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THE MALESIAN SPECIES OF CHORICERAS, FONTAINEA, AND PETALOSTIGMA (EUPHORBIACEAE)

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SUMMARY

Choriceras is represented by a single species in southern New Guinea (*C. tricorne*), as is *Petalostigma* (*P. pubescens*). The two species also occur in northern Australia. *Fontainea* comprises two endemic species in New Guinea (*F. borealis* and *F. subpapuana*).

Key words: *Choriceras*, *Fontainea*, *Petalostigma*, Euphorbiaceae, Malesia.

INTRODUCTION

The revision of three small Euphorbiaceae genera for Flora Malesiana are published here as a precursor. The genera, *Choriceras* Baill., *Fontainea* Heckel, and *Petalostigma* F. Muell., are mainly Australian with a few species in New Guinea. *Choriceras* and *Petalostigma* both have a single non-endemic species in southern New Guinea, while *Fontainea* is represented by two almost similar, very local, endemic species in the Eastern Highlands and Central Province, respectively. The three genera are not related to each other, therefore, a key to the genera is not provided. A general key to the New Guinean genera of Euphorbiaceae can be found in Airy Shaw (1980c).

TAXONOMY

CHORICERAS

Choriceras was described by Baillon (1873) based on *C. australiana* Baill. This species is conspecific with the older name *Dissiliaria tricornis* Benth., and, consequently, Airy Shaw (1961) published the new combination *C. tricornis* (Benth.) Airy Shaw. Later on, Airy Shaw (1980a) added a second species, *C. majus* Airy Shaw. Airy Shaw (1980b) also published the last full account of this small genus.

Webster (1994) places *Choriceras* in the subfamily Oldfieldioideae, tribe Caletieae, subtribe Dissilariinae together with five other genera with opposite leaves, from which it differs in the 4 or 6 stamens, pollen exine with reduced spines, presence of a pistillode, style almost absent, recurved styles, and ecarunculate seeds. Other typical characters are monoecy, simple (sub)entire to crenulate leaves, absence of petals and a disc, pollen with more than four apertures, styles simple (not bifid), and ovules anatropous.

In Malesia only *C. tricorne* occurs.

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Choriceras Baill.

Choriceras Baill., Adansonia 11 (1873) 119; Airy Shaw, Kew Bull. 14 (1961) 356; Kew Bull. 16 (1963) 344; Kew Bull. 35 (1980) 604; Kew Bull. Add. Ser. 8 (1980) 46; G.L. Webster, Ann. Missouri Bot. Gard. 81 (1994) 58. — Type species: *Choriceras australiana* Baill. [= *Choriceras tricorne* (Benth.) Airy Shaw].

Shrubs or trees, evergreen, perennial, monoecious; branchlets puberulous; stems and foliage without latex. *Indumentum* of simple, multicellular hairs, glandular and stinging hairs absent. *Stipules* entire, inconspicuous, caducous. *Leaves* opposite, petiolate, ovate to elliptic, coriaceous, penninerved, (sub)entire or crenate to serrate, glands absent. *Inflorescences* axillary, with bracteate, solitary or fascicles of flowers. *Flowers* unisexual, actinomorphic, pedicellate, sepals in 2 whorls, imbricate, free, ± equal, petals and disc absent. *Staminate flowers* in dense multiflowered fascicles; sepals 2+2 or 3+3; stamens 4 or 6, filaments free, inserted on slightly raised receptacle, anthers dorsifixed, bilobate, thecae globose and longitudinally dehiscent. *Pistillate flowers* 1–3 together; sepals 3+3; ovary 3- or 4-locular, 2 ovules per locule; style short; stigmas simple, not split. *Fruits* capsular, trilobate, smooth, dehiscing septicidally into 3 bivalved cocci; lobes horned with stigma remnants. *Seeds* ovoid; testa crustaceous; albumen fleshy; caruncle absent; cotyledons broad, flat.

