FLORA MALESIANA

UNDER THE AUSPICES OF
THE BOTANIC GARDENS OF INDONESIA, BOGOR,
AND THE RIJKSHERBARIUM, LEYDEN
CELASTRACEAE—II¹ (Ding Hou, Leyden)

The family Hippocrateaceae was established by A. L. de Jussieu (Ann. Mus. Hist. Nat. Paris 18, 1811, 486, as Hippocrateae) 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 obiterated 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: isomeric flowers in Celastraceae and anisomeric 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 Hipppocrateaceous 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, i.e. Later authors have arranged it, however, unanimously with the Celastraceae, because of its arboreous habit, capsular fruit, and isomeric stamens. Properly it should be marked as a transitional link.

The African genus Campylostemon has also proved to be such a link, since Lawarlée has described the structure of its fruit (Bull. Jard. Bot. Brux. 18, 1947, 250-254). Its flowers fit Celastraceae and are isomeric, but its capsular fruit is similar to that of the Hippocratea group. Lawarlée found the fruit characters more important than the isomeric 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.

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 floral characters, 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 its 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 to whether the anatomy of Celastraceae is rather heterogenous. 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 hypogal germination; he found this in Salacia (2 spp. observed), Cuverea (1 sp.), Simirestis (1 sp.) and Loeiseriella (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.

(1) The numbering of the genera in the key in part I, I.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 . Celastrus
8. 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 . 1. Celastrus
10. Ovary 4-celled, each cell with c. 10 ovules arranged in two series. See vol. 6, p. 243 . 3. Xyloonymus
11. Ovule 1 in each cell. See vol. 6, p. 245 . 2. Euonymus
12. Ovule 1 in each cell. See vol. 6, p. 254 . 4. Glyptopetalum
13. Ovary 3-celled. Ovules (4–6–)8–18 in each cell. 5. Glyptopetalum
14. Petals contorted, without appendage. See vol. 6, p. 258 . 6. Kokoona
15. Petals imbricate, usually with appendages on the inner side, very rarely naked. See vol. 6, p. 262 . 7. Lophopetalum
16. Ovary 2-celled, or 1-celled by abortion (*Pleurostylia*). Ovules 2 in each cell. 8. Microtropis
17. Disk more or less flat. Anthers subglobose and rounded at the apex, connective invisible on the dorsal side. See vol. 6, p. 284 . 9. Cassine
18. Disk cupular. Anthers ovoid and short-apiculate, connective distinct and broad on the dorsal side. See vol. 6, p. 287 . 10. Cassine
19. Pistil hollow in the apical part (best observed in a longitudinal section of the flower). 11. Pleurostylia
22. Stamens 3, rarely 2.
23. Calyx distinctly 5-lobed even at very young stage, spreading at anthesis.
24. Flowers in axillary fascicles . 17. Salacia
25. Flowers in axillary cymes, or terminal thyres, or panicles.
26. Inflorescences with short, supplementary branchlets in the dichotomies or in the axils of branches. Disk inconspicuous . 16. Reissantia
27. Inflorescences without short, supplementary branchlets as above. Disk conspicuous.
28. Petals subcoriaceous when dry, densely puberulous outside, subvalvate or the margins slightly overlapping . 15. Loeseneriella
29. Petals thin, rarely slightly fleshy, glabrous, imbricate, the margins much overlapping . 17. Salacia
30. 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
4. Cotyledons free . 16. Reissantia
5. Fruits otherwise. Seed wingless, or with an apical wing (*Kokoona*), or the wing surrounding the seed proper (*Lophopetalum*).
6. Leaves with crossbar-like veins between the nerves; petiole thickened at the apex beneath. See vol. 6, p. 280 . 9. Bhesa
7. Leaves with reticulate veins; petiole not thickened at the apex beneath.
8. Leaves spirally arranged or alternate.
9. Fruits less than 1/3 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.  
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.
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 laterali 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. vineria 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 ½, 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.

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, × 2/3, 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, × 2/3, g–h. ditto, longitudinal and cross-sections, × 2/3, i. seeds, × 2/3, j. columella, × 2/3 (a–b, d–e BRASS 8954, c BRASS 8889, f–i BW 5513, j NGF 9587).

Phylogenetic 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 alburnous 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. Pedicule 0–1 cm. Bracts triangular, 1–1½ mm long. Pedicels 5–8 mm. *Flowers* red or purplish red. *Calyx* lobes triangular, ½–¾ mm long. *Petals* ovate, 1½–2½ by ¾–1½ mm, short-acuminate. *Disk* ½–1½ 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.


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**


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 stamnodes; anthers latroso, 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, alburnous; 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 obsolete 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**

Fig. 24. Siphonodon celastrineus Griff. a. Habit, \( \times \frac{2}{3} \), b. opening bud, \( \times 4 \), c. young flower, with petals removed, \( \times 8 \), d. ditto, section, \( \times 8 \), e. petal, \( \times 8 \), f. stamen, \( \times 8 \), g. fruit, \( \times \frac{2}{3} \), h-i. ditto, longitudinal and cross-sections, \( \times \frac{2}{3} \).—S. peltatus Ding Hou. j. Flower seen from the top, calyx lobes and petals removed, \( \times 8 \), k. stamens, \( \times 8 \), l. flower, in section, \( \times 8 \) (a-f SAN 18729, g-i Kostermans 5860, j-l Carr 13908).


Tree up to 35 m by 90 cm \( \varnothing \), 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 \( \frac{1}{2}–1 \frac{1}{2} \) cm. Inflorescences cymose or umbelliform, (1–)few–(∞)-flowered. Peduncle \( \frac{1}{2}–1 \frac{1}{2} \) 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, \( 2 \frac{1}{4}–3 \frac{1}{2} \) by \( 1 \frac{1}{4}–2 \frac{1}{2} \) mm, obtuse. Stamens c. 1 mm; filaments flat, united at the lower \( \frac{1}{2} \) or near the base; anthers usually perpendicularly bent inward in bud. Pistillar body usually ± semi-globose, sometimes ± short conical, occasionally with 5
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. 25. Siphonodon celastrinens Griff., Bulolo logging area, New Guinea, 900 m alt. (NGF 15080; photogr. P. van Royen, 1962).

Fig. 26. Distribution of Siphonodon celastrinens 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, Inisia (scattered), Pometia, Ficus, and Nauclea (Bloembergen, 1939).

Vern. Java: danoklot kipu, karangasam, têdto, wanitam, wêlaham, 1, ki putri, ki singgukah kaju, S. laungghadeung, Md; Lesser Sunda Is., Flores: oëkapa, Endeh I.; Borneo: kalantaid, North Borneo, tulang, Dajak; Celebes: indohe hapoëte, Muna, kalawalan, Menado, kapupukina, Muna; Moluccas: tua, Sula Is.; New Guinea: aruai, Japen, mobiek, pieh, Kêbar 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. celastrinens by its pyriform fruit. However,
I have seen pyriform fruits in several specimens of *S. celastrinus*, e.g. KOORDER 1122/8 (BO) from Java. My hesitation to reduce *S. pyriformis* to *S. celastrinus* 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-i.

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 o. ± entire, with 3 faint, slightly branched veins. Petals suborbicular, c. 3 mm o, 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.


Ecol. In forest at c. 1650 m.

15. *LOESENRIELLA*


Liana, or scandent rather 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 androgyphon (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 ½–⅓ 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 ½–¾ 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, 1–1½ 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 papilllose 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-ovate-oblong, 1–2 by \( \frac{1}{2}-\frac{3}{4} \) cm; wing at one end, membranous, ovate to ovate-oblong, or elliptic, 2–4 by \( \frac{1}{4}-\frac{3}{2} \) cm, with conspicuous submedian and marginal nerves.)

**L. pauciflora**


Liana. Stipules ± intrapetiolar, lanceolate, \( \frac{3}{4}-1 \) 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, \( (5\frac{1}{2})-10-20\frac{1}{2} \) by (3–)5–8 cm; base obtuse, cuneate; apex acute, short-acuminate to acuminate; margin subentire rarely slightly crenulate; nerves 6–8 pairs; petiole \( \frac{1}{2}-1 \) 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 \( \frac{3}{4}-3 \) cm. Bracts deltoid, c. \( \frac{1}{2} \) 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, 1–1\( \frac{1}{2} \) mm long, puberulous outside. Petals ovate-oblong, \( 4\frac{1}{2}-6\frac{1}{2} \) by \( 1\frac{1}{2}-2\frac{1}{2} \) cm, densely pilose (uniseriate hairs) on the upper half or \( \frac{3}{4} \) inside and on the margins. Disk annular-pulvinate, \( 1\frac{1}{2}-2 \) mm, or \( \frac{3}{4}-2\frac{1}{2} \) 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 2–3\( \frac{1}{2} \) cm. Seeds (incl. wing) ovate-oblong, \( 3\frac{1}{2}-6 \) by \( \frac{1}{2}-1 \) cm.

Distr. From New Ireland (W. coast), the Solomon Is. (New Georgia group), and the New Hebrides (Santa Cruz group) to Ceylon; in Melasia: Sumatra (Indragiri, Palembang), Riouw (P. Durian), Malay Peninsula (Perak, Selangor, Pahang, Johore, Singapore), Banka, Central Java (Kediri and Kinderez), Borneo (North Borneo, Banjermasin, and Sarawak), SE. and Central Celebes (Kendari and Latooé), 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).


