BLUMEA 43 (1998) 131–164

REVISIONS AND PHYLOGENIES OF MALESIAN EUPHORBIACEAE: Subtribe Lasiococcinae (Homonoia, Lasiococca, Spathiostemon) and Clonostylis, Ricinus, and Wetria

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SUMMARY

A cladogram of the subtribe Lasiococcinae (*Homonoia*, 2 species, *Lasiococca*, 3 species, and *Spathiostemon*, 2 species) is presented with the genus *Wetria* as outgroup. All three taxa are monophyletic groups of species with *Lasiococca* and *Spathiostemon* as sistergroups and *Homonoia* related to both of them. Within *Lasiococca, L. comberi* and *L. malaccensis* are probably closest related.

The two species of *Homonoia* are rheophytes, one is restricted to India where it shows two distinct forms, the other species is widespread from India throughout Malesia.

Lasiococca is represented by one species in Malesia, *L. malaccensis*, only known from three localities, ranging from the Malay Peninsula to Sulawesi and the Lesser Sunda Islands.

Spathiostemon has two species in Malesia, one is widespread in Malesia, the other one is restricted to part of Peninsular Thailand.

Clonostylis, a monotypic genus only known from the Sumatran type specimen, is not synonymous with *Spathiostemon*. *Clonostylis* is seemingly most similar to *Mallotus* and *Macaranga*.

Ricinus, also a monotypic genus, is introduced to Malesia and is generally cultivated. It is not part of the Lasiococcinae. The presence of phalanged stamens, also typical for the Lasiococcinae, is a parallel development as *Ricinus* shows many more androphores and the connective is often appendaged. *Ricinus* cannot readily be classified and retaining it in its present monotypic subtribe seems to be the best solution.

Wetria shows two species in Malesia. One is restricted to West Malesia, the other one is found in New Guinea and appears to be similar to the recently described *W. australiensis* of Queensland.

INTRODUCTION

Several genera will be revised in this article, starting with a revision of the subtribe Lasiococcinae, comprising the genera *Homonoia*, *Lasiococca*, and *Spathiostemon*. *Clonostylus* is discussed because it was synonymized with *Spathiostemon*, but in my opinion incorrectly so (see introduction to *Spathiostemon*). *Ricinus* is treated because, at one time, it was included in the Lasiococcinae. *Wetria* is included to serve as an outgroup for the phylogenetic analysis of the Lasiococcinae.

Pax & Hoffmann (1919) placed *Homonoia*, *Lasiococca*, and *Spathiostemon* together with *Ricinus* in the tribe Ricininae of the subfamily 'Acalypheae'. Webster (1994), like

1) The revision of *Lasiococca* is by Nguyen Nghia Thin, Vu Hoai Duc & P.C. van Welzen; the revisions of *Spathiostemon* and *Wetria* are by P.C. van Welzen assisted by J. Kruizinga and H. Zwols, and by H. Hangelbroek and G. Kolff van Oosterwijk, respectively. All other genera are revised by P.C. van Welzen

Airy Shaw (1974), considered this group to be artificial due to too much emphasis on the single character of united stamens. They consider the union of the stamens into phalanges to be a parallel development in *Ricinus* and the other three genera (perhaps an adaptation to wind pollination). *Ricinus* is indeed in many aspects very different from the other three genera (stipules, leaves, extrafloral nectaries, inflorescences, and seeds). Webster united *Homonoia*, *Lasiococca*, and *Spathiostemon* into the subtribe Lasiococcinae (of the tribe Acalypheae, subfamily Acalyphoideae). Airy Shaw (1974) discussed a possible close relationship between the Lasiococcinae and the large genus *Mallotus*, from which *Lasiococca* and *Spathiostemon* mainly differ in their phalanged stamens and leaf glands; *Homonoia*, though lacking the glands, adds a rheophytic habit and scale hairs (Airy Shaw, 1981).

The three genera in the Lasiococcinae have been kept separate by several authors, while others (partly) united them. Blume described the genus *Spathiostemon* and its single species *S. javense* (1825). Baillon (1858) transferred *Haematospermum* (a synonym of *Homonoia*, but Baillon had not seen *Homonoia* properly yet, see his page 659) to *Spathiostemon* and maintained it as a separate section. Müller (1865/66, 1866) synonymized *Spathiostemon* with *Homonoia*. Pax & Hoffmann (1919) followed Müller's view, but raised both sections of Baillon to subgeneric level. [Pax & Hoffmann (1919) also incorrectly attributed a sectional division within *Homonoia* to Müller (1866), but all Müller did was that in his 'key' he indicated the sections of Baillon (1858) within *Spathiostemon*.] Merrill (1940) even went one step further, he united all species of *Spathiostemon* and *Lasiococca* into *Homonoia*, including his *Mallotus pseudoverticillatus* (Merrill, 1935). Nowadays, *Spathiostemon* and *Lasiococca* are considered to be separate genera, a view followed in this revision, because the two genera can easily be distinguished (see Key to the genera of the Lasiococcinae) and because the phylogenetic analysis shows them to be monophyletic groups of species (see next chapter).

Lasiococca, described by Hooker (1887a) is the most poorly known genus in the subtribe. It comprises three species and resembles *Spathiostemon* in having the stamens united in phalanges and in the possession of typical small glands in or just along the margin on the upper surface of the leaf. *Lasiococca* differs from *Spathiostemon* in the narrowly cordate leaf base, the much larger sepals of the pistillate flowers, and the leaves which are in (pseudo)whorls or subopposite. The glands are positioned slightly differently: in *Lasiococca* they occur in the lower third of the leaves, in *Spathiostemon* subbasally. *Lasiococca* usually has more than three glands, in the margin in *L. symphylliifolia* (like in *Spathiostemon*), submarginally on the upper surface in the other two species.

Homonoia is in fact the most atypical genus in this subtribe because of its rheophytic habit, presence of scales on the lower surface of the leaves, the stamens united into a single androphore instead of several, and the apex of the fruit axis which after dehiscence tapers instead of broadens towards the apex.

In Webster's key (1994) to the genera of the subtribe *Lasiococcinae* a small mistake has been made, *Homonoia* and *Spathiostemon* are monoecious and not dioecious as mentioned in this key. This mistake is easily made, because the plants usually show inflorescences of only one type, only very few have staminate and pistillate inflorescences at the same time.

PHYLOGENY

It is difficult to decide which genera should be included in a phylogenetic analysis of the Lasiococcinae. *Clonostylis* has to be excluded, because this species is incompletely known and its relationships with the Lasiococcinae are uncertain. Also *Ricinus* has to be excluded from the analysis. Although it once was included in the Lasiococcinae because of the presence of phalanged stamens, *Ricinus* is very different in many respects (palmatifid peltate leaves, single leaf-opposite stipule, terminal bisexual inflorescences, extrafloral nectaries) and even in the stamens two differences are present. In *Ricinus* the connective often shows an appendage, which is always absent in the Lasiococcinae, and the number of androphores is much higher (more than 50) than in the Lasiococcinae (less than 10 in *Lasiococca* and *Spathiostemon*, or c. 8 groups branching off form a single androphore in *Homonoia*). Therefore, it is likely that the presence of united stamens is a parallel development in *Ricinus* and in the Lasiococcinae. The developmental mechanism of the branching stamens might be that the original stamens started to split dichotomously, a process which was repeated several times. Therefore, the number of androphores (or phalanged groups of stamens) might reflect the original number of stamens, whereby the Lasiococcinae had a different base number than *Ricinus*. Probably, *Homonoia* shows a further development with all androphores united into a single androphore as the stamens still branch off in c. 8 groups.

The genus *Wetria* was selected as outgroup. It is not closely related to the Lasiococcinae, but still within the same tribe (Webster, 1994). A more likely candidate would have been the genus *Mallotus*, but this genus has never been revised completely and it is very large. *Wetria* with its two species is easier to comprehend.

Most characters selected (Table 1) do not need an explanation, only a few have to be discussed. Character 4 refers to glands present on the upper and lower surface of

Table 1. Characters and character states used in the phylogenetic analysis of the subtribe Lasiococcinae with the genus *Wetria* as outgroup.

1. Habit:	1 = normal; 2 = rheophyte
2. Phyllotaxis:	1 = alternate; 2 = pseudowhorls or subopposite
3. Hairs:	1 = simple only; 2 = glandular as well; 3 = scale hairs
4. Glands on leaf:	0 = absent; 1 = present
5. Leaf margin:	1 = entire, without glands; 2 = serrate, with glands
6. Domatia:	0 = absent; 1 = hair tufts
7. Black glands:	0 = absent; 1 = present
8. Position black glands:	1 = in margin; 2 = submarginal, adaxial
9. Number black glands:	1 = 3; 2 = more than 3
10. Leaf base:	1 = narrowly cordate; 2 = rounded to cuneate
11. Petiole length:	1 = 0.1–1.5 cm; 2 = 1.3–5.5 cm
12. Staminate flowers:	1 = 1 per node; 2 = 2–4 per node
13. Pistillate flowers:	1 = several per inflorescence; 2 = 1 flower only
14. Stamens:	1 = free; 2 = several androphores; 3 = single androphore
15. Anther locules:	1 = almost separate; 2 = normal
16. Connective appendix:	0 = absent; 1 = present
17. Ovary:	1 = smooth; 2 = muricate
18. Endosperm:	0 = absent; 1 = present
19. Leaf shape:	1 = obovate; 2 = elliptic; 3 = narrowly elliptic

the leaves of *Wetria*. These glands are different from the ones shown by *Lasiococca* and *Spathiostemon* (character 7). The latter glands, c. 3 (character 9), are subbasally present in the margin of the leaves of *Spathiostemon* (character 8). The leaves of *Lasiococca* also possess them, but there are many more (character 9) and usually submarginally on the upper surface in the lower half of the leaves (character 8); only *L. symphylliifolia* has them also in the margin like *Spathiostemon*. The character of black glands is divided over three characters to ensure that it may be a synapomorphy for both genera together, but also that special features are typical for the separate (parts of) genera. Character 8 and 9 are dependent on the presence of character 7, therefore question marks are coded for those species which do not possess the black glands.

Character 11 does not really show a gap in measures, but it is used because the much longer petioles are typical for *Spathiostemon*.

Table 2 shows the data matrix, which was analysed with PAUP version 3.1.1 (Swofford, 1993) via an exhaustive search under default conditions. A bootstrap was also performed under default conditions (1000 repeats). The resulting cladogram was optimized with MacClade version 3 (Maddison & Maddison, 1992).

Table 2. Data matrix for phylogenetic analysis of the subtribe Lasiococcinae with the genus *Wetria* as outgroup.

Species \ Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Wetria australiensis	1	1	1	1	2	0	0	?	?	2	1	2	1	1	2	1	1	1	1
Wetria insignis	1	1	1	1	2	0	0	?	?	2	1	2	1	1	2	0	1	1	1
Homonoia retusa	2	1	3	0	2	0	0	?	?	2	1	1	1	3	1	0	1	0	1
Homonoia riparia	2	1	3	0	2	0	0	?	?	2	1	1	1	3	1	0	1	0	3
Lasiococca comberi	1	2	1	0	1	0	1	2	2	1	1	1	2	2	1	0	2	0	1
Lasiococca malaccensis	1	2	1	0	1	1	1	2	2	1	1	1	2	2	1	0	2	0	1
Lasiococca symphylliifolia	1	2	2	0	1	0	1	1	2	1	1	1	2	2	1	0	2	0	1
Spathiostemon javensis	1	1	1	0	1	1	1	1	1	2	2	1	1	2	1	0	2	0	2
Spathiostemon moniliformis	1	1	1	0	1	0	1	1	1	2	2	1	1	2	1	0	1	0	2

The resulting cladogram (Fig. 1) has a length of 23 steps, a consistency index of 0.91 and a retention index of 0.93. Only one parallel development (hair tuft domatia, character 6) and one reversal (muricate ovaries, character 17) are present. The bootstrap values show a very high confidence in all clades (most are over 90%). The three genera of Lasiococcinae appear to be monophyletic groups of species with *Lasiococca* and *Spathiostemon* as sistergroups and *Homonoia* related to both (Fig. 1). The bootstrap values are somewhat less for the subdivision in *Lasiococca* and for the genus *Spathiostemon*. The latter is caused by the fact that character 6 shows a parallel development and character 9 is a dependent character, which either is an apomorphy for *Lasiococca* or for *Spathiostemon*. Here, the latter option has been favoured, with the idea that Euphorbiaceae usually show many glands in or near the margin, and, therefore, the lower number in *Spathiostemon* is considered to be apomorphic (of course, the rule 'common is primitive' is a weak argument for designating polarity to characters).

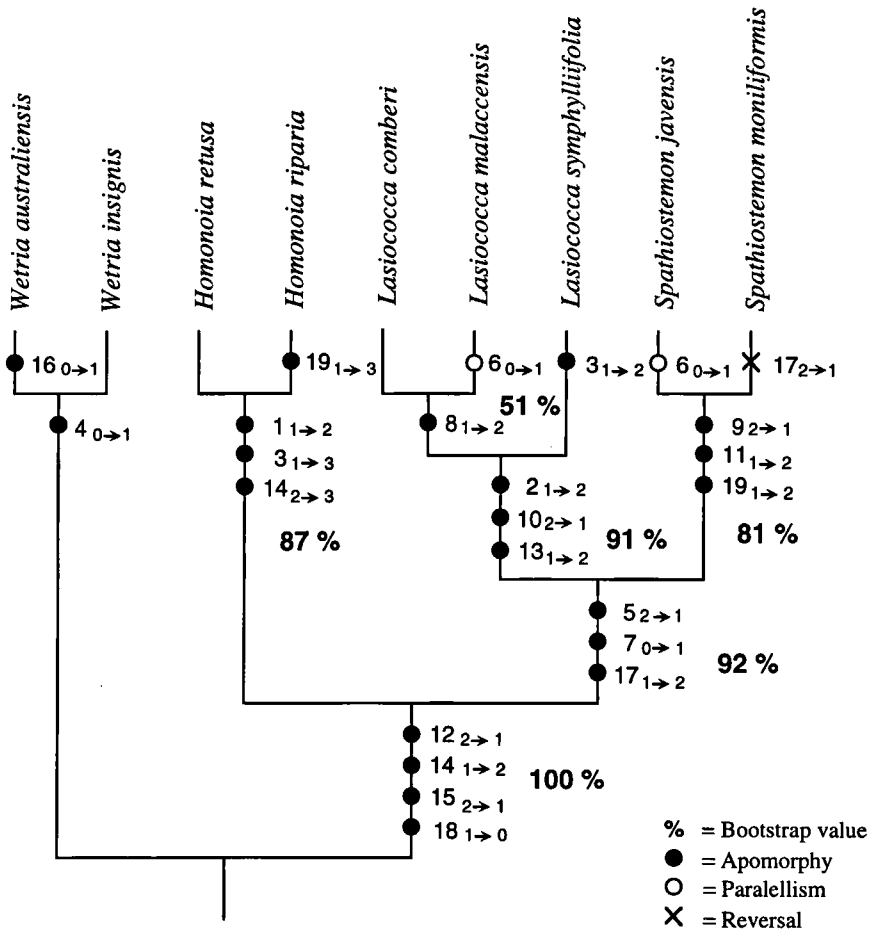


Fig. 1. Most parsimonious cladogram of the subtribe Lasiococcinae.

