



# Five new species of *Barringtonia* (Lecythidaceae) from Papua New Guinea

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## Key words

*Barringtonia*  
monocauly  
new species  
Papua New Guinea

**Abstract** Five new species of *Barringtonia* from Papua New Guinea are described and discussed: *B. lumina*, *B. monticola*, *B. pinnifolia*, *B. serенаe* and *B. tagala*. All five species belong to section *Barringtonia* with closed flower buds. Notes are also provided for the seven monocaulous pachycaul species of *Barringtonia* in New Guinea.

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## INTRODUCTION

During the course of a long residence in Papua New Guinea one of us (MJ) studied the genus *Barringtonia* extensively in the field and found a number of putative new species. These were partially written up over fifteen years ago, but due to other commitments were never published. GTP is in the process of preparing a monograph of the genus and so the new species upon which we both agree are published here prior to the monograph (Prance in prep.).

New Guinea is one of the three main centres of diversity of *Barringtonia*, the others being Peninsula Malaysia (see Prance 2010) and Borneo. The addition of these five species brings the total for PNG to 24. One of the most interesting features of the *Barringtonias* of PNG is the number of monocaulous species exhibiting Corner's model of tree architecture. These include three of the new species described here (*B. lumina*, *B. monticola* and *B. pinnifolia*). All five of the new species belong to the section *Barringtonia* which has a preanthic calyx completely enclosing the flower buds.

### The New Guinea pachycauls

- *B. calyptrocalyx* K. Schum. in K. Schum. & Hollrung
- *B. clemensii* Knuth
- *B. lumina* Jebb & Prance
- *B. monticola* Jebb & Prance
- *B. papeh* Lauterb.
- *B. papuana* Lauterb. (incl. *B. josephstaalensis* Takeuchi)
- *B. pinnifolia* Jebb & Prance

The pachycaulous species of *Barringtonia*, with the exception of *B. corneri* Kiew & K.M. Wong from the Malay Peninsula, are apparently New Guinea endemics occurring mainly in northern PNG and the adjacent Bismark Archipelago. *Barringtonia calyptrocalyx* is undoubtedly the most widespread species, being found throughout the north coast forests up to 1500 m, as well as in Central and Western Provinces on the south coast (see Map 1). It is characterised by its slender lanceolate leaves, and fusiform fruits. Two similar species occur within its range. *Barringtonia pinnifolia* found in Morobe and Northern Provinces has a more obovate leaf, as well as being an altogether more

slender and petite species. *Barringtonia papuana* of the north and south coast of Central Province is found through to Irian Jaya and has the most slender leaves in the genus, characteristically widest at the centre and not towards the apex as with the foregoing. We believe that *B. josephstaalensis* should be placed in synonymy under *B. papuana*.

These three species are in many ways very similar, and appear to occupy a similar ecological niche, being small understorey trees rarely exceeding 6 m in height. *Barringtonia calyptrocalyx* in particular shows great variation in leaf size, and in some populations gives the impression that two taxa are present, one with large leaves, a thick stem, larger inflorescence and bigger fruits, and the other smaller in all dimensions. Fruit shape and size varies considerably, some collections having clearly four- or eight-angled or ridged fruits.

