

# JOURNAL of the ADELAIDE BOTANIC GARDENS

AN OPEN ACCESS JOURNAL FOR AUSTRALIAN SYSTEMATIC BOTANY

[flora.sa.gov.au/jabg](http://flora.sa.gov.au/jabg)

Published by the

**STATE HERBARIUM OF SOUTH AUSTRALIA**

on behalf of the

**BOARD OF THE BOTANIC GARDENS AND STATE HERBARIUM**

© Board of the Botanic Gardens and State Herbarium,  
Adelaide, South Australia

© Department of Environment, Water and Natural Resources,  
Government of South Australia

All rights reserved

State Herbarium of South Australia  
PO Box 2732  
Kent Town SA 5071  
Australia



Board of the  
Botanic Gardens and  
State Herbarium



## A TAXONOMIC REVISION OF THE GENUS *Gmelina* L. (VERBENACEAE)\* IN AUSTRALIA

Ahmad Abid Munir

State Herbarium, Botanic Gardens, North Terrace,  
Adelaide, South Australia, 5000.

### Abstract

A taxonomic revision of *Gmelina* in Australia is presented. The following five species are recognised: *G. elliptica*, *G. leichhardtii*, *G. fasciculiflora*, *G. schlechteri* and *G. dalrympleana*. *G. schlechteri* and *G. elliptica* are recorded from Australia for the first time. *G. leichhardtii*, *G. fasciculiflora*, *G. schlechteri* and *G. dalrympleana* are typified. *G. vitiensis* and *Vitex vitiensis* are regarded as new synonyms of *G. dalrympleana*. A range of specimens have been examined from Malesia.

The affinities and distribution are considered for the genus and each species. A key to the species is provided and a detailed description of each species is supplemented by a habit sketch of a flowering branch and analytical drawings of the flower.

### Taxonomic History of the Genus

The genus *Gmelina* was described by Linnaeus (1753) with one species, *G. asiatica*, the type of which came from India. It was placed in "Didynamia Angiospermia" without reference to any family, where it was retained by Burman (1768), Murray (1774), Reichard (1778), Loureiro (1793), Schreber (1791), Gmelin (1791), Persoon (1797, 1807), Roxburgh (1832), Willdenow (1800), Poirét (1823), Sprengel (1825), Blanco (1837), Dietrich (1843) and a few others. Adanson (1763) placed it in "Verbeneae", Scopoli (1777) in "Personatar", Gaertner (1788) in "Centuria Quarta", Jussieu (1789) in "Vitices", Necker (1790) in his "Chasmatophytorum", Ventenat (1799) in "Pyrenaceae", and Reichenbach (1828) under the tribe "Verbeneae" in the Labiatae. In 1806, de Jussieu referred it to the family Verbenaceae where it has been retained by most, if not all, botanists.

Dumortier (1829) divided the Verbenaceae into two tribes: Verbeneae and Viticeae, with *Gmelina* in the tribe Viticeae. This tribe was accepted for the genus by Bartling (1830), Spach (1840), Schauer (1847), Walpers (1852), Miquel (1858), Bentham (1870), Bentham & Hooker (1876), Bailey (1883, 1901, 1913), Clarke (1885), Durand (1888), King & Gamble (1909), Fletcher (1938) and Lemée (1943). The above-named tribes were called "sections" by Bartling (1830) and Spach (1840). In 1836, Endlicher divided the family Verbenaceae into three tribes: Lippieae, Lantaneae and Aegiphileae, with *Gmelina* in the tribe Lantaneae. This tribe was accepted for the genus by Meisner (1840), Endlicher (1841), Brongniart (1843), Dietrich (1843) and Walpers (1845).

In 1895, Briquet reclassified the Verbenaceae and upgraded the tribe Viticeae to a subfamily Viticoideae. The latter consisted of four tribes: Callicarpeae, Tectoneae, Viticeae and Clerodendreae, with *Gmelina* in the tribe Viticeae. This classification was accepted by Dalla Torre & Harms (1904), H.J. Lam (1919), Junell (1934) and Moldenke (1959, 1971). In the same treatment, Briquet (1895) subdivided the genus into two sections: Microstromatae and Bracteosae, each characterised chiefly by the size, colour and venation of their floral bracts. He referred all Australian species to the section Microstromatae. These infrageneric sections were adopted by Dalla Torre & Harms (1904) and Moldenke (1959, 1971). The majority of botanists, however, have not divided the genus into sections, but have retained it in the Verbenaceae without reference to any subfamily or a tribe.

---

\*The present treatment of the genus *Gmelina* is the third in the series of taxonomic revision in the family Verbenaceae in Australia (See Munir, 1982, 1984).

### Australian History of the Genus

The first Australian collection of *Gmelina* was made by Banks & Solander during 1770 from northern Queensland. It was described by Robert Brown (1810) as *Vitex macrophylla*. In 1847, Schauer recorded this species under "species non satis notae" without elaborating on its short original description or citing any plant collection from Australia. It was later recorded by Seemann (1865) and F. Mueller (1868). In 1862, Mueller described one of Dr Ludwig Leichhardt's collections from New South Wales as *Vitex Leichhardtii*. About two years later, F. Mueller (1864) described J. Dallachy's collection(s) from Rockingham Bay, Queensland, as *Vitex dalrympleana*. Benthams (1870) published a detailed account of the Australian Verbenaceae, and listed three *Gmelina* species: *G. macrophylla* (R. Br.) Benth., *G. leichhardtii* (F. Muell.) Benth. and *G. fasciculiflora* Benth. Of these, *G. fasciculiflora* Benth. was described as a new species. Subsequently, the occurrence of these species in Australia was recorded by F. Mueller (1882, 1889), Bailey (1883, 1901, 1913), and Francis (1951). Of these, *G. macrophylla* (R. Br.) Benth. was later found by H.J. Lam (1919) to be an illegitimate name, and was, therefore, replaced by *G. dalrympleana* (F. Muell.) H.J. Lam. All these species were later recorded for Australia by Moldenke (1959, 1971, 1980).

In the present publication, Briquet's (1895) classification of the Verbenaceae is accepted for the genus, and all Australian species are retained in the subgeneric section *Microstromatae*. *G. dalrympleana* var. *schlechteri* (H.J. Lam) Moldenke is reinstated as a species, *G. schlechteri* H.J. Lam. *Vitex vitiensis* Seemann is regarded as a new synonym of *G. dalrympleana* (F. Muell.) H.J. Lam. In all, five species are recognised from Australia of which *G. schlechteri* and *G. elliptica* are newly recorded.

### GMELINA L.

*Gmelina* L. [Gen. Pl. edn 2 (1742) 526; Fl. Zeyl. (1747) 103], Sp. Pl. 2 (1753) 625; Gen. Pl. edn 5 (1754) 274; Burman f., Fl. Ind. (1768) 132; Gaertner, Fruct. Sem. Pl. 1 (1788) 268, t. 56, f. 5; A.L. Juss., Gen. Pl. 2 (1789) 108; Lour., Fl. Cochinch. 2 (1790) 376; Necker, El. Bot. 1 (1790) 356; Schreb., Gen. Pl. 2 (1791) 412; Roxb., Pl. Corom. 2 (1798) 32, t. 162; Willd., Sp. Pl. 3 (1800) 313; A. St. Hil., Expos. Fam. 1 (1805) 248; A.L. Juss., Ann. Mus. 7 (1806) 75; Sprengel, Syst. Veg. 2 (1825) 765; Blume, Bijdr. Fl. Ned. Ind. (1826) 814; Reichb., Consp. Reg. Veg. (1828) 117; Dumort., Anal. Fam. Pl. (1829) 22; Sprengel, Gen. Pl. 2 (1831) 481; Roxb., Fl. Ind. 3 (1832) 82; Endl., Gen. Pl. 2 (1836) 636, no. 3704; Blanco, Fl. Filip. edn 1 (1837) 492; Meisner, Pl. Vasc. Gen. 1, Tab. Diagn. (1840) 291; Pl. Vasc. Gen. 2, Comment. (1840) 200; Spach, Hist. Natur. Veg. Phan. 9 (1840) 232; Endl., Ench. Bot. (1841) 312; D. Dietr., Syn. Pl. 3 (1843) 372, 613; Walp., Rep. Bot. Syst. 4 (1845) 97; Schau. in DC., Prod. 11 (1847) 678; Walp., Ann. Bot. Syst. 3 (1852) 239; Miq., Fl. Ind. Bat. 2 (1858) 865; Benth., Fl. Aust. 5 (1870) 64; L. Pfeiffer, Nomen. Bot. 1, part 2 (1874) 1468; Benth. & Hook. f., Gen. Pl. 2 (1876) 1153; F. Muell., Syst. Cens. Aust. Pl. 1 (1882) 103; F.M. Bail., Synop. Qld Fl. (1883) 378; C.B. Clarke in Hook. f., Fl. Br. Ind. 4 (1885) 581; T. Durand, Gen. Phan. (1888) 321; F. Muell., Sec. Syst. Cens. Aust. Pl. 1 (1889) 173; Briq. in Engl. & Prantl, Pflanzenfam. 4, 3a (1895) 173; F.M. Bail., Qld Fl. 4 (1901) 1177; Dalla Torre & Harms, Gen. Siphon. (1904) 433, no. 7188; H.J. Lam, Verbenac. Malay. Arch. (1919) 214; Bartling, Ord. Natur. Pl. (1830) 180; Junell, Symb. Bot. Ups. 4 (1934) 92; Lemée, Dict. Descrip. Syn. Gen. Pl. Phan. 8b (1943) 656; Mold., Résumé Verbenac. etc. (1959) 276, 297, 298, 318, 320, 395, 397; Backer & Bakh. f., Fl. Java 2 (1965) 606; Mold., Fifth Summary Verbenac. etc. 1 & 2 (1971) 472, 523, 524, 526, 569, 572, 739, 742; Farr & al., Index Nom. Gen. Pl. 2 (1979) 730; Mold., Sixth Summary Verbenac. etc. (1980) 375, 394, 405, 408, 409, 412, 423, 445.

Type: *G. asiatica* L., Sp. Pl. 2 (1753) 626.

Trees or tall shrubs. *Stem* and branches almost cylindrical, glabrous or pubescent with simple hairs. *Leaves* simple, decussate, exstipulate, reticulate-veined, unicostate, petiolate. *Inflorescence* cymose, compound and much branched, terminal, pedunculate. *Flowers* complete, zygomorphic, bisexual, hypogynous; bracts small, narrow. *Calyx* of 4 or 5 fused sepals, persistent, tubular or somewhat campanulate, truncate or 4-5-toothed or sinuate-lobed, scarcely accrescent, generally with large (? nectariferous) glands. *Corolla* of (4-) 5 fused petals, deciduous, tubular below, more or less 2-lipped above, upper lip 2-lobed, lower lip 3-lobed with midlobe largest; tube narrow at base, much dilated upwards, infundibuliform with wide throat. *Stamens* 4, slightly exserted above the corolla-tube or almost included, didynamous, alternate with the corolla-lobes, epipetalous, inserted in the lower part of the corolla-tube; filaments flat, filiform, often sparsely glanduliferous; anthers dorsifixed, oblong or elliptic, 2-lobed, lobes longitudinally dehiscent. *Ovary* bicarpellary, syncarpous, 4-locular, with one ovule in each cell attached to an axile placenta at or above the middle; style filiform, slightly exserted, with two unequal stigmatic lobes. *Fruit* a succulent drupe, with hard endocarp, 4-celled or rarely 2-celled. *Seeds* solitary in each cell, exalbuminous.

Number of species: World ± 33; Australia 5.

*Derivation of name*

Named after Johann George Gmelin, 1709-1755, German botanist of Tübingen.

*Distribution (Map 1)*

The genus *Gmelina* is distributed in the tropical and subtropical regions of Australia, Asia and Africa. In temperate regions it is known from Nepal and Southern China. The main distribution, however, extends from India to Indochina and eastwards throughout Malesia and tropical Australia.

Of the five Australian species, two are endemic in Australia and the other three are dispersed in Malesia. Of these, *G. leichhardtii*, is cultivated in Australia and the Hawaiian Islands, and *G. elliptica* in several countries of Asia, Europe, Africa and America.

*Affinities*

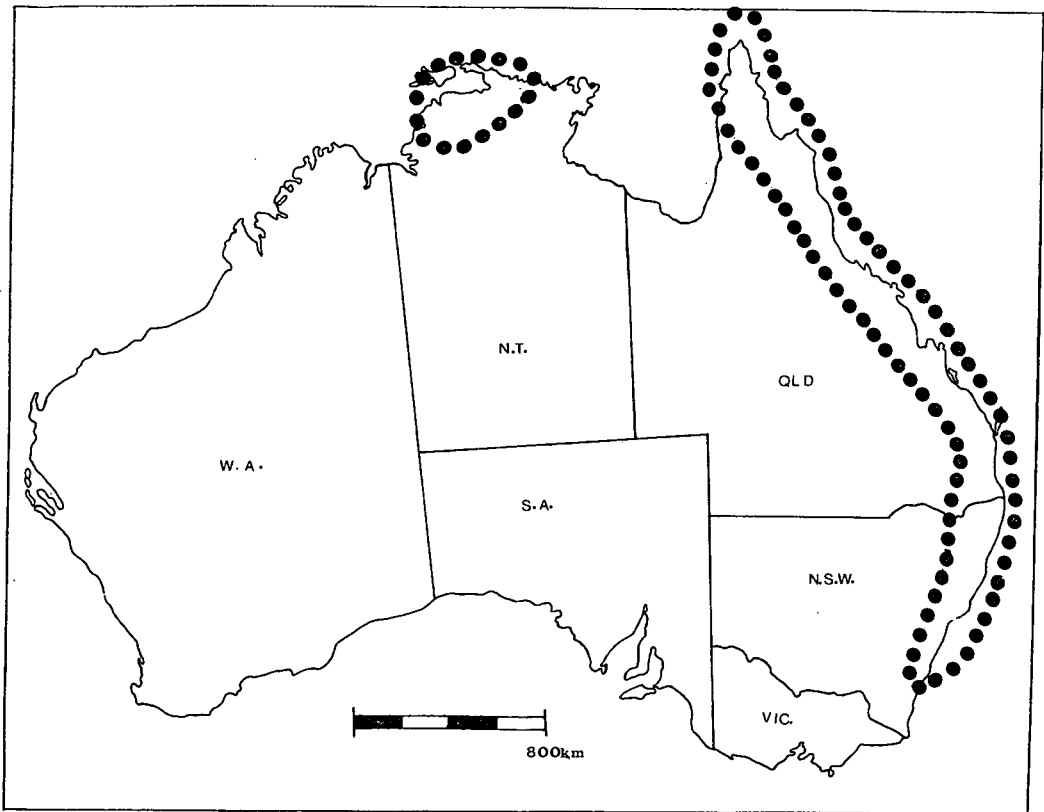
*Gmelina* is closely related to *Premna* in its inflorescence being terminal; corolla 2-lipped, fertile stamens 4, didynamous; fruit a drupe with 4-celled pyrenes. Nevertheless, it can easily be distinguished by its corolla-tube being large, mostly infundibuliform, greatly enlarged above; style unequally 2-lobed at the apex. *Gmelina* is also closely allied to *Vitex* in having a 2-lipped corolla with a short cylindrical tube, didynamous stamens and drupaceous fruit. The latter, however, can readily be distinguished by its leaves being mostly digitately compound with 3-7 leaflets, rarely 2 or 1, and stigma equally lobed.