Other problematic optimisations are the characters at the base of the cladogram. The presence of glands on the leaf is considered to be apomorphic for *Wetria* (character 4), the others are thought to be apomorphic for the Lasiococcinae, although this is very uncertain for character 15 and 18. The fact that the anther locules are hardly connected to the connective (character 15) is not typical for the Lasiococcinae, it is also found in several species of *Mallotus* and in *Ricinus*. Absence of endosperm (character 18) is considered to be apomorphic. Character 14 is presently regarded as a synapomorphy for the Lasiococcinae (stamens phalanged in several groups) with a further development in *Homonoia* (stamens all united into a single androphore). Of course, the presence of several androphores may also be regarded as a synapomorphy of *Lasiococca* and *Spathiostemon* together instead of a synapomorphy for the whole subtribe.

KEY TO THE GENERA OF LASIOCOCCINAE

1a. Plant rheophytic. Leaves below with scale hairs. Stamens united into a single androphore. Ovaries smooth. Fruits small, 3.2–4.5 by 2.7–4 mm; column after dehiscense apically tapering ..... **Homonoia**
b. Plant not rheophytic. Leaves below without scale hairs. Stamens united into several androphores. Ovaries echinate (or smooth). Fruits larger, 9–12 by 6–7 mm; column after dehiscence with a broadened apex, obtriangular in longitudinal section 2

2a. Leaves in pseudowhorls or subopposite, base narrowly cordate .... **Lasiococca**
b. Leaves alternate, base rounded to cuneate ..... **Spathiostemon**

HOMONOIA

INTRODUCTION

Loureiro (1790) described the genus *Homonoia* with its type species *H. riparia*. This species is often a common rheophyte (plant with a willow-like habit growing in or along rivers) widespread in Southeast Asia. Therefore, it has independently been described by several other authors, usually in an already existing genus, once in a new genus: *Lumanaja* (Blanco, 1837). Wallich (1832) used the name *Haematospermum* to indicate a new genus, but this genus, and its species, have never been properly described (nomina nuda).

A second species was described by Wight (1852) as *Adelia retusa* and moved to *Homonoia* by Müller (1865/66), who distinguished two varieties in this species.

Typical for *Homonoia* are the shallowly to distinctly crenate leaves with marginal glands and lepidote scales at the lower surface, an absence of petals and discs, staminate flowers with the numerous stamens united into a 'staminate tree', a striate pollen sexine (Webster, 1994), pistillate flowers with smooth but hairy ovaries, small fruits, which after dehiscence show a narrow, tapering column, and seeds covered with an arilloid.

Only *H. riparia* will be described here, because it is the only species occurring in Malesia. However, *H. retusa* and *H. riparia* can easily be distinguished from each other: *H. retusa* has obovate, short, relatively broad leaves, 1.5–4.3 cm long, index 1.3–4.2, widest subapically, apex emarginate to rounded, lower surface with (almost) no papillae; inflorescences very short, up to 2 cm long, and *H. riparia* has narrowly elliptic leaves, 3.5–20.7, index 5–13.8, widest in the middle, apex acute, lower surface (densely) papillate; inflorescences much longer, up to 10 cm long. The two varieties distinguished in *H. retusa* by Müller (1865/66) are distinct in the few specimens I have seen, specimens with either shorter, broader leaves with an emarginate apex (var. '*genuina*', nom. inval., should be var. *retusa*), or specimens showing longer, narrower leaves with a truncate to rounded apex (var. *truncata* Müll. Arg.). *Homonoia retusa* is found in Central India only (see Map 1, inset).

Homonoia Lour.

Homonoia Lour., Fl. Cochinch. (1790) 636; Müll. Arg. in DC., Prodr. 15, 2 (1866) 1022; D. Vidal, Sin. Gen. Pl. Lenos. Filip. (1884) 236; Hook. f., Fl. Brit. India 5 (1887) 455; J.J. Sm. in Koord. & Valeton, Meded. Dept. Landb. Ned.-Indië 10 (1910) 542; Pax & K. Hoffm. in Engl., Pflanzenr. IV.147, xi (1919) 114; Merr., Enum. Philipp. Flow. Pl. 2 (1923) 447; Ridl., Fl. Malay Penins. 3 (1924) 309; Gagnep. in Lecomte, Fl. Indo-Chine 5 (1925) 330; Corner, Wayside Trees Malaya (1940) 258; Backer & Bakh. f., Fl. Java 1 (1963) 491; H.L. Li, Woody Fl. Taiwan (1963) 430; Airy Shaw, Kew Bull. 26 (1971) 282; Whitmore, Tree Fl. Malaya 2 (1973) 102; Airy Shaw, Kew Bull. Add. Ser. 4 (1975) 136; Kew Bull. Add. Ser. 8 (1980) 121; Kew Bull. 36 (1981) 310; Steenis, Rheoph. World (1981) 240; Airy Shaw, Kew Bull. 37 (1982) 25; Alph. Enum. Euphorb. Philipp. Isl. (1983) 33; G.L. Webster, Ann. Missouri Bot. Gard. 81 (1994) 90. — *Spathiostemon* Blume sect. *Haematospermum* Wall. ex Baill., Étude Euphorb. (1858) 293. — *Homonoia* Lour. subg. *Lumanaja* (Blanco) Pax & K. Hoffm. in Engl., Pflanzenr. IV.147, xi (1919) 114, nom. inval. (ICBN, 1994, art. 22.2). — Type species: *Homonoia riparia* Lour.

[*Haematospermum* Wall., Cat. (1832) 7953, nom. nud. — Based on *Haematospermum neriifolium* Wall., nom. nud. (= *Homonoia riparia* Lour.)].

Lumanaja Blanco, Fl. Filip. ed. 1 (1837) 821. — Type species: *Lumanaja fluviatilis* [= *Homonoia riparia* Lour.].

Shrub (to small tree), usually dioecious, also monoecious (see the note). *Indumentum* consisting of simple, hirsute to sericeous hairs and scale hairs. *Stipules* small, triangular to ovate with an asymmetric base, thick, caducous. *Leaves* spirally arranged, simple; petiole short, kidney-shaped in transverse section, not pulvinate; blade coriaceous, willow-shaped, not punctate, base acute, margin laxly indistinctly (to distinctly) serrate, flat, with a gland in each tooth at the lower surface, apex acute, very apex mucronulate, upper surface smooth, glabrous except for the basal part of the midrib, lower surface papillate in *H. riparia*, with scale hairs, venation pinnate, looped and closed near the margin, reticulate. *Inflorescences* solitary axillary spikes, usually only with staminate or pistillate flowers, occasionally spikes with staminate flowers basally and pistillate ones apically; staminate flowers one per node. *Bracts* and *bracteoles* ovate to triangular, margin and outside sericeous. *Flowers* actinomorphic, sessile, without petals and disc, no odour. *Staminate flowers:* sepals 3, inequal, (sub)glabrous; stamens united into a thick androphore from which branches branch off alternately, branches splitting up dichotomously, ending with an anther, the latter more than 100, very small, opening latro-introrsely; pistillode absent. *Pistillate flowers:* sepals 5 (or 6), imbricate, apex acute, margin and outside sericeous; ovary hirsute, 3-locular, ovules 1 per locule, descending, epitropous, anatropous, axillary, subapically attached to the column, style usually absent, stigmas 3, apically (not) split, stigmatic lobes on upper surface and along margin. *Fruit* an ovoid to slightly coccoid rhegma, outside sericeous, inside glabrous, dehiscing loculicidally and later also partly septicidally into 3 bivalved segments; wall thin, woody; septa with a basal vein and a vein halfway (at apex of column); column after dehiscence with a narrow straight septum margin, apically tapering, not broadened. *Seeds* usually 3 per fruit, ovoid, but keeled at one side, somewhat flattened; arillode sarcotesta-like, covering seed completely, red. *Embryo* flat, without endosperm.

Distribution — Two species, *H. retusa* restricted to Central India, *H. riparia* widespread from India to China and Taiwan, throughout Malesia to New Guinea (on Borneo only found in Sabah).

Ecology & Habitat — Rheophytes, often common and mainly found in and along rivers at low altitudes.

Note — In *H. riparia* most specimens only show staminate or pistillate flowers, which probably indicates dioecy. Several specimens contain separate branches (perhaps from different plants), each with flowers of one sex, but with both sexes present. A handful of specimens show flowers with mixed inflorescences on the same branch, some with staminate flowers, others with pistillate flowers, and several with staminate flowers basally and pistillate flowers apically. These plants are of course monoecious. Perhaps the species is monoecious and the different sexes appear on the same plant, but separated in time and on different inflorescences.

Homonoia riparia Lour. — Fig. 2; Map 1

Homonoia riparia Lour., Fl. Cochinch. (1790) 637; Müll.Arg. in DC., Prodr. 15, 2 (1866) 1023; Fern.-Vill., Nov. App. (1880) 196; Hook.f., Fl. Brit. India 5 (1887) 455; J.J. Sm. in Koord. & Valeton, Meded. Dept. Landb. Ned.-Indië 10 (1910) 547; Pax & K.Hoffm. in Engl., Pflanzenr. IV.147, xi (1919) 114, f. 27a–e; Merr., Enum. Philipp. Flow. Pl. 2 (1923) 448; Ridl., Fl. Malay Penins. 3 (1924) 309; Gagnep. in Lecomte, Fl. Indo-Chine 5 (1925) 330, f. 38: 5–8; Burkill, Dict. Econ. Prod. Malay Penins. 1 (1935) 1186; Corner, Wayside Trees Malaya (1940) 258, f. 82; W.H.Br., Useful Pl. Philipp. 2, Techn. Bull. Dept. Agric. Philipp. Isl. 10 (1950) 311; K.Heyne, Nutt. Pl. Indonesië 1, 3rd ed. (1950) 932; Backer & Bakh.f., Fl. Java 1 (1963) 492; H.L.Li, Woody Fl. Taiwan (1963) 430, f. 152; Airy Shaw, Kew Bull. 26 (1971) 282; Whitmore, Tree Fl. Malaya 2 (1973) 103; Airy Shaw, Kew Bull. Add. Ser. 4 (1975) 136; Kew Bull. Add. Ser. 8 (1980) 121; Kew Bull. 36 (1981) 310; Steenis, Rheoph. World (1981) 241; Airy Shaw, Kew Bull. 37 (1982) 25; Alph. Enum. Euphorb. Philipp. Isl. (1983) 33. — Type: *Loureiro 222* (BM, holo), Cochinchina (Vietnam), Ri ri bo foung.

Croton salicifolius Geiseler, Croton. Monogr. (1807) 6, non *C. salicifolius* Gagnep. — Type: *Vahl's herbarium (ex Hb. Richard) s.n.*, s.d. (C), Java.

Adelia neriifolia K.Heyne ex Roth, Nov. Pl. Spec. (1821) 375; Wight, Ic. Pl. Ind. Or. 5 (1852) 20, t. 1868. — *Haematospermum neriifolium* (K.Heyne ex Roth) Wall., Cat. (1832) 7953. — *Spathiostemon salicinum* Baill., Étude Euphorb. (1858) 293, nom. superfl. — Type: *Wallich 7953B (Hb. Heyne)* (K, holo; iso in BM, K), India orientalis.

[*Haematospermum riparium* Wall., Cat. (1832) 7953, nom. nud. — Based on *Wallich 7955* (A, K), Assam.]

Lumanaja fluviatilis Blanco, Fl. Filip. ed. 1 (1837) 821; ed. 2 (1845) 568, ed. 3, 3 (1879) 236, f. 338. — Neotype (proposed here): Fl. Filip. ed. 3, 3 (1879) f. 338. Placed in synonymy of *H. riparia* by Fernández-Villar (1880).

Ricinus ? salicinus Hassk., Cat. Hort. Bot. Bogor. (1844) 237; Pl. Java Rar. (1848) 264. — *Spathiostemon salicinus* (Hassk.) Hassk., Hort. Bogor. Descr. (1858) 41. — Type: *Hasskarl s.n.*, 1841 (L, holo, no. 904.75-252), Java, Bantam.

Spathiostemon salicinus (Hassk.) Hassk. var. *angustifolius* Miq., Fl. Ned. Ind., eerste bijv. (1860) 452. — Syntypes: *Diepenhorst HB 552* (U), Sumatra, Lubu-alang; *Diepenhorst HB 1397* (U), Sumatra, Priaman; *Teijsmann HB 4341* (U), Sumatra, Lampong Prov., Tega-nennin.

