petals* fleshy, broad-elliptic, obovate, 2½–3 by 1–1½ mm, with slightly inflexed margin, densely papillose on both surfaces. Free part of *disk* slightly 5-angular. *Stamens* ⅔–1 mm; filaments densely covered with papilla-like hairs. *Pistil* ⅔–1 mm emerging from the disk; stigma obscurely 3-lobed. *Ovules* 4–8 in each cell. *Follicles* ovate to elliptic-oblong, 6½–8½ by 2½–5 cm, the valves rather woody, *c.* ⅔ mm thick. *Seeds* (*incl.* wing) 6–7 by 1½–¾ cm, seed proper ellipsoid, 1½–2 by ⅔–1 cm.

Distr. South Peninsular Thailand (Nakawn Sritamarat) and *Malesia:* S. Sumatra (Palembang), Banka, W. Java (Mt Salak), Lesser Sunda Is. (Timor), and Borneo (North Borneo and Sarawak).

Ecol. In lowland forests up to 480 m.

Vern. Java: (*areu*) *mangèndèr*, S.

Note. I have seen only 3 collections with fruits, in 2 of which the follicle is elliptic-oblong, 6–8½ by 2½–3 cm, and *c.* 2½ times as long as wide; in the type of *Hippocratea beccarii* it is ovate, 7½ by 5 cm; this is not correlated with floral differences.

**3. Reissantia ferruginea** (KING) DING HOU, Blumea 12 (1963) 33.—*Hippocratea ferruginea* KING, J. As. Soc. Beng. 65, ii (1896) 357; RIDL. Fl. Mal. Pen. 1 (1922) 455.

Liana up to 20 m. Stipules triangular, *c.* ⅓ mm long. *Leaves* chartaceous, ovate, obovate, or elliptic, 7–10½ by 3¾–5 cm; base cuneate; apex acute, obtuse; margin entire; nerves 4–7 pairs; petiole 6–8 mm. *Inflorescences* paniculate, sometimes ramiflorous, up to 5 cm long, densely covered with rust-coloured papillae or uniseriate hairs. Peduncle 1½–2½ cm. Bracts ⅔ mm long. Pedicels 1–1½ mm. *Flowers* light greenish yellow. Calyx and petals densely covered with rust-coloured papillae and short-uniseriate hairs especially on the outer surfaces. *Calyx* lobes triangular or ovate, *c.* ¾ mm long, margin laciniate or short-fimbriate. *Petals* spatulate, 3–3½ by *c.* ⅔ mm, usually boat-shaped, with erose margin. Free part of *disk* wavy or slightly 5-angular. *Stamens c.* ½ mm; filaments densely covered with papillae or uniseriate hairs especially on the outer surface. *Pistil c.* $^1/_5$ mm emerging from the disk. *Ovules* 6 in each cell. *Fruit* unknown.

Distr. *Malesia:* Malay Peninsula (Penang) and SE. Borneo (W. Kutai).

Ecol. Lowland forests, up to 450 m.

**4. Reissantia grahamii** (WIGHT) DING HOU, Blumea 12 (1963) 33.—*Hippocratea grahamii* WIGHT, Ill. Ind. Bot. (1839) 134; Ic. Pl. Ind. Or. 2 (1840) t. 380; LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 624.—*Hippocratea salacioides* KORTH. Kruidk. (1842) 188; Flora 31 (1848) 580; MIQ. Fl. Ind. Bat. 1, 2 (1859) 600; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 153.—*Hippocratea zippeliana* MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 153.—*Hippocratea megalocarpa* MERR. Philip. J. Sc. 13 (1918) Bot. 20; En. Philip. 2 (1923) 486.—*Hippocratea ellipticarpa* MERR. Philip. J. Sc. 17 (1920) 275; En. Philip. 2 (1923) 485.—*Kokoona luzoniensis* MERR. Philip. J. Sc. 27 (1925) 32 ('*Kokoonia*'), *ex char.*—*Loeseneriella zippeliana* A. C. SMITH, Am. J. Bot. 28 (1941) 440.—*Pristimera grahamii* A. C. SMITH, J. Arn. Arb. 26 (1945) 178.—**Fig. 29.**


Fig. 29. *Reissantia grahamii* (WIGHT) DING HOU. *a.* Habit, × ⅔, *b* flower, × 4, *c. ditto*, calyx lobes and petals removed, × 16, *d.* style, × 16, *e.* young and old anthers seen from top, × 32, *f.* flower in section, petals removed, × 16, *g.* seed, with basal wing, × ⅔ (*a–f* ZIPPELIUS *s.n.*, *g* JAHERI *s.n.*).

Liana or scandent shrub, up to 25 m. Stipules triangular, *c.* ½ mm long. *Leaves* subcoriaceous to coriaceous, broad-elliptic, elliptic, elliptic- or ovate-oblong, slightly obovate, or suborbicular, (5–)8–19½ by (2½–)5–10 cm; base cuneate or rounded; apex short-acuminate, sometimes obtuse or rounded; margin entire or remotely crenulate; nerves 5–6 pairs; petiole $^4/_5$–1¼ cm. *Inflorescences* paniculate or thyrsiform, (3½–)10–14 cm long, many-flowered. Peduncle (1–)5–5½ cm. Bracts deltoid, ⅓–½ mm long, laciniate. Pedicels ½–1¾ mm. *Flowers* pale yellowish green. *Calyx* almost divided to the base, lobes suborbicular, rarely deltoid, ⅔–1 mm long, erose or laciniate. *Petals* obovate-oblong or oblanceolate, 2½–3 by 1 mm, usually with inflexed margin, slightly curved inward at anthesis, erose. *Disk* sometimes slightly 5-angular and the angles alternate with the petals. *Stamens c.* ⅓ mm; filaments usually papillose on the outer and sometimes also the inner surface. *Pistil c.* ⅓ mm emerging from the disk, triangular, *c.* ¾ mm ø at the base. *Ovules* (4–)6(–7) in each cell. *Follicles* obovate-oblong, 9–13 by 3½–4½ cm; pericarp ± woody, valves *c.* 1½ mm thick. *Seeds* (*incl.* wing) oblong-lanceolate, 6–10 by 1¾–2¾ cm; seed proper elliptic- or ovate-oblong, 2–2¼ by ¾–$^4/_5$ cm.

Distr. India (Concan, Sylhet, and S. Andaman), Upper Burma (Mingin), Thailand (Nu Song, Makum, Muang Pua and Watana) and *Malesia*: West Central Sumatra (Mt Singalang), E. Java (Besuki and Kediri), Borneo (Kapuas), Philippines (Palawan, Mindoro, Luzon, and Mindanao), Moluccas (Kai Is.), and New Guinea (Sorong, Ramoi, and Milne Bay).

Ecol. Lowland forests, sometimes up to 700 m,

once found on limestone.

Note. In the original description of *Hippocratea salacioides* the number of ovules in each cell was recorded as 2. However, I have dissected some flowers of the type specimen and found mostly 6, sometimes 4, 5, or 7 in each cell.

## 17. SALACIA

LINNÉ, Mant. (1767) 159; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 217; A. C. SMITH, Brittonia 3 (1940) 423; WILCZEK, Fl. Congo Belge 9 (1960) 181; HALLÉ, Mém. Inst. Fr. Afr. Noire *n.* 64 (1962) 151.—*Johnia* ROXB. Fl. Ind. ed. Wall. 1 (1820) 172; Fl. Ind. ed. Carey 1 (1832) 168.—*Salacicratea* LOES. Nova Guinea 8 (1910) 281; A. C. SMITH, Am. J. Bot. 28 (1941) 441.—**Fig. 32—33, 35—36.**

Lianas, scandent or sometimes erect shrubs, rarely small trees. Twigs usually terete and greyish. *Leaves* decussate, sometimes subopposite, rarely spiral. *Flowers* axillary, fascicled, or in cymes, thyrsiform or paniculiform. *Calyx* deeply 5-lobed, or in some species slightly irregularly 3–5-lobed in the apical part and then circumscissile at the base or lengthwise splitting, or not lobed. *Petals* (4–)5(–7), sometimes the innermost 1 or 2 slightly irregularly cleft or lobed in the upper half. *Disk* intrastaminal, fleshy, annular-pulvinate, sometimes truncate-conical or flattened, rarely cupular. *Stamens* 3 or (in *S. erythrocarpa* and *S. forsteniana*) 2, inserted at the base of the free part of the pistil, usually reflexed at anthesis; filaments subulate, usually broadened towards the base; anthers transversely oblong or ellipsoid, or ± reniform, sometimes ovoid, transversely or rarely lengthwise to obliquely extrorse, or apical-dehiscent. *Ovary* partly or completely immersed in the disk, the free part conical or triangular, 3- or (in *S. erythrocarpa* and *S. forsteniana*) 2-celled, gradually narrowed into a distinct or obscure style; stigma obscure. *Ovules* 2–8 in each cell, axile. *Fruit* drupaceous, subglobose, 1–3-celled; pericarp coriaceous when dry. *Seeds* 1 to several, embedded in mucilaginous pulp; cotyledons massive, free or united.

Distr. Pantropic. It is very difficult to estimate the number of species in this genus because of the different opinions regarding the generic delimitation. A. C. SMITH (1940, p. 424) recorded 29 species for the New World. There are about 90 species in Africa (*cf.* HALLÉ, *l.c.*). In Malesia 29 species are known. Fig. 30.

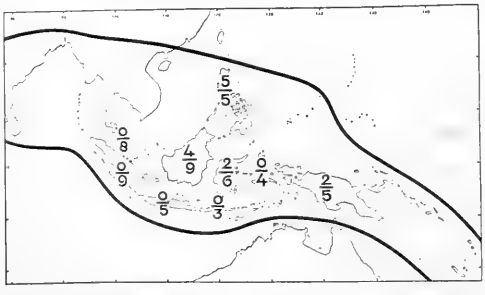



Fig. 30. Distribution of *Salacia* in Malesia. Species density indicated in each subarea, endemics above the hyphen, non-endemic below it.

Ecol. In Malesia in forests and thickets, sometimes found on limestone, occasionally in freshwater swamps, from sealevel up to 1800 m.

Uses. The fruits of some species are edible, a little flesh coating the seeds. A decoction from the roots of a few species is used for medicinal purpose (*cf.* BURKILL, Dict. 1935, 1942–1943; HEYNE, Nutt. Pl. 1927, 985).

Morph. The morphological status of the edible flesh coating the seeds (actually the endocarp), here

designated as 'pulp', is not known to me. It could be tissue from either mesocarp or endocarp, or from both of them. The peculiar thing is that in herbarium material it forms thin loose lamella-like appendages attached to both exocarp and endocarp. Under the microscope the lamellae appear parenchyma-like cells, *e.g.* in *S. leucoclada* (CLEMENS 29599). It has been well observed in *S. leucoclada*, *S. laurifolia*, and *S. oblongifolia*. This uncertainty can only be verified in fresh material at various stages of development.

In some species, *e.g. S. oblongifolia*, the floral parts contain sulphur-yellow particles in the tissue; a Papuan species, *Salacicratea glandulosa*, is even named after this property (see under 6. *S. papuana*). I am grateful to Dr MAAS GEESTERANUS who has examined the material; he said that the sulphur-yellow particles are dried latex dissolving completely in KOH (10%) solution and are obviously a kind of kautchuk.

Note. The fruits of several species are unknown; this made it difficult to frame the key.

## KEY TO THE SPECIES

1. Flowers in distinctly peduncled cymes.
 2. Calyx distinctly 5-lobed even in very young stage.
  3. Cymes lax, rachises or internodes distinct.
   4. Disk annular-pulvinate, 1–2 times as wide as high. Bracts without colleters. Fruits subglobose, 2–3 cm ø . . . . . **1. S. korthalsiana**
   4. Disk flat, 3–4 times as wide as high. Bracts with colleters inserted at the base inside.
    5. Calyx without colleters on the inner base, lobes always distinctly imbricate, apex obtuse or round, very rarely slightly acute.
     6. Calyx lobes ± reniform, entire. Disk with a thin, rim-like extension at the base. Ovules 4 in each cell . . . . . **2. S. cymosa**
     6. Calyx lobes very broad-ovate or -obovate, erose or slightly laciniate. Disk without such extension. Ovules 2 in each cell. Fruits globose, 4–5 cm ø . . . . . **3. S. subalternifolia**
    5. Calyx with fimbriate colleters attached on the inner base and protruding from the margins, lobes separate from each other at least in open flowers, apex acute . . . . **4. S. blepharophora**
  3. Cymes condensed, rachises or internodes invisible. Disk orbicular, usually flat, sometimes slightly convex in the central part, ⅓–½ mm high, 1½ mm ø. Fruits subglobose or very broadly obovoid, 4–8(–12) cm long, slightly contracted at the base . . . . . **5. S. oblongifolia**
 2. Calyx almost unlobed, or slightly, irregularly lobed at the apex, breaking away transversely along an irregular line near its base during anthesis, sometimes irregularly, longitudinally splitting.
  7. Calyx dehiscing transversely near its base, the upper part calyptra-like, and the basal part ± like a narrow ring remaining below the petals, very rarely associated with some longitudinally splitting ones.
   8. Flowers with 3 stamens and ovary 3-celled. Anthers obliquely dehiscent.
    9. Flower-buds broad-ovoid, or ovoid, or conical, 2½–5 by 2½–3½ mm. Calyx thickened in the apical part (*c.* 1 mm in length) seen on a longitudinal section.
     10. Calyx with free membranous tissue or in a mass at the apical end inside . . **6. S. papuana**
     10. Calyx without such free tissue as above . . . . . **7. S. sororia**
    9. Flower-buds subglobose, *c.* 1½–2 mm ø. Calyx evenly thick seen on a longitudinal section. **8. S. ledermannii**
   8. Flowers usually with 2 stamens and ovary 2-celled. Anthers transversely dehiscent. **9. S. forsteniana**
  7. Calyx not lobed, or splitting irregularly lengthwise, and persistent at the base of a flower.
   11. Cymes lax, rachises or internodes distinct. Calyx splitting at anthesis and remaining at the base of a flower. Anthers slightly obliquely dehiscent . . . . . **10. S. intermedia**
   11. Cymes condensed, or flowers almost fascicled. Calyx not lobed, saucer-shaped at the base of a mature flower. Anthers transversely dehiscent . . . . . **11. S. wenzelii**
1. Flowers in fascicles, or on a very short, axillary, bracteate tubercle or peduncle.
 12. Calyx in the mature flower erose but not lobed, saucer-shaped . . . . . **11. S. wenzelii**
 12. Calyx distinctly 5-lobed.
  13. Stamens 2. Ovary 2-celled. Fruits globose, 1–1¾ cm ø, 1-seeded . . . **12. S. erythrocarpa**
  13. Stamens 3. Ovary 3-celled.
   14. Disk in mature flowers thin, cupular, sometimes stamens inserted on the ovary at some distance above this disk, the interval resembling a short "gynandrophore". Ovules (2–)4 in each cell. Leaves large, yellowish when dry. Fruits broadly ovoid or subglobose, usually 5½–6½ by 5–5½ cm . . . . . **13. S. macrophylla**
   14. Disk rather fleshy, flat, discoid, or annular-pulvinate, no interval between disk and insertion of stamens. Ovules usually 2 in each cell (4–5 in each cell in *S. marginata*).
    15. Disk flat, slightly concave or discoid, or slightly convex towards the center, 4–7 times as wide as high.
     16. Disk large, 3½–5 mm ø.

17. Pedicels 1⅓–2 cm. Calyx lobes slightly erose. Disk suborbicular, sometimes obscurely 5-lobed. **14. S. longipedicellata**
17. Pedicels 1/5–½ cm. Calyx lobes short-fimbriate. Disk distinctly 5-lobed.
18. Branchlets sharply 4-angular. Leaves distinctly serrate-crenate. Petals suborbicular or broad-elliptic, 3½–4 by 2¾–3¾ mm. Ovules 2 in each cell . . . **15. S. castaneifolia**
18. Branchlets terete. Leaves entire. Petals ± oblong, 6 by 4 mm. Ovules 4–5 in each cell. **15. S. marginata**
16. Disk rather small, usually less than 2 mm ø.
19. Disk convex at the central part, thin and rim-like at the margin. Calyx lobes unequal in size and shape . . . . . **17. S. grandiflora**
19. Disk thick on the margin.
20. Disk with a thin, membranous extension at the base just beneath the margin. Pedicels without elastic threads shown on breaking. Branches usually densely covered with lenticels. **18. S. verrucosa**
20. Disk without the extension as above. Pedicels with elastic threads shown on breaking. Branches rather smooth . . . . . **19. S. ovalis**
15. Disk annular-pulvinate, usually higher than wide, rarely twice as wide as high or less.
21. Anthers short-apiculate, ± longitudinally dehiscent. Fruits subglobose, *c.* 6½ cm ø. **20. S. leucoclada**
21. Anthers obtuse, transversely, very rarely slightly obliquely dehiscent.
22. Disk 2–3 mm wide. Petals usually ovate or broad-ovate, 3–6 by 2½–4 mm.
23. Leaves bluntish, greenish when dried, upper surface finely prominently reticulate-veined. Disk annular-pulvinate, apical end almost as wide as the base, *c.* 1 mm high and 2 mm ø. **21. S. venosa**
23. Leaves almost always distinctly acuminate, brownish when dried, upper surface smooth. Disk conical-pulvinate, gradually narrowed towards the apex, 1½–2 mm high and 3 mm ø. **22. S. maingayi**
22. Disk ¾–1¾ mm wide. Petals usually oblong or elliptic, 1½–3¼ by ¾–1¾ mm.
24. Ovules attached at the central part of the axis. Fruits 2¾–4⅓ mm ø (not known in *S. nitidissima*).
25. Flower-buds broad-oblong, usually angular. Petals slightly keeled.
26. Disk with a thin narrow rim-like extension a little above the base. Fruits rugose. Leaves usually entire or subentire.
27. Leaves especially the old ones with elastic threads shown on breaking. Calyx entire. Fruits globose or subglobose, 2¾–3½ cm ø, not contracted at the base. **23. S. laurifolia**
27. Leaves without elastic threads shown on breaking. Calyx glandular. Fruits broad-obovoid, *c.* 4⅓ by 3⅓ cm, contracted at the base. . . . . **24. S. exsculpta**
26. Disk without the rim-like extension as above. Fruit smooth. Leaves usually distinctly crenulate . . . . . **25. S. euphlebia**
25. Flower-buds globose, not angular. Petals smooth. Disk 1 mm high, 1¾ mm ø, wider at base, gradually narrowed upwards . . . . . **26. S. nitidissima**
24. Ovules attached at the top of the axis. Fruits small, 1–1½ cm ø.
28. Leaves spiral or sometimes subopposite. Flowers brownish . . . . . **27. S. viminea**
28. Leaves decussate, rarely associated with some subopposite ones.
29. Petals distinctly yellowish marginate, 3–4 by 2½–4 mm. Disk 1 mm high, 1–1½ mm ø. **28. S. chinensis**
29. Petals not yellowish marginate, *c.* 2 by ⅔ mm. Disk *c.* ⅔ mm high, ⅔–1 mm ø. **29. S. kalahiensis**

**1. Salacia korthalsiana** MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 152; KOORD.–SCHUM. Syst. Verz. (1911) Fam. 159, 1; BACK. Schoolfl. (1911) 237; RIDL. Fl. Mal. Pen. 1 (1922) 457; MERR. Pl. Elm. Born. (1929) 171; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 226.—*S. radula* (*non* G. DON) DIETR. *ex* HASSK. Tijd. Nat. Gesch. Phys. 11 (1844) 190; HASSK. Pl. Jav. Rar. (1848) 231.—*S. sinensis* (*non* LINN.) BLANCO, Fl. Filip. ed. 3, 1 (1877) t. 86, *excl. descr.*—*Hippocratea obtusifolia* (*non* ROXB.) MERR. Philip. J. Sc. 1 (1906) Suppl. 86.—*S. philippinensis* MERR. Philip. J. Sc. 7 (1912) Bot. 291; En. Philip. 2 (1923) 487; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 226.—*Hippocratea obtusa* RIDL. Fl. Mal. Pen. 5 (1925) 299.—*Hippocratea sp.* BURKILL & HANIFF, Gard. Bull. S.S. 6 (1930) 184.

Liana up to 18 m, rarely erect shrub or small tree up to 10 m. Stipules triangular, *c.* ½ mm long. *Leaves* chartaceous to subcoriaceous, elliptic- or ovate-oblong, sometimes ovate or elliptic, 6½–26½ by 3–13 cm (in sterile material up to 32 by 14 cm); base cuneate, or obtuse; apex acuminate, cuspidate; margin remotely, slightly crenulate; nerves 6–11 pairs; petiole ½–1½ cm. *Inflorescences* cymose, axillary, sometimes ramiflorous, 1–2 in a leaf axil, 1–3 cm long, rarely crowded on a young shoot with reduced leaves or bracts simulating a thyrsiform inflorescence up to 8–15 cm long. Peduncle 0–1½ cm. Bracts deltoid, *c.* ¾ mm long. Pedicels 4½–12 mm. *Flowers* yellowish green, slightly concave at the base,

floral parts containing sulphur-like particles. *Calyx* lobes deltoid or suborbicular, ¾–1 mm long, obtuse, margin slightly erose, laciniate or short-fimbriate. *Petals* broad-elliptic, -ovate, -obovate, or oblong, 2½–4½ by 1½–2¾ mm, obtuse or rounded, entire. *Disk* annular-pulvinate, ½–1 mm high, *c.* 1¼ mm ø, usually covered with fine papillae, truncate at the apex, the tissue opposite the calyx lobes slightly extended outward and downward. *Stamens* 3, 1–1½ mm; anthers ± transversely dehiscent. Pistil ¾–1 mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2(–3) in each cell, attached at the upper inner angle. *Fruit* subglobose, 2–3 cm ø. *Seed* 1, subglobose, 1⅓–2 cm ø.

Distr. Peninsular Thailand (Talang) and *Malesia*: Sumatra (Palembang), Malay Peninsula (Pahang, Johore, and Singapore), Java (throughout), Lesser Sunda Is. (Bali), Borneo (Kuching, N. Borneo, Kutai, Blu-u, and Mt Medadam), Philippines (Palawan, Luzon, Romblon, Bohol, Biliran, Cebu, Panay, and Mindanao). Fig. 31.

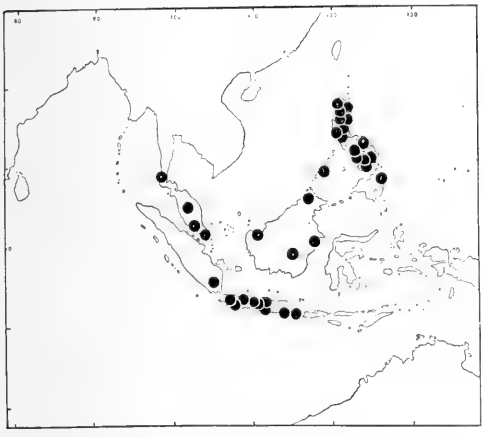


Fig. 31. Distribution of *Salacia korthalsiana* MIQ.

Ecol. In forests and thickets, sometimes occurring on limestone rocks, in E. Java found in teak forest, 50–1400 m.

Galls. Leaves with insect galls.

Uses. The plant under the name '*akar bĕting*' (SF 17583, SING) was identified as *Hippocratea sp.* by BURKILL & HANIFF (*l.c.*). It is said to be used for cracked lips. An extract from the root with water is drunk (*cf.* BURKILL, Dict. 1935, 1177).

Vern. *Pĕtja pinygan*, Palembang; Mal. Pen.: *akar bĕting*, *akar mĕnjéla*, M; Java: *a'roy kúluk l'ökük*, S, *tjantĕl wĕsi*, J; Philippines: *aropit*, Tag., *bagi*, *balagin*, Tagb.

Notes. MIQUEL cited the collections of KORTHALS (*s.n.*, L) and JUNGHUHN (*s.n.*, L) with the original description. Since the epithet is '*korthalsiana*', I have chosen the KORTHALS collection as the lectotype.

HASSKARL, *l.c.*, attributed *S. radula* to 'A. DTR. II.691.3'. He might have intended to ascribe the species to D. DIETRICH (Synopsis Plantarum, 1839, in which there is no such name as *S. radula*), or refer to the name *S. radula* G. DON (Gen. Syst. 1, 1831, 628). I have not seen any specimen annotated by HASSKARL as *S. radula*, but from his detailed description there is no doubt about its identity. BACKER, *l.c.*, rightly reduced it to the present species.

**2. Salacia cymosa** ELMER, Leafl. Philip. Bot. 5 (1913) 1792; MERR. En. Philip. 2 (1923) 486.—**Fig. 36i.**

Climbing and sprawling shrub. Stipules triangular, *c.* ½ mm long, entire. *Leaves* subcoriaceous, shining above and rather dull beneath, elliptic- or slightly ovate-oblong, 8–15 by 3–7 cm; base cuneate, slightly obtuse, or rarely rounded; apex acuminate; margin subentire, sparsely and slightly crenulate; nerves 5–6 pairs; petiole 1–1½ cm. *Inflorescences* paniculate-cymose, on axillary brachyblasts, up to 2 cm long. Peduncle obscure. Bracts deltoid or ± reniform, 1–1½ mm long, with laciniate or subulate colleters inserted at the base on the inner side, margin laciniate or fimbriate. Pedicels 3–4 mm. *Calyx* lobes ± reniform, ½–1 mm long, entire. *Petals* broad-elliptic, or -oblong, 3–3½ by 2–2¼ mm, entire, slightly contracted at the base. *Disk* fleshy, orbicular, flattened, ± convex at the central part, 1½–2 mm ø, ½ mm high, when dried with a thin yellowish rim. *Stamens* 3, *c.* ¾ mm; anthers transversely dehiscent. Pistil *c.* ⅓ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 4 in each cell, attached at the top inner angle.

Distr. *Malesia*: Philippines (Palawan), once collected.

Ecol. In thickets at low altitudes.

**3. Salacia subalternifolia** MERR. & PERRY, J. Arn. Arb. 20 (1939) 236.—**Fig. 36d.**

Liana. Stipules laciniate, inserted obliquely on the branchlets just below the articulation of the petiole. *Leaves* sometimes also associated with subopposite or even subalternate ones, shining on the upper surface, elliptic to elliptic-oblong, 9–15 by 4½–8 cm; base cuneate; apex acute, sometimes obtuse; margin remotely crenulate; nerves 5–7 pairs; petiole 4–6 mm. *Inflorescences* axillary, paniculate-cymose, sometimes branched from the very base and then seemingly more than one in a leaf-axil. Peduncles usually short. Bracts triangular, *c.* 1 mm long, laciniate, short-fimbriate, or erose on the margin, with filiform or laciniate colleters inserted at the base inside. Pedicels 5–6 mm, with elastic threads shown on breaking. *Flowers* greenish yellow. *Calyx* almost divided to the base, lobes very broad-ovate or -obovate, ⅔–1 mm long, obtuse or rounded, or slightly acute at the apex, erose or slightly laciniate at the margin. *Petals* elliptic, oblong, or obovate-oblong, 3 by 1½–1¾ mm, obtuse, ± entire, with distinct 5 or more longitudinal veins slightly elevated on the outer surface when dry. *Disk* fleshy, flat, suborbicular, slightly concave at the central part, *c.* 1½ mm ø, *c.* ½ mm high, the

basal part slightly extended outward into a narrow, thin rim. *Stamens* 3, *c.* ½ mm; anthers transversely dehiscent. Pistil slightly emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell. *Fruit* globose, 4–5 cm ø, pericarp 3½ mm thick, the inner surface with irregular meshes. *Seeds* suborbicular, ± planoconvex, *c.* 2½ mm ø.

Distr. *Malesia*: New Guinea (Lower Fly R. and Middle Tor R.), twice collected.

Ecol. In lowland forests.

Notes. This species is very closely related to *S. cymosa* of the Philippines especially in the characters of the disk. However, the ovules are two in each cell in the present species, being 4 in *S. cymosa*.

The phyllotaxy of the present species is not constantly subalternate or subopposite. The duplicate of the type (BRASS 8066, BO, L) in the Bogor Herbarium and a specimen collected by GJELLERUP (731, L) have opposite or decussate leaves associated with some subopposite ones on the same branch.

**4. Salacia blepharophora** DING HOU, Blumea 12 (1963) 35.

Low liana. Branchlets verrucose. Stipules deltoid, *c.* 1 mm long. *Leaves* subcoriaceous, shining above, elliptic to elliptic-oblong, rarely obovate-oblong, 4–13 by 2–5 cm; base cuneate; apex obtuse, acute, or short-acuminate; margin ± entire, or obscurely crenulate; nerves 4–8 pairs; petiole 5–7 mm. *Inflorescences* axillary, short, paniculate-cymose, or on an axillary brachyblast, 1–2 cm long. Peduncle very short (up to 3 mm) or 0. Bracts triangular, ½–⅔ mm long, lacerate, with fimbriate colleters inside. Pedicels *c.* 5 mm. *Calyx* short-cupular, with fimbriate colleters attached at the base on the inner side and protruding beyond its margin, lobes spreading and separate from each other at anthesis, triangular, ½–1 mm long, acute, ± entire. *Petals* persistent (?), broad-oblong, rarely broad-elliptic, obtuse, entire or slightly erose, 2–2⅔ by 1½–1⅔ mm. *Disk* fleshy, flat, orbicular, *c.* 2 mm ø and *c.* ½ mm high, the tissue at the base slightly protruding outward like a thin rim. *Stamens* 3, *c.* ½ mm; anthers transversely dehiscent; free part of the pistil pyramidal, *c.* ½ mm high. *Ovary* 3-celled. *Ovules* 2 in each cell, attached at the upper inner angle. Immature *fruit* slightly triangular.

Distr. *Malesia*: Central Celebes (Matana Lake), once collected.

Ecol. In thickets along a lake, 400 m.

**5. Salacia oblongifolia** BLUME, Bijdr. (1825) 220, *non* G. DON, 1831, *nec* OLIVER, 1868; MIQ. Fl. Ind. Bat. 1, 2 (1859) 598; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 150, t. 6, *incl. f. latior* MIQ.; KOORD.-SCHUM. Syst. Verz. (1911) Fam. 159, 1; BACK. Schoolfl. (1911) 238; KOORD. Exk. Fl. Java 2 (1912) 527; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 226.—*S. melitocarpa* BLUME, Bijdr. (1825) 220; MIQ. Fl. Ind. Bat. 1, 2 (1859) 599.—*S. lanceolata* TEYSM. & BINN. Nat. Tijd. N.I. 25 (1863) 424; KOORD. Exk. Fl. Java 2 (1912) 528.—*S. campanuloidea* KING, J. As. Soc. Beng. 65, ii (1896) 363; RIDL. Fl. Mal. Pen. 1 (1922) 457.—*S. viridis* CRAIB, Kew Bull. (1926) 352.—*S. amentacea* RIDL. Kew Bull. (1938) 239.—*S. klossii* RIDL. *l.c.* 240.

Liana up to *c.* 30 m. Stipules triangular, laciniate. *Leaves* chartaceous to subcoriaceous, elliptic-oblong to -lanceolate, broad-elliptic, or obovate, 6–17½ by 2¼–7 cm; base cuneate, or obtuse; apex short-acuminate to cuspidate; margin crenulate or subentire; nerves 5–10 pairs; petiole 8–17 mm. *Inflorescences* axillary, condensed cymes, very short, usually less than 1½ cm long, internodes of the rachises invisible, few-flowered, usually appearing as a very short or obscure peduncle bearing 2 or 3 slender bracteolate branches. Bracts deltoid, *c.* 1 mm long, slightly erose at the margin. Pedicels 3–4 mm. *Flowers* yellowish or yellowish green, floral parts usually with abundant sulphur-yellow particles in the tissue. *Calyx* lobes ± erect at anthesis, triangular, or ± semi-orbicular, ½–1 mm long, erose or glanduliform at the margin. *Petals* unequal, the inner one or 2 smaller than the others, rather fleshy, ± oblong, or broad-obovate, 2–3 by 1–2½ mm, obtuse, margin thin and slightly erose. *Disk* usually ± flat, orbicular, the outer margin thin and sometimes turning upward, rarely convex at the central part caused by the abundant sulphur-like particles, 1–1½ mm ø, ⅓–½ mm high. *Stamens* 3, ½–1½ mm. Pistil ½–1 mm emerging from the disk. *Ovary* 3-celled. *Ovules* (3–)4(–6) in each cell, in two series. *Fruit* subglobose, or very broad-obovoid, 4–8(–12) by 3½–4½(–7) cm, slightly contracted at the base, pinkish or red. *Seeds* ± ellipsoid or subglobose, 1½–2¼ by 1½ cm, covered with dried pulp.

Distr. Central and Peninsular Thailand, and *Malesia*: West Central Sumatra (Asahan, Siberut I., and Taram), Malay Peninsula (Perak, Penang, and Johore), North and West Borneo, and Java (W. part, Madiun, and Besuki).

Ecol. In forests from the lowland up to 1000 m, sometimes found on sandstone (Taram), in swampy forest (Johore) and in peat forest (Borneo).

Vern. Java: *areuj langari*, *ki-hapiet*, *kikopi*, *manggong*, *tjun-kankan* or *tjun-kaukĕn*, *treng langari*, S.

Galls. DOCTERS VAN LEEUWEN (Zoocecidia 1926, 329, f. 591 & 592) recorded two kinds of leaf-galls found in the present species: (i) disk-like swellings 1½–2 mm ø, caused by an unknown animal, developed on both surfaces of the leaves and (ii) the leaf-blade curved and rolled up, caused by thripses, so that the margins touch each other. I have also seen these two kinds of galls occurring on some specimens.

Note. BLUME erroneously described the flowers having 5 stamens, as already pointed out by MIQUEL (*l.c.* 1869, 151).

**6. Salacia papuana** (LOES.) DING HOU, Blumea 12 (1963) 34.—*Salacicratea papuana* LOES. Nova Guinea 8 (1910) 282, t. 65; in E. & P. Pfl. Fam. ed.

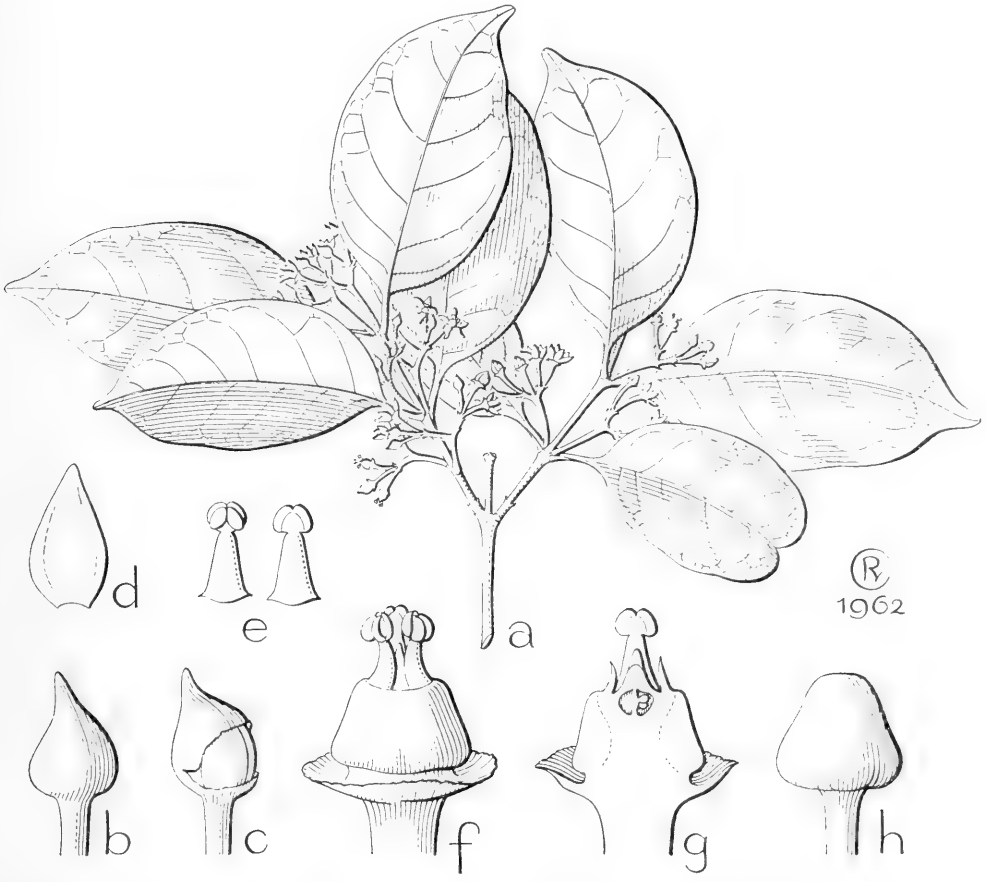



Fig. 32. *Salacia sororia* MIQ. *a.* Habit, × ⅔, *b.* flower-bud, showing calyptriform calyx, × 4, *c. ditto*, showing calyx transversally splitting near base, × 4, *d.* petal, × 4, *e.* exterior and interior view of stamen, × 8, *f.* flower, after calyx split circumscissile near base, petals removed, × 8, *g. ditto*, in section, × 8. —*S. papuana* (LOES.) DING HOU. *h.* Flower-bud, × 4 (*a–g* BRASS 28536, *h* RÖMER 86).

2, 20b (1942) 216.—*Salacicratea glandulosa* A. C. SMITH, Am. J. Bot. 28 (1941) 441.—**Fig. 32h.**

Scandent shrub. Stipules triangular, sometimes obliquely inserted just below the articulation of the petiole. *Leaves* subcoriaceous, elliptic- or ovate-oblong to lanceolate, 7–20 by 2⅓–8⅓ cm; base obtuse, acute; apex acuminate; margin entire but undulate, sometimes sparsely crenulate; nerves 6–8 pairs; petiole ¾–1⅓ mm. *Inflorescences* axillary, dichotomously cymose, 3½–5 cm long. Peduncle 1¾–3 cm. Bracts ovate, 2–3 mm long, obtuse. Pedicels 2–5 mm. Flower-buds broad-ovoid, 3–5 by 2½–3½ mm, gradually narrowed towards the obtuse top. *Flowers* yellowish green. *Calyx* calyptriform, splitting transversely near the base. *Petals* 5(–7), ovate to ovate-oblong, or oblong, 3–6½ by 2–2½ mm, entire, or the innermost one or two slightly irregularly lobed at the upper half. *Disk* annular-pulvinate, 2½–3 mm ø, 1¼–1¾ mm high, slightly broader at the base. *Stamens* 3, 1–3 mm, slightly apiculate, erect at anthesis; anthers obliquely dehiscent. Pistil *c.* 1⅓ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell. *Fruit* globose, *c.* 2½ cm ø, 1-seeded (always?). *Seed* subglobose, *c.* 2 cm ø, with reticular meshes on the rather smooth inner surface of the pericarp.

Distr. *Malesia*: New Guinea (Andai, Lorentz R. region, and Morobe Distr.).

Ecol. In the Lorentz R. region in riverine forests, in the Morobe District in hill forests at 1500–1800 m.

Note. A. C. SMITH derived the epithet *glandulosa* from the gland-like occurrence of the sulphur-yellow kautchuk particles in the floral parts.

**7. Salacia sororia** MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 151.—*Salacicratea sororia* A. C. SMITH, Am. J. Bot. 28 (1941) 441.—*Salacicratea brassii* A. C. SMITH, *l.c.* 442.—**Fig. 32a-g.**

Large rambling shrub or liana. Stipules triangular, *c.* ½ mm long, with colleters inside. *Leaves*

chartaceous to subcoriaceous, elliptic- or ovate-oblong, sometimes broad-elliptic, 3½–11(–27) by 1¾–8(–12) cm; base cuneate; apex short-acuminate; margin ± entire, sometimes obscurely repand with sparse, callose-tipped obsolete crenations; nerves (2–)6–8 pairs; petiole 6–14 mm. *Inflorescences* axillary, cymose, dichotomously 1–3-branched, 2–4 cm long. Peduncle 1–2½ cm. Bracts deltoid or triangular, ½–1 mm long. Pedicels 4–11 mm, with elastic threads shown on breaking. Flower-buds broad-ovoid, or rarely subglobose, (2½–)3–4 by 2½–3 mm, acuminate or rarely obtuse. *Flowers* green. *Calyx* calyptriform, transversely splitting near the base, sometimes longitudinally splitting. *Petals* (4–)5(–6), ovate, 3–4 by 1¾–2¾ mm, ± entire. *Disk* annular-pulvinate, 1–1½ mm high, 2–2½ mm ø, slightly 5-angular at the base. *Stamens* 3, *c.* 1–1½ mm; anthers obscurely apiculate, slightly obliquely dehiscent. Pistil *c.* 1 mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell. Immature *fruit* globose.

Distr. *Malesia*: Moluccas (Sula Is.), New Guinea (Normanby, Aru Is., Hollandia, Sepik and Sogeri region), and Louisiades (Sudest and Rossel Is.).

Ecol. Forests and thickets, from the lowland up to 950 m.

**8. Salacia ledermannii** (LOES. *ex* HARMS) DING HOU, Blumea 12 (1963) 34.—*Salacicratea ledermannii* LOES. [in E. & P. Pfl. Fam. ed. 2, 20b (1942) 216] *ex* HARMS, Notizbl. Berl.-Dahl. 15 (1942) 676.—*Salacicratea sarasinorum* HARMS, *l.c.* 677.

