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The Genus *Bauhinia* in Australia. Taxonomy and palynology

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Abstract

Larsen K. and S.S. (1983). The genus *Bauhinia* in Australia. Taxonomy and palynology. Bot. Helv. 93: 213–220. An annotated key to the 6 indigenous species of *Bauhinia* on the Australian continent is offered. For each species nomenclatural, taxonomic and phytogeographic comments are provided. The morphology of the pollen is described after LM and SEM observations for the first time.

Introduction

During several years the authors have studied the genus *Bauhinia* in tropical Asia (see e.g. Larsen 1975, Larsen & Larsen 1973, 1980, 1981, and 1982).

From Australia all material from the following herbaria have been studied: AD, BRIS, CANB, MEL, NE, NSW; furthermore mainly older collections from the following European herbaria were used: BM, C, and K. The directors of these institutions are thanked for sending the material on loan.

The present account follow the system worked out by Wunderlin, Larsen & Larsen 1981.

Taxonomy

Six species of *Bauhinia* are indigenous to the Australian continent. We have omitted lengthy descriptions of the species as such are found in various floristic manuals, and furthermore will be repeated in the new Australian flora.

Key to the species

1. Leaves entire. Inflorescence a panicle, partial inflorescences dense, narrow racemes up to 20 cm long. Pods oblong-lanceolate, thin-valved, $3.5-4.5 \times 1.0-1.3$ cm, seeds 1-2 *B. syringifolia*
1. Leaves emarginate to bifid or consisting of two free leaflets. Inflorescence not as above. Pods strap-shaped $15-25 \times 1.0-1.5$ cm or narrowly oblong to oblong, more than 2 cm broad, seeds 3 - many 2

2. Leaves emarginate to bifid. Flowers unisexual (rarely bisexual), plants mostly dioecious. Pods strap-shaped 15–25 × 1.0–1.5 cm, striate *B. malabarica*
2. Leaves consisting of two free leaflets. Flowers bisexual. Pods narrowly oblong to oblong, 2.0–4.5 cm broad, smooth 3
3. Receptacle tubular 0.7–1.5 cm long, calyx-segments free. Stipe adnate. Pods ± woody valved 4
3. Receptacle turbinate or disc-like up to 0.5 cm long, calyx campanulate 5-toothed. Stipe free. Pods coriaceous often wavy 5
4. Tendrils present, early caducous, stipe ca. 0.5 cm, slightly lengthening after anthesis, up to ca. 1 cm in pod *B. binata*
4. Tendrils not present, stipe ca. 1 cm, much lengthening after anthesis up to ca. 3.5 cm in pod *B. hookeri*
5. Receptacle turbinate ca. 0.5 cm long, buds ± ovoid. Both receptacle and buds appressed pubescent, smooth *B. carronii*
5. Receptacle very short and broad disc-like not more than 0.5 cm, buds short conical. Both receptacle and buds velvety tomentose, often ribbed *B. cunninghamii*
 - a. Flowers reddish, indumentum of receptacle, buds and petals brown to reddish brown subsp. *cunninghamii*
 - b. Flowers yellowish, indumentum of receptacle, buds and petals yellowish subsp. *gilva*

1. *B. syringifolia* (F. Muell.) Wunderlin, *Phytologia* 44: 325. 1979; Wunderlin, K. Larsen & S.S. Larsen in Polhill & Raven: *Advances in Leg. Syst.*: 107. 1981.

Barklya syringifolia F. Muell., *Journ. Linn. Soc. Bot.* 3: 158. 1859; Benth., *Fl. Austr.* 2: 275. 1864.

The species is easily recognized by its entire leaves; small, bright yellow flowers in dense narrow racemes forming large panicles; pods thin-valved, oblong-lanceolate, small, 1–2-seeded.

Distribution: Endemic to Australian, NE. and E. Queensland.

2. *B. malabarica* Roxb., *Hort. Beng.* 31. 1814 nom. nud.; *Fl. Ind.* ed. 2, 2: 321. 1832.

B. gilesii F. Muell. & Baily in *Wing, South Sc. Record* 2: 151. 1882 syn. nov.

B. hawkesiana Bail., *Queensl. Agric. Journ.* 15: 897. 1905.

For further synonymy see K. Larsen, S.S. Larsen & J. Vidal: *Fl. Camb., Laos & Vietnam* 18:162. 1980.