Shrub (to small tree), up to 2(–7) m high, dbh up to 15 cm; flowering branches 2–5 mm thick, smooth to slightly ribbed, lenticular, sericeous. Outer *bark* grey-brown to red-brown, smooth to horizontally and vertically fissured; corky middle bark red; inner bark green to cream. *Sapwood* white, hard. *Leaves*: stipules 4.8–6.5 by 0.5–1.2 mm, margin entire, apex acute, margin and upper surface glabrous except for some basal scale hairs, lower surface hirsute; petiole 4–13 mm long; blade elliptic (to somewhat obovate), 3.5–21 by 0.5–2.5 cm, index 5–14, above dark green, below silvery to

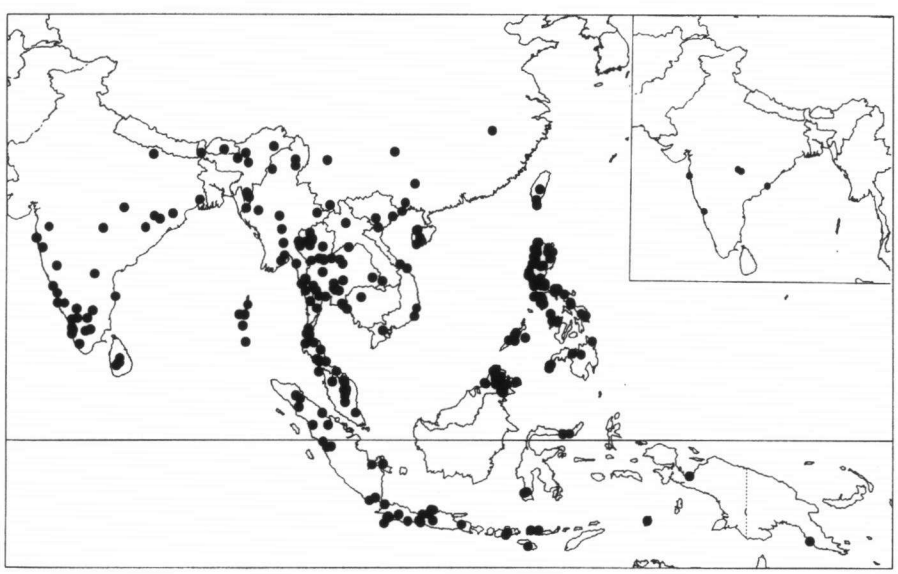
Fig. 2. *Homonoia riparia* Lour.: a. Habit; b. lower surface of leaf margin, showing marginal gland and scale hairs; c. staminate flower; d. pistillate flower; e. fruit; f. column after dehiscence with hardly any remnants of the septae and a tapering apex [a: × 0.5; b–f: × 12.5, all L; a, c: *van Balgooy 2566*; b: *KEP FRI (Everett) 14466*; e, f: *KEP FRI (Loh Hoy Shing) 17237*].

whitish to glaucous, venation raised on both sides, nerves 13–16 per side. *Inflorescences* up to 7(–10) cm long, dirty green-yellow with a reddish tinge. *Bracts* 1–2.2 by 0.7–1.7 mm; bracteoles 0.6–1.5 by 0.3–1 mm. *Staminate flowers* 4.5–5 mm in diam.; sepals ovate to elliptic, 2.8–4.3 by 0.8–3.3 mm, outside dark red, inside very pale reddish pink; androphore 3–5.8 mm high, white, connective dark red, anthers c. 0.4 by 0.2 mm, white to yellow. *Pistillate flowers* c. 2 mm in diam.; sepals ovate, 1.1–2.3 by 0.4–1.1 mm, dull green tinged reddish; ovary globose, 0.8–2 by 0.7–2 mm, style absent (to up to 0.3 mm long, cream), stigmas 1.4–4 mm long, red-brownish. *Fruits* 3.2–4.5 by 2.7–4 mm, (yellowish red to) brown (to blackish); wall thin, less than 1 mm thick. *Seeds* 1.3–1.8 by 1.8–2.2 by 1–1.5 mm. *Embryo:* cotyledons 1.5–1.8 by 1.2–1.5 mm; plumule and radicle c. 0.3 mm long.

Distribution — Widespread, found in Bhutan, India, Sri Lanka, Myanmar, China, Taiwan, Laos, Cambodia, Vietnam, Thailand, and throughout Malesia (on Borneo in Sabah only), but rare towards the east (Moluccas, New Guinea). See Map 1.

Ecology & Habitat — Rheophyte, usually in groups on riverbanks, in rocky (fast running) streambeds, and along the coast. Soil usually (temporarily) inundated, in some areas for months. Anchorage of the plants superb (Van Steenis, 1981). Flowers are presumably wind-pollinated. The seeds are very hard and durable; they sink in water and may be transported by the river into even the sea, where they can still germinate in salt water along the coast. Soil: limestone, rocks (gravel), sand. Altitude sea level up to 700 m. Flowering and fruiting throughout the year.

Uses — The plant is used as a medicine against different diseases. Laos: decoction of leaves to be used against itch. Cambodia: stem and leaves are used as a medicine to depurate the skin of diseases, young leaves and shoots produce hair oil, and wood is used in an infusion against malaria. Thailand: mashed and powdered leaves are a treat-



Map 1. Distribution of *Homonoia riparia* Lour. and *H. retusa* Müll. Arg. (inset).

ment against skin eruption. Malaysia (N Perak): pounded leaves and fruits are used against skin diseases too, either in a poultice and/or as a decoction to be drunk. Java: used as a medicine, unknown for which cause; also used to fasten loose teeth. S Philippines: the plant may be a stimulant against certain venereal diseases; a root decoction acts as an emetic, while water running at the foot of the shrubs may have depurative properties.

Other uses — Due to the elaborate and large root system the plant is used in North Sumatra (Gajo Lands; Van Steenis, 1981) and Java to protect riverbanks or is planted to prevent erosion. The sap of the plant may dye teeth black (Java). In South China the bark is used as rope (Van Steenis, 1981). The leaves are used for forage in Vietnam. The root is used to make bolo handles (Sabah, N Borneo) (after Airy Shaw, 1975; W.H. Brown, 1950; Burkill, 1935; Heyne, 1950, N.N. Thin, msc.).

Vernacular names — Sri Lanka: omi, werawala (Singh). – Myanmar: kyauk(a)naga, momaka, nyin ye bin. – China: shui yeung mui. – Laos: kek khay. – Cambodia: rey tuck. – Vietnam: cây rù rì nuóc, rì rì, rù rì. – Thailand: k(l)ai nam (Lao); klai hin, mai kerai, (ta)kri nam. – Malay Peninsula: willow spurge (English); kalire (Batek); champenai, kelereh, kayu suarah, mempenai, kelerai. – Sumatra: sangka, sangkir (Malay); sansang haroes/sesang aroes (Lampung); serkil (Gajo Lands). – Java: kajoe soebah, keding djati, soebah/sobah, tambahoea (Javanese); djoerai/joerei/tjoerei/tjurai (Sundanese). – Borneo: *Sabah:* bongai tidong (Idahan); parang-parang (Bajan). – Philippines: agooi, agoioi, agukuk, balanti, dumanai, kagoioi, lumanai, lumanaia, apoioi mangagos, managos (Tagalog); baha (Tagbanua); balanti (Zambal); daguwas (S.L. Bis.); dumanai (Iloho); hangarai malabugos, miagook, miagus (Bisaya); liuhon (Sambali); mamalis (Ilog). – Sulawesi: tidemobugato. – Lesser Sunda Islands: *Flores:* kenga waé, mela waé. (After W.H. Brown, 1950; Corner, 1940; Heyne, 1950; J.J. Smith, 1910, Whitmore 1973; N.N. Thin, msc.)

LASIOCOCCA

(by Nguyen Nghia Thin[2], Vu Hoai Duc[2] & Peter C. van Welzen)

The genus *Lasiococca* (with *L. symphylliifolia*) was described by Hooker (1887a), based on *Homonoia symphylliaefolia* Kurz (1875), a species only known from India. Haines (1920) added a second species for China, *L. comberi* (see for a note on this species Airy Shaw, 1963a: 358). The third species was described by Airy Shaw (1968), *L. malaccensis*, based on a single specimen from Peninsular Malaysia.

Lasiococca malaccensis is the only species present in Malesia. Besides the type specimen from Peninsular Malaysia it is only known from two other localities, one in Sulawesi (vegetative specimen only) and the other from the Lesser Sunda Islands (specimen with young staminate inflorescences). This distribution is very disjunct and probably the species may be present in intermediate regions. It is likely that more material exists, but the genus is so badly known that specimens are probably incorrectly identified. A likely candidate is the genus *Mallotus*, but a search of the unidentified material did not reveal any additional specimens, nor did a search through several other genera.

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The three species can easily be separated. Airy Shaw (1968) already mentions differences among them; however, a few may be added here:

	L. symphylliifolia	*L. comberi*	*L. malaccensis*
Glands on leaf	in margin	upper surface, submarginal	upper surface, submarginal
Domatia	absent	absent	hair tufts
Inflorescence	densely hairy	hairy	(sub)glabrous
Hairs on sepals	hairy outside	margin only pilose	margin only pilose
Sepals pistillate flower	glandular hairs	without	without
Fruit processes	dense, narrow, sometimes branched with many setae	coarse, unbranched 1 or 2 setae	dense, narrow, unbranched 1 or 2 setae

The presence of domatia is typical for *L. malaccensis* and enables identification of the eastern Malesian material even in spite of the very scarce and incomplete material.

Typical for the genus *Lasiococca* are the (pseudo)whorled to subopposite leaves with narrow cordate base, glands in or along the margin on the upper surface in the lower third of the leaves, inflorescences with either racemes of many solitary staminate flowers or with a single pistillate flower, staminate flowers with 3 valvate sepals, stamens united in phalanges, opening introrse, pistillate flowers with large persistent sepals, fruits echinate, axis with broadening apex.

Lasiococca Hook. f.

Lasiococca Hook. f., Hook. Icon. Pl. 16 (1887) pl. 1587; Fl. Brit. India 5 (1887) 456; Pax in Engl. & Prantl, Nat. Pflanzenfam. III, 5 (1890) 72, f. 43; Pax & K. Hoffm. in Engl., Pflanzenr. IV.147, xi (1919) 118, f. 28; in Engl. & Harms, Nat. Pflanzenfam. ed. 2, 19c (1931) 149, f. 76; Airy Shaw, Kew Bull. 16 (1963) 358; Kew Bull. 21 (1968) 406; Whitmore, Tree Fl. Malaya 2 (1973) 104; Nguyen Ngia Thin, Biol. J. Hanoi 8 (1986) 36. — Type species: *Lasiococca symphylliifolia* (Kurz) Hook. f.

Shrubs to trees, presumably monoecious, but sexes flowering at different times; bark pale, deeply fluted, buttressed; flowering twigs smooth, glabrous except on nodes. *Indumentum* existing of simple hairs only except for glandular hairs on bracts and sepals in the pistillate flowers of *L. symphylliifolia*. *Stipules* triangular, outside hairy, inside glabrous, early caducous. *Leaves* spirally arranged, in pseudowhorls or subopposite, simple; petiole short, reniform, completely pulvinate; blade chartaceous, usually symmetric, base narrowly cordate, margin entire, wavy, with glands in the margin or on the upper surface along the margin in the lower third of the blade, apex cuspidate, very apex rounded, usually green when dry, somewhat paler below, nerves looped and joined near margin, with hair dot domatia in *L. malaccensis*, veins scalariform, quaternary veins reticulate. *Inflorescences:* staminate flowers in solitary axillary racemes, unbranched, flattened, one flower per node; pistillate flowers single in the axils. *Bracts* and *bracteoles*: in staminate flowers broadly ovate, forming a cup under each single flower, bracts outside hairy, bracteoles subglabrous, keeled; in pistillate flowers triangular, subglabrous, caducous. *Flowers* actinomorphic, petals and disc absent, odour unknown. *Staminate flowers* shortly pedicelled; sepals 3, subglabrous to glabrescent, with c. 4 obvious nerves; stamens more than 100, very small, united into 4–7 androphores, the latter bifurcating into separate stamens; an-

thers 2-locular, opening introrsely with lengthwise slits; pistillode absent. *Pistillate flowers:* pedicel very long, with abscission zone in upper part; sepals 5, leaf-like, subglabrous, reflexed in fruit; pistil 3-locular, lobed in transverse section, one ovule per locule, papillate, puberulous, with one or several bristle hairs; style short, hairy, stigmas 3, apically not split, hairy below, above with flat, broad papillae. *Fruits* slightly lobed capsules, outside puberulous, echinate, woody, thin-walled, septicidally breaking into three bivalved parts; column after dehiscence with a narrow, straight, non-fibrous septum margin and a broadened apex, obtriangular in longitudinal section. *Seeds* usually 2 or 3 per fruit, obovoid, slightly triangular in transverse section; caruncle or arilloid absent; embryos not seen.

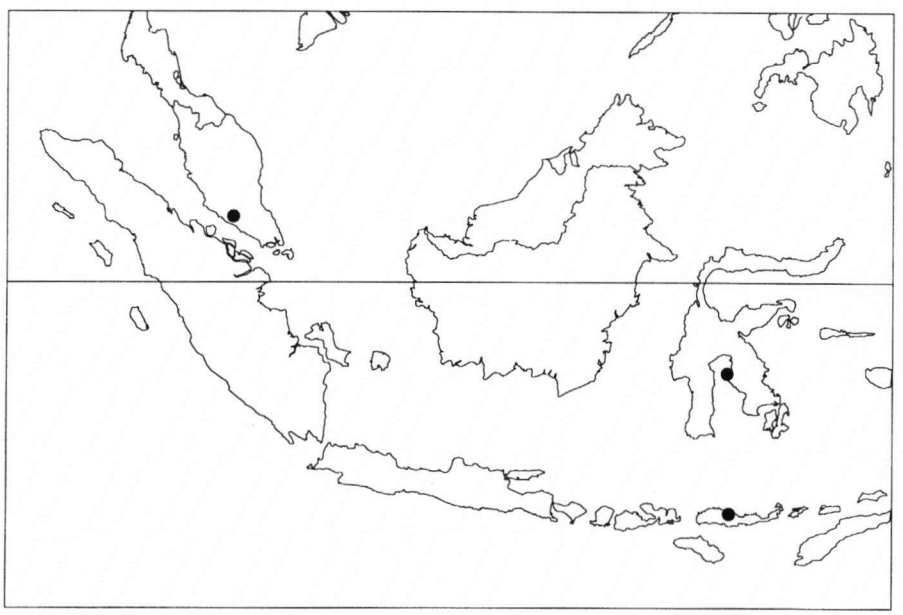
Distribution — Three species: *L. symphylliifolia* (Kurz) Hook. f. is restricted to India (Bihar, Sikkim), *L. comberi* Haines ranges from India (Madras, Orissa) to North Vietnam (Ha Son Binh, Lang Son) and China (Hainan), and only *L. malaccensis* Airy Shaw is found in Malesia (Malay Peninsula, Sulawesi, Lesser Sunda Islands).

Ecology & Habitat — Small to relatively large trees, in scrubs or semi-evergreen forest. Soil: sand and perhaps other types. Altitude 60–1200 m. Flowering Apr.–Aug., fruiting July–Aug.

Lasiococca malaccensis Airy Shaw — Fig. 3; Map 2

Lasiococca malaccensis Airy Shaw, Kew Bull. 21 (1968) 406; Whitmore, Tree Fl. Malaya 2 (1973) 104. — Type: *SF (Kiah) 37231* (SING, holo, n.v.; iso in K, n.v., L), Peninsular Malaysia, Malacca, Batang Malakka Forest Reserve.

Lasiococca sp.?: Airy Shaw, Kew Bull. 37 (1982) 26, pro *bb 26278* (L), Celebes, Ond. Kolaka, Mala-mala.



Map 2. Distribution of *Lasiococca malaccensis* Airy Shaw.