Liana. Branchlets usually angular. Stipules deltoid or triangular, *c.* ½ mm long. *Leaves* subcoriaceous, elliptic to elliptic-oblong, 3½–17½ by 2–7 cm; base cuneate to attenuate; apex short-acuminate; margin crenulate, rarely subentire; nerves 6–9 pairs; petiole 3–8 mm. *Inflorescences* axillary, dichotomously cymose, 1½–3 cm long, the flowers usually crowded at the end of the first fork, sometimes an axillary flowering branch with reduced leaves or bracts resembling a thyrsiform inflorescence. Peduncle ½–1½ cm. Bracts triangular, ½–1 mm long, erose, with colleters at the base inside. Pedicels 4–6 mm. Flower-buds subglobose, 1½–2 mm ø. *Flowers* green. *Calyx* calyptriform, pointed at the apex, splitting transversely near the base, rarely associated with some flowers in which the calyx is longitudinally dehiscent. *Petals* 5 (or 6), ovate, 2–4 by 1⅓–2½ mm. *Disk* annular-pulvinate, *c.* ¾ mm high and 1½ mm ø. *Stamens* 3, *c.* ¾–1 mm; anthers obliquely dehiscent, obscurely apiculate. Pistil *c.* ¾ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell. *Fruit* globose, *c.* 2½ cm ø, dark olive green. *Seed* 1, globose, *c.* 1½ cm ø.

Distr. Solomon Is. (Owa Raha I.) and *Malesia*: Celebes (Buton I., Kabaëna I.; and Loka, *sec.* HARMS) and New Guinea (Jappen, Lala R., Isuarava, Western Highlands, Morobe Distr., and Northern Div.).

Ecol. Rain-forests, sometimes in thickets and secondary forest, from the lowland up to 1500 m.

Vern. New Guinea: *horowa*, Orokaiva lang., *warren*, Papua.

Note. The type of *Salacicratea sarasinorum* HARMS was collected by SARASIN (1267, not seen) near Loka, Celebes; this was lost at Berlin during the war. From the description, locality and some collections from that area, I have concluded to its reduction.

**9. Salacia forsteniana** MIQ. Ann Mus. Bot. Lugd.-Bat. 4 (1869) 308.—*S. diandra* MIQ. *ibid.* 151, *nom. illeg.*, *non* THWAITES 1858.—*Salacicratea kraemeri* LOES. Bot. Jahrb. 63 (1930) 275.—*Salacicratea diandra* (MIQ.) A. C. SMITH, Am. J. Bot. 28 (1941) 441; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 216, *comb. illeg.*—*S. kraemeri* DING HOU, Blumea 12 (1963) 34.

Scandent shrub or liana. Stipules triangular or lanceolate, ¼–1 mm long. *Leaves* subcoriaceous, ovate to ovate-oblong, elliptic or broad-elliptic, 6½–15½ by 3–9 cm; base cuneate, rarely obtuse; apex short-acuminate; margin entire; nerves 6–8 pairs, petiole ½–2 cm. *Inflorescences* axillary, cymose, 1½–6½ cm long, usually 2–4 times dichotomously branched, sometimes an axillary shoot with reduced leaves or bracts resembling a thyrsiform inflorescence. Peduncle ¾–3 cm. Bracts triangular, *c.* ½ mm long, entire or slightly erose. Pedicels ½–1 cm. Flower-buds broad-ovoid or subglobose, 2–4½ by 1½–2 mm, apiculate or sometimes obtuse. *Flowers* light green or yellowish green. *Calyx* calyptriform, narrowed towards the apex, transversely dehiscent near the base, rarely irregularly lengthwise splitting into 2 segments. *Petals* 5(–7), ovate or oblong, 2–4 by 1½–2½ mm, entire or wavy. *Disk* annular-pulvinate, ⅔–1¾ mm high, 1⅓–2 mm ø, slightly broader and 5-angular at the base, finely papillose. *Stamens* 2, very rarely associated with some flowers containing 3 stamens, ½–1 mm, short-apiculate, erect at anthesis, the connective usually separating the thecae; anthers dehiscing transversely or ± at the top. Pistil *c.* ⅔ emerging from the disk. *Ovary* 2-celled. *Ovules* 2 in each cell. *Fruit* globose, *c.* 2–2¾ cm ø, 1-seeded (always?). *Seeds* globose, 1½–1¾ cm ø, rather smooth on the surface.

Distr. Micronesia (Palau Is.) and *Malesia*: Central Celebes (Malili), Moluccas (Ternate, Ambon, and Morotai) and New Guinea (Waigeo I. and Normanby I.).

Ecol. Forests, from the lowland up to *c.* 700 m, once found on limestone cliffs.

Vern. Moluccas: *gumi ganèm*, Ternate.

Note. LOESENER cited two collections in the original description of *Salacicratea kraemeri* from Palau Is., *viz* KRAEMER *s.n.* and LEDERMANN 14096. These specimens were lost during the war and I have not seen any duplicate of them. From the detailed descripton, this species is clearly conspecific with *S. diandra*, and in 1942 LOESENER himself reduced his own species to the latter. Because *S. diandra* MIQ. is a later homonym MIQUEL proposed a new name.

Fig. 33. *Salacia intermedia* DING HOU (cult. Hort. Bog. *sub n.* VI.B.5, from Celebes).

**10. Salacia intermedia** DING HOU, Blumea 12 (1963) 34.—*S. diandra* MIQ. *f. lanceolata* MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 151, *non S. lanceolata* TEYSM. & BINN. 1863.—**Fig. 33.**

Shrub (taken from cultivated plant). Stipules triangular, *c.* ½ mm long, slightly erose. *Leaves* chartaceous, lanceolate to narrow-lanceolate, sometimes narrow-elliptic, 12½–17½ by 3¾–4¼ cm; apex acuminate; base cuneate, or obtuse; margin subentire or faintly and sparsely crenulate; nerves 6–9 pairs; petiole ½–1 cm. *Inflorescences* axillary, cymose, 2–4½ cm long, 2–4 times dichotomously branched. Peduncle ½–2½ cm. Bracts triangular, ½–1 mm long, glanduliform at the margin, with colleters at the base inside. Pedicels 4–7 mm. Floral parts with sulphur-yellow particles in the tissue. *Calyx* ½–1 mm long, when young almost globular and undivided, the apical margin ± glandular and sometimes irregularly slightly 3–5-lobed, the lobes bent inward, later irregularly slightly splitting or deeply divided. *Petals* yellow, broad-elliptic or ovate, 3–3½ by 1¾–2 mm, obtuse or acute, entire or slightly erose. *Disk* annular-pulvinate, ¾–1 by 1⅓–1½ mm, slightly 5-angular. *Stamens* 3, *c.* 1 mm, erect; anthers obscurely apiculate, slightly obliquely dehiscent. Pistil *c.* ½ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell. Very immature *fruit* globose.

Distr. *Malesia*: Celebes (Gorontalo, Bonthain and Pangkadjene).

Ecol. No data available.

**11. Salacia wenzelii** MERR. Philip. J. Sc. 13 (1918) Bot. 23; En. Philip. 2 (1923) 487.—**Fig. 36h.**

Scandent shrub *c.* 4 m. *Leaves* subcoriaceous to coriaceous, rather shining when dry, elliptic or broad-elliptic, or ovate, 8½–14(–20½) by 4½–7 (–11½) cm; base rounded; apex short acuminate; margin entire; nerves 5–7 pairs; petiole 8–15 mm. *Inflorescences* cymose or umbelliform, 2½ cm long. Peduncle 4–10 mm, sometimes obscure, the flowers appearing in fascicles on very short, densely bracteolate brachyblasts. Bracts triangular, ⅔–1 mm long, slightly erose. Pedicels 6–14 mm. *Calyx* slightly concave at the base outside, enveloping the floral parts except the top at very young stage, saucer-shaped at the base of the mature flower, 2½–3 mm ø, margin ± truncate, slightly erose or short-fringed, rarely irregularly lobed and reflexed. *Petals* ovate or broad-elliptic, 3–4 by 2–2½ mm, slightly erose. *Disk* fleshy, annular-pulvinate, 1½–2 mm ø, *c.* 1 mm high, slightly contracted at the middle, papillose. *Stamens* 3, ⅔–2 mm; anthers transversely dehiscent. Pistil 1–1⅓ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell, pendulous. *Fruit* depressed-globose, *c.* 3 cm ø. *Seeds* subglobose, *c.* 1½ cm ø.

Distr. *Malesia*: Philippines (Luzon, Leyte, Cebu and Mindanao).

Ecol. In forests at low altitudes.

**12. Salacia erythrocarpa** K. SCH. in K. Sch. & Hollr. Fl. Kais. Wilh. Land (1889) 70; in K. Sch. & Laut. Fl. Schutzgeb. (1901) 413; A. C. SMITH, Am. J. Bot. 28 (1941) 441; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 220.

Liana up to 20 m, rarely small shrub or tree up to *c.* 6 m. Stipules triangular, *c.* ½ mm long. *Leaves* chartaceous, elliptic, broad-elliptic, elliptic- or obovate-oblong, 3½–13 by 2⅓–5½ cm; base cuneate; apex acuminate, short-cuspidate; margin

crenulate; nerves 6–8 pairs; petiole 3–8 mm. *Flowers* dull or greenish yellow, axillary, fascicled, or on short bracteolate tubercles. Bracts triangular, ½–1 mm long, short-fimbriate. Pedicels 2–6 mm. *Calyx* lobes triangular, *c.* ½ mm long, short-fimbriate. *Petals* broad-obovate, 1¾–2 by 1–1¾ mm, sometimes slightly keeled outside, with reddish brown pigment in the tissue, sometimes slightly contracted at the base and with one or 2 depressions near the apex inside, margin erose. *Disk* fleshy, annular-pulvinate, slightly broader at the base (in young flowers the disk slightly, gradually narrowed towards the apex of the pistil), ½–1 mm high, 1–1⅓ mm ø. *Stamens* 2 (once found a flower with 3), *c.* ⅔ mm; anthers ± transversely dehiscent. Pistil *c.* ½ mm emerging from the disk, compressed. *Ovary* 2-celled. *Ovules* 2 in each cell. *Fruit* globose, 1–1¾ cm ø, bright red or orange, usually 1-seeded. *Seed* globose, ¾–1½ cm ø.

Distr. Solomon Is. (New Georgia) and *Malesia*: Celebes (Minahassa, Nuha Distr., Malili, Buton, Watten Sopeng, and Kendari), New Guinea (Hollandia, Fly R., Andai, Western Highlands, Augusta R., Kaulo, Saugueti-Aitape, Morobe Distr., Koitaki, Kokoda, Milne Bay Distr.).

Ecol. Forests, from the lowland up to 900 m, also found on limestone.

Vern. SW. Celebes: *ampaërae*, Watten Sopeng.

**13. Salacia macrophylla** BLUME, Bijdr. (1825) 221, *non* MIQ. 1851; HASSK. Tijd. Nat. Gesch. Phys. 11 (1844) 192; Pl. Jav. Rar. (1848) 233; MIQ. Fl. Ind. Bat. 1, 2 (1859) 598; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 148, *incl. var. angustifolia* MIQ.; WARBURG, Bot. Jahrb. 13 (1891) 366; KOORD.-SCHUM. Syst. Verz. (1911) Fam. 159, 1; BACK. Schoolfl. (1911) 238; KOORD. Exk. Fl. Java 2 (1912) 527; HEYNE, Nutt. Pl. (1927) 985.—*S. macrocarpa* KORTH. Kruidk. (1842) 184; Flora 31 (1848) 579, *non* WELW. *ex* FRITSCH, 1901; MIQ. Fl. Ind. Bat. 1, 2 (1859) 598; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 150.—*S. celebica* BLUME, Rumphia 4 (1848) 19, t. 178C, f. 1; MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 149.—*Microtropis? coriacea* WALL. [Cat. (1831) *n.* 4338] *ex* ETTINGSH. Denkschr. Ak. Wiss. M.-N. Kl. Wien 13 (1857) 64, t. 4, f. 12; MERR. & FREEM. Proc. Am. Ac. Arts Sc. 73 (1940) 306.—*S. buddinghii* SCHEFF. Flora 52 (1869) 306; Nat. Tijd. N.I. 31 (1870) 16.—*S. flavescens* KURZ, J. As. Soc. Beng. 41, ii (1872) 300; LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 627; KURZ, J. As. Soc. Beng. 44, ii (1875) 163; For. Fl. Burma 1 (1877) 260; KING, J. As. Soc. Beng. 65, ii (1896) 368, *incl. var. dumosa* KING; RIDL. J. Fed. Mal. St. Mus. 10 (1920) 86; Fl. Mal. Pen. 1 (1922) 459; BURKILL & HANIFF, Gard. Bull. S.S. 6 (1930) 185; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 228.—*S. ovalis* LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 627, *non* KORTH. 1842.—*S. kamputensis* PIERRE, For. Fl. Coch. 19 (1894) t. 312B, in text; PITARD, Fl. Gén. I.-C. 1 (1912) 905.—*S. prinoides var. macrophylla* (BL.) KING, J. As. Soc. Beng. 65, ii (1896) 367, *pro nomen, excl. specimina*; RIDL. Fl. Mal. Pen. 1 (1922) 459.—*S. lawsoni* KING, J. As. Soc. Beng. 65, ii (1896) 369, new name for *S. ovalis* LAWS.—*S. oblonga* (*non* WALL.) RENDLE, J. Bot. 62 (1924) Suppl. 23.—*Siphonodon celastrineus var. integrifolia* TARDIEU, Suppl. Fl. Gén. I.-C. 1 (1948) 824.—*S. amplifolia* MERR. *ex* CHEN & HOW, Act. Phytotax. Sinica 7 (1958) 55, t. 18, f. 1 & 2.—**Fig. 36e.**

Liana, sometimes shrub or shrubby creeper. Stipules triangular or reniform, ¼–⅔ mm long, erose or laciniate. *Leaves* subcoriaceous, sometimes shining, elliptic to narrow elliptic-lanceolate, obovate-oblong, broad-ovate, lanceolate to narrow-lanceolate, 7½–34 by 4½–13½ cm (on sterile branches up to 43 by 16½(–20) cm); base cuneate, attenuate, obtuse or rounded; apex acuminate, cuspidate, rarely acute or obtuse; margin entire rarely remotely crenulate; nerves 7–14 pairs; petiole ½–2½ cm. Bracts triangular, *c.* 1 mm long, slightly erose. Pedicels 6–10 mm. *Flowers* greenish yellow or pale yellow, or whitish, sometimes light rose, pink or red, in fascicles, on very short axillary bracteate tubercles, sometimes ramiflorous. *Calyx* lobes triangular, *c.* 1 mm long, acute or obtuse, slightly erose, rarely laciniate. *Petals* ± erect at anthesis, broad-elliptic, elliptic-oblong, ovate, broad-ovate, 1–3 by ½–2 mm, acute or obtuse. *Disk* thin, roundish, developing from discoid to cupular, 1½–2 mm ø. *Stamens* 3, 1–1¼ mm. Pistil *c.* ½ mm emerging from the disk, pyramidal at the base and narrowed into a cylindric style. *Ovary* 3-celled. *Ovules* (2–)4 in each cell. *Fruit* broad-ellipsoid or subglobose, 5½–6½ by 5–5½ cm, sometimes up to 8 cm ø (*cf.* HEYNE, *l.c.*), orange or red. *Seeds* 3 or more in each fruit, white, ellipsoid, 2–3 by 1–2 cm.

Distr. Widely distributed but scattered in India (Concan and Andamans), Burma (Tenasserim), Peninsular and SE. Thailand, Indo-China (Cambodia), Hainan, through *Malesia*: Sumatra, Malay Peninsula, Borneo, Java, Lesser Sunda Is., and Celebes to New Britain (Massawa). Fig. 34.

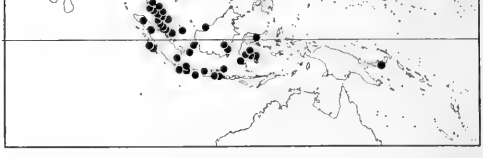


Fig. 34. Distribution of *Salacia macrophylla* BL.

Ecol. In lowland forests, near the coast, occasionally occurring in freshwater swamps, or on limestone rocks, sometimes up to 1200 m.

Vern. Sumatra: *paling manwa*, Menggala, *pasoo krumbing*, Banka; Mal. Pen.: *hĕmpĕdal itĕk*, *kĕtimbong*, *nasi sĕjuk*, (*pokok*) *sĕdang*, *sĕpapat*, M; Natuna Is.: *marot*, M; Java: *areuj*

*kětjipot, aröj ki gauggarangan, aröj mata pötjang, djěroik, kětjipot, kidjeruk, ki-konèng, ki-těllor, mata pötjang, ralasari, trěng kipěnti*, S, *katjipot, ketjiput*, Md.; Lesser Sunda Is.: *gěděblag*, Bali.

Uses. A decoction from the roots is used in Pahang after childbirth. The ground leaves are applied for belly-ache and also used as a poultice against eczema. The fruits, *i.e.* the flesh round the seeds, are sweetish and edible (*cf.* HEYNE, Nutt. Pl. 1927, 985; BURKILL, Dict. 2, 1935, 1942).

Notes. A fairly common, widely distributed species. Its leaves are very variable in shape and size. The disk is usually discoid or short-cupular and rather flat when young; sometimes it is contracted at the base and seems to be carried by a short stalk or 'androgynophore'.

The colour of the flowers is usually recorded as greenish yellow or pale yellow, or white; however, it has also been noted on several specimens as light rose, pink or red (*cf.* BÜNNEMEIJER 6083, CURTIS 2653, HUME 8785, KEP 6776 & 24156, and MAT 5994).

WARBURG (*l.c.*) stated that NAUMANN had observed it in western New Guinea and he himself found it in fruit at MacCluer Gulf (SW. New Guinea) and Finschhafen (former Kaiser Wilhelmsland). Though the present species quite likely occurs in New Guinea and I have even seen a specimen collected by SCHLECHTER (13727, BO, BM) in New Britain (Massawa), no material is yet collected in the Moluccas and New Guinea.

The type of *S. kamputensis* PIERRE is PIERRE 4065 (P) and the type of *Siphonodon celastrineus var. integrifolia* TARDIEU is POILANE 14646 (P). Both of them are from Cambodia and in fruit. I have examined the type specimens and they evidently belong to the present species.

I have examined several collections from Hainan in the Paris Herbarium, *viz* LAU 451, 1447, 1738, 3252; LIANG 61577, 61774 (also in K), and three of them have been cited with the original description of *S. amplifolia*. They clearly belong to the present species.

**14. Salacia longipedicellata** DING HOU, Blumea 12 (1963) 34.

Liana. Stipules triangular, *c.* 1 mm long. *Leaves* chartaceous to thin-coriaceous, elliptic-oblong, 15–24 by 6–10 cm; base cuneate or obtuse; apex acuminate; margin ± entire or slightly crenulate; nerves 6–9 pairs; petiole 8–10 mm. Bracts triangular, *c.* 1½ mm long. Pedicels 1⅓–2 cm. *Flowers* green, in axillary fascicles. *Calyx* lobes suborbicular or sometimes triangular, 2–2¼ by 2–3 mm, slightly erose. *Petals* rather fleshy, suborbicular, or broad-obovate, 4–6 by 4–6 mm, slightly contracted at the base; margin rather thin, yellowish (when dry), wavy. *Disk* fleshy, flat, suborbicular, sometimes slightly 5-lobed, 3½–4½ mm ø, *c.* ½ mm high. *Stamens* 3, *c.* 2 mm; anthers transverse-dehiscent. Pistil *c.* 1 mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell.

Distr. *Malesia*: Borneo (Sandakan and W. Kutai).

Ecol. Lowland hill forests up to 150 m.

**15. Salacia castaneifolia** RIDL. Kew Bull. (1938) 241.

Branchlets sharply 4-angular. Stipules triangular, *c.* 1 mm long, laciniate. *Leaves* subcoriaceous, elliptic-lanceolate, or lanceolate, 14–19 by 4½–6½ cm; base cuneate to attenuate; apex acuminate; margin serrate-crenate; nerves *c.* 12 pairs; petiole 1–1⅓ cm. *Flowers* fascicled, a few in a leaf axil. Pedicels 2–5 mm. *Calyx* lobes (from flower-bud) deltoid or triangular, ½–1 mm long, short-fimbriate. *Petals* green, fleshy, subrotund, or broad-elliptic, 3½–4 by 2¾–3¾ mm; margin thin, yellowish and transparent (after boiling), entire or slightly erose. *Disk* round, flat, 3–4 mm ø, slightly convex near the central part (½–⅔ mm high) and gradually, slightly thinner towards the margin. *Stamens* 3, *c.* 1 mm; anthers slightly obliquely dehiscing. Pistil *c.* 1 mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell, pendulous.

Distr. *Malesia*: Borneo (Sarawak), once collected.

**16. Salacia marginata** DING HOU, Blumea 12 (1963) 35.

Liana. Stipules triangular, *c.* ½–1 mm, erose or laciniate. *Leaves* coriaceous, rather shining above, ovate to ovate-oblong, elliptic-oblong, rarely obovate-oblong, 9–19 by 5–8½ cm; base obtuse or cuneate; apex acute; margin entire; nerves 6–9 pairs; petiole ± terete, 1¼–2 cm. *Flowers* greenish, a few on an axillary brachyblast or short peduncle (*c.* 1½ mm). Bracts triangular or deltoid, *c.* 1 mm long. Pedicels 2½–4 mm. *Calyx* lobes ovate, 2–3 mm long, short-fimbriate. *Petals* ± oblong, thin coriaceous when dry, 6 by 4 mm, obtuse; margin rather thin, yellowish when dry. *Disk* fleshy, flat, *c.* 5 mm ø, ¾–1 mm high, 5-lobed. *Stamens* 3, *c.* 2 mm long; anthers transversely dehiscent. Free part of the pistil pyramidal, *c.* 1 mm high. *Ovary* 3-celled. *Ovules* 4–5 in each cell.

Distr. *Malesia*: Philippines (Palawan: Puerto Princesa and Mt Victoria).

Ecol. Lowland forests, from sea-level up to 100 m.

**17. Salacia grandiflora** KURZ, J. As. Soc. Beng. 41, ii (1872) 300, *non* PEYRITSCH, 1878; LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 626; KURZ, J. As. Soc. Beng. 44, ii (1875) 163; For. Fl. Burma 1 (1877) 259; KING, J. As. Soc. Beng. 65, ii (1896) 365, *incl. var. longifolia* (HOOK. *f.*) KING; RIDL. J. Fed. Mal. St. Mus. 10 (1920) 86; Fl. Mal. Pen. 1 (1922) 458, f. 45; HEYNE, Nutt. Pl. (1927) 985; BURKILL & HANIFF, Gard. Bull. S.S. 6 (1930) 185. —*S. longifolia* HOOK. *f. ex* LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 626, *nom. illeg., non* WALL. 1832.—*S. scortechinii* KING, J. As. Soc. Beng. 65, ii (1896) 364; RIDL. Fl. Mal. Pen. 1 (1922) 457.

Liana or scandent shrub, rarely small tree. Branchlets sometimes puberulous, usually whitish when dry. Stipules triangular, *c.* ½ mm long. *Leaves* sometimes spiral, subcoriaceous to coria-

Fig. 35. *Salacia verrucosa* WIGHT (cult. Hort. Bog. *sub n.* XVII.G.74, from Sumatra).

ceous, usually shining on both surfaces, elliptic-oblong, or -lanceolate, narrow oblong-lanceolate, ovate to ovate-oblong, oblong, very rarely obovate -oblong, 7–34½ by 2½–11½ cm; base obtuse, cuneate; apex acuminate, short-acuminate, or acute, very rarely rounded; margin entire, sometimes sparsely, slightly crenate; nerves 6–12 pairs; petiole 6–15 mm. Bracts triangular, *c.* 1 mm long, laciniate at the margin. Pedicels 3–6 mm. *Flowers* whitish or yellowish, 3–6 or rarely more on very short, axillary or extra-axillary, bracteolate tubercles, sometimes ramiflorous. Outer 2 *calyx* lobes smaller, deltoid or ovate, 1¼–2 mm long, the inner 3 suborbicular, sometimes slightly subreniform, 2–4 mm long, short-fimbriate. *Petals* spreading at anthesis, obovate, or obovate-elliptic, 4–7 by 3–6 mm. *Disk* brown when fresh, suborbicular, ½–1¾ mm high, 1¾–3 mm ø, fleshy, flat, convex in the central part, thin and rim-like towards the margin. *Stamens* 3, ½–⅔ mm; anthers transverse-oblong. Pistil *c.* ¼ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell. *Fruit* orange pink, 2½–5 cm ø, rugose, subtended by the persistent calyx lobes and petals. *Seeds* 2 or more in each fruit, broad-ellipsoid, 1½–2 by 1–1½ cm.

Distr. India (Andamans), Burma (Mergui), Peninsular Thailand (Nan Chut), and *Malesia*: Sumatra (Tapanuli), Malay Peninsula (throughout but scattered), and E. Borneo (W of Samarinda).

Ecol. In forests from lowland up to 750 m.

Vern. Sumatra: *andor solpu*, Tapanuli; Mal. Pen.: (*akar*) *mĕmpĕdal ayam, akar pudal ayam, ampĕdal ayam, hĕmpĕdal ayam, mĕmbatu pasir, mĕriku, masi sĕjuk, pĕdal ayam, sĕrapat.*

Uses. A decoction from the roots is used after childbirth. The fruits have a sweetish pulp round the seeds which can be eaten (*cf.* BURKILL, Dict. 2, 1935, 1943; HEYNE, Nutt. Pl. 1927, 985).

Notes. I have chosen MAINGAY 400/2 from Malaya as the lectotype (in K, isotype in L).

The type of *S. scortechinii* was cited by KING as SCORTECHINI 1848 (BM, SING). There is one collection of SCORTECHINI in the Kew Herbarium with the same field label and KING's annotation as the above mentioned two specimens but bearing the number '848'.

**18. Salacia verrucosa** WIGHT, Ill. Ind. Bot. 1 (1840) 134; LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 628; KURZ, J. As. Soc. Beng. 44, ii (1875) 163; For. Fl. Burma 1 (1877) 259; RIDL. J. Fed. Mal. St. Mus. 10 (1920) 86; Fl. Mal. Pen. 1 (1922) 459; MERR. En. Philip. 2 (1923) 488; CRAIB, Fl. Siam. En. 1 (1926) 292; TARDIEU, Suppl. Fl. Gén. I.-C. 1 (1948) 823, *excl. syn.—S. polyantha* KORTH. Kruidk. (1842) 182, *non* STEUD. 1841; Flora 31 (1848) 579; MIQ. Fl. Ind. Bat. 1, 2 (1859) 579; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 150;

KING, J. As. Soc. Beng. 65, ii (1896) 367.—*S. kunstleri* KING, *l.c.* 368; RIDL. Fl. Mal. Pen. 1 (1922) 460.—**Fig. 35.**

Liana, sometimes erect shrub, rarely a small tree up to 6 m. Branchlets usually densely covered with lenticels, rarely rather smooth. Stipules deltoid, *c.* 1 mm long, erose. *Leaves* sometimes associated with some spirally arranged ones, chartaceous, shining above, elliptic to elliptic-lanceolate, broad-elliptic, or obovate, 8–18½ by 4–6 cm (on sterile branches up to 24 by 12 cm); base cuneate, obtuse; margin crenulate or subentire; nerves 6–10 pairs; petiole 3–10 mm. Bracts deltoid, *c.* ½ mm long, short-fimbriate. Pedicels 9–14½ mm. *Flowers* pale dull green, or greenish yellow, many on a short, axillary, bracteate tubercle. *Calyx* divided almost to the base, lobes deltoid, or suborbicular, *c.* 1 mm long, obtuse, slightly erose or short-fimbriate. *Petals* broad-elliptic, or obovate, 2–3 by 1½–2 mm, rather fleshy, obtuse, entire, with obscure, longitudinal veins. *Disk* suborbicular, flat, slightly concave in the central part, 1¼–1½ mm ø, *c.* ⅓ mm high, the tissue at the base slightly extended outward into a narrow membranous rim. Pistil *c.* ½ mm emerging from the disk, pyramidal. *Ovary* 3-celled. *Stamens* 3, ½–¼ mm; anthers brown coloured at the base. *Ovules* 2, inserted near the inner angle at the base. *Fruit* subglobose, *c.* 2½ cm ø, red. *Seeds* slightly planoconvex, 1½–1¾ by 1–1½ cm.

Distr. India (Assam & Khasia Hills), Thailand (scattered), Burma (Tenasserim and Mergui), Indo-China (Laos and Cochinchina) and *Malesia*: Sumatra (Indragiri, also in Banka and Billiton), Malay Peninsula (Perak, Kelantan, Pahang, and Langkawi Is.), Borneo (Sarawak, North Borneo, G. Pamatton, Martapura and P. Lampei), Philippines (Luzon), and Celebes (Gorontalo).

Ecol. In forests from lowland up to 920 m.

Vern. *Akar pělutang tanga*, Banka.

Note. According to MERRILL (*l.c.*), CERON (Cat. Pl. Herb. Manila 1892, 48) recorded the occurrence of *S. verrucosa* WIGHT in the Philippines, on the strength of VIDAL 2402, 2403, and 2405 (K) from Luzon. I have not seen CERON's publication, but these collections of VIDAL are correctly identified.

**19. Salacia ovalis** KORTH. Kruidk. (1842) 182; Flora 31 (1848) 579, *non* LAWS. 1875; MIQ. Fl. Ind. Bat. 1, 2 (1859) 597; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 149; AMSHOFF, Blumea 5 (1945) 519.—*S. roxburghii* (*non* WALL.) VIDAL, Sinopsis (1883) 20, t. 31D; MERR. En. Philip. 2 (1923) 487. —*S. integrifolia* MERR. Philip. J. Sc. 1 (1906) Suppl. 85; En. Philip. 2 (1923) 487.—**Fig. 36f-g.**

Liana up to 12 m. Stipules laciniate, attached along the branchlet just below the articulation of the petiole. *Leaves* chartaceous, elliptic-oblong, or elliptic, ovate-oblong or obovate-oblong, 5½–12½ by 2–5 cm; base cuneate; apex acuminate; margin usually entire, very rarely slightly, remotely crenulate; nerves 4–7 pairs; petiole 3–7 mm. Bracts triangular, ¾–1 mm long, usually fimbriate. Pedicels 5–11 mm, with elastic threads shown on breaking. *Flowers* yellowish (once noted), several in fascicles on axillary, short, condensed bracteate tubercles. *Calyx* lobes triangular or deltoid, ½–¾ mm long, laciniate or short-fimbriate. *Petals* suborbicular, or broad-elliptic, 1½–2½ by 1½–2¼ mm, slightly erose, slightly contracted at the base. *Disk* discoid, 1–1½ mm ø, *c.* $^1/_5$ mm high, sometimes slightly 5-angular. *Stamens* 3, *c.* ¾ mm; anthers transverse-dehiscent. Pistil *c.* ½ mm emerging from the disk. *Ovary* 3-celled. *Ovules* (1–)2 in each cell. *Fruit* subglobose, 2–3 cm ø.

Distr. *Malesia*: Sumatra (East Coast), Java (Djakarta, Pasuruan, Kedungdjati, Besuki), Philippines (Mindoro, Luzon, Panay and Mindanao), Celebes (Pangkadjene, Menado, Ko-Walowa, and Malili), and Moluccas (Sula Is.).

Ecol. In thickets and forests from lowland up to 1200 m.

Vern. Sumatra: *gurach batu*, Asahan; Philippines: *matang olang*, Tag.

**20. Salacia leucoclada** RIDL. Kew Bull. (1938) 238.—*S. litseifolia* RIDL. *l.c.*

Liana. Branchlets slightly whitish or light brown when dry. Stipules triangular, *c.* 1 mm long, slightly erose. *Leaves* chartaceous to subcoriaceous, rather shining on both surfaces, elliptic-oblong to -lanceolate, 4½–20 by 1½–6 cm; base cuneate; apex acuminate, apiculate; margin entire or sometimes slightly crenulate; nerves 3–7 pairs; petiole 2–3 mm. Bracts triangular, *c.* 1 mm long, short-fimbriate at the margin. Pedicels 1½–4 mm, with elastic threads shown on breaking. *Flowers* axillary or ramiflorous, 1 or 2, sometimes several in fascicles, usually on short bracteate tubercles. *Calyx* lobes fleshy, semi-orbicular or ± reniform, 1–1½ by 1½–3 mm, glanduliform or slightly erose, sometimes entire at the margin. *Petals* persistent, fleshy, elliptic, or oblong-elliptic, sometimes obovate-oblong, 4–5 by 2–3 mm, obtuse, entire or slightly erose. *Disk* fleshy, annular-pulvinate, slightly contracted at the base, 1½–1¾ mm ø, 1⅓–1¾ mm high, sometimes slightly narrowed at the apex and base, rather smooth. *Stamens* 3, 1½–2 mm long; anthers free at the lower ⅔, ± longitudinally dehiscent, short-apiculate. Pistil 1–1½ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2(–3) in each cell, inserted at the central part of axis. *Fruit* subglobose, rusty green, *c.* 6½ cm ø. *Seeds* planoconvex, *c.* 3 by 2 cm, densely covered with a layer (*c.* 3 mm thick) of pulp.

Distr. *Malesia*: Borneo (Sarawak: Lundu, Mt Mulu, Kuala Belait Distr.; Mt Kinabalu; S. Borneo: S of Kuala Kwajan).

Ecol. In forests from lowland up to 1590 m.

Note. RIDLEY described the flowers of *S. litseifolia* as sessile. However, the duplicate of the type (HAVILAND 871, K, SAR) in the Sarawak Herbarium has distinctly pedicelled flowers still attached on the specimen. It might be possible that the specimen which RIDLEY examined had

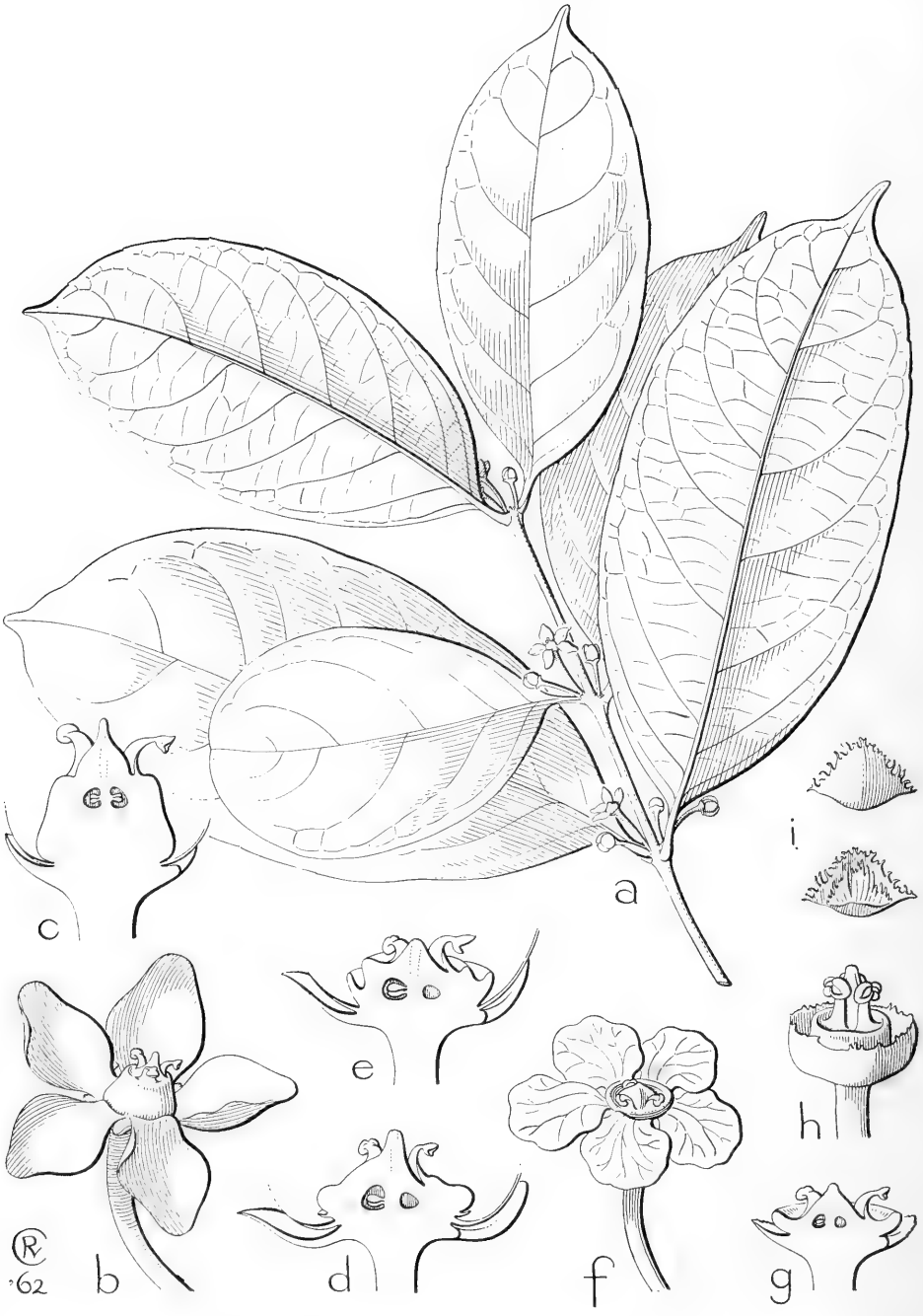



Fig. 36. *Salacia maingayi* LAWS. *a*. Habit, × ⅔, *b*. flower, × 4, *c*. *ditto*, in section, × 8.—*S. subalternifolia* MERR. & PERRY. *d*. Flower, in section, × 16.—*S. macrophylla* BL. *e*. Flower, in section, × 16.—*S. ovalis* KORTH. *f*. Flower, × 8, *g*. *ditto*, in section, petals removed, × 16.—*S. wenzelii* MERR. *h*. Flower, petals removed, × 8.—*S. cymosa* ELMER. *i*. Exterior and interior view of bract, × 8 (*a–c* CURTIS 3288, *d* GJELLERUP 731, *e* DILLEWIJN 606, *f–g* KOORDERS 28743*β*, *h* WENZEL 1534, *i* ELMER 12997).

very young flower-buds or detached flowers with pedicels broken off.

**21. Salacia venosa** DING HOU, Blumea 12 (1963) 34.—*Hiptage lawsonii* ELMER, Leafl. Philip. Bot. 8 (1915) 2751, *non S. lawsoni* KING, 1896.

Scandent shrub. Stipules triangular. *Leaves* thin-coriaceous, rather shining, elliptic-oblong, 6–13 by 2⅔–5 cm; base cuneate to attenuate; apex bluntish, sometimes acute; margin entire; nerves 5–8 pairs; petiole 3–7 mm. Bracts triangular *c.* 1 mm long, short-fimbriate or erose. Pedicels *c.* 6 mm, with elastic threads shown on breaking. *Flowers* green, few in axillary fascicles. *Calyx* lobes triangular, ⅔–1 mm long, obtuse, short-fimbriate. *Petals* broad-ovate, -elliptic, or suborbicular, 3½–4 by 3–4 mm, entire. *Disk* annular-pulvinate, *c.* 1 mm high, *c.* 2 mm ø, slightly narrower and truncate at the apex. *Stamens* 3, *c.* 1⅓ mm; anthers ± transversely dehiscent. Pistil *c.* 2 mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell.

Distr. *Malesia*: Philippines (Luzon: Prov. of Zambales; Sibuyan; Leyte).

Ecol. In lowland forests and in sandy gravelly ground along the wooded banks, up to 225 m.

Note. From the floral structure of the type (ELMER 12551, BO, K, L) and the characters of the deflorate flowers of MERRILL 2401 (K), it is clear that this species belongs to *Salacia*. Its leaves resemble those of *Hippocratea lawsonii* ELMER (= *Loeseneriella pauciflora*), based on ELMER 12241 (BO, BM, K, L, P), in shape and densely reticulate venation, and MERRILL erroneously reduced it to that species; this mistake was perpetuated by JACOBS in this Flora, vol. 5, p. 136.

**22. Salacia maingayi** LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 626; KING, J. As. Soc. Beng. 65, ii (1896) 363; RIDL. Fl. Mal. Pen. 1 (1922) 461.—*S. lobbii* LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 626; KING, J. As. Soc. Beng. 65, ii (1896) 370.—*S. megasperma* RIDL. Kew Bull. (1938) 237.—**Fig. 36a-c.**

Shrubby creeper. Stipules deltoid or triangular, ⅓–½ mm long. *Leaves* subcoriaceous, shining, elliptic-oblong, sometimes broad-elliptic, rarely obovate-oblong, (4–)7–16½ by (2½–)3¼–7 cm; base cuneate, or obtuse; apex acuminate to short-cuspidate; margin subentire; nerves 5–8 pairs; petiole 3–7 mm. Bracts triangular, *c.* ½ mm long, slightly erose, with filiform or laciniate colleters attached on the inner surface. Pedicels rather stout, 8–13 mm, with elastic threads shown on breaking. *Flowers* waxy pale green, or ochraceous yellow, sometimes greenish yellow, usually 1 or 2 in a leaf axil. *Calyx* lobes fleshy, triangular or semi-orbicular, *c.* 1 mm long, slightly erose. *Petals* rather fleshy, ovate, broad-ovate, or elliptic, 4½–6 by 2½–4 mm, obtuse, entire. *Disk* conical-pulvinate, *c.* 3 mm ø, 1½–2 mm high, truncate at the apex. *Stamens* 3, 1–1½ mm; anthers transversely dehiscent. Pistil ½–1¾ mm emerging from the disk, pyramidal. *Ovary* 3-celled. *Ovules* 2 in each cell, attached at the central part of axis. *Fruit* (only a piece of cross-section seen) *c.* 4 cm ø (*c.* 6 cm long, *fide* RIDLEY). *Seeds* several in each fruit, ± oblong, *c.* 3 cm long, ± triangular on cross-section, *c.* 2 cm wide.