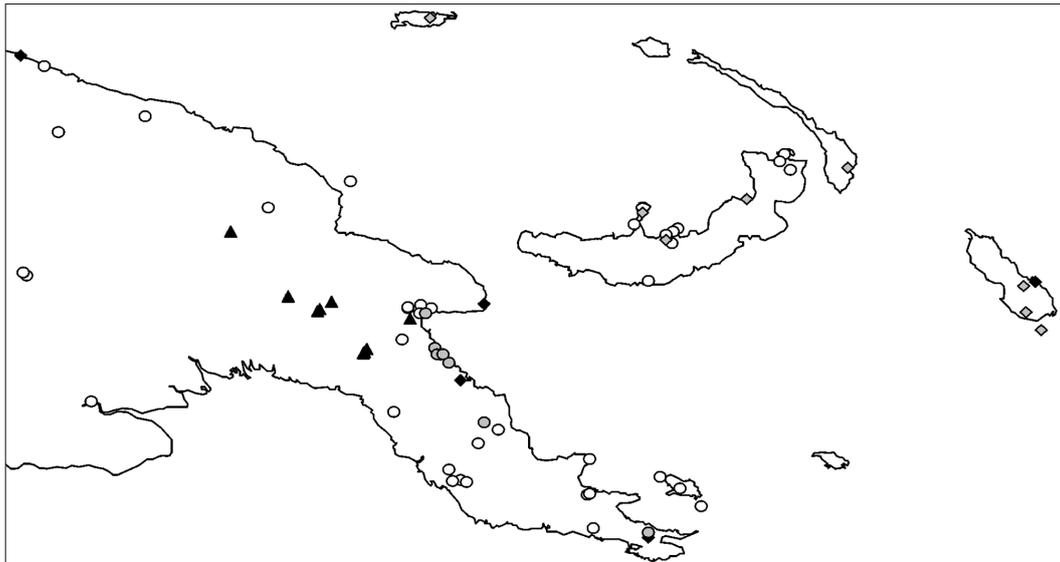
From Central and Sepik Provinces there are a few collections of *B. calyptrocalyx* with ant-inhabited stems. The phenomenon of hollow stems with ant-occupants is an intriguing feature of many New Guinea understorey trees. It has been recorded for over 32 species from 11 families, amongst them *Annonaceae*, *Leguminosae*, *Meliaceae* and *Monimiaceae* (MJ pers. obs.). In other features many of these trees show no other specialisations towards ant-occupancy, and the relationship appears more commensural than mutualistic. Many such relationships are clearly facultative, with certain forest areas containing numerous ant-inhabited trees, often adjacent to one another, while in other areas no ants may be present, even when the same species are involved.

Two other species, not to be confused with the foregoing by their massive construction, also occur; in New Britain *Barringtonia papeh*, and on the mainland *B. lumina*. These two species have thick, often unbranched stems to 15 m tall with a solitary whorl of 1.5–2 m long leaves at its apex. As with the foregoing species the plants are capable of branching, although usually as a result of injury to the primary stem rather than as a normal character state.

*Barringtonia papeh* is recorded as having a terminal inflorescence, although this apparently a variable feature, the species probably conforming to Chamberlain's Model of tree architecture. In *B. lumina* the inflorescences are borne on the trunk, well below the whorl of leaves. The two species differ markedly in their calyx and fruit characters, the former having a 4-lobed calyx divided in the bud, and a square-sectioned fruit, while the

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**Map 1** Distribution of most of the pachycaul species of *Barringtonia*: *B. calyptrocalyx* K.Schum. (○); *B. lumina* Jebb & Prance (◆); *B. monticola* Jebb & Prance (▲); *B. papeh* Lauterb. (◇); *B. pinnifolia* Jebb & Prance (◉).

latter has a closed calyx that splits circumscissily, even though there are four apparent sulci in the bud, and a round-sectioned fruit. The two are probably closely related.

Most species of *Barringtonia* are low-altitude plants. Payens (1967) only records eight species as reaching to 1000 m. *Barringtonia monticola* is therefore unique in that it has not been collected below 1200 m, and occurs up to 1950 m. It is found in Morobe and East Highlands Provinces. The recently described *B. jebbiana* Takeuchi (2010) from the limestone Muller Range is also an high-altitude species at 1450 m. Unfortunately these altitude limits coincide with the maximum density of human populations in Papua New Guinea, making forest at these altitudes scarce and fragmented in the central highlands. Furthermore, monocaulous *Barringtonia* species suffer from direct selection pressure, their straight stems are often preferentially felled for house construction. It may be that the species is more common and widespread than anticipated, certainly it is abundant in the Okapa and Aseki areas. *Barringtonia monticola* (Fig. 2) is a large leaved species similar to a broad-leaved *B. calyptrocalyx*.

Lastly *B. clemensii*, which was placed in synonymy within *B. samoensis* A.Gray by Payens (1967), is not easy to characterise architecturally. It can certainly flower as a monopodial treelet, although it appears to develop into a branching tree later through reiteration. *Barringtonia clemensii* is certainly distinct from *B. samoensis* and will be recognised in a forthcoming monograph of the genus.

The pachycaul species of *Barringtonia* would undoubtedly merit further fieldwork and study since there is still further variation that needs to be analysed within the context of a molecular study. We commend them as a fascinating subject for evolutionary investigation into tree architecture and the role of different pollinators and dispersal agents.