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, \( 5\frac{1}{2}-11 \) by \( 2\frac{1}{2}-4\frac{1}{2} \) cm; base cuneate; apex acuminate; margin crenulate; nerves 5–9 pairs; petiole \( \frac{1}{2}-1 \) cm. Inflorescences 3 or 4 times branched, \( 1\frac{1}{2}-2\frac{1}{2} \) cm long, densely puberulous, ferrugineous. Peduncle 1–2 cm. Bracts triangular, 1–1\( \frac{1}{2} \) mm long. Pedicels 1–3 mm. Flowers yellowish. Calyx lobes semiobovate or triangular, \( \frac{3}{4}-1 \) mm long, puberulous on the outside. Petals ovate-oblong to lanceolate, 4–5 by \( 1\frac{1}{2}-1\frac{3}{4} \) mm, pilose on the upper \( \frac{1}{2}-\frac{3}{4} \) mm and on the margins. Disk annular-pulvinate, \( 1\frac{1}{4}-1\frac{1}{2} \) mm high, \( 1\frac{1}{2}-2 \) mm, or short-pilose at the top, in the basal part before the calyx lobes slightly extended outward and downward. Stamens \( 1\frac{1}{2}-2 \) mm. Pistil 1–1\( \frac{1}{2} \) mm emerging from the disk. Ovules 6–10 in each cell. Follicles obovate, c. \( 4\frac{1}{2} \) by \( 2\frac{1}{2} \) cm, pericarp woody. Seeds (incl. wing) ovate-oblong or lanceolate, \( 3\frac{1}{4}-4 \) by \( 1\frac{1}{2} \) cm.


Ecol. In lowland forests and along mangrove swamp.

Notes. The type of *L. sagerensis* 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

Scandent shrub. Stipules triangular or lanceolate, 1/2–1 mm long, spacious. *Leaves* coriaceous, broad-elliptic or rotund, sometimes ovate, 3–11 by 2½–7½ 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, 1½–4 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 1½–1½ mm, pilose on the upper ½–1½ inside and on the margins. *Disk* annular-pulvinate, c. 1 mm high, 1½–2 mm o, 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

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

**Ecot.** In lowland forests along streams and on limestone.

Notes. **Lawson** in the original description of his new species *Hippeastrum cunningii* cited only *Malacca, Griffiinth.—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.l.), from the Horta. Bog. of unknown provenance; it bears both flowers and mature fruits. The flowers of this specimen are similar to those of other specimens.

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 dehisc 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. Inflorences dichotomous-cymose, usually with supplementary branchlets in the dichotomies. 2.


3. Inflorences thyrsiform or paniculate, occasionally with short, supplementary shoots in the axis of branchlets. 2.

4. Inflorences 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

5. Inflorences glabrous. Calyx and petals only (2½–3 mm long). Scars of stipules separated


Liana, sometimes a small shrub or tree. Stipule triangular, 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 elliptico-oblong, rarely obovate, or broad-elliptic, 3½–13 by 2½–3½ cm; base cuneate; apex acuminate, short-apatulate; margin crenulate; nerves 5–8 pairs; petiole 5–8 mm. Inflorences 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, ½ mm long, laciniate, sometimes fimbriate at the base. Pedicels ½–1 mm. Flowers light yellow or greenish yellow, small. Calyx thin, papillose on both surfaces, almost divided to the base, lobes triangular, ½–3½ 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 1½–2½ cm; pericarp leathery, valves c. ½ mm thick, the sutural margins slightly spreading after dehiscence. Seeds (incl. wing) 2½–3½ by 1 cm, seed proper broad-elliptic, or elliptic, 1–1½ by ½–3½ cm.

**Distr.** Widely distributed but scattered in India, Ceylon, Burma, Thailand, Indochina, S. China (Yunnan and Hainan), and Malesia: Sumatra (Tallabu and Mangoli), Malay Peninsula (Perlis, Pahang, Perak, 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).

Ecot. 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 childbirth, and compounded with another vulgar plant (Altaxis sp.) are used for poultice in treating rheumatism.

Vern. Java: (areu) mangënder, hörh tünting, 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 sita (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.


Liana. Stipules ± intrapetiolar, triangular, 3-lobed, or laminicate, c. ½ 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 3½–4½ 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, c. 1½–1 mm long, slightly erose at the margin. Petals fleshy, broad-elliptic, obovate, c. 2½–3 by 1½–1½ cm, with slightly inflexed margin, densely papillose on both surfaces. Free part of disk slightly 5-angular. Stamens ½–1 mm; filaments densely covered with papilla-like hairs. Pistil ½–1 mm emerging from the disk; stigma obscurely 3-lobed. Ovolies 4–8 in each cell. Follicles ovate to elliptic-oblong, 6½–8½ cm by 2½–5 cm, the valves rather woody, c. ½ mm thick. Seeds (incl. wing) 6 by 1½–2½ cm, seed proper ellipsoid, 1½–2 by ½–1 cm.

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

Ecot. In lowland forests up to 480 m. Vern. Java. (areu) mangënder, S.

Note. I have seen only 3 collections with fruits, in 2 of which the follicle is elliptic-oblong, 6½–8½ cm by 2½–3 cm, and c. 2½ times as long as wide; in the type of Hippocratea beccarii it is ovate, ½½ by 5 cm; this is not correlated with floral differences.


Liana up to 20 m. Stipules triangular, c. ½ mm long. Leaves chartaceous, ovate, obovate, or elliptic, 7–10½ by 3½–5 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 ½½ 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. ½ mm long, margin laminicate or short-fimbriate. Petals spatulate, 3½–4½ by c. ½ 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. ½½ mm emerging from the disk. Ovolies 6 in each cell. Fruit unknown.

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

Ecot. Lowland forests, up to 450 m.

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 ¼-1¼ cm. Inflorescences paniculate or thyrsiform, (3½-)10-14 cm long, many-flowered. Peduncle (1-)5-5½ cm. Bracts deltoid, ½-1½ mm long, laciniate. Pedicels ½-1¼ mm. Flowers pale yellowish green. Calyx almost divided to the base, lobes suborbicular, rarely deltoid, ½-1 mm long, erose or laciniate. Petals obovate-oblong or ob lanceolate, 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. ½ mm; filaments usually papilllose on the outer and sometimes also the inner surface. Pistil c. ½ mm emerging from the disk, triangular, c. ¾ mm 0 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 1³/4-2½ cm; seed proper elliptic- or ovate-oblong, 2–2½ by ¾-¼ 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**


Lianas, scendent 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 reflected 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. Burkhill, 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. leucocladu (Clemens 29599). It has been well observed in S. leucocladu, 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, Salaciterea glandulosa, is even named after this property (see under 6. S. papuan). I am grateful to Dr Maas Gelestanus 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 kautchu.

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 5lobed even in very young stage.
3. Cymes lax, rachises or internodes distinct.
5. Disk flat, 3-4 times as wide as high. Bracts with colleters inserted at the base inside.
6. Calyx without colleters on the inner base, lobes always distinctly imbricate, apex obtuse or round, very rarely slightly acute.
7. Calyx lobes ± reniform, entire. Disk with a thin, rim-like extension at the base. Ovules 4 in each cell. 2. S. cymosa
8. Calyx lobes very broad-ovate or -obovate, erose or slightly lacinate. Disk without such extension. Ovules 2 in each cell. Fruits globose, 4-5 cm o. 3. S. subalternifolia
9. 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
10. Cymes condensed, rachises or internodes invisible. Disk orbicular, usually flat, sometimes slightly convex in the central part, ½-⅓ mm high. 1½ mm o. Fruits subglobose or very broadly obovoid, 4-8(12) cm long, slightly contracted at the base. 5. S. oblongifolia
11. 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.
12. 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.
14. 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. 6. S. papuan
15. Without such free tissue as above. 7. S. sororia
16. Flower-buds subglobose, c. 1½-2 mm o. Calyx evenly thick seen on a longitudinal section. 8. S. ledemannii
17. Flowers usually with 2 stamens and ovary 2-celled. Anthers transversely dehiscent.
18. S. forsteniana
19. S. intermedia
20. Calyx not lobed, or splitting irregularly lengthwise, and persistent at the base of a flower.
21. 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
22. Calyx condensed, or flowers almost fascicled. Calyx not lobed, saucer-shaped at the base of a mature flower. Anthers transversely dehiscent. 11. S. wenzelli
23. Flowers in fascicles, or on a very short, axillary, bracteate tubercle or peduncle.
24. Calyx in the mature flower erose but not lobed, saucer-shaped. 11. S. wenzelli
25. Calyx distinctly 5-lobed.
28. Disk in mature flowers thin, cupular, sometimes stamens inserted on the ovary at some distance above this disk, the interval resembling a short "gynandrophone". Ovules (2-4) in each cell. Leaves large, yellowish when dry. Fruits broadly ovoid or subglobose, usually ½-6½ by 5-5½ cm. 13. S. macrophylla
29. 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).
30. Disk flat, slightly concave or discoid, or slightly convex towards the center, 4-7 times as wide as high.
31. Disk large, 3½-5 mm o.
17. Pedicels 1 1/2-2 cm. Calyx lobes slightly cuneate. Disk suborbicular, sometimes obscurely 5-lobed.

14. S. longipedicellata

17. Pedicels 1/4-1/2 cm. Calyx lobes short-fimbriate. Disk distinctly 5-lobed.

18. Branchlets sharply 4-angular. Leaves distinctly serrate-crenate. Petals suborbicular or broad-elliptic, 3/2-4 by 2 1/4-3 1/2 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 φ.

19. Disk convex at the central part, thin and rim-like at the margin. Calyx lobes unequal in size and shape. ... 17. S. grandiflora


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.


20. S. leucochola

21. Anthers obtuse, transversely, very rarely slightly obliquely dehiscent.

22. Disk 2-3 mm wide. Petals usually ovate or broad-ovate, 3-6 by 2 1/2-4 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 φ.

21. S. venosa

23. Leaves almost always distinctly acuminate, brownish when dried, upper surface smooth.

Disk conical-pulvinate, gradually narrowed towards the apex, 1 1/2-2 mm high and 3 mm φ.