Distribution — Two species in Australia, one extending to New Guinea.

Choriceras tricorne (Benth.) Airy Shaw — Fig. 1

Choriceras tricorne (Benth.) Airy Shaw, Kew Bull. 14 (1961) 356; Kew Bull. 35 (1980) 604; Kew Bull. Add. Ser. 8 (1980) 46. — *Dissiliaria tricornis* Benth., Fl. Austral. 6 (1873) 91; Pax & K. Hoffm. in Engl., Pflanzenr. IV.147.xv (1922) 292. — Lectotype (Airy Shaw, 1980a): *A. Cunningham 265* (K), Australia, Northern Territory, Port Essington.

Choriceras australiana Baill., Adansonia 11 (1873) 119. — Type: *Leguillou s.n.* (P), Australia, Northern Territory, Raffles Bay.

Shrubs to small trees up to 7 m high, often multistemmed. Outer *bark* grey to brown, rough to flaky; inner bark streaky dark pink to red; cambium furrowed; sapwood pale amber, rather hard; heartwood dark pink. *Indumentum* of uncoloured to yellow-ferruginous simple hairs, glabrescent unless stated otherwise. *Stipules* subulate, 1–1.8 by c. 0.3 mm, densely pubescent. *Leaves:* petioles 2–7 by 0.8–1 mm, (sub)glabrous to densely pubescent; lamina elliptic to elliptic-lanceolate, 10–90 by 4.5–32 mm, index 2.2–2.8, base cuneate to truncate; margins crenate to serrate with 20–40 short teeth; apex obtuse to acute; strongly discolorous, upper surface dark glossy green, glabrous or with scattered hairs on the midrib; lower surface pale green, subglabrous; venation comprising 6–8 nerves per side, veins reticulate, indistinct. *Inflorescences* up to 10 mm long. *Staminate flowers* 2.3–4 by 2–3 mm diam., cream-yellow; pedicels 2.6–9 by c. 0.1 mm diam., glabrous; sepals orbicular to lanceolate, 1–1.6 by 0.7–0.9 mm, glabrous; stamens 4 or 6; filaments 1.2–2 by c. 0.1 mm, basally sparsely to densely hairy; anthers globose, 0.4–0.6 by 0.3–0.5 mm. *Pistillate flowers* 2–3.5 by 2.4–4.5 mm diam.; pedicels 1.5–2 by c. 0.4 mm diam., with scattered hairs; sepals lanceolate-ovate, 1.5–1.8 by 1–1.3 mm, glabrous or with scattered hairs; ovary usually 3-locular, subglobose, 1–1.5 by 2–2.5 mm diam., glabrous; styles 1.5–2.5 mm long, strongly recurved, papillose. *Fruits* globose, 4–7 by 5–11 mm diam., green-grey. *Seeds* ovoid, 3.5–4.8 by 2.5–3 by 2–3 mm thick, smooth, pale brown.