## NEW SPECIES OF BARRINGTONIA

### 1. *Barringtonia lumina* Jebb & Prance, *sp. nov.* — Fig. 1

Species *B. procera* affinis, arboribus monocaulinis, foliis majoribus 100–190 cm longis, 22–42 cm latis (haud 29–62 × 2–16 cm), verticellis staminarum 8–12 haud 5–6, hypanthio calycisque extus veludo-pubescentibus, gemmis quadratis differt. — Typus: *M. Jebb* 920 (holo K; iso L, LAE, NY), Papua New Guinea, Morobe Province, 1 km W of north end of Finschhafen airstrip, 6°36.9'S, 147°50.7'E, 80 m, 19 May 1991.

Monocaulous tree to 15 m tall, dbh 15 cm; bark flaky grey, pustular lenticels to 0.8 by 0.2 cm, pink within; axes segmented at 10–40 cm intervals; architecture conforming to Corner's Model. *Leaves* in a single whorl of 12–25 in mature trees, several whorls in younger trees; scarcely petiolate; leaf scars rounded, obovate-rhomboid, crowded, 2.5 by 2 cm; leaf blades flat, recurved, narrowly-obovate; 100–190(–228) by 22–42, widest at 2/3 its length, coriaceous, dark green above, paler below; dead or damaged leaves yellow to red, new leaves pinkish red; primary veins 50–65 pairs, arising obliquely from midrib, straight and parallel, and arched and joined at margin, more pronounced below; apex rounded and abruptly acuminate, the acumen to 2.5 cm; base tapering to petiole; midrib prominent below, angular, with a narrow raised ridge above; margin minutely crenulate; terminal bud a prominent spike to 30 by 5 cm. Cataphylls lanceolate, 5–19 by 3–4.5 cm, caducous, pinkish red; apex rounded to acute, base auriculate; margin finely serrate; venation reticulate irregular. *Inflorescences* lateral in groups of 2–6, usually arising from a single previous whorl of leaves, axillary to a former leaf base; racemes 80–100 cm long, to 1.5 cm diam, scarcely tapered, fissured; bracts triangular, acuminate, to 1.2 by 0.6 cm, densely velvety pubescent throughout, khaki green to light brown, base blunt; young inflorescence with buds compressed, quadrangular form maintained through development; basal bracts oblong, 4.5 by 2.5 cm, caducous, apex ± bifurcate, rounded. *Flowers* 80–100, sessile; buds obovate, entire, not porate but with a minute apical depression, square in apical view, with 4(–5) narrow sulci along the corners, densely velvety pubescent, khaki-green; calyx circumscissile, the persistent part becoming thickened in fruit; to 1.5 by 0.4 cm; petals 4(–5), obtusely triangular to obovate, to 40 by 15 mm, white with a faint pink flush, apex rounded; stamens 450–500, in 8–12 whorls, to 50 by 0.5 mm, connate at their very base only, innermost whorl staminodal, 3–20 mm long; anthers elliptic, 0.75 by 0.5 mm, 4-celled; disc to 9.5 mm diam, the inner annulus 4 mm diam and < 1 mm high, becoming strikingly hemispherically concave in fruit; style slender, tapering, to 55 by 1 mm; ovary rounded-cupuliform, sessile, 0.7 by 0.7 cm; locules 4, each with 3 ovules. *Fruit* sessile, obovate, to 7.5 by 3.5 cm; apex obtuse, base tapering, acute, almost circular in section.

*Distribution & Habitat* — Jayapura, Sepik, Morobe, Milne Bay and Bougainville, forest. Altitude: 0–300 m.





Fig. 2 Type of *Barringtonia monticola* Jebb & Prance (Henty & Streimann NGF 38894, K, L).

### 3. *Barringtonia pinnifolia* Jebb & Prance, *sp. nov.* — Fig. 3

Species *B. papuana* similis sed foliis minoribus, 19–36 cm longis, 2.5–4.5 cm latis (haud 47–126 × 1.5–8 cm), nervis primariis 16–21 jugis (haud 70–95), sepalis minoribus circulis differt. — Typus: *Takeuchi & Ama 16438* (holo L; iso A), Papua New Guinea, Morobe Province, Kamiali Wildlife Management Area, ridgeline leading to Bulili Mountain, 7°19'S, 147°08'E, 300 m, 6 Oct. 2002 (fl).