The only species in Australia with normally unisexual flowers (rarely bisexual); plants mostly dioecious.

Distribution: From India throughout SE. Asia to the Philippines and Timor. In Australia only found in Northern Queensland and Northern Terr. (Port Darwin).

3. *B. binata* Blanco, *Fl. Filip.* 331. 1837.

B. holzei (holtzei) F. Muell. in *Vict. Natural.* 8: 131. 1892 nom. nud.

Lysiphyllum binatum (Blanco) de Wit, *Reinwardtia* 3: 432. 1956. For further synonymy see this author.

Closely related to *B. hookeri*, but differs from this species in having caducous tendrils on the young branches and in the much shorter stipe which lengthen only slightly after anthesis.

Distribution: Thailand, Philippines, New Guinea, Ceram, Australia: Northern Terr. and Northern Queensland.

Note. Only found near the coast most often on sandy beeches. In another connection (Larsen & Larsen 1982) we have discussed the probability of the species being introduced to Mainland Asia in recent times. The Australian localities fit well into the distribution area.

4. *B. hookeri* F. Muell., Trans. Phil. Ins. Vict. 3: 51. 1859; Benth., Fl. Austr. 2: 296. 1864. Plate 1: a, d.

B. hookeri var. *puberula* Benth. l.c.

Lysiphyllum hookeri (F. Muell.) de Wit ex Schmitz, Bull. Jard. Bot. Nat. 43: 407. 1973 nom. inval.

Type has to be designated.

For distinction from the closely related *B. binata* see above.

Distribution: Endemic to Australia (Queensland and Northern Terr.)

Note: We have observed a wide variation in indumentum of receptacle and calyx, from densely hairy to nearly glabrous; also the size of the receptacle vary from 8–15 cm. The pods vary from 2.5–4 cm in width.

5. *B. carronii* F. Muell., Trans. Phil. Inst. Vict. 3: 49. 1859. Plate 1: b, e.

Type: F. Mueller s.n. Queensland: Burdkin. Lectotype (here selected) MEL 69680, iso-: K. We have selected the only specimen with open flowers that we have seen.

B. carronii is closely related to *B. cunninghamii* and the two are often wrongly named. The main separating character are in the key; but also fruiting specimens can often easily be separated as in *B. carronii* the receptacle + calyx loose from the stipe and form a membranous tubular sheath; in *B. cunninghamii* it remains at the base of the stipe.

Distribution: Endemic to Australia (Queensland, New South Wales).

6. *B. cunninghamii* (Benth.) Benth., Fl. Austr. 2: 295. 1864.

Phanera cunninghamii Benth., Pl. Jungh. 1: 264. 1852.

B. leichhardtii F. Muell., Trans. Phil. Inst. Vict. 3: 50.

Lysiphyllum cunninghamii (Benth.) de Wit, Reinwardtia 3: 341. 1956. syn. nov.

B. cunninghamii forma *rosea* Baily; Queensl. Agric. Journ. 25: 287. 1910. syn. nov.

Subsp. *cunninghamii*. Plate 1: c, f.

Type: Cunningham 224/1820 Carrening Bay. Lectotype (here selected) NSW, iso-: K, NE.

Distribution: Endemic to Australia (Northern Terr., Centr. Queensland, coast of Western Australia and S. Australia).

Subsp. *gilva* (Baily) K. & S.S. Larsen stat. nov. Plate 1: g.

Basionym: *B. cunninghamii* forma *gilva* Baily l.c.

Syn. *B. leichhardtii* F. Muell., Trans. Phil. Inst. Vict. 3: 50. 1959.

Type: E. W. Bick s.n., Georgina River. Holo-: BRIS, iso-: K.

Distribution: Endemic Georgina River.

Note: Besides the colour of the flowers and the indumentum this subspecies deviates from ssp. *cunninghamii* in leaf-shape; this character is difficult to describe, but the analysis of a large material has shown the leaflets of ssp. *gilva* to be narrower and broadest below the middle.

Two specimens, viz. Bick s.n. & 106 and Chippendale 254 from Georgia River have leafshape as subsp. *gilva* but flowers of a paler colour than subsp. *cunninghamii*. They form a transition between the two subspecies. The population along Georgia River should be studied closer.