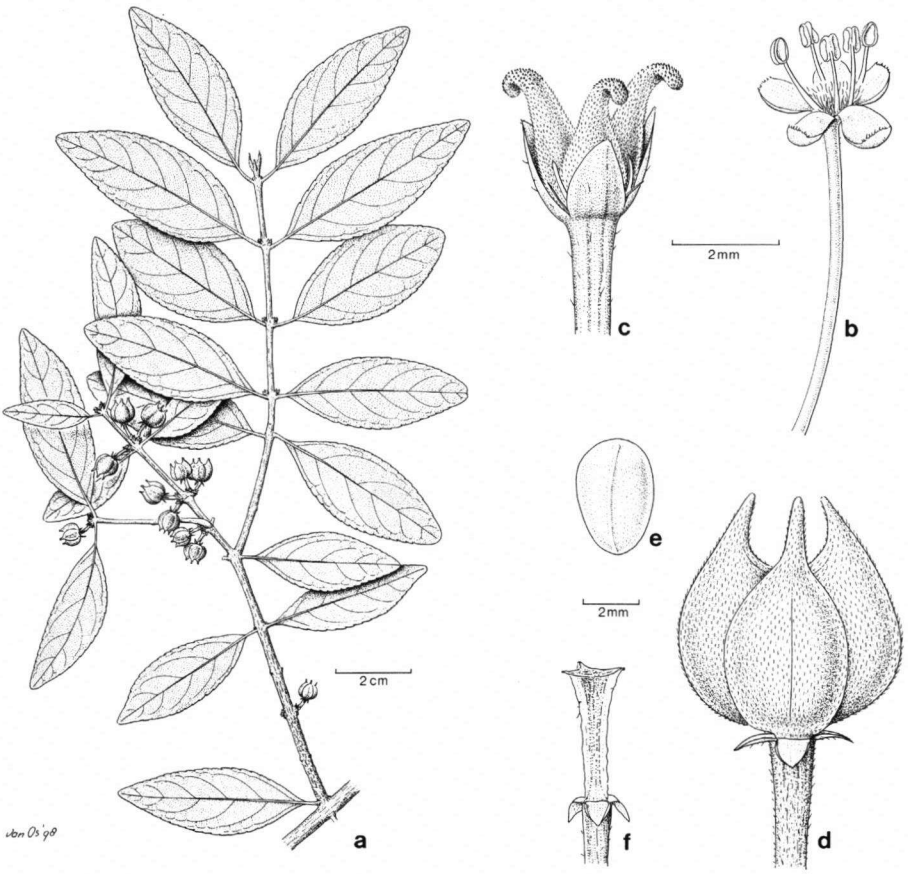

Fig. 1. *Choriceras tricorne* (Benth.) Airy Shaw. a. Habit; b. staminate flower; c. pistillate flower; d. fruit; e. seed; f. fruit column after dehiscence [all L; a, d: *NGF (Henty & Katik) 38771*; b, c: *Brass 8391*; e, f: *Paijmans 319*].

Distribution — North Australia (Northern Territory and Queensland) and in Malesia: New Guinea (SE Irian Jaya and Western Province in Papua New Guinea).

Ecology & Habitat — Heathland, savannah with *Acacia*, *Eucalyptus*, and *Melaleuca*, open forest, vine thickets, and margin of rain forest, usually on sandy soils, also on reddish loam. Altitude: sea level up to 400 m. Flowering and fruiting throughout the year after heavy rain.

FONTAINEA

Heckel (1870) introduced the genus *Fontainea* in his thesis, based on a single species [*F. pancheri* (Baill.) Heckel] of New Caledonia. Later on the genus was also found in New Guinea, Australia, and Vanuatu. The most recent revision, especially of the Australian species, is by Jessup & Guymer (1985). They recognised six species, of which five are endemic to Australia. However, they did not really address the identity of the

New Guinean specimens. Airy Shaw (1980c) referred these to *F. pancheri*, which is an unlikely identification. Recently, Forster (1997) revised the New Guinean specimens and recent Australian material, which resulted in the description of two new species for New Guinea and one for Australia.

Webster (1994) classifies *Fontainea* in the subfamily Crotonoideae, tribe Codiaeae. Typical for the genus are the simple hairs, unlobed leaves, often with basal glands, unbranched laticifers, cymose inflorescences, almost truncate staminate calyx, non-accrescent pistillate calyx, hairy petals, partly connate 18–40 stamens, inaperturate pollen grains, 'crotonoid' sexine, deeply bifid stigmas, drupaceous fruits with a sharply 3–5(–6)-angular endocarp, seeds with copious endosperm, and flat cotyledons. According to Airy Shaw (1980c) it is close to *Dimorphocalyx* (also classified in the Codiaeae). It differs from *Dimorphocalyx* in its non-accrescent calyx (though sometimes also the case in *Dimorphocalyx*), tomentose instead of glabrous petals, and drupaceous instead of capsular fruits.