22. S. maingai

22. Disk 3/4-1 1/4 mm wide. Petals usually oblong or elliptic, 1 1/2-3 1/4 by 3/4-1 3/4 mm.

24. Ovules attached at the central part of the axis. Fruits 2 1/2-4 1/2 mm φ (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, 2 1/4-3 1/2 cm φ, not contracted at the base. 23. S. laurifolia

27. Leaves without elastic threads shown on breaking. Calyx glandular. Fruits broad-obovoid, c. 4 1/2 by 3 1/2 cm, contracted at the base. ... 24. S. exsulcata

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, 1 1/2 mm φ, wider at base, gradually narrowed upwards. ... 26. S. nitidissima

24. Ovules attached at the top of the axis. Fruits small, 1-1 1/2 cm φ.

28. Leaves spiral or sometimes subopposite. Flowers brownish.

28. Leaves decussate, rarely associated with some subopposite ones.

29. Petals distinctly yellowish marginate, 3-4 by 2 1/2-4 mm. Disk 1 mm high, 1 1/2-2 1/2 mm φ.

28. S. chinensis

29. Petals not yellowish marginate, c. 2 by 1 1/2 mm. Disk c. 1 1/2 mm high, 3/4-1 1/2 mm φ.

28. S. kaalawiensis


Liana up to 18 m, rarely erect shrub or small tree up to 10 m. Stipules triangular, c. 1/2 mm long. Leaves chartaceous to subcoriaceous, elliptic-ovate-oblong, sometimes ovate or elliptic, 6 1/2-26 1/2 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; petiolo 1/2-1 1/2 cm. Inflorescences cymose, axillary, sometimes ramiiformis, 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 0-1/2 cm. Bracts deltoid, c. 1/4 mm long. Pedicels 4 1/2-12 mm. Flowers yellowish green, slightly concave at the base,
floral parts containing sulphur-like particles. *Calyx* lobes deltoid or suborbicular, ⅓–1 mm long, obtuse, margin slightly erose, laciniate or short-fimbriate. *Petals* broad-elliptic, -ovate, ob-vate, or oblong, 2½–4⅓ by 1⅓–2⅔ mm, obtuse or rounded, entire. *Disk* annular-putvinate, ½–1 mm high, c. ⅓ 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 ⅓–1 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, 1½–2 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 bêting*’ (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).


**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.

**HASSEKARL, 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, ± 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 2–2½ 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. ⅔ mm; anthers transversely dehiscent. Pistil c. ½ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 4 in each cell, attached at the top inner angle.


**Ecot.** In thicket at low altitudes.

3. *Salacia subalternifolia* MERR. & PERRY, J. Am. 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, ½–1 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 1½–3 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
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basal part slightly extended outward into a narrow, thin rim. Stamen 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 o, pericarp 3½ mm thick, the inner surface with irregular meshes. Seeds suborbicular, ± planoconvex, c. 2½ mm o. 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 phylloxy 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 Gijllerup (731, L) have opposite or decussate leaves associated with some subopposite ones on the same branch.


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, ½–3½ mm long, lacerate, with fimbriate collets inside. Pedicels c. 5 mm. Calyx short-cupular, with fimbriate collets 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 (i), broad-oblong, rarely broad-elliptic, obtuse, entire or slightly erose, 2–2½ by 1½–1⅞ mm. Disk fleshy, flat, orbicular, c. 2 mm o and c. 1½ 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.


Liana up to c. 30 m. Stipules triangular, laciniate. Leaves chartaceous to subcoriaceous, elliptic-oblong to lanceolate, broad-elliptic, or obovate, 6–17½ by 2½–7 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, ½–1½ 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 o, ½–1½ mm high. Stamens 3, ½–1½ mm. Pistil ½–1 mm emerging from the disk. Ovary 3-celled. Ovules (3–)4–6 (–6) in each, in two series. Fruit subglobe, or very broad-obovoid, 4–8 (–12) by 3½–4½ (–7) cm, slightly contracted at the base, pinkish or red. Seeds ± ellipsoid or subglobe, 1½–2½ by 1½ cm, covered with dried pulp.

Distr. Central and Peninsular Thailand, and Malesia: West Central Sumatra (Asahan, Sibebur I., and Taram), Malay Peninsula (Perak, Penang, and Johore), North and West Borneo, and Java (W. part, Madun, 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: areul langari, ki-hapiet, kikopi, manggong, tjun-kankan or tjun-kauken, treng langari, S.

Galls. Docters van Leeuwen (Zoococcidia 1926, 329, f. 591 & 592) recorded two kinds of leaf-galls found in the present species: (i) disk-like swellings 1½–2 mm o, caused by an unknown animal, developed on both surfaces of the leaves and (ii) the leaf-blade curved and rolled up, caused by thrips, 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 (I.c. 1869, 151).

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2, 20b (1942) 216.—Salacriceae 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 2½-8½ cm; base obtuse, acute; apex acuminate; margin entire but undulate, sometimes sparsely crenulate; nerves 6-8 pairs; petiole ¾-1½ 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 broadly 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, 1⅓-1⅓ mm high, slightly broader at the base. Stamens 3, 1-3 mm, slightly apiculate, erect at anthesis; anthers obliquely dehiscent. Pistil c. 1½ mm emerging from the disk. Ovary 3-celled. Ovules 2 in each cell. Fruit globose, c. 2½ cm, l-seeded (always?). Seed subglobose, c. 2 cm, with reticular meshes on the rather smooth inner surface of the pericarp.

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.—Salacriceae sororia A. C. Smith, Am. J. Bot. 28 (1941) 441.—Salacriceae 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-oblung, sometimes broad-elliptic, 3½—11½(—27) by 1½—8(—12) cm; base cuneate; apex short-acuminate; margin ± entire, sometimes obscurely repand with sparse, callose-tipped obsolete crenations; nerves (2½—6)½—8 pairs; petiole 10—14 mm. Inflorescences axillar, cymose, dichotomously 1—3-branched, 2—4 cm long. Peduncle 1½—2½ cm long. Pedicels 4—11 mm, with elastic threads shown on breaking. Flower-buds broad-ovoid, or rarely subglobose, (2½—)3—4 by 1½—3 mm, acuminate or rarely obtuse. Flowers green. Calyx calyptriform, transversely splitting near the base, sometimes longitudinally splitting. Petals (4½—)5½—6, ovate, 3—4 by 1½—2½ mm, ± entire. Disk annular-pulvinate, 1½—1½ mm high, 2½—2½ mm wide, slightly 5-angular at the base. Stamens 3, c. 1½—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.


Liana. Branchlets usually angular. Stipules deltoid or triangular, c. ½½ mm long. Leaves subcoriaceous, elliptic to elliptic-oblung, 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 axillar, dichotomously cymose, 1½—3½ 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 ½½—1½ cm. Bracts triangular, ½½—1½ mm long, erose, with collers at the base inside. Pedicels 4—6 mm. Flower-buds subglobose, 1½—½ mm. 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 1½—2½ mm. Disk annular-pulvinate, c. ½½ mm high and 1½ mm wide. Stamens 3, c. ½¼—1½ mm; anthers obliquely dehiscent, obscurely apiculate. Pistil c. ½½ mm emerging from the disk. Ovary 3-celled. Ovules 2 in each cell. Fruit globose, c. 2½½ cm, dark olive green. Seed 1½, globose, c. ½½½ cm.  

Distr. Solomon Is. (Owa Raha I.) and Malesia: Central Celebes (Malili), Moluccas (Ternate, Ambo, and Morotai) and New Guinea (Waigeo I. and Normanby I.).

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 Salacietrea sarasinarum 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.


Scandent shrub or liana. Stipules triangular or lanceolate, ½½—1½ 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 ½½—2½ cm. Inflorescences axillar, cymose, 1½—6½—2½ cm long, usually 2—4 times dichotomously branched, sometimes an axillary shoot with reduced leaves or bracts resembling a thyrsiform inflorescence. Peduncle ½½—½½ cm. Bracts triangular, c. ½½½ mm long, entire or slightly erose. Pedicels ½½—1½ cm. Flower-buds broad-ovoid or subglobose, 2½½—1½½ by ½½½—2½½ 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 5½—7½, ovate or oblong, 2—4 by 1½—2½½ mm, entire or wavy. Disk annular-pulvinate, ½½—1½½ mm high, 1½½—2½½ mm wide, slightly broader and 5-angular at the base, finely papillose. Stamens 2, very rarely associated with some flowers containing 3 stamens, ½½—1½ mm, short-apiculate, erect at anthesis, the connective usually separating the thecae; anthers dehiscing transversely or ± at the top. Pistil c. ½½½ mm emerging from the disk. Ovary 2-celled. Ovules 2 in each cell. Fruit globose, c. 2½½ cm, 1-seeded (always?). Seeds globose, 1½½—1½½¼ cm, 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 ganem, Ternate.

Note. LOESER cited two collections in the original description of Salacietrea 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 description, this species is clearly conspecific with S. diandra, and in 1942 LOESER himself reduced his own species to the latter. Because S. diandra Miq. is a later homonym MIQUEL proposed a new name.
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Fig. 33. Salacia intermedia DING HOU (cult. Hort. Bog. sub n. VI.B.5, from Celebes).


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 3½-4½ 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 ½-2½ mm, obtuse or acute, entire or slightly erose. Disk annular-pulvinate, ½-1 by 1½-1½ mm, slightly 5-angular. Stamens 3, c. 1 mm erect; anthers obscurely apiculate, slightly obliquely dehiscence. 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 wenzelli 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 roundish; 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, ½-1 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, 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, c. 1 mm high, slightly contracted at the middle, papillose. Stamens 3, ½-2 mm; anthers transversely dehiscence. Pistil 1-1½ mm emerging from the disk. Ovary 3-celled. Ovules 2 in each cell, pendulous. Fruit depressed-globose, c. 3 cm. Seeds subglobose, c. 1½ cm. c. 0.


Ecol. In forests at low altitudes.


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 2½-5½ cm; base cuneate; apex acuminate, short-cuspidate; margin
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Liana, sometimes shrub or shrubby creeper. Stipules triangular or reniform, 1/2–2 mm long, erose or laciniate. Leaves subcoriaceous, sometimes shining, elliptic to narrow elliptic-lanceolate, ovate-oblong, broad-ovate, lanceolate to narrow-lanceolate, 11/2–3 cm wide, (on sterile branches up to 11/2–2 cm); base cuneate, attenuate, obtuse or rounded; apex acuminate, cuspidate, rarely acute or obtuse; margin entire rarely remotely crenulate; nerves 7–14 pairs; petiole 1/2–2 cm long. 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 rami-flores. 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 1/2–2 mm, acute or obtuse. Disk thin, roundish, developing from discoid to cupular, 11/2–2 mm wide. Stamine 3, 1–11/2 mm. Pistil c. 1/2 mm emerging from the disk, pyramidal at the base and narrowed into a cylindrical style. Ovary 3-celled. Ovules (2–)4 in each cell. Fruit broad-ellipsoidal or subglobose, 11/2–61/2 cm by 5–51/2 cm, sometimes up to 8 cm (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 Sundas Is., and Celebes to New Britain (Massawa). Fig. 34.