Pollen Morphology

All the species were studied following the methods described in earlier papers (Larsen 1975 and Larsen & Larsen 1981). The terminology follows Larsen l.c. with some alterations after the admitted resolutions at the APLF symposium (Cerceau-Larrival et al. 1975) and the recommended palynological terms and definitions (Nilsson & Müller 1978). The terms: apiculate, rhomboidal, compressed oval (Fægri & Iversen

1966) are used for the outline of pollen grains in meridional limb. The result are summarised in Table I, the measurements shown in the table are based on 10-15 expanded, normal pollen grains.

<i>Bauhinia</i>	Amb	Pollen grains size P × E	P/E	Shape	Apo- colpia size	Colpi size	Exine thickness		
							Ora size	at meso- colpia	at poles
<i>binata</i>	C-TL	42-50 × 35-42	1.05-1.31	PSPH-SP	8-11	31-40 × 6-11	5-10	2.0-2.5	2.5-3.0
<i>carronii</i>	C-RT (-TL)	34-45 × 28-37	(0.97-) 1.06-1.33 (-1.43)	(OSPH-) PSPH-SP(-P)	4-7	26-37 × 6-11	4-8	1.5-2.0	2.0-3.0
<i>cunninghamii</i>	C-RT	40-51 × 33-45	(1.00-) 1.07-1.28	(RH), (AP) PSPH-SP(-P)	4-8	32-44 × 7-16	5-10	2.0-3.0 (-4.0)	2.5-3.5 (-4.0)
- <i>cunn.</i>									
- <i>aff. cunn.</i>	± TL	39-45 × 33-39	1.05-1.26	AP, PSPH-SP	4-5	34-38 × 7-13	5-7	2.0	2.0-3.0
- <i>gilva</i>	C-TL	40-46 × 32-42	(1.00-) 1.02-1.23	AP, PSPH-SP(-P)	4-6	34-38 × 6-10	5-7	1.5-2.0	2.0-3.0
<i>hookeri</i>	± TL	39-52 × 34-43	1.05-1.27 (-1.35)	(RH), PSPN-SP(-P)	6-11	30-41 × 6-10	4-8	2.0-3.0	2.0-3.5
<i>syringifolia</i>	± TL	20-27 × 16-22	1.14-1.33 (-1.44)	CO, SP(-P)	7-8	14-18 × 2-3	3-5	2.0-2.5	1.5-2.0

Table 1. Pollen morphological data

(All the measurement are in μm)

Abbreviations. Amb.: C = circular, RT = rounded triangular, TL = trilobate. Shape: AP = apiculate, CO = compressed oval, OSPH = oblate spheroidal, P = prolate. PSPH = prolate spheroidal, RH = rhomboidal, SP = subprolate.

General description

Pollen grains 3-colporate, prolate spheroidal to subprolate, rarely spheroidal or prolate, P/E = (1.00-)1.05-1.33(-1.45), subcircular to oval or compressed oval rarely rhomboidal or apiculate in meridional limb. Amb circular or rounded triangular or \pm trilobate. Apocolpia 4-8(-11) μm . Ectoapertures, colpi fairly long ca 3/4-4/5 of polar axis, colpus membrane finely granulate to granulate, apices acute to rounded sometimes invaginated. Endoapertures, ora lalongate, circular or lolongate, rarely irregular. Exine 1.5-3.0 μm thick at mesocolpia, consisting of sexine (tectum and collumellae) and nexine. Tectum finely perforate to perforate-rugulose or rugulose.

The pollen can be divided into three types based on the size and shape.

1. *Syringifolia* type. Plate 2, fig. 1-5.

Pollen small, size P 20-27 μm , E 16-22 μm , subprolate rarely prolate, compressed oval in meridional limb. Amb \pm trilobate. Colpi narrow ca. 2-3 μm wide et equator, apices acute. Endoaperture lalongate extending beyond the margin of colpi.

Exine ca. 2 μm thick at mesocolpia, thinner toward the poles but thicker towards endoaperture. Sexine \pm equally thick for the whole grain but nexine thicker at mesocolpia. Collumellae thin, indistinct.

Only *B. syringifolia* belong here.