Small pachycaul tree 5–8 m tall; monocaulous or sparsely branched; bark smooth, grey-brown, striate when dry; architecturally conforming to Corner's Model(?); branch internodes to 10 cm long; ultimate branch tips to 0.8 cm across, ± terete, striate when dry; leaf scars prominent, round-triangular, 0.6 by 0.5 cm, pale grey-brown. Leaves in whorls of 12–18; petiole 2–5 cm, inconspicuously winged, ± indistinguishable from leaf blade, the base with a large pulvinus to 1 by 0.6 cm; leaf blades linear-obovate, 19 by 25 to 36 by 4.5 cm, widest at c. 4/5 to 5/6 its length; apex rounded acuminate, acumen to 2 cm long; base tapering evenly to petiole; midrib rounded, prominent below, raised above; primary veins c. 16–21, arising obliquely from the midrib gently curved, arching and joined near the margin; margin crenulate towards apex, otherwise entire. Cataphylls foliaceous, lanceolate, 3–8 by 0.4–1 cm, acute, widest at 2/3 its length. Inflorescences arising from leaf axil in the terminal whorls, or when fruiting from the axils of fallen leaves; 1–3 within a leaf whorl; raceme 35–45 by 0.1 cm. Flowers 15–18; 1–3 cm apart, inserted on 1 mm long bosses; pedicel to 5 mm; calyx entire in bud, spherical, to 10 mm diam, circumscissile; glabrous, reddish green; apex minutely apiculate; petals to 15 mm; stamens to 20 mm; style to 20 mm; disc to 5 mm diam; ovary conical, 4 by 4 mm, locules 4, each with 1–2 ovules. Fruits obovoid, 23 by 15 mm, immature; red.

Distribution & Habitat — Morobe, Northern and Milne Bay Provinces, Hillside rainforests on steep slopes in ultrabasic areas and on rocky slopes. Altitude: 0–100 m.

*Additional specimens examined.* PAPUA NEW GUINEA, Morobe, Helicopter site 2, Lae SD, 7°33'S, 147°20'E, 7 May 1967, *Ridsdale NGF 31653* (LAE); Opposite Lasanga Island, 7°25'S, 147°10'E, 10 Nov. 1973, *Jacobs 9550* (BISH, L, LAE); Gurako, July 1983, ?*Heads 333* (LAE); Lasanga Island, 7°25'S, 147°15'E, 2 Nov. 1969, *Streimann NGF 44158* (LAE); Northern, Gwaiiri village, 15 Aug. 1953, *Hoogland 3646* (LAE); Milne Bay, Kaporika village, Mt Dalaia, Alotau, 120 m, 10°15'S, 150°10'E, 21 Nov. 1975, *Larivita LAE 67157* (LAE).

Note — The long feather-shaped leaves (Lat. *Pinna* = feather) are a characteristic feature of this species. Like *B. papuana* the new species has narrowly lanceolate leaves, but the blades are much smaller, with fewer primary veins and widening towards the apex rather than with parallel margins. The flowers are smaller and the calyx is entire rather than strongly divided into lobes. This species is also similar to *B. boridiensis* R.Knuth, but differs in having chartaceous leaves with fewer primary leaf veins (21–26 vs 32–65), shorter pedicels, and shorter styles.

### 4. *Barringtonia serенаe* Jebb & Prance, *sp. nov.* — Fig. 4

Species *B. racemosa* affinis, stylis curtibus ad medium filamentarum extensis, calycibus gemmarum inapertis, lobis calycibus post aperiens annulis cupuliformis remnatis, pedicellis articulatis differt, *B. tagala* affinis stylis curtibus, petiolis 2–7 cm (haud 1 cm) longis, petalis 38 mm longis, 22 mm latis (haud 22 × 15 mm) differt. — Typus: *Jebb 905* (holo K; iso L), Papua New Guinea, Madang Province, River gorge 0.8 km W of Sein village, near Madang, by path to Og Cave, 5°18'S, 145°42.3'E, 90 m, 7 Apr. 1991.