Fontainea Heckel

Fontainea Heckel, Etude *Fontainea pancheri* (1870) 9; Pax & K. Hoffm. in Engl., Pflanzenr. IV.147.iii (1911) 30; Airy Shaw, Kew Bull. Add. Ser. 8 (1980) 91; Jessup & Guymer, Austrobaileya 2 (1985) 112; G.L. Webster, Ann. Missouri Bot. Gard. 81 (1994) 106; P.I. Forst., Austrobaileya 5 (1997) 29. — Type species: *Fontainea pancheri* (Baill.) Heckel.

Shrubs or trees, evergreen, dioecious; stems with conspicuous brown or red latex from unbranched laticifers. *Indumentum* of simple, golden, sericeous hairs, dense in young shoots; glandular and stinging hairs absent. *Stipules* absent. *Leaves* alternate, simple, petiolate, elobate, chartaceous, not decurrent, entire, penninerved, nerves looped and closed near the margin, basilaminar glands often present. *Inflorescences* axillary or terminal, variously cymose, solitary. *Flowers* bracteate; calyx lobes basally united, cupuliform, unequal; petals 4–6, imbricate, free, densely velutinous outside and inside; disc annular, extra-staminal. *Staminate flowers* pedicellate; calyx lobes 3–6; stamens 18–40, filaments connate for part of their length and attached to a slightly raised receptacle; anthers dorsifixed, bilobate, thecae oblong and longitudinally dehiscent; pistillode absent. *Pistillate flowers* pedicellate; calyx not accrescent, 2–6-lobed; ovary 2–5-locular, one ovule per locule; styles short; stigmas deeply bifid. *Fruits* drupaceous, tri- to pentalobate; sarcocarp fleshy, surface smooth, pink to orange-red; endocarp woody. *Seeds* ellipsoid; testa membranous; albumen fleshy; caruncle absent; cotyledons broad, flat.

Distribution — Nine species from Australia (6 spp.), New Caledonia and Vanuatu (1 sp.), and Malesia (Papua New Guinea, 2 spp.).

Ecology & Habitat — Rain forest. Altitude 400–2000 m. Flowering and fruiting sporadic after seasonal rain.

KEY TO THE SPECIES

1a. Leaf lamina without glands; petioles somewhat swollen at base and apex (difficult to distinguish) ..... **1. F. borealis**

b. Leaf lamina with gland, ± marginal near the base; petioles somewhat swollen at the apex only (difficult to distinguish) ..... **2. F. subpapuana**

1. **Fontainea borealis** P.I. Forst. — Fig. 2

Fontainea borealis P.I. Forst., Austrobaileya 5 (1997) 29. — Type: *NGF (L. S. Smith) 1030* (holo K; iso BRI, L), Papua New Guinea, Eastern Highlands, Aiyura.

Shrub or small tree to 12 m high; colour of stem exudate unknown. *Bark* dark grey, smooth. *Leaves:* petioles 10–26 by 1–1.4 mm diam., somewhat swollen at base and apex, narrowly channeled above, glabrous; lamina elliptic to oblanceolate, 56–240 by 22–70 mm, index 2.5–3.4; base cuneate, without glands; apex acute to acuminate; upper surface dark green, lower surface pale green; venation with 8–14 nerves per side, veins and veinlets reticulate. *Staminate inflorescences* axillary or terminal, sparsely hairy. *Staminate flowers* 5–7 by 7–8 mm diam.; pedicels 2.5–5 by c. 1 mm, with scattered hairs; calyx 4-lobed, 2.8–3.5 mm long, lobes ovate, red; petals 5, lanceolate-ovate to obovate, 5–6 by 2–3.5 mm, cream, weakly recurved; disk undulate with grooves, c. 0.6 by 2.5 mm diam., glabrous, yellow; stamens 24–28, cream, filaments connate for the basal 1–1.5 mm, free for 2–2.5 mm, densely hairy at base only, anthers