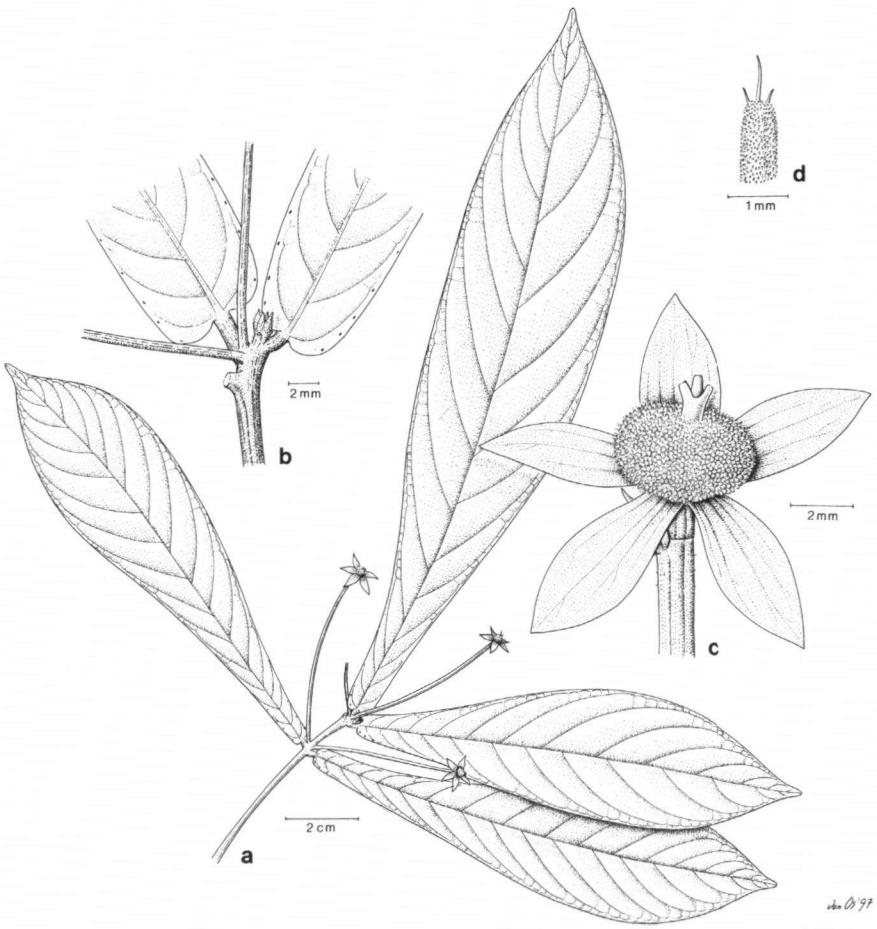


Fig. 3. *Lasiococca malaccensis* Airy Shaw: a. Habit; b. base of leaf showing glands on upper surface; c. pistillate flower; d. detail of tubercles with a single long and several smaller stiff hairs [*SF (Kiah) 37231*, L].

Tree to 8 m high or more; flowering twigs c. 2 mm thick. *Bark* smooth, whitish. *Stipules* c. 2.3 by 0.9 mm. *Leaves:* petiole 1–4 mm long, subglabrous; blade obovate, 8–20 by 2.6–5.7 cm, ratio 3–3.5, on both sides smooth, glabrous except for hair tuft domatia on lower surface in axils of veins, venation raised on both sides, especially below, with 9–12 pairs of nerves. *Staminate inflorescences* and *flowers* not seen. *Pistillate flowers:* bracts and bracteoles caducous; pedicel 5–7 cm long, (sub)glabrous; flowers c. 1.3 cm in diam.; sepals 5, elliptic, 6–8.2 by 2.5–3 mm, apex cuspidate, subglabrous; pistil c. 3.5 by 2 mm; style c. 0.5 mm long; stigmas c. 1.8 mm long. *Fruits* not seen.

Distribution — Very disjunct in Malesia: Malay Peninsula (Malacca), Sulawesi, and Lesser Sunda Islands (Flores).

Ecology & Habitat — Apparently a very rare species. In Malaysia on hill slopes, flowering in April.

Vernacular name — Lesser Sunda Islands: *Flores:* mborong.

SPATHIOSTEMON

(by Peter C. van Welzen)[3]

INTRODUCTION

Blume (1825) introduced the monotypic genus *Spathiostemon* with the single species *S. javensis*. Hooker (1887b) independently described it as the monotypic genus *Polydragma*, with *P. mallotiformis*. Within the genus *Mallotus* it was described twice, as *M. eglandulosus* by Elmer (1908) and as *M. calvus* by Pax & Hoffmann (1914). Based on the united stamens it has been synonymized with the genus *Homonoia* by several authors (see general introduction).

Airy Shaw (1963b) described the second species, *S. moniliformis*, which is only found in the peninsular part of Thailand.

Airy Shaw (1978) considered the monotypic Sumatran genus *Clonostylis* (with *C. forbesii*), described by S. Moore (1925) to constitute the third species in *Spathiostemon*. In 1981, Airy Shaw reconsidered his *S. moniliformis* of Thailand; he then regarded it to be synonymous with *C. forbesii* and made the new combination *S. forbesii*. However, the type specimen, *Forbes 3027*, is completely unlike *Spathiostemon*: First of all, *Spathiostemon* is unknown for Sumatra. Secondly, *Forbes 3027* has leaves with distinct basal nerves, glands at the upper and lower surface close to the margin (both absent in *Spathiostemon*), and deeply split stigma lobes (undivided stigmas in *Spathiostemon*), while the glands in the margin near the leaf base, typical for *Spathiostemon*, are absent. Therefore, no other conclusion can be drawn then to reinstate *Clonostylis* and *C. forbesii*. *Spathiostemon moniliformis* is the accepted name for the Thai species of *Spathiostemon* and not *S. forbesii*.

Typical for *Spathiostemon* are the relatively large, more or less elliptic leaves with rounded to cuneate base, entire margin, and cuspidate to caudate apex. On each side of the base, at the slightly thickened margin, 2 or 3 very small black glands can be found; sometimes these are confluent into a black line. The bracteoles beneath the staminate flowers form a cup, while the staminate flowers themselves have 3 sepals and lack petals and a disc. The stamens are numerous and united on several androphores (also called phalanges). The fruits are slightly lobed and 3-locular, they can be muricate or smooth; after dehiscence the column has straight narrow margins which broaden into an, in longitudinal section, obtriangular apex. The seeds lack an arilloid or caruncle. Webster (1994) also mentions a non-striate sexine of the pollen as typical.

Spathiostemon Blume

Spathiostemon Blume, Bijdr. (1826) 621; Airy Shaw, Kew Bull. 26 (1972) 341; Whitmore, Tree Fl. Malaya 2 (1973) 132; Airy Shaw, Kew Bull. Add. Ser. 4 (1975) 196; Kew Bull. Add. Ser. 8 (1980) 202; Kew Bull. 36 (1981) 345; Kew Bull. 37 (1982) 35; Alph. Enum. Euphorb. Philipp. Isl. (1983) 45. — *Spathiostemon* Blume sect. *Euspathiostemon* Baill., Etude Euphorb. (1858) 203, nom. illeg. — *Homonoia* subg. *Spathiostemon* (Blume) Pax & K. Hoffm. in Engl., Pflanzenr. IV.147, ix (1919) 117. — Type species: *Spathiostemon javensis* Blume.

Polydragma Hook. f., Hook. Ic. Pl. 18 (1887) pl. 1701; Fl. Brit. India 5 (1888) 456. — Type species: *Polydragma mallotiformis* Hook. f. (= *Spathiostemon javensis* Blume).

3) Revision assisted by two students, Jaco Kruizinga and Henk Zwols.

Shrubs to trees, monoecious, but sexes flowering at different times; flowering twigs smooth, lenticellate, glabrous except when young. *Indumentum* existing of simple hairs only. *Stipules* deltoid, outside hairy, inside glabrous, early caducous. *Leaves* spirally arranged, simple; petiole relatively long, flattened above, basally and apically somewhat pulvinate; blade papery, usually symmetric, base rounded to cuneate, at margin with 2 or 3 glands at each side, the latter sometimes confluent into a glandular zone, margin entire, wavy, apex cuspidate to caudate, very apex rounded to acute and mucronulate, usually green when dry, paler below, nerves looped and joined near margin, usually with hair dot domatia in *S. javensis*, veins scalariform, quaternary veins more reticulate. *Inflorescences* axillary to pseudoterminal racemes, unbranched, usually one per axil, with either staminate or pistillate flowers, flattened, pendulous when staminate, erect when pistillate; staminate flowers single per node. *Bracts* and *bracteoles* broadly ovate to deltoid, forming a cup under each single flower, outside or margin hairy, bracteoles in staminate flowers of especially *S. moniliformis* spreading and cordate. *Flowers* actinomorphic, petals and disc absent, odour unknown. *Staminate flowers* sessile to shortly pedicelled; sepals 3, mainly glabrous, with c. 4 obvious nerves; stamens more than 100, very small, united into 4–7 androphores, the latter bifurcating into separate stamens; anthers 2-locular, opening latero-introrsely? with lengthwise slits; pistillode absent. *Pistillate flowers:* pedicel elongating or not, with abscission zone in upper part; sepals 5 or 3 + 3, margin ciliate; pistil 3-locular, triangular in transverse section, one ovule per locule, smooth or papillate with hairs; style absent to short, stigmas 3, apically not split, glabrous, above with flat, broad papillae. *Fruits* slightly lobed capsules, outside glabrous, smooth or echinate, woody, thin-walled, septicidally breaking into three bivalved parts; column after dehiscence with a narrow, straight, non-fibrous septum margin and a broadened apex, obtriangular in longitudinal section. *Seeds* usually 2 or 3 per fruit, obovoid, slightly triangular in transverse section; caruncle or arilloid absent; embryos not seen.

Distribution — Two species, one endemic in Peninsular Thailand, the other one ranging throughout Malesia from the Malay Peninsula to Papua New Guinea, though absent from Sumatra.

KEY TO THE SPECIES

1a. Petioles subhirsute; leaves usually with hair tuft domatia. Inflorescences subhirsute; staminate ones up to 7.3 cm long. Sepals of pistillate flowers 5. Ovary and fruit echinate ..... **S. javensis**

b. Petioles glabrous; leaves without domatia. Inflorescences glabrous; staminate ones 6–28 cm long. Sepals of pistillate flowers in two whorls of 3. Ovary and fruit smooth ..... **S. moniliformis**

Spathiostemon javensis Blume — Fig. 4a–h; Map 3

Spathiostemon javensis Blume, Bijdr. (1826) 622; Baill., Etude Euphorb. (1858) 293; Airy Shaw, Kew Bull. 20 (1966) 45; Whitmore, Tree Fl. Malaya 2 (1973) 132; Airy Shaw, Kew Bull. Add. Ser. 4 (1975) 196; Kew Bull. Add. Ser. 8 (1980) 202; Kew Bull. 37 (1982) 35; Alph. Enum. Euphorb. Philipp. Isl. (1983) 45. — *Adelia javanica* (Blume) Miq., Fl. Ind. Bat. 1, 2 (1859) 388. — *Homonoia javensis* (Blume) Müll. Arg., Linnaea 34 (1865) 200; in DC., Prodr. 15, 2 (1866) 1022; J. J. Sm. in Koord. & Valeton, Bijdr. Boomsoort. Java 12 (1910) 544; Nova Guinea

Bot. 8 (1910) 240; Merr., Philipp. J. Sci. 11, Bot. (1916) 283; Pax & K. Hoffm. in Engl., Pflanzenr. IV.147, ix (1919) 117, f. 27f; Backer & Bakh.f., Fl. Java 1 (1963) 492; Kulshreshtha & Ahmed, Feddes Repert. 104 (1994) 362, pl. III, 1. — *Spathiostemon javensis* Blume var. *javensis*: Airy Shaw, Kew Bull. Add. Ser. 8 (1980) 202. — Lectotype (here proposed): *Anonymous 1324* (L, sh. 904.75-232), Indonesia, Java, Tjiradjas.

Polydragma mallotiformis Hook.f., Hook. Ic. Pl. 18 (1887) pl. 1701; Fl. Brit. India 5 (1888) 457; Ridl., Fl. Malay Penins. 3 (1924) 310. — Type: *Scortechini 1781* (K, holo; iso in K), Malaysia, Perak.

Mallotus eglandulosus Elmer, Leafl. Philipp. Bot. 1 (1908) 313. — Type: *Elmer 7152* (PNH†, holo; iso in A, K, NY), Philippines, Leyte Isl., Leyte Prov., Palo.

Homonoia javensis (Blume) Müll. Arg. var. *ciliata* Merr., Philipp. J. Sci. 7, Bot. (1912) 391. — Type: *FB (Everett) 7246* (n.v.), Philippines, Negros Isl., Cauayan.

Mallotus calvus Pax & K. Hoffm. in Engl., Pflanzenr. IV.147, vii (1914) 195. — Syntypes: *Lauterbach 2855* (B†; no. 855 in A, K could be identical), Papua New Guinea, Ssigaun; *Schlechter 16356* (B†; no. 16336 in K could be identical), Papua New Guinea, Wobbe; *Schlechter 19993* (A), Papua New Guinea, Peso. See also Airy Shaw, Kew Bull. 20 (1966) 45 and note 2 below.

Spathiostemon javensis Blume var. *nimae* Airy Shaw, Kew Bull. Add. Ser. 8 (1980) 202. — Type: *NGF (Henty) 29378* (BRI, holo, n.v.; iso in K, n.v., L), Papua New Guinea, Morobe Prov., Lae Subprov., trans-Busu, near Sankwep River, 147° 05' E, 6° 40' S.

Shrub to tree, up to 20 m high, dbh up to 45 cm; buttresses seldom present, up to 1 m high and long, 30 cm thick; flowering twigs 1.5–4 mm thick. *Bark* smooth, fluted, peeling off in scales or strips, white to grey to white mottled to dark red to pale brown to dark brown to black, 0.3–1 mm thick; inner bark 2–3 mm thick, white to yellow to reddish to brown; wood soft to usually hard, sapwood white to brownish, heartwood brownish. *Stipules* 1–2.4 by 0.8–1.1 mm. *Leaves:* petiole 0.9–5.5 cm long, subhirsute with long and, less often, short hairs; blade elliptic to somewhat obovate, 4.3–24 by 1.7–11 cm, ratio 1.8–3.2, above smooth, glabrous, below smooth, glabrous except for some hairs on the midrib (to seldom completely subhirsute), venation raised on both sides, with 6–8 pairs of nerves, below usually with hair bundle domatia in axils. *Inflorescences* hirsute with short and usually long hairs, staminate ones up to 7.3 cm long, pistillate ones up to 3.8 cm long. *Bracts* and *bracteoles* 0.8–1 by 1–1.2 mm. *Flowers* green to white to yellow to brown, often tinged red. *Staminate flowers* 5.5–6 mm in diam.; pedicel 1–1.3 mm long, subhirsute with short and usually long hairs; sepals ovate to elliptic, 2.7–3.5 by 1.6–2.3 mm, glabrous except for the acute apex; stamens: androphores and filaments up to 5 mm long, white, anthers c. 0.4 by 0.3 mm. *Pistillate flowers* 2.2–3.8 mm in diam.; pedicel elongating in fruit, up to 8 mm long, subhirsute with short and usually long hairs; sepals 5, triangular to ovate, 1–2 by 0.5–0.8 mm, recurved in older flowers; pistil c. 0.8 by 0.8 mm in young flowers, light cream to yellowish to green, subhirsute and papillate; style absent to 0.9 mm long; stigmas elongating in fruit to 6.5 mm, glabrous, brown. *Fruits* 1–1.2 by 0.6–0.7 cm, echinate with long papillae with on top various hairs of which one at least longer, glabrescent, pink brownish to reddish to yellow. *Seeds* 5–5.5 by 4.5–5 mm.