Tree, leptocaul, 20 m tall, upright, bole 6 m, dbh 25 cm; bark smooth with large lenticels in ± regular rows, to 1 cm thick,



Fig. 3 *Barringtonia pinnifolia* Jebb & Prance. Leaves and inflorescence (Ridsdale NGF 31653, LAE).

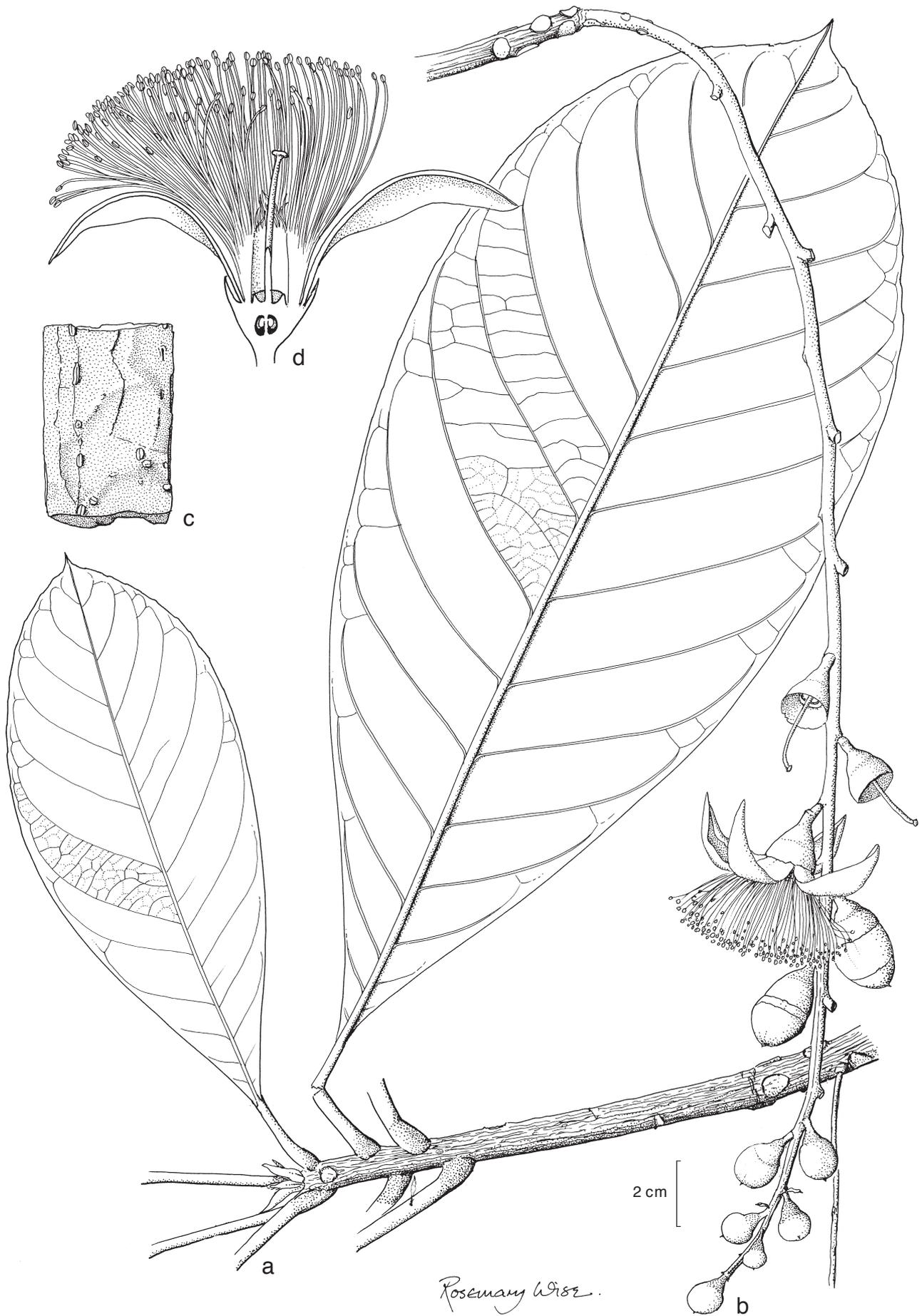


Fig. 4 *Barringtonia serenae* Jebb & Prance. a. Leaves and branch; b. inflorescence; c. bark; d. half flower (Jebb 905, K, L & 909, K).