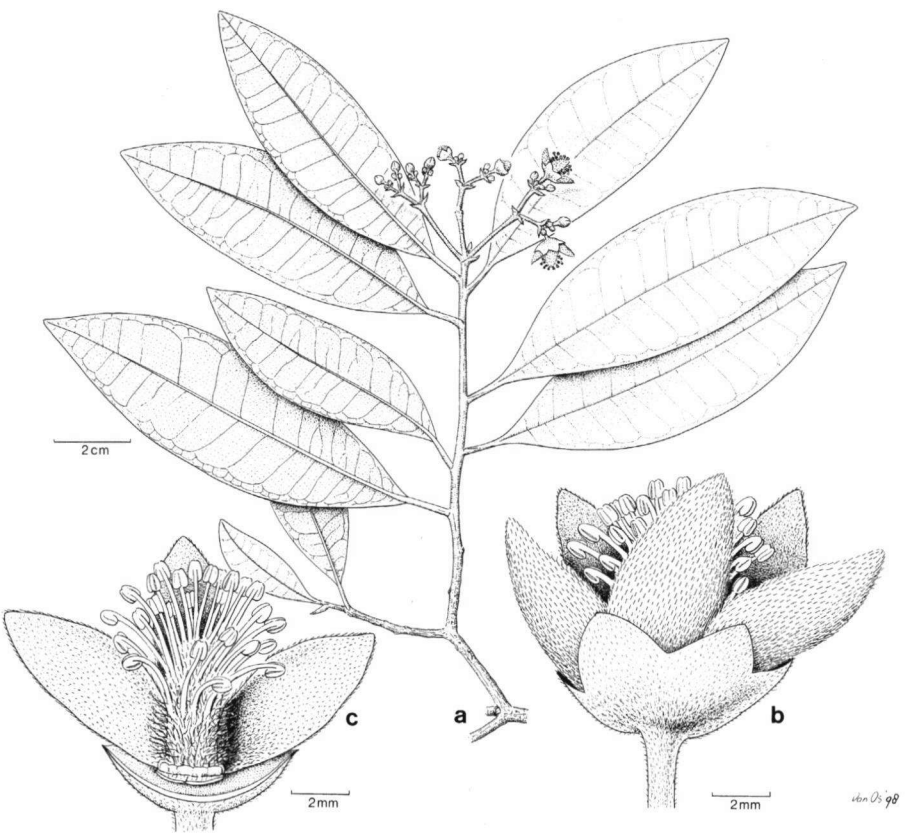

Fig. 2. *Fontainea borealis* P.I. Forst. a. Habit; b. staminate flower; c. staminate flower with part of sepals and petals removed showing stamens [all L, *Stauffer & Sayers 5608*].

c. 0.8 by 0.5 mm. *Pistillate flowers* and *fruits* not seen (pistillate disc reported to be orange on one label, but no preserved specimens present).

Distribution — Malesia: Papua New Guinea (Eastern Highlands Province).

Ecology & Habitat — Rain forest. Altitude 1800–2000 m. Phenology poorly known.

2. Fontainea subpapuana P.I. Forst.

Fontainea subpapuana P.I. Forst., Austrobaileya 5 (1997) 32. — Type: *LAE (Streimann & Kairo) 51548* (holo K; iso BRI, K, L), Papua New Guinea, Central Province, Kuriva Forestry area, near Weimauri River.