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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, Manggala, pasoe kruhmring, Banka; Mal. Pen.: hémipédal iték, kétimbing, nasi séjuk, (pokok) sédang, sépapat, M; Natuna Is.: marot, M; Java: areui

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Fig. 34. Distribution of Salacia macrophylla Bl.

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 1–1½ 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, 3⅓–4 by 2¼–3½ mm; margin thin, yellowish and transparent (after boiling), entire or slightly erose. Disk round, flat, 3–4 mm, 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.


Liana. Stipules triangular, c. ½–1 mm, erose or laciniate. Leaves coriaceous, rather shining above, ovate to oval-oblong, elliptic-oblong, rarely obovate-oblong, 9–19 by 5–8⅓ cm; base obtuse or cuneate; apex acute; margin entire; nerves 6–9 pairs; petiole ± terete, ⅔–2 cm. Flowers greenish, a few on an axillary brachyblast or short peduncle (c. ½ 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, ±⅔–1 mm high, 5-lobed. Stamens 3, c. 2 mm long; anthers transversely dehiscing. 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.


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 1½–2 cm. Flowers green, in axillary fascicles. Calyx lobes suborbicular or sometimes triangular, 2–2½ by 2½–3 mm, slightly erose. Petals rather fleshy, suborbicular, or broad-obovate, 4–6 by 4½–6 mm, slightly contracted at the base; margin rather thin, yellowish (when dry), wavy. Disk fleshy, flat, suborbicular, sometimes slightly 5-lobed, 3½–4½ mm, ±½ mm high. Stamens 3, c. 2 mm; anthers transverse-dehiscing. Pistil c. 1 mm emerging from the disk. Ovary 3-celled. Ovules 2 in each cell.

Distr. Malesia: Borneo (Sandakan and W. Kutai).
Fig. 35. Salacia verrucosa Wight (cult. Hort. Bog. sub n. XVII.G.74, from Sumatra).

Ecol. In forests from lowland up to 750 m.

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 ‘484’.

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King, J. As. Soc. Beng. 65, ii (1896) 367.—S. kunstleri King, l.c. 368; Ridl. Fl. Mal. Pen. Ind. (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 obvate-oblong, 8–18 cm by 4–6 cm (on sterile branches up to 24 by 12 cm); base cuneate, obtuse; margin crenulate or sub-entire; nerves 6–10 pairs; petiole 3–10 mm. Bracts deltoid, c. 1 1/2 cm long, short-fimbriate. Pedicels 9–14 1/2 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 obvate, 2–3 by 1 1/2–2 mm, rather fleshy, obtuse, entire, with obscure, longitudinal veins. Disk suborbicular, flat, slightly concave in the central part, 1/4–1 1/2 mm, c. 1/2 mm high, the tissue at the base slightly extended outward into a narrow membranous rim. Pistil c. 1/2 mm emerging from the disk, pyramidal. Ovary 3-celled. Stamens 3, 1 1/2–1 1/2 mm, anthers brown coloured at the base. Ovules 2, inserted near the inner angle at the base. Fruit subglobose, c. 2 1/2 cm, red. Seeds slightly planoconvex, 1 1/2–1 1/2 cm by 1 1/2 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. Pamatbon, Martapura and P. Lamperl), Philippines (Luzon), and Celebes (Gorontalo).

Ecol. In thickets and forests from lowland up to 1200 m. Vern. Sumatra: gurah batu, Asahan; Philippines: matang olong, Tag.


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, 4 1/2–20 by 1/2–6 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 1 1/2–4 mm, with elastic threads shown on breaking. Flowers axillary or ramiiflorous, I or 2, sometimes several in fascicles, usually on short bracteate tubercles. Calyx lobes fleshy, semi-orbicular or ± reniform, 1–1 1/2 by 1 1/2–3 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, 1 1/2–1 1/2 mm, c. 1 1/2–3 mm high, sometimes slightly narrowed at the apex and base, rather smooth. Stamens 3, 1 1/2–2 mm long; anthers free at the lower 3/4, ± longitudinally dehiscence, short-apiculate. Pistil 1 1/2 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. 6 1/2 cm. Seeds planoconvex, c. 3 cm by 2 cm, densely covered with a layer (c. mm thick) of pulp.

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

Ecol. In forests from lowland up to 1590 m. Note. Ridley described the flowers of S. litseaefolia 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, \( \times \frac{3}{2} \), b. flower, \( \times 4 \), c. ditto, in section, \( \times 8 \).—S. subalternifolia Merr. & Perry. d. Flower, in section, \( \times 16 \).—S. macrophylla Bl. e. Flower, in section, \( \times 16 \).—S. ovalis Korth. f. Flower, \( \times 8 \), g. ditto, in section, petals removed, \( \times 16 \).—S. wenzelli Merr. h. Flower, petals removed, \( \times 8 \).—S. cymosa Elmer. i. Exterior and interior view of bract, \( \times 8 \) (a–c Curtis 3288, d Gjellerup 731, e Dillewijn 606, f–g Koorders 28743β, h Wenzel 1534, i Elmer 12997).
very young flower-buds or detached flowers with pedicels broken off.


Scandent shrub. Stipules triangular. *Leaves* thin-or-coriaceous, rather shining, elliptic-oblong, 6–13 by 2½–5 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 elliptic threads shown on breaking. *Flowers* green, few in axillary fascicles. *Calyx* lobes triangular, ½–1 mm long, obtuse, short-fimbriate. *Petal* broad-ovate, -elliptic, or suborbicular, 3/4–4 by 3–4 mm, entire. *Disk* annular-pulvinate, c. 1 mm high, c. 2 mm α, slightly narrower and truncate at the apex. *Stamens* 3, c. ½ mm; anthers ± linear. *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 pacuiflora*), 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 perpetrated by JacOBS in this Flora, vol. 5, p. 136.


Shrubby creeper. Stipules deltoid or triangular, ½–1½ mm long. *Leaves* subcoriaceous, shining, elliptic-oblong, sometimes broad-elliptic, rarely obovate-oblong, (4–)7–16½ by (2½–)3½–7 cm; base cuneate, or obtuse; apex acuminate to short-cuspitate; 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 elliptic 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-elliptic, or elliptic, 4½–6 by 2½–4 mm, obtuse, entire. *Disk* conical-pulvinate, c. 3 mm α, 1½–2 mm high, truncate at the apex. *Stamens* 3, 1½–1½ mm; anthers transversely dehiscing. *Pistil* ½–1½ 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 0 (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, i.e.) already reduced *S. lobbii* as a synonym.


Liana. Branches light greyish, terete sometimes 4-angular. Stipules triangular, c. ½ mm long, laciniate. *Leaves* chartaceous to subcoriaceous, usually the old leaves with elliptic threads shown on breaking, elliptic-oblong, -lanceolate, and lanceolate, rather obovate-oblong, 6½–18½ by 2½–8 cm; base cuneate to attenuate, sometimes obtuse; apex acuminate to cuspidate; margin subentire, or remotely, slightly crenulate; nerves 6–8 pairs; petiole ½–1½ 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 tubercules. *Calyx* lobes fleshy, deltoid, ½–2½ cm long, erect, obtuse, and entire. *Petal* slightly spreading at anthesis, fleshy, thinner near the margin, slightly varying in size, oblong, 2½–6½ by ½–1½ cm, 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, 1½–2½ cm high, ½½ cm α, obtuse at the apex, the base slightly extended outward and forming a narrow rim. *Stamens* 3, c. ½ cm; anthers slightly obliquely dehiscing. *Pistil* c. ½ mm emerging from the disk. *Ovary* 3-celled. *Ovules* 2 in each cell, attached at the central part of the axis. *Fruit* globose or sub-globose, 2½–3½ cm α, rugose outside. *Seeds* subglobose, 1½–2 cm α, densely covered with pulp.

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

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

Flora Malesiana


Liana. Branchlets usually whitish. Stipules triangular or reniform, $1/2-3/4$ mm long, laciniate or short fimbriate. Leaves chartaceous to subcoriaceous, rather shining above, elliptic to elliptic-oblong, 5–9 by 21/2–4 cm; base acute to attenuate; apex acuminate; margin entire or subentire; nerves 5–8 pairs; petiole $1/2–3/4$ cm. Bracts triangular, $1/2–3/4$ mm long, short-fimbriate. Pedicels 21/2–3 mm. Flowers yellow, axillary, fascicled. Calyx lobes deltoid, c. 1/2 mm long, fleshy, glandular on the margin. Petals ovate-oblong, 11/2–2 by $1/2–1$ mm, slightly keeled outside, obtuse or acute, rarely slightly erose. Disk round, short-cylindric, c. 1/2–1 mm high, $1/2–1$ mm $\theta$, with a narrow rim at the base, truncate or slightly cuneate at the apex. Stamens 3, c. 1/3 mm; anthers transversely dehiscent. Pistil c. 1/2 mm emerging from the disk. Ovary 3-celled. Ovules 2 in each cell, attached at the central part of the axis. Fruit (brown) subglobose, c. 21/2 cm $\theta$, 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.


Liana. Stipules small, triangular, c. 1/3 mm long. Leaves chartaceous to subcoriaceous, rather shining above, elliptic-oblong, or elliptic, rarely ovate-oblong, 51/2–14 by 2–61/2 cm; base cuneate; apex acuminate; margin subentire; nerves 5–9 pairs; petiole 7–12 mm. Bracts triangular, 1/2–1 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, $1/2–1$ mm long, entire or slightly erose. Petals rather fleshy, elliptic or broad-elliptic, 2–31/2 by 11/2–11/2 mm, entire. Disk annular-pulvinate, c. 1 mm high, c. 1/3 mm $\theta$, broader at the base, gradually narrowed upwards. Stamens 3, c. 1/3 mm; anthers transverse-dehiscent. Pistil c. 1/2 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.