Distribution — Endemic in Malesia, found in Peninsular Malaysia (Perak), Java, Borneo (especially Sabah), Philippines (except Luzon), Sulawesi, Moluccas, Lesser Sunda Islands, and New Guinea; absent in Sumatra.

Ecology & Habitat — Often common in understorey of primary and secondary forest, shrubbery, on cliffs, along rivers, and in rubber and cocoa plantations on usually flat to undulating country. Soil dry to periodically inundated, often limestone, also on

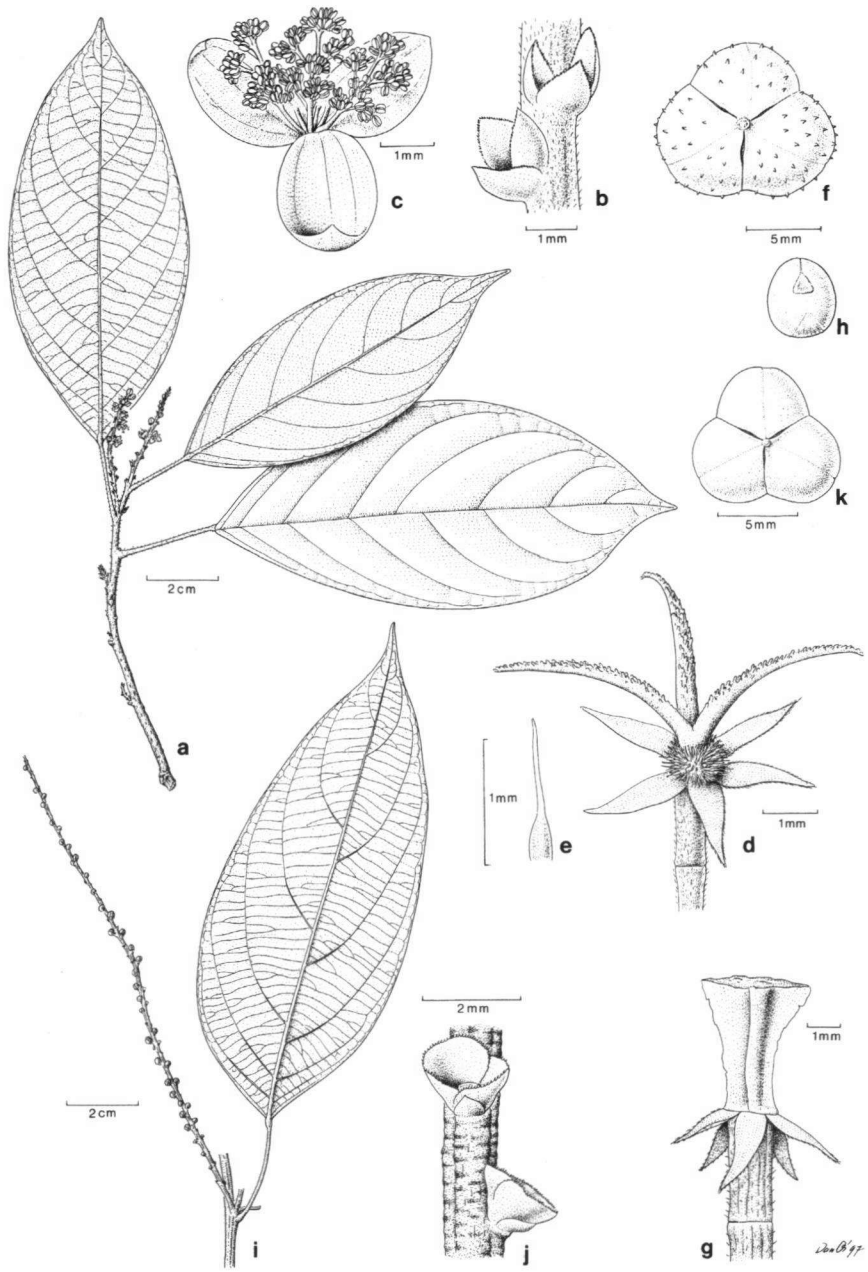


Fig. 4. *Spathiostemon javensis* Blume: a. Habit with staminate inflorescence; b. axis of staminate inflorescence with bracts; c. staminate flower with 3 equal bracts; d. pistillate flower; e. detail of ovary papil with apical stiff hair; f. fruit; g. column after dehiscence; h. seed. — *S. moniliformis* Airy Shaw: i. Staminate inflorescence; j. bract and bracteoles under staminate flower; k. fruit [all L; a–c: *Apostol 7103*; d, e: *Elmer 20702*; f. *Endert 5106*; g, h: *SAN (Matin) 12240*; i–k: *van Beusekom & Santisuk 2821*].

alluvial, black or brown clay, clay-loam, and sand. Altitude: sea level up to 670 m. Flowering and fruiting throughout the year.

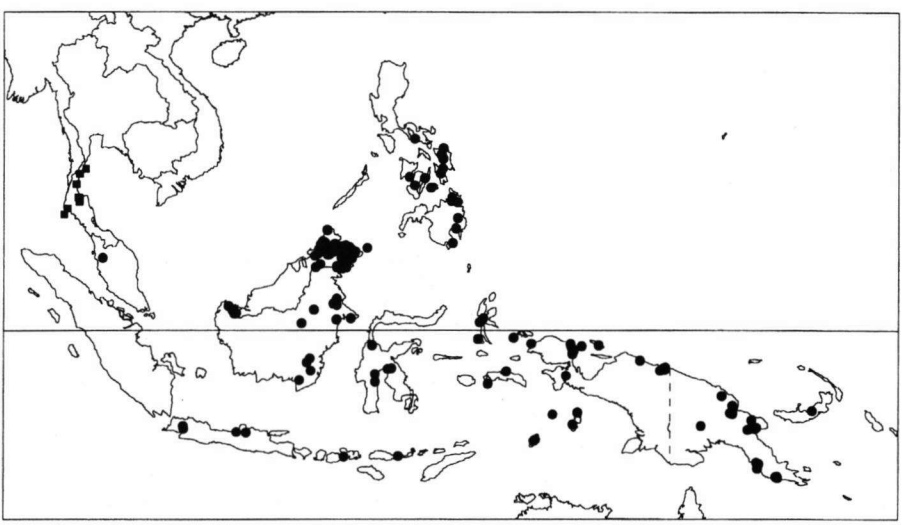
Anatomy — Kulshreshtha & Ahmed (1993: plate III, 1) report the wax on the leaves to be granular.

Uses — The wood is used for construction in the Philippines and for bridges in sea water on Halmahera (Moluccas).

Vernacular names — Borneo: *Kalimantan:* wajan koreng; *Sabah:* kubur (Dusun Banggi); ansalapan, mengkig, toto (Dusun Kinabatangan); lengkan (K.); kilas (Murud); sengulpid (Sungei); *Sarawak:* bantas (Iban). – Philippines: oyagingon (Manobo); apanang (Waray-waray). – Moluccas: *Halmahera:* obadinga mabedeka (Tobaro). – New Guinea: *Irian Jaya:* megwe (Berik); darmor (Biak); djangere (Iraroetoe); hoekane (Irian); batogara (Kemtoek); boeboekwa, kegboi, sorohok (Manikiong); samakjor (Numfur); pole (Sentani); anan (Wain); boeboeika, menom; *Papua New Guinea:* ali'es, baulai, kalikal, konos, kulis, o, oluai, on'as, sanam, uk, unase, yehaye (Amele); gale, galud, keka, kisos, menag, ninegsi, niniki (Bilia); asoadzim (Bogia); bisip, dzumpiam, kala, malamamoi, mempong, pasip, sarenki, singas, tumpahop, wasirip (Dumpu); bulim, dabe, gwandere, mai, orare, sariri, tukai, unai, wime (Faita); sarr (Jal).

Notes — 1. This species is not very variable. In the Philippines the hairy domatia are usually absent. Most variation can be found in New Guinea, where the leaves can become quite small, the hairy domatia can be absent too, and the lower surface of the leaves can be differently coloured (the not accepted var. *nimae*) or very hirsute.

2. Three syntypes are mentioned for the name *Mallotus calvus* by Pax and Hoffmann (1914). Two of these could not be traced anymore, but the possibility exists that *Lauterbach 855* (present in K and a leaf print in A) and *Schlechter 16336* (K) were misspelled as *Lauterbach 2855* and *Schlechter 16356* by Pax and Hoffmann (Airy Shaw, 1966). Both K specimens are *Spathiostemon javensis*, but due to the problems



Map 3. Distribution of *Spathiostemon javensis* Blume (●) and *S. moniliformis* Airy Shaw (■ in Peninsular Thailand).

with the collector numbers the synonym status of *M. calvus* was still uncertain. The third specimen cited, *Schlechter 19993* (duplicate in A), not seen by Airy Shaw, is indeed *S. javensis*. Therefore, Airy Shaw's interpretation that *Mallotus calvus* is a synonym of *S. javensis* is correct.

3. The variety '*nimae*', described by Airy Shaw (1980), based on colour differences in the leaf, cannot be recognized satisfactorily and is therefore treated as a synonym.

Spathiostemon moniliformis Airy Shaw — Fig. 4i–k; Map 3

Spathiostemon moniliformis Airy Shaw, Kew Bull. 16 (1963) 357; Kew Bull. 20 (1967) 408; Kew Bull. 26 (1972) 341; Hook. Icon. Pl. 38 (1974) tab. 3720. — Type: *Kerr 18162* (K, holo, n.v.; iso in L), Thailand, Surat, Ban Krut.

Spathiostemon forbesii auct. non Airy Shaw: Airy Shaw 36 (1981) 345, p.p. pro Thai specimens.

Shrub to tree, up to 10 m high, dbh up to 11 cm; buttresses unknown; flowering twigs 1.5–3 mm thick. *Stipules* 1–2.4 by 0.8–1.1 mm. *Leaves:* petiole 1.3–2.8 cm long, glabrous; blade (somewhat ovate to) elliptic, 6.2–26.5 by 2.3–9.5 cm, ratio 1.8–2.7, smooth and glabrous on both sides, venation sunken (to raised) above, raised below, with 4–6 pairs of nerves, domatia in axils absent. *Inflorescences* (sub)glabrous, staminate ones 6–28 cm long, green; pistillate ones up to 3.3 cm long. *Flowers* white to yellowish. *Bracts* 1.1–1.3 by 0.8–1.2 mm; bracteoles: lower larger than inner, 1.1–1.3 by 1.2–2 mm. *Staminate flowers* sessile; sepals ovate to elliptic, 2.4–2.5 by 1.8–2 mm, glabrous; stamens: androphores and filaments up to 5 mm long, anthers c. 0.4 by 0.3 mm. *Pistillate flowers:* pedicel c. 0.3 mm long, not elongating in fruit, glabrous; sepals 6, in two rows of 3, ovate, outer c. 1.7 by 1.8 mm, thick, keeled, inner c. 1.1 by 1.3 mm, thinner; pistil c. 0.8 by 0.6 mm in young flowers, smooth, glabrous; style absent; stigmas triangular, also in transverse section, glabrous except for apex. *Fruits* c. 9 by 6 mm, smooth, glabrous, reddish to dark brown. *Seeds* c. 4.8 by 4 mm.

Distribution — Endemic in Peninsular Thailand.

Ecology & Habitat — Often common in evergreen and secondary forest with evergreen patches. Altitude 10–200 m. Flowering and fruiting Dec.–March, Aug., Sept.

Vernacular names — Surat Thani Prov.: kha khao, khan laen.

CLONOSTYLIS

Clonostylis is provisionally treated as a monotypic genus based on *C. forbesii*. Only one specimen with pistillate flowers is known, collected by Forbes in Sumatra. *Clonostylis* is not a synonym of *Spathiostemon* (see introduction under the latter genus). The correct classification of this genus will have to wait till staminate flowers and fruits are known. It might be close to or a species in *Mallotus* or *Macaranga*.

Clonostylis S. Moore

Clonostylis S. Moore, J. Bot. 63, Suppl. (1925) 101; Pax & K. Hoffm. in Engl. & Harms, Pflanzenfam. ed. 2, 19c (1931) 229; Airy Shaw, Kew Bull. Add. Ser. 4 (1975) 4, 14; Kew Bull. 32 (1978) 407 (in syn.); Kew Bull. 36 (1981) 345 (in syn.). — Type species: *Clonostylis forbesii* S. Moore

Trees, dioecious?; flowering twigs smooth, glabrous. *Indumentum* existing of simple hairs only. *Stipules* unknown. *Leaves* spirally arranged (to opposite), simple; petiole relatively long, reniform in transverse section, basally and apically somewhat pulvinate; blade parchment-like, symmetric, green when dry, above and below with submarginal circular glands, base attenuate, margin entire to somewhat sinuate, sometimes with glands in the undules, apex acuminate, very apex acute, venation raised on both sides, basally 3-nerved, nerves looped and joined near margin, usually with a few hair dot domatia, veins scalariform, quaternary veins reticulate. *Pistillate inflorescences* axillary racemes, one or two per axil, round, grooved, erect, sericeous, with 1 or 2 opposite flowers per node. *Staminate flowers* unknown. *Pistillate flowers* actinomorphic, sessile; sepals bract-like, 5 or 6, in two whorls, outside sericeous, inside glabrous; petals and disc absent; pistil 3-locular, ovoid, angular, tapering into the style, smooth, sericeous, one ovule per locule; style short, stigmas 3, upper two third split, sericeous, but above papillate. *Fruits* unknown.

Distribution — A single species is known from Sumatra.

Clonostylis forbesii S. Moore

Clonostylis forbesii S. Moore, J. Bot. 63, Suppl. (1925) 101, fig. — *Spathiostemon forbesii* Airy Shaw, Kew Bull. 32 (1978) 407; Kew Bull. 36 (1981) 345, p.p., type only. — Type: *Forbes 3027* (BM, holo; iso in A), Sumatra, Palembang, Moeara Mengkoelem, R. Rawas.