**Key to the Species**

- 1a. Lamina glabrous; corolla blue, mauve or purple-pink ..... 3
- 1b. Lamina tomentose below; corolla creamy-white or yellow ..... 2
- 2a. Scrambling spinescent shrub; lamina with 3 to 4 pairs of nerves, entire or 3-lobed; inflorescence racemiform, 2.5-5 (-7) cm long; corolla yellow with long slender tube, glabrous inside; ovary glabrous; fruit obovoid, yellow ..... 1. *G. elliptica*
- 2b. Tall tree; lamina with more than 4 pairs of veins, entire; inflorescence of loose pedunculate cymes, ± pyramidal in outline, 10-25 cm long; corolla creamy-white with short broad tube, villous inside at the base of stamens; ovary sparsely pubescent; fruit globular, bluish-purple ..... 2. *G. leichhardtii*

Key to species (*continued*)

- 3a. Lamina and calyx without nectariferous glands; cymes forming sessile clusters along the rhachis; corolla-tube villous inside at the base of stamens; ovary villous at the top; fruit globular ..... 3. *G. fasciculiflora*
- 3b. Lamina-base and anterior side of calyx with nectariferous glands; cymes pedunculate, lax; corolla-tube glabrous inside; ovary glabrous; fruit obovoid ..... 4
- 4a. Calyx pubescent outside; ovary often with minute glands at the top ..... 4. *G. schlechteri*
- 4b. Calyx glabrous; ovary without glands at the top ..... 5. *G. dalrympleana*



Map 1. Distribution of the genus *Gmelina* L. in Australia.

1. *Gmelina elliptica* J.E. Smith in Rees, *Cycop.* 16 (1810) no. 2; Merr., *Enum. Philip. Fl. Pl.* 3 (1923) 399; Meeuse, *Blumea* 5 (1942) 73; Mold., *Résumé Verbenac. etc.* (1959) 55, 142, 157, 163, 166, 176, 178, 180, 184, 186-193, 195-197, 199, 218, 296, 297, 341; Fifth Summary *Verbenac. etc.* 1 & 2 (1971) 100, 230, 264, 276, 283, 296, 301, 305, 317, 320, 325, 330, 332, 334, 363, 523, 524, 615; *Phyt. Mem.* 2 (1980) 93, 220, 253, 263, 273, 275, 286, 289, 293, 296, 298, 307, 311, 315, 320, 322, 324, 354, 408, 627.

*Type:* East Indies, undated (LINN, holotype. Microfiche!).

[*Radix deiparae spuria* Rumph. *Herb. Amb.* 2 (1741) 124, t. 39.]

*Type:* n.v., only the above cited tab. 39 seen on microfiche.

*G. villosa* Roxb., *Hort. Beng.* (1814) 46, *nom. nud.*; *Fl. Ind.* edn 2, 3 (1832) 86; Walp., *Rep. Bot. Syst.* 4 (1845) 98; Schau. in DC., *Prod.* 11 (1847) 679; Miq., *Fl. Ind. Bat.* 2 (1858) 867; *Suppl.* 1 (1861) 242; F.-Vill., *Novis App.* (1880) 159; C.B. Clarke in Hook. f., *Fl. Br. Ind.* 4 (1885) 582; Vidal, *Rev. Pl. Vasc. Filip.* (1886) 210; Kuntze, *Rev. Gen. Pl.* (1891) 507; Koord. & Val., *Bijdr. Boom. Java* 7 (1900) 197; Merr., *Philip. Bureau Forest. Bull.* 1 (1903) 51; *Dict. Pl. Names Philip. Isl.* (1903) 153; Rev. Sp. Blanc. *Fl. Filip.* (1905) 68; King & Gamble, *J. As. Soc. Beng.* 74 (1908) 824; Merr., *Interp. Rumph. Herb. Amb.* (1917) 454; H.J. Lam, *Verbenac. Malay. Arch.* (1919) 217; Jack, *Descrip. Malay. Pl. No. 1* (1820) 17; Ridley, *Fl. Malay. Pen.* 2 (1923) 623; Hook., *Bot. Misc.* 1 (1830) 284; *Dop. Fl. Gen. Indochin.* 4 (1935) 846; Fletcher, *Kew Bull.* (1938) 423.

*Type: Roxburgh s.n.*, cultivated in Botanic Garden at Calcutta, undated, (possibly in K, n.v.). The plant is said to be a native of Pulo Pinang, from where it was introduced by Dr W. Hunter into the Botanic Gardens at Calcutta in 1802.

*G. asiatica* sensu Wall. *Cat.* (1828) No. 1818, p.p.; sensu Kurz, *For. Fl. Br. Burma* 2 (1877) 265, non Linn.; sensu Blanco, *Fl. Filip. edn 1* (1837) 492, non Linn.; ed 2 (1845) 344.

*G. asiatica* L. var. *villosa* (Roxb.) Bakh. in van Leeuwen et al., *Bull. Jard. Bot. Buitenz. Ser. III*, 3 (1921) 70; Bakh. & H.J. Lam in van Leeuwen et al., *Bull. Jard. Bot. Buitenz. Ser. III*, 4 (1922) 285; Heyne, *Nutt. Pl. Ned. Ind. edn 2* (1927) 1320.

*Type:* as for *G. villosa* Roxb., *Fl. Ind.* 2 (1832) 86.

### *Description* (Fig. 1)

A scrambling spinescent shrub or small tree, (1.5-) 2.5-5 (-8) m high. *Stem* with olive-coloured bark; branchlets spreading and drooping, spinescent, fulvous-villous; spines axillary, straight, 0.5-2 cm long. *Leaves* elliptic, ovate or somewhat trapeziform, blunt or slightly pointed at apex, cuneate towards the base, entire or sometimes acutely 3-lobed, chartaceous, (3-) 5-9.5 cm long, (2-) 3-5 (-6) cm broad, the upper surface pubescent when young, glabrous and dark-coloured when old, the lower surface fulvous-tomentose, pairs of veins 3 to 4; petiole slender, fulvous-pubescent, channelled above, (1-) 1.5-3 (-4) cm long. *Inflorescence* racemiform, 2.5-5 (-7) cm long, fulvous-tomentose. *Flowers* very shortly pedicellate, golden-yellow; pedicels 1.5-2.5 mm long, fulvous-tomentose; bracts  $\pm$  leafy, caducous, lanceolate or ovate-lanceolate, acuminate or cuspidate, 1-2 cm long, 4-8 mm broad. *Calyx* campanulate, with 4 small teeth on top, 3-4 (-5) mm long, 3-4 mm in diameter, persistent, slightly expanded under the fruit, with 3-6 nectariferous glands on the anterior side, densely pubescent outside, glabrous within. *Corolla* yellow, membranous, 4-lobed, softly pubescent outside, glabrous inside, (3-) 3.5-4.5 cm long; upper lip entire, 6-7 mm long, 8-12 mm broad at the base; lower lip 3-lobed, the middle lobe (i.e. the lowest lobe) largest, broadly ovate-oblong, 1-1.7 cm long, 9-12 mm broad, the lateral lobes  $\pm$  rounded in outline, 5-10 mm long, 8-12 mm broad at the base; tube very slender below for up to half its length, then abruptly and obliquely dilating upwards, several times longer than the calyx, 2-2.5 (-2.8) cm long, 1-1.5 cm broad at top, 2-2.5 mm in diameter in the lower slender portion. *Stamens* almost included, inserted about the middle of the corolla-tube near the top of slender portion; filaments filiform, with glandular hairs, the anterior pair longer, 1.6-2 cm long, the lateral pair 8-10 mm long; anthers oblong, lobes free and divergent in the lower halves, 1.5-2.5 mm long, 1-2 mm broad, the longest pair with their

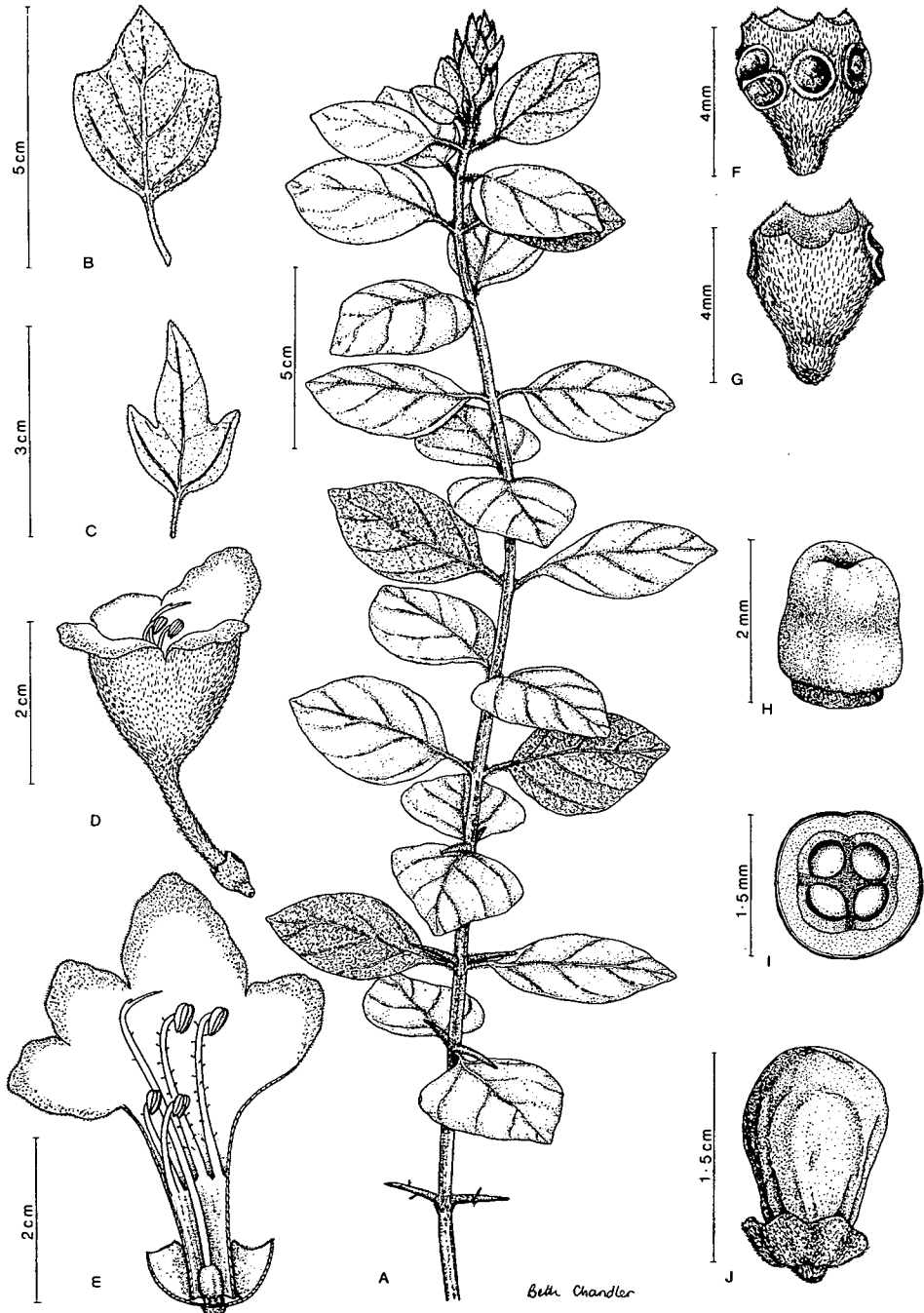


Fig. 1. *Gmelina elliptica* J.E. Smith (A & D-I, *S.E. Duenas s.n.*: PNH 23099; B, C & J, *S.L. Everist s.n.*: BRI 141090). A, habit drawing of a branch; B & C, lobed leaves; D, flower; E, flower vertically cut open to show androecium and gynoecium; F, calyx showing nectariferous glands on the anterior face; G, calyx showing nectary free posterior face; H, ovary; I, transverse section of ovary; J, fruit with persistent calyx.

connectives much enlarged on the back. *Ovary* obovoid-globose, glabrous, 1.5-2.5 mm long, 1-2 mm in diameter; style slightly exerted, filiform, glabrous or with sparsely glandular hairs, 2.5-3.7 cm long, stigma unequally 2-lobed. *Fruit* globose-obovoid, (1-) 1.5-2 cm long, 0.8-1.3 cm in diameter, glabrous, fleshy, yellow when ripe.

### *Specimens examined*

AUSTRALIA: QUEENSLAND: *Everist s.n.*, Splitter Creek, Yeppoon-Rockhampton road, 19 km from Rockhampton, 5.vi.1972 (BRI 141090); *Lands Department s.n.*, Yeppoon, 23° 08'S, 150° 45'E, iv.1971 (BRI 118988).

INDONESIA: *Asdat 191*, Sumatra, Atjeh, Koeala Kepong, O. van Troemon, 2.ix.1941 (BO, BRI, SING); *Henderson 20147*, Anambas Island, 31.iii.1928 (BRI, SING); *Kornassi 1079*, Ambon, Moluccas, 2.iv.1918 (BO, BRI); *Meijer 10184*, Celebes, Central part, Kulora near Palu, 18.v.1975 (BO, L, MO, US); *Posthumus (2) 266*, Celebes, Donggala, 3.xi.1930 (BO); *Rahmat 1120*, Sumatra, East Coast, Hessa Asahan, 27.viii.1928 (MICH, SING); *Rahmat 3603*, Sumatra, Langgapajoeng, 7-30.iii.1933 (MICH, QRS); *Rahmat 3962*, Sumatra, Kajoe Garijang, Kota Pinang, 15 April-16 May, 1933 (MICH, QRS); *van Steenis 9315*, Sumatra, Atjeh, Gajolanden, 26.ii.1937 (BO, BRI, SING).

MALAYA: *Burkill & Shah HMB 290*, Pangkor Island, Parak, 10.vii.1955 (BRI, SING); *Corner s.n.*, Kemamau, Tringganu, 29.vii.1932 (SING); *Ridley s.n.*, Selandor, Malacca, 7.vi.1890 (SING); *Ridley s.n.*, Kuala Pahang, Pahang, May 1890 (SING).

SINGAPORE: *Choa Chuking s.n.*, 1896 (SING); *Leg ? s.n.*, Botanic Garden, 10.ix.1889 (MEL, SING).

BORNEO: *Henderson SF 38965*, Kalawat, N. Borneo, 8.iv.1950 (SING).

