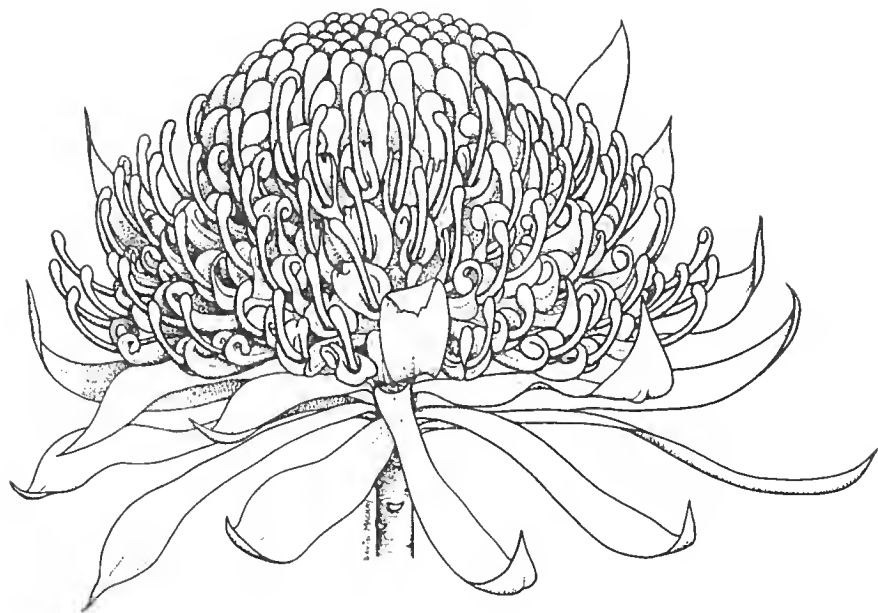


TELOPEA

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Cover illustration

The Waratah, *Telopea speciosissima* (Sm.) R. Br., belongs to the family Proteaceae. The species is endemic in eastern New South Wales and is the official State floral emblem. Illustration by David Mackay

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TELOPEA

A journal of plant systematics

CONTENTS

- Systematic studies in the eucalypts. 5. New taxa and combinations in *Eucalyptus* (Myrtaceae) in Western Australia **K.D. Hill & L.A.S. Johnson** 561
- New species, lectotypes and synonyms of Australasian *Nymphaea* (Nymphaeaceae) **S.W.L. Jacobs** 635
- New species of *Plectranthus* and *Westringia* (Labiatae) from New South Wales **Barry J. Conn** 643
- Status of the genus *Eichlerago* (Labiatae) **Barry J. Conn** 649
- New taxa and a new combination in *Triodia* (Poaceae) **S.W.L. Jacobs** 653
- Additions to the lichen flora of Tasmania **G. Kantvilas & A. Vězda** 661

TELOPEA 4(4): 561–670 MARCH 1992

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Systematic studies in the eucalypts. 5. New taxa and combinations in *Eucalyptus* (Myrtaceae) in Western Australia

K.D. Hill & L.A.S. Johnson

Abstract

Hill, K.D. & Johnson, L.A.S. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney NSW Australia 2000) 1991. *Systematic studies in the eucalypts. 5. New taxa and combinations in Eucalyptus (Myrtaceae) in Western Australia*. *Telopea* 4(4): 561–634. New taxa and combinations in *Eucalyptus* subgenus *Symphomyrtus* section *Bisectaria* from Western Australia are presented (some species occur in adjacent regions of South Australia and the Northern Territory). New species described are *Eucalyptus pruiniramis*, *E. blaxellii*, *E. vegrandis*, *E. suggrandis* (with subsp. *alipes*), *E. goniocarpa*, *E. tenera*, *E. tephroclada*, *E. depauperata*, *E. phylacis*, *E. misella*, *E. foliosa*, *E. argyphaea*, *E. recta*, *E. balanopelex*, *E. rosaceu*, *E. educta* and *E. lata*. New subspecies are recognised in *E. loxophleba* Benth. (subsp. *supralaevis* and subsp. *lissophloia*), *E. sargentii* (subsp. *fallens*), *E. angustissima* F. Muell. (subsp. *quaerenda*), *E. mannensis* Boomsma (subsp. *vespertina*), *E. goniantha* Turcz. (subsp. *notactites*), *E. kessellii* Maiden & Blakely (subsp. *eugnosta*), *E. balladoniensis* Brooker (subsp. *sedens*), *E. leptopoda* Benth. (subsp. *arctata*, subsp. *subluta* and subsp. *elevata*) and *E. websteriana* Maiden (subsp. *norsemanica*). Taxa changed in status are *E. gratiae* and *E. semiglobosa*. A new name is provided for *E. occidentalis* var. *stenantha* (*E. aspratilis*). Taxa discussed under new circumscription are *E. spathulata* Hook., *E. eremophila* (Diels) Maiden, *E. synandra* Crisp, *E. websteriana* Maiden and *E. orbifolia* F. Muell. Misapplication of the name *E. goniantha* is corrected.

Introduction

New taxa described here are a selection from many that we have defined during our current revision of the eucalypts. These are taxa occurring in Western Australia, although some have sister taxa in South Australia and the Northern Territory. Many of these taxa are treated as undescribed species or subspecies in the semi-popular account of south-western taxa by Brooker & Kleinig (1990). The new taxa discussed both here and by Brooker & Kleinig were delineated by us during a comprehensive revisionary study of the eucalypts, and were freely discussed with Ian Brooker in order to allow the treatment in Brooker & Kleinig. A number of other new species from Western and South Australia have also been formally described by other workers (Brooker & Kleinig 1990, Brooker & Hopper 1991, Brooker & collaborators, in prep.).

At this stage, *Eucalyptus* L'Hérit. will be used in the traditional sense. The species are not allocated alphabetic codes according to the system of Pryor & Johnson (1971) since these are being revised. Species are treated in the order in which they occur in the revised classification being developed from that of Pryor & Johnson.

Rare or threatened species are allocated conservation status codes according to the system of Briggs & Leigh (1988).

We are both acquainted with all the new and related taxa in the field.

Terminology

The term 'stemophore' is used throughout as a more acceptable combination of Greek elements than the Latin-Greek hybrid 'staminophore' (after Johnson & Briggs 1984).

The term 'calyptra' is used throughout in place of 'operculum' as traditionally used in *Eucalyptus*. The latter term has been used in *Eucalyptus* alone, whereas the former is the accepted term for the fused perianth structures occurring widely in Myrtaceae (Johnson & Briggs 1984, following McVaugh 1968).

Bark is described as 'persistent' in cases where it is not regularly shed, and 'smooth' when regularly shedding. The former includes 'stringybark', 'box' and 'ironbark' among other types, and the latter covers the 'gum' barks.

Nomenclature

Names of subgenera, sections, series and subseries used by us are intentionally published in a system (PJ) devised by Pryor & Johnson (1971) and external to the International Code of Botanical Nomenclature. This avoids the confusion created by formal recognition of 'series' and 'subseries' that were used by Maiden (1903–1933) in a loose and informal sense, and classifying according to particular organ sets rather than as taxa. Moreover, as explained previously by Pryor & Johnson (1971), it allows for clear application of names and categories. Since it has a perfectly clear formalism of its own, the term 'extracodical', rather than 'informal', is appropriate.

As in lists recently privately distributed to some eucalypt workers, subseries names here differ from those used by Pryor & Johnson in ending with '-osae'. This is because '-inae' previously used is a subtribal ending (International Code of Botanical Nomenclature, 1988, Art. 19.2).

Chippendale (1988) has followed the Pryor & Johnson classification, but simplified it in recognising one infrageneric rank only (series). This has lost much of the information contained within the Pryor & Johnson hierarchical system, and has also created considerable confusion at the rank of series by attempting to formalise Maiden's informal groupings.

Brooker & Kleinig (1990) follow the PJ system in almost all areas.

Subgenus *Symphyomyrtus*, section *Bisectaria*

All species included here are part of subgenus *Symphyomyrtus*, section *Bisectaria*. This is the largest section of the largest subgenus in *Eucalyptus*, and is substantially Western Australian in distribution. The section is characterised by the deeply divided cotyledons, but is otherwise highly diverse. A number of distinctive and clearly defined series are recognisable within *Bisectaria*, and will be discussed in more detail in a future publication.

One distinct group comprising two sister series has already been discussed (Series *Salubres* and *Annulatae*, Johnson & Hill 1991). Other groups will be revised by us in the future, and still others are under revision elsewhere. Species treated here are miscellaneous new taxa arising out of our revisionary studies. All taxa treated here have separate inner and outer calyptra, the outer (calycine) calyptra shedding early in bud development.

Series *Accedentes*

Species 1 is placed in series *Accedentes*, which is defined by the combination: pith glands present; filaments regularly inflexed; anthers oblong, dorsifixed, versatile; seeds shallowly pitted, dorsally compressed.

1. *Eucalyptus pruiniramis* L. Johnson & K. Hill, sp. nov.

Affinis *E. accedenti* sed characteribus sequentibus distinguitur: ramuli et alabastra etiam fructus glauci, alabastra et antherae etiam fructus majores.

TYPE: WESTERN AUSTRALIA: 2.5 km W of Midland Highway along turnoff 5.5 km N of Watheroo, K.D. Hill 370, L.A.S. Johnson, D.F. Blaxell & M.I.H. Brooker, 26 Oct 1983 (holo NSW; iso AD, BRI, CANB, MEL, PERTH).

[*Eucalyptus* sp. D of Brooker & Kleinig (1990)]

Tree to 7 m, often several-stemmed. Bark persistent on lower trunk or smooth; rough bark fibrous to ribbony, smooth bark white or grey to pinkish orange, powdery. Branchlets pruinose. Juvenile leaves disjunct early, ovate to orbicular, to 6 cm long, 6 cm wide. Adult leaves dull, grey-green, disjunct, broad-lanceolate, 8–15 cm long, 11–25 mm wide; petiole 15–25 mm long; lateral veins regular, at 40–50° to midrib. Inflorescences simple, axillary; umbellasters 7–11-flowered; peduncles flattened, 10–18 mm long, to 6 mm wide; pedicels 2–4 mm long. Buds ovoid to fusiform, glaucous, 14–17 mm long, 6–7 mm diam.; calyptra conical, about as long as hypanthium or slightly shorter. Stamens all fertile; filaments regularly inflexed; anthers oblong, dorsifixed, versatile, dehiscing through parallel slits. Style tip in pit in calyptra. Fruits 4-locular, cup-shaped to cylindrical or obconical, 10–12 mm long, 8–10 mm diam.; calyptra and stemonophore scars flat; disc depressed; valves triangular, raised, tips rim-level or exerted. Seeds ovoid, dorsiventrally compressed, grey-brown, very shallowly pitted; hilum ventral.

Distinguished from *E. accedens* W. Fitzg. by the glaucous twigs, buds and fruits, and the larger buds, anthers and fruits.

DISTRIBUTION: Known only from scattered populations in a restricted area between Arrino and Mogumber (mainly Irwin District, into Drummond and Dale Districts). Figure 1.

ECOLOGY: An uncommon small to medium tree or mallee, on rather nutrient-deficient, shallow soils over laterite or sandstone. It appears to hybridise in places with *E. accedens*, which also occurs in this area.

CONSERVATION STATUS: 2V-. Restricted and local in distribution, in an area which has suffered considerable agricultural disturbance.

The epithet is from the Latin *pruina*, rime or hoar-frost, and *ramus*, a branch, referring to the pruinose branchlets.

SELECTED SPECIMENS (from 7 examined): WESTERN AUSTRALIA (N to S): Arrino to Three Springs, Johnson W49, 11 Dec 1960 (NSW); 4.9 km N of Sykes Road, N of Mogumber, Brooker 8521, 23 Apr 1984 (CANB, NSW, PERTH).

E. accedens – *E. pruiniramis* intergrades: 7 km N of Burma Road, Brooker 8138a, 27 May 1983 (CANB, NSW, PERTH); 6.8 km SE of Arrino, Brooker 8734, 1 Nov 1984 (CANB, NSW, PERTH); 9 km NW of Three Springs, B. Briggs 7745, 7746, 7747 & Johnson, 1 Oct 1984 (NSW).

Series *Loxophlebae*

Species 2 to 4 are placed in series *Loxophlebae*, which is defined by the combination:

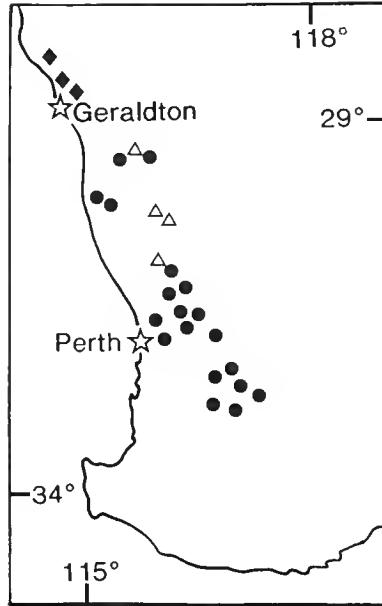


Figure 1. Distribution of *E. pruiniramis* (Δ), *E. accedens* (\bullet) and *E. blaxellii* (\blacklozenge).

pith glands present; adult leaves glossy, with small stomata; filaments regularly inflexed, geniculate; anthers small, cuboid, dorsifixed (often attached very low on connective), versatile; seeds shallowly pitted, dorsiventrally compressed.

2. *Eucalyptus blaxellii* L. Johnson & K. Hill, sp. nov.

Affinis *E. loxophlebae* sed characteribus sequentibus differt: folia juvenilia lanceolata vel late lanceolata nitentia nec glauca, venatione foliorum adultorum acuta minus irregulari. Habitus multicaulis plusminusus humilis ab eo formae sympatricae *E. loxophleba* differt.

TYPE: WESTERN AUSTRALIA: Howatharra Gap, N of Geraldton on Highway 1 (28°30' S, 114°36' E), D.F. Blaxell 1978, L.A.S. Johnson, M.I.H. Brooker & S.D. Hopper, 22 May 1983 (holo NSW; iso CANB, K, MEL, PERTH).

[*Eucalyptus* sp. 1 of Brooker & Kleinig (1990)]

Mallee to 3 m. Bark smooth, olive-brown to bronze. Juvenile leaves disjunct, semi-glossy to glossy, green, lanceolate to broad-lanceolate. Adult leaves disjunct, narrow-lanceolate, acuminate, glossy, 6–9 cm long, 7–16 mm wide; petioles 5–9 mm long; lateral veins moderately spaced, at 20–40° to midrib, irregular and partly broken, secondary reticulum irregular and broken; intramarginal vein distinct, 1.0–1.5 mm from margin. Inflorescences simple, axillary, umbellasters 7-flowered; peduncles terete or slightly angular, 3–6 mm long; pedicels slightly angular, 1–3 mm long. Mature buds ovoid-cylindrical, 7–8 mm long, 3–4 mm diam.; calyptra hemispherical, hypanthium 2–3 times longer than calyptra; filaments regularly inflexed, constricted (geniculate) at point of flexure; style constricted at base. Fruits cup-shaped to conical, 5–6 mm long, 4–6 mm diam., 4–5-locular; calyptra scar flat, c. 0.5 mm wide; disc vertically depressed, 1.0–1.5 mm wide; valves triangular, enclosed, held \pm horizontally. Seeds elliptic, grey-

brown, shallowly reticulate, c. 1.5 mm long; hilum ventral; chaff smaller, paler. Figure 2.

This taxon is nearest the *E. loxophleba* group of taxa (including *E. gratiae*, discussed below). It is distinguished from that group by the lanceolate to broad-lanceolate, green juvenile leaves, the absence of pruinosity, the acute, not strongly irregular venation, and the mostly simple, axillary inflorescences.

DISTRIBUTION: Known from two or three small populations in the Howatharra Gap area and north-east along the Moresby Range, from Geraldton to north of Northampton (Irwin District). Figure 1.

ECOLOGY: *E. blaxellii* occurs around breakaways in low sandstone hills, growing in mallee heath with a wide variety of scleromorphic shrub species.

CONSERVATION STATUS: 2E (*Eucalyptus* sp. 22, Briggs & Leigh 1988, p. 119).

The specific epithet honours our colleague Donald F. Blaxell, Assistant Director (Living Collections) at the Royal Botanic Gardens, Sydney, who first noted the distinctive nature of this species in the course of his extensive field studies of the eucalypts.

SELECTED SPECIMENS (from 16 examined): WESTERN AUSTRALIA (N to S): Rob Road, 0.4 km W of Pt Gregory road, *Brooker* 9277, 8 May 1986 (CANB, NSW, PERTH); Nanson Road, *Brooker* 9193, 12 Mar 1985 (CANB, NSW, PERTH); 9 miles [14 km] NE of Geraldton on Yuna road, *Chippendale* 320, 16 Mar 1968 (CANB, NSW).

3. *Eucalyptus loxophleba* Benth., Fl. Austral. 3: 252 (1867).

TYPE CITATION: 'W. Australia. Swan River and Darling range, Collie; Drummond, 2nd Coll. n. 82; York district, Preiss, n.246 (and 248?); Murchison river and Champion Bay, 'York Gum', Oldfield.'