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 2–61/2 cm; base attenuate; apex acuminate; margin slightly crenulate to subentire; nerves 5–9 pairs; petiole 3–5 mm. Bracts triangular, c. 1/2 mm long, slightly erose. Pedicels 4–9 mm. Flowers in fascicles on axillary, bracteate brachyblast. Calyx lobes triangular, 1/2 mm long, glandular or erose on the margin. Petals broad-elliptic, or ovate, 11/2–21/2 by 11/2–11/2 cm, obtuse. Disk annular-pulvinate, 1/2–1/2 mm thick, c. 1 mm $\theta$, slightly broader at the base, papilllose. Stamens 3, 1/2 mm; anthers transversely dehiscent. Pistil $1/2$–1/2 emerging from the disk. Ovary 3-celled. Ovules 2 in each cell. Fruit globose, c. 2 cm $\theta$, 1-seeded. Seeds globose, c. 1/2 cm $\theta$, 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.


Liana, scandent shrub, or rarely a small tree. Stipules deltoid or reniform, 1/2—1/4 mm long. Leaves suborbicular, rather discolorous, ovate, broad-elliptic, elliptic to elliptic-lanceolate, obovate, rarely suborbicular, or obovate-oblong, 4—17 by 1 1/4—9 1/2 cm; base cuneate; apex acute, short-acuminate to acuminate, sometimes obtuse; margin entire, or slightly crenulate; nerves 4—10 pairs; petiole 1—1 1/2 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 ramiﬂoros. Calyx lobes triangular, semi-ovar-bicelate, 1/2—1/3 mm long, obtuse or rounded, slightly erose. Petals broad-elliptic, -ovate, ovate, or suborbicular, 3—4 by 2 1/2—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 ungleivate. Disk annular —pulvinulate, 1 1/2—2 mm, 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. 1 1/2 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, 1 1/2—2 cm, red or orange-red when ripe, usually 1-seeded. Seeds globose, 1—1 1/2 cm.

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.


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

Notes. The epithet chinensis was changed into
sinensis by GMELIN (I.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. Blan. 1918, 236) correctly interpreted Conocladia serrata BLANCO and S. sinensis as belonging to S. prionoides (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 Salaciacratae kraemeri Loes. in KANEHRA'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 calyptro-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.


Scandent shrub. Stipules lanceolate, ½–1 mm long, sometimes laciniate or short-limbriate at the margin. Leaves elliptic to elliptic-lanceolate, or ovate-oblong, 6-14½ by 1½–5 cm; base cuneate; apex short-acuminate to apiculate; margin crenulate; nerves 4–7 pairs; petiole 3–7 mm. Bracts triangular, obtuse, c. ½ mm long. Pedicels 4–4½ mm. Flowers several in fascicles on an axillary, short, simple or sometimes once branch- ed, bracteate brachyblast. Calyx lobes ± deltoid or suborbicular, c. ½ mm long, glandular or short-ciliate at the margin. Petals broad-elliptic, 1½–2 by ½–1 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. ½–1 mm ø, c. ½ mm high. Ovary 3-celled. Stamens 3, c. 1 mm. Pistil c. ½ mm emerging from the disk. Ovules 2–(1) in each cell. Fruit subglobose, c. ½ 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.

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DUBIOUS AND EXCLUDED


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

Kurrinia pulcherhima (non WALL.) BAKER f. J. Bot. (1924) Suppl. 22, a record from West Java, based on Forbes 566 = Elaeocarpus oxyphyren K. & V. (Elaeocarpaceae).

Salacia bartlettii RIDL. Kew Bull. (1938) 239, according to kind information of Mr L. L. FORMAN, Kew = Anacaloxa frutescens Bl. (Olacaceae).


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 calyptro-like calyx. The specimen mentioned above may belong to it.

Celastrus stylosa WILD.; F.-VILL. Nov. App. (1880) 47; MERR. En. Philip. 2 (1923) 482.

Gymnospora neglecta WALL.; F.-VILL. l.c.; MERR. l.c. 483.

Hippocreata arborea ROXB.; F.-VILL. l.c.; MERR. l.c. 487.

Salacia oblonga WALL.; F.-VILL. l.c.; MERR. l.c.

Salacia rosburghii 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.

_Hypsagynhe_ 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 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 (i.e. 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 pseudowhors, 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 *Epacrieae* (with numerous ovules per cell); only the first tribe is represented in Malesia.

In Malesia 3 genera occur, of which *Decatoea* 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 acuminita* 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 *Trocho-

carpa 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 is known—is bearded inside as are the lobes and partly down the tube in many species. In these unciliated 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. Didot., 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. Didot. 2 (1950) 840; L. Watson in New Phyt. 61 (1962) 36–40, as to stomatal distribution).

Polymorphism of leaves (in the same 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.


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) ursoilic 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 drupeaceous fruit into a compact (2-)3-5(-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

3. Corolla lobes valvate in anthesis (tips only slightly imbricate in bud)

   3. _Trochocarpa_

1. _STYPHELIA_


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 2. 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, truncate 5-lobed, or consisting of 5, ± free lobes. Ovary (2-)3-5(-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. MÜLLER. The differences between Brown's genera are either slight or inconsistent, and maintaining them, as BENTHAM (PI. Austr. 4, 1869, 142 seq.) with some hesitation did, does not seem to be justified.

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*

4. Leaves ciliate from the beginning, (15-)20-50(-80) by (2-)3-10 mm (juvenile microforms excepted) ........................................................... 2. *S. malayana*

5. Ovary glabrous. Style glabrous or patently short-hairy in the lower part.

6. *S. malayana var. malayana*

7. 2. *S. malayana var. novoguineensis*

8. Leaves covering the apex of the lamina and stronger (or more conspicuous) than the outer ones, which are fan-like diverging from them, generally (shortly) petioled.

9. Leaves ending in a very short (not caducous or breakable) callose, acute point or tip, or subacute, or obtuse ................................................................. 3. *S. suaveolens*

10. Leaves ending with a conspicuous hair- or needle-like, pungent and rather persistent (though breakable) 1-2 mm long point.

11. Corolla 6-7 mm. Leaves densely and rather coarsely serrulate-ciliate ... 4. *S. javanica*

12. Corolla up to 4 mm. Leaves whether or not finely and appressed ciliate.

13. Leaves all equal, oblanceolate. (Corolla 3 1/2-3 1/2 mm.) ........................... 5. *S. forbesii*

14. Leaves in the same specimen lanceolate to linear-lanceolate.

15. Leaves subdensely to rather densely arranged, (1-)1 1/2-2 mm wide. Corolla 2 1/2-2 1/2(-3) mm ......................................................... 6. *S. acuminata*

16. Leaves densely to very densely, i.e. imbricately arranged, 2-3 mm wide. Corolla (3-)3 1/2 mm .......................... 7. *S. abnormis*

17. *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. § Stylophilia 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.

Distg. 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.


Shrub, c. 1½ m. Stem decumbent to erect. Branchlets rather robust, tips puberulous, older parts early ciliate, dark blackish, lissured lengthwise. Leaves very dense or imbricate, sessile, lanceolate, apex acute-acuminate, ending in a short (1/2-1 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, ciliate, ± 2 mm. Sepals oblong to ovate, obtuse, ciliate, c. 3 by 1½-2 mm. Corolla funnel-shaped, 5-parted to 1½-2½, c. 4½-5 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 exerted 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.

Distg. Malesia: West New Guinea (Doorman-
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.


*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. 2. Distributional areas of *Styphelia subg. Leucopogon* (— — —) and subg. *Cyathodes* (—— ).
in the older parts; dark dark, splitting lengthwise. Leaves densely crowded round the twigs, lanceolate, apex gradually attenuate or sub-acuminate, 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 transluently 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-pubercent or -subvillous, 1½–1(–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, ciliate, 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 deltoïd, subacute, spreading or reflexed, villous inside as is the upper inner part of the corolla tube, glabrous outside. Anthers narrow-oblong, c. 3/4 mm, on filiform filaments (c. 3/4 mm), a little exerted from the throat. Ovary sub-orbicular, 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.** Chorēng (or chuchar) atap, hujang atap, jiring atap, kaju glam, kaju ēmna, kémili bawang, maki china, mępandang, mėntadh, tasek timbal, M, kémili bawang, sekun'jing, t(a)ratap, Banka, kaju djarum, mata udang, W. Borneo, Malayen Heath, E.

**Note.** The most related species is *S. cymbulae* (Labc.) 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 globose, 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 Cyclopus Mts above Kotanica.
Fig. 4. *Styphelia malayana* (Jack) Spr. var. *novoguineensis* Sleum. Cycloop Mts (New Guinea) (van Royen & Sleumer 6200) (Sleumer, 1961).


Diocious, low, erect, diffuse or bushy, stiff shrub, (0.15-)0.5(-0.3) 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 ± blunted, 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. 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 Ardujono (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 axis, (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 sepal, 1-1½ mm. *Sepals* oblong to obovate-oblong, obtuse, membranous, dull reddish, often distinctly veined lengthwise, ciliate, ½-2 mm. *Corolla* suburoceolate, white, creamy or pinkish red, ½-4 mm long in all, apparently usually slightly longer in the ♀ flowers, lobed from ½ to almost ½ their length, tube slightly to rather long exserted from the sepal, lobes lanceolate, acute, covered with woolly white hairs inside, ± reflexed in full anthesis. — Flower: anthers attached above the middle of the corolla, oblong, ½-1 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* subglobose, disk lobes closely attached; style columnar, ½-1 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 Wilhelmit at 4690 m. *Fl.* fr. Jan.–Dec.


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.


Creeping, much much, 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 truncate narrowly 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, 1/2 mm. Bracteoles 2, ± rounded, forming a cup, which is appressed to the sepals, 1–1½ mm, ciliate, 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 sur-rounded by the fleshy disk. Style slender, red, long white-hairy below, c. 3½ mm, topped by a capitulate stigma. *Drupe* ellipsoid or subglobose, slightly 5-angled, yellow or orange coloured, c. 4½ mm across.