Tree to 7 m high; stems with red exudate. *Leaves:* petioles 12–20 by 1–1.4 mm diam., somewhat swollen at the apex only, narrowly channeled above, with scattered hairs; lamina elliptic to oblanceolate, 60–170 by 30–60 mm, index 2–2.8; base cuneate to weakly attenuate with elliptic, sessile glands, 1–2 mm long, ± marginal, 0.5–1 mm from the base; apex acuminate; upper surface dark green, lower surface pale green; venation with 13–15 nerves per side, veins and veinlets reticulate. *Staminate inflorescences* and flowers not seen. *Pistillate inflorescences* terminal, comprising 1–3 flowers. *Pistillate flowers* 5–8 by 10–13 mm diam.; pedicels 7–15 by 1–1.2 mm diam., sparsely hairy; calyx 4- or 5-lobed, 2–2.5 mm long, lobes rounded-ovate, with sparse hairs; petals 5, lanceolate-ovate, 6–8 by 2.5–3 mm, ± recurved; disk not dissected; ovary 3- or 4-locular, ovoid, densely hairy; styles 3–3.5 mm long. Intact *fruit* not seen; sarcocarp red; endocarp very shortly beaked, 3-ridged at sutures; intersutural faces smooth, convex, 25–26 by 12–13 mm.

Distribution — Malesia: Papua New Guinea (Central Province).

Ecology & Habitat — Lowland rain forest on river flats. Phenology poorly known.

PETALOSTIGMA

Petalostigma was described by Mueller (1857), with the single species *P. quadriloculare* F. Muell. Many more new taxa were subsequently published, species as well as infraspecific entities. This resulted in a long list of synonyms as only six species remained recognised after the last revision (Airy Shaw, 1976, 1980b). All species are Australian except *P. pubescens* Domin, which is also found in the Western Province of Papua New Guinea. The latter species is also the most variable.

Webster (1994) classifies *Petalostigma* in the subfamily Oldfieldioideae, tribe Caletieae, monotypic subtribe Petalostigmatinae. Typical characters are dioecy, stipules early caducous, leaves simple, alternate, entire, flowers in axillary fascicles or racemes with groups of flowers, pistillate sepals caducous, petals and disc absent, stamens basally connate, locules 2-ovulate, ovules anatropous, styles entire, very large, exserted, petal-like, and capsule fleshy.

This treatment only describes the Malesian material (*P. pubescens*). New in this revision is the reduction of *P. nummularium* Airy Shaw to *P. pubescens*, due to which the genus now comprises five species only.

Petalostigma F. Muell.

Petalostigma F. Muell., Hook. J. Bot. Kew Gard. Misc. 9 (1857) 16; Pax & K. Hoffm. in Engl., Pflanzenr. VI.147.xv (1922) 281; Airy Shaw, Kew Bull. 31 (1976) 366; Kew Bull. 35 (1980) 661; Kew Bull. Add. Ser. 8 (1980) 178; G.L. Webster, Ann. Missouri Bot. Gard. 81 (1994) 58. — Type species: *Petalostigma quadriloculare* F. Muell.

Shrubs or trees, evergreen, dioecious; stems and foliage without conspicuous latex. *Bark* greyish black, tessellated. *Indumentum* of simple hairs, not glandular, stinging hairs absent. *Stipules* entire, inconspicuous, caducous. *Leaves* alternate, simple, petiolate, elobate, penninerved, margin entire, glands absent. *Inflorescences* axillary, bracteate fascicles or very short racemes with groups of flowers. *Flowers* actinomorphic; petals absent; disc absent. *Staminate flowers* pedicellate; sepals 4, free, imbricate, cucullate, ± equal; petals absent; disc absent; stamens 18–86, filaments connate and attached to a slightly raised receptacle; anthers dorsifixed, bilobate, thecae oblong, longitudinally dehiscent; pistillode absent. *Pistillate flowers* sessile to pedicellate; sepals 6–8, imbricate, free; ovary 3- or 4-locular, ovules 2 per locule, style short, stigmas simple, flabellate (petal-like). *Fruits* capsular, quadri- or trilobate, tardily dehiscing septicidally into bivalved cocci; sarcocarp fleshy, orange to red. *Seeds* ellipsoid to flattened ellipsoid to ovoid; testa crustaceous; albumen fleshy; caruncles entire, non-arilloid; cotyledons broad, flat.

Distribution — Five species from Australia, one also in Malesia: New Guinea.