TYPE: WESTERN AUSTRALIA: Swan River Colony, *J. Drummond*, 2nd collection, no. 82, 1843 (lecto K; isolecto BM, CGE, E, G, NSW, W). A fragment in NSW, which was a part of the K specimen, is annotated in Maiden's handwriting 'Drummond's 82 is the type.' This collection is here designated the lectotype.

≡ *E. foecunda* Schauer var. *loxophleba* (Benth.) Luehm. ex Maiden, Crit. Revis. *Eucalyptus* 1: 112, pl. 23, figs. 1–3; pl. 24 (1904).

Regarded as a variety of *E. foecunda* by Luehmann (1898) and Maiden (Crit. Revis. *Eucalyptus* 1: 112 (1904)), but again recognised as a species by Blakely (1934).

Tree to 15 m or mallee to 8 m. *Bark* persistent to smaller branches or partly smooth, rough bark grey, shortly fibrous-flaky, smooth bark brownish, yellow-brown or greenish, smaller twigs glaucous. *Juvenile leaves* petiolate, ovate to orbicular, acute to rounded, dull, bluish, 8–13 cm long, 5–9 cm wide. *Adult leaves* glossy, lanceolate to broad-lanceolate, falcate, acute, 6–14 cm long, 10–25 mm wide; petioles 10–18 mm long; lateral veins at 10–30° to midrib and highly irregular. *Umbellasters* axillary, 7-flowered or often more, often clustered at leafless ends of small branches; peduncles 2-angled, 3–24 mm long; pedicels grooved, 2–5 mm long. *Mature buds* obovoid, 6–10 mm long, 3–4 mm diam.; calyptra shorter than hypanthium, hemispherical, rarely apiculate; filaments regularly inflexed, constricted (geniculate) at point of flexure; style constricted at base. *Fruits* conical, sometimes vaguely angular, 3–4-locular, 4–9 mm long, 4–6 mm diam.; disc narrow, flat; valves deeply sunken. *Seeds* dull, dark brown, cuboid, to 1 mm long; chaff similar, thinner, or linear, to 4 mm long.

Distinguished within the series by the combination: juvenile leaves ovate to orbicular, dull, bluish; adult leaves lanceolate to broad-lanceolate, glossy, venation acute, highly irregular; inflorescences aggregated onto short, leafless shoots.

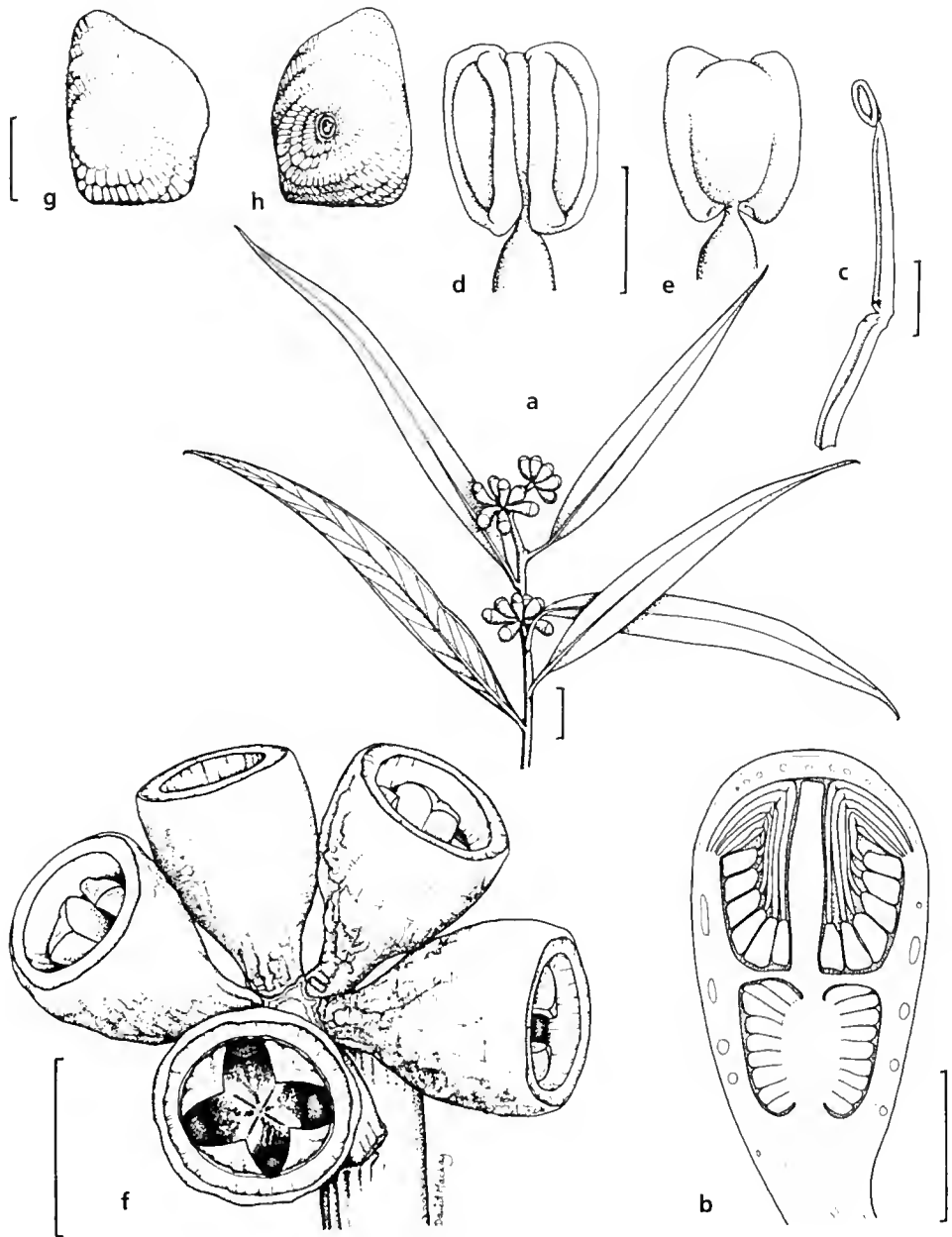


Figure 2. *E. blaxellii*. a, adult leaves and buds; b, section of bud; c, filament showing flexure; d, e, anther; f, fruits; g, h, seed (all from Blaxell 1978). Scale bar: a = 1 cm; f = 5 mm; b = 2 mm; c = 1 mm; d, e, g, h = 0.5 mm.

Three geographic subspecies may be recognised within this taxon.

- 1 Tree; bark persistent at least on lower trunk
- 2 Bark persistent to small branches 3a. subsp. *loxophleba*
- 2* Bark smooth on larger branches and often upper trunk 3b. subsp. *supralaevis*
- 1* Mallee; bark wholly smooth 3c. subsp. *lissophloia*

3a. *Eucalyptus loxophleba* Benth. subsp. *loxophleba*

[*E. amygdalina* Schauer in Lehm., Pl. Preiss. 1: 130 (1844); non Labill., Nov. Holl. Pl. 2: 14 (1806). Based on *Preiss* 246 & 248 from York, which were included in *E. loxophleba* by Bentham (1867: 254).]

Tree to 15 m. *Bark* persistent to smaller branches, grey, fibrous-flaky; smaller twigs not or very slightly glaucous. *Juvenile leaves* petiolate, ovate to orbicular, acute to rounded, dull, bluish, to 12 cm long, 5 cm wide. *Adult leaves* glossy, lanceolate, falcate, acute, 6–10 cm long, 10–25 mm wide. *Peduncles* 2-angled, 7–12 mm long; pedicels grooved, 2–5 mm long. *Mature buds* obovoid, c. 6 mm long, c. 4 mm diam. *Fruits* conical, 4-locular, 6–8 mm long, 4–6 mm diam.

Distinguished by the combination: tree habit; bark persistent to smaller branches; twigs not or scarcely glaucous. Fruits are relatively small within the species.

DISTRIBUTION: A species of the Wheat Belt, from around Moora to Bruce Rock, south-east to around Chillinup on the Pallinup River (Avon, Dale, Roe and Eyre Districts). Figure 3.

ECOLOGY: A common tree of the higher rainfall and higher-nutrient soils of the wetter western parts of the Wheat Belt.

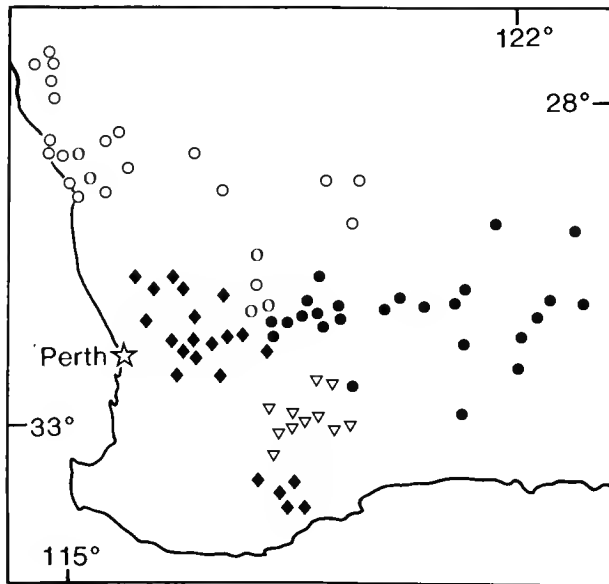


Figure 3. Distribution of *E. loxophleba* subsp. *loxophleba* (◆), subsp. *supralaevis* (○), subsp. *lissophloia* (●) and *E. gratae* (▽).

Intergrades occur with subsp. *supralaevis* where the ranges join, and hybrids are recorded with *E. erythronema* Turcz. (sens. lat.), *E. spathulata*, *E. vegrandis* and *E. wandoo* Blakely.

CONSERVATION STATUS: Not considered to be at risk.

SELECTED SPECIMENS (from 47 examined): WESTERN AUSTRALIA: 7 miles [11 km] NW of Wongan Hills, *Tindale* 2795, 24 Aug 1973 (NSW, CANB, PERTH); 0.9 km W of Highway 95 on Gin Gin road, *Hill* 2963, 30 Aug 1988 (NSW); Bindoon, *Johnson* W 7, 9 Dec 1960 (NSW); near Northam, *Morrison*, Aug 1959 (NSW); near York, *Diels* 2914, 24 May 1901 (B, NSW); 67 km ESE of Perth on Brookton road, *Blaxell* W75/4, 2 Oct 1975 (NSW); Cowcowing, *Koch* 1094, Sep 1904 (NSW); Cunderdin, *Beadle* 105, 25 Oct 1972 (NSW); Meares Lake, c. 10 miles [16 km] E of County Peak, Beverley, *St Barbe Moore per Sargent* 706, Oct 1910 (NSW); 4 km NW of Ongerup, on Newbey's property, *Hill* 336, *Johnson & Blaxell*, 23 Oct 1983 (NSW); 1 km N of Chillinup, *B. Briggs* 7879 & *Johnson*, 11 Oct 1984 (NSW).

Intergrades between subsp. *loxophleba* and subsp. *supralaevis*: WESTERN AUSTRALIA: 10–15 km SW of Three Springs on Eneabba road, *Foreman* 539, 4 Sep 1984 (MEL, AD, CANB, NSW, PERTH); 28.6 miles [45.8 km] W of Watheroo, *Chippendale* 26, 18 Oct 1966 (CANB, NSW).

E. erythronema (sens. lat.) x *E. loxophleba* subsp. *loxophleba*: North Bungulla Nature Reserve, *Brooker* 9729, 23 July 1987 (CANB, NSW, PERTH).

E. loxophleba subsp. *loxophleba* x *E. spathulata*: 0.5 km W of Eldridge St on main road, Ongerup, *Brooker* 9638, 18 May 1987 (CANB, NSW, PERTH).

E. loxophleba subsp. *loxophleba* x *E. vegrandis*: 4 km NW of Ongerup, *Hill* 334, *Johnson & Blaxell*, 23 Oct 1983 (NSW).

E. loxophleba subsp. *loxophleba* x *E. wandoo* subsp. *pulverea*: S of Eneabba Nat. Res., *Hopper & Brooker* 10084, 20 Sep 1988 (CANB, NSW, PERTH); c. 7 miles [11 km] N of Watheroo, *Johnson* W 22, 9 Dec 1960 (NSW).

E. loxophleba subsp. *loxophleba* x *E. wandoo* subsp. *wandoo*: 5.6 km from Irishtown Hall on Dumbarton road, *Brooker* 9585, 23 Apr 1987 (CANB, NSW, PERTH); Clackline, *Brooker* 9586, 23 Apr 1987 (CANB, NSW, PERTH).

3b. *Eucalyptus loxophleba* Benth. subsp. *supralaevis* L. *Johnson & K. Hill*, sp. nov.

Inter subspecies *E. loxophlebae* combinatione sequenti caracteribus distinguitur: habitus arborescens; cortex ramorum laevis; ramuli plusminusve pruinosi; pedicelli graciles, mediocres vel longi; ovarium 3–4-loculare.

TYPE: WESTERN AUSTRALIA: 16.6 km W of highway on fence line 57.7 km N of Murchison River, *K.D. Hill* 2569, *L.A.S. Johnson*, *D.F. Blaxell & M.I.H. Brooker*, 21 Nov 1986 (holo NSW; iso CANB, CBG, MEL, PERTH).

≡ *E. loxophleba* Benth. var. *fruticosa* Benth., Fl. Austral. 3: 252 (1867).

TYPE CITATION: 'Murchison river, Oldfield; Salt river, Maxwell.'

TYPE: WESTERN AUSTRALIA: Murchison River, *A. Oldfield* (lecto NSW; isolecto K, MEL; here designated). This specimen is designated the lectotype in order to fix this name to this taxon, the original syntypes representing two different subspecies (the Maxwell collection is subsp. *loxophleba*). This variety was included in *E. foecunda* var. *loxophleba* by Maiden (Crit. Revis. *Eucalyptus* 1: 112 (1904)), recognised as a variety by Blakely (1934), and included in *E. loxophleba* by Hall & Johnston (1964).

Tree to 15 m. *Bark* persistent to around top of trunk, grey, fibrous-flaky; branches smooth, smaller twigs glaucous. *Juvenile leaves* petiolate, ovate to orbicular, acute to rounded, dull, bluish, to 12 cm long, 5 cm wide. *Adult leaves* glossy, lanceolate, falcate, acute, 6–10 cm long, 10–25 mm wide; petioles 10–18 mm long; lateral veins at 10–30°

to midrib. *Peduncles* 2-angled, 7–12 mm long; pedicels grooved, 2–5 mm long. *Mature buds* obovoid, c. 6 mm long, c. 4 mm wide. *Fruits* conical, 3–4-locular, 6–8 mm long, 4–6 mm diam.

Distinguished by the combination of tree habit and the smooth bark from the top of the trunk. The twigs are variably glaucous, but usually distinctly so. Pedicels are slender and medium to long, and the ovary is 3–4-locular (tending to 3-locular in the north of the range).

DISTRIBUTION: Widespread and common across the north of the range of the species, from the region between north of the Murchison River (27°S) and around Dongara on the coast east to Lake Barlee and the Die Hardy Range, and south to Wongan Hills and Kunoppin (Irwin, Avon, Austin and Coolgardie Districts). Figure 3.

ECOLOGY: Locally abundant on deeper, loamy, often red soils on flat sites.

CONSERVATION STATUS: Widespread, not considered to be at risk.

The epithet is derived from Latin *supra*, above, and late Latin *laevis* (classically *levis*), smooth, in reference to the partly deciduous bark leaving the branches and sometimes the upper trunk smooth.

SELECTED SPECIMENS (from 40 examined): WESTERN AUSTRALIA: 34 km S of Wannoo, *Blaxell W75/109 & Brooker*, 9 Oct 1975 (NSW, CANB); 6 miles [10 km] E of Pindar, *Beard 6680*, 26 Sep 1973 (PERTH, NSW); 27.6 km N of Burnerbinmah turnoff on Paynes Find – Yalgoo road, *Hill 2582 & Johnson*, 24 Nov 1986 (NSW, CANB, CBG, MEL, PERTH); 4 miles [6 km] E of Geraldton, *Chippendale 239*, 8 Aug 1967 (CANB, NSW); near Mingenew, *Diels 3037*, 9 June 1901 (B, NSW); Dongara, *Maiden*, Oct 1909 (NSW); summit of Mt Singleton, *Hill 2591 & Johnson*, 24 Nov 1986 (NSW, PERTH); Cliff Head turnoff on Brand Highway, *Brooker 8633*, 28 Aug 1984 (CANB, NSW, PERTH); between Beacon and Mt Churchman, *Brooker 8495*, 16 Mar 1984 (CANB, NSW, PERTH); 31.6 km S of Diemals–Menzies road on Bullfinch road, *Hill 2613 & Johnson*, 25 Nov 1986 (NSW, PERTH); 3 km E of Kununoppin, *Hill 2500, Johnson & Blaxell*, 16 Nov 1986 (NSW, PERTH).