**Dist. Malesia**: East Java (from Mt Penang- gungan, 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 nudigena* 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.

**Disp.etals.** 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 ciliate, 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.


Erect shrub. Branchlets slender, densely shortly grey-pubescent, imbricately leaved. *Leaves* all equally obovate-oblong or ob lanceolate, 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, or sessile or almost so, with several basal minute scaly bracts. Subtending bract small, bracteoles 2, ovate, ciliate, 1–1½ mm. *Sepals* oblong-elliptic, (sub)obtuse, rather longish ciliate, 2½ mm. *Corolla* white, 3½ mm in all, 5-lobed ± halfway, tube cylindric, ± included by the sepals, lobes densely set with ± retrorse villous hairs in side. *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, 1½ mm, central stone 1–3-celled.

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

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

**Vern.** Kewana, wuwe, Alor.


Shrublet, c. ½ mm. Branchlets slender, puberulous, subdensely to rather densely foliate. *Leaves* lanceolate to linear-lanceolate, apex ending in an aciculiform point or cusp (1 mm), base narrowed, sessile or practically so, subcoriaceous, rather stiff, glabrous and shining, minutely subserulate-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, ciliate, ½–½½ mm. Bracteoles suborbicular-ovate, strongly keeled and ± mucronulate, ciliate, appressed to the sepals, c. 1 mm. *Sepals* ovate to ovate-elliptic, apiculate, ciliate, veined lengthwise, 1½–1½½ mm. *Corolla* tubular below, funnel-shaped above, white, glabrous outside, 2½–2½½(–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* subglobose, glabrous, style slender, terete, glabrous, ¾ mm. *Fruit* bovid-ellipsoid, apex truncate, c. 3½ by 3 mm at maturity.

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

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. leptospermo-moides (R. Br.) Sp. from Queensland, which, however, has decidedly larger flowers.


Erect, twiggry shrub, 1–1 1/2–3 m. Branches scarred. Branchlets rather slender, younger parts greyish puberulous, densely appressed and imbricately leaved. Leaves subsessile, lanceolate, the lowest ones in the new shoots ob lanceolate, 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 simply narrowed, truncate, no proper petiole, often convex above, coriaceous, stiff, shining, glabrous, finely ± ciliately sub-serrulate-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 (1/2–1)2 mm, grey-puberulous, with several minute basal bracts. Subending bract ovate, hardly 1 mm. Bracteoles 2, ovate-acuminate, keeled dorsally, the keel ending in short mucro, ciliate, c. 1/2 mm. Sepals oblong, acute or submucronate by a very short apical callus, ciliate, rather obscurely veined lengthwise as are the bracteoles, c. 2 mm. Corolla tubular below, funnel-shaped above, white or greenish, 1/2–4 mm long in all, 5-lobed down to almost 1/2, glabrous outside, tube hidden in the sepals, lobes erecto-patent, subovate-lanceolate, acute, densely set with reverse, stout hairs inside. Anthers oblong, 1/4 mm, slightly exerted from the corolla tube. Ovary pear-shaped, glabrous, 1 mm across; style slenderly columnar, glabrous, c. 11/2 mm. Subs infruct ellipsoid, much truncate distally, c. 3 by 2 1/2 mm, 4–5-celled (endocarp and walls separating the seeds rather thin), said to become yellowish at maturity.


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. Tolenaas, Talaud, papua, Taliabu, papua laki, Buru.

2. Subgenus Cyathodes


—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. Stypheia brassi 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 coriaceous below; bark dark, splitting lengthwise. Leaves scattered though rather dense, ± spreading or subflexed, linear or lanceolate-linear, apex short-acuminate, tapering to a rigid, pale pungent point (1/2–1 mm),

base very short and broadly attenuate into a rather slender, certainly well marked petiole (1/2–1 mm), coriaceous, stiff, entire, initially ciliate, glabrous with age, brownish olivaceous and shining above when dry, greyish glaucous beneath, (1/2–1)1–1 1/2 cm by 1–1 1/2 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
Flora Malesiana

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, 1–1 1/2 mm, decreasing in size downwards. Sepals oblong, obtuse, ciliate, ± 1 1/2 mm. Corolla tubular-subcampanulate, white, 3 1/2–4 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, 1–1 1/4 mm, on filiform, glabrous filaments (1/2 mm), exserted from the corolla tube for almost their full length. Ovary broadly-obovate, glabrous, c. 3/4 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, central stone covered by a thin mesocarp, containing 2 or 3 seeds.

Distr. Malesia: SE. New Guinea (Milne Bay Distr., only known from Mts Maneo, Simpson, and Dirriwa.)


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. brevistylo Moore (Society Is.) in which the corolla is practically glabrous inside.

Fig. 10. Styphelia brassii Sleum. a. Habit, × 2/3, b. leaf, × 3/4, c. flower with bracteoles, × 4, d. open corolla with stamens, × 6, e. ovary and style, × 8, f. fruit with bracteoles on pedicel, × 3/4, g. cross-section of fruit, × 3 1/3 (a–g Brass 22274).

2. DECATOCA

F. v. M. Trans. R. Soc. Vict. 1, 2 (1889) 25; Sleum. Blumea 12 (1963) 163.—Fig. 111-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 subcylindrical, exceeding the sepals, subdensely hairy in the upper 2/3 inside, lobes imbricate in bud and remaining so in anthesis, attaining c. 1/3 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 Trochocharpa) 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, x 2/3, b. ♀ flower, x 4, c. open corolla of ♀ flower, x 6, d. ovary, x 6, e. leaf, x 4.—Trochocarpa dekokii (J.J.S.) H. J. Lam. f. Habit, x 2/3, g. ♀ flower, x 4, h. open corolla of ♀ flower, x 6, i. ovary, x 6, j. leaf, x 4, k. fruit, x 2.—Decatoca spenceri F. v. M. J. Flower bud, x 4, m. flower, x 6, n. open corolla of ♀ flower, x 6, o. ovary, x 6, p. leaf, x 2 (a-e van Royen & Sleumer 7977, f-k Sleumer 4150, l-p Brass 4675).


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, 1/2–1 3/4 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 4–4 1/2 by 2–2 1/2 mm, glabrous outside, ± densely covered with longish subpatent hairs in the upper 3/5, glabrous above the base inside, lobes sub-ovate, erect or hardly reflexed, margin irregularly crisped and finely erose, ± 1 1/2 mm, hairy at the base inside, glabrous otherwise. Anthers narrowly oblong, c. 1 1/4 mm in the ♀, only 0.7 mm and without pollen in the ♀ flower. Disc bluntly 5-lobed. Ovary broadly pear-shaped, glabrous, 1 mm; style thick-columnar, glabrous, c. 1 1/2 mm; stigma obtuse. Fruit depressed-globular, dark purple, 5–6 mm at full maturity; mesocarp rather thick and succulent, including the 10 small, separate pyrenes.


Ecol. In forest glades, more common in fringes of forest and along banks of grassland streams or in open grassland shruberies, 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.

![Distributional area of the genera Trochocarpa R. Br. (——) and Decatoca F.v.M. (-----).](image-url)

**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-
Epacridaceae

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

1. Subgenus Trochocarpa

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


Erect, much branched shrub or treelet, rarely small tree, (0.3-)1-1½-4 (sometimes up to 10) m; trunk up to 15 cm across. Branchlets tetra, 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) cm, rarely up to 8½ cm by (½-)1-2(2½) mm, usually up to 3½ cm, in microforms reduced to 16-16 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-)2-4½(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 subrect, 1-1½ mm, bearded to the middle as well as the upper part of the tube inside with retorse hairs, otherwise glabrous. Anthers narrow-oblong, c. 1½ 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 —
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. Boidzjemiet, kèru, Manikiong, duon, Andjai, perannek, Kèbar, hutmatkau, uer, 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.
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. 2½ 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, ciliated, ½-1½ mm. Corolla whitish or mostly pale green, almost funnel-shaped, c. 1½ 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, subquadangular, retuse or shortly 3-lobed. Fruit depressed-subglobose, 3-4 by 2-3½(-6) mm, pink or light purple when fully mature, containing 10 loose pyrenes in a rich pulp.


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, ankwari, Manikiong.


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 dekokii* (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-)1 1/2-2 1/2(-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, 1/4-1 mm. *Inflorescences* axillary and terminal, (4-)6-8(-13)-flowered abbreviated racemes or dense ± recurved clusters; rachis puberulous, up to 5 mm. *Flowers* subsessile, each with one orbicular-ovate subtending bract (1 1/4 mm) and 2 opposite suborbicular bracteoles (1 1/2 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, 3 1/2-4 1/2 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 (1 1/2-2 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 1-1 1/4 mm) is only known from Mt Mambulling in Central Celebes, at 2700 m.

5. *Trochocarpa nutans* (J.J.S.) H. J. Lam, Blumea 5 (1945) 573; Sleumer, Blumea 12 (1963) 166.— *Styphelia carstenensis* Wernh. Trans. Linn. Soc. II, Bot. 9 (1916) 100.—Fig. 16, 17, 11a–e.

Erect, much-branched shrub, 1/4–2(–4) m. Branchlets slender, subangular, densely leaved, ± 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. rubicola*, dark green to yellowish green, subpatent, oblong- to narrow-lanceolate, apex subacuminate, 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

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 caducely 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, ± 1 mm. Inflorescences terminal and axillary, suberect, short, dense, (5–)17–12-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, ± 1 mm. Sepals green, often with red hue, ovate, ciliate, darker parallel-nerved, 1½–2(–2½) mm. Corolla subcylindric, pink whitish creamy, or white, 5-lobed to ¼–½, 4–5(–6) by 2–3 mm, glabrous outside, tube ± inflated, much exserted from the clasping sepals, sparingly to subdensely short-hairy in the upper ½ of the tube (not at the lobes) inside, lobes often with pink hue in white corollas, oblong-triangular, slightly spreading; Anthers oblong, ± ½ mm (no pollen) and but a little exserted from the throat in the ß2½–3½ mm (containing pollen) and more exserted in the normal ß flower. Ovary subglobose; style glabrous, terete, c. 1 mm in the ß, 1½ mm in the ß2½ flower; stigma obtuse. Disk lobes retuse. Fruit depressely globose, 3½–5 by 5–6 mm, dark purple-blush when ripe, rather seedy.