PHILIPPINES: *Edano 8871*, Cabucan Island, Sulu Prov., 16.ii.1957 (PNH); *Santos E. Duenas s.n.*, Bo. Matuya-tuya, Torrijos Marinduque Island, 3.vii.1955 (PNH 23099); *Fenix s.n.*, Tanculan, Bukidnon sub. Province, Mindanao, vii.1916 (BRI, PNH 26124); *Frake 232*, Mampay, Zamboanga del Norte Mindanao, 4.x.1957 (PNH); *Kellman ANU 1595*, Coronon Valley near Santa Cruz, Davao Prov., Mindanao, iii.1964 (CANB); *Pascua s.n.*, Basilan and Zamboanga, Mindanao, ii.1926 (BRI, PNH 30231); *Piper 128*, Oroquieta Prov. Mindanao, iv.1911 (BRI, PNH); *Robinson s.n.*, Bulalacao Mindoro, 14-24.iii.1909 (BRI, PNH 6692, MEL 583541); *Salaudin s.n.*, Basilan, Basilan, xii.1930 (PNH 31384, SING); *Sulit s.n.*, Bo. Manual, Mansalay, Mindoro, xii.1952 (PNH 17009); *Taleon s.n.*, Bagacay, Pototan, Iloilo Prov., 19.viii.1953 (PNH 22267).

### *Distribution (Map 2)*

In Australia, *G. elliptica* is known only from Queensland, where it occurs in the coastal area around Rockhampton and Yeppoon. Collections from overseas have been examined from all over Malesia excepting New Guinea. H.J. Lam (1919) gave its distribution as being from Nicobar, Burma, Siam, Malay Peninsula and Archipelago, Philippines, Palau Islands and Indonesia. In addition to the above localities, Moldenke (1971, 1980) recorded it from Jamaica, Belgian Congo, Mauritius, India, Indochina, Caroline Island and Riouw Archipelago. It is likely that the records of this species from Jamaica, Congo and Mauritius may have resulted from cultivated plants.

### *Comments*

The first and the only Australian record of *G. elliptica* is made here from near Rockhampton in Queensland. So far, it has not been recorded from any part of New Guinea, therefore, its occurrence in Australia may possibly be an escape from cultivation. However, according to a collector's note with one of a Lands Department Collection in Herb. BRI (No. BRI 118988), this species is so well established in one part of the State that "it has become a problem on property near Yeppoon". It is the only Australian *Gmelina* with scrambling habit, spinescent branchlets, small elliptic leaves, golden-yellow corolla and yellow fruit. The spine-like axillary thorns are in fact the abortive branchlets, some of them with rudimentary buds or leaves. The corolla seems to be the longest of all Australian species, with a long slender tube abruptly dilating above the middle.

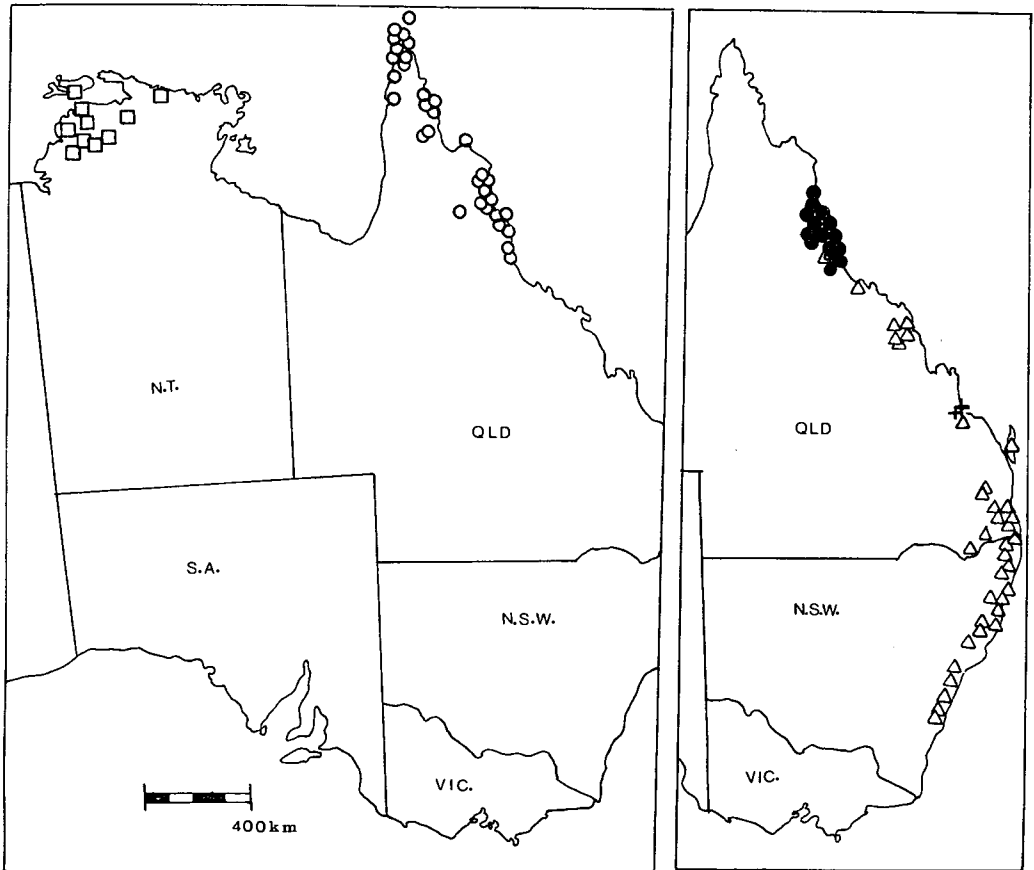
Of the many specimens examined from overseas, and two from Australia, no collection has noted the precise period of flowering and fruiting for the species. There is also no such



mention in the recent literature. According to Roxburgh (1832), however, the trees of this species, cultivated in the Botanic Gardens at Calcutta, are in flower and fruit all the year round.

Moldenke (1971, 1980) states that this species is cultivated in Java, India, England, Belgium, Congo, Mozambique, Zaire, Zanzibar, Brazil, Porto Rico, Florida, Hawaiian Islands and Tahiti.

The plant is said to have various medicinal use by the natives in Malaya and Indonesia.



Map 2. Distribution of *G. elliptica* +; *G. leichhardtii* Δ; *G. fasciculiflora* ●; *G. schlechteri* □; *G. dalrympleana* ○ in Australia.

*Affinities*

*G. elliptica* is nearest to *G. leichhardtii* in its lamina being tomentose below; calyx pubescent outside; filaments with sparse glandular hairs; fruit glabrous. However, *G. elliptica* can easily be distinguished by its scrambling shrubby habit, spinescent branchlets, both entire and 3-lobed leaves each with 3-4 pairs of main nerves, racemiferous inflorescence, nectariferous calyx, 4-lobed yellow corolla, long and slender corolla-tube which is several times longer than calyx and glabrous inside, more distinctly didynamous stamens, glabrous ovary and yellow obovoid fruit. There are several characters common between *G. elliptica* and *G. schlechteri*. In both species, calyces are with nectariferous glands; calyx and corolla pubescent outside, glabrous within; filaments with glandular hairs; ovary glabrous and fruit obovoid. The latter, however, may readily be identified by its habit being a tall tree; leaves large with lamina (10-) 15-25 (-36) cm long, glabrous all over, with nectariferous gland at the base and pairs of main nerves more than 4; inflorescence large, lax,  $\pm$  pyramidal, 15-25 (-30) cm long; calyx-tube truncate; corolla mauve or pale-lilac, distinctly 5-lobed, 1.5-2.5 cm long, tube short and broad; fruit reddish-purple or purple-pink.

2. *Gmelina leichhardtii* (F. Muell.) Benth., Fl. Aust. 5 (1870) 66; Hill, Coll. Qld Timber (1880) 16; F. Muell., Syst. Cens. Aust. Pl. 1 (1882) 103; F.M. Bail., Synop. Qld Fl. (1883) 379; Moore, Cens. Pl. N.S.W. (1884) 52; Nilson, Timb. Trees N.S.W. (1884) 84; Keys, Proc. Roy. Soc. Qld 2 (1885) 48; F.M. Bail., Qld Woods (1888) 91; F. Muell., Sec. Syst. Cens. Aust. Pl. 1 (1889) 173; F.M. Bail., Cat. Indig. & Natur. Pl. Qld (1890) 35; Briq. in Engl. & Prantl. Pflanzenfam. 4, 3a (1895) 173 in obs.; F.M. Bail., Qld Fl. 4 (1901) 1178; Maiden & Betche, Proc. Linn. Soc. N.S.W. 27 (1902) 62; Maiden, For. Fl. N.S.W. 1 (1904) 185, t. 33; Dixon, Pl. N.S.W. (1906) 235; Maiden, J. & Proc. Roy. Soc. N.S.W. 42 (1908) 110; F.M. Bail., Comp. Cat. Qld Pl. (1913) 386; Maiden & Betche, Cens. N.S.W. Pl. (1916) 178; Maiden, N.S.W. For. Handb. part 2 (1917) 205, t. 33; Francis, Aust. Rain-For. Trees (1951) 367, figs. 231, 232; Forest & Timber Bureau, For. Trees Aust. (1957) 202; Mold., Résumé Verbenac. etc. (1959) 209, 297, 385; R.H. Hend., Trees N.S.W. edn 4 (1968) 254; Hall et al., For. Trees Aust. (1970) 286; Mold., Fifth Summary Verbenac. etc. (1971) 346, 363, 523, 524, 720; Maiden, Usef. Nat. Pl. Aust. rep. edn (1975) 549; Wrigley & Fagg, Aust. Nat. Pl. (1979) 335, 336; Mold., Sixth Summary Verbenac. etc. (1980) 337, 354; Bains, Aust. Pl. Gen. (1981) 167; Beadle et al., Fl. Syd. Reg. edn 3 (1982) 510.

*Type*: *L. Leichhardt s.n.*, Myall Creek, New South Wales, 20.xi.1843 (MEL 583165, lectotype designated here!). *H. Beckler s.n.*, Clarence River, New South Wales, undated (MEL 583164, syntype!).

*Vitex leichhardtii* F. Muell., Fragm. 3 (1862) 58, basionym; F. Muell., Fragm. 6 (1868) 153.

*Type*: As for *G. leichhardtii* (F. Muell.) Benth.

*Typification*

*G. leichhardtii* is based on two (syntype) collections, one by Dr Ludwig Leichhardt (s.n., MEL 583165) from Myall Creek, and another by Dr Herman Beckler (s.n., MEL 583164) from Clarence River. Both collections come from New South Wales and are apparently without any duplicate. Since the original author (F. Mueller) did not choose a type, it is, therefore, proposed to select a lectotype for this species. Annotations by F. Mueller indicate that he did examine both the syntypes in MEL. Of these, the one collected by L. Leichhardt (s.n., MEL 583165) is particularly complete and well preserved and is selected here as the lectotype.

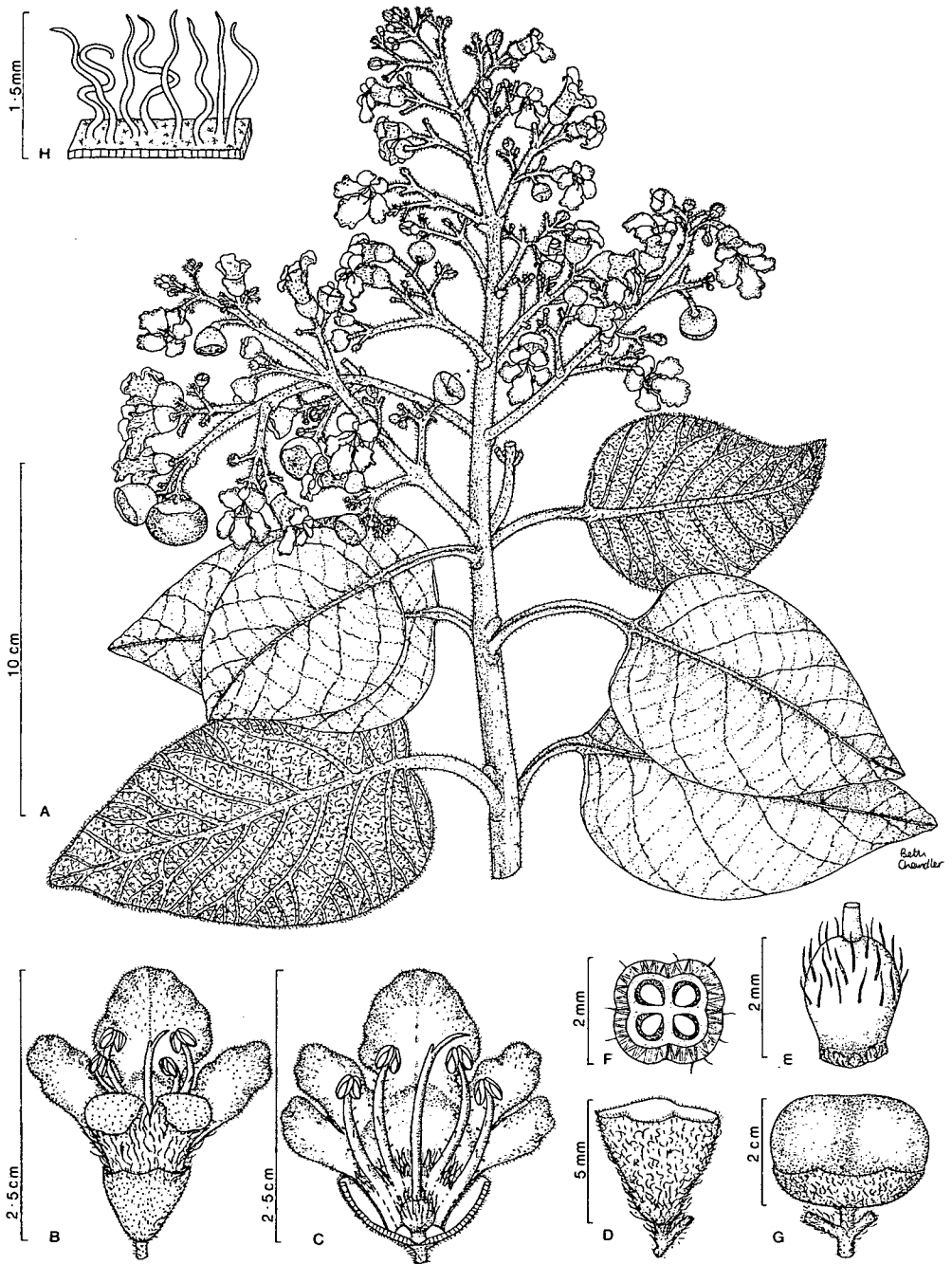


Fig. 2. *Gmelina leichhardtii* (F. Muell.) Benth. (A-H, A.A. Munir 5575 & L. Haegi: AD). A, flowering branch; B, flower; C, flower with calyx and corolla vertically cut open to show androecium and gynoecium; D, calyx; E, ovary; F, transverse section of ovary; G, fruit; H, portion of leaf showing hairs on the abaxial surface.