3c. *Eucalyptus loxophleba* Benth. subsp. *lissophloia* L. Johnson & K. Hill, subsp. nov.

Inter subspecies *E. loxophlebae* habitu pluricauli, cortice deciduo, ramulis plerumque valde pruinosis distinguitur. Ab subspecie *loxophleba* alabastris fructibusque majores differt.

TYPE: WESTERN AUSTRALIA: Cardunia Rocks, *D.F. Blaxell 1749 & L.D. Pryor*, 16 Sep 1978 (holo NSW; iso CANB, K, PERTH).

Mallee to 8 m. *Bark* smooth, brownish, yellow-brown or greenish to bronze, smaller twigs glaucous. *Juvenile leaves* petiolate, ovate to orbicular, acute to rounded, dull, bluish, to 12 cm long, 9 cm wide. *Adult leaves* glossy, lanceolate, falcate, acute, 8–14 cm long, 10–15 mm wide; petioles 10–18 mm long; lateral veins at 10–30° to midrib. *Peduncles* 2-angled, 8–18 mm long; pedicels grooved, 2–5 mm long. *Mature buds* obovoid, 6–10 mm long, 3–4 mm wide. *Fruits* cup-shaped to conical, 4-locular, 6–9 mm long, 4–6 mm diam. Figure 4.

Distinguished by the mallee habit, the mostly or entirely smooth bark, and the usually strongly glaucous branchlets. Buds and fruits are larger than those of subsp. *loxophleba*.

Subsp. 'smooth bark' of Brooker & Kleinig (1990).

DISTRIBUTION: Locally abundant through the inland southwest of Western Australia, from around Bencubbin and west of Merredin east to south of Lake Minigwal and Coonana, and south to Peak Charles (Avon, Roe, Coolgardie and southern Austin districts). Figure 3.

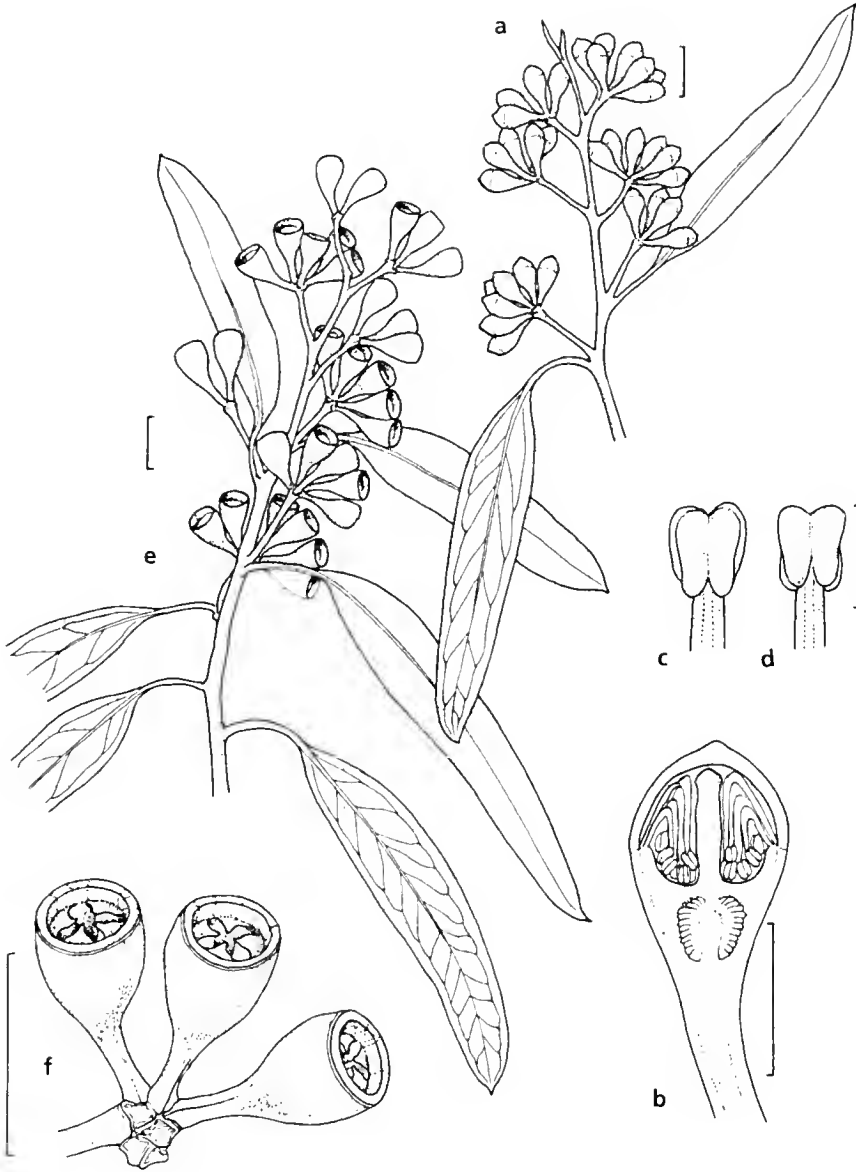


Figure 4. *E. loxophleba* subsp. *lissophloia*. **a**, adult leaves and buds; **b**, section of bud; **c**, **d**, anther; **e**, adult leaves and fruits; **f**, fruits (all from Blaxell 1749). Scale bar: **a**, **e**, **f** = 1 cm; **b** = 5 mm; **c**, **d** = 1 mm.

ECOLOGY: A widely distributed taxon, occurring with a variety of mallee species on sandy soils, especially where these are shallow and overlie granitic rocks. Subspecies *lissophloia* does not appear to intergrade with subspecies *loxophleba* or with subspecies *supralaevis* to any great extent.

Hybrids are known with *E. kruseana* F. Muell. This hybrid was named *E. brachyphylla* C. Gardner, though it was regarded as a distinct species by its author. It was also treated as such by Chippendale (1988). Field observations show a full range of variation between the parent species, and progeny trials show segregation between the parents (Pryor & Blaxell, pers. comm. & in prep.). Limited intergradation also occurs between *E. loxophleba* subsp. *lissophloia* and *E. gratiae* (Brooker) L. Johnson & K. Hill.

CONSERVATION STATUS: Not considered to be at risk.

The epithet is from the Greek *lissos*, smooth, and *phloios*, bark of tree, in reference to the distinctive smooth bark of this subspecies.

SELECTED SPECIMENS (from 38 examined): WESTERN AUSTRALIA: 3 miles [5 km] SW of Merredin, Chippendale 80, 6 Mar 1967 (CANB, NSW); 6.4 km N of Southern Cross, Brooker 6475, 24 Aug 1979 (CANB, NSW, PERTH); 61 km W of Coolgardie on Southern Cross road, Brooker 5665, 6 Apr 1977 (CANB, NSW, PERTH); E side of Peak Charles, Hill 2331, Johnson & Blaxell, 8 Nov 1986 (NSW, PERTH); 55.8 km E of highway in Goongarrie Reserve, Brooker 9091, 13 Nov 1985 (CANB, NSW, PERTH); 26.7 km E of Norseman on highway, Hill 677A & Blaxell, 14 Nov 1983 (NSW, CANB, PERTH); 51.7 km E of Karonie, Hill 567, Johnson, Blaxell, Brooker & Hopper, 5 Nov 1983 (NSW, CANB, PERTH).

E. kruseana x *E. loxophleba* subsp. *lissophloia*: c. 40 km E of Widgiemooltha on road to 'Binnerinjie' homestead, Blaxell 1662, 21 June 1978 (NSW); Cardunia Rocks, Blaxell 1654 & Pryor, 20 June 1978 (NSW).

E. gratiae x *E. loxophleba* subsp. *lissophloia*: cited under *E. gratiae*.

4. *Eucalyptus gratiae* (Brooker) L. Johnson & K. Hill, comb. nov.

BASIONYM: *Eucalyptus loxophleba* Benth. subsp. *gratae* Brooker, Nuytsia 1: 248 (1972).

TYPE CITATION: 'Type: 0.5 mile west of Burngup, Western Australia (33°01'S, 118°41'E), 3 Nov. 1969, M.I.H. Brooker 2273 (holo: PERTH).'

Mallee to 8 m. Bark smooth, brownish, yellow-brown or greenish to bronze, smaller twigs glaucous. Juvenile leaves petiolate, ovate to orbicular, acute to rounded, dull, bluish, 8–13 cm long, 5–9 cm wide. Adult leaves glossy, lanceolate, falcate, acute, 8–16 cm long, 15–28 mm wide; petioles 10–18 mm long; lateral veins at 10–30° to midrib. Umbellasters axillary, 7-flowered, often clustered at leafless ends of small branches; peduncles 2-angled, 3–24 mm long; pedicels grooved, 2–5 mm long. Mature buds obovoid, 9–15 mm long, 4–5 mm diam.; calyptra shorter than hypanthium, hemispherical, rarely apiculate. Fruits conical, 4–5-locular, 9–12 mm long, 6–9 mm diam.; disc narrow, flat; valves deeply sunken. Seeds dull, dark brown, cuboid, to 1.5 mm long; chaff similar, thinner, or linear, to 4 mm long.

Distinguished by the mallee habit, the smooth bark, the glaucous branchlets, and the large buds and fruits. *E. gratiae* is in part broadly sympatric with *E. loxophleba* subsp. *loxophleba*, occupying sites with poorer or shallower soils. The two do not appear to interbreed, although limited intergradation occurs with *E. loxophleba* subsp. *lissophloia* where ranges adjoin. *E. gratiae* is also morphologically more distinct from the subspecies of *E. loxophleba* than these are from each other, and is hence raised to specific rank.

DISTRIBUTION: Locally abundant in the south-eastern Wheat Belt, around the area including Pingrup, Lake Grace, Hyden and Newdegate (Roe District). Figure 3.

ECOLOGY: Largely restricted to mallee shrublands on less fertile soils, often on lower areas or shallow soils.

CONSERVATION STATUS: Not considered to be at risk.

SELECTED SPECIMENS (from 14 examined): WESTERN AUSTRALIA (W to E): 5.6 km N of Nyabing towards Kukerin, *Brooker* 9142, 9 Dec 1985 (CANB, NSW, PERTH); 14 km N of Lake Grace township, *Hill* 327, *Johnson & Blaxell*, 23 Oct 1983 (NSW, CANB, PERTH); 15 km E of Hyden on Lake King road, *Brooker* 6322, 12 Aug 1979 (CANB, NSW, PERTH); 4.1 km N of Giles Road on Magenta Road, *Hill* 3142, 7 Sep 1988 (NSW); 15.5 miles [25 km] W of Lake King township, *Chippendale* 224, 17 Mar 1967 (CANB, NSW).

E. gratiae x *E. loxophleba* subsp. *lissophloia*: Dragon Rock, *Hill* 2473, *Johnson & Blaxell*, 14 Nov 1986 (NSW, PERTH).

Series *Astringentes*

Species 5 and 6 are placed in series *Astringentes*, which is defined by the combination: pith glands present; adult leaves glossy, green, with small stomata; filaments erect; anthers oblong, dorsifixed, versatile; stemonophore narrow; seeds shallowly pitted, dorsiventrally compressed. The extracodical series epithet *Astringentes* (referring to the included species *E. astringens* (Maiden) Maiden) is here substituted for 'Occidentales' as used by Pryor & Johnson (1971), to preserve the independence of the extracodical system by avoiding confusion with Ser. *Occidentales* Blakely (used by Chippendale, 1988), which includes a quite different group of species of subgenus *Eucalyptus* ('Monocalyptus'). The extracodical epithet *Occidentales* for the subseries including *E. occidentalis* can remain.

5. *Eucalyptus aspratilis* L. *Johnson & K. Hill*, nom. et stat. nov.

≡ *Eucalyptus occidentalis* Endl. var. *stenantha* Diels ex Blakely, Key Eucalypts: 110 (1934).

TYPE CITATION: 'W.A. – Lake Cowan.'

TYPE: WESTERN AUSTRALIA: near Lake Cowan, *Diels* 5245, 1 Nov 1901 (holo NSW).

[*E. occidentalis* Endl. var. *stenantha* Diels ex Maiden, Crit. Revis. Eucalyptus 4: 147 (1919), nom. prov.]

≡ *E. occidentalis* Endl. var. *grandiflora* Maiden, Crit. Revis. Eucalyptus 4: 149 (1919).

TYPE CITATION: 'Kurrawang, W.A. (Dr. J.B. Cleland.) Type of var. *grandiflora*' (legend to pl. 150).

TYPE: WESTERN AUSTRALIA: Kurrawang, *J.B. Cleland* 8161/15, Sep 1915 (holo: NSW).

≡ *E. cremophila* (Diels) Maiden var. *grandiflora* Maiden, Crit. Revis. Eucalyptus 7: 22 (1923).

Mallee to 5 m. Bark usually persistent on trunk, fibrous-scaly and shaggy; smooth above, grey and light brown. Adult leaves disjunct, lanceolate to ovate-lanceolate, acuminate, 5–12 cm long, 10–30 mm wide; petioles 9–22 mm long, slightly flattened; lateral veins indistinct, well-spaced, at 20–60° to midrib, irregularly branched; intra-marginal vein indistinct. Umbellasters axillary, 7-flowered; peduncles 2-angled or somewhat flattened apically, 1.6–2.3 cm long, to 4 mm wide, often reflexed; pedicels angled, 6–11 mm long. Mature buds 25–33 mm long, 5–6 mm diam.; calyptra cylindrical, obtuse, slightly flared at base, narrower than hypanthium, 2–3 times longer than hypanthium. Fruits elongate, cup-shaped or pyriform, 4- or 5-locular; hypanthium

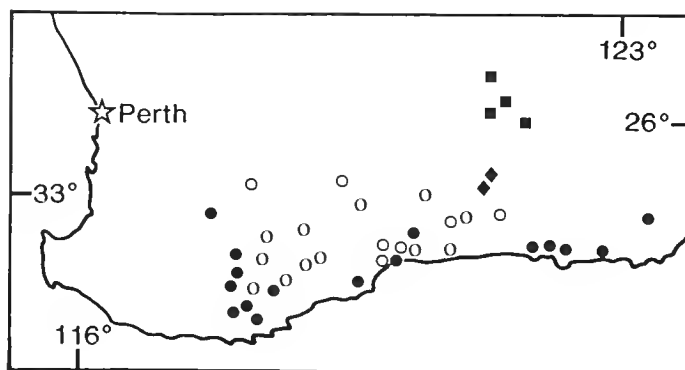


Figure 5. Distribution of *E. occidentalis* (●), *E. species F* (○), *E. aspratilis* (■) and *E. aspratilis* – *E. species F* intergrades (◆).

11–14 mm long, 8–10 mm wide; calyptra scar c. 1 mm wide, appearing continuous with disc; disc broad, initially slightly raised, ultimately strongly incurved for more than half its width, and enclosing valve bases; valves narrowly triangular, vertically exerted, strongly acuminate. *Seeds* dark brown, satiny, angular, cuboid, to 2 mm long; chaff dull, brown, either cuboid, to 1 mm long, or linear, to 4 mm long.

Distinguished within the series *Occidentales* by the mallee habit and the persistent bark on the trunk. Anthers are relatively large in comparison with those of related species.

DISTRIBUTION: An uncommon species in the region south from around Coolgardie to east of Norseman (Coolgardie District). Figure 5. A disjunct population around Peak Charles is intermediate between this taxon and *E. species F* of Brooker & Kleinig (1990).

ECOLOGY: Restricted to mallee heath communities on shallow sandy soils around granite domes.

CONSERVATION STATUS: 3R-. Although widely scattered, *E. aspratilis* is restricted to a very narrow habitat range.

The epithet is from the Latin *aspratilis*, rough, referring to the persistent bark, in contrast to that of the related *E. species F*.

SELECTED SPECIMENS (from 7 examined): WESTERN AUSTRALIA (N to S): Twenty-five Mile Rocks, Brooker 8902, 7 Apr 1985 (CANB, NSW, PERTH); Burra Rock, Hill 2636 & Johnson, 26 Nov 1986 (NSW, PERTH); 52.5 km W of Coolgardie–Norseman road on Hyden track, Hill 2854, 25 Aug 1988 (NSW).

E. aspratilis – *E. species F* intergrade: E side of Peak Charles, Hill 2333, Johnson & Blaxell, 8 Nov 1986 (NSW, PERTH).

6. *Eucalyptus sargentii* Maiden, Crit. Revis. *Eucalyptus* 7: 58 (1924).

TYPE CITATION: 'Type – Meare's Lake, County Peak, Beverley, Western Australia, O.H. Sargent. No. 707.'

TYPE: holo NSW; iso CANB.