reddish, fibrous, soft; wood white; architecturally conforming to Champagnat's Model; branches few, ± pendulous, upcurved at ends, ultimate twigs 8–16 mm diam, its bark glabrous, smooth, to 3 mm thick; lenticels in ± straight rows, to 2 by 1 mm; leaf scars prominent, transverse-obovate, 1.3 by 1.7 cm; internodes 8–40 cm long. Leaves in whorls of 8–11(–16), terminal; petiole 2–7 by c. 0.8–1.2 cm, rounded below, flattened above,

glabrous, green, furnished with 2 abrupt ridges contiguous with the leaf blade, pulvinate in the lower 1/3 to 1/2 and there scabrous, grey-brown; leaf blades obovate; 13–39(–60) by 5.5–16.5(–24) cm, flat, coriaceous, dark dull green above, pale glossy green below; apex acuminate; base tapering, abruptly cuneate; midrib rounded below, narrowly ridged above; primary veins 10–14 pairs, prominent below ± above, arising obliquely,

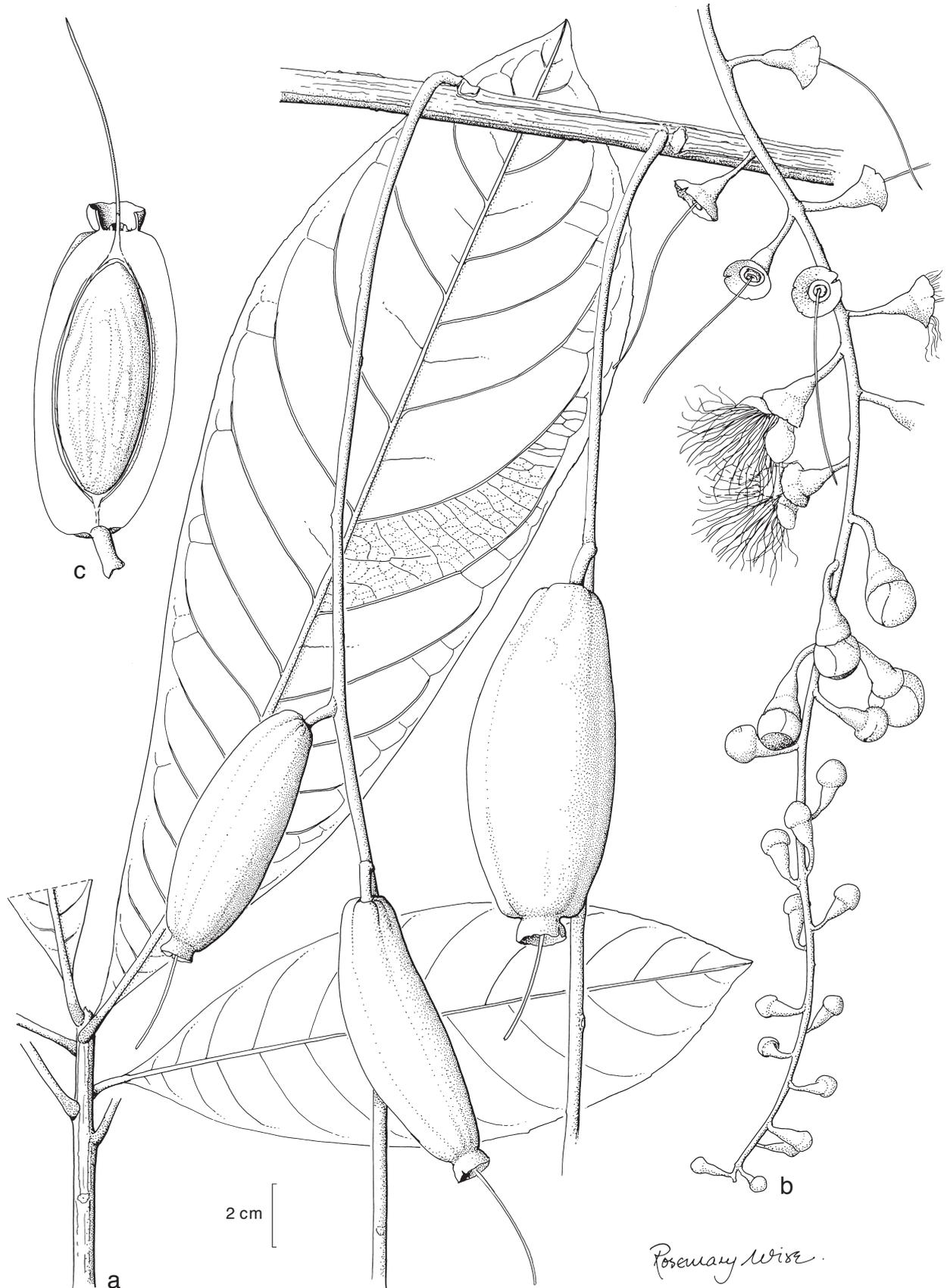


Fig. 5 *Barringtonia tagala* Jebb & Prance. a. Leaves and branch; b. inflorescence; c. half fruit (Jebb 884, K, L, LAE).

arched and united at the margin; margin asymmetrically crenulate, and minutely apiculate between crenulations, these becoming worn,  $\pm$  entire towards base. Cataphylls leaf-like, below leaf whorls obovate, sessile; at stem apices broad-ovate, smallest 0.9 by 0.6 cm; apex acute; base truncate; margin serrate. *Inflorescences* lateral, from old leaf axils of branches, to 4 cm diam, rarely terminal on leafless shoots; racemes 1–5, 30–35 by 0.5 cm, striate; pedicels to 3 mm long, 2 mm diam, thickened at their apices; bracts to 5 by 1 mm, minutely serrulate, caducous. *Flowers* 20–28, opening sequentially 1–3 at a time; pedicels to 2.5 by 1 mm; buds spherical, apiculate, to 14 mm diam; splitting circumscissily at their widest point, glabrous, pale green,  $\pm$  flushed with pink; calyx cupuliform, developing a red margin after corolla abscission; petals 4, obovate, puberulous, white, flushed with pink along the lower