Distr. *Malesia*: Malay Peninsula (Perak, Malacca, Penang and Singapore) and Borneo (Sarawak and North Borneo).

Ecol. Lowland forests, in ravines, sometimes on hilly rocks, up to 300 m.

Note. The type of *S. maingayi*, MAINGAY 398 (K), has rather young branchlets, smaller ovate leaves (4–5 by 2½–3½ cm) while the type of *S. lobbii*, LOBB *s.n.* (K), has older branchlets, elliptic to elliptic-oblong leaves (7–11 by 3–5 cm). This may be the reason why LAWSON described them as two distinct species at the same time. Additional collections show that these characters are variable, but that the floral characters are constant. RIDLEY (1922, *l.c.*) already reduced *S. lobbii* as a synonym.

**23. Salacia laurifolia** STAPF, Trans. Linn. Soc. Bot. II, 4 (1894) 141.—*S. beccarii* RIDL. Kew Bull. (1938) 238.

Liana. Branches light greyish, terete sometimes 4-angular. Stipules triangular, *c.* ½ mm long, laciniate. *Leaves* chartaceous to subcoriaceous, usually the old leaves with elastic threads shown on breaking, elliptic-oblong, -lanceolate, and lanceolate, rarely obovate-oblong, 6½–18½ by 2¼–8 cm; base cuneate to attenuate, sometimes obtuse; apex acuminate to cuspidate; margin subentire, or remotely, slightly crenulate; nerves 6–8 pairs; petiole ¼–1½ cm. Bracts fleshy, deltoid, or ovate, *c.* 1 mm long, short-fimbriate. Pedicels 2-3 mm. *Flowers* greenish, or dull yellow, in fascicles on short, axillary, bracteate tubercles. *Calyx* lobes fleshy, deltoid, ½–⅔ mm long, erect, obtuse and entire. *Petals* slightly spreading at anthesis, fleshy, thinner near the margin, slightly varying in size, oblong, 2⅓–2¾ by ¾–1¼ mm, entire, obtuse, slightly keeled, sometimes slightly triangular in cross-section, the overlapping margins pressed on the ones below, or fitting in a shallow groove on the dorsal surface of the ones below. *Disk* broad-oblong, 1–1¼ mm high, ¾–1 mm ø, obtuse at the apex, the base slightly extended outward and forming a narrow rim. *Stamens* 3, *c.* ½ mm; anthers slightly obliquely dehiscing. Pistil *c.* ⅓ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell, attached at the central part of the axis. *Fruit* globose or subglobose, 2¾–3½ cm ø, rugose outside. *Seeds* subglobose, 1½–2 cm ø, densely covered with pulp.

Distr. *Malesia*: Borneo (Sarawak, Mt Kinabalu, Sandakan, Batu Mili, and W. Kutai).

Ecol. Primary forests, from the lowland up to 1500 m.

**24. Salacia exsculpta** KORTH. Kruidk. (1842) 183; Flora 31 (1848) 579; MIQ. Fl. Ind. Bat. 1, 2 (1859) 597; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 149.—*S. rubra* LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 627; KING, J. As. Soc. Beng. 65, ii (1896) 370;

RIDL. Fl. Mal. Pen. 1 (1922) 460. —*S.wrayi* KING, J. As. Soc. Beng. 65, ii (1896) 367; RIDL. Fl. Mal. Pen. 1 (1922) 460.

Liana. Branchlets usually whitish. Stipules triangular or reniform, ⅓–¾ mm long, laciniate or short fimbriate. *Leaves* chartaceous to subcoriaceous, rather shining above, elliptic to elliptic-oblong, 5–9 by 2½–4 cm; base acute to attenuate; apex acuminate; margin entire or subentire; nerves 5–8 pairs; petiole ⅓–¾ cm. Bracts triangular, ½–¾ mm long, short-fimbriate. Pedicels 2½–3 mm. *Flowers* yellow, axillary, fascicled. *Calyx* lobes deltoid, *c.* ½ mm long, fleshy, glandular on the margin. *Petals* ovate-oblong, 1½–2 by ¾–1 mm, slightly keeled outside, obtuse or acute, rarely slightly erose. *Disk* round, short-cylindric, *c.* ½–¾ mm high, ¾–1 mm ø, with a narrow rim at the base, truncate or slightly concave at the apex. *Stamens* 3, *c.* ⅓ mm; anthers transversely dehiscent. Pistil *c.* ½ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2(–3) in each cell, inserted at the middle of the axis. *Fruits* broad-obovoid, *c.* 4⅓ by 3⅓ cm, ± stalk-like, contracted at the base, rugose.

Distr. *Malesia*: Sumatra (Asahan and Singalang) and Malay Peninsula (Perak, Malacca, Penang, and Singapore).

Ecol. In forests, from the lowland up to 1000 m.

Vern. Sumatra: *kaju baringin*, Asahan; Mal. Pen.: *akar mata kuching*, M.

Notes. In the original description of *S. rubra*, LAWSON cited only 'Malacca, MAINGAY'. There are two sheets of MAINGAY's under that name in the Kew Herbarium; MAINGAY 1525 (lectotype) has two small branches and one of them bears a detached fruit mounted near the pedicel from which it obviously broke off; MAINGAY 398/2 has three branchlets with some detached leaves. Each of these two specimens has a small package containing fruits under the number MAINGAY 3407 mounted on the sheet.

The type of *S. wrayi*, WRAY *Jr* 2542 (K), has both flowers and fruit; the fruits, which are distinctly rugose, broad-obovoid and contracted at the base, and the leaves are similar to those of *S. rubra*. The flowers of *S. wrayi* very well match those of the present species, the type of which has no fruit.

**25. Salacia euphlebia** MERR. Philip. J. Sc. 13 (1918) Bot. 22; En. Philip. 2 (1923) 486.

Scandent shrub. Young branchlets slightly angular. Stipules triangular, ⅓–½ mm long. *Leaves* chartaceous, elliptic-oblong and lanceolate; 10–21 by 4–6¾ cm; base cuneate, obtuse or rounded; apex acuminate to acuminate-caudate; margin distinctly or rarely obscurely apiculate-crenulate; nerves 6–8 pairs; petiole 3–8 mm. Bracts triangular, *c.* ¾ mm long, slightly short-fimbriate. Pedicels 1–3 mm. *Flowers* greenish yellow, in axillary fascicles on a very short bracteolate brachyblast. *Calyx* lobes triangular or deltoid, *c.* ½ mm long, slightly erose at the margin. *Petals* rather fleshy, oblong, 1½–2 by ⅓–1 mm, rounded. *Disk* short cylindric, *c.* 1 mm high, *c.* ⅔ mm ø. *Stamens* 3, ⅓–1 mm; anthers transversely or sometimes slightly obliquely dehiscent. Pistil *c.* ⅓ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell, attached at the central part of the axis. *Fruit* (broken) subglobose, *c.* 2¾ cm ø, smooth.

Distr. *Malesia*: Malay Peninsula (Perak and Selangor) and Philippines (Mindoro and Mindanao).

Ecol. In thickets and forests at low altitude up to 150 m.

**26. Salacia nitidissima** MERR. J. Str. Br. R. As. Soc. 86 (1922) 325.

Liana. Stipules small, triangular, *c.* ⅓ mm long. *Leaves* chartaceous to subcoriaceous, rather shining above, elliptic-oblong, or elliptic, rarely ovate-oblong, 5½–14 by 2–6½ cm; base cuneate; apex acuminate; margin subentire; nerves 5–9 pairs; petiole 7–12 mm. Bracts triangular, ½–1 mm long, slightly erose. Pedicels 3 mm, with elastic threads shown on breaking. *Flowers* yellowish brown or brownish green, 1–3 in a leaf axil. *Calyx* lobes fleshy, triangular or semi-orbicular, ½–1 mm long, entire or slightly erose. *Petals* rather fleshy, elliptic or broad-elliptic, 2–3¼ by 1½–1¾ mm, entire. *Disk* annular-pulvinate, *c.* 1 mm high, *c.* 1¾ mm ø, broader at the base, gradually narrowed upwards. *Stamens* 3, *c.* ¾ mm; anthers transverse-dehiscent. Pistil *c.* ½ mm emerging from the disk, pyramidal. *Ovary* 3-celled. *Ovules* 2, attached at the central part of the axis.

Distr. *Malesia*: Sumatra (Riouw: Kuala Belilas) and Borneo (Sibuga near Sandakan and Peak of Balikpapan).

Ecol. In lowland forests and also found on limestone at 600 m.

**27. Salacia viminea** WALL. [Cat. (1831) *n.* 7267] *ex* LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 627; KING, J. As. Soc. Beng. 65, ii (1896) 362; RIDL. Fl. Mal. Pen. 1 (1922) 456.

Scandent or rarely erect shrub, or vine. Stipules small, triangular. *Leaves* chartaceous, usually spirally arranged, sometimes also associated with opposite or subopposite ones, elliptic to elliptic-lanceolate, sometimes ovate-oblong, 5–14 by 2–6½ cm; base attenuate; apex acuminate; margin slightly crenulate to subentire; nerves 5–9 pairs; petiole 3–5 mm. Bracts triangular, *c.* ⅔ mm long, slightly erose. Pedicels 4–9 mm. *Flowers* in fascicles on axillary, bracteate brachyblasts. *Calyx* lobes triangular, ⅓ mm long, glandular or erose on the margin. *Petals* broad-elliptic, or ovate, 1⅔–2⅓ by 1⅓–1½ mm, obtuse. *Disk* annular-pulvinate, ½–⅔ mm thick, *c.* 1 mm ø, slightly broader at the base, papillose. *Stamens* 3, ⅔ mm; anthers transversely dehiscent. Pistil ⅓–½ emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell. *Fruit* globose, *c.* 2 cm ø, 1-seeded. *Seeds* globose, *c.* 1½ cm ø, covered with dried pulp.

Distr. Burma (Mergui), Siam, Indo-China (Cambodia), and *Malesia*: Sumatra (Siberut, Sibo-

langit, and Asahan) and Malay Peninsula (Perak, Trengganu, Pahang, Penang, and Singapore).

Ecol. Lowland forests, up to 350 m.

**28. Salacia chinensis** LINNÉ, Mant. 2 (1767) 293; GMEL. in Linné, Nat. Reg. Veget. ed. 13, 1 (1791) 107 ('*sinensis*'); repr. in Syst. Veg. 1 (1796) 107; BLANCO, Fl. Filip. (1837) 26; ed. 2 (1845) 19; ed. 3, 1 (1877) 36, *excl.* t. 86.—*Tonsella prinoides* WILLD. Ges. Naturf. Fr. Neue Schr. (Act. Acad. Cur. Berl.) 4 (1803) 184 (type not seen).—*Tonsella chinensis* (L.) SPRENG. Syst. 1 (1824) 177.—*S. prinoides* DC. Prod. 1 (1824) 571; BL. Bijdr. (1825) 22; W. & A. Prod. 1 (1834) 105; SPAN. Linnaea 15 (1841) 179, *incl. var. timorensis* SPAN.; KORTH. Kruidk. (1842) 184; HASSK. Tijd. Nat. Gesch. Phys. 11 (1844) 190; Pl. Jav. Rar. (1848) 233; MIQ. Fl. Ind. Bat. 1, 2 (1859) 597; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 148; LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 626; KURZ, J. As. Soc. Beng. 44, ii (1875) 163; For. Fl. Burma 1 (1877) 260; F.–VILL. Nov. App. (1880) 47; VIDAL, Sinopsis (1883) 20, t. 31, f. E; Phan. Cuming. (1885) 103; K. SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 70; KING, J. As. Soc. Beng. 65, ii (1896) 366, *incl. var. macrophylla quoad specimina, non quoad nomen*; K. SCH. & LAUT. Fl. Schutzgeb. (1901) 413; LOES. Nova Guinea 8 (1910) 281; KOORD.–SCHUM. Syst. Verz. (1911) Fam. 159, 2; BACK. Schoolfl. (1911) 237; KOORD. Exk. Fl. Java 2 (1912) 527; MERR. Fl. Manila (1912) 303; Philip. J. Sc. 11 (1916) Bot. 286; Sp. Blanc. (1918) 236; En. Born. (1921) 355; RIDL. Fl. Mal. Pen. 1 (1922) 459; MERR. En. Philip. 2 (1923) 487; RENDLE, J. Bot. 62 (1924) Suppl. 23; MERR. Philip. J. Sc. 29 (1926) 388; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 228.—*S. patens* DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 441; Herb. Timor. Descr. (1835) 113, *non* TRIANA & PLANCH. 1872; STEUD. Nom. ed. 2, 2 (1844) 492; MIQ. Fl. Ind. Bat. 1, 2 (1859) 598.—*Comocladia serrata* BLANCO, Fl. Filip. (1837) 30.—*S. evonymiflora* ZIPP. *ex* MIQ. Ann. Mus. Bot. Lugd.–Bat. 4 (1869) 149.—*S. latifolia* WALL. [Cat. (1831) *n.* 4222] *ex* LAWS. in Hook. *f.* Fl. Br. Ind. 1 (1875) 629; KING, J. As. Soc. Beng. 65, ii (1896) 366; RIDL. J. Fed. Mal. St. Mus. 10 (1920) 86; Fl. Mal. Pen. 1 (1922) 459; AMSHOFF, Blumea 5 (1945) 518.—*S. naumanni* ENGL. Bot. Jahrb. 7 (1886) 464; Forschungsr. Gazelle 4 (1886) Phanerog. 36, t. 13, *ex descr. & pl.*; KANEHIRA, Fl. Microes. (1933) 195, f. 82; LOES. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 228.—*S. littoralis* BACK. Fl. Bat. 1 (1907) 305.—*S. ovalis* (*non* KORTH.) KOORD.–SCHUM. Syst. Verz. (1911) Fam. 159, 2; BACK. Schoolfl. (1911) 237; KOORD. Exk. Fl. Java 2 (1912) 527.—*S. socia* CRAIB, Kew Bull. (1926) 352.—*Salacicratea kraemeri* (*non* LOES.) KANEHIRA, Fl. Microes. (1933) 196, f. 83.

Liana, scandent shrub, or rarely a small tree. Stipules deltoid or reniform, ⅓–½ mm long. *Leaves* subcoriaceous, rather discolorous, ovate, broad-elliptic, elliptic to elliptic-lanceolate, obovate, rarely suborbicular, or obovate-oblong, 4–17 by 1¾–9½ cm; base cuneate; apex acute, short-acuminate to acuminate, sometimes obtuse; margin entire, or slightly crenulate; nerves 4–10 pairs; petiole 1–1½ cm. Bracts triangular, slightly erose. Pedicels 5–10(–18) mm. *Flowers* yellowish or yellowish green, few to many in fascicles on axillary bracteate tubercles, sometimes ramiflorous. *Calyx* lobes triangular, semi-orbicular, ½–⅔ mm long, obtuse or rounded, slightly erose. *Petals* broad-elliptic, -ovate, obovate, or suborbicular, 3–4 by 2½–4 mm, obtuse, with reddish brown pigment in the tissue of the central part, the marginal part yellowish when dry, sometimes the marginal part at the base reflexed and the petals seemingly unguiculate. *Disk* annular -pulvinate, 1½–2 mm ø, *c.* 1 mm high, slightly contracted at the central part, narrower at the upper part, slightly lobed and extended downward at the base, usually papillose especially at the lower half. *Stamens* 3, *c.* 1½ mm; anthers transversely dehiscent, slightly oblique when young. Pistil *c.* 1 mm emerging from the disk, triangular. *Ovary* 3-celled. *Ovules* 2 in each cell, inserted at the upper inner angle. *Fruit* globose, sometimes broad-ellipsoid, 1⅓–2 cm ø, red or orange-red when ripe, usually 1-seeded. *Seeds* globose, 1–1½ cm ø.

Distr. Widely distributed but scattered in India, Ceylon, Burma, Thailand, Indo-China, China (Hainan), and throughout *Malesia* to the Carolines (Yap and Palau), N. Queensland (Cape York Peninsula), New Britain, Solomon Is., and as far as Fiji. Fig. 37.

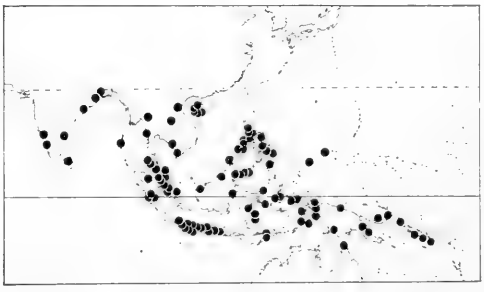


Fig. 37. Distribution of *Salacia chinensis* LINN., also in Fiji.

Ecol. In forests along the seashore and sandy river banks, in lowland primary forests up to 450 m, once recorded at 900 m in Ceylon.

Vern. Sumatra: *akan pělanduk*, Pariman, *mata pělanduk*, N. Sum.; Mal. Pen.: *daun puyu, rakiat kěchil*, M; Java: (*areuj*) *djahah, kětjipot, ki tělor, ojot lěma, treng kamander konèng*, S, *katjipot, mata kantijl, tjawelan, wangon*, J, *ketjiput*, Md; Lesser Sunda Is.: *anok*, Alor; Philippines: *matang-úlang*, Tag., *ope*, Ig.; Moluccas: *wolè sèroso*, Halmaheira; New Guinea: *adé-adé*, S. New Guinea, *andian*, Papua, *kwangoer-patoe*, Aru Is.

Galls. A leaf-gall is caused by an aphid. The leaf blade is rolled or folded up (DOCTERS VAN LEEUWEN, Zoocecidia 1926, 330, f. 593).

Notes. The epithet *chinensis* was changed into

*sinensis* by GMELIN (*l.c.*); it was not that of a new species, as GMELIN cited the literature of LINNÉ. BLANCO applied *S. sinensis* for his plant, citing GMELIN in the second edition of his Flora. MERRILL (Sp. Blanc. 1918, 236) correctly interpreted *Comocladia serrata* BLANCO and *S. sinensis* as belonging to *S. prinoides* (WILLD.) DC. (= *S. chinensis* LINNÉ); the characters given in BLANCO's descriptions are rather clear. Plate 86 in BLANCO's Fl. Filip. ed. 3 (1877) prepared by F.–VILLAR & NAVES named *S. sinensis* is, however, *S. korthalsiana* MIQ., as shown by the ovate-oblong leaves and cymose inflorescences.

The description and drawing of *Salacicratea kraemeri* LOES. in KANEHIRA's Flora Micronesica (1933, 196, f. 83) do not fit to that species, but match rather well *S. chinensis* L., because of the fascicled flowers (not in cymes), 3 stamens (not 2), and the 5-lobed calyx (not calyptra-like).

BRITTON (in Forbes, Wand. 1885, 502) identified two collections of FORBES (3804 and 4075) from Timor as *S. patens* DECNE. According to Dr VAN STEENIS, one of them, the number 3804 (L), is *Glochidion sp.* (*Euphorbiaceae*). Of the other collection I have not seen any material; this also may not belong to *Celastraceae*.

**29. Salacia kalahiensis** KORTH. Kruidk. (1842) 183, t. 38; Flora 31 (1848) 579; MIQ. Fl. Ind. Bat. 1, 2 (1859) 597; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 149.—*S. subscandens* ELMER, Leafl. Philip. Bot. 5 (1913) 1793; MERR. En. Philip. 2 (1923) 487.—*S. minutiflora* RIDL. Kew Bull. (1938) 238, *non* A. C. SMITH, 1939.

Scandent shrub. Stipules lanceolate, ½–1 mm long, sometimes laciniate or short-fimbriate at the margin. *Leaves* elliptic to elliptic-lanceolate, or ovate-oblong, 6–14½ by 1¾–5 cm; base cuneate; apex short-acuminate to apiculate; margin crenulate; nerves 4–7 pairs; petiole 3–7 mm. Bracts triangular, obtuse, *c.* ¾ mm long. Pedicels 4–4½ mm. *Flowers* several in fascicles on an axillary, short, simple or sometimes once branched, bracteate brachyblast. *Calyx* lobes ± deltoid or suborbicular, *c.* ⅔ mm long, glandular or short-ciliate at the margin. *Petals* broad-elliptic, 1½–2 by ⅔–1 mm, obtuse, slightly contracted at the base, margin lengthwise reflexed at anthesis, with 5–8 longitudinal veins elevated on the outer surface when dry. *Disk* fleshy, annular-pulvinate, *c.* ⅔–1 mm ø, *c.* ⅔ mm high. *Ovary* 3-celled. *Stamens* 3, *c.* 1 mm. *Pistil c.* ⅔ mm emerging from the disk. *Ovules* 2(–1) in each cell. *Fruit* subglobose, *c.* 1½ cm ø, red. *Seeds* broad-ellipsoid, *c.* 9 by 7 mm, slightly planoconvex.

Distr. *Malesia*: Java (Palabuhanratu, Banjumas, G. Gombong, and Banjuwangi), Borneo (Sarawak, Kalahiën and Mt Kinabalu), and Philippines (Palawan, Mindoro, Luzon, Samar, Guimaras, and Mindanao).

Ecol. In forests from the lowland up to *c.* 1200 m.

Vern. Java: *areuj kamander konèng*, S.

## Dubious and Excluded

*Hippocratea bojeri* TUL. Ann. Sc. Nat. Bot. IV, 8 (1857) 92.

This species was erroneously listed in Ind. Kew. as from 'Malacc.'. It is an African (Madagascar) species (*cf.* H. PERRIER DE LA BÂTHIE, Fl. Madagascar, Fam. Hippocrateac., 1946, 22).

*Kurrimia pulcherrima* (*non* WALL.) BAKER *f.* J. Bot. (1924) Suppl. 22, a record from West Java, based on FORBES 566 = *Elaeocarpus oxypyren* K. & V. (*Elaeocarpaceae*).

*Salacia bartletti* RIDL. Kew Bull. (1938) 239, is according to kind information of Mr L. L. FORMAN, Kew = *Anacolosa frutescens* BL. (*Olacaceae*).

*Salacicratea australis* LOES. [in E. & P. Pfl. Fam. ed. 2, 20b (1942) 216] *ex* HARMS, Notizbl. Berl.-Dahl. 15 (1942) 676.

Distr. *Malesia:* New Guinea: Kani Berg, R. SCHLECHTER 17257; Waube Bache, R. SCHLECHTER 17257.

The two collections cited above were destroyed at Berlin and I have not seen any duplicate of them. The characters indicated in the original description are too concise to place this species. It may be related to *Salacia sororia* MIQ. or even be conspecific with it.

HARMS mentioned also an Australian collection: Queensland, Cooktown, on the way to Herberton, WARBURG 19049. Because of the insufficient flowering material, he could not identify it with certainty. I have not seen the specimen or any duplicate of it. So far, there is only one species of *Salacia*, *S. disepala* (C. T. WHITE) DING HOU, known from Queensland bearing a calyptra-like calyx. The specimen mentioned above may belong to it.

*Celastrus stylosa* WILLD.; F.-VILL. Nov. App. (1880) 47; MERR. En. Philip. 2 (1923) 482.
*Gymnospora neglecta* WALL.; F.-VILL. *l.c.*; MERR. *l.c.* 483.
*Hippocratea arborea* ROXB.; F.-VILL. *l.c.*; MERR. *l.c.* 487.
*Salacia oblonga* WALL.; F.-VILL. *l.c.*; MERR. *l.c.*
*Salacia roxburghii* WALL. *ex* LAWS.; F.-VILL. *l.c.*; MERR. *l.c.*

The five names listed above are evidently misapplied for the Philippines by F.-VILLAR. There is neither description nor specimen cited for any one of them.

## Nomina nuda

For reference these unvalidly published names, which have been mentioned in literature, are listed here instead of placing them in the synonymy of species concerned.

*Hippocratea timorensis* SPAN. Linnaea 15 (1841) 178.—This name was listed in the Ind. Kew. but does not occur in the cited work.

*Hypsagyne* JACK *ex* BURKILL, J. Str. Br. R. As. Soc. 73 (1916) 219, 221, 247.—This name was mentioned by JACK in a letter to N. WALLICH. According to MERRILL, J. Arn. Arb. 33 (1952) 227, it is *Salacia* L.

*Johnia sumatrana* JACK *ex* BURKILL, J. Str. Br. R. As. Soc. 73 (1916) 221.—This name was mentioned by JACK in a letter to N. WALLICH. According to MERRILL, J. Arn. Arb. 33 (1952) 228, it is *Salacia prinoides* (WILLD.) DC. = *S. chinensis* L.

*Salacia alternifolia* SCORT. MSS. in Herb. Calc., *non* HOCHST. 1844.—KING, J. As. Soc. Beng. 65, ii (1896) 362, cited this name in the synonymy of *Salacia viminea* WALL. *ex* LAWS.

*Salacia cerasiformis* TEYSM. & BINN. Cat. Hort. Bog. (1866) 219.

*Salacia coromandeliana* TEYSM. & BINN. Cat. Hort. Bog. (1866) 392 = *S. chinensis* L.

*Salacia triplinervis* LLANOS, Mem. Acad. Cienc. Madr. 3, 4 (1857) 500; repr. in Blanco, Fl. Filip. ed. 3, 4, 1 (1880) 101; MERR. Sp. Blanc. (1918) 236; En. Philip. 2 (1923) 487.—I agree with MERRILL (*l.c.* 1923) that from the specific name LLANOS's plant can not have been a representative of the *Hippocrateaceae*.

*Macanea arborea* BLANCO, Fl. Filip. (1837) 431, according to MERRILL, Philip. J. Sc. 10 (1915) Bot. 233; Sp. Blanc. (1918) 146; En. Philip. 2 (1923) 165 = *Alphonsea arborea* (BLANCO) MERR. (*Annonaceae*).

## Addendum

Some additional collections have caused a slight extension of the generic range of the genus *Glyptopetalum*, see p. 256, and Blumea 12 (1963) 65.

p. 256 line 5 from top add to Hainan: and Kweichow, and add to line 6: Lesser Sunda Is. (Timor).

p. 258b *G. marivelense* (ELM.) MERR. A new collection has been made in Timor by CINATTI (*n.* 340 in L), but the material is in fruit and therefore only tentatively referred to this species.

## EPACRIDACEAE (H. Sleumer, Leyden)

Small trees or mostly shrubs. *Leaves* spirally arranged, sometimes imbricate or crowded at the end of the shoots in ± distinctly spaced pseudowhorls, xeromorphic, generally stiff and coriaceous, entire (Mal. *spp.*), subsessile or petioled; venation palmate, *i.e.* several longitudinal, simple or forked nerves or streaks, prominent at least underneath. Stipules 0. *Spikes* or *spike-like racemes* terminal and/or axillary, bracteate, solitary, rarely reduced to a single flower; rachis, if any, usually ending in a rudimentary flower or its subtending bract. *Flowers* bisexual, rarely polygamous (and plants gynodioecious) or unisexual (and plants dioecious). Bracteoles 2 or several, imbricate, inserted immediately below the calyx (Mal. *spp.*). *Sepals* 4–5, free, imbricate, persistent, usually finely marked with parallel or diverging veins as are the leaves, bracts and bracteoles. *Corolla* campanulate or tubular below, the limb rather deeply divided, lobes often spreading, valvate or imbricate. *Stamens* isomerous, inserted high in the corolla tube (Mal. *spp.*) and alternating with the corolla lobes, included or exserted to various degree; anthers 1-celled, free (Mal. *spp.*), both locules dehiscing by a common longitudinal slit. Disk entire, 5-lobed or consisting of 5 distinct scales, rarely absent. *Ovary* 1, superior, 1–10-celled; placentas axillary; ovules solitary (Mal. *spp.*). *Fruit* a berry-like drupe (Mal. *spp.*) containing a central stone with as many cells as the ovary, or the cells becoming hard pyrenes and remaining ± separate from each other within the pulpy mesocarp. *Seeds* with a thin testa; embryo straight; endosperm fleshy.

Distribution. About 21 genera with *c.* 400 *spp.*, the bulk of which occur in Australia (incl. Tasmania), 1 Mal. *sp.* extending to S. Indo-China, Tenasserim and S. Siam, *c.* 30 *spp.* in New Zealand (partly also occurring in Australia), *c.* 20 *spp.* in New Caledonia and the New Hebrides, 1 *sp.* in Micronesia (Marianas), 4 *spp.* in Polynesia (incl. Hawaii, Marquesas and Rapa, but not yet known from Samoa), 1 *sp.* in SW. temperate South America, and in Malesia 18 *spp.*, four of which known from outside Malesia. Fig. 1.

Fig. 1. Distribution of *Epacridaceae.*

The family is mainly distinguished from the *Ericaceae* by entirely free (and imbricate) sepals and unilocular anthers. It is naturally subdivided into 2 tribes, *viz* the *Styphelieae* (with 1 ovule per cell) and the *Epacrideae* (with numerous ovules per cell); only the first tribe is represented in Malesia.

In Malesia 3 genera occur, of which *Decatoca* is endemic in New Guinea; *Trochocarpa* and *Styphelia* are also found in Australia; the latter genus extends from SE. Asia far into the Pacific (Hawaii, Marquesas, Rapa).

The close alliance of the Malesian *Epacridaceae* with those of Australia and/or New Zealand is emphasized by the occurrence of *Styphelia acuminata* R.Br. in N. Australia and the Lesser Sunda Is., of *Styphelia suaveolens* (Hook. *f.*) Warb. in Malesia, SE. Australia, and New Zealand, and of *Trochocarpa laurina* (R.Br. *ex* Rudge) R.Br. which is found in NE. and E. Australia and in NW. New Guinea.

The wide distribution of some species is remarkable.

Ecology. Malesian *Epacridaceae* are bound to acid soils as are most Malesian *Ericaceae*, with which they not rarely grow gregariously together, especially in summit vegetation. They are always terrestrial and partly are found both on coastal sands, lowland hills and again in the mountains, mostly in open or rather open places; they are distinctly light demanding. As to altitude they are found up to 4700 m (Mt Carstensz, Mt Wilhelm) under frigid conditions; there they belong to the few species which are found immediately below the eternal snow. In Malesia most species occur under everwet conditions but the habitat of the species of East Java and the Lesser Sunda Is. is subject to seasonal drought. As to soil humidity, they seem to occur both in dry places and on moist, peaty ground.

*Dispersal.* Practically nothing is known about the dispersal of Mal. *spp.*, but their drupes are surrounded by a rather well-developed pulpy mesocarp which may be attractive and palatable for birds; in this way the stones or pyrenes may become dispersed endozoically.

*Pollination.* The corolla—fragrant as far as known—is bearded inside as are the lobes and partly down the tube in many species. In these unicellular hairs, the walls are densely covered with brief longitudinal ridges; this structure is presumably an adaptation for insect-pollination (H. F. Copeland, Am. J. Bot. 41, 1954, 219. *Cf.* also what is said under *Styphelia javanica*).

Morphology & Anatomy. Work on floral morphology up to now has been done exclusively on a number of Australian members of the family (short review by B. R. Paterson in Bot. Gaz. 122, 1961, 259–279). The scattered results have not yet influenced the taxonomy of the family and the definition of the genera. The same can be said of the work done on the morphology of the leaves, the vegetative shoot and of the general anatomy of the family (review by Solereder, Syst. Anat. Dicot., rev. by D. H. Scott, 1 (1908) 490; K. J. Dormer in New Phyt. 44 (1945) 149; M. Y. Orr in Trans. Bot. Soc. Edinb. 34 (1948) 472, pl. 10; Metcalfe & Chalk, Anat. Dicot. 2 (1950) 840; L. Watson in New Phyt. 61 (1962) 36–40, as to stomatal distribution).

Polymorphism of leaves (in the same specimen) has been observed by the author in New Guinea in *Styphelia malayana* and in several *spp.* of *Trochocarpa*, exactly corresponding to what Virot has stated from *Styphelia* (*subg. Leucopogon*) in New Caledonia (Mém. Mus. Nat. Hist. Nat. Paris sér. B, Bot. 7, 1956, 103, f. 6, 1). Such extremely narrow-leaved shoots are either juvenile forms or probably sports. Sometimes a whole plant—may be previously damaged by fire or cut down by man—is built up from such anomalous shoots, called 'microform' in descriptions.

Palynology. Work on pollen has started but recently and still is limited to Australian species, *cf.* S. Smith White in Austr. J. Bot. 3 (1955) 48–67 (chromosome numbers and pollen types; C. Venkata Rao in J. Ind. Bot. Soc. 40 (3) (1961) 409–423 (pollen types); L. Watson in Nature 194 (1962) 889 (pollen of *Styphelia sect. Styphelia*); J. W. Franks & L. Watson in Pollen & Spores, Mus. Nat. Hist. Nat. Publ. semestr. 5 (1) (1963) 51–68. The pollen of the *subfam. Epacrideae* is nearly always borne in full tetrads and so far seems unpromising for elucidating the system of genera in this subfamily. In the *subfam. Styphelieae* where solitary pollen grains occur in a number of genera and species, the palynological diversity is surprising considering the close relation of the genera on ground of floral gross morphology. In the present state of knowledge both cytology, karyology and palynology of the subfamily do not allow to define the genera more sharply.

In *Styphelia s. str.* pollen grains are provided with peculiar warts, which gives additional value to its distinction as a section. There is no need to overrate this single character, *i.e.* to use it for keeping apart *Styphelia s. str.* on the generic level from other groups of species so closely allied with it. These groups are more naturally arranged on the subgeneric and sectional level within *Styphelia s. lat.* as used by the author in his precursory work on the family.

Phytochemistry. Curiously enough phytochemists have never been attracted by this highly interesting family, generally regarded as closely related to *Ericaceae*. In the leaves leucoanthocyanins seem to be widespread (R. C. Cambie *c.s.*, New Zeal. J. Sc. 4, 1961, 604; E. C. Bate-Smith, J. Linn. Soc. Lond. Bot. 58, 1962, 95). High concentrations of tannins and the presence of saponins (Cambie *c.s.*) are recorded in literature for a few species. According to a very old statement (Rochleder, 1866) ursolic acid accumulates in great amounts in leaves of a species of *Epacris*. A few observations on the nature of the anthocyanins in flowers of some Australian species were recorded by Gascoine *c.s.* (J. Proc. R. Soc. N.S.W. 82, 1948, 44).—R. Hegnauer.

Uses. Of *Styphelia malayana* the roots and leaves are used medicinally, the inner bark to make canoes waterproof.

Notes. In habit *Epacridaceae* show a distinct resemblance to *Ericaceae*, from which they are generally easily distinguished by the palmate, almost monocotylean 'open' nervation of the leaves.

The family has almost been monographed by BENTHAM in the fourth volume of his 'Flora Australiensis' (1869) and little work has been done since on the family. For Malesia and the Pacific a precursory paper was published by the present author (Blumea 12, 1963, 145–171).

KEY TO THE GENERA

1. Cells of the fruit, *i.e.* the endocarp of all carpels, consolidated within the drupaceous fruit into a compact (2–)5(–10)-celled, hardly or not 5–10-ribbed hard stone (putamen), with 1 seed per cell. Mesocarp mostly rather thin and dry or certainly not very pulpy. Fruit of a light colour (white, greenish, pinkish, rarely red) when ripe . . . . . **1. Styphelia**
1. Cells of the fruit, *i.e.* the endocarp of the single carpels within the fruit either remaining separate, or loosely coherent, or rarely ± concrescent to a deeply 8–10-ribbed stone-like centre, each cell becoming a one-seeded, distinct, or easily, respectively finally separable, ± hard pyrene within the rather rich and ± pulpy mesocarp. Fruit mostly dark blue or purplish-blackish, rarely pink when ripe.
2. Corolla lobes decidedly imbricate in anthesis . . . . . **2. Decatoca**
2. Corolla lobes valvate in anthesis (tips only slightly imbricate in bud) . . . . **3. Trochocarpa**

## 1. STYPHELIA

J. E. SMITH, Sp. Bot. New Holl. (1793) 45, t. 14, *sensu* F. v. M. Fragm. 6 (1867) 50; SLEUM. Blumea 12 (1963) 145.—*Cyathodes* LAB. Nov. Holl. Pl. 1 (1805) 57, t. 81, *em.* R.BR. Prod. (1810) 539.—*Astroloma* R.BR. Prod. (1810) 538.—*Stenanthera* R.BR. *l.c.* 538.—*Melichrus* R.BR. *l.c.* 539.—*Lissanthe* R.BR. *l.c.* 540.—*Leucopogon* R.BR. *l.c.* 541.—*Anacyclodon* JUNGH. Nat. Geneesk. Arch. N.I. 2 (1845) 49.—**Fig. 2—10.**

Shrubs or small trees, bisexual, dioecious or polygamous (gynodioecious). *Leaves* often whitish underneath between the nerves. *Flowers* sessile, or, when solitary, on top of a very short peduncle. Bracteoles 2 and strictly opposite, or several (3 or more) and imbricate. *Sepals* 5. *Corolla* tube cylindric, as long as or shorter or slightly longer than the sepals (Mal. *spp.*); tube mostly hairy above the middle inside, rarely glabrous; limb ± deeply 5-parted; lobes valvate in bud, spreading or recurved in the upper portion, their inner surface entirely or partly bearded, rarely glabrous. Stamens wholly or partially enclosed in the tube or the erect base of the lobes, reduced in size and without pollen in ♀♀. *Filaments* short, filiform, inserted at the top of the corolla tube or almost so, attached at or near the top of the anthers. Disk cup-shaped, truncately 5-lobed, or consisting of 5, ± free lobes. *Ovary* (2–)5(–10)-celled, with 1 ovule per cell; style mostly short, stigma obtuse. *Fruit* a baccate drupe, with a compact crustaceous or hard endocarp (putamen) with as many cells as are found in the ovary (or less by abortion); mesocarp around the central stone rarely pulpy, usually rather dry and of a whitish-greenish, pink or rarely (light) red colour (in the Mal. *spp.* never purplish-blackish) at full maturity.

Distr. Chiefly in Australia (incl. Tasmania) with about 130 *spp.*, also in New Zealand (incl. Stewart, Chatham, Campbell, and Auckland Is.) (8 *spp.*), in New Caledonia (*c.* 13 *spp.*), found all over the Pacific area (6 *spp.*), in the Marianas (1 *sp.*), S. Indo-China, Lower Burma (Tenasserim), and S. Siam (1 *sp.*, which is also widely distributed in Malesia), in *Malesia* 8 *spp.*

Ecol. As substage in forest, mostly in open sunny places, on the seashore and again in the mountains upwards to alpine height in North Borneo and New Guinea, on acid, sandy or peaty soils, often gregarious.

Note. The genus is taken here in the broad sense as proposed by F. v. MUELLER. The differences between BROWN's genera are either slight or inconsistent, and maintaining them, as BENTHAM (Fl. Austr. 4, 1869, 142 *seq.*) with some hesitation did, does not seem to be justified.

KEY TO THE SPECIES

1. Bracteoles 2, strictly opposite. SUBG. LEUCOPOGON.
 2. Leaves with (very) numerous equally faint nerves close to each other, the individual course of which can hardly be traced; sessile or almost so.
  3. Leaves initially ciliate along the entire margin, at full maturity still so at least in the basal part, 12–25 by 4–6 mm . . . . . **1. S. abscondita**
  3. Leaves eciliate from the beginning, (15–)20–50(–80) by (2–)3–10 mm (juvenile microforms excepted) . . . . . **2. S. malayana**
   4. Ovary glabrous. Style glabrous or patently short-hairy in the lower part. **2. S. malayana** *var.* **malayana**
   4. Flattened top of ovary hairy. Style always patently short-hairy in the lower half. **2. S. malayana** *var.* **novoguineensis**
 2. Leaves with fewer nerves, the inner 3–5(–7) ones running straight and parallel from the base to the apex of the lamina and stronger (or more conspicuous) than the outer ones, which are fan-like diverging from them, generally (shortly) petioled.
  5. Leaves ending in a very short (not caducous or breakable) callose, acute point or tip, or subacute, or obtuse . . . . . **3. S. suaveolens**
  5. Leaves ending with a conspicuous hair- or needle-like, pungent and rather persistent (though breakable) 1–2 mm long point.
   6. Corolla 6(–7) mm. Leaves densely and rather coarsely serrulate-ciliate . . . **4. S. javanica**
   6. Corolla up to 4 mm. Leaves whether or not finely and appressedly ciliolate.
    7. Leaves all equal, oblanceolate. (Corolla 3⅓–3½ mm.) . . . . . **5. S. forbesii**
    7. Leaves in the same specimen lanceolate to linear-lanceolate.
     8. Leaves subdensely to rather densely arranged, (1–)1½–2 mm wide. Corolla 2½–2¾(–3) mm **6. S. acuminata**
     8. Leaves densely to very densely, *i.e.* imbricately arranged, 2–3 mm wide. Corolla (3–)3½ mm **7. S. abnormis**
1. Bracteoles 7–10, imbricate. SUBG. CYATHODES . . . . . **8. S. brassii**

## 1. Subgenus Leucopogon

(R.BR.) DRUDE in E. & P. Pfl. Fam. 4, 1 (1889) 78; SLEUM. Blumea 12 (1963) 146. —*Leucopogon* R.BR. Prod. (1810) 541; MIQ. Fl. Ind. Bat. 2 (1859) 1052, *incl.* § *Stypheliopsis* MIQ. *et* § *Anacyclodon* (JUNGH.) MIQ.; CLARKE in Hook. *f.* Fl. Br. Ind. 3 (1882) 477; GAMBLE, J. As. Soc. Beng. 74, ii (1905) 83; RIDL. Fl. Mal. Pen. 2 (1923) 223.—*Anacyclodon* JUNGH. Nat. Geneesk. Arch. N.I. 2 (1845) 49.—**Fig. 2—9.**

Bracteoles 2, strictly opposite, inserted immediately below the sepals and covering their basal part.