Tree to 12 m or mallee. *Bark* usually persistent on lower of trunk, dark grey to black,

coarsely platy-fibrous, smooth above, semiglossy grey, olive, red-brown or bronze. *Juvenile leaves* subsessile, opposite and lanceolate for 3–4 nodes, then becoming disjunct, linear, to 7 cm long, 3 mm wide. *Adult leaves* narrow-lanceolate, 5–10 cm long, 5–13 mm wide; petioles 8–14 mm long; lateral veins moderately spaced, at 20–40° to midrib; oil glands densely packed, spherical. *Inflorescences* simple, axillary; umbellasters 7-flowered; peduncles 6–22 mm long; pedicels 3–8 mm long. *Buds* cylindrical, 16–30 mm long, 4–7 mm diam.; calyptra 3 or more times longer than hypanthium, elongate-conical, acuminate. *Stamens* all fertile; filaments erect in bud; anthers oblong, dorsifixed, versatile, dehiscing through parallel slits. *Fruits* cylindrical, usually wider at apex, to obconical, 7–12 mm long, 5–9 mm diam.; stemonophore persistent, flat; disc flat, depressed towards centre; valves erect, acicular, basally enclosed, apically exerted. *Seeds* brown to red-brown, satiny, ovoid, shallowly regularly reticulate; chaff dull.

Two geographic subspecies are recognised.

1 Buds less than 24 mm long; fruits 8 mm or less diam. 6a. subsp. *sargentii*

1* Buds more than 24 mm long; fruits 8 mm or more diam. 6b. subsp. *fallens*

6a. *Eucalyptus sargentii* Maiden subsp. *sargentii*

Tree to 12 m, rarely a mallee. *Bark* persistent on lower trunk. *Adult leaves* narrow-lanceolate, 6–10 cm long, 5–13 mm wide; petioles 8–12 mm long. *Peduncles* 6–22 mm long; pedicels 3–5 mm long. *Buds* cylindrical, 16–23 mm long, 4–5 mm diam. *Fruits* cylindrical to obconical, 7–10 mm long, 5–8 mm diam.

DISTRIBUTION: From Coorow to Lake Meares, east to Lake Hurlstone (Avon and Roe Districts). Figure 6.

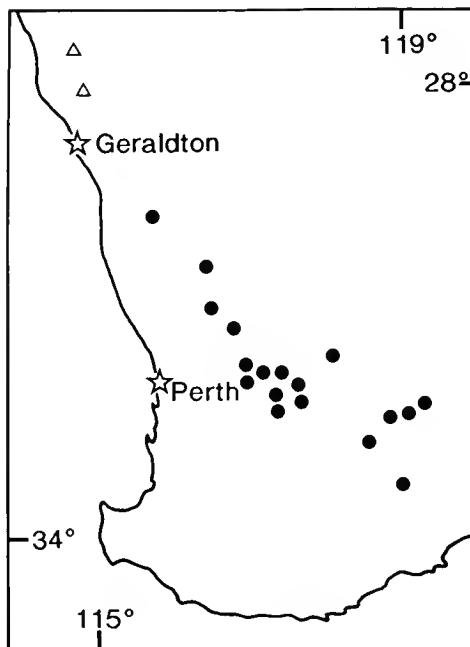


Figure 6. Distribution of *E. sargentii* subsp. *sargentii* (●) and subsp. *fallens* (△).

ECOLOGY: Sporadically distributed but locally abundant in highly saline situations bordering salt lakes and swamps.

CONSERVATION STATUS: Not considered to be at risk.

SELECTED SPECIMENS (from 27 examined): WESTERN AUSTRALIA (W to E): Woollberoo, ESE of Coorow, *Brooker 9058*, 3 Nov 1985 (CANB, NSW, PERTH); 11.8 km E of rail crossing at Carani, *Brooker 7582*, 26 Aug 1982 (CANB, NSW, PERTH); 1.0 km W of Kauring rail crossing on York road, *Hill 2965m* 30 Aug 1988 (NSW); 8 miles [c. 12 km] SSE of Dangin, *Johnson W117*, 14 Dec 1960 (NSW); saltflats near Quairading, *Blaxell W75/80 & Brooker*, 4 Oct 1975 (NSW, CANB, K, PERTH); 7.9 km W of Pingaring, *Brooker 9478*, 21 Oct 1986 (CANB, NSW, PERTH); 12.1 km N of Ryans Road on Lockhart Road, *Hill 3140*, 7 Sep 1988 (NSW); 2.3 km E of Ravensthorpe road on Holland track, *Hill 2475, Johnson & Blaxell*, 14 Nov 1986 (NSW, CANB, CBG, MEL, PERTH).

6b. *Eucalyptus sargentii* Maiden subsp. *fallens* L. Johnson & K. Hill, subsp. nov.

Ab subspecie *sargentii* alabastris fructibusque majoribus distinguitur.

TYPE: WESTERN AUSTRALIA: 3 km N of Binu on Highway 1, *K.D. Hill 2565, L.A.S. Johnson, D.F. Blaxell & M.I.H. Brooker*, 21 Nov 1986 (holo NSW; iso PERTH).

Tree to 6 m or mallee. *Bark* persistent on base of trunk in larger individuals only. *Adult leaves* narrow-lanceolate, 5–8 cm long, 6–12 mm wide; petioles 9–14 mm long. *Peduncles* 12–16 mm long; pedicels 4–8 mm long. *Buds* cylindrical, 25–30 mm long, 6–7 mm diam. *Fruits* cylindrical to obconical, 10–12 mm long, 8–9 mm diam. Figure 7.

Distinguished from subsp. *sargentii* by the larger buds and fruits (buds 16–23 mm long, 4–5 mm diam., fruits 7–10 mm long, 5–8 mm diam. in *E. sargentii*). Anthers in the Binu population are larger than those of subsp. *sargentii*.

DISTRIBUTION: Known from two populations, near Binu, and about 60 km north of there on Eurardy Station (Irwin District). Figure 6.

ECOLOGY: Restricted to somewhat saline soils around salty swamps or creek lines.

No intergrades occur with the more southerly *E. sargentii*, which, though somewhat variable in size of its parts, does not exhibit any widespread clinal approach to subsp. *fallens*.

CONSERVATION STATUS: 2R-.

The epithet is from the Latin *fallens*, in its sense of 'deceiving', since on its earlier observations it was mistaken for a species of the *E. eremophila* group.

SELECTED SPECIMENS (from 5 examined): WESTERN AUSTRALIA: Bungabandi Creek, *Brooker 9471*, 9 Oct 1986 (CANB, NSW, PERTH); 3 km N of Binu, *Brooker 9063*, 4 Nov 1985 (CANB, NSW, PERTH).

Series *Erythronemae*

Together with others to be described elsewhere, species 7 to 14 are placed in series *Erythronemae* subseries *Platypodosae*, defined by the combination: pith glands present; stomata large, translucent; filaments erect well before maturity of the bud; anthers oblong, dorsifixed, versatile; stemophore broad; seeds distinctly reticulately pitted, dorsiventrally compressed.

7. *Eucalyptus spathulata* Hook., Hooker's Icon. Pl. 7: t. 611 (1844).

TYPE CITATION: 'Hab. Swan River. Jas. Drummond, (Suppl. Coll. n. 20).'

TYPE: WESTERN AUSTRALIA: Swan River Colony, *J. Drummond, supplementary collection, no. 20* (holo K).

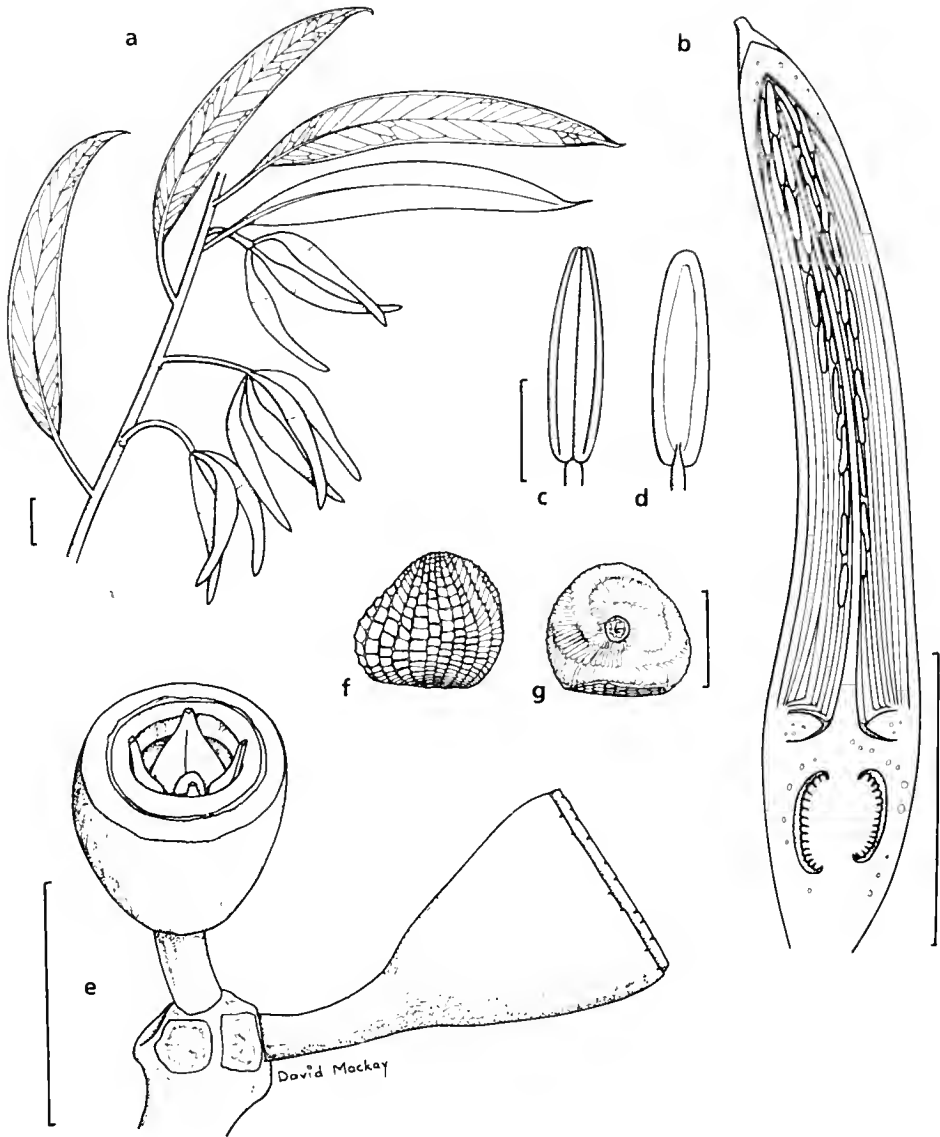


Figure 7. *E. sargentii* subsp. *fallens*. a, adult leaves and buds; b, section of bud; c, d, anther; e, fruits; f, g, seed (all from Brooker 9036). Scale bar: a, b, e = 1 cm; c, d, f, g = 1 mm.

Tree (mallet) to 12 m. *Bark* smooth, semiglossy, dark grey to red-brown or bronze. Juvenile leaves disjunct, linear. *Adult leaves* disjunct, linear, glossy, with a distinct bluish sheen from the large translucent stomata, 5–9 cm long, 2–4 mm wide; lateral veins scattered; reticulation sparse, incomplete; oil glands crowded, spherical. *Inflorescences* simple, axillary; umbellasters 7-flowered; peduncles flattened, 5–15 mm long; pedicels flattened or angular, 2–4 mm long. *Buds* cylindrical, 10–13 mm long, 3–4 mm diam.; calyptra more than 2 times longer than hypanthium, cylindrical, apically rounded to acute. *Stamens* all fertile; filaments erect; anthers oblong, dorsifixed, dehiscing through parallel slits. *Fruits* ovoid to obconical or hemispherical, 4–6 mm long, 4–6 mm diam.; stemonophore broad, flat, persistent; disc flat; valves acicular, basally enclosed, apically exerted. Figure 8.

The above description applies to a narrowed circumscription of *E. spathulata*, and is included here to allow comparison with segregate taxa described below.

The non-lignotuberous 'mallet' habit, where main branches arise acutely at more or less the same point on the trunk, occurs apparently independently in several groups of otherwise mallee species in Western Australia. *E. spathulata* in the restricted sense is an example, being a 'mallet' whereas the segregate taxa (below) are mallees. It is also more restricted in range and more specialised in habitat.

DISTRIBUTION: Locally frequent, in the Tammin–Pingaring–Dumbleyung–Ongerup region (Avon and Roe Districts). Figure 9.

ECOLOGY: Localised in mallet woodlands, on saline sites around salt pans or along drainage lines.

Intergrades occur with *E. vegrandis*, and hybrids are known with *E. loxophleba* subsp. *loxophleba* and *E. platypus* Hook. (a specimen of the latter hybrid constitutes the type of *E. platypus* Hook. var. *heterophylla* Blakely).

CONSERVATION STATUS: 3V. Although locally frequent, this species occurs almost entirely in agricultural country. The habitat is also very narrow, fringing saline areas. Agricultural practices are causing rapid spread of these saline areas, in many sites engulfing the habitat of this species faster than the species can propagate into the newly created fringing zones.

SELECTED SPECIMENS (from 15 examined): Western Australia: 4.5 km W of Tammin, *L. Johnson* 9112 & *M. Johnson*, 18 May 1988 (NSW, PERTH); 21.8 km S of Lake Grace, *Hill* 328, *Johnson* & *Blaxell*, 23 Oct 1983 (NSW); 24 km from Katanning on road to Nyabing, *Crisp* 5195, 16 Jan 1975 (CBC, CANB, MO, NSW, PERTH); Ongerup – Pingrup road (33°52'S 118°28'E), *Johnson* 9171 a–c & *B. Briggs*, 31 Oct 1988 (NSW, CANB).

E. loxophleba subsp. *loxophleba* × *E. spathulata*: cited under the former.

E. platypus × *E. spathulata*: 10 km NNW of Ongerup, *Hopper* 2401, 31 July 1982 (PERTH, photo NSW); near Ongerup, *Stoward* 133, 30 May 1917 (NSW, type of *E. platypus* var. *heterophylla*).

E. spathulata – *E. vegrandis* intergrades: Harrismith, *Gardner* 2105, 5 May 1924 (PERTH, NSW); 6 miles [10 km] N of Lake Grace, *Johnson* W 235, 19 Dec 1960 (NSW); 19 km N of Ongerup on Lake Grace road, *B. Briggs* 7926 & *Johnson*, 11 Oct 1984 (NSW, PERTH).

8. *Eucalyptus vegrandis* *L. Johnson* & *K. Hill*, sp. nov.

Affinis *E. spathulatae* sed habitu pluricauli, foliis latioribus et fructibus majoribus distinguitur.

TYPE: WESTERN AUSTRALIA: 5 km NW of Ongerup, *K.D. Hill* 337, *L.A.S. Johnson* & *D.F. Blaxell*, 23 Oct 1983 (holo NSW; iso CANB, PERTH)

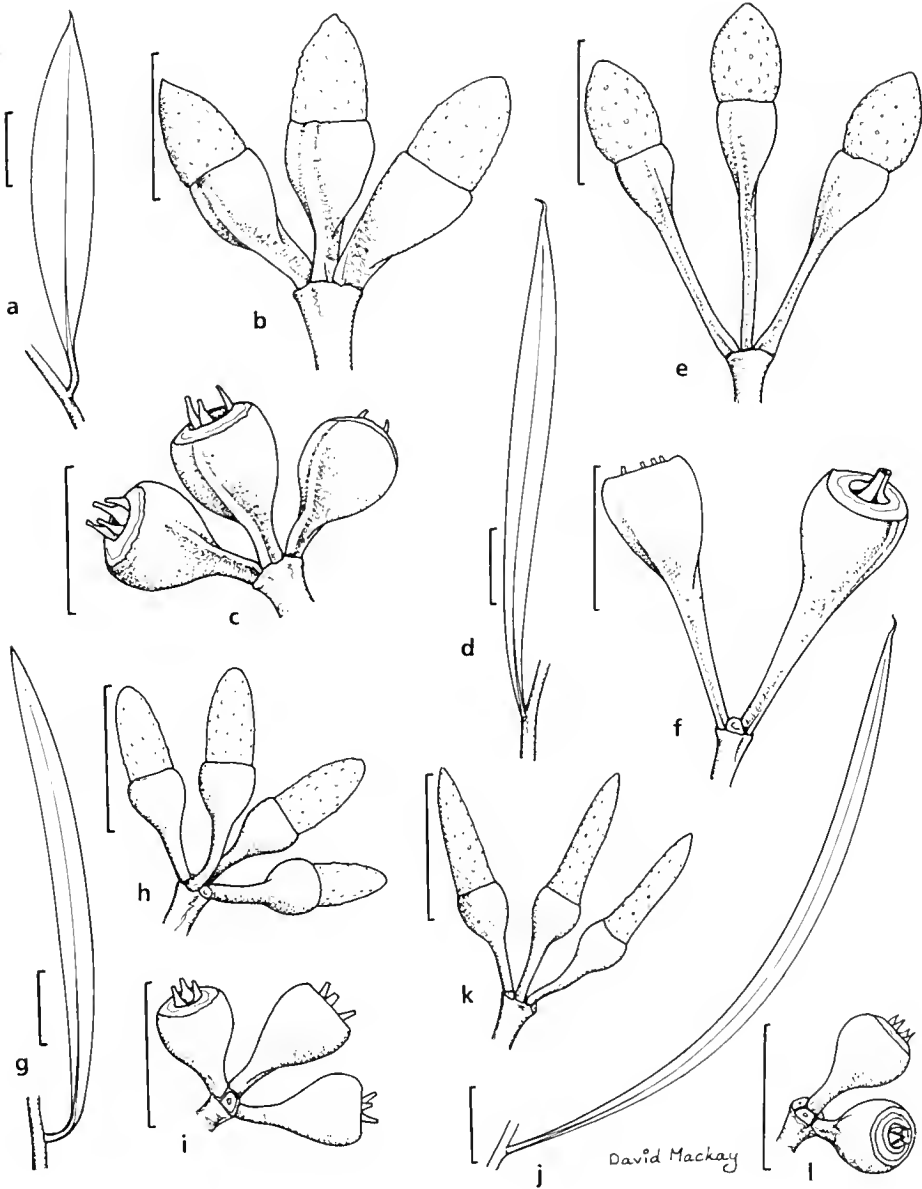


Figure 8. *E. suggrandis* subsp. *suggrandis*. a, adult leaf; b, buds; c, fruits (a, c from Blaxell 1697, b from Brooker 8659). *E. suggrandis* subsp. *alipes*. d, adult leaf; e, buds; f, fruits (all from Blaxell W75/26 & Brooker). *E. vegrandis*. g, adult leaf; h, buds; i, fruits (all from Fitzgerald, Nov 1907). *E. spathulata*. j, adult leaf; k, buds; l, fruits (all from Hill 328, Johnson & Blaxell). Scale bar = 1 cm.