Tree; flowering twigs 1.5–2 mm thick. *Leaves:* petiole 2.4–3.7 cm long, glabrous; blade elliptic, 8.4–13.5 by 3.5–6 cm, ratio 2.3–2.4, smooth and glabrous on both sides, venation with c. 5 pairs of nerves. *Pistillate inflorescences* up to 3 cm long. *Pistillate flowers:* sepals triangular to ovate, c. 1.3 by 1.5 mm, thick; pistil 2.5–2.8 by 2.3–2.5 mm; style 0.7–0.8 mm long; stigmas 5–5.5 mm long, upper 2.4–3.8 mm dichotomous.

Distribution — Endemic on Sumatra, but only known from the type specimen.

RICINUS

INTRODUCTION

Ricinus is a very well-known genus; officially it was established by Linnaeus (1754), but well before that time it was already described (e.g., there is a beautiful plate in Rumphius, 1743). Burkill (1935) even refers to the presence of seeds in the pyramids of the pharaohs, c. 4000 B.C. The plant has a high economical importance, not only horticultural, but also industrial and medicinal. Oil from the seeds can easily be used in the production of very diverse items, varying from paint to hair lubricant. The oil is also used medicinally as a purgative. However, also the leaves are important for a variety of mainly skin diseases and as such they play an important role in traditional medicine in China and Southeast Asia.

The plant is probably of African origin, but it has been grown for centuries on a worldwide scale in the tropics and subtropics. The plant easily escapes from cultivation and can readily settle on most soils, usually in waste places and as such it often is a common sight around cultivated areas in Malesia.

Because of the fact that *Ricinus* has been introduced in Malesia only a qualitative description of the species is provided. This will be the policy for all introduced Euphorbiaceae in Malesia (e.g., *Hevea*, *Jatropha*, *Manihot*, *Vernicia*, and several species in a few other genera, like *Acalypha*, *Euphorbia*, and *Phyllanthus*).

The exact relationship of *Ricinus* to other Euphorbiaceae is still uncertain. Webster (1944) suggests that *Adriana* (an Australian genus of 2 species, see Gross & Whalen, 1996) might be closely related and that both might belong to the Acalypheae. *Adriana*, like *Ricinus*, has extrafloral nectaries, terminal inflorescences, and carunculate seeds, but in *Adriana* the leaves are opposite, the extrafloral nectaries stipular, and the plants dioecious. *Ricinus* might be related if the leaf-opposing stipule is in fact an opposite leaf and if the extrafloral nectaries are true stipules. However, the stipule is probably stipular and the extrafloral nectaries are found in several more places than just at the base of the leaf. Moreover, the distribution of both genera (Australia and Africa) does not support a supposed close relationship. The peltate, palmatifid leaves of *Ricinus* with opposite stipule and many extrafloral nectaries are reminiscent of the genus *Macaranga*, which, like *Ricinus*, also occurs in Africa. However, *Macaranga* is dioecious and has no terminal inflorescences. *Macaranga* often possesses glandular hairs on the lower surface of the leaf; these are absent in *Ricinus*, but the dark epidermal cells on the lower surface, especially visible in young leaves, might have the same function as the glandular hairs of *Macaranga*.

Ricinus communis L.

Ricinus communis L., Sp. Pl. (1753) 1007; Müll.Arg. in DC., Prodr. 15, 2 (1866) 1017; Pax & K.Hoffm. in Engl., Pflanzenr. IV.147, xi (1919) 119, f. 29; W.H.Br., Bull. Dept. Agric. Nat. Res. Bur. For. 22 (1921) 143; Burkill, Dict. Econ. Prod. Malay Penins. 2 (1935) 1907; K.Heyne, Nutt. Pl. Indonesië 1, 3rd ed. (1950) 928; G.L.Webster, J. Arnold Arbor. 48 (1967) 379, f. 4; Arañez, Nat. Apl. Sc. Bull. 32 (1980) 53; G.L. Webster, Ann. Missouri Bot. Gard. 81 (1994) 158. — Possible type specimens: *Herb. Linnaeus no. 1142-1, 1142-2* (LINN), *392-11, 392-13* (S).

Monoecious (herb to) shrub (to tree), up to 6 m high, dbh up to 5 cm; stems green, brown, reddish or glaucous (when young), hollow or with some soft pith tissue. *Indumentum* absent. *Bark* reddish brown; inner bark pale grey; sapwood whitish. *Extrafloral nectaries* sessile or peduncled convex discs, at various places variously present: base and basal part of petiole, inside margins of stipule, base of leaf blade, base of bracts. *Stipules* united, opposite leaf, encircling stem, triangular, symmetric, parallel-nerved, caducous, leaving raised scar. *Leaves* alternate, simple; petiole long, often reddish; blade palmatifid with (6–)7(–11) broadly ovate to linear ovate lobes, symmetric, papery, green, red, or brown, base (narrowly) peltate, margin serrate with smaller and larger teeth, each with a terminal adaxial gland, apices of lobes acute, on lower surface many glandular cells in epidermis, well visible when young, somewhat pitted when older; venation open, nerves ending in major teeth, part of veins on lower surface tinged light red to violet. *Inflorescences* terminal racemes or panicles with a few short branches, in fruit pseudo-axillary due to elongation of axillary buds, sel-

dom very short truly axillary inflorescences with staminate flowers only, glaucous, with basally groups of staminate flowers, and apically 1 to a few pistillate flowers per node or a combination of pistillate and (non-opened) staminate flowers. *Bracts* triangular, dark brown to purplish. *Flowers* symmetric, pedicelled with abscission zone in upper third, fragrant; sepals 5, valvate, ovate, dehiscing often into three parts; petals and disc absent. *Staminate flowers:* sepals yellowish green, pale yellow; stamens many (> 100), united in many dichotomously splitting androphores, cream, white, or light yellow, anthers opening lengthwise, latrorse?, connective apically often with continuation of filament; pistillode absent. *Pistillate flowers:* sepals bract-like, early caducous, leaving a raised scar, green to red; ovary 3-locular, usually echinate outside with long papillae ending in a translucent stinging hair on top, ovules 1 per locule; style short; stigmas 3, light to deep red, connate to halfway, connate part above with long papillae, smooth below, split parts with short somewhat irregular papillae all over. *Fruits* capsular, somewhat lobed, higher than broad, falling septicidally apart into three bivalved parts, the latter loculicidal except for apex, red to brown, smooth to sparsely to densely echinate; exocarp somewhat fleshy, sometimes dehiscing from mesocarp; mesocarp and endocarp woody; column tapering towards base, apex broadened, obtriangular in longitudinal section, septum remnant narrow, frayed, 1 vascular bundle per septum. *Seed* ellipsoid, dorsoventrally flattened, usually marbled with various shades of brown and white, shiny, apically with a 2-lobed caruncle. *Embryo* flattened, surrounded by a copious endosperm. *Seedling:* cotyledons opposite, ovate, base emarginate with 2 glands adaxially at connection with petiole, margin entire, basally 3-nerved, nerves few, looped and joined near margin. First leaves like normal leaves but opposite, stipules 2, interpetiolar; all other leaves alternate with a single leaf-opposite stipule.

Distribution — Presumably originally from North Africa, presently cultivated and occurring subspontaneously worldwide in tropical and subtropical areas; found throughout Malesia.

Habitat & Ecology — When semi-wild mainly found in waste places in all kinds of habitats on usually a rather rich soil, from seashore to midmontane areas, scattered to locally common; however, also reported from primary forest, but probably planted by villagers. Altitude: sea level up to 2400 m. Flowering and fruiting throughout the year.

Uses — The main value is in the oil of the seeds (castor oil, wonder oil), but the plants also have a high horticultural value. The plant is cultivated in plantations and improvement schemes are carried out to increase its oil content. The oil from the seeds is used in the industry for a large variety of products and in medicine. It is a versatile fixed oil, which means that it can be altered chemically. It can be changed into sebacic acid which is used to manufacture plastics and synthetic, durable fibres. The oil can also be changed into a drying oil for varnishes, enamels, and paints (softer, more elastic, and better resistant against yellowing than linseed or tung oil = *Vernicia fordii*). Other uses are in linoleum, leather, printing ink, lithographic varnishes, a special kind of soap, lubricants, sticky fly paper. When sulfonated it is used as a red dye (Turkey red oil). Medicinally it is mainly a purgative due to the fact that lipases change

triricinolein (main component of castor oil) into glycerin and rininoleic acid; the latter irritates the intestines (Arañez, 1980). The residual oil cake is poisonous and only buffaloes seem able to eat it; however, the cake is an excellent fertilizer (Burkill, 1935).

Other uses, also mainly medicinal: leaves and stem are used by the Dusun Kinabatangan (Borneo, Sabah) as a remedy against stings and bites of insects and animals. Sap from heated petioles and young branches is used as ear drops (Indonesia). In the Philippines pound leaves applied as a poultice to the breast are recommended to stimulate milk secretion, boiled pound leaves may be used to wash ulcers and pound roasted seeds mixed with oil can be applied over affected skin areas and is good for hemorrhoids; variations exist in other countries, but especially the leaves seem to act against all kinds of skin diseases. The seeds are eaten cooked in Irian Jaya (but uncooked seeds are toxic due to the phytotoxin ricin) or burned and used to paint hair or head black (Papua New Guinea). After Heyne (1950), Webster (1967), and Arañez (1980).

Vernacular names — Dutch: Wonderboom. English: Castor bean. French: Ricin common. – Thailand: la hoong (Southwestern, Kanchanaburi); mahung. – Malay Peninsula: jarak, jarak besar (Burkill, 1935). – Sumatra: doelang bajora, kaliki. – Java: djarak kaliki (Sundanese); djarak, djarak kepjar, djarak leutik, djarak poetih. – Borneo: *Kalimantan:* djarak tjina; *Sabah:* dowar (Dusun); katimah (Dupe). – Philippines: getlaoua, katana, lansina, taca-taca, talam-punai, tangan-tangan(-hawa), taua-taua (-sina) (Brown, 1921; Arañez, 1980). – Lesser Sunda Islands: *Flores:* padu goa, tai bara toko lakai (So'a, Ngadha). – New Guinea: *Irian Jaya:* labu (Dani); sebluk; *Papua New Guinea:* fayita (Okapa); itumpa (Tairora); ovomasuro (Biagi); palawa-palawa-i(l) (Gododala). See also Heyne (1950: 928) for many more Indonesian names.

Notes — 1. This species is morphologically very variable, presumably due to centuries of cultivation and escapes from cultivation (seeds are known from Egyptian pharaoh graves dating 4000 B.C.; Burkill, 1935). Many species and infraspecific taxa have been described (see Müller Argoviensis, 1866; Pax & Hoffmann, 1919), but all species names are synonyms of *Ricinus communis* (or synonyms of taxa accidentally confused with *Ricinus*). The infraspecific taxa and also species names probably refer to certain cultivars. No synonyms will be treated here, partly because there are too many and partly because few have been described for Malesia. Those which were described are often untraceable or refer to pre-Linnean names by Rumphius; only the material of one Blume type (*Ricinus spectabilis*) could be found in the Leiden herbarium.

2. Many cultivars are known, and new ones are still being bred. Growing of spineless fruits is one of the successful aims of today's improvement schemes. Several races have oil of inferior quality and/or low quantity, while others produce high quality oil in sufficient quantity. Differences between races can be large and they have been used to describe several species. For one of the islands in the Pacific it was indicated that two forms were present, green plants and red ones, only the latter were used medicinally by Chinese. It was suggested that both forms represent different species. It cannot be repeated too often that recognizing species in man-made cultivation systems is a very hazardous job and usually futile.

WETRIA

(by Peter C. van Welzen)[4]

INTRODUCTION

The first species in this genus was described by Blume (1826) as *Trewia macrophylla*. Unfortunately, this name was a later homonym. Several authors tried to correct this (see under *Wetria insignis*), of which Steudel was the first (*Trewia insignis*, 1841). Baillon (1858) was the first to describe the genus *Wetria* (acronym of *Trewia*) in a footnote. Airy Shaw (1972) made the final correct combination: *Wetria insignis* (Steud.) Airy Shaw. This species is found in the peninsular part of the Southeast Asia mainland and West Malesia. Here it is newly recorded for the Lesser Sunda Islands.

Recently, Forster (1994) described a second species for a local area in NE Australia, *W. australiensis*. This species is apparently also present in Papua New Guinea, a large extension of the species' known range. A few of the differences mentioned by Forster could not be verified with the New Guinean material. It seems that the stigmas, at least in New Guinea (one specimen with very young flowers), are less divided than mentioned (not up to the base) and they are erect and not spreading. Therefore, the latter two differences have not been mentioned in the key. Added is the length of the style, which is well present in *W. insignis*, but absent or very short in *W. australiensis*. This character can best be used in older flowers or fruits.

Wetria can be classified within the subfamily Acalyphoideae, tribe Alchorneae. Within the Alchorneae it was considered to be related to *Alchornea*; Müller (1866) even included *Wetria* as a section in *Alchornea*. Webster (1994), on the other hand, considers *Wetria* to be more closely related to *Cleidion* and unites both genera in the subtribe Cleidiinae together with the SE Asian monotypic genus *Sampantaea*. Forster (1994, his table 1) shows that *Wetria* is distinct enough from both *Alchornea* and *Cleidion* to merit generic distinction. Personally, I am inclined to follow Webster's view, also because specimens of *Cleidion* are sometimes confused with those of *Wetria*.

Typical for *Wetria* are the short basally pulvinate petioles, the relatively large, somewhat obovate leaves with slightly serrate margin, teeth ending in glands. Never mentioned before are the glands on the upper (especially basally) and lower (especially apically) surface of the leaves, often quite large round, black dots, usually numerous and then always restricted to a region of the leaf (c. 1/3 of leaf width from margin in *W. insignis* and c. 1/3 of leaf width from midrib in *W. australiensis*); however, in some specimens the glands are rare and difficult to find. Also typical is the hirsute indumentum on various parts, axillary (and solitary) to ramiflorous (and grouped) unbranched spikes with single pistillate flowers and 2–5 staminate flowers per node, pistillate pedicel less than 1 cm long, flowers without petals and disc, with 5 sepals, many free, often muticous stamens, and 3- (or 4-)locular ovaries with a style and 3 deeply split stigmas; pollen grains vermiculate-rugulose; fruits lobed velvet rhegmas; seeds naked, and embryos with basally some endosperm (partly after Webster, 1994).

4) Revision assisted by two students, Helen Hangelbroek and Gwen Kolff van Oosterwijk.

Wetria Baill.