Distr. About 125 *spp.* in Australia (incl. Tasmania), 4 *spp.* in New Zealand (of which 3 endemic), *c.* 13 *spp.* in New Caledonia (one of them also in the New Hebrides and Fiji), in *Malesia* 7 *spp.*, one of them (*S. acuminata*) also in N. Australia, a second one (*S. malayana*) extending into S. Siam, Lower Burma (Tenasserim), and Southern Indo-China, a third one (*S. suaveolens*) extending into SE. Australia, New Zealand, and Melanesia (Bougainville). Fig. 2.

**1. Styphelia abscondita** J.J.S. Nova Guinea 18 (1936) 124, t. 33, 2; SLEUM. Blumea 12 (1963) 147.

Shrub, *c.* 1½ m. Stem decumbent to erect. Branchlets rather robust, tips puberulous, older parts early corticate, bark blackish, fissured lengthwise. *Leaves* very dense or imbricate, sessile, lanceolate, apex acute-acuminate, ending in a short (½–1 mm), rather early caducous, almost pungent point, base narrowed into a 1–1½ mm wide foot, light green and bordered red when fresh, initially ciliate, glabrous except some basal ciliae when mature, ± coriaceous, entire, edge semipellucid, (12–)15–25 by 4–6 mm. *Inflorescences* axillary, 3–5-flowered, ± hidden among the leaves. Peduncle *c.* 2 mm, covered by several concave, ciliolate, imbricate, minute bracts, puberulous as is the very short rachis. Subtending bract and the 2 bracteoles suborbicular, dorsally glabrous, ciliolate, ± 2 mm. *Sepals* oblong to ovate, obtuse, ciliolate, *c.* 3 by 1½–2 mm. *Corolla* funnel-shaped, 5-parted to ⅓–$^2/_5$, *c.* 4½ mm long in all, by 2 mm across the tube, white, glabrous outside, villous at the throat and all over the lobes inside, lobes narrow-triangular, subacute. *Anthers* oblong, *c.* 1 mm, fertile, slightly exserted from the tube. *Ovary* pear-shaped, 5-celled, glabrous, 1 mm, style conical-cylindric, 2 mm, subdensely long patently hairy to almost the top. Fruit not known.

Distr. *Malesia*: West New Guinea (Doorman-

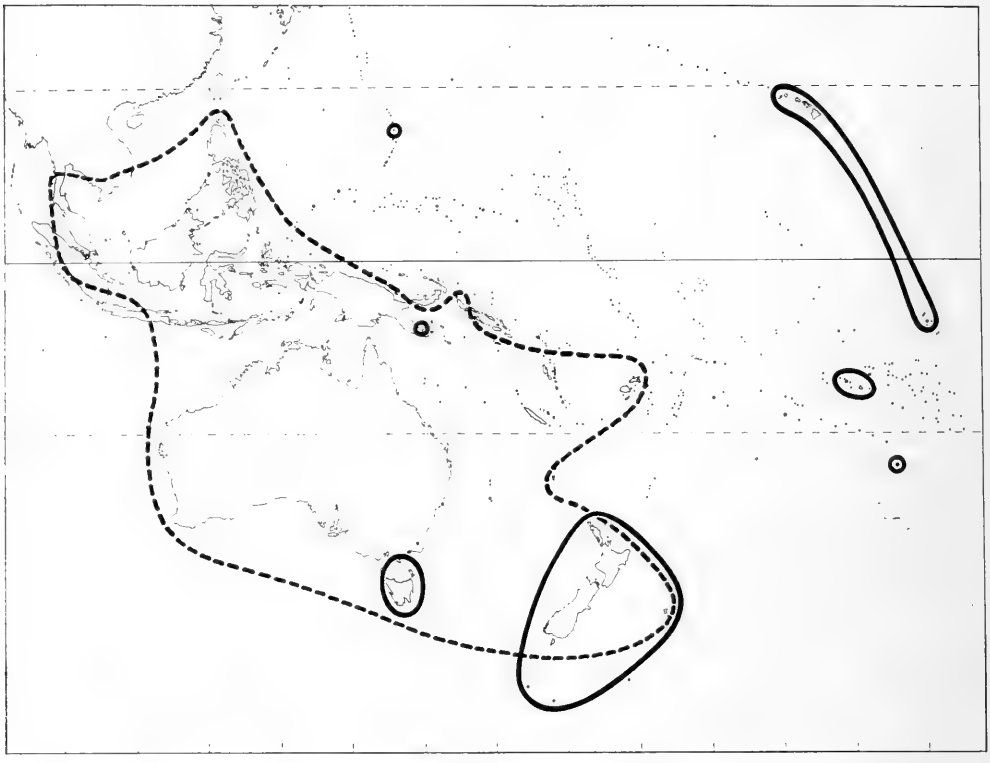


Fig. 2. Distributional areas of *Styphelia subg. Leucopogon* (- - - - -) and *subg. Cyathodes* (————).

top), once found.

Ecol. In dry open, nearly flat places, at 3250 m. *Fl.* Oct.

Note. To judge from the size of the anthers and the form of the ovary, the species has apparently bisexual flowers similarly as the closely related *S. malayana* (JACK) SPR., of which *S. abscondita* is perhaps a mere variety.

**2. Styphelia malayana** (JACK) SPR. Syst. 4 (1827) Cur. post. 67 ('*malaica*'); F. v. M. Fragm. 6 (1867) 56; DRUDE in E. & P. Pfl. Fam. 4, 1 (1889) 78; KOORD. Rec. Trav. Bot. Néerl. 7 (1910) 65, *in text.*; J.J.S. Ic. Bog. 4 (1910) 82; Nova Guinea 8 (1912) 797; GIBBS, J. Linn. Soc. Bot. 42 (1914) 107; MERR. En. Born. (1921) 467; STEEN. Bull. Jard. Bot. Btzg III, 13 (1933) 52; RICHARDS, J. Ecol. 24 (1936) 35 & 352; DUNSELMAN, Trop. Natuur 28 (1939) 74; HEINE in Fedde, Rep. 54 (1951) 246; MERR. J. Arn. Arb. 33 (1952) 230; SLEUM. Blumea 12 (1963) 147.—*Leucopogon malayanus* JACK, Mal. Misc. 1, 5 (1820) 20, ref. Edinb. Phil. J. 6 (1822) 397, repr. WALL. in Roxb. Fl. Ind. ed. Carey & Wall. 2 (1824) 301, *ditto* in Hook. Bot. Misc. 2 (1830) 71; DON, Gen. Syst. 3 (1834) 777; DC. Prod. 7 (1839) 744; VOIGT, Hort. Suburb. Calc. (1845) 334; MIQ. Fl. Ind. Bat. 2 (1859) 1052; Sum. (1861) 250, 585; KURZ, Nat. Tijd. N.I. 27 (1864) 215; SCHEFF. *ibid.* 31 (1870) 363; HANCE, J. Bot. 15 (1877) 335; KURZ, J. As. Soc. Beng. 46, ii (1877) 217, *var.* α; For. Fl. Burma 2 (1877) 95; CLARKE in Hook. *f.* Fl. Br. Ind. 3 (1882) 477; STAPF, Trans. Linn. Soc. II, Bot. 4 (1894) 198; RIDL. J. Str. Br. R. As. Soc. 33 (1900) 103; GAMBLE, J. As. Soc. Beng. 74, ii (1905) 83; RIDL. J. Linn. Soc. Bot. 38 (1908) 314, repr. J. Fed. Mal. St. Mus. 2 (1908) 121; *ibid.* 6 (1915) 49, 158; MERR. Philip. J. Sc. 10 (1915) Bot. 191; RIDL. Fl. Mal. Pen. 2 (1923) 223, f. 94; DOP, Fl. Gén. I.–C. 3 (1930) 747, f. 83; BURK. Dict. (1935) 1340; SYMINGTON, J. Mal. Br. R. As. Soc. 14 (1936) 355; FLETCHER in Craib, Fl. Siam. En. 2 (1938) 320; CORNER, Ways. Trees (1940) 218, f. 58; HENDERS. Mal. Nat. J. 6 (1950) 265, f. 248.—*Leucopogon malayanus* JACK *var. moluccanus* (*non* SCHEFF. *pro spec.*) KURZ, J. As. Soc. Beng. 46, ii (1877) 217 (based on a narrow-leaved, apparently juvenile microform); For. Fl. Burma 2 (1877) 96; CLARKE in Hook. *f.* Fl. Br. Ind. 3 (1882) 477; RIDL. J. Fed. Mal. St. Mus. 7 (1916) 46; Fl. Mal. Pen. 2 (1923) 224; DOP, Fl. Gén. I.–C. 3 (1930) 748.—**Fig. 3–5.**

*var.* **malayana.**—**Fig. 3.**

Shrub, or sometimes a small tree, up to 5 m, sparingly branched. Branchlets rather slender, densely puberulous in the younger, early corticate

Fig. 3. *Styphelia malayana* (JACK) SPR. *var. malayana*. Pasir Pandjang, Singkawang (W. Borneo) (A. ELSENER, 1961).

in the older parts; bark dark, splitting lengthwise. *Leaves* ± densely crowded round the twigs, lanceolate, apex gradually attenuate or subacuminate, acute, tip sharply spine-pointed or hair-like (± caducous with age), base narrowed and truncate, without proper petiole, hard or coriaceous, glabrous, pale green and shining above, whitish or glaucous papillose-puberulent beneath, withering yellow-brown to reddish, quite entire, narrowly and rather translucently marginate, (25–)30–50(–60, rarely up to 80) by (3–)5–10 mm, in – generally sterile – microforms (sports) narrow-lanceolate, 15–30 by 2–4 mm; no proper midrib, nerves or veins numerous, equal, fine, parallel with the edge and close to each other, well visible though hardly raised on both faces. *Inflorescences* axillary, in abbreviate, 3–7 (rarely 10)-flowered spikes; rachis slender, densely whitish-pubescent or -subvillous, ½–1(–1½) cm, with numerous basal perulae. *Flowers* bisexual. Pedicel very short or almost absent. Subtending bract and two bracteoles ovate, concave, glabrous and generally but faintly veined dorsally, ciliolate, 1–2 mm. *Sepals* ovate-oblong to elliptic, glabrous and generally hardly or not veined dorsally, ciliate, 3½–4 by *c.* 2 mm. *Corolla* white, sometimes with pink tinge, fragrant, tubular for 2½–3 mm, funnel-shaped and 5-partite for 2–2½ mm, lobes deltoid, subacute, spreading or reflexed, villous inside as is the upper inner part of the corolla tube, glabrous outside. *Anthers* narrow-oblong, *c.* ¾ mm, on filiform filaments (*c.* ¾ mm), a little exserted from the throat. *Ovary* suborbicular, glabrous, 1 mm; style rather slenderly columnar, (2–)2½ mm, glabrous or laxly patently short-pubescent especially below. *Fruit* round, 4–5 mm across, mesocarp thinly pulpy and translucent, of a sweet though rather adstringent taste, yellow or orange, finally red, endocarp a central stone with generally 5 cavities, each with one seed.

Distr. S. Indo-China, Lower Burma, S. Siam, in *Malesia*: Sumatra (Tapanuli, West Coast), Malay Peninsula, Banka, Billiton and Riouw, Anambas Is., Borneo incl. Karimata Arch.

Ecol. On exposed cliffs or rocks and sandy beach plains, in sandy 'blukar' behind coconut groves near the sea, in open spots in bushy 'kerangas' woodland on sandstone or sandy soils, often associated with *Baeckea frutescens*, in 'padang' vegetation at low altitudes up to 1800 m, again in the mountains in rather dry *Leptospermum* forest, and widespread in mossy forest, on Mt Kinabalu up to 2745 m on open ridges, generally on acid soil, sandstone or granitic sands, locally gregarious. *Fl. fr.* Jan.–Dec., mainly July–Aug.

Uses. A decoction of leaves and roots is drunk for stomach ache and pain all over the body. In Banka the fibre (*i.e.* the inner bark) is used to make canoes waterproof.

Pollination. The flowers are visited by various *Hymenoptera*.

Vern. *Chorèng* (or *chuchur*) *atap, hujong atap, jiring atap, kaju glam, kaju tjina, kĕmili bawang, maki china, mĕmpadang, mĕntadah, tasĕk timbul*, M, *kĕmili bawang, sĕkun'jung, t(a)ratap*, Banka, *kaju djarum, mata udang*, W. Borneo, *Malayan Heath*, E.

Note. The most related species is *S. cymbulae* (LAB.) SPR. from New Caledonia, New Hebrides, and Fiji, which has shorter, generally distinctly veined sepals (*c.* 2 mm), longer filaments (1–1½ mm), a constantly short style (1 mm), the ovary abruptly truncate apically, whilst in *S. malayana* the ovary is ± gradually tapering into the rather long style.

*var.* **novoguineensis** SLEUM. Blumea 12 (1963) 148. —**Fig. 4–5.**

Ovary hairy all over the top. Style 1½–2 mm, patently hairy in the lower half. *Fruit* globular, red, edible, 3½–4 mm across in fresh specimens. *Leaves* 25–45 by 4–10 mm; much narrower and more lanceolate leaves observed in part of the branchlets on the same specimen, probably due to bud-mutation (sports). Otherwise as in *var. malayana*.

Distr. *Malesia*: New Guinea, only known from the S. slope of the Cycloop Mts above Kotanica.

Fig. 4. *Styphelia malayana* (JACK) SPR. *var. novoguineensis* SLEUM. Cycloop Mts (New Guinea) (VAN ROYEN & SLEUMER 6200) (SLEUMER, 1961).

Ecol. In woody grassland with *Xanthostemon brassii* MERR. & PERRY and *Stenocarpus moorei* F. v. M., scattered at 600–700 m, on laterite soil. *Fl. fr.* July.

**3. Styphelia suaveolens** (HOOK. *f.*) WARB. in Sarasin, Reisen 2 (1905) 329, *in text.*; KOORD. Rec. Trav. Bot. Néerl. 7 (1910) 65; J.J.S. Nova Guinea 8 (1912) 798; KOORD. Exk. Fl. Java 3 (1912) 22; GIBBS, Linn. J. Soc. Bot. 42 (1914) 107; MERR. En. Born. (1921) 468; H. J. LAM, Blumea 5 (1945) 571; SLEUM. Blumea 12 (1963) 148.—*Leucopogon obtusatus* HOOK. *f.* in Hook. Lond. J. Bot. 6 (1847) 269, *non* SOND. (1844/45).—*Leucopogon suaveolens* HOOK. *f.* Ic. Pl. (1852) *sub* t. 898; WALP. Ann. 5 (1858) 454; VID. Sinopsis, Atlas (1883) 30, t. 60, f. A.—*Leucopogon colensoi* HOOK. *f.* Fl. Nov. Zel. 1 (1853) 165.—*Leucopogon hookeri* SOND. Linnaea 26 (1854) 248, *non* SOND. (1844/45); HOOK. *f.* Fl. Tasm. 1 (1857) t. 75; BENTH. Fl. Austr. 4 (1869) 205; WRIGHT, Kew Bull. (1899) 104; BAIL. Fl. Queensl. 3 (1900) 933; RODWAY, Tasm. Fl. (1903) 108; EWART, Fl. Vict. (1930) 931.—*Cyathodes colensoi* (HOOK. *f.*) HOOK. *f.*

Fig. 5. *Styphelia malayana* (JACK) SPR. *var. novoguineensis* SLEUM. Cycloop Mts (New Guinea) (VAN ROYEN & SLEUMER 6200 A) (SLEUMER, 1961).

Handb. New Zeal. Fl. (1864) 177; CHEESEMAN, Man. New Zeal. Fl. (1906) 412; Ill. New Zeal. Fl. (1914) t. 125; ALLAN, Fl. New Zeal. 1 (1961) 517.—*S.* '*montana*' F. v. M. Fragm. 6 (1867) 45, *pro parte* (*excl. basion. Lissanthe montana* R. BR. 1810), 55; Trans. R. Soc. Vict. 1, 2 (1889) 25, as to *var. hookeri, in text.*—*S. hookeri* (SOND. 1854) J.J.S. Nova Guinea 8 (1912) 797, *non* F. v. M. (1867); MAIDEN & BETCHE, Cens. New S. Wales Pl. (1916) 165.—*S. obtusifolia* J.J.S. Nova Guinea 8 (1912) 798, t. 143; *ibid.* 12 (1917) 539, *incl. var. hypoleuca* J.J.S. *l.c.* 799; DIELS, Bot. Jahrb. 62 (1929) 488; J.J.S. Nova Guinea 18 (1936) 123.—*S. trilocularis* J.J.S. Nova Guinea 8 (1912) 798, 799, t. 144; *ibid.* 18 (1936) 123, *incl. var. quinquelocularis* J.J.S.—*S. vandewateri* WERNH. Trans. Linn. Soc. II, Bot. 9 (1916) 101.—*S. spicata* J.J.S. Nova Guinea 12 (1917) 539, t. 224; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 484, f. 7.—*S. philippinensis* MERR. Philip. J. Sc. 20 (1922) 419; En. Philip. 3 (1923) 252.—*S.* '*obovata*' MALM in Fedde, Rep. 41 (1937) 295, *excl. basion. Leucopogon obovatus* FAWC.—*Leucopogon philippinensis* (MERR.) HOSOKAWA, Trans. Nat. Hist. Soc. Formosa 30 (1940) 336.—**Fig. 6.**

Dioecious, low, erect, diffuse or bushy, stiff shrub, (0.15–)½–2(–3) m, becoming prostrate and mat-forming at high altitude. Branchlets slender, rather rigid, densely short-hairy, subdensely to densely leaved; bark transversely cracking. *Leaves* linear to linear- or lanceolate-oblong, rarely oblong or subovate-oblong, variable in shape and size, apex generally shortly attenuate, or acuminate to various degree, ending with a ± bluntish, callous point, rarely more long-acuminate and acutely pointed (Philippines and New Guinea in part), base attenuate into a short broadened petiole, coriaceous, ± stiff, flat or the edge slightly recurved, entire, ciliate initially and often remaining so in the upper part or at the apex and/or the base, generally glabrescent with age and finally quite glabrous, medium-green and dull above, ± whitish or greyish glaucous beneath, often finely white-papillose between the nerves, (6–)8–15(–18) by (1½–)2–3(–3½) mm, few- to rather many-nerved, nerves or ribs 3–5, parallel to each other, close or more distant, ± obscure above, mostly

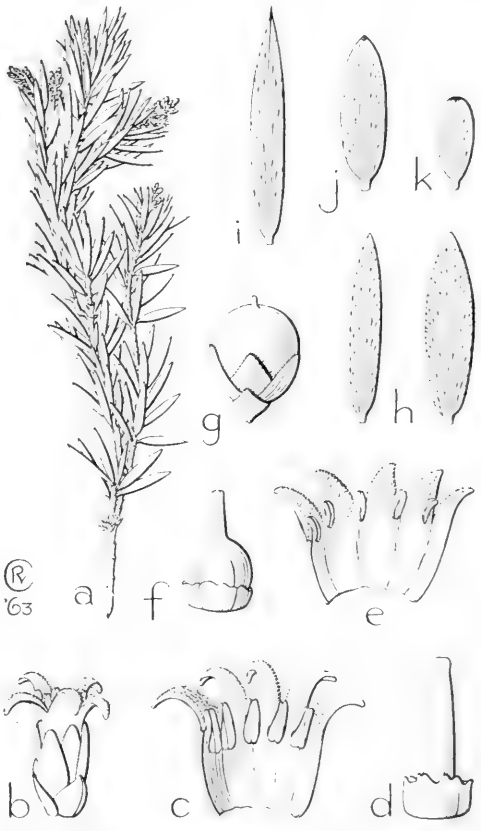



Fig 6. *Styphelia suaveolens* (HOOK. *f.*) WARB. *a.* Habit, × ⅔, *b.* flower, × 4, *c.* ♂ flower, open corolla, × 6, *d.* rudimentary ovary in ♂ flower, × 12, *e.* ♀ flower, open corolla, × 6, *f.* ♀ flower, ovary, × 12, *g.* fruit, × 2, *h.* two leaves, × 2, *i.* leaf, × 2, *j.* leaf, × 2, *k.* leaf, × 2 (*a–h* SLEUMER & VINK 4299, New Guinea: Arfak Mts, 2400 m, *i* ELMER 11389, Philippines: Mindanao, Mt Apo, 2600–2800 m, *j* JACOBS 5747, Borneo: Mt Kinabalu 3500–4000 m, *k* BRASS 10099, New Guinea: Mt Wilhelmina, 4250 m).

Fig. 8–9. *Styphelia javanica* (DE VRIESE) J.J.S. in the dunes of the Sandsea, within the caldera of Mt Tengger (E. Java), *c.* 2050 m; above associated with *Calamagrostis australis* and *Imperata* in background (photogr. CLASON, 1928), below almost covered with volcanic sand (photogr. JESWIET, 1918).

Fig. 7. *Styphelia javanica* (DE VRIESE) J.J.S. Mt Ardjuno (E. Java), *c.* 3000 m.

± distinctly raised beneath, the inner 1 or 3 ones straight from the base to the top of the lamina and not branched, outer ones fan-like branched from below or upwards only. *Spikes* either solitary and terminal, or 2–3 in the upper axils, (2–)3–8-flowered; rachis slender, grey-puberulous, up to 5 mm, with several minute basal bracts. *Flowers* sessile or almost so, sweet-scented. Subtending bract subovate, hardly 1 mm. Bracteoles 2, suborbicular, obtuse, ciliate, clasping the base of the sepals, 1–1¼ mm. *Sepals* oblong to obovate-oblong, obtuse, membranous, dull reddish, often distinctly veined lengthwise, ciliate, 1¾–2 mm. *Corolla* suburceolate, white, creamy or pinkish red, 3½–4 mm long in all, apparently usually slightly longer in the ♂ flowers, lobed from ⅓ to almost ½ their length, tube slightly to rather long exserted from the sepals, lobes lanceolate, acute, covered with woolly white hairs inside, ± reflexed in full anthesis.—♂ *Flowers*: anthers attached above the middle of the corolla, oblong, ¾–1 mm, slightly exserted from the throat. Pistil columnar, *c.* 2 mm, its basal part (ovary) hardly swollen, disk lobes ± spreading.—♀ *Flowers*: anthers much reduced in size, hardly ½ mm, less exserted and without pollen. *Ovary* subglobular, disk lobes closely attached; style columnar, ¾–1 mm. *Drupe* subglobose, (3–)4–5 mm across, 2–3(–5)-celled, mesocarp fleshy, thin, either whitish or yellowish (Arfak Mts), or pink to red at maturity. *Seeds* red.

Distr. Australia (S. Queensland, New South Wales, NE. Victoria, Tasmania), New Zealand, Solomon Is. (Bougainville), in *Malesia*: N. Borneo (Kota Belud and Kinabalu), Lesser Sunda Is. (Timor), Central and SW. Celebes, Philippines (Luzon, Negros, Mindanao), and New Guinea.

Ecol. In Timor a common to subdominant undergrowth in *Eucalyptus* and *Podocarpus* mountain-forest, 1800–3000 m, in Celebes, Borneo, and New Guinea rare in (even secondary) montane forest, more common in scrub forest, open mossy forest and forest glades, summit vegetation, in alpine grassland and on rocks, mostly on dry, also on moist, peaty ground, and on ultrabasic rock, locally common and even gregarious, (1800–) 2000–4000 m, on the southern slope of Mt Carstensz in fissures of rock between 4500 and 4700 m, and just below the top of Mt Wilhelm at 4690 m. *Fl. fr.* Jan.–Dec.

Vern. *Kadoro buku*, Makassar, *bacay*, Negros, *gaing*, *sadumdum*, Bag.; New Guinea: *mukehfa*, Dunantina, *zamosa*, Asaro: Kefamo, *muasopo*, Chimbu: Masul, *wamoreh*, Mairi: Mondo, *nubiri*, *porparu*, Mendi, *mundumund*, *paungupi*, *rone*, Enga, *nakat-nakat*, Dani.

Uses. In Negros the roots are used to treat hemorrhage. Reported to be ± fire-resistant from Timor.

Note. GODLEY (Nature 180, 1957, 284) has found the flowers of '*Cyathodes colensoi*' unisexual, and the ♀♀ flowers smaller than the ♂♂ in New Zealand; the present author found the same within populations of *S. suaveolens* in New Guinea.

**4. Styphelia javanica** (DE VRIESE) J.J.S. Ic. Bog. 4 (1910) 82; SLEUM. Blumea 12 (1963) 150.—*Anacyclodon pungens* JUNGH. Nat. Geneesk. Arch. N.I. 2 (1845) 49, *non S. pungens* (SOND.) F. v. M. (1867).—*Pentachondra javanica* ZOLL. *ibid.* 2 (1845) 576, repr. Flora 30 (1847) 601, *nom. illeg.*—*Leucopogon javanicus* DE VRIESE in Miq. Pl. Jungh. 1 (1851) 84; JUNGH. Java ed. 2, 1 (1853) 597, 666; *ibid.* 3 (1854) 734; ZOLL. Syst. Verz. 2 (1854) 137; MIQ. Fl. Ind. Bat. 2 (1859) 1053; F. v. M. Fragm. 6 (1867) 56 *in text.*; BOERL. Handl. 2, 1 (1891) 274; SCHIMPER, Pflanzengeogr. (1898) 768, f. 428; KOORD. Nat. Tijd. N.I. 60 (1901) 263.—*S. pungens* KOORD. Jungh. Gedenkb. (1910) 185, *non* (SOND.) F. v. M. (1867); Rec. Trav. Bot. Néerl. 7 (1910) 64; Exk. Fl. Java 3 (1912) 21, f. 5; KOORD.-SCHUM. Syst. Verz. 1 (1912) fam. 234, p. 113; J.J.S. Nova Guinea 8 (1912) 798; DAMMERMAN, Pres. Wild Life & Res. Neth. Ind. (4th Pac. Sc. Congr. Java, 1929) 49, fig.; DOCTERS VAN LEEUWEN, Pangrango (1933) 258, f. 67; HOCHR. Candollea 6 (1936) 470; STEEN. Trop. Natuur 25 (1936) 38, f. 2; BACK. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 164, p. 1.—**Fig. 7–9.**

Creeping, much branched, low-growing and mat-forming shrub, 10–30 cm, with squamiferous runners. Branchlets ± erect, slender, dark purple in the younger, puberulent and imbricately leaved parts, densely scarred and early defoliate in the older ones. *Leaves* obliquely erect, elliptic-oblong or oblong or mostly subobovate-oblong, apex

shortly acuminate, ending with a pale needle-like pungent point or cusp (1 mm), base suddenly and truncately narrowed into a red petiole (hardly 1 mm), rather hard, glabrous, rather lustrous, dark green-glaucous when fresh, red-brown when old, edge rather coarsely and persistently serrulate-ciliate (lens!), 6–13 by 1½–2 mm, midrib distinct, not branched, nerves 5–7, parallel to the midrib, fan-like branched and generally so only on the outer side, *i.e.* towards the edge, slightly raised beneath, less visible above. *Flowers* normally solitary in the upper axils, (4–)5-merous, bisexual; peduncle 2–3 mm, grey-pubescent, with *c.* 6 basal bracts, the latter similar to the subtending bract, small, ½ mm. Bracteoles 2, ± rounded, forming a cup, which is appressed to the sepals, 1–1⅓ mm, ciliolate, keeled and mucronulate. *Sepals* ovate-oblong, acuminate, 3(–4) mm. *Corolla* white or ± suffused with pink, very sweet-scented, 6(–7) mm long in all, tube urceolate, ± equalling the sepals in length, glabrous in- and outside, lobes acute, recurved, densely hairy within, 2½(–3) mm. *Anthers* oblong, *c.* 1 mm, slightly exserted from the throat. *Ovary* ovoid, 1 mm, base surrounded by the fleshy disk. Style slender, red, long white-hairy below, *c.* 3½ mm, topped by a capitate stigma. *Drupe* ellipsoid or subglobose, slightly 5-angled, yellow or orange coloured, *c.* 4½ mm across.

Distr. *Malesia*: East Java (from Mts Penanggungan, Ardjuno, and Kawi to Mt Jang).

Ecol. In sunny, dry, sandy or stony places, may be near craters, occasionally also in *Casuarina* forest, locally common, gregarious, even vegetation-forming, often interlaced in low mats of *Festuca nubigena* at Mt Penanggungan at 1650 m, otherwise 2100–3350 m. *Fl. fr.* Jan.–Dec.

Pollination. According to DOCTERS VAN LEEUWEN the stigma leans often against the anthers and this renders self-pollination possible. The sweetly scented flowers are visited by *Bombus rufipes var. flavipes*.

Dispersal. DOCTERS VAN LEEUWEN observed on Mt Kawi that the fruits were regularly eaten by the thrush *Turdus javanicus whiteheadii*, and that the stones and seedlings were not rare in the excrements of these birds.

Vern. *Dukut malelo*, J.

Note. Apparently most related to *S. cuspidata* (R. BR.) SPR. from Queensland, the leaf-margin of which is, however, finely ciliolate, and not as coarsely serrulate-ciliate as it is in *S. javanica*. In the habitually very similar *S. nesophila* (DC.) SLEUM. from New Zealand, the corolla is definitely longer, and no proper unbranched midrib is present.

**5. Styphelia forbesii** SLEUM. Blumea 12 (1963) 151. —*Leucopogon obovatus* FAWC. in Forbes, Wand. (1885) App. 6, p. 509, *non* (LAB.) R. BR. (1810).— *S. obovata* J.J.S. Ic. Bog. 4 (1910) 82; *ibid.* (1913) 172, *in text.*; Nova Guinea 8 (1912) 798, *non* LAB. (1805).

Erect shrub. Branchlets slender, densely shortly grey-pubescent, imbricately leaved. *Leaves* all equally obovate-oblong or oblanceolate, apex rather suddenly acuminate, ending with a pale, needle-like and breakable cusp (1–1½ mm), base attenuate to a flattened, very short petiole, almost sessile, hard and rather rigid, glabrous besides some hairs at the very base, very finely, sometimes hardly visibly appressed-ciliolate along the edge (lens!), nerves numerous, fan-like branched except the middle one, minutely raised or impressed, often rather obscure especially above, 11–15 by 3–4 mm. *Flowers* bisexual, mostly solitary, sometimes in twos in the upper axils, sessile or almost so, with several basal minute scaly bracts. Subtending bract small, bracteoles 2, ovate, ciliolate, 1–1½ mm. *Sepals* oblong-elliptic, (sub)obtuse, rather longish ciliolate, 2½ mm. *Corolla* white, 3½ mm in all, 5-lobed ± halfway, tube cylindric, ± included by the sepals, lobes densely set with ± retrorse villous hairs inside. *Anthers* oblong, ½ mm, slightly exserted from the throat. *Ovary* pear-shaped, glabrous as is the slender style (1 mm). *Fruit* subglobose-ellipsoid, *c.* 2½ by 2 mm, striate lengthwise, apex truncate, style subpersistent, 1⅕ mm, central stone 1–3-celled.

Distr. *Malesia*: Timor (eastern part: Mt Telulah), Alor.

Ecol. In *Eucalyptus* forest, 1000–1220 m, locally plentyful. *Fl. fr.* April–May.

Vern. *Kewana*, *wuéwe*, Alor.

**6. Styphelia acuminata** (R. BR.) SPR. Syst. 1 (1825) 659; SLEUM. Blumea 12 (1963) 151.—*Leucopogon acuminatus* R. BR. Prod. (1810) 545; BENTH. Fl. Austr. 4 (1869) 216; EWART & DAVIES, Fl. North. Terr. (1917) 216.—*S. wetarensis* J.J.S. Ic. Bog. 4 (1913) 171, t. 352.

Shrublet, *c.* ⅓ m. Branchlets slender, puberulous, subdensely to rather densely foliate. *Leaves* lanceolate to linear-lanceolate, apex ending in an acicular point or cusp (1 mm), base narrowed, sessile or practically so, subcoriaceous, rather stiff, glabrous and shining, minutely subserrulate-ciliate (lens!), 5–11 by (1–)1½–2 mm; nerves numerous, parallel to the edge, fan-like branched, not much visible especially not above. *Flowers* bisexual, axillary, mostly in twos, rarely in threes, puberulous on a peduncle, 1–1½ mm long, which bears some minute bracts or scales. Pedicel very short or almost 0. Subtending bract ovate-acuminate, finely mucronulate, ciliolate, ½–¾ mm. Bracteoles suborbicular-ovate, strongly keeled and ± mucronulate, ciliolate, appressed to the sepals, *c.* 1 mm. *Sepals* ovate to ovate-elliptic, apiculate, ciliolate, veined lengthwise, 1½–1¾ mm. *Corolla* tubular below, funnel-shaped above, white, glabrous outside, 2½–2¾(–3) mm long in all, 5-lobed halfway, lobes erecto-patent, recurved distally, acute, set with retrorse long spreading hairs inside. *Anthers* oblong, *c.* ¾ mm. *Ovary* subglobular, glabrous, style slender, terete, glabrous, ¾ mm. *Fruit* obovoid-ellipsoid, apex truncate, *c.* 3½ by 3 mm at maturity.

Distr. N. Australia (precise locality not known), in *Malesia*: Lesser Sunda Is. (Wetar, twice found).

Ecol. In *Eucalyptus* bush, on rather dry volcanic tuff, 150–550 m. *Fl. fr.* Febr.

Note. The fruit of *S. acuminata* from Australia is described by BENTHAM as 5-celled, whilst the one specimen from Wetar with fruits has only 2 cells by abortion. I have, however, also found 2- and 1-celled fruits in the original collection of *S. acuminata* and there are otherwise no differences. Similar to *S. acuminata* in leaves is *S. leptospermoides* (R. Br.) Spr. from Queensland, which, however, has decidedly larger flowers.

**7. Styphelia abnormis** (Sond.) J.J.S. Ic. Bog. 4 (1910) 82, *in text.*; *ibid.* (1913) 172, *in text.*; Nova Guinea 8 (1912) 797; Sleum. Blumea 12 (1963) 151.—*Leucopogon acuminatus* (*non* R. Br.) Duperrey, Voy. Coquille Bot. Atlas (1826) t. 53. —*Leucopogon abnormis* Sond. in Lehm. Pl. Preiss. 1 (1845) 325.—*Leucopogon lancifolius* Hook. *f.* Ic. Pl. (1852) t. 898.—*Leucopogon moluccanus* Scheff. Nat. Tijd. N.I. 32 (1873) 419; Boerl. Handl. 2, 1 (1891) 274.—*Leucopogon malayanus* Jack *var. moluccanus* Kurz, J. As. Soc. Beng. 46, ii (1877) 217; For. Fl. Burma 2 (1877) 96, *pro stirp.molucc.*—*S. lancifolia* J.J.S. Ic. Bog. 4 (1910) 82, *in text.*; Nova Guinea 8 (1912) 797; Gibbs, J. Linn. Soc. Bot. 42 (1914) 107; Merr. En. Born. (1921) 467.—*S. moluccana* J.J.S. Ic. Bog. 4 (1910) 72, *in text.*; Nova Guinea 8 (1912) 798; H. J. Lam & Holthuis, Blumea 5 (1942) 224.

Erect, twiggy shrub, 1–1½(–3) m. Branches scarred. Branchlets rather slender, younger parts greyish puberulous, densely appressedly and ± imbricately leaved. *Leaves* subsessile, lanceolate (the lowest ones in the new shoots oblanceolate), apex acuminate, ending with a needle-like point or brittle pungent tip (± 1 mm) when young, less pungent when the very tip is gone in later stages, base very shortly narrowed, truncate, no proper petiole, often convex above, coriaceous, stiff, shining, glabrous, finely ± caducously subserrulate-ciliate (lens!) along the whole margin, 11–18(–20) by 2–3 mm, with numerous close though distinct nerves parallel to the edge, only the outer ones fan-like-branched, all rather conspicuous on both faces. *Flowers* bisexual, axillary, solitary or in twos, rarely in threes; peduncle (½–)1–2 mm, grey-puberulous, with several minute basal bracts. Subtending bract ovate, hardly 1 mm. Bracteoles 2, ovate-acuminate, keeled dorsally, the keel ending in short mucro, ciliolate, *c.* 1½ mm. *Sepals* oblong, acute or submucronate by a very short apical callus, ciliolate, rather obscurely veined lengthwise as are the bracteoles, *c.* 2 mm. *Corolla* tubular below, funnel-shaped above, white or greenish, 3½(–4) mm long in all, 5-lobed down to almost ⅔, glabrous outside, tube hidden in the sepals, lobes erecto-patent, subovate-lanceolate, acute, densely set with reverse, stout hairs inside. *Anthers* oblong, ¾ mm, slightly exserted from the corolla tube. *Ovary* pear-shaped, glabrous, 1 mm across; style slenderly columnar, glabrous, *c.* 1½ mm. *Submature fruit* ellipsoid, much truncate distally, *c.* 3 by 2½ mm, 4–5-celled (endocarp and walls separating the seeds rather thin), said to become yellowish at maturity.

Distr. *Malesia*: N. Borneo (incl. Balambangan I.), SE. Celebes (Kabaena I.), Moluccas (Ceram, Talaud Is., Sula Is., Manipa I., Buru, Ambon), New Guinea (only P. Gebe and Waigeo).

Ecol. In xeromorphic vegetation on red, nickel- and chrome-containing clay in Waigeo, in the Moluccas on open sunny slopes and stony ground, on Kabaena I. on crystalline schists, in many places locally rather common, 0–1000 m. *Fl.* Jan.–Dec.

Vern. *Tolenasu*, Talaud, *pupua*, Taliabu, *papua laki*, Buru.

## 2. Subgenus Cyathodes

(Lab.) Drude in E. & P. Pfl. Fam. 4, 1 (1889) 78; Sleum. Blumea 12 (1963) 155. —*Cyathodes* Lab. Nov. Holl. Pl. 1 (1805) 57, t. 81, *em.* R.Br. Prod. (1810) 539. **—Fig. 10.**

Bracteoles 7–10, imbricately arranged immediately below the calyx.

Distr. About 15 *spp.*, 6 of which in SE. Australia (S. Victoria and Tasmania), 4 *spp.* in New Zealand incl. Stewart I., Auckland I., Campbell I., and Chatham I., in Micronesia 1 *sp.* on Alamagan I. (Marianas Group), in the proper Pacific (Tahiti, Moorea, Raiatea, Hawaii, Rapa, Marquesas) 4 *spp.*, in *Malesia* 1 *sp.* in SE. New Guinea. Fig. 2.

**8. Styphelia brassii** Sleum. Blumea 12 (1963) 160. **—Fig. 10.**

Straggling or dense woody shrub, or treelet, up to 6 m, with spreading branches. Branchlets slender, tips finely patent-puberulous, early glabrescent and corticate below; bark dark, splitting lengthwise. *Leaves* scattered though rather dense, ± spreading or subreflexed, linear or lanceolate-linear, apex short-acuminate, tapering to a rigid, pale pungent point (½–1 mm), base very shortly and broadly attenuate into a rather slender, certainly well marked petiole (½–1 mm), coriaceous, stiff, entire, initially ciliate, glabrous with age, brownish olivaceous and shining above when dry, greyish glaucous beneath, (¾–)1–1½ cm by 1–1½ mm, midrib and 2–3 nerves on each side parallel to the edge, slightly or hardly impressed above, finely though well visibly raised beneath, the outer 1 or 2 nerve(s) fan-like branched from at least the upper

half (less distinctly or more shortly so in the flush). *Flowers* solitary in the upper 3–6(–8) axils of the new shoots, subsessile, apparently bisexual. Bracteoles completely covering the very short peduncle (hardly 1 mm), ovate to oblong-ovate, obtuse, ciliate, 1–1½ mm, decreasing in size downwards. *Sepals* oblong, obtuse, ciliate, ± 1¾ mm. *Corolla* tubular-subcampanulate, white, 3¾–4 mm long in all, almost halfway 5-lobed, glabrous outside, subdensely soft-hairy at the lobes and the upper half of the tube inside, tube very shortly or hardly exserted from the sepals. *Anthers* narrow-oblong, 1–1¼ mm, on filiform, glabrous filaments (½ mm), exserted from the corolla tube for almost their full length. *Ovary* broadly obovate, glabrous, *c.* ¾ mm, tapering to a rather slender glabrous style (0.6–0.7 mm). Disk thin, cup-shaped, 5-lobed halfway. *Fruit* globose, white, turning pink or purple at maturity, *c.* 4 mm ø, central stone covered by a thin mesocarp, containing 2 or 3 seeds.

Distr. *Malesia*: SE. New Guinea (Milne Bay Distr., only known from Mts Maneao, Simpson, and Diriwa.)

Ecol. Edge of mossy or stunted forest, 2600–2900 m. *Fl. fr.* May–June.

Notes. Certainly closely related to *S. juniperina* (FORST.) PERS. from New Zealand, which differs by a completely glabrous corolla and a longer, campanulate corolla tube, exserted from the sepals. *S. oxycedrus* LAB. from Australia (S. Victoria and Tasmania) is similar in habit but its nerves are hardly or not branched outward. Also closely related to *S. rapae* SLEUM. (from Rapa I.), which differs by glabrous branchlets and not or inconspicuously ciliate bracteoles, and to *S. brevistyla* MOORE (Society Is.) in which the corolla is practically glabrous inside.