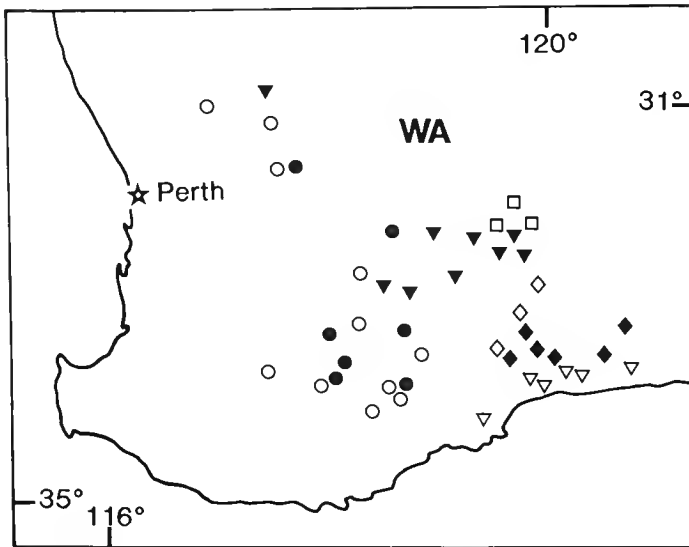


Figure 9. Distribution of *E. spathulata* (●), *E. vegrandis* (○), *E. suggrandis* subsp. *suggrandis* (▽), subsp. *alipes* (▼), subsp. *alipes* - subsp. *suggrandis* intergrades (◆), *E. steedmanii* (□) and *E. goniocarpa* (◇).

Mallee to 6 m, often less. Bark smooth, semiglossy, grey to brown or bronze. *Juvenile leaves* disjunct, linear to narrow-lanceolate. *Adult leaves* disjunct, linear to lanceolate, glossy, with a distinct bluish sheen from the large translucent stomata, 3–8 cm long, 3–8 mm wide; lateral veins scattered; reticulation sparse, incomplete; oil glands crowded, spherical. *Inflorescences* simple, axillary; umbellasters 3- or 7-flowered; peduncles 5–15 mm long; pedicels 2–4 mm long. *Buds* cylindrical, 8–12 mm long, 3–5 mm diam.; calyptra slightly longer to almost 2 times longer than hypanthium, cylindrical, apically rounded. *Stamens* all fertile; filaments erect; anthers oblong, dorsifixed, dehiscing through parallel slits. *Fruits* ovoid to obconical or hemispherical, 5–8 mm long, 5–8 mm diam.; stemophore broad, flat, persistent; disc flat; valves acicular, basally enclosed, apically exerted. Figure 8.

Differs from *E. spathulata* in the mallee habit, shorter and broader leaves, shorter calyptra and larger fruits. This taxon has a considerably wider range than *E. spathulata*, although the two are sympatric in the south of the range of *E. vegrandis*. Where the two are sympatric, *E. spathulata* occurs on low saline sites while *E. vegrandis* occurs on higher, sandy sites.

There is some breakdown between the two taxa in areas where both occur. Both species and some intergrades in the contact zones can be observed on the Pingrup road N of Ongerup, as was pointed out to us in the field by the late Ken Newbey. Occasional hybrids with *E. xanthonema* Turcz., i.e. *E. xanthonema* subsp. *xanthonema* as recognised by Brooker & Hopper (1991), are also recorded.

In the northernmost part of its area (north of c. 31°15'S), *E. vegrandis* has 3-flowered umbellasters (mostly 7-flowered in the south) and the fruits are larger than is general in the south.

DISTRIBUTION: Scattered and sporadic, from Wongan Hills south to Arthur River and southeast to Ongerup (Avon and Roe Districts). Figure 9.

ECOLOGY: Usually on moderately well-drained sandy loams, but often not far from somewhat saline areas.

CONSERVATION STATUS: Not considered to be at risk.

The epithet is from the Latin *vegrandis*, not very large, referring both to its small stature and because it has been confused with *E. suggrandis* under the name *E. spathulata* var. *grandiflora*.

SELECTED SPECIMENS (from 14 examined): WESTERN AUSTRALIA (W to E): c. 12 km E of rail crossing at Carani, *Brooker 7584*, 26 Aug 1982 (CANB, NSW, PERTH); 0.9 km from Dowerin–Trayning road on Minnievale Road, *Brooker 9748*, 3 Sep 1987 (CANB, NSW, PERTH); Cunderdin, *Fitzgerald*, Nov 1907 (NSW); Carganocking Hill, *Hill 654*, *Johnson, Blaxell, Brooker & Hopper*, 8 Nov 1983 (NSW, CANB, PERTH); Broome Hill, *Morrison*, 16 Apr 1904 (NSW); 6 km N of Borden, *Crisp 5174*, 15 Jan 1979 (CBG, CANB, NSW, PERTH).

E. spathulata – *E. vegrandis* intergrades: cited under the former.

E. toxophleba subsp. *toxophleba* x *E. vegrandis*: specimens cited under the former.

E. vegrandis x *E. xanthonea*: 24 miles [38 km] S of Williams, *Melville 4358 & Royce*, 28 Aug 1953 (K, NSW)

9. *Eucalyptus suggrandis* L. *Johnson & K. Hill*, sp. nov.

Ab *E. spathulata* habitu multicauli plusminusve fruticoso, ab illa et ab *E. vegrandi* et *E. spathulata* alabastris fructibusque majoribus distinguitur.

TYPE: WESTERN AUSTRALIA: Hamersley Drive, 32.5 km from Old Ongerup Road, Fitzgerald River National Park, *K.D. Hill 3147*, 7 Sep 1988 (holo NSW; iso CANB).

≡ *Eucalyptus spathulata* Hook. var. *grandiflora* Benth., Fl. Austral. 3: 236 (1867).

TYPE CITATION: 'Phillips Range, Maxwell.'

TYPE: WESTERN AUSTRALIA: Phillips Range, *Maxwell* (holo K; iso NSW).

≡ *E. spathulata* Hook. subsp. *grandiflora* (Benth.) L. *Johnson & Blaxell*, Contrib. New South Wales Natl Herb. 4(7): 453 (1973).

Although this taxon includes a previously published variety (and subspecies), we have chosen to publish it as a new species with a new type from a known locality. This is preferred because the old concept of *E. spathulata* is now divided into four taxa, and where possible we have nominated types from known and studied populations.

Mallee to 4 m. *Bark* smooth, semiglossy, grey to light brown or bronze. Juvenile leaves disjunct, narrow-lanceolate. *Adult leaves* disjunct, narrow-lanceolate to lanceolate, glossy, with a distinct bluish sheen from the large, translucent stomata, 4–8 cm long, 5–15 mm wide; lateral veins scattered; reticulation sparse, incomplete; oil glands crowded, spherical. *Inflorescences* simple, axillary; umbellasters 3–7-flowered; peduncles flattened, 8–15 mm long; pedicels flattened, 3–8 mm long. *Buds* often 2-winged, ovoid to shortly fusiform, 11–17 mm long, 5–7 mm diam.; calyptra slightly longer to 1.5 times longer than hypanthium, shortly cylindrical or convex-conical, apically rounded, smooth or finely verrucose. *Stamens* all fertile; filaments erect; anthers oblong, dorsifixed, dehiscing through parallel slits. *Fruits* ovoid to obconical, 8–12 mm long, 6–9 mm diam.; stemonophore broad, flat, persistent; disc flat; valves acicular, basally enclosed, apically exerted. Figure 8.

This taxon differs from *E. spathulata* and *E. vegrandis* in the larger buds with shorter calyptra, the larger fruits, and the broader leaves.

The epithet is from the Latin *suggrandis*, rather large, referring to the size of buds and fruits in comparison with *E. spathulata* and *E. vegrandis*.

Two subspecies, showing considerable intergradation where their ranges meet, are recognised on the basis of regional variation in leaf shape, bud number and ornamentation, and pedicel length.

- 1 Pedicel less than 4 mm long, umbellasters 3–7-flowered 9a. subsp. *suggrandis*
 1* Pedicel more than 4 mm long, umbellasters consistently 3-flowered
 9b. subsp. *alipes*

9a. *Eucalyptus suggrandis* L. Johnson & K. Hill subsp. *suggrandis*

Mallee. *Adult leaves* lanceolate to broad-lanceolate. *Umbellasters* 3–7-flowered. *Peduncle* 8–12 mm long, not strongly flattened. *Pedicels* 3–5 mm long, ribbed but not strongly winged. *Buds* 11–15 mm long, 5–6 mm diam, calyptra smooth or finely verrucose. *Fruits* 8–11 mm long, 8–9 mm diam. Figure 8.

Distinguished by the short pedicels and often 7-flowered umbellasters. In mature buds the calyptra is generally more warty than in subsp. *alipes*. The characters of the subspecies are most marked in the southernmost parts of the range.

DISTRIBUTION: Locally frequent, from the Gairdner River to the Young River, south of about 33°35'S (Eyre District). Figure 9.

ECOLOGY: A component of mixed mallee heath on various low-nutrient substrates.

Hybrids are recorded with *E. platypus* Hook. and *E. species F* (Brooker & Kleinig 1988).

CONSERVATION STATUS: Not considered to be at risk.

SELECTED SPECIMENS (from 19 examined): WESTERN AUSTRALIA (W to E): c. 10 km S of Ravensthorpe on Hopetoun road, *Blaxell 1697*, 23 June 1978 (NSW); Elderton via Ravensthorpe, *Brooker 8659*, 4 Sep 1984 (CANB, NSW, PERTH); E slope of Mt Desmond, *B. Briggs 7716 & Johnson*, 10 Oct 1984 (NSW, PERTH); 4.5 km S of highway on Mason Bay road, *Hill 2359, Johnson, Blaxell & Brooker*, 9 Nov 1986 (NSW); 14.1 km S of Old Ongerup Road on Hamersley Drive, Fitzgerald River Natl Park, *B. Briggs 7685, 7686, 7687 & Johnson*, 9 Oct 1984 (NSW, PERTH); 10.0 km NW of Fitzgerald River Natl Park entrance on Devils Creek Road, *Hill 3111, 3112*, 6 Sep 1988 (NSW, CANB, PERTH); NW of Mt Maxwell, *Brooker 9910, 9911*, 9 Mar 1988 (CANB, NSW).

Intergrades between the subspecies (8 examined): 44 km N of Ravensthorpe – Albany road on Lake King road, *Hill 2381, Johnson, Blaxell & Brooker*, 9 Nov 1986 (NSW, PERTH); 11.7 km from Ravensthorpe–Lake King road on Aerodrome Road, *Hill 3023*, 1 Sep 1988 (NSW); 13.5 km from highway on Fitzgerald Road (33°25'S 119°45'E), *Brooker 8808*, 18 Jan 1985 (CANB, NSW, PERTH); 55 km W of Fields Road (5 ways) on Ravensthorpe track, *Hill 2343, Johnson & Blaxell*, 8 Nov 1986 (NSW, PERTH); Ravensthorpe, *Ralph & Stamford*, 26 June 1924 (NSW).

E. suggrandis subsp. *suggrandis* x *E. species F*: 15.6 km from Highway 1 along Brook Road (33°49'S 119°05'E), *Brooker 9641*, 18 May 1987 (CANB, NSW, PERTH).

9b. *Eucalyptus suggrandis* L. Johnson & K. Hill subsp. *alipes* L. Johnson & K. Hill, subsp. nov.

Ab subspecie typica pedicellis longis aliquanto alatis et umbellastris semper trifloris differt.

TYPE: WESTERN AUSTRALIA: 46.0 km N of Coolgardie – Hyden road on Southern Cross road, *K.D. Hill 2894*, 26 Aug 1988 (holo NSW; iso CANB, PERTH).

Mallee. *Adult leaves* narrow-lanceolate to lanceolate. *Umbellasters* 3-flowered. *Peduncle* strongly flattened, 10–15 mm long. *Pedicels* 2-winged, 4–8 mm long. *Hypanthium* 2-winged;

calyptra smooth. Fruits 8–12 mm long, 6–8 mm diam. Figure 8.

Distinguished by the long, winged pedicels and always 3-flowered umbellasters. The related taxa *E. goniocarpa* and *E. steedmanii* are also 3-flowered, but have substantially larger buds and fruits (see below).

DISTRIBUTION: This subspecies ranges from Lake Grace to east of Hyden and midway between Lake King and Ravensthorpe (Roe and Eyre Districts). Figure 9.

ECOLOGY: A frequent component of mallee heath on sandy loam or sandplain, usually in low mixed mallee communities.

Hybrids are recorded with *E. depauperata*.

CONSERVATION STATUS: Not considered to be at risk.

The epithet is from the Latin *ala*, a wing, and *pes*, a foot, referring to the pedicels. It does not change with gender of the generic name and is pronounced as three syllables with the stress on the first.

SELECTED SPECIMENS (from 11 examined): WESTERN AUSTRALIA (W to E): 0.95 miles [1.5 km] E of Manmanning, *Smith 1158*, 11 Mar 1989 (MEL, AD, BRI, CANB, NSW, PERTH); 31.8 km W of Hyden towards Kondinin, *Hill 643, Johnson, Blaxell, Brooker & Hopper*, 8 Nov 1983 (NSW, CANB, PERTH); 4.2 km S of Varley road on Dragon Rock road, *Hill 2470, Johnson & Blaxell*, 14 Nov 1986 (NSW, PERTH); 43 km E of Hyden, *Blaxell W75/26 & Brooker*, 3 Oct 1975 (NSW); 46.0 km N of Coolgardie–Hyden road on Southern Cross road, *Hill 2894*, 26 Aug 1988 (NSW, CANB, PERTH); 13 miles [22 km] NE of Lake Grace, *M.I.H. Brooker 2271*, 5 June 1969 (CANB, NSW, PERTH).

E. suggrandis subsp. *alipes* – subsp. *suggrandis* intergrades x *E. vegrandis*: Facup Creek, *Diels 4767*, 8 Oct 1901 (B, NSW).

E. depauperata x *E. suggrandis* subsp. *alipes*: cited under *E. depauperata*.

E. platypus x *E. suggrandis* subsp. *alipes*: 10 km from Lake King towards Newdegate, *Strid 21964*, 1 Jan 1983 (NSW).

10. *Eucalyptus goniocarpa* L. *Johnson & K. Hill, sp. nov.*

Ab *E. eremophila* umbellastris saepissime trifloris et alabastris fructibusque bialatis differt. Ab *E. suggrandi* subsp. *alipede* foliis alabastris et fructibus plerumque majoribus differt.

TYPE: WESTERN AUSTRALIA: 5.6 km from Lake King on Ravensthorpe road, *K.D. Hill 2383, L.A.S. Johnson, D.F. Blaxell & M.I.H. Brooker*, 9 Nov 1986 (holo NSW; iso PERTH).

Tree (mallet) to 5 m, sometimes mallee to 4 m. Bark smooth, semiglossy, grey to brown or bronze. Juvenile leaves disjunct, lanceolate. Adult leaves disjunct, lanceolate, glossy, with a distinct bluish sheen from the large, translucent stomata, 4–8 cm long, 5–10 mm wide; lateral veins scattered; reticulation sparse, incomplete; oil glands crowded, spherical. Inflorescences simple, axillary; umbellasters 3(–7)-flowered; peduncles flattened, 8–15 mm long; pedicels flattened, 3–8 mm long. Buds distinctly 2-winged, ovoid to shortly fusiform, 11–17 mm long, 5–7 mm diam.; calyptra slightly longer to 2 times as long as hypanthium, shortly cylindrical or convex-conical, apically rounded. Stamens all fertile; filaments erect; anthers oblong, dorsifixed, dehiscing through parallel slits. Fruits 2-winged, ovoid to obconical, 8–12 mm long, 6–9 mm diam.; stemonophore broad, flat, persistent; disc flat; valves acicular, basally enclosed, apically exerted. Seeds ovoid, somewhat flattened, grey-brown, regularly shallowly reticulate. Figure 10.