margins to 38 by 22 mm, fleshy at centre, membranous near margin, gently recurved along length; apex rounded; margins strongly recurved in open flower, giving the appearance of acute-triangular tapering petals 10 mm wide; stamens 200–250, 30–40 by 0.5 mm (including the connate base), arranged in numerous whorls from the thick-walled (2.5 mm), 8 by 6 mm staminiferous tube, shortest towards centre of flower, innermost whorl anatherous, staminodes few, to 20 mm long, flattened, unbranched, tapering; anthers elliptic, 4-celled, 1.5 by 1 mm; style 20–23 by 1 mm, tapering, white below, deep red in upper half; stigma flattened, capitate, to 2 mm across,  $\pm$  4-lobed, yellow; disc 8 mm across, with an annular scar from the staminiferous tube; within this scar a prominent, narrow, sharp-edged, cupuliform rim to 1 mm tall, and 5 mm diam, sloping inwards to base of style, yellow; ovary triangular, 6 by 9 mm broad, locules each with 2 ovules. *Fruits* unknown.

**Distribution & Habitat** — Madang Province. Rare? Only known from two collections. Growing on coral rock by river edge at 100 m.

**Additional specimen examined.** PAPUA NEW GUINEA, Madang Prov., 0.8 km NW of Sein Villlage, pathway to Og Cave, 5°18'S, 145°42.3'E, 90 m, *Jebb 829* (K, L).

**Note** — The short style of this species, almost half the length of the stamens, and covered by the staminodes is a rare character in the genus. The failure of this tree to set fruit, even though it flowered successfully over the three years it was under observation (1988–1991), may be a result of its solitary existence, and an incompatibility mechanism, or it may be a consequence of the short style being incapable of receiving pollen. Some sterile collections from Morobe Province may pertain to this species or to *B. clemensii*. MJ names this species in honour of his delightful wife Serena who allowed him “the frivolous pursuit of hunting for *Barringtonia*, and who is also one of a kind.”