2. *Tubicalyx* type (Larsen 1975) Plate 2, fig. 6-27.

B. binata, *B. carronii*, *B. cunninghamii* and *B. hookeri* belong here.

Inter- and intraspecific variation: Variation between the species as well as within the species mainly concerns the size and shape of the pollen and the thickness and structure of the exine. In the earlier paper (l.c.) P 37-54 μm and E 33-42 μm , was reported; from

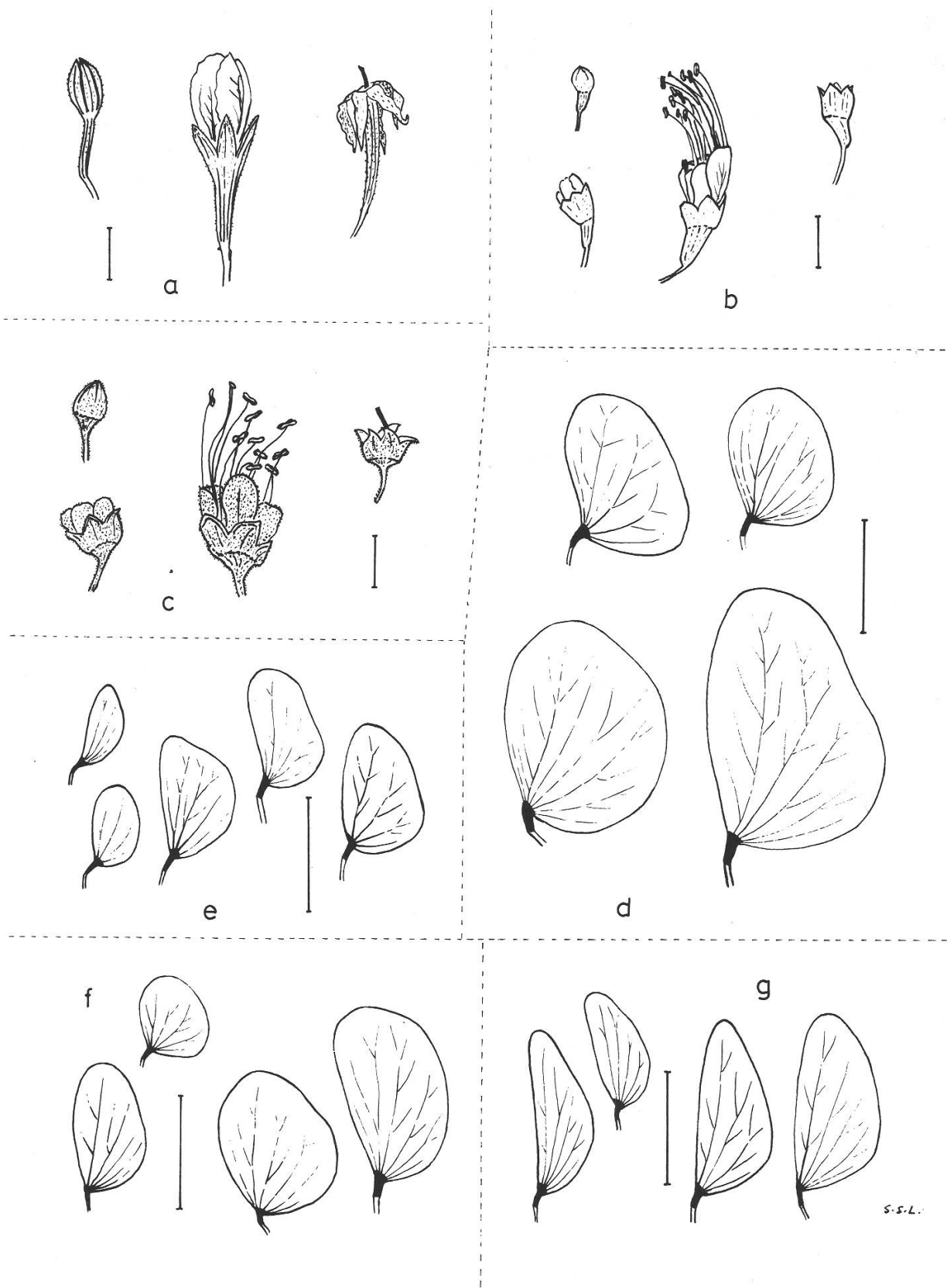
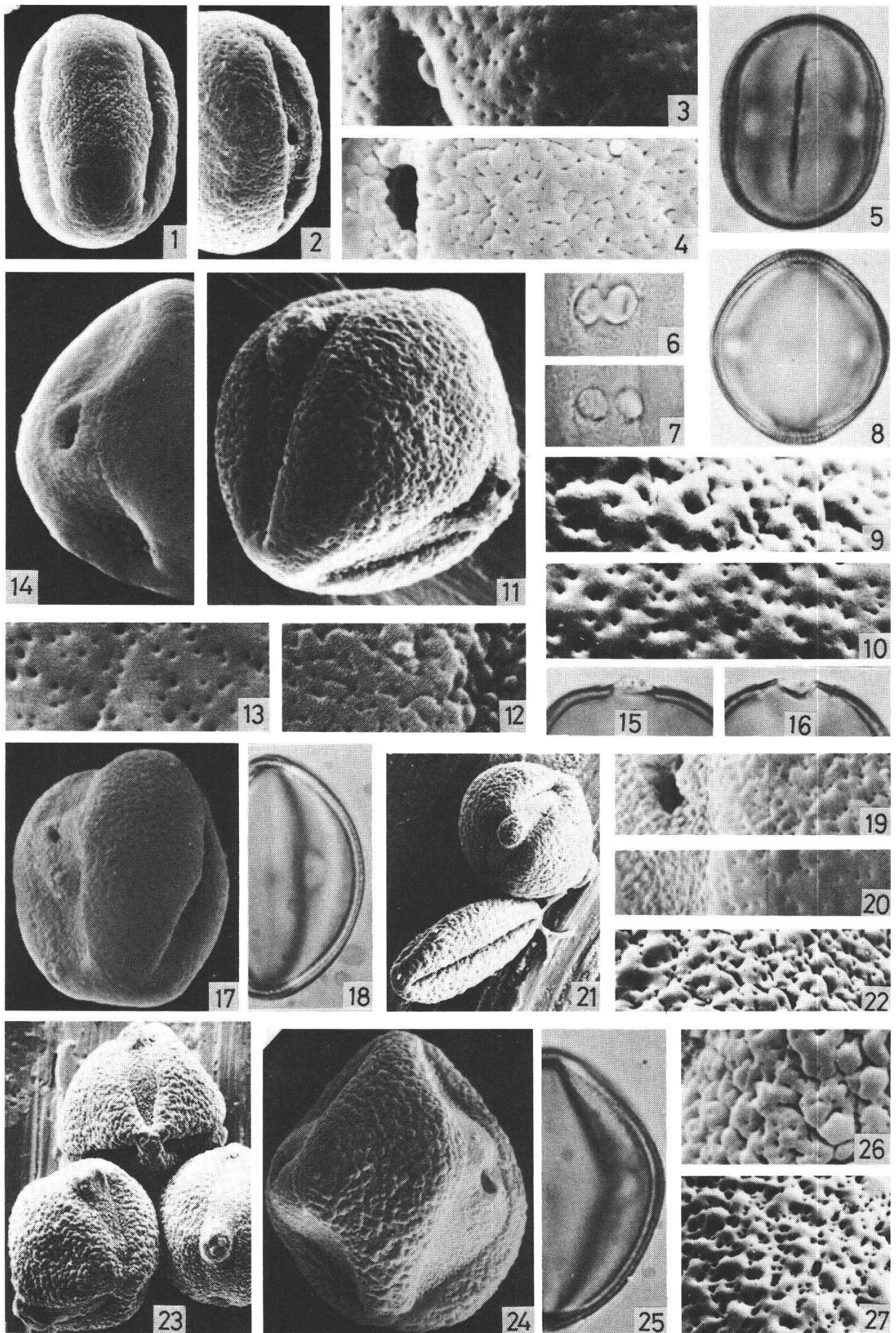


Fig. a & d: *Bauhinia hookeri*; Fig. b & e: *B. carronii*; Fig. c & f: *B. cunninghamii* subsp. *cunninghamii*; Fig. g: *B. cunninghamii* subsp. *gilva*. - The scale in Fig. a-c is 1 cm, in Fig. d-g 2 cm.