Distinguished from *E. eremophila* by the mostly 3-flowered umbellasters and the 2-winged buds and fruits. This taxon shows some resemblances to *E. suggrandis* subsp. *alipes*, from which it differs in the larger leaves, buds and fruits. *E. steedmanii* is also 3-flowered, but has strikingly quadrangular buds and fruits.

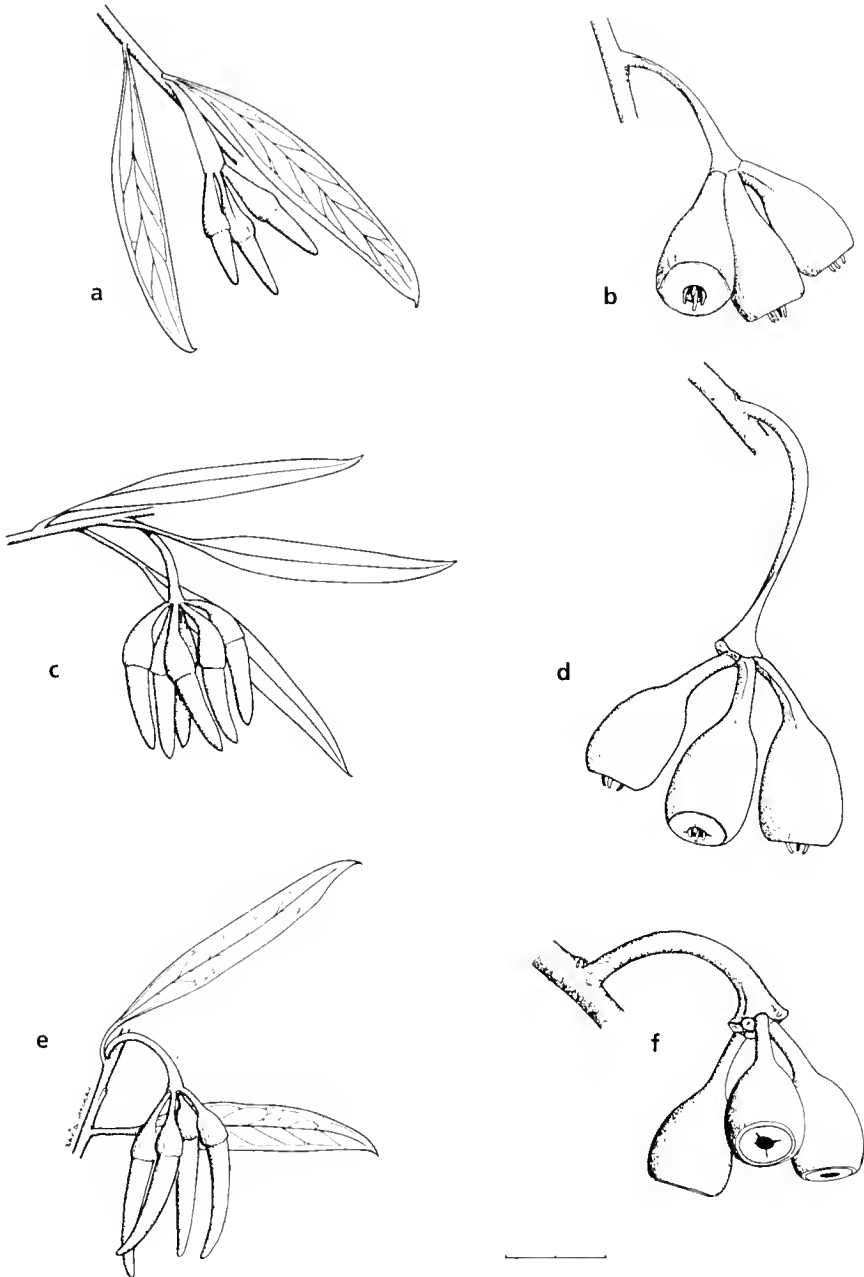


Figure 10. *E. goniocarpa*. **a**, adult leaves and buds; **b**, fruits (all from Hill 2383, Johnson, Blaxell & Brooker). *E. eremophila*. **c**, adult leaves and buds; **d**, fruits (all from Hill 219 & Johnson). *E. tenera*. **e**, adult leaves and buds; **f**, fruits (all from Hill 2480 & Johnson). Scale bar = 1 cm.

This taxon has been referred to *E. eremophila* subsp. *pterocarpa* (Blakely & Steedman) L. Johnson & Blaxell (Brooker & Kleinig 1990: 146). The latter is, however, said to occur in rocky sites, with no mention of the 'mallet' habit. This represents another possibly distinct species related to *E. eremophila*, and has not been rediscovered to date. It is distinguished by the larger fruits on longer pedicels, and the entire adult leaves.

DISTRIBUTION: Restricted to the Lake King district (Roe District). Figure 9.

ECOLOGY: This species forms dense, often monospecific, thickets on sandy loams on flat or slightly low areas.

Extensive intergrades occur with *E. platypus* Hook., forming dense low mallet stands in country west and northwest of Ravensthorpe (these are treated as *E. platypus* subsp. *congregata* ined. by Brooker & Kleinig 1990).

CONSERVATION STATUS: Not considered to be at risk.

The epithet is from the Greek *gonia*, an angle, and *karpos*, a fruit, referring to the strongly angled fruits.

SELECTED SPECIMENS (from 6 examined): WESTERN AUSTRALIA (N to S): 4.7 km from Lake King-Norseman road on Pickernill Road, *Brooker 8766*, 18 Dec 1984 (CANB, NSW, PERTH); 17.6 km E of Tarco Road (33°14'S 119°33'E), *Brooker 9716*, 15 July 1987 (CANB, NSW, PERTH); 9 km SW of Koornong Road on Fitzgerald Road, *Foreman 1339*, 29 Nov 1985 (MEL, CANB, NSW, PERTH).

Intergrades with *E. platypus* (from 3 examined): 5.8 km NW of Fitzgerald Road on West River Road, *Hill 2397*, *Johnson, Blaxell & Brooker*, 9 Nov 1986 (NSW).

11. *Eucalyptus eremophila* (Diels) Maiden, J. & Proc. Roy. Soc. New South Wales 54: 71 (1920).

BASEONYM: *Eucalyptus occidentalis* Endl. var. *eremophila* Diels in Diels & Pritzel, Bot. Jahrb. Syst. 35: 442 (1904).

TYPE CITATION: 'Hab. in distr. Coolgardie pr. Boorabbin in glareosis fl. m. Nov. (*E. Pritzel* Pl. Austr. occ. 917), pr. munic. Coolgardie in fruticetis apertis arenoso-lutosis flor. m. Oct. (D. 5237), in fruticetis apertis lutoso-lapidosus fl. m. Nov. pr. Gilmores (D. 5264).'

TYPE: WESTERN AUSTRALIA: near Coolgardie, *L. Diels 5237* (lecto NSW, here designated). Diels cited 3 syntypes in the protologue, but Maiden recorded the above as the Type for Diels's variety (Crit. Revis. *Eucalyptus* 4: 176, pl. 149, Figure 7). This specimen is hence here designated as the lectotype.

Tree (mallet) to 12 m or mallee to 6 m. *Bark* smooth, semiglossy, pale grey or silver to pale brown, yellow-brown or greenish. *Juvenile leaves* disjunct, broad-lanceolate to ovate, dull, grey, petiolate. *Adult leaves* disjunct, lanceolate, glossy, with a distinct bluish sheen from the large, translucent stomata, 4–12 cm long, 5–17 mm wide; lateral veins scattered; reticulation sparse, incomplete; oil glands crowded, spherical. *Inflorescences* simple, axillary; umbellasters 7-flowered; peduncles flattened, 15–30 mm long, to 6 mm wide; pedicels 4–8 mm long. *Buds* cylindrical, 20–30 mm long, 5–7 mm diam.; calyptra 2.5 or more times longer than hypanthium, cylindrical, apically rounded or acuminate. *Stamens* all fertile; filaments erect; anthers oblong, dorsifixed, dehiscing through parallel slits. *Fruits* ovoid to obconical, 8–13 mm long, 7–11 mm diam.; stemonophore broad, flat, persistent; disc flat; valves acicular, basally enclosed, apically exserted. *Seeds* ovoid, somewhat flattened, grey-brown, regularly shallowly reticulate. Figure 10.

E. eremophila is described here under a reduced circumscription to allow comparison with segregate taxa described below.

DISTRIBUTION: Though here restricted from its most inclusive usage, this is a widespread and frequent species, extending from the Southern Wheat Belt (as far west as Lake Chinokup) through the southern and central Goldfields to the edges of the Nullarbor Plain and Great Victoria Desert. It is replaced in adjoining areas by one or other of the following three species or more locally by the partly sympatric *E. incerata* Brooker & Hopper ined. Figure 11.

ECOLOGY: *E. eremophila* shows a wide ecological tolerance, but is absent from the lightest and heaviest soils. It tends to occur as trees of mallet form in woodlands on heavier or more calcareous soils, and as mallees in mallee shrublands on sandier soils.

Hybrids are recorded with *E. grossa* F. Muell. ex Benth. and (in cultivation) *E. torquata* Luehm. The latter is an intersectional hybrid with a member of sect. *Dumaria*.

CONSERVATION STATUS: Widespread and abundant, not considered to be at risk.

SELECTED SPECIMENS (from 48 examined): WESTERN AUSTRALIA: 1 km SW of S shore of Lake Chinokup, Hill 2462, Johnson & Blaxell, 13 Nov 1986 (NSW, PERTH); corner of Ardlor Road and Old Ravensthorpe Road, L. Johnson 9082 & M. Johnson, 15 May 1988 (NSW, PERTH); 7.2 miles [11.5 km] E of Southern Cross, Chippendale 98, 7 Mar 1967 (CANB, NSW); Mt Short, 10 miles [16 km] N of Ravensthorpe, Wrigley, 5 Nov 1968 (CBG 030980, NSW); 33.1 km W of Coolgardie – Norseman road on Hyden track, Hill 605, Johnson, Blaxell, Brooker & Hopper, 7 Nov 1983 (NSW); 30.8 km W of highway on Griggs Road, Hill 2305, Johnson & Blaxell, 7 Nov 1986 (NSW, PERTH); 52.1 km S of Norseman on highway, Hill 2234, Johnson, Blaxell & Brooker, 5 Nov 1986 (NSW, PERTH); 109 km W of Balladonia on Norseman road, Brooker 6457, 22 Aug 1979 (CANB, NSW, PERTH); 22.5 km W of Balladonia Roadhouse on Highway 1, Hill 219 & Johnson, 19 Oct 1983 (NSW); 8.6 km S of Queen Victoria Spring on Cundeeclee track, Hill 2682 & Johnson, 30 Nov 1986 (NSW); 13 miles [21 km] E of Zanthus, Brooker 2573, 18 June 1970 (PERTH, NSW).

E. eremophila x *E. grossa*: 23.6 km W of highway on Lake King road, Brooker 8844, 12 Feb 1985 (CANB, NSW, PERTH).

E. eremophila x *E. torquata*: Cult. Oaklands, N.S.W., O'Rourke, July 1971 (NSW).

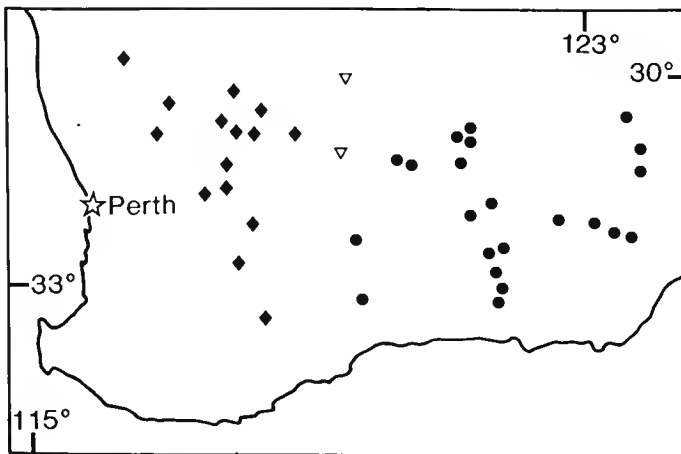


Figure 11. Distribution of *E. eremophila* (●), *E. tenera* (◆) and intergrades between the two (▽).

12. *Eucalyptus tenera* L. Johnson & K. Hill, sp. nov.

Affinis *E. eremophilae* sed characteribus sequentibus distinguitur: habitus et partes multi minores, umbellastreae saepissime 11-florae, pedunculi breviores gracilioresque, calyptra proportione longior acutiorque.

TYPE: WESTERN AUSTRALIA: Bencubbin, M.I.H. Brooker 8493, 16 Mar 1984 (holo NSW; iso AD, CANB, MEL, PERTH).

Mallee to 4 m. Bark smooth, semiglossy, pale grey or grey to red-brown or bronze. Juvenile leaves disjunct, linear for first 3–4 nodes, then becoming lanceolate. Adult leaves disjunct, lanceolate to broad-lanceolate, glossy, with a distinct bluish sheen from the large, translucent stomata, 4–8 cm long, 7–18 mm wide; petioles 10–14 mm long; lateral veins scattered; reticulation sparse, incomplete; oil glands crowded, spherical. Inflorescences simple, axillary; umbellasters 7–11-flowered; peduncles narrowly flattened, 18–25 mm long, to 5 mm wide; pedicels 3–6 mm long. Buds cylindrical, 25–40 mm long, 5–7 mm diam.; calyptra 3 times or more longer than hypanthium, cylindrical, apiculate. Stamens all fertile; filaments erect; anthers oblong, dorsifixed, dehiscing by parallel slits. Fruits ovoid to obconical, 8–11 mm long, 7–10 mm diam.; stemonophore broad, flat, persistent; disc flat; valves acicular, basally enclosed, apically exerted. Seeds ovoid, somewhat flattened, grey-brown, regularly shallowly reticulate. Figure 10.

E. tenera is distinguished from *E. eremophila* by the generally smaller form and smaller parts, the frequently 11-flowered umbellasters (always 7-flowered in the latter), the shorter, thinner and narrower peduncles, and the longer buds with a relatively longer and more acute calyptra.

DISTRIBUTION: Sporadically distributed over a wide area of the western and northern Wheat Belt, from Coorow to Chiddarcooping Rock, south towards Lake Chinokup. Figure 11.

ECOLOGY: Restricted to shallower, sandy soils with various other mallee species in areas where wandoo woodlands occupy the deeper soils.

Hybrids are recorded with *E. erythronema* sens. lat.

CONSERVATION STATUS: Not considered to be at immediate risk. The habitat of this species lies entirely within the Wheat Belt agricultural country, and continued degradation of that area may place the entire habitat at risk in the future.

The epithet is from the Latin *tener*, delicate, referring to the species having smaller and more slender parts than those of *E. eremophila* and *E. tephroclada*.

SELECTED SPECIMENS (from 17 examined): WESTERN AUSTRALIA (N to S): 'Doley's Farm', ESE of Coorow, Brooker 9059, 3 Nov 1985 (CANB, NSW, PERTH); 33.8 km S of Koorda on Wyalkatchem road, Hill 2918, 27 Aug 1988 (NSW); 28.3 km from Tammin on York road, Brooker 9105, 15 Nov 1985 (CANB, NSW PERTH); 9 km N of Scotsmans Road on Bimbijy Road, Brooker 8435, 25 Jan 1984 (CANB, NSW, PERTH); 2.0 km E of Dickinson Road on Nambadilling Road, Hill 2480, Johnson & Blaxell, 15 Nov 1986 (NSW, CANB, CIB, MEL, PERTH); Chiddarcooping Nature Reserve, Brooker 7980, 11 Feb 1983 (CANB, NSW, PERTH).

E. erythronema sens. lat. x *E. tenera*: Kellerberrin, Vachel, Dec 1903 (NSW); 'Oxendale' farm, Barnes Road, SE of Yelbeni, Brooker 9735, 23 July 1987 (CANB, NSW, PERTH).

13. *Eucalyptus tephroclada* L. Johnson & K. Hill, sp. nov.

Inter species affinitatis *E. eremophilae* combinatione characterum sequentium distinguitur: ramuli pruinosi, fructus parvi.

TYPE: WESTERN AUSTRALIA: 6 km from Bruce Rock on Narembeen road, *K.D. Hill 2484*, *L.A.S. Johnson & D.F. Blaxell*, 15 Nov 1986 (holo NSW; iso PERTH).