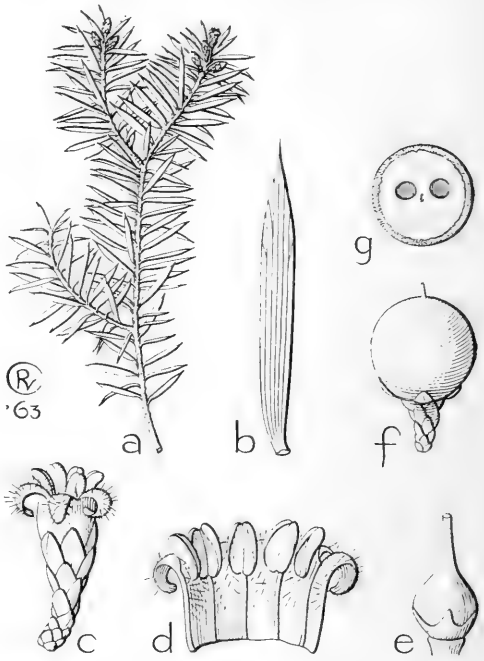



Fig. 10. *Styphelia brassii* SLEUM. *a.* Habit, × ⅔, *b.* leaf, × 3⅓, *c.* flower with bracteoles, × 4, *d.* open corolla with stamens, × 6, *e.* ovary and style, × 8, *f.* fruit with bracteoles on pedicel, × 3⅓, *g.* cross-section of fruit, × 3⅓ (*a–g* BRASS 22274).

## 2. DECATOCA

F. v. M. Trans. R. Soc. Vict. 1, 2 (1889) 25; SLEUM. Blumea 12 (1963) 163.— **Fig. 11l-p.**

Shrub or low tree, apparently gynodioecious. *Leaves* spirally arranged, shortly petioled. Inflorescences terminal and axillary, in the form of short spikes or spike-like racemes (the axis ending with a sterile flower respectively with a subtending bract). *Flowers* sessile. Bracteoles 2, strictly opposite. *Sepals* 5, imbricate. *Corolla* tube subcylindric, exceeding the sepals, subdensely hairy in the upper ⅔ inside, lobes imbricate in bud and remaining so in anthesis, attaining *c.* ⅓ of the total length of the corolla, hairy at the base inside, otherwise glabrous. *Stamens* attached below the corolla lobes; filaments very short; anthers pendent, narrow-ellipsoid, hardly exserted from the corolla tube. Hypogynous disk deeply 5-lobed. *Ovary* 10-celled, with 1 ovule per cell; style columnar, short; stigma subcapitate. *Fruit* (as in *Trochocarpa*) baccate; mesocarp rather thick and pulpy, penetrating between the separated 10 pyrenes of the endocarp at full maturity.

Distr. Monotypic, in *Malesia:* East New Guinea. Fig. 12.

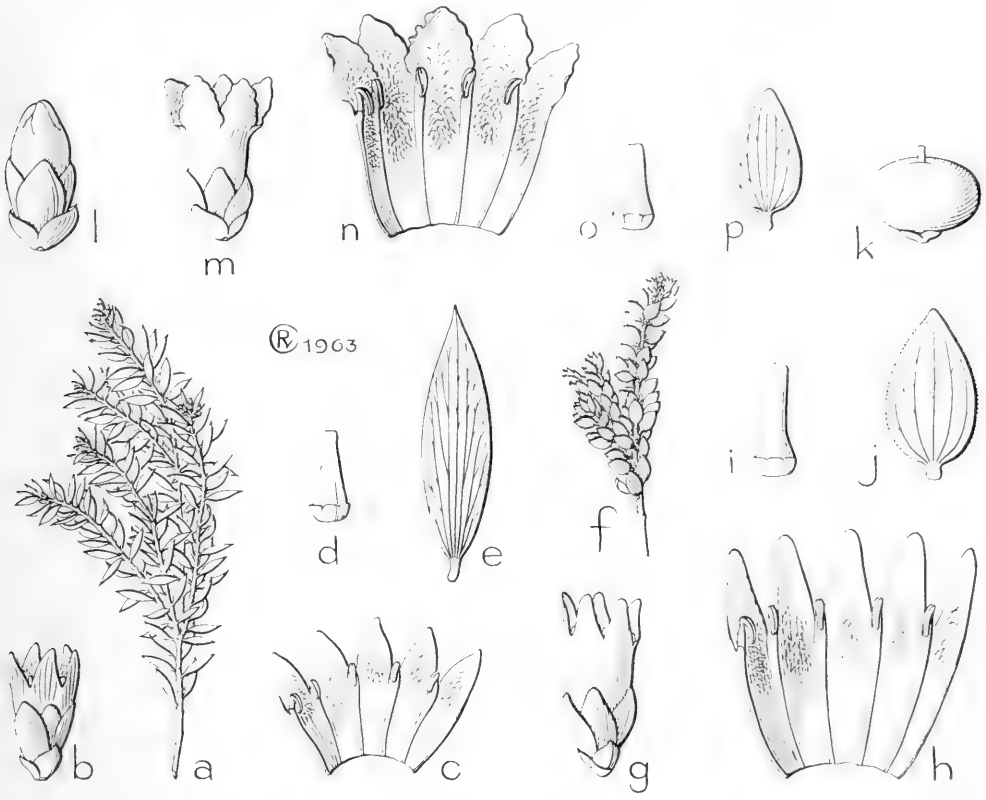



Fig. 11. *Trochocarpa nutans* (J.J.S.) H. J. LAM. *a.* Habit, × ⅔, *b.* ♀ flower, × 4, *c.* open corolla of ♀ flower, × 6, *d.* ovary, × 6, *e.* leaf, × 4.—*Trochocarpa dekockii* (J.J.S.) H. J. LAM. *f.* Habit, × ⅔, *g.* ♀ flower, × 4, *h.* open corolla of ♀ flower, × 6, *i.* ovary, × 6, *j.* leaf, × 4, *k.* fruit, × 2.—*Decatoca spenceri* F. v. M. *l.* Flower bud, × 4, *m.* flower, × 6, *n.* open corolla of ♀ flower, × 6, *o.* ovary, × 6, *p.* leaf, × 2 (*a–e* VAN ROYEN & SLEUMER 7977, *f–k* SLEUMER 4150, *l–p* BRASS 4675).

**1. Decatoca spenceri** F. v. M. Trans. R. Soc. Vict. 1, 2 (1889) 25; WRIGHT, Kew Bull. (1899) 104; J.J.S. Nova Guinea 8 (1912) 798; DIELS, Bot. Jahrb. 62 (1929) 488; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 203; SLEUM. Blumea 12 (1963) 163.—**Fig. 11l–p.**

Compact, densely erect-branched, stiff shrub or treelet, up to 2 m, sometimes dwarfed to rounded clumps *c.* 20 cm high, or procumbent. Branchlets rather short, densely set with short spreading hairs. *Leaves* crowded, somewhat spreading, suborbicular- to lanceolate-ovate, apex subacute, not rarely subapiculate, base ± rounded, subcoriaceous, curved inwards in dry specimens, finely shortly ciliate (lens!), glabrous, dark green and rather glossy above, paler beneath, marginate, entire, 3–5(–6) by 2–3 mm, midrib not branched, lateral nerves in 3 pairs ± parallel to the midrib, fan-like branched outward, prominent beneath, hardly visible above; petiole reddish, slender, subterete, ½–¾ mm. *Racemes* spike-like, few-flowered, generally terminal, rarely axillary. Subtending bract and the 2 bracteoles ovate, ciliolate, reddish and strongly veined lengthwise as are the *sepals*; the latter oblong-ovate, slightly keeled, red-tipped, *c.* 2 mm. *Corolla* subcampanulate--tubular, *i.e.* slightly dilated from base to top, white, rather fleshy, 5(–6) mm long in all, tube 4–4½ by 2–2½ mm, glabrous outside, ± densely covered with longish subpatent hairs in the upper ⅔, glabrous above the base inside, lobes suboovate, erect or hardly reflexed, margin irregularly crisped and finely erose, ± 1½ mm, hairy at the base inside, glabrous otherwise. *Anthers* narrow-oblong, *c.* 1¼ mm in the ♂, only 0.7 mm and without pollen in the ♀ flower. Disk bluntly 5-lobed. *Ovary* broadly pear-shaped, glabrous, 1 mm; style thick-columnar, glabrous, *c.* 1½ mm; stigma obtuse. *Fruit* depressed-globular, dark purple, 5–6 mm ø at full maturity; mesocarp rather thick and succulent, including the 10 small, separate pyrenes.

Distr. *Malesia*: East New Guinea (Mt Saruwaged, Owen Stanley and Wharton Ranges).

Ecol. In forest glades, more common in fringes of forest and along banks of grassland streams or in open grassland shrubberies, 2840–3680 m. *Fl. fr.* May–Sept.

### 3. TROCHOCARPA

R.Br. Prod. (1810) 548; Sleum. Blumea 12 (1963) 163.—**Fig. 11—18.**

Small trees or shrubs, bisexual or polygamous (gynodioecious). *Leaves* flat or convex, shortly petioled, with a few longitudinal, generally prominent, whether or not branched nerves. *Inflorescences* terminal and/or axillary, from many-flowered spikes to few-flowered clusters, rarely solitary or in twos, each flower subsessile within the axil of a small subtending bract, provided with two or numerous (7–10) bracteoles. *Sepals* 5, imbricate. *Corolla* tube ± cylindric, limb ± deeply 5-partite, lobes valvate (sometimes slightly imbricate distally in bud stage), ± expanded to recurved. *Stamens* generally partially included in the tube, reduced to half their length (and then without pollen) in ♀ specimens; *filaments* inserted at or slightly below the top of the corolla tube, short, filiform, attached at or near the top of the anthers. Disk truncate, lobed or consisting of 5 distinct scales. *Ovary* (8–)10(–11)-celled, with 1 ovule per cell; style rather thick, short; stigma small, obtuse, subpeltate or subcapitate. *Fruit* baccate, ± globular, mostly dark purplish to bluish blackish, rarely pink or light purple at maturity; mesocarp pulpy; endocarp separating or separable into (8–)10(–11) distinct, rather hard pyrenes.

Distr. About 12 *spp.*, 1 *sp.* in E. Australia (Queensland and New South Wales) and in New Guinea, 1 *sp.* in SE. Australia, 3 *spp.* in Tasmania; in *Malesia:* 1 *sp.* in North Borneo, 1 *sp.* in Central Celebes, 6 *spp.* in New Guinea (one of them also in E. Australia). Fig. 12.

Ecol. At rather low elevations (from *c.* 600 m upwards) in Australia, Tasmania, and NW. New Guinea, up to the highest summits in North Borneo (Mt Kinabalu, *c.* 4000 m), in Central Celebes (*c.* 3460 m) and on the main range of New Guinea (up to *c.* 4000 m), as undergrowth in light forest, along forest fringes or in open places, not rarely gregarious, on acid soil.

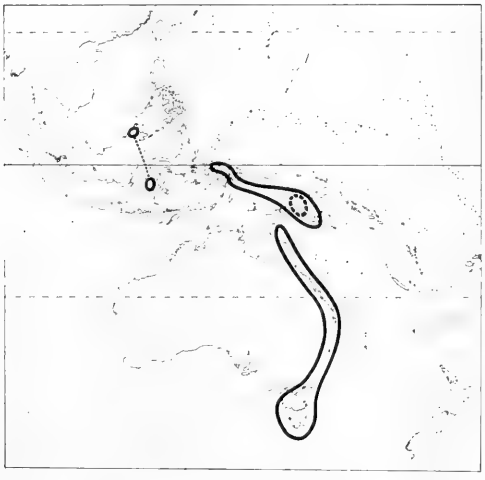


Fig. 12. Distributional area of the genera *Trochocarpa* R. Br. (————) and *Decatoca* F.v.M. (- - - - -).

#### KEY TO THE SPECIES

1. Bracteoles 2, opposite. Flowers in spikes, racemes or at least 3-flowered clusters. Subg. Trochocarpa.
2. Leaves (2½–)3–5(–7½, rarely up to 8½) by (½–)1–2½(–2¾, occasionally up to 3½) cm, juvenile microforms excepted. Spikes many-flowered, suberect, (1½–)2–4(–5) cm. Pyrenes very close to-

gether, forming a deeply (8–)10-ribbed kind of stone initially, finally separable from each other. **1. T. laurina**

2. Leaves up to 1¾ by 0.6 cm. Flowers condensed in spikes or spike-like, very short inflorescences, or ± recurved clusters. Pyrenes close together, separated by a conspicuous layer of pulpy mesocarp from the beginning, easily separable from each other.
3. Main nerves on the undersurface of the leaves few and spaced, whether or not branched, more distinct than their branches.
4. Leaves lanceolate-acicular, ½–1 (rarely in part in the same specimen up to 1½) mm wide. Fruit pink to light purple at full maturity . . . . . **2. T. gjellerupii**
4. Leaves lanceolate, oblong or ovate, on an average (much) wider, juvenile microforms excepted. Fruit blue-purple or -blackish at full maturity.
5. Corolla 5-partite ± halfway (the tube ± equalling the sepals) . . . . . **3. T. celebica**
5. Corolla 5-lobed in the upper ⅓ (or less), the tube decidedly longer than the sepals. **4. T. dekockii**
3. Main nerves on the undersurface of the leaves rather numerous and close together, much fan-like branched, not much different in appearance from their branches.
6. Corolla ± campanulate, 5-partite ± halfway, prominently lengthwise many-veined outside. **5. T. nutans**
6. Corolla urceolate-cylindric or urceolate, 5-lobed in the upper ⅓, not veined, *i.e.* quite smooth outside.
7. Corolla 4–5 mm long in all. Leaves lanceolate to lanceolate-oblong; nerves hardly prominent or mostly a little sunk on both faces or underneath in mature leaves . . . **6. T. nubicola**
7. Corolla 5–6(–6½) mm long in all. Leaves ovate to elliptic-ovate or ovate-oblong; nerves ± strongly prominent on both faces in mature leaves . . . . . **7. T. dispersa**

1. Bracteoles numerous (7–10), imbricate. Flowers solitary, rarely in twos. SUBG. PSEUDOCYATHODES.
8. Branchlets very densely leaved. Leaves lanceolate or narrow-lanceolate, (6–)8–10 by 1–1½(–2) mm; petiole *c.* ½ mm. Corolla 3½–4 mm . . . . . **8. T. arfakensis**
8. Branchlets less densely leaved. Leaves lanceolate to oblong-lanceolate, 8–10 by 2½–3½ mm; petiole 1–1½ mm. Corolla 5–6 mm . . . . . **9. T. papuana**

### 1. Subgenus Trochocarpa

Flowers in spikes, racemes or at least 3-flowered clusters. Bracteoles 2, opposite, inserted immediately below the base of the calyx.

**1. Trochocarpa laurina** (R. BR. *ex* RUDGE) R. BR. Prod. (1810) 548; HOOK. Bot. Mag. (1834) t. 3324; BENTH. Fl. Austr. 4 (1869) 166; BAIL. Queensl. Fl. 3 (1900) 928; DOMIN, Bibl. Bot. 89 (1928) 496, f. 172 (above); WHITE, J. Arn. Arb. 4 (1933) 85; SLEUM. Blumea 12 (1963) 165.—*Cyathodes laurina* R. BR. *ex* RUDGE, Trans. Linn. Soc. 8 (1807) 293.—*Styphelia cornifolia* RUDGE, *l.c.* t. 9.—*Styphelia trochocarpoides* F. v. M. Pap. Pl. 1 (1875) 107; J.J.S. Ic. Bog. 4 (1913) 173; Nova Guinea 12 (1917) 540, *in text.*; in Gibbs, Arfak (1917) 168; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 485.—*Decaspora laurina* O. KTZE, Rev. Gen. Pl. 2 (1891) 391.—*T. bellendenkerensis* DOMIN, Bibl. Bot. 89 (1928) 496, f. 172 (below).—**Fig. 13.**

Erect, much branched shrub or treelet, rarely small tree, (0.3–)1½–4 (sometimes up to 10) m; trunk up to 15 cm across. Branchlets terete, slender, glabrous, early greyish corticate. *Leaves* either clustered at the ends or scattered, though rather close together in the upper part of each year's shoots, mostly ovate- or elliptic-lanceolate, more rarely ovate, sometimes rather narrowly lanceolate or almost elliptic, variable both in shape and size, apex gradually long or more shortly acuminate, subacute, base broadly cuneate to almost rounded, glabrous, pinkish to reddish in young shoots, at maturity glossy, dark green above, light green beneath, subcoriaceous, flat, entire, normal ones (2½–)3–5(–7½, rarely up to 8½) by (½–)1–2(–2¾, occasionally up to 3½) cm, in microforms reduced to 12–16 by 2½–4½ mm, 5–7 (rarely 9)-plinerved, main nerves somewhat prominent on both faces, each nerve giving way to numerous less prominent ascending or sometimes rather obsolete veins or streaks which are crossing each other and form a kind of fine network between the main nerves; petiole rather slender, grooved above, (2–)3–4(–7) mm. *Flowers* bisexual, arranged in terminal and axillary solitary or terminally clustered, suberect spikes; rachis stoutish, glabrous or laxly to subdensely puberulous, (1½–)2–4(–5) cm; perulae several, small. Subtending bract ovate-oblong, striate, 1½–2 mm, subpersistent. Bracteoles 2, ovate, keeled, striate, ciliate, *c.* 1.2 mm. *Sepals* subovate, obtuse, indistinctly striate, ciliate, *c.* 2 mm. *Corolla* white or whitish green or pink, subcylindric, tube 2–2½ mm, lobes suberect, 1–1½ mm, bearded to the middle as well as the upper part of the tube inside with retrorse hairs, otherwise glabrous. *Anthers* narrow-oblong, *c.* 1¼ mm, exserted for about half their length. Disk shortly 5-lobed. *Ovary* subglobose, glabrous, tapering to a thick style (1 mm). *Fruit* depressed-globular, 6–8 by 4–5 mm, dull, bluish-blackish and often a little pruinose at full maturity, the (8–)

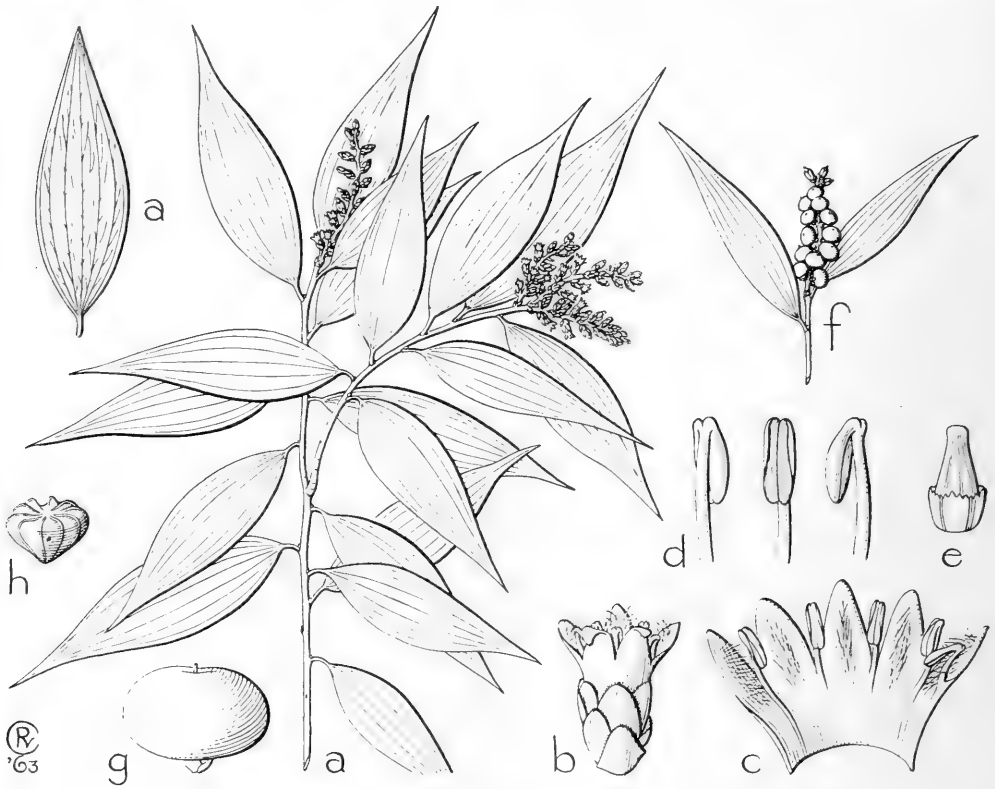



Fig. 13. *Trochocarpa laurina* (R. BR. *ex* RUDGE) R. BR. *a*. Leaf, × ⅔, *b*. flower, × 4, *c*. open corolla, × 6, *d*. stamens, × 12, *e*. ovary, × 8, *f*. infructescence, × ⅔, *g*. fruit, × 2, *h*. pyrenes in submature fruit still close together in form of a central 10-ribbed stone, × 2 (*a* VAN ROYEN & SLEUMER 7335, *b–e* SLEUMER & VINK 4352, *f* VAN ROYEN 3940, *g–h* VAN ROYEN & SLEUMER 7335).

10(–11) pyrenes very close together with scanty mesocarp tissue between them forming a semi-globose, sharply 10-ribbed, almost compact kind of stone for a long time, finally separable from each other, surrounded by a rather abundant pulpy mesocarp.

Distr. Australia (Queensland, New South Wales), in *Malesia*: NW. New Guinea (Vogelkop Peninsula).

Ecol. In New Guinea edge of primary (*Araucaria-Castanopsis-Nothofagus*) forest or in (also secondary) scrub forest or shrubberies on steep, rocky slopes or summit vegetation, on clayey or sandy soil, (600–)700–2600 m, locally common. *Fl. fr.* Jan.–Dec.

Uses. The wood is of a pinkish colour, close-grained, hard, and nicely marked.

Vern. *Botdzjemiei*, *kěru*, Manikiong, *duon*, Andjai, *perannek*, Kèbar, *humtotkau*, *urer*, Hattam.

Note. The New Guinea specimens show the same variation in size and form of the leaves and the length of the spikes as do the Queensland specimens, and there is no difference in the flowers.

**2. Trochocarpa gjellerupii** (J.J.S.) H. J. LAM, Blumea 5 (1945) 573; SLEUM. Blumea 12 (1963) 165.—*Styphelia gjellerupii* J.J.S. Nova Guinea 12 (1917) 540; *ibid.* (1918) t. 225; in Gibbs, Arfak (1917) 167; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 203; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 484.—**Fig. 14.**

Much branched, erect shrub, often compact, subglobose or subovoid in shape, with a short stem in open, more loosely branched and less densely leaved in shadowy places, part of the branches sometimes prostrate and rooting, the branchlets then short, erect, partly with larger leaves; (½–)1–2(–4) m. Branchlets very slender, younger parts densely leaved and covered with a subvillous yellowish tomentum, older defoliate parts with a longitudinally splitting blackish bark. *Leaves* lanceolate-acicular, apex gradually acuminate, base subobtuse, glabrous, entire, minutely ± caducously appressed-ciliolate (lens!), (2½–)3–5(–6) by ½–1 mm (up to 8 by 1½ mm in rooting prostrate branches), midrib prominent beneath, obscure above, with 1–2 parallel lateral

Fig. 14. *Trochocarpa gjellerupii* (J.J.S.) H. J. LAM, Mt Sensenemés, Anggi Gigi Lake, Arfak Mts (New Guinea), 2500 m (SLEUMER & VINK 4312) (SLEUMER, 1962).

main nerves on each side, these whether or not branched at the outer side mainly in the upper half, raised beneath only; flush pinkish; petiole subsemiterete, transversely rugose, *c.* ½ mm. *Inflorescences* terminal and axillary, 3–7-flowered, abbreviate racemes or clusters. *Flowers* sessile, *c.* 3 mm, glabrous in all outer parts, with reddish-purplish tinge in bud stage. Bracteoles 2, shortly ovate-triangular, 0.8–1 mm. *Sepals* green, ovate, obtuse, ciliolate, 1⅓–1½ mm. *Corolla* whitish or mostly pale green, almost funnel-shaped, *c.* 2¾ mm long in all, 5-partite nearly halfway, tube slightly exceeding the sepals, lobes ± divergent, finally ± recurved, elongate-triangular, subacute, villous in the lower half inside. Anthers deeply inserted in the throat, reaching almost the apex of the corolla lobes; filaments fleshy, 1–1.3 mm; anthers narrow-oblong, ½ mm. *Ovary* ovoid-subglobose, glabrous; style thick, *c.* ¾ mm; stigma subcapitate. Disk lobes 5, ovate, subquadrangular, retuse or shortly 3-lobed. *Fruit* depressed-subglobose, 3–4 by 4–5(–6) mm, pink or light purple when fully mature, containing 10 loose pyrenes in a rich pulp.

Distr. *Malesia*: NW. New Guinea (Tamrau, Nettoti and Arfak Mts).

Ecol. Both in open shrubby heath vegetation and as undershrub in low *Nothofagus–Tristania* forest or forest edge, on peaty, clayey, or sandy soil, 1900–2550 m, locally plentiful. *Fl. fr.* Jan.–Dec.

Vern. *Angwar*, *ankwarie*, Manikiong.

**3. Trochocarpa celebica** (J.J.S.) STEEN. in H. J. Lam, Blumea 5 (1945) 573; SLEUM. Blumea 12 (1963) 166.—*Styphelia celebica* J.J.S. Ic. Bog. 4 (1910) 81, t. 325; Nova Guinea 8 (1912) 798; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 203.—*Styphelia learmonthiana* GIBBS, J. Linn. Soc. Bot. 42 (1914) 105, f. 5; MERR. En. Born. (1921) 467. —*T. learmonthiana* (GIBBS) H. J. LAM, Blumea 5 (1945) 574.

Shrub or shrublet, dwarf, decumbent or trailing, or rarely erect (up to 70 cm), much ramified. Branchlets slender, tips patently puberulous, densely to subimbricately leaved in their youngest parts, set with leaf-cushions in their lower, defoliate and glabrescent part. *Leaves* ovate to

Fig. 15. *Trochocarpa dekockii* (J.J.S.) H. J. LAM, Mt Wilhelm, Eastern Highlands (New Guinea), 3500 m (SLEUMER 4150) (SLEUMER, 1961).

ovate-lanceolate or elliptic-oblong, rarely lanceolate or narrow-lanceolate, apex subacutely acuminate, base ± broadly narrowed to the petiole, coriaceous, ± convex above in dry specimens, minutely puberulous at the petiole and at the base above, finely and ± caducously serrulate-ciliolate all along the margin, otherwise glabrous, shining, paler beneath, (4–)5–6(–7, rarely up to 9) by (rarely 1–)1½–2½(–3) mm, with 5 (or 7, rarely up to 9) robust main nerves parallel to the edge which are faintly or not immersed above, and ± markedly prominent beneath, 1 or 2 outer ones fan-like few-branched into less distinct secondary nerves mainly in the upper half of the lamina; petiole reddish, slender, subterete, ¾–1 mm. *Inflorescences* axillary and terminal, (4–)6–8(–13)-flowered abbreviate racemes or dense ± recurved clusters; rachis puberulous, up to 5 mm. *Flowers* subsessile, each with one orbicular-ovate subtending bract (1¼ mm) and 2 opposite suborbicular bracteoles (1½ mm), strongly red-veined as are the *sepals*, the latter ovate- or elliptic-oblong, obtuse, ciliate, ± 2 mm, ± including the corolla tube. *Corolla* tubular in the lower, 5-partite and spreading in the upper half, pink to reddish, 3½–4½ mm long in all, villous at the throat and the base of the lobes inside, otherwise glabrous, lobes elongate-triangular, subacute. *Stamens* exserted; anthers linear, *c.* 1 mm; filaments almost 2 mm. *Ovary* subglobose, tapering to the thick columnar style (1½–2 mm). Disk obconical-cup-shaped, shortly 5-lobed. *Fruit* subglobose, dull blue-purple, *c.* 4 mm ø, containing 10 separable pyrenes in a pulpy mesocarp.

Distr. *Malesia*: Central Celebes (Quarles and Latimodjong Mts) and North Borneo (Mt Kinabalu).

Ecol. In forest or mostly in mountain heath or open summit vegetation, (2700–)3000–3650 m, on Mt Kinabalu prostrate in rock crevices on the summit at 3800–4000 m. *Fl. fr.* Jan.–Dec.

Note. A form with narrow-lanceolate leaves (6–8(–9) by 1–1¾ mm) is only known from Mt Mambuliling in Central Celebes, at 2700 m.

**4. Trochocarpa dekockii** (J.J.S.) H. J. LAM, Blumea 5 (1945) 574; SLEUM. Blumea 12 (1963) 166.—*Styphelia dekockii* J.J.S. Nova Guinea 8 (1912) 802, t. 146 B; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 203; J.J.S. Nova Guinea 18 (1936) 124; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 484.—*Styphelia vannouhuysii* J.J.S. Nova Guinea 8 (1912) 801, t. 146 A; *ibid.* 12 (1917) 541; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 203; J.J.S. Nova Guinea 18 (1936) 124.—*Styphelia culminis* WERNH. Trans. Linn. Soc. II, Bot. 9

(1916) 101.—*T. vannouhuysii* H. J. LAM, Blumea 5 (1945) 573.—**Fig. 15, 11f–k.**

Small, often dwarf or prostrate, much branched shrub, mostly in flat tussocks or branchlets ascending, 10–20 (rarely up to 50) cm; a trailing form with elongate branchlets (up to 80 cm) and narrower leaves (± 1 mm) in swampy places. Branchlets slender, though firm, tips patently puberulous or ± glabrescent, densely ± imbricately set with leaves on thick, wart-like leaf-cushions. *Leaves* ovate to oblong- or lanceolate-ovate (more ovate in the eastern, more lanceolate in the western part of New Guinea, and from there also known with narrow-lanceolate leaves in swampy places), apex acute, not pungent, base broadly attenuate to rounded, coriaceous, ± concave and brown above when dry, ± shining, 3–6(–8) by (1–)2–3(–3½) mm, finely caducously to subpersistently serrulate-ciliolate, midrib and nerves obscure above, nerves 5–7, spaced, prominent beneath, all nerves or mostly but the outer 2 pairs minutely branching from the base or mostly (or more distinctly) from the upper part of the lamina; flush pink; petiole ± compressed dorsally, transversely rugose, *c.* 1 mm. *Inflorescences* terminal and axillary, suberect, short, dense, (5–)7–12-flowered racemes; rachis *c.* 5 (–8) mm, provided with numerous minute perulae below, short-pubescent. *Flowers* polygamous (apparently synodioecious), subsessile, each in the axil of a minute cup-shaped bract (± 1 mm). Bracteoles 2, ovate, ciliolate, *c.* 1 mm. *Sepals* green, often with red hue, ovate, ciliate, darker parallel-nerved, 1½–2(–2½) mm. *Corolla* suburceolate-cylindric, pink whitish creamy, or white, 5-lobed to ¼–⅓, 4–5(–6) by 2–3 mm, glabrous outside, tube ± inflated, much exserted from the clasping sepals, sparsely to subdensely short-hairy in the upper ⅓ of the tube (not at the lobes) inside, lobes often with pink hue in white corollas, oblong-triangular, slightly spreading. *Anthers* oblong, *c.* ¾ mm (no pollen) and but a little exserted from the throat in the ♀, ¾–1 mm (containing pollen) and more exserted in the normal ♂ flower. *Ovary* subglobose; style glabrous, terete, *c.* 1 mm in the ♀, 1½ mm in the ♂ flower; stigma obtuse. Disk lobes retuse. *Fruit* depressedly globose, 3½–5 by 5–6 mm, dark purple-bluish when ripe, 10-seeded.

Distr. *Malesia*: New Guinea (in the Vogelkop Peninsula only known from the Tamrau and Arfak Mts, in the Main Range from Mt Carstensz to the Maneau Range in SE. New Guinea).

Ecol. On open rocky slopes or summits, locally common in alpine tussock grassland, in grassy glades or in bog turf, (2000–)3000–4000 m. *Fl. fr.* Jan.–Dec.

Vern. *Momani*, *tadampso*, Mendi, *andidam*, Enga: Poio.

**5. Trochocarpa nutans** (J.J.S.) H. J. LAM, Blumea 5 (1945) 573; SLEUM. Blumea 12 (1963) 166.—*Styphelia nutans* J.J.S. Nova Guinea 8 (1912) 800, t. 145; *ibid.* 12 (1917) 541; in Gibbs, Arfak (1917) 167, *incl. var. arfakensis* J.J.S.; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 203; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 484.—*Styphelia carstensensis* WERNH. Trans. Linn. Soc. II, Bot. 9 (1916) 100.—**Fig. 16, 17, 11a–e.**

Fig. 16. *Trochocarpa nutans* (J.J.S.) H. J. LAM, Koëbré ridge between Anggi Lakes, Arfak Mts (New Guinea), 2400 m (SLEUMER & VINK 4478) (SLEUMER, 1962).

Erect, much-branched shrub, ¼–2(–4) m. Branchlets slender, subangular, densely leaved, densely ± patently short-pubescent in the younger, defoliate part, set with the prominent leaf-cushions and grey-corticated in the older parts. *Leaves* similar to those of *T. papuana* and *T. nubicola*, dark green to yellowish green, subpatent, oblong- to narrow-lanceolate, apex subacutely acuminate, though subobtuse at the very tip by a minute apical gland, base rather broadly narrowed into the petiole, ± coriaceous, finely puberulent initially, quite glabrous and shining on the surface with age, paler beneath, ± persistently serrulate-ciliolate, (5–)6–8(–9, rarely up to 12) by 1½–3 (very rarely up to 4) mm, (5–)7–9-nerved, all main nerves parallel to each other and to the edge, and much fan-like branched mainly outward, paler than the interjacent tissue and minutely sunken beneath, slightly impressed as is the generally obscure branching above; petiole downy, ± 1 mm. *Inflorescences* terminal and from several of the upper axils, (4–)6–8-flowered, abbreviate, nodding racemes or clusters; rachis puberulous, 3–4 mm. *Flowers* sessile or practically

Fig. 17. *Trochocarpa nutans* (J.J.S.) H. J. LAM, Mt Koëbré, ridge between Anggi Lakes, Arfak Mts (New Guinea), 2400 m (SLEUMER & VINK 4478) (SLEUMER, 1962).

so (pedicel up to 1 mm). Subtending bract ovate-triangular, obtuse, longitudinally veined, as are the bracteoles and sepals, ciliate, ± 1¼ by 1 mm. Bracteoles 2, ovate, suborbicular, erose, slightly keeled dorsally, ± 1 mm. *Sepals* ovate, obtuse, ciliate, sometimes puberulous at base and apex, 1⅓–2 by 1–1½ mm, ± clasping the corolla tube. *Corolla* ± campanulate, white, cream or greenish white in shady places, often pinkish especially at the lobes when exposed to full sun or in later stages, (3–)3½–4 mm long in all, 5-partite ± halfway, all over prominently and longitudinally many-veined outside, lobes ± recurved, subacute, villous inside downwards to the throat, glabrous at the apex inside and all over outside. *Stamens* slightly exserted from the throat; anthers oblong, ½ mm in ♀, *c.* 1 mm in ♂ specimens. Disk cup-shaped, 5-lobed. *Ovary* subglobose; style columnar, *c.* 2½ mm; stigma subpeltate. *Fruit* depressedly globose, *c.* 3 by 5 mm, bluish- or purple-blackish, (8–)10-seeded.

Distr. *Malesia*: New Guinea, in the Vogelkop Peninsula (Tamrau, Nettoti and Arfak Mts) and in the Main Range from Mt Carstensz to Hellwig and Wichmann Mts.

Ecol. Undergrowth in ± open, subalpine *Nothofagus–Myrtaceous* forest and in forest edges, shrubberies, mossy thickets, often on ridges or steep slopes, on peaty or stony ground, 1900–3000 m, locally common. *Fl. fr.* Jan.–Dec.

Vern. *Angwar*, Manikiong.

**6. Trochocarpa nubicola** (WERNH.) SLEUM. Blumea 12 (1963) 167.—*Styphelia nubicola* WERNH. Trans. Linn. Soc. II, Bot. 9 (1916) 101.

Erect, much-branched shrub, ¼–1½(–2) m, very similar in habit and leaves to *T. nutans* and *T. papuana*. Branchlets slender, subterete, densely leaved, tips generally densely clothed with short, whitish, subappressed hairs, lower defoliate parts set with the remaining leaf-cushions, early covered with longitudinally splitting greyish or blackish cork. *Leaves* subpatent, lanceolate to oblong-lanceolate, apex subacuminate, base narrowed to the petiole, or sometimes subtruncate, glabrous, ± persistently serrulate-ciliolate, 6–9 by (2–) 2½–4 mm, (5–)7–9-nerved, all nerves parallel to the edge and fan-like branched outward from below, or partly only in the upper part, ± raised in the immature leaves, faintly so or generally a little impressed on both faces in mature ones of dry specimens; petiole *c.* 1 mm. *Inflorescences* terminal and from a few upper axils, 4–6(–8)-flowered, recurved, abbreviate racemes or clusters; rachis puberulous, 2–4 mm. *Flowers* sessile or almost so, apparently gynodioecious. Subtending bract triangular-ovate, strongly keeled and longitudinally prominently veined as are the bracteoles, glabrous, ciliolate, *c.* 1 mm. Bracteoles 2, ovate to suborbicular, erose, 1½ mm. *Sepals* suffused with red, oblong-ovate, markedly veined longitudinally, ciliolate, *c.* 2 by 1½ mm. *Corolla* urceolate, white, greenish or pink, or pinkish in later stages especially at the lobes, smooth, (4–)5 mm long in all, 5-partite to *c.* ⅓, lobes suberect, villous at the base and a little down the throat inside. *Stamens* slightly exserted from the throat; anthers elongate, *c.* ½ mm in the ♀, *c.* 1 mm in the ♂ specimens. Disk cup-shaped, shortly 5-lobed. *Ovary* subglobose; style columnar, 1½–2 mm. *Fruit* depressedly globose, blackish blue at full maturity, *c.* 4 by 5 mm.

Distr. *Malesia*: New Guinea, in the Main Range from Mt Carstensz to Mt Wilhelmina, and again on Mt Scratchley.

Ecol. In subalpine forest or mossy thickets, and in alpine peat-covered ridges, (2530–)3000–3960 m. *Fl. fr.* Aug.–Sept.

**7. Trochocarpa dispersa** SLEUM. Blumea 12 (1963) 167.

Shrub with numerous suberect, ramified branches, 0.3–1½(–2½) m. Branchlets slender, subdensely patently hairy or subhirsutulous. *Leaves* dense, subpatent, ovate or elliptic-ovate, more rarely or in part in the same specimen only ovate-oblong, apex gradually subacuminate-attenuate, base rounded to broadly cuneate, initially puberulous at the base and the petiole, edge ± caducously subserrulate-ciliolate, otherwise glabrous, ± coriaceous, shining above, paler and

rather dull beneath, 7–9(–13) by (3–)4–5 (rarely up to 6) mm, main nerves numerous, parallel to the edge, close to each other and much fan-like branched, main nerves and branching ± equally markedly prominent beneath, less so above; petiole *c.* 1 mm. *Racemes* abbreviated and recurved, terminal or from a few upper axils (3–)4–8(–10)-flowered; rachis very short, densely short-hairy, covered by several perulae below. *Flowers* (sub)-sessile, basal bract ovate, *c.* 1 mm, the two bracteoles ovate, subopposite, *c.* 1½ mm. *Sepals* oblong-ovate, 2–2½ mm, keeled, ciliolate and prominently veined lengthwise as are the bracts and bracteoles, glabrous dorsally. *Corolla* white, urceolate-cylindric, 5–6(–6½) mm long in all, subdensely set with longish retrorse hairs in the upper third of the tube inside, otherwise glabrous, lobes ovate-oblong, 1½–1.8 mm, slightly expanded. Anthers in ♂ flowers 1.2 mm. Disk cup-shaped, shortly 5–10-lobed. *Ovary* subglobose, glabrous; style thick, 1½–2 mm, stigma peltate. Mature *fruit* depressed-globose, pale blue or purplish, 3–4 by 5–6 mm.

Distr. *Malesia*: New Guinea (scattered in the Western and Eastern Highlands).

Ecol. In subalpine forest undergrowth or forest edge or in alpine thickets, 3400–3600 m. *Fl. fr.* June–Sept.

Vern. *Ngal*, Minj.

## 2. Subgenus Pseudocyathodes

SLEUM. Blumea 12 (1963) 167.

Flowers solitary, rarely in twos, terminal and/or axillary, (sub)sessile. Bracteoles numerous (7–10), imbricate.

**8. Trochocarpa arfakensis** (KANEH. & HATUS.) SLEUM. Blumea 12 (1963) 167.—*Styphelia arfakensis* KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 483, f. 6.—**Fig. 18.**

Erect, few-stemmed, rather compact shrub, 1 (–2) m, part of the branches occasionally prostrate and rooting, the branchlets then short and erect. Branchlets ± erecto-patent, tips finely patent-puberulous, generally early practically glabrous, very densely subimbricately leaved. *Leaves* light to yellowish green, subsessile, lanceolate or narrow-lanceolate, apex long acuminate, acute, though not properly pungent, base broadly narrowed into the petiole, coriaceous, glabrous, entire (the edge not more ciliolate-serrulate with age), flat, (6–)8–10 by 1–1½(–2) mm, 5- or sub-7-nerved, nerves hardly or not impressed above, minutely though distinctly raised beneath, the outer 1(–2) pair(s) finely branched from below externally; petiole *c.* ½ mm. *Flowers* terminal and axillary, mostly solitary, rarely in twos, subsessile; rachis very short, provided with (8–)10 imbricately arranged, ovate, acute, concave, fimbriate bracteoles (½–1 mm) below the calyx. *Sepals* greenish, ovate, subacute, ciliolate, parallel-nerved, 2(–2½) mm. *Corolla* almost funnel-shaped, white or pale greenish, 5-partite halfway or slightly more, 3½–4 mm in all, tube included by the sepals, lobes spreading, triangular-lanceolate, subacute, villous in the lower half as is the uppermost part of the tube inside, glabrous otherwise. *Anthers* slightly exserted from the throat, oblong, *c.* 1 mm; filaments ½ mm. *Ovary* ovoid, glabrous, 10-locular; style thick, *c.* 1 mm; stigma subpeltate. Disk lobes short, retuse. *Fruit* ± depressedly globose to subobovoid, 6–12 by 5–10 mm when fresh, dull, bluish-blackish at full maturity, crowned by the slender 1 mm style, containing 10 hard pyrenes embedded in and separated by a soft pulp.