this study it should read P 34–54 μm and E 28–47 μm , prolate-spheroidal to subprolate rarely prolate, subcircular to oval rarely apiculate or rhomboidal in meridional limb. The thickness of the exine vary from 1.5–3.0 (–4.0) μm at mesocolpia, *B. binata*, *B. carronii* and *B. hookeri* have exine slightly thicker towards the ora while in *B. cunninghamii* exine are thinner towards the ora except *B. cunninghamii* subsp. *gilva* in which the exine is \pm thicker towards the ora. Tectum vary from perforate, perforate-rugulose to rugulose, sometimes irregularly wrinkles with fine pits and creeks in the depressions. In one collection of *B. hookeri* (Longman s.n.) some pollen grains have 2 ora per colpus and some show irregular form suggesting the 2 ora (fig. 6 & 7). Vishnu-Mittre & Sharma (1962) and Schmitz (1963) studied *B. hookeri* and published LM-photos.

Future studies of this pollentype with TEM of the pollenwalls may show that the group is not uniform as indicated by the grossmorphology.

3. *Malabarica* type (Larsen 1975)

B. malabarica has not been studied from Australia, where it seem to be a rare species, but was studied previously from several parts of S.E. Asia.

Specimens examined

The specimens have been studied both in light microscope and by SEM. The abbreviations for the herbaria follow Index Herbariorum.

B. binata Blanco-Byrnes 2372 (K); Holtze 1336 (MEL); Karsten s.n. (MEL).

B. carronii F. Muell. – Johnson 1323 (K); Small s.n. (K); Pedley 2789 (BRIS); Roe s.n. (CANB); White 12342 (BRIS).

B. cunninghamii (Benth.) Benth. subsp. *cunninghamii* – Founx s.n. (AD); Gittins 1355 (AAU); Helms s.n. (K); Perry 2977 (K); Speck 4981 (CANB).

B. cunninghamii aff. subsp. *cunninghamii* – Bick 106 (K); Chippendale 254 (NSW).

B. cunninghamii subsp. *gilva* (Baily) K. & S. S. Larsen – Basedaw 4 (K); Clemens s.n. (K).

B. hookeri F. Muell. – Gittins 1097 (AAU); Henelly 226 (CANB); Johnson 2807 (K); Longman s.n. (K); Smith 3474 (BRIS); Speck 1890 (K).

B. syringifolia (F. Muell.) Wunderlin – Longman s.n. (K); White 12479 (K).

Fig. 1–5. *Bauhinia syringifolia* (White 12479). 1, 2: equatorial view $\times 2000$; 3, 4: tectum near aperture towards pole and at mesocolpium $\times 6600$; 5: optical section, equatorial view $\times 1500$. – Fig. 6–13. *B. hookeri* (6–10 Longman s.n., 11–13 Speck 1890). 6, 7: ora in equatorial view $\times 1000$; 8: optical section, equatorial view $\times 650$; 9, 10: tectum at mesocolpia and towards the pole $\times 6500$; 11: oblique equatorial view $\times 1300$; 12, 13: tectum near aperture at mesocolpia and towards the pole $\times 10,000$. – Fig. 14. *B. binata* (Karsten s.n.) aperture in equatorial view. – Fig. 17–22. *B. carronii* (17–20 Johnson 1323, 21–22 White 12342). 17: oblique equatorial view $\times 1300$; 18: optical section, equatorial view $\times 1000$; 19, 20: tectum near aperture at mesocolpia and towards the pole $\times 4000$; 21: equatorial view, normal and collapsed grain $\times 700$; 22: tectum at mesocolpia $\times 3500$. – Fig. 15–16 & 23–27. *B. cunninghamii* (15 & 25 Basedow 4, 16 Perry 2977, 23 Speck 4981, 24 Gittins 1355, 26 Clemens s.n., 27 Chippendale 254). 15, 16: Ora in optical cross section $\times 1000$; 23: $\times 700$; 24: equatorial view $\times 1100$; 25: optical section, equatorial view $\times 1000$; 26: tectum near aperture at mesocolpia $\times 6500$; 27: tectum at mesocolpia $\times 5400$. – All SEMG's are from acetolysed pollen grains except Fig. 11, 21 and 23.

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