*Description* (Fig. 2)

A large tree attaining a height of 30 (-40) m. *Stem* up to 1.21 m diameter near the base; bark grey or dark grey, the old ones often flaky, fissured or irregularly tessellate; young branches light brown, tomentose. *Leaves*: lamina narrowly elliptic or ovate-elliptic, with rounded or somewhat cuneate base, narrowed towards the apex but not acuminate, entire, (6-) 8-15 (-23) cm long, (4-) 6-10 (-14) cm broad, somewhat coriaceous, glabrous above, densely tomentose underneath, veins very prominent and raised on the lower surface; petiole fairly thick, tomentose, (1.5-) 2-4 (-5.5) cm long. *Inflorescence* much branched, tomentose,  $\pm$  pyramidal in outline, 10-25 cm long, nearly as broad towards the base; cymes opposite, pedunculate. *Flowers* shortly pedicellate; pedicels hairy, 2-3 mm long. *Calyx* broadly turbinate-campanulate, truncate, pubescent outside, glabrous within, 4-6 mm long, 3-5 (-6.5) mm across the top, persistent, accrescent and spreading under the fruit, 1-1.8 cm diameter in fruit. *Corolla* creamy-white, the middle lobe of the lower lip bluish with yellow blotch at the base, and with two bluish streaks extending down the tube ending in a yellow blotch at the base of two anterior stamens, villous-tomentose outside, glandular-pubescent on the inner face of the lobes, glabrous inside the tube excepting the narrow villous hairy ring at the base of stamens, 2.3-2.5 cm long; the upper lip 2-lobed, lobes oblong, 7-9 mm long, 5-6 mm broad; the lower lip 3-lobed, the middle lobe ovate, 8-10 mm long, 7-10 mm broad, the lateral lobes elliptic-oblong, (5-) 7-10 mm long, 5-6 mm broad; tube very broad and abruptly dilating above the calyx, 6-8 mm long, nearly as broad at the mouth. *Stamens* exserted, inserted near the base of the corolla-tube; filaments incurved in the upper half, sparsely covered with gland-tipped hairs, the anterior pair longer, 12-13 mm long, the lateral pair 10-11 mm long; anthers  $\pm$  oblong, lobes free and divergent in the lower half, narrowing towards the free end, 1.5-2 mm long, 0.5-1 mm broad. *Ovary* globular, sparsely pubescent, becoming glabrous later, 1-2 mm in diameter; style exserted, incurved in the upper half, glabrous, 11-16 mm long, stigma unequally 2-lobed, the smaller lobe about one-tenth the length of the longer. *Fruit* nearly globular, broader than long, depressed, succulent, glabrous, bluish-purple when ripe and fresh, (1.5-) 2-2.5 cm in diameter.

*Representative specimens* (collections seen: Australian 51, non-Australian 0)

AUSTRALIA: QUEENSLAND: *Bailey s.n.*, Enoggera Creek, x.1875 (BRI 266993); *Cameron s.n.*, Yarraman, ix.1924 (BRI 266995); *Clemens s.n.*, Dalrymple Heights, Eungella, vii-xi.1947 (BRI 019235); *J. Dallachy s.n.*, Rockingham Bay, undated (MEL 583486, MEL 583493); *Domin 8158*, Tambourine Mts, iii.1910 (PR); *Francis s.n.*, Eungella Range, via Mackay, 3-12.x.1922 (BRI 266991-2); *Griffith s.n.*, Pioneer River, 1889 (MEL 527843); *Hyland 9126*, Mt Mackwood, 21° 03'S, 148° 56'E, 11.x.1976 (QRS); *McDonald, Fisher & Ryan 3244*, Bulburin State Forest, 24° 03'S, 151° 02'E, 17.iv.1980 (BRI); *Stockill s.n.*, Fraser Island, ii.1972 (BRI 133520); *Telford 1464*, D'Aguilar Range, Mt Glorious, 19.ii.1970 (CBG); *Webb & Tracey 7665*, Cawley State Forest west of Cathu, between Mackay & Proserpine, vi.1965 (BRI); *White s.n.*, Samford, undated (BRI 266994); *White 12639*, loc. cit. 6.iv.1945 (BRI).

NEW SOUTH WALES: *Bauerlen 14*, Shoalhaven River, vi.1888 (MEL 583492); *Beckler s.n.*, Clarence River, undated (MEL 583164, *syntype*); *Beuzeville 758*, Woolgoolga, 9.x.1934 (NSW 145018); *Blakely, Shires & Batt s.n.*, Head of Patonga Creek, 6.ix.1925 (NSW 145020); *Boutcher s.n.*, Dunoon, ii.1958 (NSW 145023); *Burgess s.n.*, Coff's Harbour, 26.x.1966 (CBG 018298); *Coveny s.n.*, Wherrol Flat, near Wingham, 11.i.1967 (NSW 145016); *Downmy s.n.*, Deep Creek, near Valla Beach, 24.v.1922 (NSW 145027); *Edwards s.n.*, Richmond River, x.1888 (MEL 527844); *Hay 1497*, Murwillumbah, ii.1912 (NSW 145024); *Jones 2654*, Toonambar S.F., Kyogle, 6.ii.1964 (CANB); *Jones s.n.*, Tweed River, Dec. 1966 (CANB 189175, CANB 189181); *Leichhardt s.n.*, Myall Creek, 20.xi.1843 (MEL 583165, *lectotype*); *Judd s.n.*, Minnamurra Falls, iv.1953 (NSW 145022); *Martin Poll Samp. 1368*, Lion Park, a few miles N of Lismore, 10.xi.1967 (SYD); *Moore 146 s.n.*, Clarence River, undated (MEL 513487-89); *Phillips s.n.*, Nambucca Heads, iii.1940 (NSW 145011); *Rodway 1865*, Upper Williams River, 18.viii.1935 (K, NSW); *Rudder s.n.*, Port Macquarie, undated (NSW 145014); *Wheen 484*, between Urunga and Nambucca, 6.ii.1945 (NSW); *Wilshire s.n.*, near Grafton, 3.iii.1905 (NSW 145026).

*Distribution* (Map 2)

*G. leichhardtii* is endemic in Australia where the main distribution is in the eastern coastal part of Queensland and New South Wales. Within this area, the northern-most locality is near Rockingham Bay in Queensland and the southern-most along the Shoalhaven River in New South Wales. In the south, it is fairly evenly distributed along the coast but to the north it seems to be more abundant in the McPherson Range and to the west of Mackay in the Eungella Range. From outside the mainland of Australia, it is known only from Fraser Island in Queensland. According to Moldenke (1971), *G. leichhardtii* has been cultivated in Hawaiian Islands and New South Wales. During present investigations, this species was found to have been cultivated in the Botanic Gardens of Adelaide, Brisbane, Melbourne, Sydney and the Waite Agricultural Research Institute at Glen Osmond, South Australia.

*Comments*

*G. leichhardtii* is named after Dr Ludwig Leichhardt, an explorer and botanist, who collected the type specimen from northern New South Wales. The authorship to the combination of its name has been referred by Moldenke (1959, 1971, 1980) and a few others to F. Mueller who originally described it as *Vitex*. According to present investigations, however, it was first transferred to the genus *Gmelina* by Bentham (1870).

The plant is popularly called "White Beech" or "Native Beech", and has a very juicy fruit with disagreeable taste. Generally, the leaves are entire-margined but sometimes they are distinctly toothed at the juvenile stage.

According to Francis (1951), "the timber is one of the most useful of Australian scrub woods. It is durable, easy to work, and does not shrink very much. It is used for almost all indoor purposes such as furniture-making, general fitting, and wood-carving. Owing to the high reputation of the timber in the past and present, it is not plentiful now".

*Affinities*

*G. leichhardtii* is closely allied to *G. elliptica*. For details see "affinities" under the latter. There are also several characters common between *G. leichhardtii* and *G. fasciculiflora*. Both have their lamina and calyx free of nectariferous glands, corolla-tube villous inside at the base of stamens, ovary villous at the top, fruit globular in shape and purple-mauve when ripe and fresh. The latter, however, can readily be identified by its lamina being glabrous, not cuneate towards the apex; cymes forming sessile clusters along the rachis; corolla blue or mauve-purple, with tube almost twice the length of calyx.

According to H.J. Lam (1919), *G. leichhardtii* has affinities with *G. lepidota* Scheffer. The former species, however, is a tree and differ from the latter in the texture of leaves and in the dimensions of calyx and corolla. *G. lepidota* is a climbing shrub with glabrous shining leaves which are scaly beneath and acute at the base and apex.

3. *Gmelina fasciculiflora* Benth., Fl. Aust. 5 (1870) 65; F. Muell., Syst. Cens. Aust. Pl. 1 (1882) 103; F.M. Bail., Synop. Qld Fl. (1883) 378; F. Muell., Sec. Syst. Cens. Aust. Pl. 1 (1889) 173; F.M. Bail., Cat. Indig. & Natur. Pl. Qld (1890) 35; Qld Fl. 4 (1901) 1178; Comp. Cat. Qld Pl. (1913) 386; Francis, Aust. Rain-For. Trees (1951) 454, Fig. 270; Mold., Résumé Verbenac. etc. (1959) 209; Fifth Summary Verbenac. etc. 1 & 2 (1971) 346, 523; Sixth Summary Verbenac. etc. (1980) 337; Bains, Aust. Pl. Gen. (1981) 167.

*Type: J. Dallachy s.n.*, Rockingham Bay, Queensland, Australia, 16.x.1868 (MEL 583159, lectotype designated here!). *Dallachy s.n.*, loc. cit. (Muenga Creek), 9.ix.1865 (MEL 583160, syntype!). *Dallachy s.n.*, loc. cit., 24.x.1865 (MEL 583161, syntype!). *Dallachy s.n.*, loc. cit., undated (K, MEL 583158, MEL 583162, MEL 583163—syntypes!).

*Vitex leichhardtii* F. Muell. var. *glabrata* F. Muell., pro syn. apud Benth., Fl. Aust. 5 (1870) 65.

### Typification

*G. fasciculiflora* is based on several of J. Dallachy's collections from Rockingham Bay, Queensland. These collections collectively consist of at least 23 duplicates of which 7 specimens were certainly seen by Benthham while preparing the protologue of this species. However, he did not designate any one of these as a type. It is, therefore, necessary to choose a lectotype for this name. With the exception of one syntype at Kew, all other types are preserved in Herb. MEL. Of these, the one with number MEL 583159 was definitely seen by Benthham in preparing the original description of this species. The specimen is particularly complete and well preserved, and is, therefore, selected here as the lectotype.

### Description (Fig. 3)

A tree (4-) 10-25 (-30) m high. *Stem* often straight, without prominent buttresses, glabrous, (12-) 20-80 cm diameter, bark grey, somewhat scaly; young shoots densely clothed with rust-coloured short hairs. *Leaves* ovate-elliptic, obtuse or obtusely acuminate, with rounded or somewhat cuneate base, entire, (3-) 5-12 (-16) cm long, (2.5-) 4-7 (-9) cm broad, glabrous, somewhat coriaceous, shining above, the primary veins more prominent on lower surface; petiole glabrous, 0.5-2 (-3) cm long. *Inflorescence*  $\pm$  pyramidal in outline, densely ferruginous-tomentose, 10-20 (-25) cm long, 8-15 cm across towards the base; cymes more or less sessile, reduced to dense opposite globose clusters along the rachis. *Flowers* shortly pedicellate; pedicels densely ferruginous-tomentose, 0.5-3 mm long; bracts ovate-elliptic, tomentose abaxially, glabrous adaxially,  $\pm$  2 mm long,  $\pm$  1.5 mm broad. *Calyx* broadly campanulate, almost truncate or with 5 minute lobes at the rim, ferruginous-villous outside, glabrous within, 2.5-4 mm long, 2.5-3.5 mm broad at the top, persistent, accrescent and spreading under the fruit, enlarging to 15 mm. *Corolla* blue or mauve-purple with a yellow marking on the lower lobe, densely ferruginous-villous outside, papillose on the inner face of the lobes, glabrous inside the tube excepting the narrow villous hairy ring at the base of stamens, 10-16 (-20) mm long; upper lip 2-lobed, lobes ovate-oblong, 3-6 (-7) mm long, 3-5 (-6) mm broad near the base; lower lip 3-lobed, the middle lobe broadly elliptic-ovate, with a yellow marking, 5-8 (-10) mm long, 5-7 (-8) mm broad, the lateral lobes oblong-ovate, 4-6 (-8) mm long, 3-5 (-6) mm broad; tube oblique, abruptly dilating above the calyx, 5-8 mm long, 4-7 mm broad at the top. *Stamens* exerted, inserted near the base of the corolla-tube; filaments filiform, incurved in the upper half, sparsely covered with gland-tipped hairs, anterior pair 10-11 mm long, lateral pair 8-9 mm long; anthers more or less oblong, 1.5-2 mm long,  $\pm$  1 mm broad, lobes free and divergent in the lower halves, narrowing towards the free end. *Ovary* globular, villous at the top, glabrous elsewhere, 1-2 mm diameter; style exerted, incurved in the upper half, often glanduliferous, but becoming glabrous later, 12-15 mm long, stigma very unequally 2-lobed, the smaller lobe one-tenth to one-twentieth the length of the longer lobe. *Fruit* globular, succulent, glabrous, bright violet or purplish-mauve when ripe, smooth and shiny, 1-2 cm diameter, wrinkled and black when dry.

### Representative specimens (collections seen: Australian 55)

AUSTRALIA: QUEENSLAND: *Bailey 79*, Mts Torrens and Sophia, 1904 (BRI); *Cowley 11a*, Martintown, 17° 01'S, 145° 02'E, undated (BRI); *Crome 556*, Lacy Creek, Mission Beach, 6 km W of Clump Point, 17° 50'S, 146° 05'E, 15.xi.1972 (CANB); *Dallachy s.n.*, Rockingham Bay, 16.x.1868 (MEL 583159, lectotype); *Dallachy s.n.*, loc. cit. undated (MEL 583158, MEL 583162, MEL 583163—syntypes); *Dallachy s.n.*, loc. cit., Meunga Creek, 9.ix.1865 (MEL 583160, syntype); *Dallachy s.n.*, loc. cit., 24.x.1865 (MEL 583161, syntype); *Dallachy s.n.*, loc. cit., undated (MEL 583145-48, MEL 583150, MEL 583152-54, MEL 583156-57, possible syntypes); *Dreghorn 6512*, Gadgarra Forest Reserve, 17° 18'S, 145° 44'E, 9.i.1934 (BRI); *Fitzsimon 163*, State Forest Reserve 755, 17° 26'S, 145° 46'E, 12.xi.1976 (QRS); *Gray 222*, Julatten, 16° 37'S, 145° 22'E, 11.i.1977 (QRS, 3 spec.); *Hunter 6455*, banks of the Barron River, 16° 52'S, 145° 42'E, 30.xi.1939 (BRI); *Hyland 1310*, State Forest Reserve 94, 17° 15'S, 145° 25'E, 11.iii.1968 (QRS); *Hyland 5605*, S.F.R. 756, East Downey L.A., 17° 40'S, 145° 50'E,