Wetria Baill., Etude Euphorb. (1858) 409; J.J. Sm. in Koord. & Valeton, Meded. Dept. Landb. Ned.-Indië 10 (1910) 470; Pax & K. Hoffm. in Engl., Pflanzenr. IV. 147, vii (1914) 219; Backer & Bakh. f., Fl. Java 1 (1963) 485; Airy Shaw, Kew Bull. 26 (1972) 350; Whitmore, Tree Fl. Malaya 2 (1973) 136; Airy Shaw, Kew Bull. Add. Ser. 4 (1975) 206; Kew Bull. Add. Ser. 8 (1980) 206; Kew Bull. 36 (1981) 358; Alph. Enum. Euphorb. Philipp. Isl. (1983) 48; G.L. Webster, Ann. Missouri Bot. Gard. 81 (1994) 86. — Type species: *Wetria trewioides* Baill. [= *Wetria insignis* (Steud.) Airy Shaw].

Pseudotrewia Miq., Fl. Ind. Bat. 1, 2 (1859) 414, nom. illeg. (see note). — Type species: *Pseudotrewia macrophylla* (Blume) Miq. [= *Wetria insignis* (Steud.) Airy Shaw].

Trees, dioecious; flowering twigs smooth, lenticellate, glabrous except when young. *Indumentum* existing of simple hairs only. *Stipules* falcately triangular, parallel nerved, asymmetric, mainly one side developed, glabrous to outside hairy, early caducous. *Leaves* spirally arranged, simple; petiole short, flattened above, basally to completely pulvinate; blade somewhat obovate, papery, symmetric, base cuneate, margin (indistinctly) serrate with a gland in each tooth, apex tapering acuminate to cuspidate, very apex often mucronulate, upper surface smooth, glabrous with especially basally glands, lower surface smooth, glabrous to subhirsute, with especially subapically glands, glands few to many, round, black, more ore less in line with each other, venation especially raised on lower side, nerves looped and joined near margin, veins scalariform, veinlets laxly reticulate. *Inflorescences* mainly axillary and single to ramiflorous and in small groups, unbranched racemes, pendulous, flattened, subhirsute, green, staminate ones with groups of 2–4 flowers per node, pistillate ones with single flowers per node. *Bracts* and *bracteoles* ovate, glabrous except for pilose margin. *Flowers* actinomorphic, sepals valvate, reflexed, petals and disc absent, pedicellate with a subbasal abscission zone. *Staminate flowers:* sepals (2) 3 (4), ovate, glabrous except for some apical hairs; stamens 16–26, filaments glabrous, often adnate because of mucilage; anthers 4-locular, basifixed, opening introrse with lengthwise slits, connective appendaged or not; pistillode absent. *Pistillate flowers:* pedicel elongating in fruit; sepals 5, ovate, margin pilose, apex tapering; pistil 3- (or 4-)locular, one ovule per locule, ovary smooth, tomentose; style densely hirsute, stigmas 3 (4), split, hirsute below, above papillate. *Fruits* lobed capsules, smooth, outside tomentose, inside glabrous, woody, thin-walled, septicidally breaking into three bivalved parts; column after dehiscence with a narrow frayed septum margin and a broadened apex, obtriangular in longitudinal section, with 2 extensions per septum; septa with 2 vascular bundles. *Seeds* usually 2 or 3 per fruit, globular; caruncle or arilloid absent; embryo basally covered by endosperm, latter with frayed margin.

Distribution — Two species, one ranging from peninsular SE Asia (Myanmar, Thailand) to W Malesia (up to Philippines, Borneo, Lesser Sunda Islands), the other in Papua New Guinea and NE Australia.

Note — The name *Pseudotrewia* Miq. is an illegitimat and, superfluous name, because the type species refers to the same type specimen as the type species of *Wetria*.

KEY TO THE SPECIES

1a. Leaves 8–30 cm long, nerves 14–18 pairs. Stamen connectives with an appendage of 0.5–0.7 mm. Style absent or perhaps up to 0.2 mm long. Fruits 9–10 by 4–6 mm; seeds 4–5 mm in diameter. Papua New Guinea, NE Australia ..... **W. australiensis**

b. Leaves 9.5–56 cm long, nerves 19–32 pairs. Stamen connectives without or with a very short (0.2 mm) appendage. Style 0.2–2 mm long. Fruits 13–17 by 6–10 mm; seeds 6–9 mm in diameter. SE Asia mainland, W Malesia .... **W. insignis**

Wetria australiensis P.I. Forst. — Fig. 5i, j; Map 4

Wetria australiensis P.I. Forst., Austrobaileya 4 (1994) 141. — Type: *C. Lyons 105* (BRI, holo, n.v.), Australia, Queensland, Cook District, Cairns, Currunda Creek.

Wetria insignis auct. non Airy Shaw: Airy Shaw, Kew Bull. 27 (1972) 87; Kew Bull. Add. Ser. 8 (1980) 207.

Tree, up to 15 m high; flowering twigs c. 4 mm thick. *Bark* black and white blotched or grey-brown, smooth; inner bark light brown, thin; wood straw. *Stipules* 0.3–1.1 cm by 1.5–2 mm, outside partly hairy. *Leaves:* petiole 0.4–1 cm long; blade 8–30 by 5–10 cm, ratio 1.6–3.1, pale reddish green when young, medium green when mature, glands more or less in line at c. 1/3 from midrib, nerves 14–18 pairs. *Inflorescences:* staminate ones up to 15 cm long, pistillate ones up to 28 cm long. *Bracts* 0.9–1.5 by 0.9–1 mm, bracteoles c. 0.3 by 0.2 mm. *Flower buds* of staminate flowers reddish brown. *Staminate flowers* c. 4.7 mm in diam.; pedicel 0.1–1 mm long, subglabrous; sepals 2–3 by 1.5–3 mm; stamens: filaments 1–1.7 mm long, anthers 0.5–1 by 0.7–1 mm, connective with an apical appendage of 0.5–0.7 mm long. *Pistillate flowers* c. 3 mm in diam.; pedicel up to 3.5 mm long, hirsute; sepals 1.5–2.8 by 1–1.2 mm; ovary 1–1.1 by 1–1.4 mm in diam.; style absent or perhaps up to 0.2 mm long; stigmas 3, 3–5 mm long, split after 1–1.5 mm. *Fruits* 9–10 by 4–6 mm. *Seeds* 4–5 mm in diam.; embryo not seen.

Distribution — East Malesia (Papua New Guinea: Central and E Sepik Prov.) and NE Australia (Queensland: Cook District).

Ecology & Habitat — Common in primary and secondary forest, riverine forest, Australian complex notophyll vine forest, along rivers, and margin of forest. Soil: limestone, reddish soil, metamorphics. Altitude 50–270 m. Flowering Feb., Oct., Dec.; fruiting Jan.

Wetria insignis (Steud.) Airy Shaw — Fig. 5a–h; Map 4

Wetria insignis (Steud.) Airy Shaw, Kew Bull. 26 (1972) 350; Whitmore, Tree Fl. Malaya 2 (1973) 136; Airy Shaw, Kew Bull. Add. Ser. 4 (1975) 206; Kew Bull. 36 (1981) 358; Alph. Enum. Euphorb. Philipp. Isl. (1983) 48. — *Trewia macrophylla* Blume, Bijdr. (1826) 612; nom. inval., non Roth, Nov. Pl. Sp. (1821) 373 (= *Trewia nudiflora* L.). — *Trewia insignis* Steud., Nomencl. Bot. ed. 2, 2 (1841) 698, nom. nov. — *Wetria trewioides* Baill., Étude Euphorb. (1858) 409, nom. superfl.; Ridl., Fl. Malay Penins. 3 (1924) 282. — *Pseudotrewia macrophylla* (Blume) Miq., Fl. Ind. Bat. 1, 2 (1859) 414, nom. illeg. — *Alchornea blumeana* Müll. Arg., Linnaea 34 (1865) 167, nom. superfl.; in DC., Prodr. 15, 2 (1866) 900. — *Wetria macrophylla* (Blume) J.J. Sm. in Koord. & Valeton, Meded. Dept. Landb. Ned.-Indië 10 (1910) 471, nom. illeg.; Pax

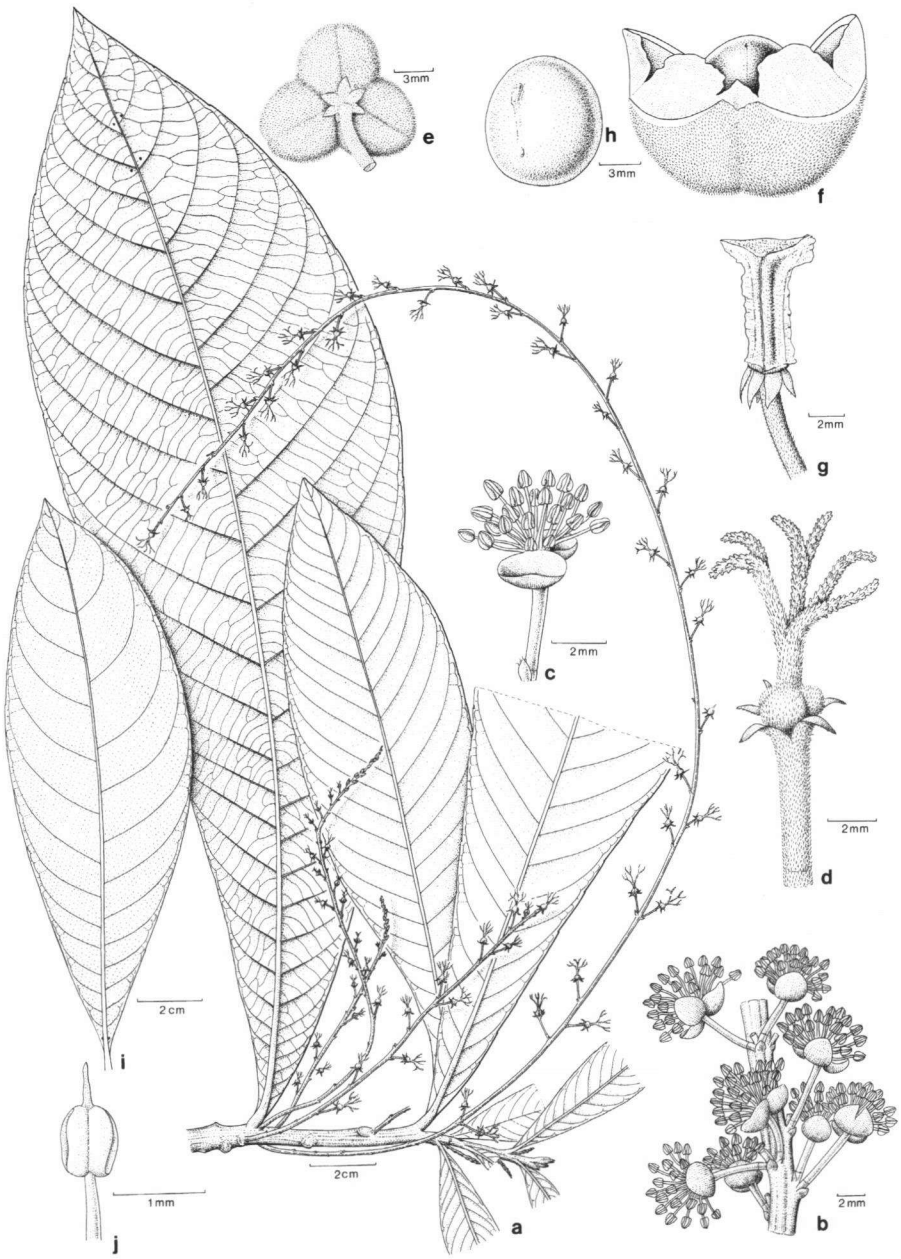


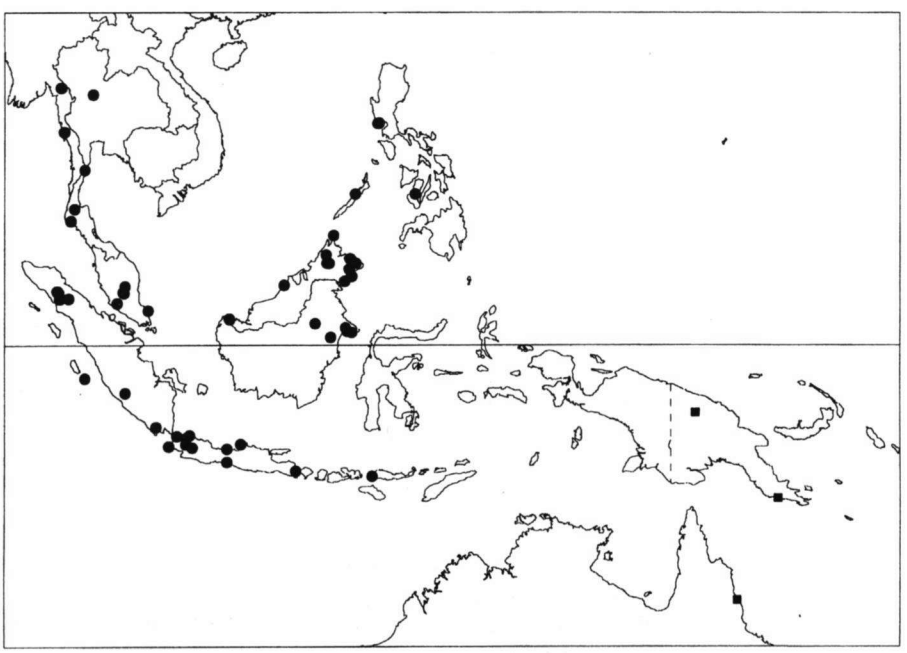
Fig. 5. *Wetria insignis* (Steud.) Airy Shaw: a. Habit; b. part of staminate inflorescence; c. staminate flower; d. pistillate flower; e. fruit, basal view; f. part of dehisced fruit with seed; g. column after dehiscence; h. seed. — *W. australiensis* P. I. Forst.: i. Leaf; j. stamen with appendaged connective [all L; a, d: *de Wilde & de Wilde-Duyfjes 20865*; b, c: *de Wilde & de Wilde-Duyfjes 20860*; e: *Kerr 18199*; f–h: *de Wilde & de Wilde-Duyfjes 18653*; i, j: *Takeuchi 6386*].

& K. Hoffm. in Engl., Pflanzenr. IV.147, vii (1914) 219; Merr., J. Straits Branch Roy. Asiat. Soc., Spec. no. (1921) 341; Enum. Philipp. Flow. Pl. (1923) 437; Philipp. J. Sci. 24 (1924) 115; Philipp. J. Sci. 29 (1926) 383; Airy Shaw, Kew Bull. 14 (1960) 473; Kew Bull. 16 (1963) 383; Backer & Bakh. f., Fl. Java 1 (1963) 485. — Lectotype (proposed here): *Blume (Anonymous) '1521'* (L, holo, barcode L 0026857; iso in K), Indonesia, Java (see note).