Distr. *Malesia*: New Guinea (Arfak Mts).

Ecol. In low ± open *Nothofagus*–Myrtaceous forest or forest edges, locally not rare, 1900–2600 m. *Fl. fr.* Jan.–Dec.

Vern. *Anggwar, těněhabar*, Manikiong.

**9. Trochocarpa papuana** (WRIGHT) SLEUM. Blumea 12 (1963) 168.—*Leucopogon papuanus* C. H. WRIGHT, Kew Bull. (1899) 104.—*Styphelia papuana* (C. H. WRIGHT) KOORD. Rec. Trav. Bot. Néerl. 7 (1910) 65, *in text.*; J.J.S. Ic. Bog. 4 (1910) 82; *ibid.* (1913) 172, *in text.*; Nova Guinea 8 (1912) 798; KOORD. Exk. Fl. Java 3 (1912) 22.—*Styphelia lamii* J.J.S. Nova Guinea 18 (1936) 123, t. 33, f. 1.—*T. lamii* H. J. LAM, Blumea 5 (1945) 574.

Small shrub or treelet, up to 2 m, with numerous slender ± erect branches. Branchlets suberect-patent, slender, tips generally densely and ± shortly pubescent and densely foliate, lower parts ± defoliate and rather tardily glabrescent. *Leaves* similar to those of *T. nutans* and *T. nubicola*, lanceolate-oblong, apex rather shortly acuminate, subacute, base ± broadly attenuate into the petiole, coriaceous, glabrous, edge very finely subserrulate-ciliate initially and still so for a fairly long time after, 8–10 by 2–3 (rarely up to 3½) mm, 7(–9)-nerved, nerves closely parallel together, inner 3–5 ones generally slightly sunk, outer ones ± obscure above, all very slightly raised, besides the innermost 3 ones, much fan-like branched from the base beneath (as in *T. nutans*); petiole mostly rather flattened, 1(–1½) mm. *Flowers* terminal and axillary, mostly solitary, rarely in twos; rachis very short (± 3 mm), covered with 7–10 imbricate bracteoles, ½–1¼ mm. *Sepals* subovate-oblong, obtuse, strongly parallel-nerved, reddish at the margins, ciliate especially distally, 2½(–3) mm. *Corolla* subcylindric below, slightly widened upwards at the tube, ± expanded at the lobes, 5–6 mm in all, greenish white with pink tips, or pink throughout, lobed to the upper ⅓,

glabrous outside, bearded at the lobes (the tips excepted) and about the upper third (or less) of the tube inside. *Anthers* exserted from the corolla tube for about half their length or slightly more, linear-oblong, 1 mm. Disk lobes retuse. *Ovary* subglobose, 10-celled, 1 mm; style thick, 1½–2 mm. *Fruit* said to be depressed-globose, purple, *c.* 5 mm ø (BRASS 4424).

Distr. *Malesia*: New Guinea (Mt Doorman and in the Main Range between the Western Highlands and Mt Scratchley).

Ecol. In montane cloud forest at the upper forest limit, and in alpine scrub vegetation, sheltered ravines, 3170–3960 m, locally fairly common as forest undergrowth. *Fl. fr.* May–Oct.

Fig. 18. *Trochocarpa arfakensis* (KANEH. & HATUS.) SLEUM. with mature fruits near Tridaga, Anggi Gigi Lake, Arfak Mts (New Guinea), 2250 m (SLEUMER & VINK 4391) (SLEUMER, 1962).

## GERANIACEAE (R. C. Carolin, Sydney)

Annual or perennial herbs (in Malesia) or shrubs with simple and capitate-glandular hairs. *Leaves* opposite or alternate, petioled, usually stipulate: blade dentate and/or lobed, dissected or even compound (very rarely entire but not so in Malesia). *Flowers* bisexual, regular or irregular, protandrous, solitary and terminal or arranged in terminal cymes which appear to be axillary due to sympodial growth. *Sepals* 5 (rarely 4 and not so in Malesia), persistent. *Petals* equal in number to sepals (rarely absent), free. *Stamens* as many as petals or twice as many (rarely three times as many but not in Malesia), free or connate, some frequently staminodal, hypogynous. *Ovary* usually 5-locular with 1–2 ± superposed pendulous ovules in each cell. *Fruit* a schizocarp (sometimes a capsule but not so in Malesia) splitting into 5 one-seeded mericarps each bearing part (an awn) of the elongated style (rostrum). *Seeds* with or without endosperm.

Distribution. Genera 11 and *c.* 600 *spp.*, centred in southern Africa but very widespread in temperate parts of the world, in the tropics mainly at higher altitudes, in Malesia exclusively so.

All Malesian species belong to a complex group—containing KNUTH's sections *Chilensia*, *Australiensia*, and fragments of *Striata* and *Columbinum*—extending from India, through Malesia, temperate Australia, New Zealand, and the Subantarctic islands, to southern America, with some links with the species grouped around *Geranium carolinianum* in North America.

Phytochemistry. At present it is impossible to characterize *Geraniaceae* chemically. The best we can do is to point out what is known about the four genera hitherto investigated.

*Geranium*. Tannins are present in especially high amounts in subterranean organs of perennial species. Gallic acid, ellagic acid and catechins have been isolated from a few species. The information available indicates that, as a rule, the tannins are mixtures of gallitannins, ellagitannins and condensed tannins. Quercetin, kaempferol and caffeic acid are probably ubiquitous and myricetin has been found hitherto in two species. Essential oils produced in glandular hairs are known for a few species; from *G. macrorrhizum* L. the so-called 'Zdravetz oil' is produced.

*Pelargonium*. Most species are accumulators of tartaric acid; this is a generic character; *Geranium* and *Erodium* do not accumulate it. Some species and hybrids produce large amounts of essential oils in glandular hairs of the leaves. The plants known as 'Geranium rosat' are cultivated widely for the production of the so-called 'Geranium oils'. The polyphenols seem to be similar to those of *Geranium*; gallic acid, ellagic acid, catechins and myricetin have, however, not yet been found in *Pelargonium*.

*Erodium*. All investigations were performed with *E. cicutarium* (L.) L'HÉRIT., which is used therapeutically in Europe. Probably this species contains a little tannin resembling *Geranium*-tannins; gallic acid has been definitely identified; furthermore traces of caffeine have been demonstrated to be present.

*Sarcocaulon*. In this xerophytic genus of southern Africa and Madagascar the bark is very rich in aromatic resins and waxes. In *S. rigidum* SCHINZ the resinous material was demonstrated to be a complex mixture of tannins, resins (containing phytosterols) and waxes (containing cerulic alcohol and feruloylcerulate).

For a chemotaxonomical discussion our present knowledge about the chemistry of *Geraniaceae* is far from sufficient.—R. HEGNAUER.

### KEY TO THE GENERA

1. Fertile stamens 10. Awns without long hairs on the inner surface. Leaves palmately lobed. **1. Geranium**
1. Fertile stamens 5 with 5 alternating staminodes. Awns with long hairs on the inner surface. Leaves bipinnatifid . . . . . **2. Erodium**

### 1. GERANIUM

LINNÉ, Gen. Pl. ed. 5 (1754) 306; Sp. Pl. (1753) 676; BENTH. Fl. Austr. 1 (1863) 295; KNUTH, Pfl. R. Heft 53 (1912) 43; in E. & P. Pfl. Fam. ed. 2, 19a (1931) 43; ALLAN, Fl. New Zeal. 1 (1961) 233.

Herbs with simple or branched basal stems ('rhizomes') from which arise ±

short-lived flowering stems. *Leaves* opposite or sometimes alternate (but not in Malesia), palmately lobed. *Flowers* solitary or twinned. *Stamens* 10, all fertile (in Mal. *spp.*), free. *Mericarps* remaining attached to the rostrum after splitting by the curved (but not spiral) awn which is almost glabrous on the inner surface. *Seeds* reticulate, usually ejaculated from the separating mericarp through a ventral dehiscense line.

Distr. About 250 *spp.*, very widely distributed, particularly in temperate regions. The infrageneric groupings adopted by KNUTH are not, in general, reliable.

KEY TO THE SPECIES

1. Bracteoles ovate to suborbicular, imbricate at the base even in the flowering stage. **1. G. monticola**
1. Bracteoles linear-lanceolate to lanceolate, scarcely imbricate in the flowering stage.
2. Flowers solitary . . . . . **2. G. potentilloides**
2. Flowers twinned . . . . . **3. G. homeanum**

**1. Geranium monticola** RIDL. Trans. Linn. Soc. Lond. Bot. II, 9 (1916) 23; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 210.—*G. dissectum* (*non* L.) HEMSLEY, Kew Bull. (1899) 98.—*G. papuanum* RIDL. Trans. Linn. Soc. Lond. Bot. II, 9 (1916) 23, *incl. var. alpestris* RIDL.; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 210.—*G. clemensiae* KNUTH in Fedde, Rep. 45 (1938) 61.

Perennial, (sometimes compact and cushion-like) herb with thick, ascending, often much-branched, rhizome covered with persistent petioles and stipules. *Flowering stems* prostrate, stoloniferous, frequently producing secondary erect rhizomes at the nodes, pubescent at least in the young stages *or* very short and ascending, 2½–40 cm long. Stipules ovate to orbicular, 3–2½ by 3–3½ mm, pubescent membranous, brown, obtuse or with a minute mucro. *Leaves* usually uniform in outline, hirsute particularly on the undersurface or almost glabrous, deeply palmately 3–5-lobed or dissected, 3–7 by 4–12 mm, the lobes sometimes toothed towards the apex; petiole covered with retrorse-appressed hairs. *Flowers* solitary. Pedicel pubescent with retrorse-appressed hairs, 2½–5 mm. Bracteoles ovate to orbicular, imbricate *c.* 2 mm ø, usually obtuse or slightly acuminate, ± pubescent, membranous, brown. *Sepals* elliptic to oblong, *c.* 3 by 1 mm, surmounted by a short mucro, pubescent with soft, appressed hairs. *Petals* spathulate, distinctly ungulate, 4 by 1½–2 mm, glabrous towards the base, pink. *Stamens* 10; filaments lanceolate, *c.* 3 mm, ciliate, bearing a subglobular anther, the outer whorl sometimes with two teeth on the shoulders. *Mericarps* and *seeds* not seen.

Distr. *Malesia*: New Guinea (Mts Carstensz, Wilhelmina, Giluwe, Saruwaged).

Ecol. Alpine grasslands and rocky outcrops, boggy grounds, sandy banks of grassland streams, 3225–4700 m, one of the flowering plants found at greatest height on Mt Carstensz.

Notes. Variable particularly in the degree of hairiness of the leaves. *G. papuanum* is based upon a more glabrous specimen, *G. monticola* on one which is hirsute particularly on the undersurface of the leaves. There seems to be gradations between these two, possibly influenced by degree of exposure. At higher altitude the plants have a much more compact habit, the basis for *G. papuanum var. alpestris*; again there seem to be gradations linking the loose and compact forms. It has not been possible to trace the type of *G. clemensiae* but from the (inadequate) description it appears to belong here.

Differs from *G. potentilloides* in the broader bracteoles, distinctly clawed petals which are glabrous towards the margin towards the base.

**2. Geranium potentilloides** L' HÉRIT. *ex* DC. Prod. 1 (1824) 639; HOOK. *f.* Fl. Nov. Zel. 1 (1852) 40; Fl. Tasm. 1 (1860) 57, *non* SPRENG. 1826, *nec* BONPL. *ex* WEDD. 1855, *nec non* KLOTSCH, 1862. —*G. philonothum* DC. Prod. 1 (1824) 639.—*G. microphyllum* HOOK. *f.* Fl. Antarct. (1844) 8; KNUTH, Pfl. R. Heft 53 (1912) 151; ALLAN, Fl. New Zeal. 1 (1961) 235.—*G. pilosum* [*non* (SOL.) FORST.] F. v. M. J. Bot. 31 (1893) 324.—*G. sarawaketense* KNUTH in Fedde, Rep. 45 (1938) 61.—**Fig. 1.**

Perennial herb with short ± erect rhizome and thin, fusiform or branched tap-root. *Flowering stems* decumbent to ascending, 2½–50 cm, pubescent with retrorse hairs, often rooting at the nodes. Stipules lanceolate, 3–10 mm, long-acuminate, often 2-fid, pubescent, subherbaceous on midrib becoming membranous towards margin. *Leaves* opposite, deeply palmately 5–7-lobed, semi-orbicular or reniform to broad ovate in outline, 1–3 by 1–5 cm, pubescent on both surfaces, often purplish on the lower surface; lobes oblong to narrow-obovate in outline; petiole slender, 1–3½ cm, pubescent. *Flowers* solitary. Pedicels pubescent with retrorse-appressed hairs, 2–4 cm, with two linear to lanceolate, subherbaceous, pubescent bracteoles 2½–4 mm long at midpoint or lower, geniculate at the bracteoles when mature. *Sepals* narrow-elliptic-oblong to lanceolate, 4–7 by 1½–2½ mm, pubescent with short, ± appressed hairs and sometimes some longer divergent ones. *Petals* obovate, 5–8 by 3–3½ mm, ciliate at base, pink, sometimes white. *Stamens* 10; filaments lanceolate-acuminate, 3 by

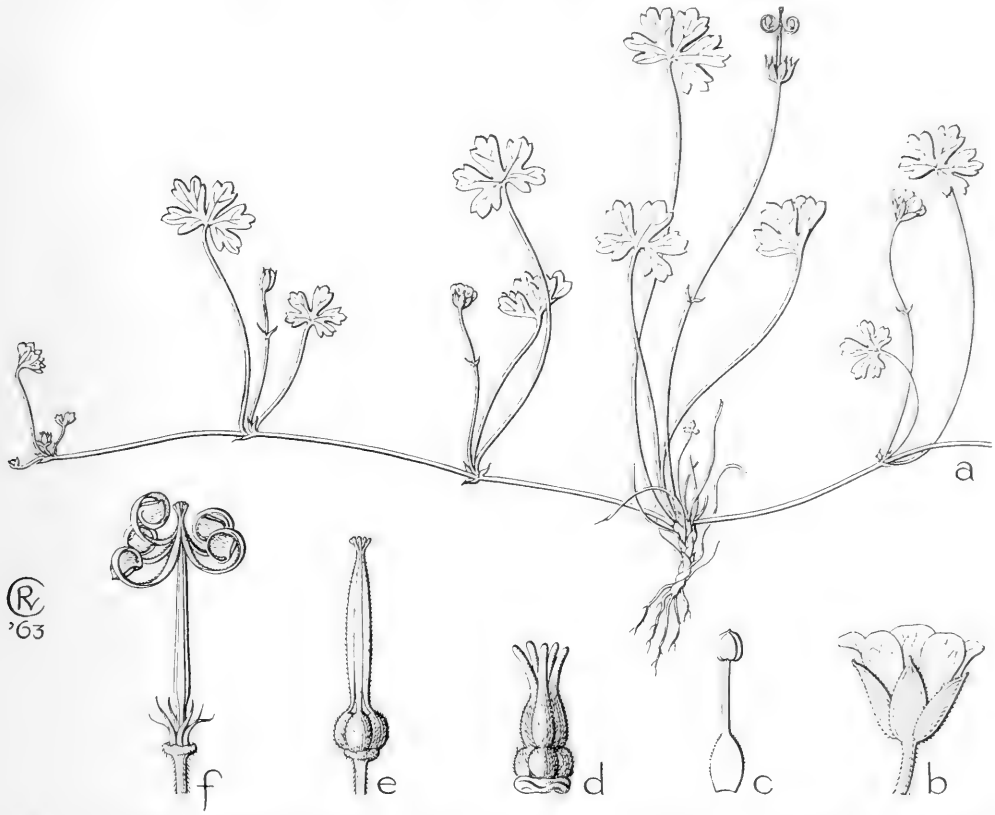



Fig. 1. *Geranium potentilloides* L'HÉRIT. *ex* DC. *a.* Habit, × ⅔, *b.* flower, × 2, *c.* stamen, × 6, *d.* pistil, × 6, *e.* young fruit, × 2, *f.* dehisced fruit without seed, × 2 (*a, e* PULLEN & HOOGLAND 5708, *b–d* BORGMANN 92, *f* CRUTWELL 1030).

½ mm. *Mericarps* oblong *c.* 3½ mm, with a rostrum 8–15 mm long. *Seeds* dark brown, *c.* 2 mm long, covered with shallow somewhat elongated alveolae.

*var.* **potentilloides.** For synonyms see above.

Secondary lobes of the leaves oblong to obovate. Sepal hairs all or almost all short and appressed.

Distr. Antarctic Islands, New Zealand, SE. Australia, in *Malesia*: eastern half of New Guinea.

Ecol. Subalpine and montane woodlands and grasslands, burned treefern grassland, moist hollows, forest edges, often on damp soil, 2250–4250 m.

*var.* **ardjunense** (ZOLL. & MOR.) CAROLIN, *Comb. et stat. nov.* — *G. ardjunense* ZOLL. & MOR. Nat. & Geneesk. Arch. N.I. 2 (1845) 585; BACKER, Schoolfl. Java (1911) 169; KNUTH, Pfl. R. Heft 53 (1912) 150; WELSEM, Trop. Natuur 2 (1913) 10, f. 8; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 210; BACKER, Bekn. Fl. Java (em. ed.) 4A (1942) fam. 67, p. 2; LAM, Blumea 5 (1945) 579; BACKER, Fl. Java 1 (1964) 243.—*G. affine* (*non* W. & A.) BRITTEN in Forbes, Wand. (1885) 501.—*G. nepalense* (*non* SWEET) DOCTERS VAN LEEUWEN, Verh. Kon. Ak. Wet. A'dam, sect. ii, 31 (1931) 255.

Secondary lobes of the leaves linear. Hairs of the sepals short and appressed but becoming stiff and ± divergent towards the margin.

Distr. *Malesia*: N. Sumatra (Atjeh), Central-East Java (Mt Merbabu to Mt Tengger), SW. Celebes (Bonthain), Timor.

Ecol. Light montane forest mixed or of *Casuarina* or *Eucalyptus*, also in open grasslands, along roadsides, sometimes in fields as an apophyte, 1900–3200 m.

Notes. The specimens from Celebes show some intermediate characteristics between these two varieties. Those from Timor show some differences, particularly in the apparently frequent occurrence of twinned flowers. In most characteristics, however, they resemble the Javanese specimens of *var. ardjunense*.

DOCTERS VAN LEEUWEN, *l.c.*, suggested self-pollination in this species which he observed on Mt Lawu, Central Java. He observed the anthers already open at 10 *a.m.* to be empty the next day. As he did not observe insects on the flowers and as he found in most flowers one or two anthers

leaning against the thick stigmas, he suggested self-pollination; he did not, however, carry out experiments to confirm this.

**3. Geranium homeanum** TURCZ. Bull. Soc. Imp. Nat. Mosc. 36 (1863) 591; CAROLIN, Proc. Linn. Soc. N.S.W. 89 (1964) in press.—*G. parviflorum* WILLD. Enum. Hort. Berol. (1809) 716, *non* CURTIS, 1798, *nec* ANDR. 1805.—*G. dissectum var. glabratum* HOOK. *f.* Handb. New Zeal. Fl. (1864) 36.—*G. glabratum* (HOOK. *f.*) SMALL *ex* HANKS & SMALL, N. Amer. Fl. 25 (1907) 10.—*G. nepalense* (*non* SWEET) BACKER, Schoolfl. Java (1911) 168; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 210; BACKER, Bekn. Fl. Java (em. ed.) 4A (1942) fam. 67, p. 2; Fl. Java 1 (1964) 243.—*G. australe* (*non* NEES in Lehm.) ALLAN, Fl. New Zeal. 1 (1961) 233.

Perennial herb with a slightly thickened and much branched tap-root. *Stems* decumbent, 50 or more cm, sprinkled with coarse reflexed hairs. Stipules narrow-lanceolate, 3–5 mm, acuminate, brown, membranous with a few scattered hairs on the outer surface. *Leaves* reniform in outline, 1–4½ by 1½–5 cm, sprinkled with coarse simple hairs, deeply palmately 5–7-lobed; lobes with up to 7 obtuse teeth or secondary lobes towards the apex on the central lobe and fewer on the lateral ones; petiole pubescent, 1½–8 cm. *Flowers* twinned. Peduncle 2–4½ cm, sprinkled with retrorse hairs. Pedicels similar, *c.* 1 cm, geniculate at the bracteoles. Bracteoles linear-lanceolate, 2–3 mm, acuminate. *Sepals* elliptic, 3–4 mm long, pubescent with a prominent awn *c.* 1 mm long. *Petals* broad oblanceolate to oblong, 3–4 mm long, scarcely clawed, ciliate at the base. *Filaments* narrow-lanceolate, 2–3 mm, surmounted by a globular anther. *Mericarps* hirsute, with a rostrum 8–13 mm long. *Seeds* very dark brown with shallow somewhat elongate alveolae.

Distr. New Zealand, SE. Australia, in *Malesia*: East Java (Mt Tengger).

Ecol. Roadsides in montane mixed and *Casuarina* forest, 1500–2000 m.

Notes. Differing from *G. nepalense* SWEET, to which it has been referred, in the smaller flower size, coarser seed-coat alveolae, vigorous decumbent stems, and wider obtuse leaf-lobes which are only toothed or further lobed at the apex.

It is not quite impossible that this species was introduced and became naturalized in Java.

## 2. ERODIUM

L'HÉRIT. Geran. (1787) t. 1–6; AIT. Hort. Kew. 2 (1789) 414; KNUTH, Pfl. R. Heft 53 (1912) 221.

Herbs sometimes with simple or branched basal stems ('rhizomes') or shrubby. *Flowering stems* ± short-lived. *Leaves* opposite or alternate, usually lobed or dissected. *Flowers* arranged in cincinnal umbels or solitary, regular or ± irregular. *Fertile stamens* 5, alternating with 5 staminodes. *Mericarps* separating completely from rostrum, surmounted by a spiral awn with ± long stiff hairs on the inner surface. *Seed* retained within the mericarp.

Distr. About 80 *spp.*, widely distributed in temperate regions particularly of the Old World, extending into tropical areas only rarely.

**1. Erodium cicutarium** (L.) L'HÉRIT. *ex* AIT. Hort. Kew. 2 (1789) 414; WILLD. Sp. Pl. 3 (1801) 629; DC. Prod. 1 (1824) 646; KNUTH, Pfl. R. Heft 53 (1912) 274; BACKER, Bekn. Fl. Java (em. ed.) 4A (1942) fam. 67, p. 3; Fl. Java 1 (1964) 244.

Annual or biennial herb (in Mal.). *Stems* decumbent ascending or erect, hirsute or glandular. Stipules membranous, lanceolate-deltoid to ovate-acuminate, white brown or red. *Leaves* basal and mostly opposite on the flowering stems, pinnate-compound, each leaflet deeply pinnatifid, ovate to oblong in outline up to 10 cm long, hirsute or glandular; lobes of the leaflets acute, often ± dentate. *Flowers* in umbels of 2–7 or solitary. Bracts connate into a wide funnel-shaped tube, ciliate. Pedicels variously hairy or even glabrous. *Sepals* oblong to elliptic, 5–7 mm long, hirsute or glandular with a short awn. *Petals* obovate to oblanceolate ± unequal, pink to white sometimes with dark spots or lines towards the base on the posterior ones. *Staminal filaments* lanceolate, 5 mm; staminodes narrow-lanceolate to narrow-elliptic 2½–3 mm. *Mericarps* surmounted by an awn 3–4½ cm long with a shallow pit on either side at the base of the awn occasionally with an additional furrow beneath each pit.

Distr. A very variable cosmopolitan weed, in *Malesia*: East Java (Mts Ardjuno: Lalidjiwo, and Tengger–Smeru), introduced.

Ecol. A weed of disturbed land, in fields and between grass, 2100–2600 m.

### Cultivated

A few species of *Pelargonium* L'HÉRIT. are cultivated, either as ornamentals in pots or for the scented oil. The genus is easily distinguished from the two others by the prominent nectary spur which is adnate to the pedicel.

Three taxa have been treated by BACKER, Fl. Java 1 (1964) 244. A fuller account of the cultivated *Pelargoniums* is provided by H. E. MOORE, Baileya 3 (1955) 71–97, fig. 23–38.

What was called *P. graveolens* THUNB. (*rose geranium*) in the past is particularly abundant in the herbarium collections; its proper name is *P.* × *asperum* EHRH. *ex* WILLD. (*P. graveolens* × *P. radens* H. E. MOORE). The *lemon geranium* is *P. crispum* and its derivatives. Hybrids are abundant in these groups.

## NYCTAGINACEAE (J. F. Stemmerik, Leyden)

Trees, shrubs, herbs, or armed climbers; roots not rarely tuberous. Indument consisting of simple hairs. *Leaves* simple, exstipulate, opposite or rarely in whorls or pseudowhorls, sometimes unequal in one pair. *Inflorescence* cymose, often thyrsoid, corymbose or umbellate terminal or axillary, sometimes cauliflorous. Bracts and bracteoles present, sometimes very small, not rarely early caducous. *Flowers* actinomorphic, bisexual or unisexual by reduction; pedicelled, with 1–3 bracteoles sometimes coloured, or sustained by an involucre. *Perianth* tubular, campanulate, funnel-shaped, or urceolate, sometimes articulated with the pedicel; the basal part persistent, enclosing the receptacle, tubular, club- or funnel-shaped, often accrescent; the apical, mostly circumscissile caducous part plicate or valvate in bud, with (4–)5–10 lobes, green or coloured. *Stamens* 1–40, rarely more, in 1–2 whorls, connate at the base, free from the perianth; anthers 2-locular, latrorse, basifixed. *Ovary* (sub)sessile, superior, 1-celled, with one erect, anatropous ovule. Style terminal, stigma capitate or fimbriate- to shortly lobed. Basal persistent part of the perianth accrescent in fruit and enveloping the fruit, the whole being known as *anthocarp*; anthocarp indehiscent, smooth, or with viscid ribs and glands, sometimes the glands accrescent into prickles; pericarp thin. *Seed* 1; embryo straight or folded; endosperm mealy or reduced to a gelatinous rest.

Distribution. About 26 genera with 300 *spp.* in the New World, particularly in South America, with poor representations of mostly widespread (native or introduced) species in the warm parts of the Old World. Although the family is predominantly tropical, its area reaches to 38° SL in New Zealand and to 45° SL in Argentina. In Malesia there are 19 *spp.* in 4 genera, of which only *Pisonia* is undoubtedly native.

Ecology. A lowland family, occurring up to *c.* 2000 m, in not too dry climates, rather indifferent to soil. *Boerhavia* is a genus of weeds; *B. chinensis* is in Malesia distinctly preferring regions with a strong dry season; *Mirabilis* sometimes runs wild; *Pisonia* is a genus of various forest types; *P. aculeata* avoids more or less the high forest in everwet regions and prefers in Malesia localities with a feeble to strong dry season.

Pollination. Though of some species the flowers are distinctly showy, little is known about pollinators. See under *Bougainvillea*.

Dispersal. The mostly sticky anthocarps of *Pisonia* are obviously spread epizoically by birds. The equally sticky anthocarps of *Boerhavia* by birds, other animals, and man.

Phytochemistry. Chemically *Nyctaginaceae* are good members of the order *Centrospermae* of VON WETTSTEIN. Red pigmentations are not caused by anthocyanins but by the characteristic chromoalkaloids, known as betacyanins (compare for instance A. S. DREIDING in W. D. OLLIS, Recent developments in the chemistry of natural phenolic compounds, Pergamon Press, 1961). Other compounds known to be present in the family are saponins (*Bougainvillea*), alkaloids (*Boerhavia*), protoalkaloids (trigonellin in *Mirabilis jalapa* L.; 3, 4-dihydroxyphenylethylamine in *Hermicium alipes* S. WATS.), great amounts of $KNO_3$ (*Boerhavia*), pinitol (found in all four species investigated for this character) and large amounts of oxalate of lime (frequently deposited in the form of raphides). On the other hand true tannins seem to be rare or lacking; small amounts of leucoanthocyanins are, however, present in the leaves (and probably in the stems too) of some species. Quercetin, kaempferol, ferulic acid and sinapic acid are probably very common constituents of *Nyctaginaceae*. The seeds are starchy and contain very little fatty oil (4.3 % was found for those of *Mirabilis jalapa*).

This set of chemical characters is found in various combinations in all other families of *Centrospermae* (compare *Aizoaceae*, *Amaranthaceae*, *Basellaceae*, *Cactaceae*, *Caryophyllaceae*, and *Chenopodiaceae* in HEGNAUER, Chemotaxonomie der Pflanzen 3, 1964).—R. HEGNAUER.

Wood anatomy. METCALFE and CHALK 2 (1950) 1063–1067 with literature references until 1950; E. REINDERS, Handl. Plantenanatomie, Centraal Magazijn Landbouwhogeschool Wageningen 1961 p. 254.—*Nyctaginaceae* are chiefly remarkable for the occurrence of anomalous secondary tissue in all woody and many herbaceous species. In *Pisonia*, the only genus with woody species, an extrafascicular cambium is formed already during the development of the initial vascular bundles. Although secondary growth begins from a vascular cambium in the normal position, this cambium soon ceases activity. The extrafascicular cambium is persistent throughout the life of the stem and, in *Pisonia*,

forms groups of radial multiples or irregular clusters of vessels, each group with a cap of included phloem; the secondary tissue between the groups consists mainly of fibres with scarce parenchyma cells and wood rays. C.A.R.-G.—Another anatomical character is the abundance of raphids of Ca-oxalate which can sometimes even be observed in dried material as fine prominent dots or lines and in some cases appear pellucid as minute short lines under obliquely transparent light.

Taxonomy. Though generally *Nyctaginaceae* have been arranged among *Centrospermae* alongside *Phytolaccaceae*, HUTCHINSON, in both editions of his Fam. Fl. Pl., considered *Nyctaginaceae* to belong to his *Herbaceae* and inserted the family in *Thymelaeales* of which it is an aberrant member by its 1-celled ovary with 1 basal ovule. I believe this position is unnatural and untenable.

I want to draw attention to the noteworthy parallel between *Boerhavia* and *Pisonia* with *Plumbago* in which the glandular calyx of the latter shows such a marked resemblance with the lower part of the anthocarp of the first two, whereas the corolline upper part of the anthocarp finds a parallel in the often scarious, unduplicate-plicate upper funnel-shaped part of the calyx of some *Plumbaginaceae*. Besides, circumscissile behaviour of flower parts is shown in both groups. This seems all parallel development, superficial, not intrinsic. But in this respect I must point to the remarkable fact that both groups have also in common a 1-celled ovary with 1 basal ovule, and anatomical resemblances. VON WETTSTEIN (Handb. Syst. Bot. ed. 2, 1911, 865) and PULLE (Compendium, 1938, in the plate representing his ideas about affinities of orders), indeed, attached *Plumbaginales* to *Centrospermae*. HUTCHINSON regards *Nyctaginaceae* as having lost the corolla; on the other hand *Nyctaginaceae* are characterized by having frequently "bracts below the flowers, occasionally simulating a calyx". The homology seems not to be clear, but if we dare to apply CORNER's hypothetical viewpoint of 'transference of function' one could assume that the anthocarp is a true calyx and has taken over at its apex the function of a corolla.

*Chromosomes.* DARLINGTON & WYLIE (1955) cite for *Mirabilis* and *Oxybaphus* x = 29, but for *Bougainvillea* x = 17 (except *B. glabra*, x = 10).

Note. Thanks are due to Mr M. JACOBS for help and criticism and to Dr R. E. HOLTTUM for data on *Bougainvillea*.

KEY TO THE GENERA

1. Herbs, unarmed.
2. Leaves equal. Inflorescence involucrate. Perianth not articulated with the pedicel, 4½–6¼ cm long. Anthocarp with faint ribs, not viscid . . . . . **1. Mirabilis**
2. Leaves subequal. Inflorescences without an involucrum. Perianth articulated with the pedicel, 1½–12 mm long. Anthocarp with 5 or 10 ribs and mostly with viscid glands. **2. Boerhavia**
1. Ligneous plants, sometimes thorny.
3. Each pedicel adnate to a subsessile coloured bract 3–6 cm long . . . . . **3. Bougainvillea**
3. Each pedicel bearing 1–3 small, not coloured bracteoles. . . . . **4. Pisonia**

## 1. MIRABILIS

LINNÉ, Gen. Pl. ed. 5 (1754) 82; Sp. Pl. (1753) 177; HEIMERL in E. & P. Pfl. Fam. 3, 1b (1889) 23; *ibid.* ed. 2, 16c (1934) 108.

Erect herbs, often branched, glandular-pubescent or glabrous; nodes thickened; roots with tubers. *Leaves* of each pair equal. *Inflorescences* terminal, corymbose, 1–∞-flowered, each flower sustained by a persistent, accrescent involucre which is divided halfway into 5 oblong, acute lobes. *Flowers* bisexual, ephemeral, trumpet-shaped, coloured, large, the tube with a constriction above the basal green part; lower portion of tube roundish oblong, ribbed or with knobs; upper portion of tube and limb coloured and circumscissile caducous after anthesis. *Stamens* 3–6, unequal, distinctly exserted. *Ovary* (sub)sessile; style distinctly exserted; stigma capitate with short lobes or fimbriate. *Anthocarp* ribbed or with knobs, not viscid. *Seed* with bended embryo; cotyledons with recurved margin and surrounding the mealy endosperm.

Distr. About 60 *spp.*, mostly American, from California to The Argentine; 1 *sp.* in the Himalayas and SW. China. Several *spp.* cultivated.

**1. Mirabilis jalapa** LINNÉ, Sp. Pl. (1753) 177; CHOISY in DC. Prod. 13, 2 (1849) 427; FILET, Pl. Bot. Tuin Weltevr. (1855) 48; MART. Fl. Bras. 14, 2 (1872) t. 81; KOORD. Med. Lands Pl. Tuin 19 (1898) 563; STANDL. Contr. U.S. Nat. Herb. 12 (1909) 366; BAKER & WRIGHT, Fl. Trop. Afr. 6, 1 (1913) 2; MERR. Int. Rumph. (1917) 215; BACK. Onkr. Suiker. 7 (1930) 233; GAGNEP. Fl. Gén. I.–C. 4 (1936) 1048; HOLTT. M.A.H.A. Mag. 8, 2 (1938) 73, fig.; BACK. & BAKH. *f.* Fl. Java 1 (1963) 270.—*Mirabilis* RUMPH. Herb. Amb. 5 (1747) 253, t. 89.—*M. longiflora* (*non* L.) BLANCO, Fl. Filip. (1837) 77.

Herb, 50–80 cm. *Leaves* 2¼–15 by 1¼–9 cm,

oblong to triangular; petiole 1–4 cm. Peduncle 1½–6 mm. *Flowers* 3–7 together; involucre 8–10 mm long, stretching after anthesis to *c.* 15 mm; pedicel 0.2 mm. *Perianth* white, crimson, yellow or variegated; lower portion of tube ½ cm, upper portion *c.* 4–5 cm, limb 2½–3½ cm ø. *Stamens* 5–6, exserted for 8–15 mm. Style equalling the stamens; stigma capitate, with short lobes to fimbriate. *Anthocarp* subglobular, 7–8 mm long, ribbed or with knobs, black when mature.

Distr. Native in Peru, now cultivated as an ornamental or medicinal plant and occasionally escaped, in all tropical regions.

Ecol. Cultivated up to *c.* 1200 m. The flowers are ephemeral, open at *c.* 4–4.30 o'clock in the afternoon and close at 9 in the morning (see VAN DER PIJL, Trop. Natuur 19, 1930, 95).

Uses. The large tubers were formerly mistaken in Europe for the source of *jalap*, and are mildly purgative. Bruised leaves are used for poulticing boils and abscesses; pounded seeds are used for making a cosmetic powder. BURKILL (Dict. 1935, 1478–1479) and HEYNE (Nutt. Pl. 1927, 609) mention some other minor uses. For a discussion of the medicinal value see QUISUMBING (Medic. Pl. Philip. 1951, 276).

Vern. *Four o'clock*, *Marvel of Peru*, E; *bonte wonderbloem*, *nachtschone*, *vieruursbloem*, D; *bunga* or *kĕmbang pukul ampat*, *kĕmbang pagi soré*, *sĕraja*, M, *kĕdĕrat*, *sĕgĕrat*, *tĕgĕrat*, J; *nodja*, Bali, *bunga lédonosok*, Roti, *loro laka*, Timor (Tètum lang.); *turaga*, Cel. (tonsaw.); *bunga waktu ketjil*, Moluccas, *kupa oras*, Ambon, *tjako raha*, Ternate.

## 2. BOERHAVIA

LINNÉ, Gen. Pl. ed. 5 (1754) 4; Sp. Pl. (1753) 3; CHOISY in DC. Prod. 13, 2 (1849) 449; HEIMERL in E. & P. Pfl. Fam. 3, 1b (1889) 26; Bot. Jahrb. 21 (1896) 617; STANDL. Contr. U.S. Nat. Herb. 12 (1909) 375 ('*Boerhaavia*'); *ibid.* 13 (1911) 418; N. Am. Fl. 21, 3 (1918) 204; Field Mus. Nat. Hist. Bot. 11, 3 (1931) 105; HEIMERL in E. & P. Pfl. Fam. ed. 2, 16c (1934) 117.—*Commicarpus* STANDL. Contr. U.S. Nat. Herb. 12 (1909) 373; *ibid.* 13 (1911) 428; N. Am. Fl. 21, 3 (1918) 215; HEIMERL in E. & P. Pfl. Fam. ed. 2, 16c (1934) 115.—**Fig. 1.**

Annual herbs, erect, ascending or creeping, puberulous-glabrescent, with sessile or stalked, club-shaped glands or hairs; stem base and root often woody. Stems often red tinged and swollen (when dry constricted) at the nodes. *Leaves* opposite, subequal in each pair, beneath paler, the epidermis with minute irregular cystolith-like sculpture, and sometimes with embedded reddish glands. *Inflorescences* axillary, in the axil of the smallest leaf of each pair, or (*B. erecta*) by reduction of leaves into bracts each stem forming one large thyrsoid inflorescence appearing terminal at the extremities, subumbels of 2–10 small flowers. Bracts (basal) and bracteoles (apical) small, acute, fimbriate, caducous. Pedicels jointed with the flower, mostly very short. *Flowers* bisexual. *Perianth* tubular-campanulate, with a distinct constriction mostly halfway; lower part (later becoming the coriaceous anthocarp) obconical, 5- or 10-ribbed, upper caducous part 5-lobed, plicate in bud, white or pink. *Stamens* 1–4, exserted. *Ovary* (sub)sessile, smooth; style as long as the perianth; stigma capitate. *Anthocarp* closed at apex, 5–10-ribbed, glabrous or set with glands, swelling and slimy in water. *Seed* with longitudinally folded embryo; cotyledons with recurved margin and surrounding the mealy endosperm.

Distr. Pantropical, generally between 35° N and 40° S, with in my opinion only 3 *spp.* in all, largely introduced, all in *Malesia*.

Ecol. Distinctly heliophilous weeds of beaches and ruderal places preferring a slightly seasonal climate, indifferent to soil, up to *c.* 1000 m.

Notes. Specific delimitation has been different; HEIMERL had in 1889 *c.* 20 *spp.* and in 1934 *c.* 36, of which he reckoned 16 *spp.* to a separate genus *Commicarpus* STANDL. (*Boerhavia* § *Adenophorae* HEIMERL of 1889) following STANDLEY, who, however, sunk this again in *Boerhavia* in 1931. Surely, the generic difference of the concept *Commicarpus* (10-ribbed larger perianth), in this Flora represented only by *B. chinensis*, is of no more than specific value.

In addition to the Malesian sheets, I have examined a very large material, under many names, from


Fig. 1. *Boerhavia chinensis* (L.) ASCHERS. & SCHWEINF. *a*. Habit, × ⅔, *b*. flower, bracteoles omitted, × 4, *c*. ovary surrounded by filaments united in basal tube, × 8, *d*. ovary and stigma, × 8, *e*. anthocarp, × 4.—*B. diffusa* L. *f*. Flower, × 8, *g*. anthocarp, × 4.—*B. erecta* L. *h*. Anthocarp, × 4 (*a* WIGHT 2468, *b–d* ELBERT 1495, *e* ELBERT 2046, *f–g* JUNGHUHN 67, *h* POPTA 541).

Africa and America, and I have come to the conclusion that there are only three variable species in all. Further it is my contention that the variability is in no mean degree due to the very different habitats occupied by these weeds, poor and rich soils, hot and dry beaches but also damp everwet places, *etc.* It is noteworthy that BALLE in the Fl. Congo Belg. also accepts 3 *spp.*, save that he calls *Commicarpus plumbaginea* what I keep under *Boerhavia chinensis*.

As the number of extra-Malesian synonyms is very large it falls outside the scope of this Flora to enter them into the synonymy.