### 5. *Barringtonia tagala* Jebb & Prance, *sp. nov.* — Fig. 5

Species *B. racemosa* affinis lobis calycibus post aperiens annulis cupuliformis remantis; fructibus 9.5 cm longis (haud 2–5.5 cm), *B. serenae* affinis petiolis ad 1 cm longis (haud 2–7 cm), petalis 22 longis, 15 mm latis (haud 38 × 22 mm); pedicellis haud articulatis differt. — *Typus*: *Jebb 884* (holo K; iso L, LAE), Papua New Guinea, Madang Province, Balek Wildlife Reserve, 5°19'S, 145°43.35'E, 16 Oct. 1990.

Upright leptocaul tree, to 20 m; bole to 8 m, profusely branched; branches horizontal to down curved; internodes 6–24 by 1.2 cm, architecturally conforming to Champagnat's Model. *Leaves* in loose whorls of 5–14(–19), in upper half of internode; petioles to 1 cm, rounded below, flat above; leaf blades flat, obovate to lanceolate, 16–33 by 5–12 cm, broadest at c. 2/3 of its

length, glossy green above; chartaceous; apex shortly round-acuminate; base cuneate; midrib rounded, prominent below; primary veins 12–17 pairs, prominent below, arising obliquely, curving, arched and united near the margin; margin asymmetrically crenulate, entire towards the base. Cataphylls spatulate, 5–11 by 1–2.5 cm, caducous; apex blunt and mucronate, more rounded in larger cataphylls, base tapering. *Inflorescences* lateral, arising from old leaf axils, often somewhat behind apex, sometimes solitary, usually in clusters of 2–3(–4); peduncle to 90 by 0.3 cm, thickening in fruit to 0.5 cm, cylindrical, smooth to striate; bracts lanceolate, to 0.5 cm long, caducous. *Flowers* 25–40, pedicels characteristically upcurved when in bud, nodding when flowering, and  $\pm$  horizontal after perianth has fallen, c. 1.5 by 0.6 cm, passing abruptly to hypanthium; buds spherical, apiculate, to 12 mm diam, splitting circumscissily at the widest point, and expanding to 16 mm and often retaining the caducous cap before finally opening; calyx truncate, to 0.5 by 1.5 cm, papery, cupuliform in fruit; margin  $\pm$  entire, flattened; petals 4, obovate, c. 22 by 15 cm, concave, white; apex rounded; stamens 200–250, in c. 7 whorls, 40–50 by 0.5 mm, connate in the lower 2–3 mm, the innermost whorl fused into a fimbriate tube 10 by 4 mm, staminodes to 20 mm long; anthers round-ovate, 1 by 1 mm, 4-celled; style 55–58 by 1 mm, tapered; white, pink towards apex; disk to 8 mm across, the raised annulus acute-topped, to 1.5 mm high, yellow; ovary conical, 0.7 by 0.8 cm; locules 2–3, each with 2–4 ovules, septae 3–4 at the base. *Fruits* narrowly cylindrical when young, 8.5 by 2 cm, becoming thicker and oblong with age, to 9.5 by 4.5 cm, apex and base blunt; surface irregularly and thickly ribbed, apex puckered, with prominent and persistent calyx and style remains, dark green when young, becoming yellow when fully ripe and then falling; embryo cylindrical, to 7 by 2.5 cm, tapering to each end.

**Distribution & Habitat** — Known from the Gogol valley of Madang Province. In lowland forest. In common with many other *Barringtonia* apparently shows poor seed dispersal. Individual trees are often accompanied by large crops of surrounding seedlings.

**Note** — Although the leaves of *B. tagala* are similar to those of *B. serenae* this new species can be distinguished from the latter by its much longer inflorescence, longer pedicels that are not articulated and the smaller flowers. The raceme length, fruit size, its long cylindrical shape and the 2–3-loculed ovary are exceptional. The generic name for *Barringtonia* in the Madang region is ‘Tagal’.

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### REFERENCES

- Payens JPDW. 1967. A monograph of the genus *Barringtonia* (Lecythidaceae). *Blumea* 15: 157–263.  
 Prance GT. 2010. Notes on the Lecythidaceae of Peninsular Malaysia. *Blumea* 55: 14–17.  
 Takeuchi W. 2010. Notes on Papuanian *Barringtonia* (Lecythidaceae): *B. jebiana* sp. nov. and *B. josephstaalensis* from the Muller limestone of southern New Guinea. *Harvard Papers in Botany* 15, 1: 27–35.