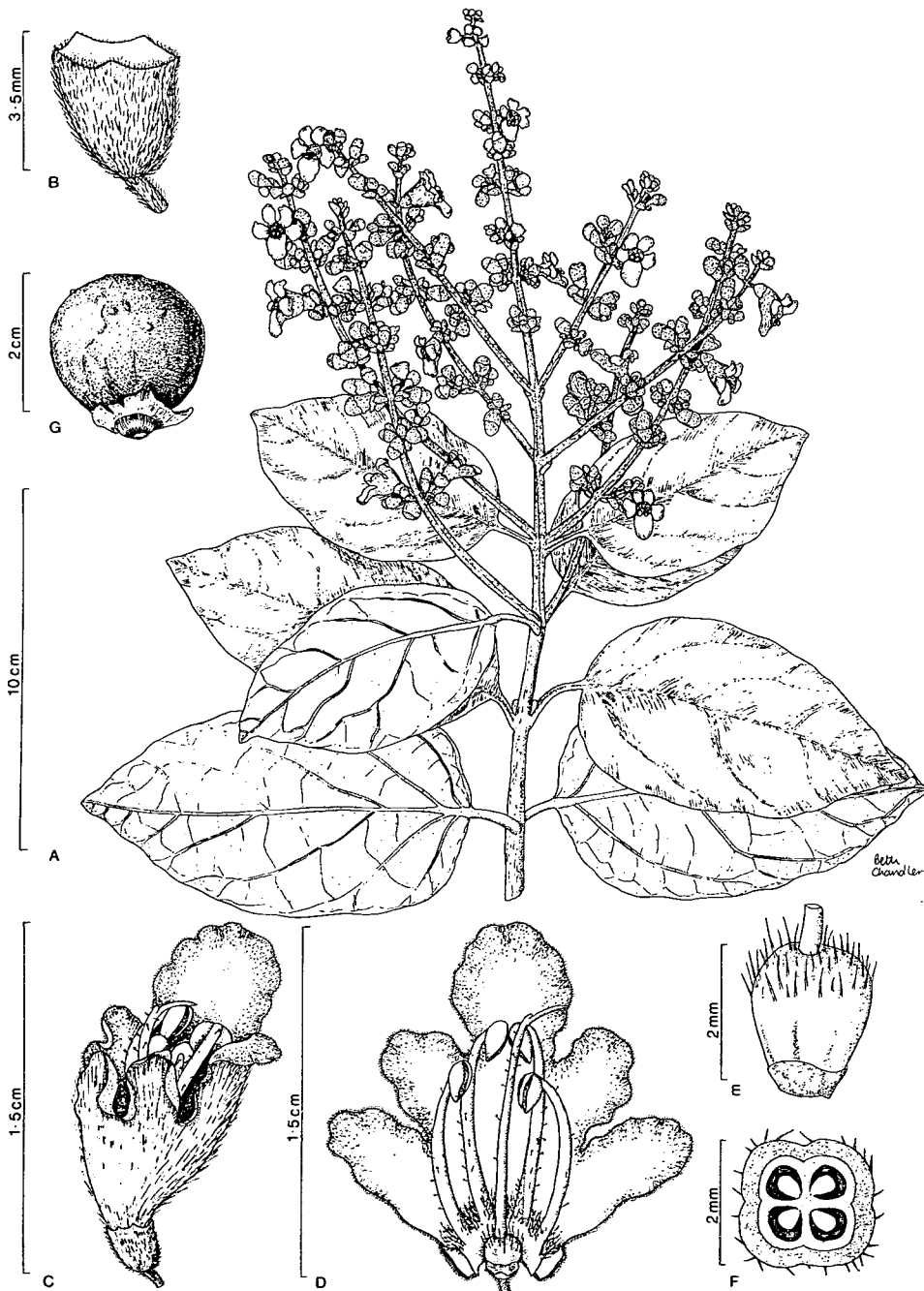


Fig. 3. *Gmelina fasciculiflora* Benth. (A-F, B. Hyland 6486: QRS; G, A. Irvine 443: QRS). A, flowering branch; B, calyx; C, flower; D, flower vertically cut open to show androecium and gynoecium; E, ovary, F, transverse section of ovary; G, fruit with persistent calyx.

1.xi.1971 (BRI 2 spec., QRS 3 spec.); *Hyland 6486*, S.F.R. 191, Barron, 17° 20'S, 145° 30'E, 15.xi.1972 (BRI, CANB, QRS); *Irvine 443*, Boonjie T.R. 1230, 17° 25'S, 145° 45'E, 23.i.1973 (BRI, CANB, QRS 3 spec.); *Irvine 1718*, Daintree River, south side near ferry, 16° 16'S, 145° 25'E, 17.xii.1975 (QRS); *Irvine 1725*, Carrington Falls near S.F.R. 194, 17° 20'S, 145° 25'E, 5.i.1976 (BRI, QRS 2 spec.); *Kajewski 1337*, Range Road, Atherton Tableland, 7.xi.1929 (BRI); *Ladbrook s.n.*, Johnstone River, xi.1917 (BRI 267153, BRI 267155); *Manuell 14*, Ravenshoe, N. Qld, undated (BRI); *Michael s.n.*, Johnstone River, ix.1917 (BRI 267160); *Moriarty 2086*, S.F.R. 755, TR 1230, Boonjie L.A., 17° 22'S, 145° 45'E, 9.vi.1976 (QRS); *Risley 172*, EP/14, S.F.R. 185, 17° 10'S, 145° 35'E, 24.i.1975 (BRI, NSW, QRS); *Risley 476*, Python L.A., 17° 10'S, 145° 37'E, 9.ii.1978 (AD, QRS); *Sanderson 1455*, S.F.R. 185, Python L.A., 17° 10'S, 145° 37'E, 23.v.1978 (QRS); *Smith 4899*, Fenby's Gap, 17° 52'S, 146° 05'E, 31.x.1951 (BRI); *Stocker 618*, S.F.R. 185, Danbulla near Gilmore's Plot, 17° 10'S, 145° 35'E, 15.iii.1971 (BRI, QRS); *Thorsborne 141*, Galmara, Meunga Creek, Cardwell, 18° 14'S, 146° 00'E, 23.i.1976 (BRI); *Webb & Tracy 11639*, 16° 55'S, 145° 15'E, x.1973 (BRI); *Webb & Tracey 6589*, Gregory Falls—lower Palmerston via Innisfail, 1962 (BRI); *Winter s.n.*, Purtaboi Island, 17° 55'S, 146° 10'E, 11.v.1975 (QRS 002741-42).

### Distribution (Map 2)

*G. fasciculiflora* is endemic in northern Queensland, Australia, where it is restricted between latitudes 16° and 19°S, and longitudes 145° and 147°E. The major distribution is on the Atherton Tableland extending from Rockingham Bay northwards to Daintree River. Most localities are in the coastal rain-forest region, and so far it has not been recorded from the interior of the State.

### Comments

All of Dallachy's collections of this species came from the same general locality, but none of them has any collection number. The following 7 specimens, however, are found to have different collecting dates: MEL 583149 (5 Nov. 1865), MEL 583151 (Nov. 1864), MEL 583155 (16 Oct. 1865), MEL 583159 (16 Oct. 1868), MEL 583160 (29 Sept. 1865), MEL 583161 (24 Oct. 1865), K s.n. (1869 Comm.). These seem to belong to different Dallachy collections. The remaining undated and un-numbered 16 specimens may possibly belong to the same collections. However, if they are an assemblage of different collections, there seems no way to find out the likely duplicates of any one collection. In all, 19 specimens of Dallachy's collections of this species (in Herb. MEL) are found in the type folders. Six of them are labelled "syntype" and the remaining 13 as "possible syntype".

In the protologue of this species, Bentham (1870) cited the type: "Rockingham Bay, Dallachy", without selecting any specimen as the type. According to present investigations, Bentham examined only the following 7 herbarium specimens of this taxon in preparing the original description: K s.n., MEL 583158, MEL 583159, MEL 583160, MEL 583161, MEL 583162 and MEL 583163. All these are labelled as "syntype". Since there is no authentic duplicate of these syntypes, therefore, status of Dallachy's other collections from Rockingham Bay, labelled "possible syntype", remains doubtful. To avoid further confusion, a lectotype is chosen here from amongst the 7 specimens (syntypes) seen by Bentham. The remaining 6 specimens being the authentic syntypes or isolectotypes.

In the synonymy of this species, Bentham (1870) cited "*Vitex leichhardtii* var. *glabrata* F. Muell.", and the same was recorded by Bailey (1901). This variety, however, has not been found to have been validly published in the available literature.

Under the "remarks" on the label of G. Stocker's collection (no. 618: QRS), the fruit is described as "1" diameter". Such a large sized fruit has not been found among the many collections examined here. The biggest fruit seen by the present author measures up to 2 cm in diameter.

According to Francis (1951), the general aspect of the *G. fasciculiflora* tree, the character of the bark and the appearance of the wood strongly resemble those of the Australian White Beech, *Gmelina leichhardtii*. The wood is cream-coloured, firm, compact, close-grained without pattern or sheen.



The species name has apparently been drawn from the clusters of flowers along the rachis of the inflorescence. It is popularly called "North Queensland Beech" or "Gray Teak".

#### *Affinities*

Amongst the Australian *Gmelina* species, *G. fasciculiflora* is closely allied to *G. leichhardtii* in its lamina and calyx being free of nectariferous glands, corolla-tube villous inside at the base of stamens, ovary villous at the top, fruit globular in outline and purple-mauve when fresh. Nevertheless, *G. fasciculiflora* may easily be distinguished by its lamina's being glabrous, not cuneate towards the apex; cymes forming sessile clusters along the rachis; corolla blue or mauve-purple, with tube almost twice the length of calyx. According to Francis (1951), these species resemble each other in general aspect, the character of the bark and the appearance of the wood.

*G. fasciculiflora* has several characters common with *G. dalrympleana* and *G. schlechteri*. All three have a glabrous lamina which is not cuneate towards the apex, blue or mauve corolla with tube twice as long as the calyx. However, the latter two can readily be identified by their lamina-base and calyx having nectariferous glands, cymes pedunculate and lax, corolla-tube glabrous inside, ovary glabrous and fruit obovoid.

#### 4. *Gmelina schlechteri* H.J. Lam, Verbenac. Malay. Arch. (1919) 226.

*Type*: R. Pullen 7662, Nunumai, c. 12 km N of Amazon Bay, Central District, Papua New Guinea, 21.vi.1969 (CANB, neotype designated here; A, BO, BRI, CANB, K, L, LAE, PNH, TNS - isoneotypes).

*G. dalrympleana* (F. Muell.) H.J. Lam var. *schlechteri* (H.J. Lam) Mold., Phytologia 4 (1953) 178; Résumé Verbenac. etc. (1959) 201-203, 297; Fifth Summary Verbenac. etc. 1 & 2 (1971) 333, 336, 338, 524; Sixth Summary Verbenac. etc. (1980) 323, 327, 328.

*Type*: As for *G. schlechteri* H.J. Lam.

*G. macrophylla* auct. non Benth.: Schumann in Schumann & Holtr., Fl. Kais.-Wilh. land (1889) 120, quoad spec. *Halbrung no. 651*, Augusta Station, New Guinea.

#### *Typification*

*G. schlechteri* was described by H.J. Lam (1919) on F.R.R. Schlechter's collection no. 17042 from New Guinea. The whereabouts of its type, however, has not been mentioned in the protologue. During the present investigation, *Gmelina* material has been examined from 23 herbaria, including B, BM, BO, BR, BRI, K, L, LAE and SING, but the type of this species has not been found. Perhaps it was deposited in Herb. B, and was destroyed during the second World War. In view of this a neotype is selected here.

Of all the specimens of *G. schlechteri* examined from New Guinea, the specimen collected by R. Pullen (no. 7662), now preserved in Herb. CANB, is very typical of this species. It conforms in all details with H.J. Lam's description, and is, therefore, designated here as the neotype.

#### *Description* (Fig. 4)

A tree 8-20 (-29) m high. *Stem* erect, young branches glandular and pubescent, the main trunk glabrous, with smooth grey or tessellated rough brown bark. *Leaves* broadly elliptic-oblong or obovate-oblong, entire, obtuse or shortly acuminate, truncate or somewhat cuneate at the base, rarely rounded, with a pair of nectariferous glands at the base of the lamina below the first pair of nerves, (10-) 15-25 (-36) cm long, (5-) 10-20 (-25) cm broad, coriaceous, glabrous, dull, green above, pale beneath; primary nerves

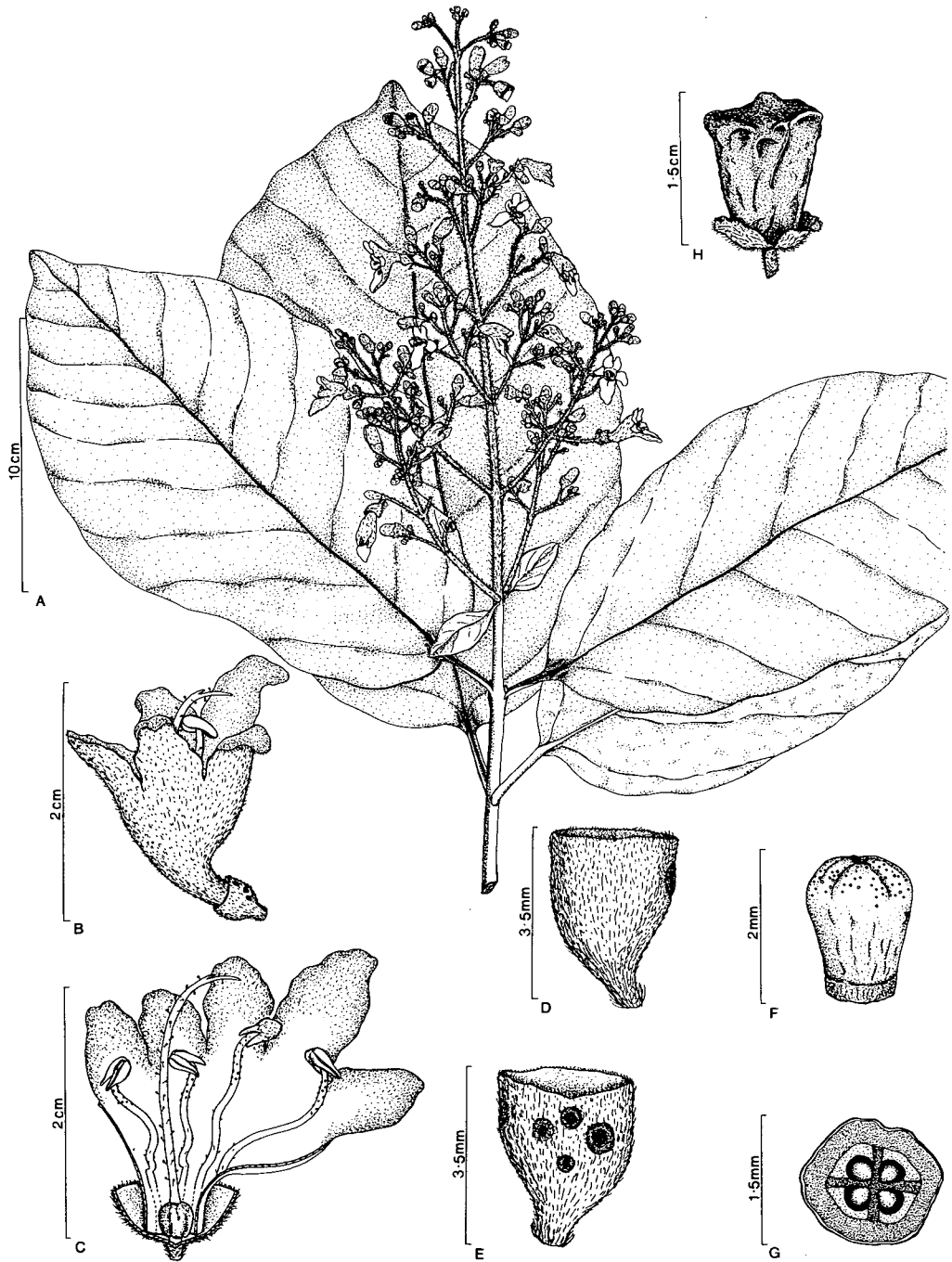


Fig. 4. *Gmelina schlechteri* H.J. Lam (A-G, *D.A. Hearne 103*: DNA: H, *M. McKean B809*: CANB). A, flowering twig; B, flower; C, flower vertically cut open to show androecium and gynoecium; D, calyx showing pubescence outside and nectary free posterior face; E, calyx showing nectariferous glands on the anterior face; F, ovary; G, transverse section of ovary; H, fruit with persistent calyx.