KEY TO THE SPECIES

1. Anthocarp to 4 mm long, 5-ribbed. Perianth to 3½ mm long, tubular-campanulate.
   2. Anthocarp club-shaped, roundish on section, with short hairs and small sessile to stalked glands, top rounded. Stamens 2–3 . . . . . **1. B. diffusa**

2. Anthocarp obconical, star-shaped on section, without glands or hairs, top truncate. Stamens 1–2. **2. B. erecta**

1. Anthocarp 7–8 mm long, 10-ribbed, with large sessile to stalked glands towards the top. Perianth (6–)10–12 mm long, funnel-shaped, on a pedicel about as long. Leaf margin sinuous. **3. B. chinensis**

**1. Boerhavia diffusa** LINNÉ, Sp. Pl. (1753) 3; BURM. *f.* Fl. Ind. (1768) 3; LOUR. Fl. Coch. 1 (1790) 20; BL. Bijdr. 14 (1826) 733; DECNE, Herb. Timor. Descr. (1835) 44; BLANCO, Fl. Filip. (1837) 8; CHOISY in DC. Prod. 13, 2 (1849) 452, *incl. var. acutifolia, var. obtusifolia et var. pubescens*; SEEM. Fl. Vit. (1866) 196, *p.p.*; BENTH. Fl. Austr. 5 (1870) 277; F.-VILL. in Blanco, Fl. Filip. ed. 3, 1 (1877) 11, t. 93; HILLEBR. Fl. Hawaii (1888) 367; HEIMERL in E. & P. Pfl. Fam. 3, 1b (1889) 26; O.K. Rev. Gen. Pl. 2 (1891) 533, *incl. f. β paniculata* (RICH.) O.K. *et γ repens* (L.) O.K. ('*Boerhavea*'); TRIM. Fl. Ceyl. 3 (1895) 390; BAILEY, Queensl. Fl. 4 (1901) 1212; VAL. Bull. Dép. Agr. Ind. Néerl. 10 (1907) 10; MERR. Sp. Blanc. (1918) 139; En. Philip. 2 (1923) 133; RIDL. Fl. Mal. Pen. 3 (1924) 1, f. 132; DOMIN, Bibl. Bot. 89, 2 (1925) 645, t. 21, f. 1–7, *incl. var. div.*; MAHESHWARI, J. Ind. Bot. Soc. 8 (1929) 219; *ibid.* 9 (1930) 42; BACK. Onkr. Suiker. 7 (1930) 236; SASAKI, Cat. Herb. Formosa (1930) 199; HEIMERL in E. & P. Pfl. Fam. ed. 2, 16c (1934) 119; GAGNEP. Fl. Gén. I.-C. 4 (1936) 1051, f. 110; KAJALE, J. Ind. Bot. Soc. 17 (1938) 243; KANJILAL & DAS, Fl. Assam 4 (1940) 1; BLACK, Fl. S. Austr. ed. 2 (1948) 333, f. 472; HEND. Mal. Nat. J. 6 (1951) 406, f. 367; BACK. & BAKH. *f.* Fl. Java 1 (1963) 271.—*B. repens* LINNÉ, Sp. Pl. (1753) 3; CHOISY in DC. Prod. 13, 2 (1849) 453; BOISS. Fl. Or. 4 (1879) 1045, *incl. var. diffusa* (L.) BOISS.; HOOK. *f.* Fl. Br. Ind. 4 (1885) 709, *incl. var. procumbens* (ROXB.) HOOK. *f.*; BACK. Onkr. Suiker. 7 (1930) 236; BACK. & BAKH. *f.* Fl. Java 1 (1963) 271.—*B. diandra* LINNÉ, Sp. Pl. 2 (1753) 1149; BURM. *f.* Fl. Ind. (1768) 3, t. 1, f. 1; MIQ. Fl. Ind. Bat. 1, 1 (1858) 992; HEIMERL, Ann. Cons. Jard. Bot. Genève (1901) 190; in E. & P. Pfl. Fam. ed. 2, 16c (1934) 119.—*B. erecta* (*non* L.) BURM. *f.* Fl. Ind. (1768) t. 1, f. 2, *excl. descr.*—*B. hirsuta* LINNÉ, Mant. Pl. (1771) 170; HOOK. & ARN. Bot. Capt. Beech. (1841) 68, 93; HOOK. Trans. Linn. Soc. 20 (1851) 193; HEIMERL in Rechinger, Bot. Zool. Wiss. Samoa Is. (1913) 109.—*B. tetrandra* FORST. Prod. (1786) 2; VAHL, En. Pl. 1 (1804) 284; HOOK. & ARN. Bot. Capt. Beech. (1841) 93; CHOISY in DC. Prod. 13, 2 (1849) 456; HILLEBR. Fl. Hawaii (1888) 367; HEIMERL, Ann. Cons. Jard. Bot. Genève (1901) 188.—*B. glutinosa* VAHL, En. Pl. 1 (1804) 287; MIQ. Fl. Ind. Bat. 1, 1 (1858) 992.—*B. pubescens* R. BR. Prod. (1810) 422.—*B. mutabilis* R. BR. *l.c.* 422; CHOISY in DC. Prod. 13, 2 (1849) 456, *incl. var. pubescens* (R. BR.) CHOISY.—*B. procumbens* BANKS *ex* ROXB. Fl. Ind. 1 (1820) 148, *nom. illeg.*; HASSK. Pl. Javan. Rar. (1848) 225.—*B. glabrata* BL. Bijdr. 14 (1826) 733.—*B. acutifolia* S. MOORE, Occ. Pap. Bish. Mus. 10, *n.* 19 (1934) 6.—**Fig. 1f–g.**

Herb, 0.4–1(–2) m, erect, ascending, creeping, climbing, puberulous glabrescent with club-shaped or stalked glands and glandular hairs, rarely hirsute. *Leaves* ovate-lanceolate, beneath often white, sometimes with red marginal glands, ½–4 by ¼–4 cm; base obtuse, cordate, or truncate; top acute to obtuse or obtusely acuminate; petiole 1–3½ cm. *Flowers* 1–12 together, campanulate, in cymose panicles, ½–7 by 1–6 cm; peduncle 2–5 cm, 1–3 times branched. Pedicel ¼–2 mm; bracteoles 1–3, lanceolate, 0.9–1 by ¼–2½ mm. *Perianth* 1½–2¼ mm, with a distinct constriction halfway, limb 1–2 mm, white, red, pink, or violet. *Stamens* 1–3, exserted up to ½ mm. Stigma exserted up to ½ mm. *Anthocarp* club-shaped, 2½–3¼ mm, with 5 ribs, with scattered, club-shaped, stalked or sessile, minute glands.

Distr. Pantropical, throughout *Malesia* and Australia (not in Tasmania), Pacific (New Caledonia, Marshall Is., Hawaii, *etc.*).

Ecol. In dry open places, secondary forest, on rocks and sand, from the coast up to *c.* 1000 m (up to 2000 m in the Himalayas).

Uses. A liquid extract of the plant is used as a diuretic; the root is purgative, anthelmintic, and a febrifuge. An extensive account of the medicinal value is given by QUISUMBING (Medic. Pl. Philip. 1951, 273).

Notes. Many authors had difficulty to distinguish *B. diffusa* and *B. repens*. LAMARCK took them together as synonyms under *B. diffusa*. BOISSIER (Fl. Or. 4, 1879, 1045) and HOOKER *f.* (Fl. Br. Ind. 4, 1885, 709) reduced *B. diffusa* to *B. repens*. BACKER kept *B. repens* and *B. diffusa* apart but it appears that specimens were partly misidentified, that the character of the glands does not hold, and that the creeping *versus* ascending habit is insufficient for specific distinction. That such tropical-ubiquist weeds show a certain degree of variability is not unexpected.

**2. Boerhavia erecta** LINNÉ, Sp. Pl. (1753) 3; BURM. *f.* Fl. Ind. (1768) 3, *non* t. 1 f. 2, *excl. syn.*; JACQ. Hort. Bot. Vindob. 1 (1770) 2, t. 5, 6; GUILL. Zephyr. Taitensis (1837) 38; CHOISY in DC. Prod. 13, 2 (1849) 450; MART. Fl. Bras. 14, 2 (1872) 370; HEIMERL in E. & P. Pfl. Fam. 3, 1b (1889) 26; Bot. Jahrb. 21 (1896) 617, *p.p.*; Ann. Cons. Jard. Bot. Genève (1901) 187; BACK. Onkr. Suiker. 7 (1930) 235; HEIMERL in E. & P. Pfl. Fam. ed. 2, 16c (1934) 118; BACK. & BAKH. *f.* Fl. Java 1 (1963) 271.—**Fig. 1h.**

Herb, 20–80 cm, erect or decumbent at the very base, puberulous, especially in the upper part at the nodes, glabrescent. *Leaves* 1¾–3½ by 1–2¼ cm, ovate, oblong, or lanceolate; base rounded to truncate; lower surface mostly white and with sunken red glands; top acute, rarely obtuse; petiole 1½–4 cm. *Flowers* 2–3 together in cymose panicles, 1–2½ by 1½–3½ cm, 1–3 times branched; peduncle 1½–2 cm. *Flowers* tubular-campanu-

late; pedicel ½–5 mm, with 1–2 lanceolate bracteoles ¾–1 by ¼ mm at the top or lower on the pedicel. *Perianth* 1¾–2½ mm, with 5 faint ribs and a distinct constriction halfway; limb 1½–2 mm, white, red, or pink. *Stamens* 2–3, exserted for ½ mm, like the stigma. *Anthocarp* obconical, glabrous, 3–3¾ mm long, top truncate, the groove between the 5 ribs somewhat undulate.

Distr. Pantropical weed, also in the Pacific, but not recorded from Australia, in *Malesia*: Singapore, S. Sumatra (Palembang), Java, Lesser Sunda Is. (Flores), New Guinea (NW. part).

Ecol. Along rail-roads, in open sandy places, from the coast up to 700 m. VAN DER PIJL described the distinct swelling of the subepidermal slime coat of the anthocarp (Trop. Natuur 26, 1927, 186–187, f. 2) which is characteristic for this species.

Vern. *Bajam mèrah*, *tjakaran*, Java.

**3. Boerhavia chinensis** (L.) ASCHERS. & SCHWEINF. Beitr. Fl. Aeth. 1 (1867) 167; DRUCE, Bot. Exch. Club Rep. 1913, 3 (1914) 415; BACK. Onkr. Suiker. 7 (1930) 234; BACK. & BAKH. *f.* Fl. Java 1 (1963) 271.—*Valeriana chinensis* LINNÉ, Sp. Pl. (1753) 33; BURM. *f.* Fl. Ind. (1768) 15, t. 6, f. 3. — *B. repanda* WILLD. Sp. Pl. 1, 1 (1797) 22; POIR. in Lamk, Enc. Méth. Bot. 5 (1804) 56; BL. Bijdr. 14 (1826) 733; DECNE, Herb. Timor. Descr. (1835) 45; CHOISY in DC. Prod. 13, 2 (1849) 455; WIGHT, Ic. (1851) t. 1766; MIQ. Fl. Ind. Bat. 1, 1 (1858) 991; BENTH. Fl. Austr. 5 (1870) 278; HOOK. *f.* Fl. Br. Ind. 4 (1885) 709; TRIM. Fl. Ceyl. 3 (1895) 390; BAILEY, Queensl. Fl. 4 (1901) 1213; RIDL. Fl. Mal. Pen. 3 (1924) 2; DOMIN, Bibl. Bot. 89, 2 (1925) 645; BHARGAWA, J. Ind. Bot. Soc. 11 (1932) 303 (*anat.*); GAGNEP. Fl. Gén. I.–C. 4 (1936) 1049; BLACK, Fl. S. Austr. ed. 2 (1948) 333, f. 473.—*Astrephia chinensis* DUFR. Hist. Nat. Médic. Valér. (1811) 51.—*B. helenae* R. & S. Mant. Syst. Veg. 1 (1822) 73.—*B. scandens var. chinensis* (L.) O.K. Rev. Gen. Pl. 1 (1891) 534.—*Commicarpus chinensis* HEIMERL in E. & P. Pfl. Fam. ed. 2, 16c (1934) 117.—**Fig. 1a–e.**

Herb, 1(–4) m, erect, sometimes climbing, puberulous-glabrescent. *Leaves* thin, 2½–4½ by 1½–4 cm; base obtuse to cordate; top acute; margin deeply sinuate; petiole 1–3 cm. *Flowers* tubular-campanulate 3–8 together in umbels ½–2 by ¼–3¼ cm; peduncle 2–6 cm; pedicels 2½–14 mm, each with 1 caducous bracteole, 2–3 by 0.2–0.3 mm. *Perianth* 10–12 mm, upper part of tube above constriction *c.* 10 mm, with 5 lobes. *Stamens* 3–4, like the style exserted for 4–5 mm. *Anthocarp* elongate, 7–8 mm, 10-ribbed, with conspicuous sessile to stalked glands, mostly only at the top.

Distr. All Old World tropics, in *S. Malesia*: E. Java (also Madura and Kangean Is.), Lesser Sunda Is. (Bali, Lombok, Sumbawa, Sumba, E. Flores, Timor), Moluccas (Key Is.). Fig. 2.

Ecol. Sandy clay, dry places, and monsoon forest, also on limestone, up to 700 m, distinctly restricted to regions subject to a seasonal climate.

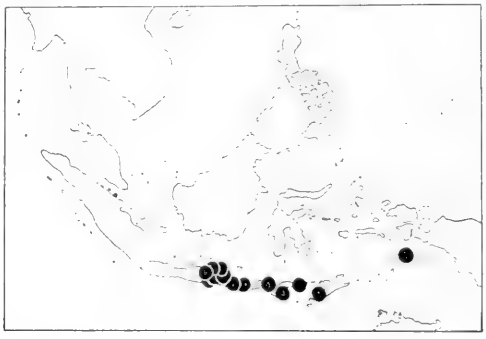


Fig. 2. Distribution in Malesia of *Boerhavia chinensis* (L.) ASCHERS. & SCHWEINF.

## 3. BOUGAINVILLEA

COMM. *ex* JUSS. Gen. (1789) 91 ('*Buginvillaea*'); SPACH, Hist. Nat. Vég. Phan. 10 (1841) 516 ('*Bougainvillea*', *etymol. cons.*); CHOISY in DC. Prod. 13, 2 (1841) 437; HEIMERL, Denkschr. K. Ak. Wiss. M.–N. Kl. Wien 70 (1900) 98; STANDL. Field Mus. Nat. Hist. Bot. 8 (1931) 308; *ibid.* 11 (1931) 96; HEIMERL, Notizbl. Berl.–Dahl. 11 (1932) 463; in E. & P. Pfl. Fam. ed. 2, 16c (1934) 122; BOR & RAIZ. J. Bomb. Nat. Hist. Soc. 47 (1948) 402; HOLTT. M.A.H.A. Mag. 8, 2 (1938) 69; *ibid.* 12, 2 (1955) 2; *ibid.* 12, 3 (1955) 2; *ibid.* 12, 4 (1955) 25; *ibid.* 13 (1956) 13, 66; *ibid.* 14 (1957) 13, 58; PANCHO & BARD. Baileya 7 (1959) 91.

Coarse climbers to 25 m, with supra-axillary spines (abortive inflorescences), more or less puberulous. *Leaves* (sub)opposite, ovate to elliptic-oblong. *Inflorescences* supra-axillary above a bud, the peduncle bearing a single apical triad of flowers (sometimes a second one lower), or the triads in dichasia 1–2(–3) times branched, each triad consisting of 3 subsessile, cordate, persistent, coloured bracts each with a single adnate pedicel. *Perianth* tubular, limb 5(–4)-lobed;

tube with 5(–4) ribs, after anthesis its top twisted, its base persistent. *Stamens* (4–)5–8(–10), unequal, not exserted. *Gynaecium* shorter than the tube; stigma fimbriate. *Anthocarp* spindle-shaped, coriaceous, 5-ribbed, not viscid; embryo longitudinally convolute.

Distr. About 14 *spp.*, Central and tropical South America. Three are cultivated everywhere in tropical and subtropical countries, a fourth, also recorded from *Malesia*, is actually a hybrid. Of the many other hybrids and cultivars, several occur in Malesia.

Ecol. Full sunlight is required for cultivation; in some cases growing in a pot will promote flowering. All plants of one clone are self-sterile. Pollination is performed by small birds and butterflies, and may lead, under dry conditions, to a limited amount of fruiting. At maturity of the fruit, which is after *c.* 30 days, the bracts dry up and may help dispersal by wind. Vegetative propagation is easy by cutting. In the tropics cultivation is possible up to *c.* 1500 m.

Uses. Ornamental, and sometimes for hedges.

Notes. All the present species belong to the type section (see HEIMERL, 1934); a second section, *Tricycla*, has only one species in S. America.

HOLTTUM extensively studied the genus at Singapore, where a great number of forms were in cultivation. His work, published in Gard. Chron. 103 (1938) 164–165, in M.A.H.A. Magazine (cited above), and in Suppl. Dict. Gard. (1956) 163, covers cultivated *Bougainvilleas* of the whole world. It has been the basis of other papers, of our concern being BOR & RAIZADA (1948) on the Indian species, and PANCHO & BARDENAS (1959) on the Philippine ones. Also the present revision has mainly been compiled from HOLTTUM's.

PANCHO & BARDENAS assumed that *Bougainvillea* was introduced into the Philippines by early Spanish settlers. The first record we found is, however, of 1880, by FERNANDEZ-VILLAR; see under *B. spectabilis*.

For abortion of the inflorescence and transitions to spines, see VAN DER PIJL, Phytomorphology 1 (1951) 185.

It lies outside the scope of this Flora to deal with the numerous infraspecific forms, for which we refer to HOLTTUM's extensive descriptions of 1955–1956 and his summary of 1956. Notwithstanding some of them bear latinized names, they all have the status of cultivar.

References to species of doubtful identity have been omitted.

KEY TO THE SPECIES

1. Flower tube very slender, 2 mm ø, and glabrous . . . . . **1. B. peruviana**
1. Flower tube wider and more or less hairy.
 2. Flower tube bearing very short hairs curved towards the top.
  3. Leaves broadly ovate. Bracts crimson or orange fading to purple or mauve; edges of bracts much crisped . . . . . **2. B. buttiana**
  3. Leaves almost evenly elliptical. Bracts purple, changing little in colour on fading; edges of bracts little crisped . . . . . **3. B. glabra**
 2. Flower tube bearing copious spreading hairs up to 1 mm long. Leaves velvety hairy. **4. B. spectabilis**

**1. Bougainvillea peruviana** HUMB. & BONPL. Pl. Aequin. 1 (1808) 147, t. 49; HEIMERL, Denkschr. K. Ak. Wiss. M.–N. Kl. Wien 70 (1900) 114; Notizbl. Berl.–Dahl. 11 (1932) 465; BOR & RAIZ. J. Bomb. Nat. Hist. Soc. 47 (1948) 407; HOLTT. M.A.H.A. Mag. 12, 2 (1955) 8; PANCHO & BARD. Baileya 7 (1959) 97, f. 27.

*Leaves* broadly ovate, on sucker shoots up to 10 by 7 cm, sparsely puberulent or glabrous. Spines 1–2½ cm. Bracts thin, 2½–3 by 1¾–2 cm, slightly crinkled, light magenta-pink all over, glabrous. *Perianth* 1½–2 cm long, the tube nearly 2 mm wide, slightly constricted in the middle, glabrous, only the limb outside hairy, 5–6 mm wide. *Stamens* 6. *Anthocarp c.* 10 mm long, glabrous.

Distr. NW. South America, introduced in Singapore in 1938; three garden varieties.

Ecol. Flowers a little after dry weather. Grows probably best on light soils.

**2. Bougainvillea × buttiana** HOLTT. & STANDL. Bot. Ser. Field Mus. 23 (1944) 44; BOR & RAIZ. J. Bomb. Nat. Hist. Soc. 47 (1948) 405; HOLTT. M.A.H.A. Mag. 12, 3 (1955) 2; PANCHO & BARD. Baileya 7 (1959) 99, f. 28.

*Leaves* on main stems very broadly ovate, to 18 by 14 cm, base often truncate to subcordate, top acuminate, densely puberulous on both sides, nerves *c.* 4 pairs; petiole to 5 cm. Bracts *c.* 3 by 2¼ cm at anthesis, later to 4½ by 2¾ cm, hairy like the leaves, edges crisped, crimson all over. *Perianth c.* 1¾ cm long, the tube 2½ mm wide, constricted about the middle, strongly angular, rather sparsely puberulous with appressed acroscopic hairs.

Distr. Only known in cultivation; discovered by Mrs. R. V. BUTT in 1910 in Colombia, and taken into cultivation by many European firms. Introduced in Singapore in 1923.

Ecol. Flowering, only after dry weather, can be timed by growing in pots. Easy in cultivation, propagation by cuttings; grafting is difficult.

Note. Several garden varieties, hybrids, and variegated forms were dealt with by HOLTTUM in 1955, who by then also had discovered that this 'species' is a hybrid between *B. peruviana* HUMB. & BONPL. and *B. glabra* CHOISY.

**3. Bougainvillea glabra** CHOISY in DC. Prod. 13, 2 (1949) 437; HEIMERL, Denkschr. K. Ak. Wiss. M.–N. Kl. Wien 70 (1900) 110; STANDL. Field Mus. Nat. Hist. Bot. 11 (1931) 97; KANJ. & DAS Fl. Assam 4 (1940) 2; BOR & RAIZ. J. Bomb. Nat. Hist. Soc. 47 (1948) 405; HOLTT. M.A.H.A. Mag. 12, 4 (1955) 25; PANCHO & BARD. Baileya 7 (1959) 99, f. 29.—*B. spectabilis var. glabra* (CHOISY) HOOK. Curt. Bot. Mag. (1854) t. 4811.

*Leaves* almost evenly elliptic, sparsely puberulous on both sides, somewhat denser on the nerves underneath; nerves above paler and slightly depressed. Bracts 3–4¼ by 1¾–3 cm, minutely hairy, persistently purple, with green nerves. *Perianth* 1½–2½ cm long, distinctly swollen and 5-angular below the constriction, with very short, to 0.2 mm, white hairs with curved top. *Anthocarp* 7–13 mm long, glabrous.

Distr. Brazil, where doubtfully wild. Flowered in Europe in 1860, mentioned from Bogor in 1866, from India in 1869, from Singapore in 1879. Very commonly planted.

Ecol. Flowers under everwet conditions.

Note. In the hairs of the perianth the cells are difficult to discern with a 30 times magnification.

**4. Bougainvillea spectabilis** WILLD. Sp. Pl. 2 (1799) 348; HOOK. Curt. Bot. Mag. (1854) t. 4810 (fig.), t. 4811 (text); HEIMERL, Denkschr. K. Ak. Wiss. M.–N. Kl. Wien 70 (1900) 108; MERR. Publ. Gov. Lab. Philip. 6 (1904) 32; En. Philip. 2 (1923) 133; STANDL. Field Mus. Nat. Hist. Bot. 11 (1931) 97; KANJ. & DAS, Fl. Assam 4 (1940) 2; BOR & RAIZ. J. Bomb. Nat. Hist. Soc. 47 (1948) 404; HOLTT. M.A.H.A. Mag. 13 (1956) 13; PANCHO & BARD. Baileya 7 (1959) 100, f. 98; BACK. & BAKH. *f.* Fl. Java 1 (1963) 271.

*Leaves* more or less ovate, proportionately wider than in *B. glabra*, velvety beneath and often above. Bracts 2½–5 by 1½–3¾ cm, sparsely puberulent or short villous, purplish red. *Perianth* 1½–3 cm long, with ½–1 mm long and more or less straight hairs; tube more slender and less distinctly angular than in *B. glabra*. *Anthocarp* 11–14 mm, densely hairy.

Distr. Peru. Introduced in Europe in 1829, recorded from Bogor in 1866, from Singapore in 1879. Very commonly planted, if not pruned sometimes climbing in trees up to 25 m height.

Ecol. Flowers only in or in response to dry weather.

Note. In the hairs of the perianth the cells are easily discernible with a 30 times magnification.

## 4. PISONIA

PLUM. [Nov. Gen. (1703) 7, t. 11] *ex* LINNÉ, Gen. Pl. ed. 5 (1754) 451; Sp. Pl. (1753) 1026; CHOISY in DC. Prod. 13, 2 (1849) 440; HEIMERL in E. & P. Pfl. Fam. 3, 1b (1889) 29; BARG.–PETR. Nuov. Giorn. Bot. Ital. n.s. 8 (1901) 604; HEIMERL in E. & P. Pfl. Fam. ed. 2, 16c (1934) 126; STEMMERIK, Blumea 12 (1964) 275. —*Ceodes* J. & G. FORST. Char. Gen. Pl. (1776) 71, t. 71; SKOTTSB. Svensk Bot. Tidskr. 30 (1936) 722; HEIMERL, Occ. Pap. Bish. Mus. 23 (1937) 27.—*Calpidia* THOUARS, Hist. Vég. Isle Fr. (1804) 37, t. 10; HEIMERL, Oest. Bot. Z. 63 (1913) 19, 280; in E. & P. Pfl. Fam. ed. 2, 16c (1934) 125—*Timeroyea* MONTROUZ. Mém. Ac. R. Lyon Sc. 10 (1860) 247.—*Vieillardia* BRONGN. & GRIS, Bull. Soc. Bot. Fr. 8 (1861) 375.—*Rockia* HEIMERL, Oest. Bot. Z. 63 (1913) 289.—*Heimerlia* SKOTTSB. Svensk Bot. Tidskr. 30 (1936) 738, *non* VON HÖHNEL, 1903.—*Heimerliodendron* SKOTTSB. Svensk Bot. Tidskr. 35 (1941) 364.—**Fig. 3—14.**

Erect shrubs or trees up to 30 m tall, unarmed except one *sp.*, sympodially branched, mostly glabrescent; wood and bark soft and spongious, brittle, pith hardly distinct from the wood. *Leaves* (sub)opposite, alternate or conferted towards the twig ends, entire, dull, midrib flat above. *Inflorescence* axillary or terminal, small or large thyrse exceptionally cauliflorous or ramiflorous, 2–8 times (sub)umbellately branched, each ultimate branch bearing diads or triads or single flowers. Pedicels with 1–3 small, caducous bracts, ½–10 mm, later stretching, in one species to *c.* 7½ cm. Dioecious or bisexual; ♂ and ♀ flowers sometimes of different shape, save in *P. aculeata* in unisexual flowers with rudiments of the other sex. *Perianth* somewhat fleshy, valvate in bud, campanulate, tubular,


Fig. 3. *Pisonia diandra* PULLE. *a.* Habit, × ⅔, *b.* ♀ flower, × 6, *c.* gynoecium with two staminodial stamens, × 12, *d.* anther, frontal and dorsal view, × 24, *e.* immature anthocarp, × ⅔ (*a* GJELLERUP 342, *b–c* GJELLERUP 347, *d* GJELLERUP 342, *e* SCHRAM BW 7831).

urceolate, or funnel-shaped, 5-, rarely 10-lobed, the basal part tubular, coriaceous, persistent and accrescent-elongating after anthesis (sometimes produced into a rostrum), the apical part coloured and often circumscissile caducous. *Stamens* 2–40, in 1–2 whorls, mostly exserted, sterile in the ♀ flowers. *Ovary* (sub)sessile on a small disk, elongate, narrowed towards the top, smooth; style longer than the ovary, stigma capitate with short lobes or fimbriate, radiating or unilateral. *Anthocarp* coriaceous, often crowned by a limb-rest, smooth or initially with 5(–6) ribs which are not seldom viscid through lengthwise rows of glands which sometimes grow into viscid prickles; sometimes a rostrum is produced; if this is long (up to *c.* 45 cm), it is twisted to the left and has also 5(–6) ribs. *Seed* oblong, with a deep longitudinal furrow and straight embryo; cotyledons recurved and surrounding the perisperm, the latter sometimes reduced to a gelatinous substance.

Distr. About 35 *spp.*, mostly in the Americas (*c.* 20), only 1 pantropical *sp.* in E. Africa, and 2 others in the Malagasian area, few in continental SE. Asia, 8 native in *Malesia*, 2 of which in North and East Australia southwards to New South Wales, Tasmania, and North Island of New Zealand, 5 endemic in Melanesia and Polynesia. Fig. 6.

Taxon. In the latest overall treatment, by HEIMERL (1934) *Pisonia* is still kept apart from *Calpidia*, which was reinstated by HEIMERL (1913), after CHOISY (1849) had reduced it to *Pisonia*. When SKOTTSBERG (1936) replaced the name *Calpidia* THOUARS 1804 by *Ceodes* J. & G. FORST. 1776, HEIMERL followed this (1937); by this *Pisonia* was, in the Old World, restricted to *P. grandis* and *P. aculeata*. The separation of *Ceodes* from *Pisonia* (Oest. Bot. Z. 63, 1913, 20) was mainly based on 3 points: (i) bracteoles at the base of the pedicel in *Calpidia*, apically in *Pisonia*; (ii) perisperm abortive, starch within the embryo, in *Calpidia*, mealy in *Pisonia*; (iii) pollen with 3 pores in *Pisonia*, 4 or more in *Calpidia*.

These characters are not very significant and would better serve for infrageneric rank. However, they are not even constant as HEIMERL himself admitted (*l.c.* 281–282) in stating that the bracteoles in *Pisonia* occur "manchmal auch etwas tiefer", that he found in two *Pisonias* pollen grains with 3 and 4 pores in a single anther, and that in *Calpidia pancheriana* the perisperm is mealy. Curiously HEIMERL failed to recognize that through these observations the distinction of two taxa thus becomes futile. As a matter of fact I could verify that in both *P. aculeata* and *P. grandis* the bracteoles can occur lower on the pedicel, sometimes at different height, and reversely that in some *Calpidias* they may occur up to halfway the pedicel. Furthermore, I found 3- and 4-pored pollen grains in one anther in *P. aculeata*, *P. excelsa*, *P. fragrans*, *P. grandis*, *P. longirostris*, *etc.*

For HEIMERL's supposed differences in habit and distribution, it is sufficient to note that the only species of which the habit is atypical for the genus, *P. aculeata*, is pantropical.

The genera *Rockia* and *Heimerlia* = *Heimerliodendron* were based on insufficient arguments and have been reduced to *Pisonia*. This I have more amply discussed in Blumea 12 (1964) 275 — 284, where also a more complete synonymy is cited.

### KEY TO THE SPECIES

*(mainly for flowering material)*

1. Plants unarmed, erect.
 2. Leaves distinctly petioled.
  3. Inflorescence terminal, at least not cauliflorous or ramiflorous. Perianth lobes not keeled on the inside.
   4. Leaves with distinct dark veins contrasting with lighter coloured intervenium. Nerves and veins hairy beneath. Perianth glandular. Anthocarp with 5 rows of mono-serial prickles.
   **7. P. grandis**
   4. Leaves without distinctly contrasting dark veins, glabrous on lower surface. Perianth never glandular. Anthocarp without prickles.
    5. Perianth lobes truncate. Stamens 3–6. Anthocarp *c.* 5 cm, rostrum *c.* 3 cm.
    **3. P. mülleriana**
    5. Perianth lobes not truncate.
     6. Perianth densely light-brown hairy. Stamens 25–40. Anthocarp with sulcate ribs. New Caledonia.
     **P. artensis** (MONTR.) BARG.–PETR.
     6. Perianth dark-brown hairy, glabrescent. Stamens less than 15. Anthocarp without sulcate ribs.
      7. Perianth 5- or 10-lobed, the lobes short and wide separated by shallow sinuses, the margin as a whole nearly sinuate rather than lobed. Stamens 2 or 4; in ♂ flower longer than the vestigial gynaecium; staminodes in ♀ flower shorter than the gynaecium. Anthocarp with a long rostrum.
      **5. P. diandra**

7. Perianth distinctly 5-lobed. Stamens 5–14.
8. Stamens 6–14. Anthocarp 2–4 cm, with 5 viscid ribs, without rostrum. **1. P. umbellifera**
8. Stamens 5–6. Leaves 18–24 by 7–11 cm. Anthocarp with a rostrum . **6. P. corniculata**
3. Inflorescence cauliflorous, sometimes ramiflorous. Perianth lobes keeled on the inside. Stamens 13–15. Anthocarp 7 cm long, not viscid . . . . . **2. P. cauliflora**
2. Leaves (sub)sessile, elliptic to obovate, tapering towards the base. Flowers densely hairy, with truncate lobes. Stamens 5. Anthocarp smooth when mature, rostrum 10–40 cm . **4. P. longirostris**
1. Plants spinose, climbing. Perianth limb with 5 large lobes, alternating with 5 smaller ones. Anthocarp with 5 rows of biserial prickles . . . . . **8. P. aculeata**

KEY TO THE SPECIES
(*mainly for fruiting specimens*)

1. Unarmed shrubs or trees. In dioecious *spp.* ♂ and ♀ flowers of similar shape. Perianth lobes 5 (but see *P. diandra*).
2. Perianth with 5 rows of black glands slightly concealed by a rather dense indument. Anthocarp *c.* 1¼ cm long, with 5 ribs, each soon provided with a row of viscid stiff prickles. Leaves 10–20 by 6–10 cm, with dark or dark-red veins contrasting with a paler intervenium, hairy on the nerves beneath . . . . . **7. P. grandis**
2. Perianth without 5 rows of black glands, sometimes with 5 faint ribs. Anthocarp without prickles. Leaves glabrous beneath.
3. Anthocarp not produced into a rostrum.
4. Inflorescence terminal. Perianth lobes not keeled inside. Anthocarp with viscid ribs. Leaves shorter than 23 cm.
5. Stamens 25–40. Ribs on anthocarp sulcate. Perianth light brown short-tomentose. New Caledonia . . . . . **P. artensis** (MONTR.) BARG.–PETR.
5. Stamens 6–14. Ribs of anthocarp not sulcate. Perianth sparsely short brown hairy or puberulous. **1. P. umbellifera**
4. Inflorescence cauliflorous or ramiflorous. Perianth lobes keeled inside. Ribs of the anthocarp not viscid. Leaves 24–60 cm long . . . . . **2. P. cauliflora**
3. Rostrum of the anthocarp 3–40 cm long.
6. Perianth densely hairy.
7. Buds almost cylindric or at least hardly constricted, not club-shaped. Inflorescential branches very thin. Perianth campanulate, *c.* 5 mm long, lobes not truncate. Stamens 2 or 4. Rostrum (immature) at least 40 cm long, thin . . . . . **5. P. diandra**
7. Buds club-shaped. Inflorescential branches not particularly thin. Perianth lobes truncate.
8. Leaves *c.* 15–24 cm long, rather elliptic; petiole (1–)2–8 cm. Flowers *c.* 4½ mm long. Stamens 3–6. Rostrum *c.* 3–4 cm long, thick (in the only fruiting specimen known). **3. P. mülleriana**
8. Leaves large, *c.* 25–50 cm long, rather obovate-oblong, sessile to subsessile; petiole 0–2 cm, coarse. Flowers *c.* 6 mm long. Stamens 5. Rostrum thin, 10–40 cm long. **4. P. longirostris**
6. Perianth sparsely hairy to puberulous, in bud constricted halfway, in the only specimen known the lower portion thicker than the upper. Stamens 5–6. Rostrum (immature) thin, at least 7 cm long. . . . . **6. P. corniculata**
1. Overhanging woody climber with mostly recurved axillary spines. ♂ and ♀ flowers of different shape. Perianth lobes 10, unequal. Anthocarp provided with 5 biserial rows of viscid prickles. **8. P. aculeata**

**1. Pisonia umbellifera** (FORST.) SEEM. Bonplandia 10 (1862) 154; J. Bot. 1 (1863) 244; KURZ, For. Fl. Burma 2 (1877) 279; F.–VILL. Nov. App. 4 (1880) 167; HEMSLEY, Ann. Bot. 10 (1896) 248; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 307; VAL. Bot. Jahrb. 52 (1915) 102; KANEH. Bot. Mag. Tokyo 45 (1931) 278; MERR. En. Philip. 2 (1923) 134; BOOBERG, Bot. Jahrb. 66 (1933) 6; KANEH. J. Dep. Agr. Kyushu Imp. Un. 4, 6 (1935) 316; HOSOKAWA, J. Jap. Bot. 13 (1937) 202.—*Ceodes umbellifera* J. & G. FORST. Char. Gen. Pl. (1776) 71, t. 71; Prod. (1786) 93 ('*umbellata*'); MERR. & CHUN, Sunyatsenia 5 (1940) 52.—*P. excelsa* BL. Bijdr. 14 (1826) 735; CHOISY in DC. Prod. 13, 2 (1849) 441; MIQ. Fl. Ind. Bat. 1, 1 (1858) 990; Sum. (1860) 14; HOOK. *f.* Fl. Br. Ind. 4 (1885) 711; HEIMERL in E. & P. Pfl. Fam. 3, 1b (1889) 29; RENDLE in Andrews, Monogr. Christm. I. (1900) 158; HEIMERL, Ann. Cons. Jard. Bot. Genève 9 (1901) 197; Denkschr. K. Ak. Wiss. M.–N. Kl. Wien 85 (1910) 280; KOORD. Exk. Fl. Java 2 (1912) 204; MERR. Sp. Blanc. (1918) 139; RIDL. Fl. Mal. Pen. 3 (1924) 3; *non* CORNER, Wayside Trees (1940) 511; CAVACO, Fl. Madagasc. (1954) fam. 68, 10, 12; BACK. & BAKH. *f.* Fl. Java 1 (1963) 272.—*P. brunoniana* ENDL. Prod. Fl. Norf. (1833) 43; CHOISY in DC. Prod. 13, 2 (1849) 441; HOOK. *f.* Handb. New Zeal. Fl. 1 (1864) 229; BENTH. Fl. Austr. (1870) 280; KIRK, For. Fl. New Zeal. (1889) 292, t. 140; BAILEY, Queensl. Fl. (1901) 1215.—*Buginvillia racemosa* BLANCO, Fl. Filip. (1837) 307; MERR. Sp. Blanc. (1918) 139. —

Fig. 4. *Pisonia umbellifera* tree in old leaf-shedding teak forest. E. Tegal (Central Java), 1914.

*Cedrota guianensis* BLANCO, Fl. Filip. ed. 2 (1845) 213; MERR. Sp. Blanc. (1918) 139.—*P. mooriana* F. v. M. Fragm. Phyt. Austr. 1 (1858) 20.—*P. aruensis* BARG.-PETR. Nuov. Giorn. Bot. Ital. n.s. 8 (1901) 618.—*P. gammillii* MERR. Philip. J. Sc. 5 (1910) Bot. 175.—*Calpidia excelsa* HEIMERL, Oest. Bot. Z. 63 (1913) 284.—*Calpidia brunoniana* (ENDL.) HEIMERL, *l.c.* 283.—*P. nishimura* KOIDZ. Bot. Mag. Tokyo 33 (1919) 120; HEIMERL in E. & P. Pfl. Fam. ed. 2, 16c (1934) 125.—*Ceodes excelsa* SKOTTSB. Act. Hort. Gothob. 2 (1926) 231; CHRISTOPH. Bull. Bish. Mus. 128 (1935) 84. —*Ceodes umbellifera* SKOTTSB. Svensk Bot. Tidskr. 30 (1936) 723.—*Ceodes brunoniana* SKOTTSB. *l.c.* 728.—*Heimerlia brunoniana* SKOTTSB. *l.c.* 738. —*Heimerliodendron brunonianum* SKOTTSB. *ibid.* 35 (1941) 364; ALLAN, Fl. New Zeal. 1 (1961) 286.

Shrub or tree to 28 m high, unarmed. *Leaves* opposite, sometimes conferted towards the end of the twigs or in pseudowhorls, ovate- to elliptic--oblong, (6½–)9–23(–31) by (3–)4–11(–13) cm; base acute to rounded; top acute to rounded; petiole ½–4 cm. *Inflorescence* terminal, branched, consisting of many-flowered umbels 3–9 cm through, puberulous or glabrous; peduncle 3½–4 cm. *Flowers* bisexual or unisexual; pedicel 1½–6 mm with 1–3 small bracteoles at the base or higher. *Perianth* 2½–7 mm long, campanulate. *Stamens* 6–14, exserted to 4 mm. Stigma fimbriate; in the ♀ flowers exserted for *c.* 1 mm and in the bisexual flowers *c.* 1½ mm. *Anthocarp* elongate, 2–4 by 0.3–0.35 cm, with 5 viscid ribs; pedicel 0.7–1½ cm. *Seed* 17–20 by 2 mm.

Distr. Cape of Good Hope (*sec.* HEIMERL!), Madagascar, Mauritius, Réunion, Mascarenes, Comores, Andaman Is., Central Cochinchina, Hainan, Formosa, Riu-Kiu Is., throughout *Malesia*, particularly in the eastern part, also in Christmas I. (S of Java), to North Australia, Queensland, New South Wales, Tasmania, and the Pacific: Bonin Is., Micronesia (Palau, Yap, and Truk), Melanesia (Bismarck Arch., Solomon Is., Fiji, Samoa, Tanna, Rapa, Mangareva, Pitcairn, Marquesas, Tubuai Is., Lord Howe I., Norfolk I., and North Island of New Zealand). Fig. 5.

Ecol. Often in coastal places, exposed to wind, both everwet and in monsoon forest, along river--banks, creeks, on sandy clay, sand, and rocks.

Birds are known to have fallen victim when they got too many fruits on their feathers. See KOORD. Med. Lands Pl. Tuin 19 (1898) 563; RIDL. Disp. (1930) 170.

Uses. The natives use the fruits to catch birds, see RIDL. *l.c.* VAN DER PIJL found on the limestone hills at Padalarang sticky clusters of fruits under the tree (Trop. Natuur 22, 1933, 95). BURKILL (Dict. 1935, 1755) mentions that the soft-wooded branches are eaten by elephants.