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


Vern. Momani, tadampso, Mendi, andidam, Enga: Polo.

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(1916) 101.—*T. vanouhuyssii* H. J. Lam, Blumea 5 (1945) 573.—Fig. 15, 11f–k.
Nothofagus—Myrtaceous forest and in forest edges, shrubberries, mossy thickets, often on ridges or steep slopes, on peaty or stony ground, 1900-3000 m, locally common. \textit{Fl. fr.} Jan.–Dec. 

\textit{Vern.} Angwar, Manikong.


Erect, much-branched shrub, 1½–1/2 (2) m, very similar in habit and leaves to \textit{T. nutans} and \textit{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. \textit{Leaves} subpatent, lanceolate to oblong-lanceolate, apex subacuminate, base narrowed to the petiole, or sometimes subtruncate, glabrous, ± persistently serrulate-ciliolate, 6–9 by (2–) 2 1/2–4 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. \textit{Inflorescences} terminal and from a few upper axes, 4–6–(8)–flowered, recurved, abbreviated racemes or clusters; rachis puberulous, 2–4 mm. \textit{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. \textit{Bracteoles} 2, ovate to suboblong, c. 1½ mm. \textit{Sepals} suffused with red, oblong-ovate, markedly veined longitudinally, ciliolate, c. 2 by 1½ mm. \textit{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. ½, lobes suberect, villous at the base and a little down the throat inside. \textit{ Stamens} slightly exserted from the throat; anthers elongate, c. ½ mm in the ½, c. 1 mm in the ¼ specimens. Disk cup-shaped, shortly 5-lobed. \textit{Ovary} subglobose; style columnar, 1½–2 mm. \textit{Fruit} depressedly globose, blackish blue at full maturity, c. 4 by 5 mm.

\text{Distr.} \textit{Malesia}: New Guinea, in the Main Range from Mt Carstensz to Mt Wilhelmina, and again on Mt Scratchley.

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


Shrub with numerous suberect, ramified branches, 0.3–1½–(2½) m. Branchlets slender, subdensely patently hairy or subhirsutulous. \textit{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 subserulate-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; racis 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. 1/2 mm. Sepals oblong-ovate, 2-2 1/2 mm, keeled, ciliolate and prominently veined lengthwise as are the bracts and bracteoles, glabrous dorsally. Corolla white, urceolate-cylindric, 5-6(-6 1/2) mm long in all, subdensely set with longish retrorse hairs in the upper third of the tube inside, otherwise glabrous, lobes ovate-oblong, 1 1/2-1.8 mm, slightly expanded. Anthers in 2 flowers 1.2 mm. Disk cup-shaped, shortly 5-10-lobed. Ovary subglobose, glabrous; style thick, 1 1/2-2 mm, stigma peltate. Mature fruit depressed-globose, pale blue or purplish, 3-4 by 5-6 mm.


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 afrakensis (Kaneh. & Hatus.) SLEUM. Blumea 12 (1963) 167.—Styphelia afrakensis Kaneh. & Hatus. Bot. Mag. Tokyo 56 (1942) 483, f. 6.—Fig. 183.

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 narrowly-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 1-1 1/2(-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. 1/2 mm. Flowers terminal and axillary, mostly solitary, rarely in twos, sessile; rachis very short, provided with (8-10) imbricately arranged, ovate, acute, concave, fimbriate bracteoles (1/2-1 mm) below the calyx. Sepals greenish, ovate, subacute, ciliolate, parallel-nerved, 2(-2 1/2) mm. Corolla almost funnel-shaped, white or pale greenish, 5-partite halfway or slightly more, 3 1/2-4 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 exerted from the throat, oblong, c. 1 mm; filaments 1/2 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.


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

Vern. Anggwar, tenuhabar, Manikiong.


Small shrub or treelet, up to 2 m, with numerous slender ± erect branches. Branchlets subrect-patent, slender, tips generally densely and ± shortly pubescent and densely foliate, lower parts ± defoliata and rather tardily glabrescent. Leaves similar to those of T. mutans and T. nubicola, lanceolate-oblong, apex rather shortly acuminate, subacute, base ± broadly attenuate into the petiole, coriaceous, glabrous, edge very finely subserulate-ciliate initially and still so for a fairly long time after, 8-10 by 2-3 (rarely up to 3 1/2) 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. mutans); petiole mostly rather flattened, 1(-1 1/2) mm. Flowers terminal and axillary, mostly solitary, rarely in twos; rachis very short (± 3 mm), covered with 7-10 imbricate bracteoles, 1/2-1 1/4 mm. Sepals subovate-oblong, obtuse, strongly parallel-nerved, reddish at the margins, ciliate especially distally, 2 1/2(-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 1/3.
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, 1 1/2–2 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, petioloed, 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 so 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 Chileensis, Australiensis, and fragments of Striata and Columbium—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 caffeïne 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 furu-loykerulate).

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


Herbs with simple or branched basal stems ('rhizomes') from which arise ±
short-lived flowering stems. *Leaves* opposite or sometimes alternate (but not in Malesia), palamately 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) aown which is almost glabrous on the inner surface. *Seeds* reticulate, usually ejaculated from the separating mericarp through a ventral dehiscent 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*
2. Flowers solitary .......................... 2. *G. potentilloides*
3. Flowers twinned .......................... 3. *G. homeanum*


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 micro. *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, usually obtuse or slightly acuminate, ± pubescent, membranous, brown. *Sepals* elliptic to oblong, c. 3 by 1 mm, surmounted by a short micro, pubescent with soft, appressed hairs. *Petals* spathulate, distinctly unguulate, 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.


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. *Hér. ex DC. Prod*. 1 (1824) 639; HOOK. *f.* FL. NOU. Zel. 1 (1852) 40; Fl. TASM. 1 (1860) 57, *non* SPRENG. 1826, nec BONPL. *ex* WEDD. 1855, *non* KNUTH. 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. *sarawakense* *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-ovobate 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, × 3/2, 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 Borghmann 92, f Crutwell 1030).

1/2 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.


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.


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 ob lanceolate 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. Road sides 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 obuse 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


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 cincinnial 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 stig 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.


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 tub.-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 ob lanceolate ± unequal, pink to white sometimes with dark spots or lines towards the base on the posterior ones. Staminial 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 Arjuno: Lalidjiwo, and Tenger—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* WILDL. (*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 representation of mostly widespread (native or introduced) species in the warm parts of the Old World. Although the family is predominantly tropical, its area reaches 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. chinenis 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 Weitstein. Red pigmentations are not caused by anthocyanins but by the characteristic chromo-alkaloids, 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 KNO3 (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. Plantanatomie, 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 glanular 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 scarios, 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 Plumbaginates 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 think 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. Holtum for data on Bougainvillea.

**KEY TO THE GENERA**

1. Herbs, unarmed.  
2. Leaves equal. Inflorescence involucrate. Perianth not articulated with the pedicel, 4½-6½ cm long. Anthocarp with faint ribs, not viscid ........................................ 1. Mirabilis  
3. Leaves unequal. 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  
4. Each pedicel adnate to a subsessile coloured bract 3-6 cm long .......... 3. Bougainvillea  
5. Each pedicel bearing 1-3 small, not coloured bracteoles. ................. 4. Pisonia

**I. MIRABILIS**


Erect herbs, often branched, glandular-pubescent or glabrous; nodes thickened; roots with tubers. Leaves of each pair equal. Inflorescences terminal, corymbose, 1-6-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 green part 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.

Herb, 50-80 cm. Leaves 2½-15 by 1½-9 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. Stamens 5-6, exerted for 8-15 mm. Style equalling the stamens; stigma capitate, with short lobes to fimbriate. Anthocarp subglobose, 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. Burkhill (Dict. 1935, 1478-1479) and Heyne (Nutt. Pl. 1927, 609) mention some other minor uses. For a discussion of the medicinal value see Qwisumbing (Medic. Pl. Philip. 1951, 276).

Vern. Four o'clock, Marvel of Peru, E; Konde wonderbloem, nachtschone, vieruursbloem, D; bunga or kembang pikul ampat, kembang pagi soré, sēraja, M, kēderat, sēgərat, tāgərat, J; nodja, Bali, bunga lēdonotok, Roti, loro laka, Timor (Tētum lang.); turaga, Cél. (tonsaw.); bunga waktu ketjil, Moluccas, kupa oras, Ambon, tijako ra, Ternate.

2. BOERHAVIA


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
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

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Fig. 1. *Boerhavia chinensis* (L.) Aschers. & Schweinf. a. Habit, × ½, 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).
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2. Anthocarp obconical, star-shaped on section, without glands or hairs, top truncate. Stamens 1–2.

2. B. erecta


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, 1/4–4/5 by 1/4–4 cm; base obtuse, cordate, or truncate; top acute to obtuse or obtusely acuminate; petiole 1–3½ cm. Flowers 1–12 together, campylane, in cymose panicles, 1/2–7 by 1–6 cm; peduncle 2–5 cm, 1–3 times branched. Pedicel 1/2–2 mm; bracteoles 1–3, lanceolate, 0.9–1 by 1/2–2½ mm. Perianth 1½–2½ mm, with a distinct constriction halfway, limb 1–2 mm, white, red, pink, or violet. Stamens 1–3, exerted up to 1/2 mm. Stigma exserted up to 1/2 mm. Anthocarp club-shaped, 2½–3½ 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. Philippine 1951, 275).

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.