Agrostistachys pubescens Merr., Philipp. J. Sci. 4, Bot. (1909) 274; Pax & K. Hoffm. in Engl., Pflanzenr. IV.147, vi (1912) 99. — Type: *FB (Curran) 5940* (PNH†, holo; iso in K), Philippines, Luzon, Butaan Prov., Mabayo.

Trigonostemon forbesii Pax in Pax & K. Hoffm. in Engl., Pflanzenr. IV.147, iii (1911) 88; Jabl., Brittonia 15 (1963) 165. — Type: *Forbes 1892* (iso in L), Indonesia, Sumatra, Lampong, Mt Tengamoes (= Gunung Tanggamus).

Tree, up to 27 m high, dbh up to 45 cm; buttresses absent; flowering twigs 4–15 mm thick. *Bark* grey, white and grey spotted, (light brown, brown-green, dark green), smooth (to scaly), 0.5–1 mm thick; inner bark yellowish, pale yellow-brown, light brown, yellow-orange, 3–5 mm thick, fibrous, laminated; cambium brown, red, white-greyish; sapwood white, medium soft. *Stipules* 0.6–1.2 cm by 2.6–4 mm, glabrous. *Leaves:* petiole 0.6–1.5 cm long; blade 9.5–56 by 4–21.5 cm, ratio 2.6–3.2, red when young, glands more or less in line at c. 1/3 from margin, nerves 19–32 pairs. *Inflorescences:* staminate ones up to 42 cm long, pistillate ones up to 90 cm long. *Bracts* 1–1.8 by 1.2–1.8 mm, bracteoles 0.4–0.9 by 0.4–0.7 mm. *Flower buds* brown-green. *Staminate flowers* white or creamy, 5–5.5 mm in diam.; pedicel 2.6–8 mm long, (sub)hirsute; sepals 2.8–3.1 by 1.3–3.2 mm; stamens: filaments creamy white, 2.8–3 mm long, anthers 0.8–1.2 by 0.7–1 mm, connective without or with very short apical



Map 4. Distribution of *Wetria insignis* (Steud.) Airy Shaw (●) and *W. australiensis* P.I. Forst (■ in New Guinea and Australia).

appendage less than 0.2 mm long. *Pistillate flowers* green to green-yellowish, 2.8–4.8 mm in diam.; pedicel up to 10 mm long, hirsute; sepals 1.5–3.2 by 0.3–2 mm; ovary 2.6–4.6 mm in diam.; style 0.2–2 mm long; stigmas 3 (4), 5.8–13 mm long, split after 0.1–3 mm. *Fruits* 1.3–1.7 by 0.6–1 cm, outside creamy white to grey tomentose, green to yellow-green when immature. *Seeds* 6–9 mm in diam.; embryo c. 8 by 7 by 6 mm.

Distribution — Ranging from Southeast Asia mainland (Myanmar, Thailand) to West Malesia (Sumatra, Java, Lesser Sunda Islands, Borneo, Philippines).

Ecology & Habitat — Often common in understorey of primary and secondary mixed Dipterocarp forest, Thai evergreen forest, riverine forest, logged-over forest, seldom also in cultivated forest; on ridges, steep slopes, level ground, and along rivers. Soil: limestone, sandstone, sandy raised coral, loam, Tertiary granodiorite; usually lime present. Altitude 5–650(–1830) m. Flowering and fruiting throughout the year.

Vernacular names — Sumatra: benoewa, langsat hutan, medang tjempaka. – Peninsular Malaysia: nye-nyelong. – Java: ki-sempoer, ki-tjaloeng, pakilan (J. J. Smith, 1910). – Borneo: *Sabah:* bubal (Dusun Banggi); rambay utan (Malay; Merrill, 1924). – Philippines: malatibig (Tagalog).

Note — Blume created a later homonym when he described *Trewia macrophylla*. Later authors tried to correct this, but all those who used the same epithet in other genera created illegitimate names (*Pseudotrewia macrophylla* Miq., *Wetria macrophylla* J. J. Sm.). Steudel was the first to correct Blume's mistake, all others who followed created superfluous names (*Wetria trewioides* Baill., *Alchornea blumeana* Müll. Arg.).

EXCLUDED SPECIES

Pseudotrewia ? cuneifolia Miq., Fl. Ned. Ind., eerste bijv. (1860) 462. — Type: *Teijsmann* (U?, n.v.), Indonesia, Sumatra, Palembang Province, Batu-radja = **Trigonostemon longifolius** Baill. (see Airy Shaw, Kew Bull. 36, 1981, 355).

ACKNOWLEDGEMENTS

I would like to thank Prof. Dr. N.N. Thin (Hanoi, Vietnam) for offering me his very useful manuscript on *Homonoia* for the PROSEA project. An anonymous referee and editor are thanked for their useful remarks. The directors of the following institutes are thanked for sending me their material on loan: A, B, BM, BRI, C, CANB, K, L, NSW, NY, U, UC, US. Jan van Os (L) produced the very nice drawing; the map was constructed with the program KORT (© Bertel Hansen, C), the coordinates for obtained from the database COOR (© Peter van Welzen, L).

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IDENTIFICATION LIST

The numbers behind the collector numbers refer to the following taxa:

Clonostylus forbesii S. Moore	=	1
Homonoia retusa (Wight) Müll. Arg.	=	2
Homonoia riparia Lour.	=	3
Lasiococca comberi Haines	=	4
Lasiococca malaccensis Airy Shaw	=	5
Lasiococca symphylliifolia (Kurz) Hook. f.	=	6
Spathiostemon javensis Blume	=	7
Spathiostemon moniliformis Airy Shaw	=	8
*Ricinus communis*L.	=	9
Wetria australiensis P.I. Forst.	=	10
Wetria insignis (Steud.) Airy Shaw	=	11

A series 2277: 7; 3506: 7; 4619: 7; 4638: 11 — Adduru 185: 3 — Agama 1115: 7 — Agullana 3870: 7 — Ahern's collector 41: 3 — Ake 744: 3 — d'Alleizette 6527: 3 — Alston 14559: 11 — Ambriansyah AA 672: 7 — Anderson 126: 11; 5322: 3 — ANU series 908: 9; 5758: 9 — Anusarnsunthorn 7: 3 — Apostol 7103: 7 — Atmodjo 297: 9; 426: 11.
Backer 1593: 3; 1647: 3; 16410: 3; 17214: 3; 17417: 3; 17526: 3; 17641: 3; 25633: 3; 27293: 9; 36041: 9; 36080: 9 — Bakhuizen van den Brink 7713: 11; 6739: 9 — Balajadia 3268: 3 — Balakrishnan 27: 3 — Balakrishnan & Bhargava 3470: 3 — van Balgooy 2566: 3; 3589: 7 — Bangham & Bangham 1090: 11 — Bartlett 14166: 3 — Bateson 59: 3 — bb series 2550: 11; 2552: 11; 12050: 7; 13848: 7; 24130: 7; 24314: 7; 25376: 7; 26278: 5; 28968: 7; 33501: 7; 33532: 7; 33683: 7 — Beaman et al. 8860: 7; 9071: 7 — den Berger 705: 3 — Beumée 658: 3; 4291: 11 — van Beusekom & Phengkhlai 14: 3 — van Beusekom & Santisuk 2761: 11; 2821: 8 — Bhargava 4126: 3 — BKF series 14171: 3; 16526: 3; 23751: 3; 26365: 3; 29725: 3; 46552: 3; 46648: 3 — Bloembergen 4777: 9 — Boden Kloss 6677: 3; 6913: 3; 14801: 11 — Boerlage 181a: 9; 181b: 9 — Bogor Botanical Garden IX.A.60: 7; IX.A.60a: 7; IX.A.124: 11; IX.A.124a: 11; IX.C.17: 7; VI.C.99: 7 — van Borssum Waalkes 2433: 3 — Bourell 2374: 3; 2387: 3 — Brinkman 702: 3; 859a: 3 — Britton 263: 3 — BS series 31: 3; 321: 3; 2180: 3; 7219: 3; 11396: 3; 16471: 3; 17661: 7; 20902: 3; 25546: 3; 39746: 3; 40697: 7; 41738: 7; 42719: 7; 42809: 7; 43583: 3; 46510: 3; 47064: 3; 76843: 3; 77347: 11 — Bünnemeijer 7964: 9; 11608: 9 — Buwalda 4343: 7; 4695: 3; 6077: 9 — BW series 593: 7; 646: 7; 1065: 7; 2569: 7; 2903: 7; 2935: 7; 3177: 7; 4129: 7; 5237: 7; 6679: 7; 8158: 7; 8498: 7; 9736: 7; 12488: 7; 13522: 7.

Carpenter 93: 3 — Carr 15644: 9; 16108: 9 — Cel /V-157: 7 — Champion 509: 3 — Cheviwat & Nimanong 33: 3 — Chew CWL 587: 11; 667: 7 — Chew, Corner & Stainton 505: 7 — Chin & Mahmud 1637: 3 — Chun & Tso 44276: 9 — Church & Ismail 4: 3 — Clarke 27279a: 3; 38206c: 3 — J. Clemens & M.S. Clemens 20665: 7; 22242: 7 — M.S. Clemens 18667: 3 — Collins 2387: 3 — Comber 4126: 4 — Conn 1796: 7 — Copeland 286: 3 — CP, BS & BN 2912: 9 — Cuming 197: 3; 1722: 3.

Dickason 7132: 3; 7167: 3; 8612: 3 — Diepenhorst HB 1397: 3; HB 552: 3 — Djamhari 414: 7; 538: 7 — Docters van Leeuwen 673: 3; 12684: 3 — Dransfield 6320: 7.

Ebalo 501: 3 — Elbert 1169: 9; 1169a: 9; 1924: 9; 2703: 9; 4130: 3 — Elmer 5729: 3; 6777: 3; 7152: 7; 7318: 7; 8777: 3; 12144a: 3; 13918: 7; 15630: 3; 20702: 7; 20704: 7; 20746: 7; 20781: 7; 20907: 7; 21684: 7 — Endert 5106: 7; 5128: 11; 5170: 11 — Enriquez 50: 3 — Evangelista 892: 11; 1038: 7 — Eyma 4200: 9.

FB series 724: 3; 2237: 3; 5940: 11; 6870: 3; 8798: 3; 11631: 7; 12983: 3; 19031: 3; 19925: 3; 23871: 11; 24100: 7; 25073: 7; 31422: 7 — Fénix 120: 3 — Fernandes 28: 2 — Floto 7806: 3 — Forbes 1690: 3; 1892: 11; 2635: 3; 3027: 1 — Fosberg 24377: 9 — Franck 290: 3.

Gamble 2819a: 6; 28021: 6 — Gammie 78: 3 — Garrett 14: 3 — Geesink 9318: 7 — Gonzales 62: 3 — Groff 6113: 3 — Gwynne-Vaughan 474: 3.

Haenke 589: 3 — Haines 4126: 4 — Hallier 128: 3; 202a: 3; 4202: 3; 4202a: 3 — Haniff 384: 3; 15511: 3 — Hartley 9876: 9; 11358: 7; 11360: 7; 13070: 7 — Heider 15: 9 — Helfer 41: 3 — Hennipman 6136: 7 — Hochreutiner 1371: 9; 1664: 11 — Hohenacker 460: 3 — Horsfield 70: 3 — Hosseus 375: 3 — Huang 2762: 9 — Hutchinson 59: 3.

Ibondi 265: 9 — Iwatsuki & Fukuoka T-7290: 3; T-7291: 3 — Iwatsuki, Murata & Gutierrez P-135: 3; P-918: 3; P-919: 3.

Ja 1901: 11; 3818: 11 — Jacobs 5148: 7; 7085: 9 — Jaheri 208: 7 — Jensma 17: 9 — Jih-Ching Liao 38: 3.

K'tung 5887: 9 — Kanehira & Hatusima 12842: 3 — Kartawinata 908: 7; 949: 7 — Kaudern 399: 9 — Keith 7109: 7 — KEP series 66554: 3; 98647: 9 — KEP FRI series 2663: 11; 4806: 3; 14466: 3; 14470: 3; 16011: 11; 17237: 3; 20881: 3; 27023: 3; 27024: 3; 29029: 11; 32639: 3 — Kerr 506: 3; 975: 3; 3770: 3; 11475: 8; 11774: 8; 12332: 11; 16347: 8; 17250: 11; 17665: 3; 18162: 8; 18162a: 8; 18199: 11; 19330: 3; 20653: 3 — Koelz 32627: 3 — Koorders 2138: 11; 2139: 11; 2559: 7; 2685: 9; 9942: 11; 14452: 9; 16931: 9; 24510: 3; 25039: 9; 25356: 3; 27436: 3; 28279: 7; 30537: 11; 34149: 7; 35084: 11; 35085: 11; 35553: 9; 36974: 11; 38080: 9 — Kostermans 87: 3; 254: 3; 2845: 7; 5102: 11; 5223: 7; 5291: 7; 5323: 7; 5747: 11; 5748: 11; 13259: 11; 13712: 7; 13774: 7; 19278: 11; 21213: 7; 21214a: 7; 21414: 11; 22055: 3; 24432: 3 — Kostermans & den Hoed 966: 3 — Kostermans & Wirawan 252: 7; 822: 3 — Koyama, Terao & Wongprasert T-33014: 3; T-33971: 11 — Kramer & Nair BSI 6445: 3 — Kuhl & van Hasselt 238: 7; 279: 3.

Lace 4708: 11 — LAE series 50147: 9; 51527: 7; 51618: 3; 54692: 7; 75122: 7 — Lagosa 105: 9 — Lakshnakara 662: 3; 852: 3 — Larsen 8030: 3 — Larsen, Smitinand & Warncke 148: 3 — S.K. Lau 353: 4 — Lauterbach 855: 7; 1398: 9 — Lei 882: 9 — Linsley Gressitt 35: 3 — Loher 4687: 3; 4700: 3; 4701: 3; 5199: 3; 6867: 3; 6875: 3; 12109: 3; 14351: 3 — Lörzing 9706: 3; 14333: 3 — Loureiro 222: 3 — Lynn Zwickey 664: 3.

Main 548: 7 — Maliwanag 107: 3 — Marcan 770: 3; 771: 3; 2604: 3 — Maung Ba Pe 12925: 11 — Maxwell 71-62: 3; 88-240: 3; 88-1327: 3; 89-290: 3; 89-498: 3; 90-326: 3; 92-129: 3; 93-254: 3; 93-1238: 2 — McClure 9620: 3 — McGregor 247: 3 — Meijer 1456: 3; 10604: 11; 10684: 3 — Merrill 41: 3; 707: 3; 1537: 3; 1578: 3; 1637: 3; 2088: 3; Spec. Blanc. 624: 9; Spec. Blanc. 343: 3 — Mooney 617: 4; 2552: 3 — Murata T-17038: 3 — Murata, Fukuoka & Phangklai T-16654: 3.

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