Vern. Sumatra: *angkola*, *gajam*, *kaju-pisang*, *loening*, *loning*, *luning*; Java: *gendala* or *pědaja*, *kitjar*, *kitjau*, *pulutan* (the latter for the fruit); Philip.: *anilin*, *balagasaha*, *malasa-a*, *padjang-*

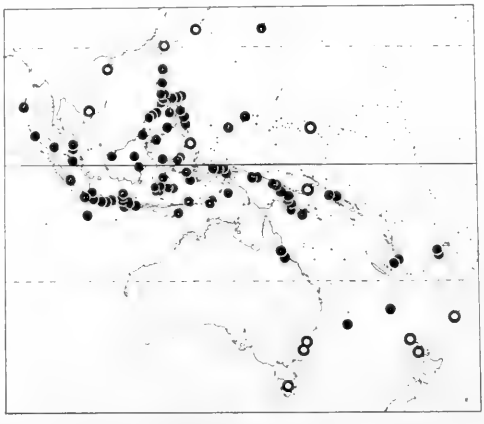


Fig. 5. *Pisonia umbellifera* FORST. Localities in and around Malesia; circled from literature data.

*-labuyo*, Tag., *budubud*, *malasaging*, *tagkuling*, *tampa*, *tkan*, C. Bis., *anuring*, P. Bis., *anuling*, Ting., Tag., Bik., P. Bis., *malagasaha*, Bik., *maklas*, Ilk., *bubog*, Maranao dial.; Celebes: *andruling*, *palindu*, *saungkapaja*; Moluccas: *hares*, Ambon, *dane*, Tanimbar; New Guinea: *kwopen*, *rising*, Nemo dial., *paribui*, *parbu*, Kebar dial., *paperu*, Andjai dial., *fafoni-mo*, Onjob dial., Koreaf, *mugur*, Madang, *map*, Usino, *mal*, Jal., *sigi*, Bembi, *besup*, *bubul*, Momi dial., *doibies*, Berik dial., *bubukwa*, Mamikiong dial., *besobba* or *kesuba*.

Note. For galls on the leaves see DOCTERS VAN LEEUWEN, Zoocecidia (1926) 178.

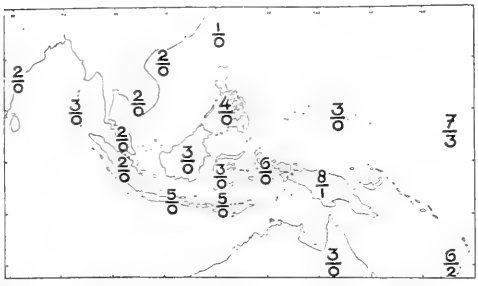


Fig. 6. Distribution density of *Pisonia* in Malesia; above the hyphen the total number of *spp.*, below it the number of endemic *spp.*

**2. Pisonia cauliflora** SCHEFF. Nat. Tijd. N.I. 32 (1873) 417; Ann. Jard. Bot. Btzg 1 (1876) 44; VAL. Ic. Bog. 1 (1897) t. 22; HEIMERL, Oest. Bot. Z. 63 (1913) 20; VAL. Bot. Jahrb. 52 (1915) 102; HOSOKAWA, Trans. Nat. Hist. Soc. Form. 32, *n.* 221 (1942) 104.—*P. major* BAILL. Adansonia 10 (1872) 185.—*Calpidia cauliflora* HEIMERL, Oest. Bot. Z. 63 (1913) 283.

Small tree, 2 m, unarmed. *Leaves* opposite or in pseudowhorls, elliptic-oblong, (4½–)24–40(–55, BAILLON) by (3½–)6–10½ cm, base acute, top acute to obtuse; petiole 1–5 cm. *Inflorescence* cauliflorous, rarely ramiflorous, corymbose-umbellate, laxly branched, 2–5½ by 3–7 cm; peduncle 5–12 cm, rarely puberulous. *Flowers* bisexual, tubular-campanulate; pedicels 6–8 mm with at the base, or higher up, one lanceolate bracteole. *Perianth* 5½ mm long with 5 faint ribs, sparsely hairy; lobes 5, keeled inside. *Stamens* 13–15, exserted for 1½–2 mm; stigma fimbriate, exserted for 2½ mm. *Anthocarp* elongate, 7 cm long, with 5 ribs, not viscid, between the ribs somewhat plicate; peduncle to 16 cm and pedicel to 6½ cm. *Seed* 28 by 2½ mm.

Distr. Micronesia (Marianas), Melanesia (Solomon Is.), in *Malesia*: Lesser Sunda Is. (Timor), Moluccas (Halmahera, Ceram, Ambon), West New Guinea. Fig. 7.

Ecol. Rain-forests, up to 150 m.

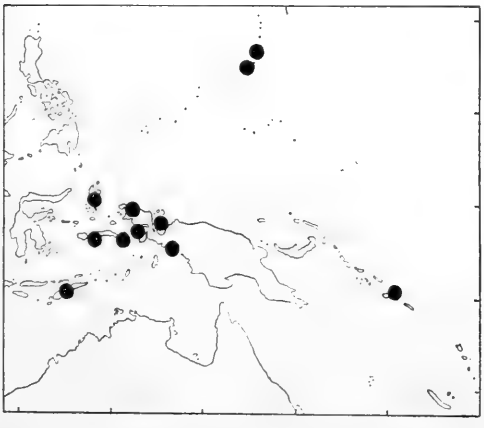


Fig. 7. Localities of *Pisonia cauliflora* SCHEFF.

**3. Pisonia mülleriana** WARB. Bot. Jahrb. 13 (1891) 304, *ex descr.*; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 307; BARG.-PETR. Nuov. Giorn. Bot. Ital. n.s. 8 (1901) 614; VAL. Bot. Jahrb. 52 (1915) 102; RIDL. Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 138.—*Calpidia mülleriana* (WARB.) HEIMERL, Oest. Bot. Z. 63 (1913) 287.—*Calpidia cuspidata* HEIMERL, *l.c.* 284.—*Ceodes corniculata* (*non* BARG.-PETR.) MERR. & PERRY, J. Arn. Arb. 20 (1939) 327, *quoad specim.*

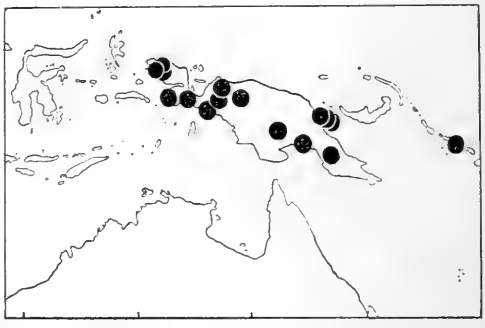
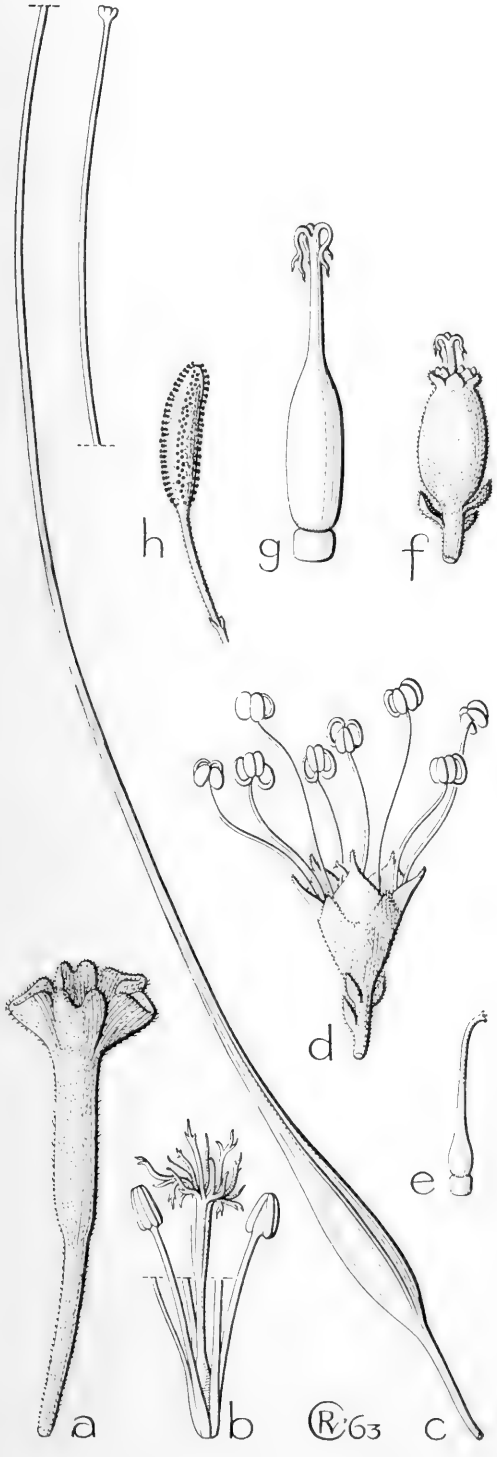


Fig. 8. Localities of *Pisonia mülleriana* WARB.

Shrub or small tree 4–10 m, unarmed, puberulous to glabrous. *Leaves* opposite, elliptic-oblong, 13–30 by 4–14 cm, base acute, top acute to obtuse; petiole 2–8 cm. *Inflorescences* terminal corymbose-umbellate, 3–10 by 5–15 cm, red-brown hairy, peduncle *c.* 7 cm. *Flowers* bisexual, pedicel 2 mm, at its base or higher 2 small acute bracteoles. *Perianth* tubular, *c.* 4½ mm high, lobes 5, truncate. *Stamens* 3–6, not exserted; stigma little fimbriate. *Anthocarp* spindle-shaped, rarely short hairy, with 5 faint ribs, 5 by 0.6–0.8 cm and a rostrum of 3 by 0.3 cm; pedicel 9 mm.

Distr. Melanesia (Solomon Is.) and *Malesia*: New Guinea. Fig. 8.

Ecol. Rain-forests, along rivers on muddy banks. Most records below 100 m; a few from 1000–1500 m.




**4. Pisonia longirostris** TEYSM. & BINN. Nat. Tijd. N.I. 25 (1863) 401; VAL. Ic. Bog. 1 (1897) t. 21; HEIMERL, Oest. Bot. Z. 63 (1913) 20; VAL. Bot. Jahrb. 52 (1915) 102; MERR. En. Philip. 2 (1923) 134.—*P. grandifolia* WARB. Bot. Jahrb. 13 (1891) 303, *ex descr.*; VAL. Bot. Jahrb. 52 (1915) 102.—*P. rostrata* WARB. Bot. Jahrb. 13 (1891) 304, *ex descr.*; VAL. *ibid.* 52 (1915) 102.—*P. spathiphylla* K. SCH. & LAUT. Fl. Schutzgeb. (1900) 308, *ex descr.*; VAL. Bot. Jahrb. 52 (1915) 102.—*P. beccariana* BARG.-PETR. Nuov. Giorn. Bot. Ital. n.s. 8 (1901) 612; HEIMERL, Oest. Bot. Z. 63 (1913) 287.—*P. triandra* BARG.-PETR. Nuov. Giorn. Bot. Ital. n.s. 8 (1901) 610.—*Calpidia grandifolia* HEIMERL, Oest. Bot. Z. 63 (1913) 286.—*Calpidia longirostris* HEIMERL, *l.c.* 287.—*Calpidia lauterbachii* WARB. *ex* HEIMERL, *l.c.* 286.—*Calpidia spathiphylla* HEIMERL, *l.c.* 288.—*Calpidia rostrata* HEIMERL, *l.c.* 288.—*Ceodes longirostris* MERR. & PERRY, J. Arn. Arb. 20 (1939) 328.—*Ceodes urocarpa* MERR. & PERRY, *l.c.* 328.—**Fig. 9a–c.**

Tree up to 30 m, unarmed. *Leaves* opposite or in pseudo-whorls or conferted towards the end of the twigs, (sub)sessile, glabrous, elliptic to oblong or obovate, (16–)25–50(–78) by (8–)10–15(–25) cm, base acute, top acute, obtuse, or obtusely-acuminate. *Inflorescences* many-flowered, dichasial umbels, 5–25 cm ø, red-brown hairy; peduncle axillary, 7½–22 cm. *Flowers* unisexual; pedicels 2–5 mm with 1–3 bracteoles, oblong-acute. *Perianth* tubular, *c.* 6 mm long, narrowed towards the throat, limb cup-shaped, *c.* 2½–3 mm long, about halfway incised with 5 truncate lobes. *Stamens* never exserted; in ♂ flowers mostly 5 and in ♀ sterile. Stigma fimbriate, filling the bottom of the limb. *Anthocarp* spindle-shaped, when young with faint ribs, later on smooth, *c.* 5 by 0.9 cm, passing into a slender rostrum 10–40 cm long at maturity twisted to the left; peduncle not elongated; pedicel *c.* 5 mm long. *Seed c.* 32–35 by 6–7 mm.

Distr. Melanesia (New Britain, Solomon Is.), in *Malesia*: Lesser Sunda Is. (Timor), Philippines (Sulu Arch., Jolo I., *sec.* MERRILL), Moluccas (Halmahera, Buru, Key & Aru Is.), New Guinea. Fig. 10.

Ecol. Swampy rain-forest, river-banks, and ridges, on clay or sandy soil, up to 400 m.

Vern. *Dudu*, Halmahera; New Guinea: *bubukwa*, Momi lang., *tohehna*, Orokaiva lang., Mumuni, *epanol*, Wapi lang., Marok, *parbu*, Andjai lang., Kebar Valley; Solomon Is.: *pupisilango*, Ulawa I.

**5. Pisonia diandra** PULLE, Nova Guinea 8 (1912) 629.—*P. micrantha* VAL. Bot. Jahrb. 52 (1915) 102.—**Fig. 3.**

Fig. 9. *Pisonia longirostris* T. & B. *a.* ♀ Flower, × 6, *b.* ovary and staminodes, × 12, *c.* anthocarp, × ⅔.—*P. aculeata* L. *d.* ♂ Flower, × 6, *e.* abortive pistil in ♂ flower, × 12, *f.* ♀ flower, × 6, *g.* ovary in ♀ flower, on receptacle, × 12, *h.* anthocarp, × 2 (*a–c* TEYSMANN, type, *d–e* JACOBS 4724, *f–g* JACOBS 4894, *h* BEUMÉE 1082).

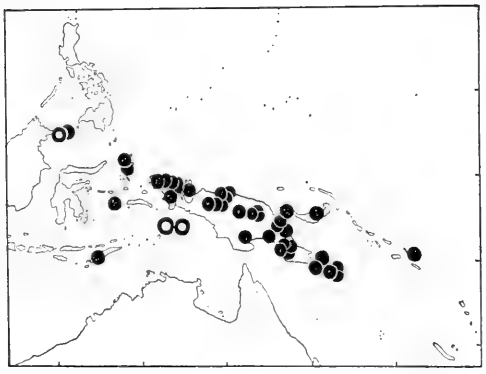


Fig. 10. Localities of *Pisonia longirostris* T. & B.

Tree, 2½–3 m, unarmed. *Leaves* opposite, brown-puberulous when young, glabrescent, elliptic-oblong, (7–)13–16(–20) by 4–7(–10) cm; base acute to rounded, top acute to obtuse; petiole *c.* 2 cm. *Inflorescences* terminal or axillary, 2–10 cm ø, dichasial, few-flowered, fairly lax, brown-hairy; peduncle 2–7 cm; pedicel *c.* 2 mm with two basal minute bracteoles. *Flowers* unisexual. *Perianth* campanulate, 5 mm long, lobes 5 or 10, obtuse, separated by shallow sinuses. *Stamens* 2 or 4, in the ♀ flower sterile and shorter than the gynaecium; in the ♂ flower exserted for 1 mm; thecae ear-shaped. Stigma fimbriate, just exserted. *Anthocarp* (immature) sparsely hairy, *c.* 8 cm long with 5 faint ribs and a rostrum of *c.* 40 cm; peduncle up to *c.* 11 cm; pedicel to *c.* 1½ cm.

Distr. *Malesia*: New Guinea.

Ecol. Rain-forests, on river-banks, on sandy clay, 45–630 m.

**6. Pisonia corniculata** BARG.–PETR. Nuov. Giorn. Bot. Ital. n.s. 8 (1901) 615, t. 11.—*Calpidia corniculata* HEIMERL, Oest. Bot. Z. 63 (1913) 283. —*Ceodes corniculata* MERR. & PERRY, J. Arn. Arb. 20 (1939) 327, *pro nomen.*

Shrub to 3 m, unarmed. *Leaves* opposite, elliptic-oblong, 14–19(–24) by 5–8(–10) cm, base and top acute; petiole 1–3 cm. *Inflorescence* axillary, cymose-dichasial, brown-hairy to glabrous; peduncle 1–1½ cm. *Flower* buds tubular, constricted in the middle, unisexual; pedicel 1–2 mm; bracteole 1, lanceolate, basal. *Perianth* 5-lobed. *Stamens* 5–6; in the ♀ flower sterile and shorter than the gynaecium. Stigma fimbriate. *Anthocarp* (immature) elongate, *c.* 4 cm long, sparsely hairy to glabrous; rostrum *c.* 7 cm; pedicel 2 cm long.

Distr. *Malesia*: Moluccas (Batjan I., *sec.* HEIMERL), West New Guinea (Vogelkop).

Ecol. Primary forests, along creeks, on limestone and sandy clay, up to 100 m.

Notes. In the holotype of BECCARI 650 (FI) I cannot find 8 stamens as BARGAGLI–PETRUCCI has described. His fig. 11 is also not correct with regard to the filaments. This specimen has only buds and young fruits.

BRASS 6789 from the Fly River in New Guinea, cited by MERRILL & PERRY under their new combination, actually belongs to *P. mülleriana* WARB.

**7. Pisonia grandis** R. BR. Prod. Fl. Nov. Holl. 1 (1810) 422; ENDL. Ic. Gen. Pl. (1838) t. 30; CHOISY in DC. Prod. 13, 2 (1849) 441; SEEM. J. Bot. 1 (1863) 245; HEIMERL in E. & P. Pfl. Fam. 3, 1b (1889) 20; Ann. Cons. Jard. Bot. Genève 9 (1901) 197; RIDL. J. Str. Br. R. As. Soc. 45 (1905) 215, 268; MERR. En. Philip. 2 (1923) 134; GILBERT, Austr. Zool. 4 (1926) 210–226; KANEH. Bot. Mag. Tokyo 45 (1931) 278; HEIMERL in E. & P. Pfl. Fam. ed. 2, 16c (1934) 126; F. B. H. BROWN, Bull. Bish. Mus. 130 (1935) 74; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 78, p. 5, *incl. var. sylvestris* (TEYSM. & BINN.) HEIMERL *in sched.*; ST. JOHN, Webbia 8 (1952) 225; SHAW, Kew Bull. (1952) 87; FOSB. Am. J. Sc. 225 (1957) 584; BACK. & BAKH. *f.* Fl. Java 1 (1963) 272; VAN BALGOOY, Pac. Pl. Areas 2 (196.) map 66 + text; GILHAM, Proc. R. Soc. Queensl. 73 (1963) 79–92.—*Olus album insulare* RUMPH. Herb. Amb. 1 (1741) 193, t. 79, f. 1.—*Olus album* RUMPH. *l.c.* 191, t. 78.—*Cordia olitoria* BLANCO, Fl. Filip. (1837) 123.—*P. procera* BERTERO *ex* GUILL. Zephyr. Taitensis (1837) 39.—*P. alba* SPAN. Linnaea 15 (1841) 342; MIQ. Fl. Ind. Bat. 1, 1 (1858) 990; HOOLA VAN NOOTEN, Fl. Fr. Feuill. Fl. Java (1863) t. 31; TEYSM. Nat. Tijd. N.I. 34 (1874) 464; HOOK. *f.* Fl. Br. Ind. 4 (1885) 711, *p.p.*; K. & V. Bijdr. 7 (1900) 123; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 307; BRANDIS, Ind. Trees (1906) 517; KOORD. Exk. Fl. Java 2 (1912) 204; Atlas (1914) t. 324; VAL. Bot. Jahrb. 21 (1915) 102; MERR. Sp. Blanc. (1918) 139; En. Philip. 2 (1923) 133; CORNER, Wayside Trees ed. 2, 1 (1952) 510, t. 159.—*P. macrophylla* (BOJ.) CHOISY in DC. Prod. 13, 2 (1849) 446; BAKER, Fl. Maurit. & Seychell. (1877) 262.—*P. morindifolia* R. BR. *ex* WIGHT, Ic. (1852) t. 1765.—*P. sylvestris* TEYSM. & BINN. Nat. Tijd. N.I. 9 (1855) 355; *ibid.* 11 (1856) 118, 188; *ibid.* 32 (1873) 73; WIGMAN, Teysmannia 2 (1891) 148; K. & V. Bijdr. 7 (1900) 123; KOORD. Exk. Fl. Java 2 (1912) 204; Atlas (1914) t. 323.—*P. inermis* (*non* JACQ.) FORST. *ex* SEEM. J. Bot. 1 (1863) 245; VIDAL, Syn. (1883) 36, t. 76, f. c.—*P. excelsa* (*non* BL.) CORNER, Wayside Trees (1940) 511.—**Fig. 11, 13.**

Shrub or tree to 30 m high, puberulous to nearly glabrous. Twigs light coloured, when dry with conspicuous furrows and large leaf-scars. *Leaves* opposite, mostly membranacous, elliptic, oblong, or ovate, (7–)10–20(–30) by (4–)6–10 (–15) cm, with red or dark coloured veins; top acute to bluntly acuminate; base acute, rounded or cordate, mostly unequal; leaves puberulous, glabrescent, tardily so on the nerves beneath; petiole 1–6 cm. *Inflorescences* terminal consisting of rather approximate cymose clusters, 1¾–3½ by 3–4½ cm; peduncle 1½ cm, light brown hairy. *Flowers* bisexual; pedicel 1–1½ mm, at the top or lower with 2–4 oblong bracteoles.

Fig. 11. *Pisonia grandis* forest on P. Sepoi (Malaya), grey trunks on granite rocks forming a belt of the Barringtonia formation, just out of reach of the waves (CORNER, 1935).

*Perianth* funnel-shaped, *c.* 4 mm, 5-lobed, with 5 rows of black glands. *Stamens* 6–10, exserted for 2 mm. Stigma fimbriate, not exserted. *Anthocarp* elongate to club-shaped, 12 by 2½ mm, with 5 ribs each bearing a row of viscid prickles 1 mm long, hairy between the ribs; after anthesis the pedicel 1–1½ cm and peduncle 3 cm. *Seed* 9–10 by 1½–2 mm.

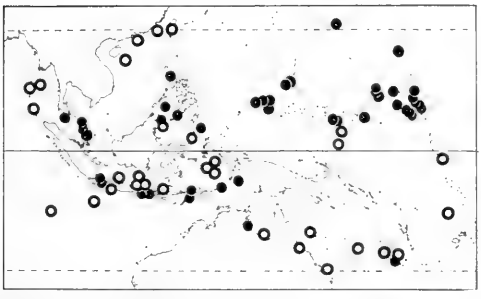


Fig. 12. Localities in and round Malesia of *Pisonia grandis* R. BR.; circles denote data derived from literature.

Distr. Madagascar, Mascarenes (Frigate I., Rodriguez I.), Seychelles, Laccadive and Maldive Is., Ceylon, India, Andaman Is., Nicobar Is., Parcel & Pratas Is. in the S. China Sea, E. Formosa, throughout *Malesia* (not in Sumatra) to Australia: islands in Carpentaria Gulf, NE. Queensland, Turtle Islet, Chesterfield Is., Capricorn Is., and the Pacific: Micronesia (Marianas, Carolines), Marcus I., Wake I., Marshall Is., Gilbert Is., New Caledonia, Loyalty Is., Polynesia (throughout, but not in Hawaii).

Ecol. On dry to semi-dry places, along coasts, sandy or rocky, up to 1200 m, on oceanic islets and atolls often dominant.

CORNER noted (under the erroneous name *P. excelsa*) that it is a medium-sized, deciduous tree shedding its leaves between April and August and flowering with the new foliage on the East coast of the Malay Peninsula where it grows best on the small granite islands in the neighbourhood of P. Tioman, being also abundant in the town of Kuala Trengganu. See fig. 11. Flowers are fragrant.

Dispersal is effected through the sticky anthocarps which attach themselves to birds, and birds are known to have fallen victim when they got too many fruits on their feathers. See also P. A. GILBERT, Austr. Zool. 4 (1926) 210–226. For the explanation of the peculiar distribution which is

largely confined to small islands, a feature which has intrigued many botanists since RUMPHIUS, AIRY SHAW recently advanced in an interesting solution, following observations by CHRISTOPHERSEN on Palmyra I. (Bull. Bish. Mus. 44, 1927). He suggested that, besides for dispersal, *P. grandis* can only grow well and maintain itself in quantity on the peculiar highly phosphatic limestone with acid reaction formed by accumulating guano of the birds. Such edaphic condition is only formed on coral and coral debris under bird colonies. The bird colonies, again, find on small islets a refuge from predating animals and man and prefer such places above nesting on large islands. If storms or other circumstances force the bird colonies to abandon the site, and the supply of guano is interrupted, *P. grandis* will gradually disappear or become rare as it seems unable to regenerate without phosphate-enriched soil. On the small rocks south of Nusa Kambangan (S. Java) KOORDERS (1918) could only locate 2 poor specimens, although 50 years earlier *c.* 20 specimens were reported from the same rock. See also FOSBERG, Pacif. Sc. 3¹ (1949); Atoll Research Bull. 2 (1951); Am. J. Sc. 255 (1957) 584.

*Vegetation. P. grandis* is a characteristic constituent of the *Barringtonia* formation; associates are frequently *Calophyllum*, *Cocos*, *Cordia*, *Erythrina*, *Guettarda*, *Messerschmidia*, *Pandanus*, *Pemphis*, *Scaevola*, and *Thespesia*. It gains especial importance on small low coral islands which are entirely covered by this type. Old trees may attain a considerable dimension, with a trunk to 2 m ø. The root system is shallow, the wood very brittle, and the massive crown with huge straggling branches so vulnerable to wind that such groves or fringes may easily fall a victim to heavy storms. However, it is observed that hollow rotted trees may produce shoots, and overleaning branches produce suckers. *Pisonia* is consequently preferring leeward faces of islets. See GIBSON-HILL, Bull. Raffl. Mus. 22 (1950) 11–28 on Cocos & Keeling Is., from where DARWIN already reported *Pisonia* groves. If on such islets the other species are lower than *Pisonia* it will take complete dominance. As it is shade intolerant, it will gradually be replaced by higher trees where such are present, and then represent a seral type. See M. E. GILHAM, Proc. R. Soc. Queensl. 73 (1963) 79–92.

In Malesia groves are reported from Zuidwachter I. (Djakarta Bay) by J. J. SMITH (Teysmannia 18, 1907, 452), Karimondjawa Is. (Nat. Tijd. N.I. 11, 1856, 118), Bali and Alor (*ibid.* 34, 1874, 464), Tjělagen islet in the Lèpar group (*ibid.* 32, 1873, 73) and Pombo islet in Ambon Bay (*ibid.* 37, 1876, 138–139); H. G. KEITH reported it from Sibuan islet near Tawao in North Borneo (*cf.* SHAW), and MERRILL stated that on Bancoran I., due East of S. Palawan, *Pisonia* covered the islet to the exclusion of all other trees (En. Philip. 2, 1923, 134). HOOGERWERF found pioneer dominance on the bird-inhabited low volcano G. Api (Banda Sea) (Trop. Natuur 28, 1939, 30, 83, f. 2, 85, 109, f. 2, 133. 134, 137).

Fig. 13. The "Moluccan cabbage" tree, an almost echlorophyllose cultigen of *P. grandis*, described as *Pisonia alba* SPAN. Cult. Hort. Bog.

Uses. Native people sometimes use the sticky fruits to catch birds. In Bali the tree is used for hedges and on several other islands the leaves are eaten as a vegetable, specially of the cultivated race with creamy or yellowish chlorotic leaves described as *P. alba*, the so-called *Moluccan cabbage*. Fig. 13. This cultigen is propagated by cuttings; it is very rarely producing flowers. See RUMPHIUS (1741), KOORDERS (1912), HEYNE, Nutt. Pl. (1927), and BURKILL, Dict. (1935).

Vern. Malay Peninsula: *saudi kivai*, Tamil, *mungkudu java*, m, *kĕmudu* or *mĕngkudu*, *k. sĕlat*, *k. siam*, Trengganu; Java: *kellor tree*, *kol-banda*, *sajur putih*, M, *widjojo kusumo*, J (see note); Borneo: *buluh*; Celebes: *daon bulan*; Talaud I.: *buran'a*; Ternate: *hate-bula*; Ambon: *ay-putih*, *sajur putih*; Bali: *dagdag sèé*, *sel* or *sirea*; Bima: *sabe*; Banda: *talla*; Philippines: *koles maluko*; Marianas: *umum*, Saipan; Enirik I.: *kanal*; Back I.: *kangl*; Moch I.: *mök* or *muök*; Aoman I.: *kanae* or *kangae*; Lukunor I.: *mük*; Vanua Levu (Fiji): *talatalambia*; Caroline I.: *mokh*, Ulithi Atoll, *puka*, Sinukutai I.

Notes. SEEMANN's reference to a *Pisonia inermis* FORST. is erroneous, since FORSTER, in his Prodromus (1786) 75, referred to MURRAY, Syst. Veg. ed. 14 (1784) 920, who cited *P. inermis* JACQ. Sel. Stirp. Amer. Hist. (1763) 275, a species which has nothing to do with *P. grandis*.

FORSTER's MS notes on his "*P. inermis*" were published by GUILLEMIN (1837) as *P. procera*, which belongs to *P. grandis*.

*Ethnobotany*. In Javanese mythology this species is well known by its vernacular name *widjojo kusomo* and is still used in the wayang shows. TEYSMANN clarified the haze of mystery round this sacred plant which nobody was to gather or possess on the penalty of death. Only for the coronation of the Sultan of Solo (Surakarta) flowers were collected from the only place known in Java, *viz* specimens on top of two very small coral rocks before the south coast of the large island Nusa Kambangan in South Central Java. The proceedings of this ceremony were described from 1893: a legation of sixty persons, directed by a priest, climbed the rock on a ladder erected in a boat, and placed the flowers (their number would be proportional with the number of prosperous years in the reign of the new prince) in a golden box, enveloped in Bengal silk. This was placed in a decorated box on two bars and held in shade with a golden payong (umbrella) on the voyage back. On arrival, the flowers were placed on the flat opened hands of the sultan, who took them to the room of sacred objects. It is also said that the wife of the sultan has to eat the flower during pregnancy, in order that the child shall be a son, and victorious, as is the meaning of the name *widjojo kusomo* as derived from Sanskrit.

In 1854 TEYSMANN received cuttings from this same locality which he grew in the Bogor Botanic Gardens on which he based his *P. sylvestris*. Later the same form was also found in the island of Bali, and in a few small islets of the Karimondjawa group (North Central Java) and in the Bay of Djakarta.

How the esteem for this plant – which does not possess any special fragrancy or showy characters – originated is not clear. It may be its extreme rarity in Java and its isolation on top of an otherwise naked rock.

*Literature about this subject*: TEYSM. Nat. Tijd. N.I. 9 (1855) 349; *ibid.* 11 (1856) 118, 188; MIQ. Fl. Ind. Bat. 1, 1 (1858) 990; TEYSM. Nat. Tijd. N.I. 32 (1873) 73; VETH, Java ed. 1, 1 (1875) 45; DE WOLFF VAN WESTERRODE, Tijd. Kon. Ned. Aardr. Gen. (1894) 915; HOEVENAARS, Ann. Jard. Bot. Btzg Suppl. 2 (1898) 153; K. & V. Bijdr. 7 (1900) 12; BLAAUW, De Tropische Natuur ed. 2 (1917) 76, f. 11; KOORD. Album Natuurmon. (1918) t. 2; KOOPER, Ned. Ind. Oud & Nieuw 18 (1933) 477.

**8. Pisonia aculeata** LINNÉ, Sp. Pl. (1753) 1026; LAMK, Ill. (1800) t. 861; ROXB. Fl. Ind. 2 (1832) 217; CHOISY in DC. Prod. 13, 2 (1849) 440; WIGHT, Ic. (1852) t. 1763–1764; BENTH. Fl. Austr. 5 (1870) 279; BAKER, Fl. Maurit. & Seychell. (1877) 263; HOOK. *f.* Fl. Br. Ind. 4 (1885) 711; HEIMERL in E. & P. Pfl. Fam. 3, 1b (1889) 20; FORB. & HEMSL. J. Linn. Soc. Bot. 26 (1891) 317; HEIMERL, Bot. Jahrb. 21 (1896) 631; BAILEY, Queensl. Fl. 4 (1901) 1214; BAKER & WRIGHT, Fl. Trop. Afr. 6, 1 (1913) 8; MERR. Sp. Blanc. (1918) 139; MERR. En. Philip. 2 (1923) 133; RIDL. Fl. Mal. Pen. 3 (1924) 3; BOOBERG, Bot. Jahrb. 66 (1933) 6; HEIMERL in E. & P. Pfl. Fam. ed. 2, 16c (1934) 127; GAGNEP. Fl. Gén. I.–C. 4 (1936) 1052; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 78, p. 5; MEYER DREES, Comm. For. Res. Inst. *n.* 33 (1951) 91; CAVACO, Fl. Madagasc. (1954) fam. 68, 10, f. 2; BACK. & BAKH. *f.* Fl. Java 1 (1963) 272.—*P. mitis* LINNÉ, Sp. Pl. 2 (1753) 1026.—*P. limonella* BL. Bijdr. 14 (1826) 735.—*P. villosa* POIR. in Lamk, Enc. Méth. Bot. 5 (1804) 347; MIQ. Fl. Ind. Bat. 1, 1 (1858) 989.—*P. anisophylla* HASSK. Hort. Bog. Descr. 1 (1858) 85.—**Fig. 9d–h.**

Overhanging climber to 20 m high, with mostly recurved, axillary thorns ½–1 cm long (abortive shoots). *Leaves* (sub)opposite, elliptic, 4–10 by 1¼–5 cm, base acute, top obtuse, puberulous or glabrous; petiole ½–2½ cm. *Flowers* unisexual in dense, cymose, axillary inflorescences, brown short-hairy, 1–2½ cm ø. Peduncle 1½–3 cm. Bracteoles 1–3, oblong at the base of the receptacle to halfway on the pedicel; pedicel 1–1½ mm. ♀ *Flower* campanulate, urceolate, 2 by 1¼ mm, androecium completely abortive. ♂ *Flower* funnel-shaped, 3 mm ø; stamens 8, exserted for ½–1 mm. Limb with 5 larger lobes (only in the ♂ flower recurved) which alternate with 5 smaller ones; opposite the latter 5 rows of black stalked glands on the outside of the perianth. Stigma fimbriate, 1–1½ mm exserted. *Anthocarp* club-shaped, 15 by 2–2½ mm, puberulous, with 5 ribs each bearing a biserial row of glandular appendages which grow out to soft viscid prickles *c.* 1½ mm long; pedicel 2–2½ cm. *Seed* 9–11 by 2–2½ mm.

Distr. (Sub)tropical America, Africa (west and east coasts), Madagascar, Mauritius, Seychelles, Ceylon, India (Deccan, Coromandel, S. Concan), Andaman Is., Burma (Tenasserim), Indo-China (Tonkin, Annam, Laos, S. Cochinchina), Hainan, Formosa, throughout *Malesia*: Central Sumatra, Malaya, Java, Lesser Sunda Is. (Bali, Sumbawa, Sumba, Flores, Timor, Alor, Wetar), North Borneo, Philippines (Luzon to Mindanao), Celebes (SW. and SE.), SW. New Guinea to Australia (N. Arnhem Land, Queensland, New South Wales), and New Caledonia.

Ecol. Along coasts, in hedges, rain-forest and

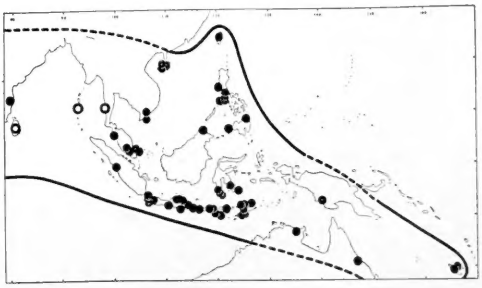


Fig. 14. Localities in Indo–Malesia of *Pisonia aculeata* L. showing clear preference for the climatically drier areas.

semi-dry places, forming impenetrable masses on forest edges reduced to a low straggling bush in open places, from the lowland up to 500 m.

Vern. *Alar*, M; *tjuhun-lamarang*, S. Bantam; *rampari*, Sumba; *matai-alât*, Alor.

Notes. If one or two peduncles and a spine occur in the same leaf-axil, their position is collateral, either near the spine or upon the base of a spine. Occasionally there is only one peduncle in a leaf-axil.

In the Linnean Herb. Cat. no. 1236 there is added on no. 4 "JACQ. amer. 275". This specimen, however, has nothing to do with *P. inermis* JACQ. Sel. Stirp. Amer. Hist. (1763) 275 and belongs to *P. aculeata* L.

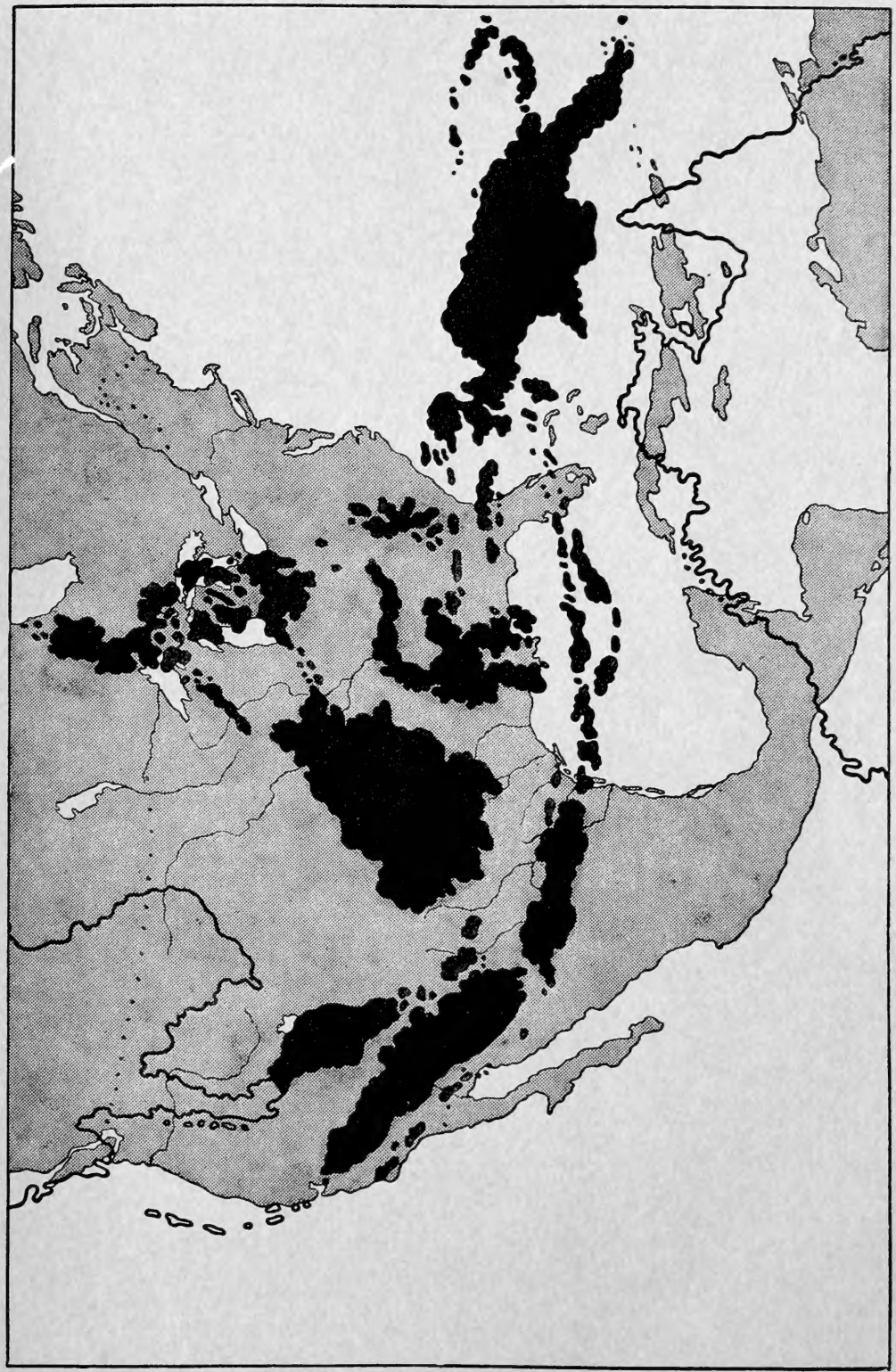
For leaf-galls see DOCTERS VAN LEEUWEN, Zoocecidia (1926) 178.

In America, probably its fatherland, *P. aculeata* seems to be a variable species and my impression is that several extremes have been described as species which do not deserve that status.

### Excluded

*Pisonia membranacea* K. SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 43; from New Guinea. – According to WARBURG, Bot. Jahrb. 13 (1891) 303, this is a mixtum with flowers of *Pisonia* but leaves and twig of another plant, that is discordant elements. The name is for this reason illegitimate and should be omitted.

*Pisonia lineatipilum* C.DC. in Lorentz, Nova Guinea 8, 6 (1914) 1009, was in the Index Kewensis recorded under *Pisonia* instead of under *Piper*, where it belongs.



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