[*Eucalyptus erythronema* Turcz. var. *roei* Beck ex Maiden, Crit. Revis. *Eucalyptus* 1: 110 (1904); in syn., nom. nud.; in part]

Mallee to 5 m. *Bark* smooth, semiglossy, dark grey to red-brown or bronze. Branchlets pruinose. *Juvenile leaves* disjunct, lanceolate to broad-lanceolate, dull, grey, petiolate. *Adult leaves* disjunct, lanceolate, glossy, with a distinct bluish sheen from the large, translucent stomata, 4–10 cm long, 7–19 mm wide; pedicels flattened, 6–16 mm long; lateral veins scattered; reticulation sparse, incomplete; oil glands crowded, spherical. *Inflorescences* simple, axillary; umbellasters 7–11-flowered; peduncles terete or narrowly flattened; 17–30 mm long, to 3 mm wide; pedicels 4–10 mm long. *Buds* cylindrical, 18–35 mm long, 5–7 mm diam.; calyptra 2.5 or more times longer than hypanthium, cylindrical, apically rounded. *Stamens* all fertile; filaments erect; anthers oblong, dorsifixed, dehiscing through parallel slits. *Fruits* ovoid to obconical, 8–11 mm long, 7–10 mm diam.; stemonophore broad, flat, persistent; disc flat; valves acicular, basally enclosed, apically exerted. *Seeds* ovoid, somewhat flattened, grey-brown, regularly shallowly reticulate. Figure 12.

Distinguished within the *E. eremophila* group by the pruinose branchlets and the small fruits. The related *E. incrata* Brooker & Hopper ined. (another member of the *E. eremophila* group) shares the bronze or coppery bark and glaucous branchlets, but has larger buds and fruits (buds 6–8 mm diam., fruits 10–14 mm long), and tends to be heavily rather than lightly pruinose. The two taxa also show a replacement distribution.

DISTRIBUTION: Sporadic and scattered in the area between Quairading, Southern Cross, Kukerin and Hyden (Avon and Roe Districts). This is now all largely cleared agricultural country. Figure 13.

ECOLOGY: Restricted to local mallee scrubs on usually shallow and sandy soils, over various substrates in otherwise woodland country.

Hybrids are recorded with *E. cylindriflora* Maiden & Blakely and *E. erythronema*.

CONSERVATION STATUS: 3V?C. The habitat has been seriously reduced by agricultural clearing.

The epithet is from the Greek *tephros*, ash-grey, and *klados*, a twig, referring to the pruinose branchlets.

SELECTED SPECIMENS (from 19 examined): WESTERN AUSTRALIA (N to S): c. 5 miles [8 km] E of Bodallin, *Johnson W 130*, 16 Dec 1960 (NSW); 3 km W of Hyden, *Strid 21940*, 31 Dec 1982 (NSW); 6 km NW of Jitarning, *Foreman 1139*, 21 Nov 1985 (MEL, AD, CANB, NSW, PERTH); Harrismith, *Gardner 2118*, 6 Mar 1924 (PERTH, NSW).

E. cylindriflora x *E. tephroclada*: 22 km SE of Pingaring, *Haegi 1083*, 21 Sep 1976 (AD, NSW, PERTH).

E. erythronema x *E. tephroclada*: Noongar, *Chippendale 286*, 13 Aug 1967 (CANB, NSW).

14. *Eucalyptus depauperata* L. *Johnson & K. Hill*, sp. nov.

Inter species affinitatis *E. eremophilae* combinatione sequenti characterum distinguitur: habitus pluricaulis et fruticosus; folia adulta, alabastra et fructus minores.

TYPE: WESTERN AUSTRALIA: 1.6 km N of Hayes Road on North Road, *K.D. Hill 3027*, 1 Aug 1988 (holo NSW; iso CANB, PERTH).

[*Eucalyptus* sp. E of Brooker & Kleinig (1990)]

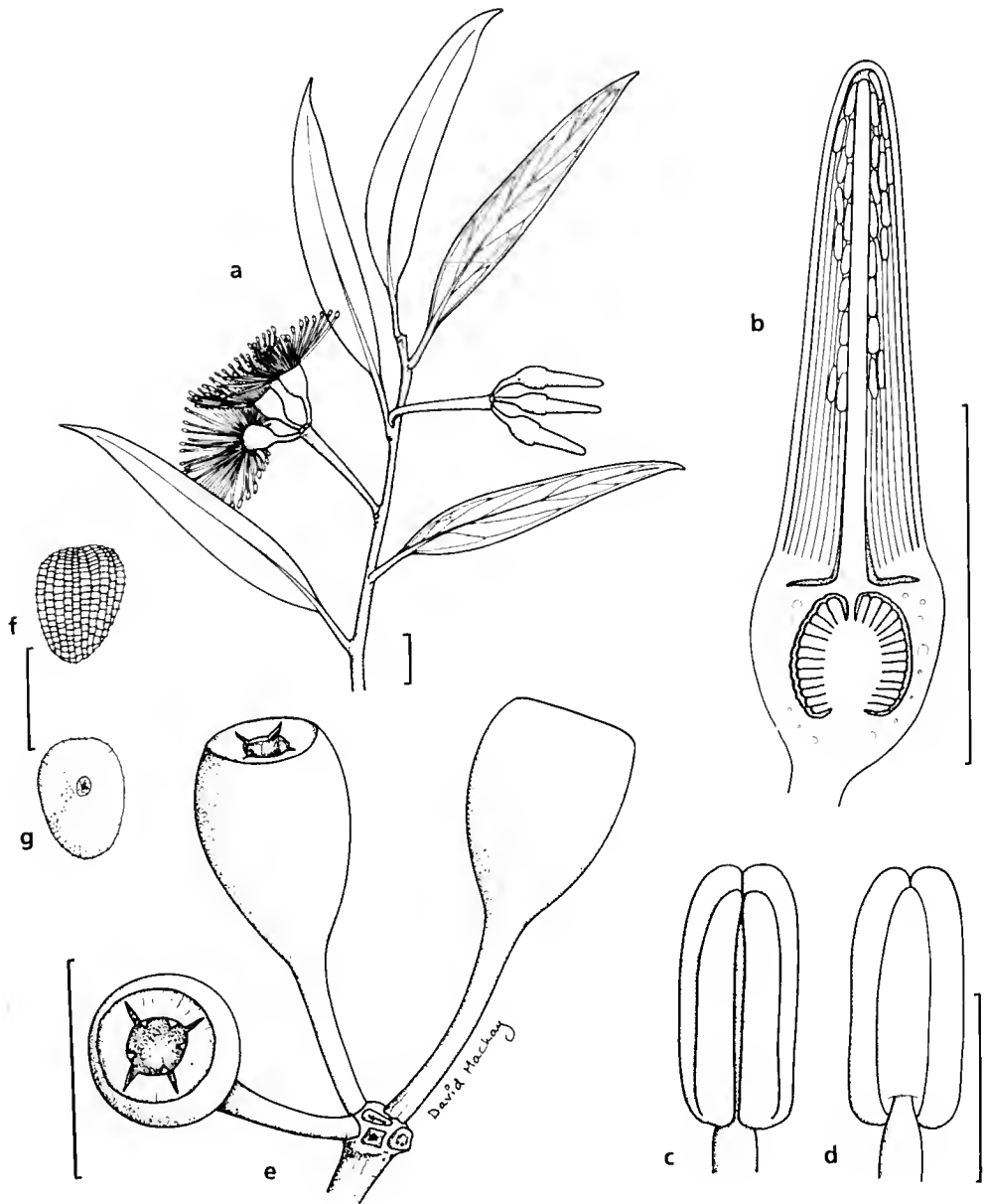


Figure 12. *E. tephroclada*. a, adult leaves, flowers and buds; b, section of bud; c, d, anther; e, fruits; f, g, seed (all from Strid 21940). Scale bar: a, b, e = 1 cm; c, d, f, g = 1 mm.

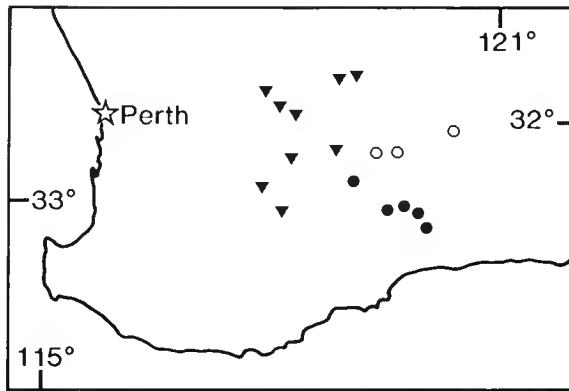


Figure 13. Distribution of *E. tephroclada* (▼), *E. iucrata* (○) and *E. depauperata* (●).

Mallee to 4 m. *Bark* smooth, semiglossy, pale grey or silver to pale brown. *Juvenile leaves* disjunct, lanceolate. *Adult leaves* disjunct, narrow-lanceolate to lanceolate, glossy, often with a distinct bluish sheen from the large, translucent stomata, 3–7 cm long, 5–12 mm wide; petioles 8–11 mm long; lateral veins scattered; reticulation sparse, incomplete; oil glands crowded, spherical. Inflorescences simple, axillary; umbellasters 7-flowered; peduncles 8–25 mm long; pedicels 3–5 mm long. *Buds* cylindrical, 16–21 mm long, 5–6 mm diam.; calyptra 2.5 times or more longer than hypanthium, cylindrical, apically rounded. *Stamens* all fertile; filaments erect; anthers oblong, dorsifixed, dehiscing through parallel slits. *Fruits* ovoid to obconical, 8–10 mm long, 6–8 mm diam.; stemonophore broad, flat, persistent; disc flat; valves acicular, basally enclosed, apically exerted. *Seeds* ovoid, somewhat flattened, grey-brown, regularly shallowly reticulate. Figure 14.

Distinguished within the *E. cremophila* group by the small leaves, buds and fruits. It is also usually a small, slender 'whipstick' mallee in contrast to the more robust habit of other members of the *E. cremophila* complex.

DISTRIBUTION: Locally frequent in the area around Lake King, extending northwest towards Pingaring (Roe District). Figure 13.

ECOLOGY: Occurs in mixed mallee shrublands, on lateritic sand or sandy loam.

Hybrids are recorded with *E. grossa* F. Muell. ex Benth. and *E. suggrandis* subsp. *alipes*.

CONSERVATION STATUS: 2R. Substantial populations occur in relatively undeveloped country. Future development could, however, threaten this species.

The epithet is from the mediaeval Latin *depauperatus*, made poor, referring to the generally smaller parts and lower stature than those of *E. cremophila* and its other close allies.

SELECTED SPECIMENS (from 7 examined): WESTERN AUSTRALIA (W to E): 4.2 km S of Varley Road on track to Dragon Rock, Hill 2469, Johnson & Blaxell, 14 Nov 1986 (NSW, PERTH); 52 km N of Ravensthorpe on Hatters Hill Road, Hill 319, Johnson & Blaxell, 22 Oct 1983 (NSW); 13.6 km S of Lake King–Norseman road on Hatters Hill Road, Brooker 8177, 7 June 1983 (CANB, NSW, PERTH); 4.5 km W of rabbit-proof fence east of Lake King, Brooker 8848, 12 Feb 1985 (CANB, NSW, PERTH).

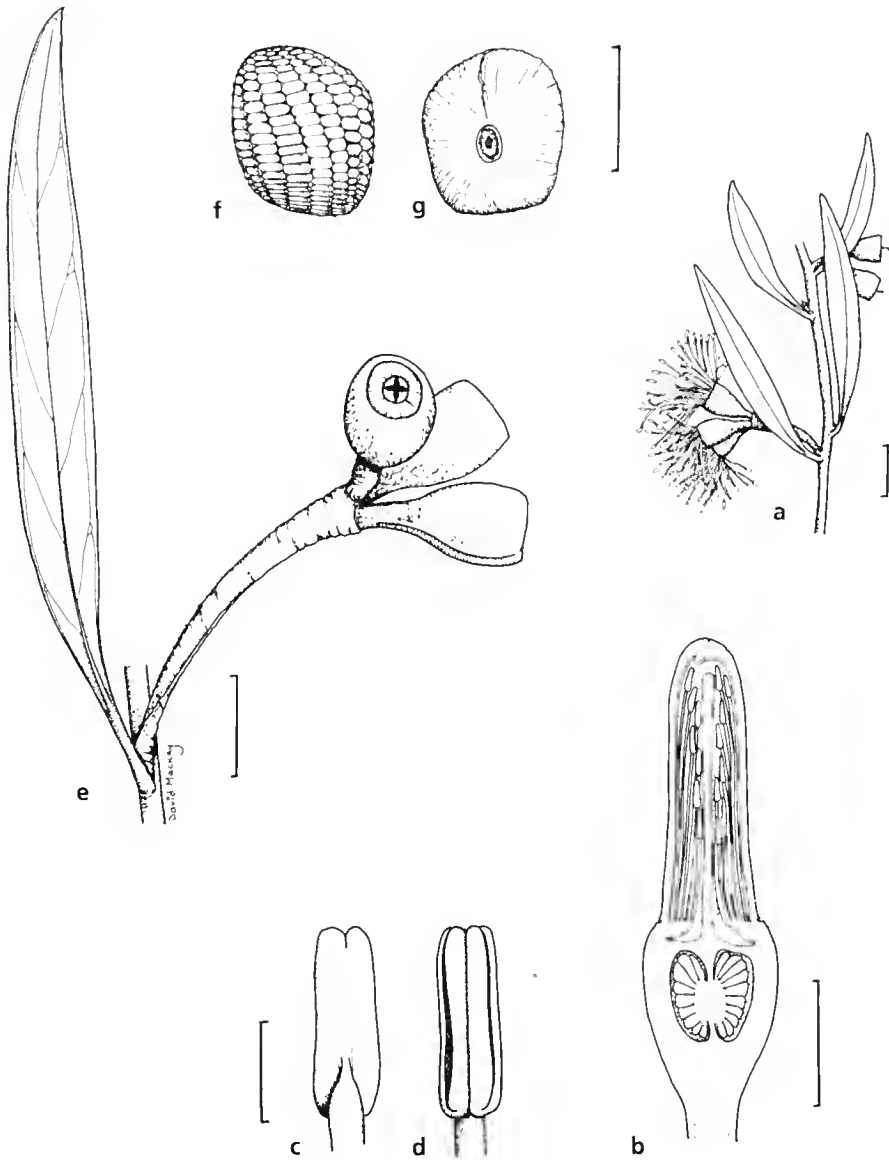


Figure 14. *E. depauperata*. a, adult leaves and flowers; b, section of bud; c, d, anther; e, adult leaf and fruits; f, g, seed (a, c, d, e, f, g from Hill 319, Johnson & Blaxell, b from Brooker 8177). Scale bar: a, e = 1 cm; b = 5 mm; c, d, f, g = 1 mm.

E. depauperata x *E. grossa*: 17.7 km W of Lake King, Hill 2391, Johnson, Blaxell & Brooker, 9 Nov 1986 (NSW).

E. depauperata x *E. suggrandis* subsp. *alipes*: 13.6 km S of Lake King–Norseman road on Hatters Hill Road, Brooker 8177, 7 June 1983 (CANB, NSW, PERTH).

Series *Cneorifoliae*

Species 15 to 19 are placed in series *Cneorifoliae*, defined by the combination: pith glands absent; filaments inflexed or irregularly flexed; anthers globoid to reniform, basifixed, subversatile, dehiscing by broad, angled slits; seeds shallowly reticulately pitted, dorsiventrally compressed.

15. *Eucalyptus phylacis* L. Johnson & K. Hill, sp. nov.

Affinis *E. decipienti* sed inter affinitatem illae combinatione sequenti characterum distinguitur: folia lanceolata; alabastra mediocria, ovoidea et non constricta; calyptra hypanthium aequans, conica; stylus brevis, rectus; fructus breviter pedicellati; pedunculus longus.

TYPE: WESTERN AUSTRALIA: Meelup, east side of Cape Naturaliste (33°35'S, 115°01'E), D.F. Blaxell 2000, L.A.S. Johnson & M.I.H. Brooker, 31 May 1983 (holo NSW; iso CANB, K, PERTH).

[*Eucalyptus* sp. K of Brooker & Kleinig (1990)]

Tree to 5 m. Bark persistent on trunk and large branches, rough, coarsely flaky, light grey-brown; outer branches smooth. Juvenile leaves disjunct, blue-grey, ovate to orbicular, to 5 cm long, 4 cm wide. Adult leaves disjunct, lanceolate to broad lanceolate, acute or acuminate, falcate, dull, 6–13 cm long, 11–30 mm wide; petioles channelled above, 7–16 mm long; lateral veins at 30–45° to midrib, ± closely spaced, regular, densely reticulate between; intramarginal vein distinct, 0.5–1.5 mm from margin. Umbellasters axillary, 7–11-flowered; peduncles terete, 7–11 mm long; pedicels terete, 1–2 mm long. Mature buds ovoid, 8–10 mm long, 4–5 mm diam.; calyptra conical, convex, obtuse, ± as long as hypanthium. Fruits cup-shaped or hemispherical, 3–4-locular, 5–7 mm long, 7–9 mm diam.; calyptra scar raised, angled incurved at c. 45°, c. 0.5 mm wide; disc ± flat, convex, 1.5–2.0 mm wide (with distinctive radial cracks crossing disc, scar and hypanthium caused by subsequent internal growth of fruit); style persistent, frequently remaining attached to one valve in open fruits; valves enclosed at base, vertically exerted, triangular. Figure 15.