Ecology & Habitat — Trees in open woodland and open forest dominated by Eucalypts. Altitude 50–900 m. Flowering and fruiting after seasonal storm rains.

Petalostigma pubescens Domin — Fig. 3

Petalostigma pubescens Domin, Biblioth. Bot. 89 (1928) 871; Airy Shaw, Kew Bull. 31 (1976) 368; Kew Bull. Add. Ser. 8 (1980) 178; Kew Bull. 35 (1980) 663. — Lectotype (Airy Shaw, 1976): *Mitchell 438/615,* young fruiting specimen (K), Australia, 'Subtropical New Holland' (Queensland, W of Brisbane).

Petalostigma quadriloculare F. Muell. var. *pubescens* Müll. Arg., Flora 47 (1864) 481. — Type: *F. Mueller s.n.,* 1855-7 (holo K), Australia, Northern Territory, Arnhem Land.

Petalostigma quadriloculare F. Muell. var. *genuina* Müll.Arg. in DC., Prodr. 15, 2 (1866) 273, nom. illeg. — Type: *F. Mueller s.n.,* 1855-7 (K), Australia, Northern Territory, Arnhem Land.

Petalostigma quadriloculare F. Muell. var. *nigrum* Ewart & O.B. Davies, Fl. Northern Territory (1917) 166, t. 17. — Syntypes: *Campbell 17* (MEL), Australia, N of 15 degrees; *G.F. Hill 387* (MEL), Australia, Northern Territory, 70 miles N of Camp IV; *G.F. Hill 908* (MEL), Australia, Northern Territory, Borroloola.

Petalostigma nummularium Airy Shaw, Kew Bull. 31 (1976) 373; Kew Bull. 35 (1980) 663. — Type: *C.R. Dunlop 2290* (holo K; iso BRI, DNA), Australia, Northern Territory, W of Frewena.

Petalostigma australianum auct. non Baill.: Baill., Adansonia 7 (1867) 356, t. 2, pro parte ('Crescit in Australia ... *Leichhardt*', t. 2), nom. superfl.

Shrub to small tree up to 7 m high, usually single-stemmed. *Bark* roughly fissured, black-grey. *Indumentum* of yellow-ferruginous simple hairs, mainly glabrescent. *Leaves:* stipules linear-lanceolate, 4–6 by 0.3–0.8 mm, with dense hairs; petioles 2.5–10 by 0.5–1 mm, densely hairy; lamina elliptic, orbicular or ovate, 10–65 by 7–45 mm, strongly discolorous, base cuneate, rounded or truncate, apex rounded to apiculate,