sub-pubescent, prominent on the lower surface; petiole glandular and pubescent, becoming glabrescent later, (1.5-) 2.5-4.5 (-8) cm long. *Inflorescence*  $\pm$  pyramidal, 15-25 (-30) cm long, 10-18 (-20) cm in diameter, ferruginous- or cinereous-pubescent. *Flowers* sessile or with a minute pubescent pedicel of 1-1.5 mm long; bracts caducous, elliptic or elliptic-oblong, densely pubescent abaxially, glabrous adaxially, 2-5 mm long, 1.5-3 mm broad. *Calyx* campanulate, truncate or obsolete 5-dentate, densely pubescent outside, glabrous inside, with nectariferous glands on the anterior side, 3-4 (-5) mm long, 3 (-4) mm broad at the top, persistent, somewhat accrescent and expanded under the fruit. *Corolla* mauve or pale lilac, appressedly pubescent outside, glabrous inside the tube, papillose on the inner faces of lobes, 1.5-2.5 cm long; upper lip 2-lobed, lobes oblong to ovate-oblong, 5-7 mm long, 3.5-5 mm broad; lower lip 3-lobed, the middle lobe oblong-ovate, with a yellow spot inside at the base, the lateral lobes oblong or oblong-ovate, 5-7 mm long, 3-5 mm broad; tube oblique, abruptly dilating above the calyx, (7-) 10-12 mm long, (5-) 7-10 mm broad at the top end. *Stamens* ascending under the upper lip, somewhat exerted, inserted in the lower part of the corolla-tube; filaments filiform, flattened, incurved and with glandular hairs in the upper half, anterior pair 8-11 mm long, the lateral pair 6-9 mm long; anthers with fairly thickened connective on the back, 1.5-2.5 mm long, 1-1.5 mm broad; lobes oblong, free and divergent in the lower half. *Ovary* obovoid-globose, glabrous with often small deciduous glands at the top, 1.5-2 mm long, 1-1.5 mm in diameter in the upper half; style exerted, incurved in the upper half, filiform, with glandular hairs, 15-20 mm long, stigma unequally 2-lobed. *Fruit* obovoid, truncate or with a small knob on top, glabrous, (8-) 10-15 (-17) mm long, (6-) 8-11 mm in diameter distally, reddish-purple or purple-pink and glossy when fresh, turning black and dull when dry.

*Representative specimens* (collections seen: Australian 20, non-Australian 12)

AUSTRALIA: NORTHERN TERRITORY: *Byrnes 228*, Koolpinyah, 1.vi.1951 (DNA); *Byrnes 1666*, 8 miles N.E. of Wangi H.S., 25.viii.1969 (DNA, NT); *Blake 17169*, between Gerowie Creek and Mary River, 4.x.1946 (BRI); *Dunlop 3663*, Koolpinyah, 10.x.1974 (DNA, NT); *Dunlop 5601*, Green Ant Creek, East Spring, 28.xi.1980 (AD, DNA); *Hearne 103*, Bamboo Creek Wangi, 21.x.1972 (DNA); *Hearne 111*, Mount Tolmer, 21.x.1972 (DNA); *Holtz 45*, Port Darwin, 1883 (MEL 3 spec.); *Martensz 304*, c. 5 m E Nourlangie Rock, 10.xi.1972 (CANB, DNA, K, NT); *J. McKean B735*, Bamboo Creek, 22 m W Batchelor, 20.x.1972 (DNA); *M. McKean B809*, 2 m N Mt Brockman Range, 11.xi.1972 (CANB, DNA, NT); *Parker 515 & 525*, "The Pine", Douglas River, 24.x.1974 (BRI, DNA, MO, NT); *Parker 1159*, Kemp Airstrip area, 9.i.1978 (BRI, DNA, NT); *Reeve, Bona & Wurrupali 570*, between Nangalala and Ramanginin, 9.i.1973 (CANB, 2 spec.); *Robinson R939*, Bamboo Creek, Marrakai tract, 20.x.1964 (DNA); *Stocker 513*, Maningrida, v.1963 (NT); *Stocker & Fox 464*, Banjo Jungle, Melville Island, 27.iv.1966 (BRI, NT); *Telford & Wrigley 7879*, Gulungul Creek, Kakadu National Park, 5 km WSW of Mt Brockman, 21.iv.1980 (CBG).

PAPUA NEW GUINEA: *Carr 15748*, Isuarava, Papua, 24.ii.1931 (CANB); *Hollrung 651*, Augusta Station, 1887 (B, MEL 2 spec.); *Johns NGF 47311*, Paiaawa, Morobe Sub-District, 12.v.1970 (A, BRI, CANB, K, L, LAE); *Kairo NGF 17260*, Maigo, near Marshall Lagoon, Central District, 18.x.1963 (A, BRI, CANB, K, L, LAE, PNH, SING, US); *Kerenga & al. LAE 73871*, Opo Creek, near Anna Village, Prov. Morobe, 4.iii.1978 (A, BRI, CANB, E, K, L, M); *Millar NGF 22979*, Bupu Village, Wampit, Morobe District, 13.vii.1967 (BRI, L, LAE); *Pullen 7662*, Nunumai, c. 12 km N of Amazon Bay, 12.vi.1969 (CANB, neotype; A, BO, BRI, K, L, LAE, PNH, TNS, isoneotypes); *Smith NGF 1345*, Eastern district, Milne Bay, near Mapo, -iii.1945 (CANB, LAE); *Turner 128*, Fife Bay, Papua, -xi.1930 (BRI 2 spec.); *Coll. ign. NGF 4167*, Sogeri, Central District, undated (BRI).

INDONESIA: MOLUCCAS: *Buwalda 5431*, Aroe Island, P. Trangan, 1.vii.1938 (BO, BRI).

*Distribution* (Map 2)

In Australia, *G. schlechteri* is found only in the Northern Territory where it occurs chiefly in the north-west between latitude 12° and 14°S, and longitude 130° and 133°E. Within this area the main concentration of this species is in the tropical forest of Darwin region. Besides this there is one locality near Maningrida along the northern coast, and one in Banjo Jungle on Melville Island.

Collections from overseas have been examined from Papua New Guinea and Aroe Island in the Moluccas.

*Comments*

*G. schlechteri* is recorded for Australia for the first time. Previously all Australian collections of this species were identified as *G. dalrympleana* (F. Muell.) H.J. Lam or *G. macrophylla* (R. Br.) Benth. Moldenke (1953) relegated *G. schlechteri* to a variety of *G. dalrympleana* without giving any reason. As a result of the present investigations, however, *G. schlechteri* is reinstated to species rank because it differs from *G. dalrympleana* in its densely pubescent calyx and apically sparsely glandular ovary. In all other characters, they are very close to each other.

The species was named after the German botanist, F.R.R. Schlechter who collected its type from Kauai Mountains, New Guinea. The type is not found in any of those herbaria where Schlechter's collections are likely to be deposited.

*Affinities*

*G. schlechteri* is nearest to *G. dalrympleana* in its lamina's being glabrous and having two nectariferous glands at the base; cymes pedunculate, lax; corolla-tube glabrous inside; ovary glabrous; fruit obovoid. Nevertheless, *G. schlechteri* may easily be identified by its calyx being densely pubescent and ovary sparsely glandular at the top. There is also a close relationship between *G. schlechteri* and *G. ledermanni* H.J. Lam. Both species have glabrous leaves with nectariferous glands at the base of the lamina, pyramidal inflorescence, pedunculate cymes and pubescent calyx. The latter, however, can easily be distinguished by its leaf-margin's being slightly curved, corolla yellow, and ovary with "stiff" hairs at the top.

5. *Gmelina dalrympleana* (F. Muell.) H.J. Lam, Verbenac. Malay. Arch. (1919) 223; C. White, Proc. Roy. Soc. Qld 38 (1927) 259; Junell, Symb. Bot. Ups. 4 (1934) 92; Mold., Résumé Verbenac. etc. (1959) 201, 202, 209, 285, 296, 297, 386; Fifth Summary Verbenac. etc. 1 & 2 (1971) 336, 338, 346, 491, 523, 524, 716; Chipp., Proc. Linn. Soc. N.S.W. 96 (1972) 256; Mold., Sixth Summary Verbenac. etc. (1980) 327, 328, 337, 409; Bains, Aust. Pl. Gen. (1981) 167; N. Beadle, Veg. Aust. (1981) 180.

*Type: J. Dallachy s.n.*, Rockingham Bay, Queensland, Australia, undated (MEL 583504, lectotype designated here!; MEL 583498, MEL 583505-583508, MEL 583512-583514, MEL 583516-583519, MEL 583521, syntypes!). *Dallachy 34*, loc. cit., 29.i.1864 (MEL 583497, syntype!). *Dallachy s.n.*, loc. cit., 16.xii.1864 (MEL 583503, syntype!). *Dallachy s.n.*, loc. cit., 8.vii.1864 (MEL 583509, syntype!). *Dallachy s.n.*, loc. cit., 5.ii.1864 (MEL 583511, syntype!). *Dallachy s.n.*, loc. cit., 14.xii.1865 (MEL 583520, syntype!).

*Vitex dalrympleana* F. Muell., Fragm. 4 (1864) 128, basionym; Fragm. 5 (1865) 72.

*Type: As for G. dalrympleana* (F. Muell.) H.J. Lam.

*G. macrophylla* (R. Br.) Benth., Fl. Aust. 5 (1870) 65, *nom. illeg.*, non Wall. ex Schau. (1847); F. Muell., Syst. Cens. Aust. Pl. 1 (1882) 103; F.M. Bail., Synop. Qld Fl. (1883) 378; F. Muell., Descrip. Notes Pap. Pl. 8 (1886) 46; Qld Woods (1888) 91; Maiden, Usef. Nat. Pl. Aust. (1889) 550; F. Muell., Sec. Syst. Cens. Aust. Pl. 1 (1889) 173; Schumann in Schumann & Hollr., Fl. Kais.-Wilh-land (1889) 120, excl. *Holtrung* 651; F.M. Bail., Cat. Indig. & Natur. Pl. Qld (1890) 35; Schumann & Lauterb., Fl. D. Schutzgeb. Südsee (1901) 524; Banks & Sol., Ill. Aust. Pl. Cook's voy. part 2 (1901) 74, t. 238; F.M. Bail., Qld Fl. 4 (1901) 1178; Pulle in Lorentz, Nova Guinea 8 (2) (1910) 402; F.M. Bail., Comp. Cat. Qld Pl. (1913) 386; Ewart & O.B. Davies, Fl. N. Terr. (1917) 238; H.J. Lam & Bakh., Bull. Jard. Bot. Buitenz. Ser. 3 (1921) 68; Bakh., J. Arn. Arb. 10 (1929) 72, excl. descrip.; Junell, Symb. Bot. Ups. 4 (1934) 92; Beer & H.J. Lam, Blumea 2 (1936) 226; Francis, Aust. Rain-For. Trees (1951) 454.

*Type: J. Banks & D. Solander s.n.*, Cape Grafton, Queensland, Australia, 1768-1771 (BM, holotype!).

*Vitex macrophylla* R. Br., Prod. Fl. Nov. Holl. (1810) 512, basionym of *G. macrophylla* (R. Br.) Benth. (1870); Schau. in DC., Prod. 11 (1847) 695; Seemann, J. Bot. 3 (1865) 258; F. Muell., Fragm. 6 (1868) 153.

*Gmelina vitiensis* Seemann, Mission to Viti 1860-61 (1862) 440, *nom. nud.*; Mold., Résumé Verbenac. etc. (1959) 207, 391; Fifth Summary Verbenac. etc. 1 & 2 (1971) 343, 731, *syn. nov.*

*Ephielis simplicifolia* Sol. ex Seemann, J. Bot. 3 (1865) 258; Fl. Viti. part 5 (1866) 189.

Type: As for *G. macrophylla* (R. Br.) Benth.

*Vitex vitiensis* Seemann, Fl. Viti. part 5 (1866) 190, t. 45, *syn. nov.*

Type: "*Mitne s.n.*, Viti, locality not specified", undated (K, n.v.).

### Typification

*G. dalrympleana* is based on several of J. Dallachy's collections from Rockingham Bay, Queensland. These collections collectively consist of at least 19 duplicates of which 13 were certainly seen by F. Mueller while preparing the original description of this species. However, he did not designate any one of these as a type. It is, therefore, necessary to choose a lectotype for this name. All these syntypes are preserved in Herb. MEL. One of these, numbered MEL 583504, is particularly complete and well preserved, and is, therefore, selected here as the lectotype for this species.

### Description (Fig. 5)

A tall shrub or small tree (2-) 4-15 (-25) m high. *Stem* straight, glabrous, 10-40 cm diameter, with bark often greyish and cracked or fissured. *Leaves* broadly ovate, ovate-oblong or elliptic-obovate, entire, obtuse or subobtusely acuminate, somewhat cuneate, rounded or cordulate at base, with a pair of nectariferous glands at the base of the lamina below the first pair of nerves, (6-) 10-25 (-36.5) cm long, (5-) 7-15 (-23) cm broad, coriaceous, glabrous but not shining; primary nerves more prominent on lower surface, glabrous or sparsely pubescent; petiole glabrous or puberulous when young, (0.5-) 1-2.5 (-4) cm long. *Inflorescence* more or less pyramidal, 12-25 (-30) cm long, 6-15 (-20) cm across; cymes in axils of foliaceous bracts. *Flowers* almost sessile or shortly pedicellate; pedicels glabrous, 1-1.5 mm long; bracts caducous, oblong-ovate, glabrous, 2-5 (-8) mm long. *Calyx* "dark blue", campanulate, truncate or somewhat sinuate, often irregularly cleft, glabrous, with nectariferous glands on the anterior side, 4-5 (-6) mm long, 3-3.5 mm broad at the top, persistent, somewhat accrescent and expanded under the fruit. *Corolla* purple-pink or blue with yellow throat and mauve lip, appressedly pubescent outside excepting lower part of the tube, glabrous inside the tube, papillose on the inner faces of the lobes, 1.5-2.5 (-3) cm long; upper lip 2-lobed, lobes oblong, (5-) 6-9 mm long, 4-5 mm broad; lower lip 3-lobed, the middle lobe oblong, with a yellow marking at the base, (7-) 8-10 mm long, 5-6 mm broad, the lateral lobes oblong-ovate, 5-9 mm long, 3.5-5 mm broad; tube oblique, abruptly dilating above the calyx, 8-13 mm long, (6-) 7-9 mm broad distally. *Stamens* ascending under the upper lobes, exerted, inserted in the lower part of the corolla-tube; filaments filiform, flattened, incurved in the upper half, glabrous, sometimes with glandular hairs in the upper third, anterior pair 9-13 mm long, lateral pair 7-11 mm long; anthers with fairly thickened connectives, lobes oblong, free and divergent in the lower half, 2-2.5 mm long, 0.5-1 mm broad. *Ovary* oblong-obovoid, glabrous, 1.5-2 mm long, 1-1.5 mm in diameter; style exerted, incurved in the upper half, filiform, sparsely glanduliferous, (1.2-) 1.5-2 cm long, stigma unequally 2-lobed. *Fruit* obovoid-truncate, glabrous, (0.8-) 1-1.5 (-1.8) cm long, (5-) 7-10 (-12) mm in diameter, soft, pink scarlet or red, drying black.