Herb, 20–80 cm, erect or decumbent at the base, puberulous, especially in the upper part at the nodes, glabrescent. Leaves 1½–3½ by 1/2–½ cm, ovate, oblone, 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, 1/2½–1½ by 1½–3½ cm, 1–3 times branched; peduncle 1½–2 cm. Flowers tubular-campanu-
late; pedicle 1/2–5 mm, with 1-2 lanceolate bracteoles 1/2-1 by 1/4 mm at the top or lower on the pedicle. **Perianth** 1 3/4–2 1/2 mm, with 5 faint ribs and a distinct constriction halfway; limb 1 1/2–2 mm, white, red, or pink. **Stamens** 2–3, exserted for 1/2, like the stigma. **Anthocarp** obconical, glabrous, 3–3 3/4 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 *Malaysia*: 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 PUL** 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 mirah, tjakaran, Java. **3. Boerhavia chinensis (L.) ASCHERS. & SCHWEIN.** 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.—**Valentina chinensis LINNÉ**, Sp. Pl. (1753) 33; **Burm. f.** f. Fl. Ind. (1768) 15, t. 6, f. 3.—**B. repanda WILDE**, Sp. Pl. 1, 1 (1797) 22; **POIR.** in Lamk, Enc. Méth. Bot. 5 (1804) 56; **BL.** Bijdr. 14 (1826) 733; **DECNE.** Herb. Timor. Deser. (1835) 45; **CHOISY** in DC. Prod. 13, 2 (1849) 455; **WIGHT**, Jc. (1851) 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; **BHARGAVA, J.** Ind. Bot. Soc. 11 (1932) 303 (anat.); **GAGNÉP.** Fl. Gén. 1–C. 4 (1936) 1049; **BLACK, Fl. S. Austr.** ed. 2 (1948) 333, f. 473.—**Astrephia chinensis** DUFRE. Hist. Nat. Médic. Valér. (1811) 51.—**B. helena R. & S.** Mant. Syst. Veg. 1 (1822) 73.—**B. scandens var. chinensis** (L.) **O.K. REV. Gen. Pl. 1 (1891) 534.—**Commicarpus chinensis** **HEIML.** in E. & P. Pfl. Fam. ed. 2, 16c (1934) 117.—**Fig. 1a–e.** Herb. 1(-4) m, erect, sometimes climbing, puberulous-glabrescent. **Leaves** thin, 2 1/2–4 1/2 by 1 1/2–4 cm; base obtuse to cordate; top acute; margin deeply sinuate; petiole 1–3 cm. **Flowers** tubular-campanulate 3–8 together in umbels 1/2–2 by 1/4–3/4 cm; peduncle 2–6 cm; pedicels 2 1/2–14 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. **Malaysia**: 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.

### 3. BOUGAINVILLEA


**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.

HOLT'TUM 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 *Bougainvillea* 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 HOLT'TUM'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 PUL, Phytomorphology 1 (1951) 185.

It lies outside the scope of this Flora to deal with the numerous infraspecific forms, for which we refer to HOLT'TUM'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 o, and glabrous .......................... 1. *B. peruviana*
2. Flower tube wider and more or less hairy.
3. Leaves broadly ovate. Bracts crimson or orange fading to purple or mauve; edges of bracts much crisped ........................................ 2. *B. buttiana*
4. Leaves almost evenly elliptical. Bracts purple, changing little in colour on fading; edges of bracts little crisped ........................................ 3. *B. glabra*
5. Flower tube bearing copious spreading hairs up to 1 mm long. Leaves velvety hairy. 4. *B. spectabilis*


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 1¼–2 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* 5. *Anthocarp* c. 10 mm long, glabrous.

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


2. *Bougainvillea × buttiana* HOLT'T. & STANDL.
Note. Several garden varieties, hybrids, and variegated forms were dealt with by Holtzum in 1955, who by then also had discovered that this 'species' is a hybrid between *B. peruviana* Humb. & Bonpl. and *B. choisyi*.


Leaves almost evenly elliptical, sparsely puberulous on both sides, somewhat denser on the nerves underneath; nerves above paler and slightly depressed. Bracts 3–4½ by 1½–3 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 evervet conditions. Note. In the hairs of the perianth the cells are difficult to discern with a 30 times magnification.


Leaves more or less ovate, proportionately wider than in *B. glabra*, velvety beneath and often above. Bracts 2½–5 by 1½–3½ 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.

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**Pisonia**


Erect shrubs or trees up to 30 m tall, unarmed except one sp., symподially branched, mostly glabrescent; wood and bark soft and spongy, brittle, pith hardly distinct from the wood. *Leaves* (sub)opposite, alternate or conformed towards the twig ends, entire, dull, midrib flat above. *Inflorescence* axillary or terminal, small or large thyse 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, ampanulate, tubular,
**Fig. 3. Pisonia diandra Pulle.**

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 exerted, sterile in the ♀ flowers. *Ovary* (sub)sessile on a small disk, elongate, narrowed towards the top, smooth; style longer than the ovary, stigma capitulate 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 Malagasy 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* = *Heimerlidiendron* 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.

7. *P. grandis*

5. Perianth lobes truncate. Stamens 3–6. Anthocarp c. 5 cm, rostrum c. 3 cm.

3. *P. mülleriana*

5. Perianth lobes not truncate.

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*

1. P. umbellifera


2. Cauliflorous. Perianth lobes without viscid stipules. Leaves 10–20 by 6–10 cm, with dark or dark-red veins contrasting with a paler interveiny, hairy on the nerves beneath.

7. P. grandis

2. Plants spine-like, 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. 1 1/4 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 interveiny, 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.


5. P. umbellifera


2. P. caulisfora

6. Rostrum of the anthocarp 3–40 cm long.

5. P. diandra

7. Buds almost cylindrical or at least hardly constricted, not club-shaped. Inflorescent 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


8. Leaves c. 15–24 cm long, rather elliptic; petiole (1–)2–8 cm. Flowers c. 4 1/2 mm long. Stamens 3–6. Rostrum c. 3–4 cm long, thick (in the only fruiting specimen known).

3. P. milleriana

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

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


Shrub or tree to 28 m high, unarmed. Leaves opposite, sometimes confused 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. Stamen 6–14, exserted to 4 mm. Stigma filiform; 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. i.c. van der Pul 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, liong, luwing; Java: gendala or pedaja, kitjar, kitjau, pulihan (the latter for the fruit); Philip.: anilin, balaga/basa, malasa/a, padjang-

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

Note. For galls on the leaves see Docters van Leeuwen, Zoococcida (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.


Small tree, 2 m, unarmed. Leaves opposite or in pseudowhors, elliptic-oblong, (4½–)32–40–(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. Anthercarp elongate, 7 cm long, with 5 ribs, not viscid, between the ribs somewhat plicate; pedicule 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. 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 7 cm. Flowers bisexual, pedicel 2 mm, at its base or higher 2 small acute bracteoles. Perianth tubular, e. 4½ mm high, lobes 5, truncate. Stamens 3–6, not exserted; stigma little fimbriate. Anthercarp 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.

Fig. 7. Localities of Pisonia cauliﬂora Scheff.

Tree up to 30 m, unarmed. Leaves opposite or in pseudo-whorls or congested 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, tip acute, obtuse, or obtusely-acuminate. Inflorescences many-flowered, dichasia umbels, 5—25 cm, 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 exerted; 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. Duda, Halmahera; New Guinea: bibubkwa, Momi lang., tohehna, Orokaiva lang., Mumuni, epanol, Wapi lang., Marok, parbut, Andjai lang., Kebar Valley; Solomon Is.: pupisilango, Ulawa 1.

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, × ½. —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 BEUMÈE 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 o, 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. Stamen 2 or 4, in the 2 flower sterile and shorter than the gynaeicum; in the 3 flower exserted for 1 mm; theca ear-shaped. Stigma filibrate, 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.


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


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. Stamen 5–6; in the 3 flower sterile and shorter than the gynaeicum. Stigma filibrate. Anthocarp (immature) elongate, c. 4 cm long, sparsely hairy to glabrous; rostrum c. 7 cm; pedicel 2 cm long.

Distr. Malesia: Molucas (Batjan l., 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—PETRUCCHI 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. mulleriana WARB.


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 membranaceous, 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, 1½–3½ 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.
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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.


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

Fig. 12. Localities in and round Malesia of Pisonia grandis R. Br.; circles denote data derived from literature.
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 islands 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. 3 (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, Peniphis, Scaevola, and Thespesia. It gains special 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 in diameter. The root system is shallow, the wood very brittle, and the massive crown with huge struggling branches so vulnerable to wind that such groves or fringes may easily fall a victim to heavy storms. However, it is also not uncommon for rotted trees may produce shoots, and overleaning branches produce suckers. Pisonia is consequently preferring leeward faces of islets. See Gibson-Hill, Bull. Raffles. 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. Gillham, 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.1. 11, 1856, 118), Bali and Alor (ibid. 34, 1874, 464), Tjelagem islet in the Lépar 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 Is., 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 chlorophyllose 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 Burkhill, Dict. (1935).

Vern. Malay Peninsula: saudi kivai, Tamil, mungkudu java, m, kelimu or mengkudu, k. sëlat, k. sëmu, Trengganu; Java: koller tree, kol-banda, sajur putih, M, widjojo kusumo, J (see note); Borneo: buml; Celebes: daon bualan; Talaud I.: burlan; Ternate: hate-bula; Ambon: ay-puth, sajur putih; Bali: dagdag séé, sel or sirea; Bima: sábe; Banda: tala; Philippines: kóles malako; Marianas: umum, Saipan; Enirik I.: kanal; Back I.: káng; Moch I.: mok or muók; Aoman I.: kanae or kangee; Lukunor I.: mik; Vanua Levu (Fiji); talatalambia; Caroline I.: mokhi, Ulithi Atoll, puka, Sinikutai 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 long bars and held in shade with a green 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.


Overhanging climber to 20 m high, with mostly recurved, axillary thorns ½-1 cm long (abortive shoots). *Leaves* (sub)opposite, elliptic, 4-10 by 1½-5 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. *Peduncle* ½-3 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 1½ mm, androecium completely abortive. *Fl* *Flower* funnel-shaped, 3 mm; stamens 8, exserted for ½-1 mm. *Limb* with 5 larger lobes (only in the *Fl* 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. *Antioecarp* 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. ½ 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. Coenca), 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
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; tjuhan-lamarang, S. Bantam; rampari, Sumba; matal-alát, 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, Zocecidia (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. & HOLL. 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.
FLORA MALESIANA

SCIENTIFIC COMMUNICATIONS

concerning Flora Malesiana should be addressed to the General Editor,
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