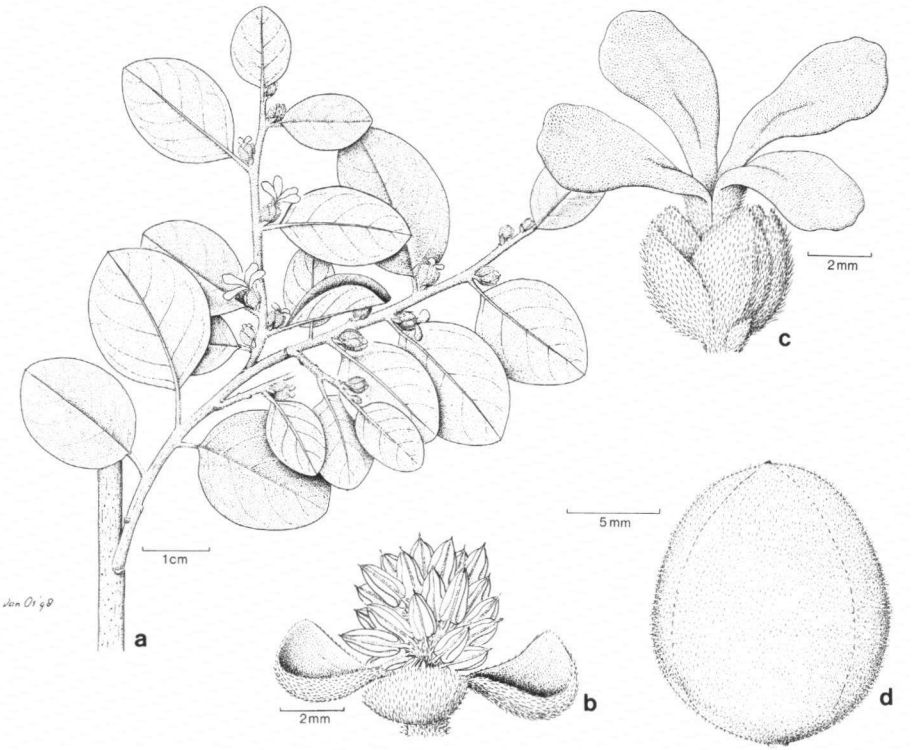

Fig. 3. *Petalostigma pubescens* Domin. a. Habit; b. staminate flower; c. pistillate flower with four large stigmas; d. fruit [all L; a, b: *Hyland 9148*; c: *Hubbard 4640*; d: *Hyland 8026*].

upper surface dark glossy green, not granular, with sparse hairs when young, lower surface cream to cream-brown or ferruginous-brown, densely sericeous; venation comprising 5–7 pairs of nerves, veins ± obscure, reticulate. *Flowers* cream. *Staminate flowers* 4–5 by 5–12 mm diam.; pedicels 1–2 by 0.7–1 mm diam., with sparse hairs; sepals 4, orbicular, broadly ovate to obovate, cucullate, 3.5–6 by 2.5–5 mm, sparsely hairy outside; stamens 28–68, connate into a column of 1.5–2 mm high; filaments 0.8–1.2 mm long, connate for most of their length, anthers oblong, 1.5–2 by 0.5–1 mm, usually with sparse hairs on apex of connective although occasionally glabrous. *Pistillate flowers* 5–10 by 5–8 mm diam.; pedicels 1.5–2.5 by 1–1.5 mm diam., densely hairy; sepals 8, ovate to lanceolate-ovate, 3.5–5.5 by 1.5–3 mm, densely hairy outside; ovary ovoid, 3.5–4 by c. 3 mm diam., with dense antrorse hairs; stigmas 4, lanceolate-oblong, 5–6.5 by 1.4–2.5 mm, with sparse hairs on top and densely hairy on back. *Fruit* globose to subglobose, 11–22 by 15–20 mm diam., orange-yellow to orange. *Seed* ellipsoid, 6–9 by 3–4.5 by 3–4 mm thick, smooth to slightly rugose, glossy red-brown; caruncle ± reniform, 1.5–2.5 by 1.8–2.5 mm, yellow to yellow-red.

Distribution — Malesia: Papua New Guinea (Western Province); and N and E Australia (Western Australia, Northern Territory, Queensland, New South Wales).

Ecology & Habitat — Open woodland and open forest dominated by eucalypts, also in coastal sand-dunes; on various soils. Altitude 20–900 m.

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IDENTIFICATION LIST

The identification list only refers to Malesian specimens. The numbers behind the collector numbers refer to the following taxa:

1 = *Choriceras tricorne* (Benth.) Airy Shaw
2 = *Fontainea borealis* P.I. Forst.
3 = *Fontainea subpapuana* P.I. Forst.
4 = *Petalostigma pubescens* Domin

Anta 189: 1.
Brass 5755: 1; 6511: 4; 7765: 1; 8391: 1; 8558: 4; 8559: 4; 8747: 4.
LAE 51548: 3; 60477: 1.
NGF 1030: 2; 17743: 1; 33489: 1; 33641: 1; 38719: 1; 38771: 1; 49704: 1.
Paijmans 319: 1 — Pullen 7135: 1; 7186: 1; 7517: 1.
Stauffer & Sayers 5608: 2.