### Representative specimens (collections seen: Australian 59, non-Australian 17)

AUSTRALIA: QUEENSLAND: *Armit 89*, Mulgrave River, undated (MEL); *Bailey 35*, Somerset, vi.1897 (BRI); *Bailey 92*, Thursday Island, vi.1897 (BRI); *Bouel 10*, Endeavour River, i.1881 (MEL); *Brass 2185*, Daintree River, 28.ii.1932 (BRI); *Cameron 2057, 2072 & 2036*, Horn Island, 23.vii.1975 (QRS); *Cameron 20535, 20550 & 20610*, Moa Island, 22.ii.1975 (QRS); *Cameron 2698, 2714 & 272081*, Badu Island, 22.xii.1976 (QRS);

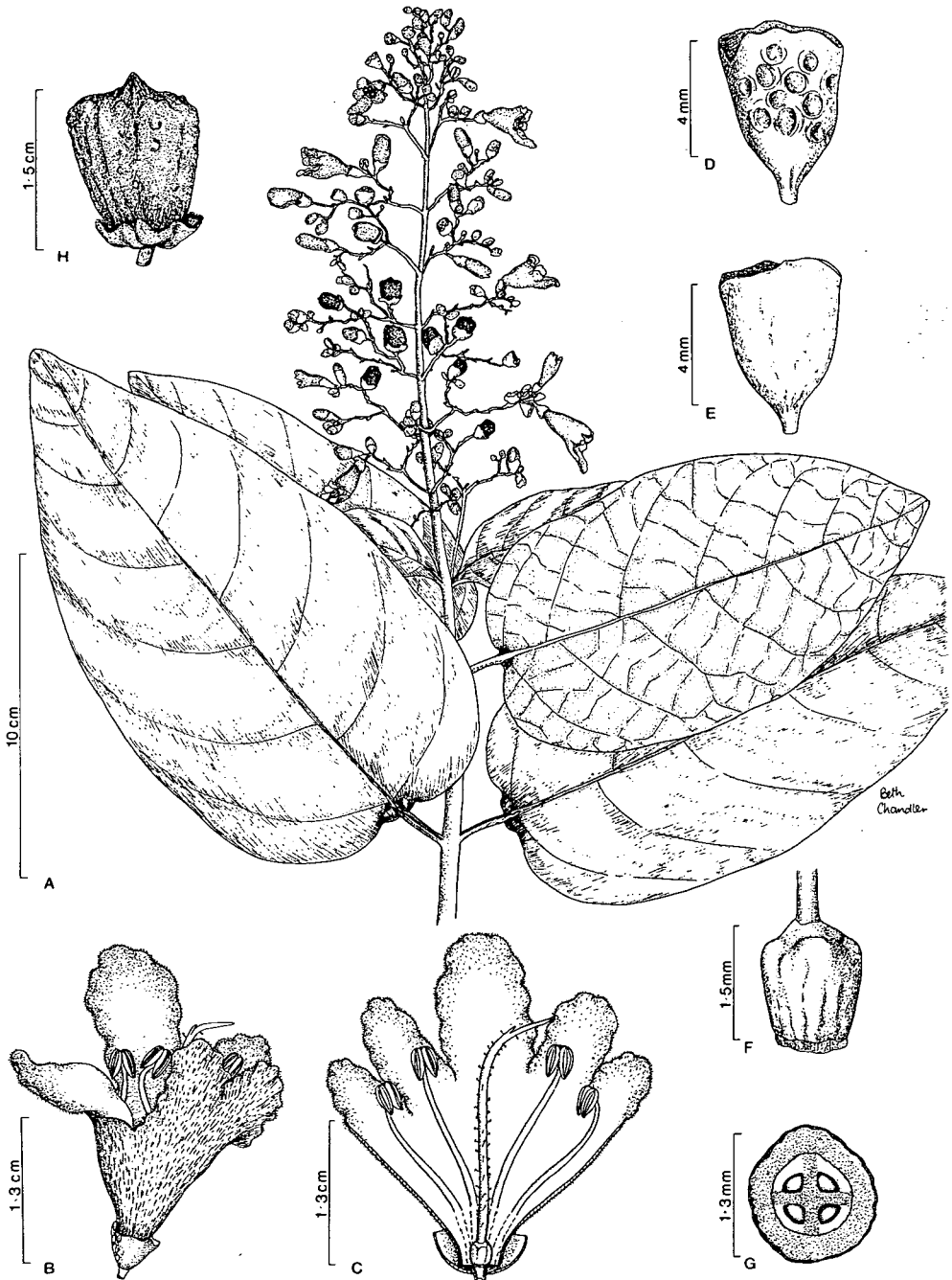


Fig. 5. *Gmelina dalrympleana* (F. Muell.) H.J. Lam (A-H, *L.J. Brass* 8539: CANB). A, flowering branch; B, flower; C, flower vertically cut open to show androecium and gynoecium; D, calyx showing nectariferous glands on the anterior side; E, calyx showing nectary free posterior side; F, ovary; G, transverse section of ovary; H, fruit with persistent calyx.

*Cameron 20416*, Prince of Wales Island, 15.ii.1975 (QRS); *Cameron & Upton s.n.*, Iron Range, 9.iv.1964 (BRI 266988, CANB 148096); *Flecker 12648*, Turtle Bay, 23.i.1949 (QRS); *Gull s.n.*, Cape York, 12.xii.1867 (MEL 583502, MEL 583510); *Hyland 2472*, Lockerbie, 23.xi.1962 (BRI 2 spec.); *Hyland 291*, Claudie River, 25.x.1973 (BRI, QRS); *Hyland 10970*, near Bamaga, 4.xii.1980 (AD, QRS); *Irvine 1958*, Jardine River, 18.x.1979 (QRS); *Jago 199*, Cairns, 10.xii.1978 (QRS); *Kajewski 1466*, Daintree River, 12.xii.1929 (BRI); *Moriarty 2543*, Whyanbeel Creek between Dayman Point and Newell, 26.xi.1978 (AD, QRS); *Persietz s.n.*, Cooktown, 1877 (MEL 583523); *Sayer s.n.*, Beach mouth of Russell River, 1887 (MEL 1021551); *Smith 12390*, Bamaga Mission, 24.x.1965 (BRI); *Specht W170*, 13.5 km ENE of Weipa Mission, 9.xii.1974 (BRI); *Stocker 1375*, Saibai, 17.vii.1975 (QRS); *Thompson 50*, Lockhart River, undated (BRI); *Webb 3130*, Goanna Creek, E of McIlwraith Range, xi.1956 (BRI); *Webb 3225*, Slopes of Iron Range, xi.1956 (BRI); *Whitehouse s.n.*, Dalhunny River, west (Gulf) side of Cape York Peninsula, undated (BRI).

PAPUA NEW GUINEA: *Bauerlen s.n.*, Fly River, 1885 (MEL 583529, MEL 583530, MEL 583537); *Brass 5753*, Oriomo River, Western Division, i-iii.1934 (BRI); *Brass 6319*, Daru Island, 10.iii.1936 (A, BRI, CANB, LAE); *Brass 7666*, Lake Daviumbu, Middle Fly River, ix.1936 (A, BRI, CANB); *Brass 8539*, Tarara, Wassi Kussa River, xii.1936 (A, BRI, CANB); *Henty NGF 49595*, Mabadauan, Daru subdistrict, 9.vi.1973 (BRI, CANB, L, LAE); *Royen 4891*, Merauke, c. 15 km NE of Koembe Village, 7.ix.1954 (CANB, L); *K.J. White & E. Gray 10374*, Oriomo River, i.1959 (BRI, CANB, LAE).

### Distribution (Map 2)

In Australia, *G. dalrympleana* is found only in Queensland where it occurs chiefly in the northern and eastern parts of Cape York Peninsula. Within this area, the main concentration of this species is on the Atherton Tableland and the northern-most part of the Peninsula. Only two localities are on the west (Gulf side) coast of the Peninsula, located north-east of Weipa Mission. There are also several records from the Torres Strait Islands of which one came from Saibai Island close to the Papua New Guinea shore, and others from the Prince of Wales Island, Thursday Island, Horn Island, Badu Island and Moa Island.

From outside Australia, specimens have been examined from Papua New Guinea and Irian Jaya, Indonesia.

In addition to the above localities, Moldenke (1959, 1971) recorded it from the Northern Territory in Australia, but this has not been confirmed. It is possible that Moldenke mistook for this a closely related species *G. schlechteri* H.J. Lam which is now known to occur in that part of Australia.

### Comments

Bentham (1870) regarded *Vitex macrophylla* R. Br. as this species and, therefore, named it *Gmelina macrophylla*. This name was readily accepted for the species by the majority of botanists and is, therefore, found recorded in the majority of publications dealing with Australian Verbenaceae. The name *G. macrophylla*, however, was already applied by Wallich ex Schau. (1847) to a different species in the genus, therefore, Bentham's name became a later homonym and thus illegitimate.

Moldenke (1959, 1971) reduced *G. ledermanni* H.J. Lam to synonymy in *G. dalrympleana*. I have not seen the type of the former, but from its protologue it seems to differ from the latter by its corolla being yellow, calyx pubescent, ovary pilose on top and fruit deep blue. These differences seem good enough to treat *G. ledermanni* as a distinct species.

Two of L.J. Brass's collections (nos 959 & 1376f) from Papua New Guinea were identified by Bakhuizen (1929) as "*G. macrophylla* (R. Br.) Benth". In the description, he mentioned that the leaves were paler beneath, flowers yellow, tinged pink, calyx tomentose and glandular without, ovary hairy on top but becoming glabrous soon, and fruit pale blue. These characters seem to agree more closely with *G. ledermanni* than this species. I have not been able to examine the above-named Brass's collections now preserved in Herb. A, but on the basis of above mentioned characters they do not agree with *G. dalrympleana* (= *G. macrophylla*).

At the base of lamina, the two prominent brown spots are regarded here as nectariferous glands. They are convex on the upper and concave on the lower surface of the leaf. Schumann (1889) called them cavities or ant-hollows, and H.J. Lam (1919) named them as extrafloral nectaries. Schumann (1889) found the leaves of Australian specimens to be lacking glands, but during the present investigation almost all Australian collections of *G. dalrympleana* were found to have glands at the base of their lamina. Similar glands are also found on the anterior face of the calyx-tube. The leaves and calyces of *G. schlechteri* also have similar glands.

One of Banks & Solander's (s.n.) collection from Cape Grafton, Queensland, was described by Robert Brown (1810) as *Vitex macrophylla* R. Br., and the same collection in the BM was later used by Seemann (1865) in describing *Ephielis simplicifolia* Seemann. Since there is no other known duplicate of this collection, therefore, it may be regarded as the holotype for both the names. Both these taxa are now included in the synonymy of *G. dalrympleana*.

Similarly, one of Milne's un-numbered collection from Fiji, with no specified locality, was named by Seemann (1862) as *Gmelina vitiensis* (nom. nud.). In 1866, he identified the same plant as *Vitex*, and described it as a new species *Vitex vitiensis*. Its protologue is accompanied by a coloured plate depicting a habit sketch of a flowering branch and analytical drawings of the flower. Under the description, the author has acknowledged that its truly simple leaves and unequally lobed stigma point to its relationship with *Gmelina*. Nevertheless, he transferred it from *Gmelina* to *Vitex*, and in doing so was possibly influenced by Robert Brown (1810) and F. Mueller (1862) who had earlier each erroneously described one *Gmelina* species as *Vitex*. Seemann (1866) assumed that all other characters in his new species are those of a genuine *Vitex*, and it may be that the species has compound leaves like most of its congeners. During present investigations, however, this assumption has not been confirmed, and *Vitex vitiensis* is found to be conspecific with *G. dalrympleana* (F. Muell.) H.J. Lam. It is, therefore, recorded here as a new synonym of this species. The occurrence of the genus *Gmelina* in Fiji has not been confirmed. The type of *Vitex vitiensis* Seemann, now recognized here as a *Gmelina* species, may have come from a cultivated plant. Since the publication of Seemann's Flora Vitiensis (1865-73), *Gmelina* has never been reported wild from any part of the Fijian Islands.

Moldenke (1959, 1971) regarded *G. schlechteri* as a variety of *G. dalrympleana*, but he did not record its occurrence in Australia. In the present treatment, *G. schlechteri* is reinstated to species rank.

According to Maiden (1889), the wood of this species is a useful timber for flooring boards and planking, the timber closely resembling that of *G. leichhardtii*.

In Australia, this species is popularly called "Dalrymple's White Beech", "Queensland Beech" or "long-leaved *Gmelina*". The only known record of its cultivation is in the Lae Botanical Garden in Papua New Guinea.

### *Affinities*

*G. dalrympleana* is very closely related to *G. schlechteri*. For similarities and distinguishing characters see "affinities" under the latter. *G. dalrympleana* is also related to *G. fasciculiflora* in its lamina being glabrous, non-cuneate towards the apex, corolla blue with the tube almost twice as long as the calyx. Nevertheless, *G. fasciculiflora* is readily distinguished by its lamina and calyx being without nectariferous glands, cymes in sessile clusters along the rachis; corolla-tube villous inside at the base of stamens; ovary villous at the top and fruit globular in outline.



H.J. Lam (1919) pointed out that his *G. ledermanni* "has a close resemblance with *G. dalrympleana*, but differs from it by smaller leaves which never have more than two basal glands, its narrower inflorescence, its glabrous calyx, and its yellow corolla". The mention of a "glabrous calyx" seems contrary to the "pubescent calyx" given by Lam himself in the protologue. He also pointed out, that *G. macrophylla* Wall. has "its affinity with *G. dalrympleana*, from which it differs, however, by the texture of the leaves and young parts, obtuse apex, the subequal corolla-lobes, and the yellow (not blue) corolla".

According to White & Francis (1927), their newly described *Gmelina sessilis* is also "allied to *G. dalrympleana* (FvM.) H.J. Lam and to *G. macrophylla* Wall. From the latter it differs in its narrow inflorescence, and from the former in its dense inflorescence".

### References

- Adanson, M. (1763). Familles des Plantes. Vol. 2: 195-201. (Vincent: Paris).
- Bailey, F.M. (1883). Verbenaceae. "A Synopsis of the Queensland Flora": 375-381. (Government Printer: Brisbane).
- Bailey, F.M. (1901). Verbenaceae. "The Queensland Flora". Part IV: 1164-1185. (H.J. Diddams & Co.: Brisbane).
- Bailey, F.M. (1913). Verbenaceae. "Comprehensive Catalogue of Queensland Plants": 381-387. (Government Printer: Brisbane).
- Bakhuizen van den Brink, R.C. (1929). The Verbenaceae of British Papua collected for the Arnold Arboretum by L.J. Brass. *J. Arn. Arb.* 10: 69-75.
- Bartling, F.G. (1830). "Ordines Naturales Plantarum". (Dietrich: Goettingen).
- Bentham, G. (1870). Verbenaceae. "Flora Australiensis". Vol. 5: 31-70. (L. Reeve & Co.: London).
- Bentham, G. & Hooker, J.D. (1876). Verbenaceae. "Genera Plantarum". Vol. 2: 1131-1160. (L. Reeve & Co.: London).
- Blanco, F.M. (1837). Didinamia Angiospermia. "Flora de Filipinas. Segun el Sistema Sexuale de Linneo". 484-519. (En la imprenta de Sto. Thomas por D. Candido Lopez: Manila).
- Briquet, J. (1895). Verbenaceae. In Engler, A. & Prantl, K., "Die natürlichen Pflanzenfamilien". IV, 3a: 132-182. (Wilhelm Engelmann: Leipzig).
- Brongniart, A.T. (1843). "Enumeration des genres de plantes cultivés au Muséum d'histoire naturelle de Paris". (Fortin, Masson & Co.: Paris).
- Brown, R. (1810). Verbenaceae. "Prodromus Florae Novae Hollandiae et Insulae Van-Diemen": 510-514. (Richard Taylor & Co.: London).
- Burman, N.L. (1786). Didynamia Angiospernia. "Flora Indica": 126-139. (Johannes Schreuder: Amsterdam).
- Clarke, C.B. (1885). Verbenaceae. In Hooker, J.D. "The Flora of British India". Vol. 4: 560-604. (L. Reeve & Co.: Ashford).
- Dalla Torre, C.G. & Harms, H. (1904). Verbenaceae. "Genera Siphonogamarum ad Systema Englerianum Conscripta": 429-434. (Wilhelm Engelmann: Leipzig).
- Dietrich, D.N.F. (1843). Didinamia Angiospermia. "Synopsis Plantarum". Vol. 3: 370-372, 600-620. (B.F. Voight: Weimar).
- Dumortier, B.C.J. (1829). Verbenaceae. "Analyse des Familles des Plants": 22. (J. Casterman: Tournay).
- Durand, Th. (1888). Verbenaceae. "Index Generum Phanerogamorum": 319-322. (Dulau & Co.: London).
- Endlicher, S.L. (1836). Verbenaceae. "Genera Plantarum Secundum Ordines Naturales Disposita". Vol. 1: 632-639. (Fr. Beck: Vienna).
- Endlicher, S.L. (1841). Verbenaceae. "Enchiridion Botanicum": 311-314. (Wilhelm Engelmann: Leipzig).
- Fletcher, H.R. (1938). The Siamese Verbenaceae. *Kew Bull.* 401-445.
- Francis, W.D. (1951). "Australian Rain-Forest Trees": 367-373, 454. (Forestry and Timber Bureau. Government of Australia: Sydney).
- Gaertner, J. (1788). "De Fructibus et Seminibus Plantarum". Vol. 1: 266-275. (G.H. Schramm: Tübingen).
- Gmelin, J.F. (1791). "Caroli a Linné . . . Systema Naturae" per regna tria naturae, secundum classes, ordines, genera, species . . . (G.E. Beer: Leipzig).
- Junell, S. (1934). Zur Gynäceummorphologie und Systematik der Verbenaceen und Labiaten. *Symb. Bot. Upsal.* 4: 1-219.
- Jussieu, A.L. de (1789). Vitices. "Genera Plantarum Secundum Ordines Naturalis Disposita": 106-110. (Viduum Herissant & T. Barrois: Paris).
- Jussieu, A.L. de (1806). Sur la famille des Plantes Verbenacees. *Ann. Mus. Hist. Nat. Paris* Vol. 7: 63-77.
- King, G. & Gamble, J.S. (1909). Verbenaceae. "Material for a Flora of The Malayan Peninsula". Vol. 4: 1004-1079. (W. Newman & Co.: London).
- Lam, H.J. (1919). "The Verbenaceae of the Malayan Archipelago". (M. De Waal: Groningen).
- Lemée, A. (1943). Verbenaceae. "Dictionnaire descriptif et synonymique des genres de plantes phanerogames". Vol. 8b: 650-657. (Imprimerie Commerciale et Administrative: Brest).

- Linnaeus, C. (1753). *Didymia Angiospermia*. "Species Plantarum". Edn 1, Vol. 2: 602-639. (Laurentius Salvius: Stockholm).
- Linnaeus, C. (1754). *Didymia Angiospermia*: "Genera Plantarum". Edn 5: 262-286. (Laurentius Salvius: Stockholm).
- Loureiro, J. (1793). *Didymia Angiospermia*. "Flora Cochinchinensis". Edn 2, Vol. 2: 455-478. (Haude & Spener: Berlin).
- Maiden, J.H. (1889). "The Useful Native Plants of Australia including Tasmania". (Turner & Henderson: Sydney).
- Meisner, C.F. (1840). *Verbenaceae*. "Plantarum Vascularium Genera Secundum Ordines Naturalis Digesta . . .". Vol. 1. "Tabulis Diagnosticiis": 290-292. Vol. 2 "Commentarius": 197-200. (Libraria Weidmannia: Leipzig).
- Miquel, F.A.W. (1858). *Verbenaceae*. "Flora Indiae Batavae". Vol. 2: 856-913. (C.G. von Der Post: Amsterdam).
- Moldenke, H.N. (1953). Notes on New and Noteworthy Plants. XV. *Phytologia* 4: 173-180.
- Moldenke, H.N. (1959). "A Résumé of the Verbenaceae, Avicenniaceae, Stilbaceae, Symphoremaceae, and Eriocaulaceae of the World as to valid Taxa, Geographic Distribution and Synonymy". (H.N. Moldenke: Mountainside, New Jersey).
- Moldenke, H.N. (1971). "A Fifth Summary of the Verbenaceae, Avicenniaceae, Stilbaceae, Dicrostylidaceae, Symphoremaceae, Nyctanthaceae, and Eriocaulaceae of the World as to valid Taxa, Geographic Distribution, and Synonymy". Vol. 1 & 2. (H.N. Moldenke: Wayne, New Jersey).
- Moldenke, H.N. (1980). "Phytologia Memoirs II. A Sixth Summary of the Verbenaceae, Avicenniaceae, Stilbaceae, Chloanthaceae, Symphoremaceae, Nyctanthaceae, and Eriocaulaceae of the World as to valid Taxa, Geographic Distribution and Synonymy". (H.N. Moldenke & A.L. Moldenke: Plainfield, New Jersey).
- Mueller, F.v. (1862). "Fragmenta Phytographiae Australiae". Vol. 3: 58-59 & 168. (Government Printer: Melbourne).
- Mueller, F.v. (1864). "Fragmenta Phytographiae Australiae". Vol. 4: 128-129. (Government Printer: Melbourne).
- Mueller, F.v. (1868). "Fragmenta Phytographiae Australiae". Vol. 6: 151-158. (Government Printer: Melbourne).
- Mueller, F.v. (1882). *Verbenaceae*. "Systematic Census of Australian Plants". Part 1. Vasculares: 102-103. (McCarron, Bird & Co.: Melbourne).
- Mueller, F.v. (1889). *Verbenaceae*. "Second Systematic Census of Australian Plants". Part 1. Vasculares: 171-173. (McCarron, Bird & Co.: Melbourne).
- Munir, A.A. (1982). A Taxonomic Revision of the genus *Callicarpa* L. (*Verbenaceae*) in Australia. *J. Adelaide Bot. Gard.* 6(1): 5-39.
- Munir, A.A. (1984). A Taxonomic Revision of the genus *Premna* L. (*Verbenaceae*) in Australia. *J. Adelaide Bot. Gard.* 7(1): 1-43.
- Murray, J.A. (1774). "Caroli a Linné . . . Systema Vegetabilium Secundum Classes Ordines Genera Species cum Characteribus et Differentiis". (J.C. Dietrich: Goettingen).
- Neckar, N.J. (1790). "Elementa Botanica Genera Genuina, Species Naturales Omnium Vegetabilium . . ." (Societas Typographica: Neoweda ad Rhenum).
- Persoon, C.H. (1797). "Caroli a Linné Systema Vegetabilium Secundum Classes Ordines Genera Species . . ." (J.C. Dietrich: Goettingen).
- Persoon, C.H. (1807). *Didymia Angiospermia*. "Synopsis Plantarum". Vol. 2: 138-182. (J.G. Cotta: Tübingen).
- Poiret, J.L.M. (1823). In Lamark, J.B.P.A.M. & Poiret, J.L.M. "Tableau Encyclopedique et Methodique des trois regnes de la nature. Botanique. vol. 3". (Chez Mme Ve Agasse: Paris).
- Reichard, J.J. (1778). *Didymia Angiospermia*. "Linné's Genera Plantarum". Edn 7. (Varrentrapp: Frankfurt).
- Reichenbach, H.G.L. (1828). *Labiatae*. "Conspectus Regni Vegetabilis Per Gradus Naturales Evoluti". Part 1: 115-117. (Carolus Cnobloch: Leipzig).
- Roxburgh, W. (1832). *Didymia Angiospermia*. "Flora Indica". Edn 2. Vol. 3: 1-116. (W. Thacker & Co.: Serampore, Calcutta).
- Schauer, J.C. (1847). *Verbenaceae*. In De Candolle, A., "Prodromus Systematis Naturalis Regni Vegetabilis". Vol. 11: 522-700. (Victoris Masson: Paris).
- Schreber, J.C.D. (1791). *Didymia Angiospermia*. "Caroli a Linné Genera Plantarum . . ." Edn 8: 381-431. (Warrentrapp & Wenner: Frankfurt a/M).
- Schumann, K. & Hollrung, M. (1889). *Verbenaceae*. "Die Flora von Kaiser Wilhelms Land": 118-122. (Asher & Co.: Berlin).
- Scopoli, G.A. (1777). "Introductio ad Historiam Naturalem Sistens Genera Lepidum, Plantarum et Animalium . . ." (W. Gerle: Prague).
- Seemann, B. (1862). "An Account of a Government Mission to the Vitian or Fijian Islands in the year 1860-61". (Macmillan & Co.: Cambridge).
- Seemann, B. (1865). On *Faradaya*, A New Australian Genus. *J. Bot. London*, 3: 256-259.
- Seemann, B. (1866). *Verbenaceae*. "Flora Vitiensis: A description of the Plants of the Viti or Fiji Islands with an account of their History, Uses, and Properties": 186-191. (L. Reeve & Co.: London).
- Spach, E. (1840). "Histoire Naturelle des Vegetaux Phanerogams". Vol. 9: 225-243. (Librerie Encyclopedique de Roret: Paris).
- Sprengel, K. (1825). *Didymia Angiospermia*. "Caroli a Linné Systema Vegetabilium". Edn 16, Vol. 2: 747-844. (Dietrich: Goettingen).
- Ventenat, E.P. (1799). *Pyreneaceae*. "Tableau du Règne Végétal". Vol. 2: 315-324. (Imprimerie de J. Drisonnier: Paris).

- Walpers, W.G. (1845). Verbenaceae. "Repertorium Botanices Systematicae". Vol. 4: 3-134. (Fr Hofmeister: Leipzig).
- Walpers, W.G. (1852). Verbenaceae. "Annales Botanices Systematicae". Vol. 3: 231-240. (Ambrosii Abel: Leipzig).
- White, C.T. & Francis, W.D. (1927). Plants collected in Papua by C.E. Lane-Poole. *Proc. Roy. Soc. Qld* 38: 225-261.
- Willdenow, C.L. (1800). *Didymia Angiospermia*. "Caroli a Linné Species Plantarum . . .". Edn 4, Vol. 3, Part 1: 2-403. (G.C. Nauk: Berlin).

### Acknowledgements

I would like to thank Dr J.P. Jessop for reading the manuscript and making useful suggestions; to Dr H.N. Moldenke for supplying literature and references relevant to this work; to Mrs Beth Chandler for preparing the illustrations, and Miss Barbara Welling for typing the manuscript.

Thanks are also due to the Directors/Curators of the following institutions for the loan of herbarium specimens: ADW, B, BM, BO, BR, BRI, CANB, CBG, DNA, JCT, K, L, LAE, MEL, NSW, NT, PERTH, PNH, PR, QRS, SING, SYD, Z.

### Index to Scientific Names

#### Names

New names and combinations are in **bold**. Synonyms, misapplied, misspelt, illegitimate or invalid names are in *italics*.

#### Page numbers

Page numbers in **bold** refer to the main taxonomic treatment. Page numbers asterisked refer to figures and maps.

- |   |  |
|---|--|
| CENTURIA QUARTA 91  | CALLICARPEAE 91                        |
| <i>Ephielis simplicifolia</i> 110, 113                          | :CHASMATOPHYTORUM 91                   |
| Gmelina 91, 92, 93, 94*, 97, 102, 106, 113                      | :CLERODENDREAE 91                      |
| :Bracteosae 91  | :LANTANEAE 91                          |
| :Microstromatae 91, 92  | :LIPPIEAE 91                           |
| —asiatica 91, 92, 95  | :PERSONATAR 91                         |
| —var. <i>villosa</i> 95   | :TECTONEAE 91                          |
| —dalrympleana 91, 92, 94, 98*, 106, 109, 110-114                | :VERBENEAE 91                          |
| —var. <i>schlechteri</i> 92, 106                                | :VITICEAE 91                           |
| —elliptica 91-93, 95, 96*, 97, 98*, 99, 102                     | :VITICES 91                            |
| —fasciculiflora 91, 92, 94, 98*, 102, 103, 104*, 105, 106, 113  | :VITICOIDEAE 91                        |
| —ledermanni 109, 112, 114                                       | Vitex 102, 113                         |
| —leichhardtii 91-93, 98*, 99, 100*, 102, 105, 106, 113          | — <i>dalrympleana</i> 92, 109          |
| —lepidota 102   | — <i>leichhardtii</i> 92, 109          |
| — <i>macrophylla</i> 92, 106, 109, 110, 112, 114                | —var. <i>glabrata</i> 105              |
| —schlechteri 91, 92, 94, 98*, 99, 106, 107*, 108, 109, 112, 113 | — <i>macrophylla</i> 92, 109, 112, 113 |
| —sessilis 114   | — <i>vitiensis</i> 91, 92, 110, 113    |
| — <i>villosa</i> 95   |  |
| — <i>vitiensis</i> 91, 110, 113                                 |  |
| —Premna 91  |  |
| LABIATAE 91   |  |
| :VERBENEAE 91   |  |
| PYRENACEAE 91   |  |
| <i>Radix deiparae spuria</i> 95                                 |  |
| VERBENACEAE 91, 92  |  |
| :AEGIPHILEAE 91   |  |