Distinguished within the *E. decipiens* Endl. group by the following combination of characters: Juvenile leaves obtuse to rounded (not emarginate); adult leaves lanceolate; buds medium to large (8 mm long, 5 mm diam.), ovoid, not constricted; calyptra about as long as hypanthium, conical, convex; style short, straight, tip shallowly engaged in calyptra; fruits pedicellate (pedicel 1–2 mm long); peduncle to 12 mm long. The widespread *E. decipiens* is distinguished by the emarginate juvenile leaves, and the apparently closely related rare species *E. balauites* Grayling & Brooker ined. is distinguished by the rounded calyptra which is narrower than the hypanthium, and the larger buds (to 10 mm long).

DISTRIBUTION: Discovered by Dr Neville Marchant of the Western Australian Herbarium, *E. phylacis* is known only from a single population in the Cape Naturaliste area in the far south-west (Menzies District). Figure 16.

ECOLOGY: Localised and not frequent, in a patch of mallee-heath country on undulating laterite, in an open area in otherwise *E. calophylla* Lindley – *E. unmarginata* Sm. woodland.

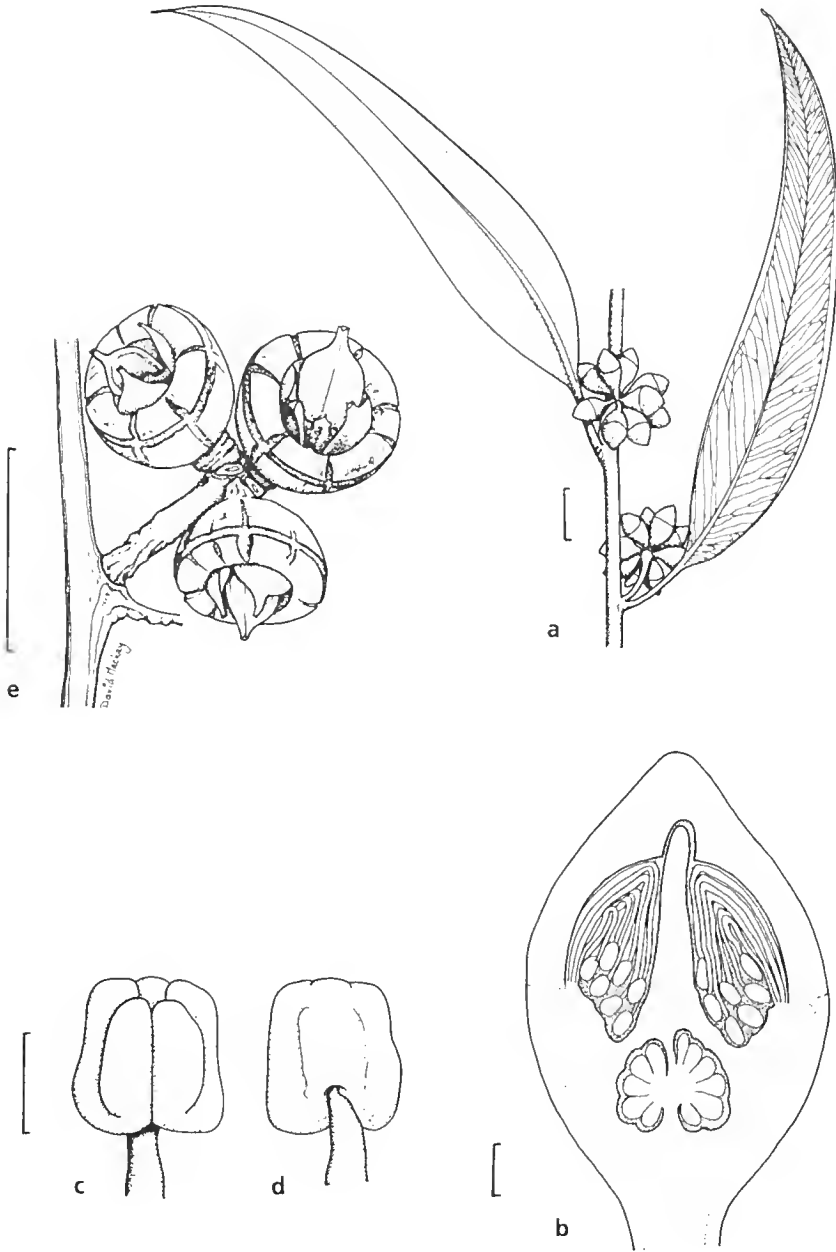


Figure 15. *E. phylaxis*. a, adult leaves and buds; b, section of bud; c, d, anther; e, fruits (all from Blaxell 2000). Scale bar: a, e = 1 cm; b = 1 mm; c, d = 0.5 mm.

CONSERVATION STATUS: 2V-. Known only from the type area, where the population has already been damaged by roadworks.

The specific epithet is from the Greek *phylakis*, a watcher or guard (female), referring to its occurrence on a hill overlooking the ocean. The feminine word (masculine equivalent *phylax*) is chosen to agree with the gender of *Eucalyptus*, but the word is a noun and not subject to change with a change of generic association. The 'y' is short as in 'lyrical', the stress is on the first syllable, and the 'c' is soft in modern usage.

SELECTED SPECIMENS (from 7 examined): WESTERN AUSTRALIA (N to S): 2 km S of Meelup, Hill 3074 A, 4 Sep 1988 (NSW); 0.9 km from Cape Naturaliste road on Meelup road, Johnson 9133 & B. Briggs, 26 Oct 1988 (NSW, CANB); hilltop 2 km S of Meelup Beach, Marchant 84/102, 14 Nov 1984 (PERTH, NSW).

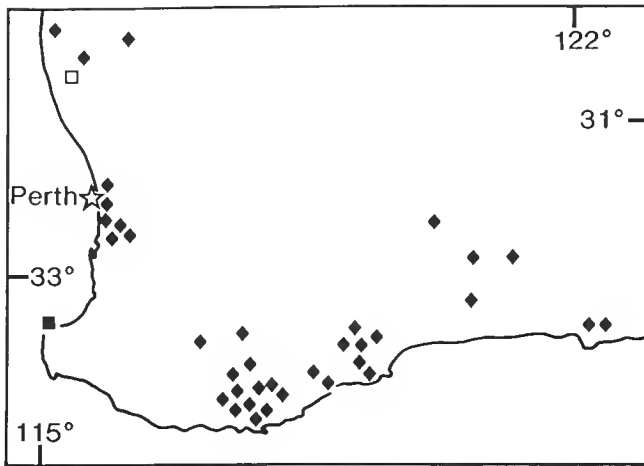


Figure 16. Distribution of *E. phylaxis* (■), *E. balanites* (□), *E. decipiens* (◆).

16. *Eucalyptus misella* L. Johnson & K. Hill, sp. nov.

Affinis *E. angustissimae* sed characteribus sequentibus distinguitur: folia adulta latiora, non nitida et faciebus similioribus; folia juvenilia latiora; fructus obconici in pedunculis pedicellisque longioribus crassioribusque; calyptra brevior, plus rotundata et quam hypanthio angustior.

TYPE: WESTERN AUSTRALIA: 11.9 km N of Rollands Road along Fields Road North, W of Grasspatch (33°08'S, 121°11'E), K.D. Hill 302, L.A.S. Johnson & D.F. Blaxell, 22 Oct 1983 (holo NSW; iso CANB, K, PERTH).

[*Eucalyptus* sp. L of Brooker & Kleinig (1990)]

Mallee to 2.5 m, often less. Foliage dense, extending to ground. Bark smooth throughout, dull, grey. Seedling leaves opposite for 5–6 nodes, linear, ± sessile. Juvenile leaves disjunct, lanceolate, ± sessile, to 5 mm wide. Adult leaves disjunct, simlifacial, lanceolate to broad-lanceolate, dull, bluish, 5–9 cm long, 8–16 mm wide; petioles to 8 mm long, broad, flattened; lateral veins moderately spaced, ± regular, at 40°–50° to midrib; oil glands large, ± dense; intramarginal vein ± obscure, 0.5–1.0 mm from margin. Inflorescences simple, axillary; umbellasters 7-flowered; peduncles terete, thick, 3–5 mm long, to 3 mm thick; pedicels thick, angular, 2 mm long, tapering into hypanthium. Mature buds ovoid, 5–7 mm long, 4–5 mm diam.; calyptra hemispherical or

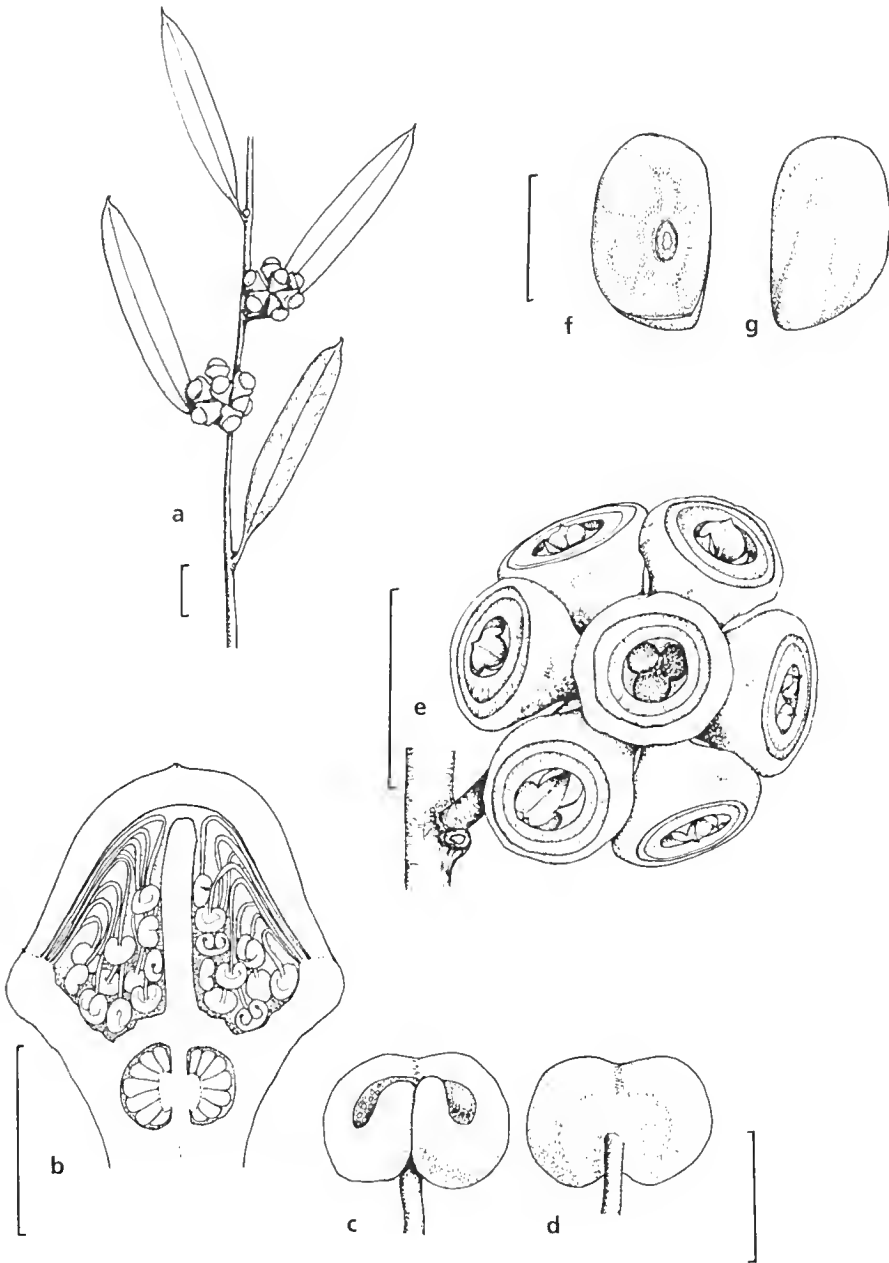


Figure 17. *E. misella*. a, adult leaves and buds; b, section of bud; c, d, anther; e, fruits; f, g, seed (all from Hill 302, Johnson & Blaxell). Scale bar: a, e = 1 cm; b = 3 mm; f, g = 1 mm; c, d = 0.5 mm.

slightly higher, sometimes finely apiculate, about as long as hypanthium, distinctly narrower than hypanthium. *Fruits* broadly obconical to almost cup-shaped, usually 3-locular, 5–6 mm long, 6–8 mm diam.; calyptra scar flat, c. 0.2 mm wide; stemonophore expanded by tissue expansion within the hypanthium after flowering, flat, 0.5–1.0 mm wide; disc flat, 0.5–1.0 mm wide; valves broadly triangular, obtuse, apically rim level, flat, with small dorsal protuberances. *Seeds* semiglossy, pale red-brown, flattened, elliptic, regularly very shallowly reticulate (almost smooth); hilum ventral; chaff similar. Figure 17.

E. misella differs from *E. angustissima* F. Muell. in the broader, dull, more simlifacial adult leaves, the broader juvenile leaves, the generally larger, obconical fruits on longer, thicker peduncles and pedicels, and the shorter, more rounded calyptra that is distinctly narrower than the hypanthium. The very similar *E. foliosa* (below) has greener, narrower leaves and slightly more delicate fruits than *E. misella*, and occurs in a quite different habitat, viz. on saline samphire flats.

DISTRIBUTION: Known only from a small area west of Grasspatch in the Esperance district. Figure 18.

ECOLOGY: Locally abundant in flat, low-lying grey or white sand-plain heath country, with *Eucalyptus tetragona* (R. Br.) F. Muell., *Eucalyptus uncinata* Turcz., *E. incrassata* Labill. (sens. lat.), *E. leptocalyx* Blakely, *E. perangusta* Brooker, *E. dolichorhyncha* (Brooker) Brooker & Hopper ined. and *E. tumida* Brooker & Hopper.

CONSERVATION STATUS: 2R.

The epithet is from the Latin *misellus*, wretched, in reference to the often low growth of this species.

SELECTED SPECIMEN (from 5 examined): WESTERN AUSTRALIA: 12.3 km N from Rollands Road on Fields Road North, Hill 2309, Johnson & Blaxell, 7 Nov 1986 (NSW).

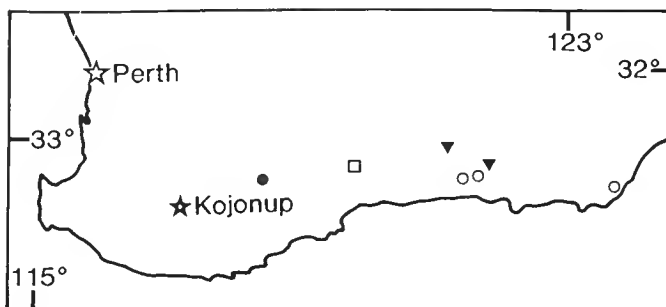


Figure 18. Distribution of *E. misella* (▼), *E. angustissima* subsp. *angustissima* (○), subsp. *quaerenda* (●) and intergrades between the two subspecies (□).

17. *Eucalyptus foliosa* L. Johnson & K. Hill, sp. nov.

Affinis et simillima *E. misellae* sed characteribus sequentibus et habitatione distincta distinguitur: folia adulta angustiora, virides et aliquanto nitentiores; fructus aliquanto minores in pedicellis gracilioribus; statura saepissime major.

TYPE: WESTERN AUSTRALIA: 2 km W of Norseman–Esperance road on Griffiths Road (33°29'S, 121°44'E), K.D. Hill 2299, L.A.S. Johnson, M.I.H. Brooker & D.F. Blaxell, 7 Nov 1986 (holo NSW; iso CANB, MEL, PERTH).

Mallee to 4 m. *Foliage* dense, extending to ground. *Bark* smooth throughout, dull, grey. *Seedling* leaves opposite for 5–6 nodes, linear, \pm sessile. *Adult leaves* disjunct, narrow-lanceolate, green, semiglossy, 4–8 cm long, 5–10 mm wide; petioles to 10 mm long, broad, flattened; lateral veins moderately spaced, \pm regular, at 30°–50° to midrib; oil glands large, \pm dense; intramarginal vein \pm conspicuous, 0.5–1.0 mm from margin. *Inflorescences* simple, axillary; umbellasters 7-flowered; peduncles terete, 2–5 mm long, to 2 mm thick; pedicels angular, 2 mm long, 1.5 mm thick, tapering into hypanthium. *Mature buds* ovoid, 5–7 mm long, 4–5 mm diam.; calyptra hemispherical or slightly longer, often broadly pointed, about as long as hypanthium, distinctly narrower than hypanthium. *Fruits* broadly obconical to almost cup-shaped, usually 3-locular, 5–6 mm long, 6–7 mm diam.; calyptra scar flat, c. 0.2 mm wide; stemonophore slightly expanded by post-flowering growth within the hypanthium, flat or slightly raised, to 0.5 mm wide; disc flat or slightly raised, 0.5–1.0 mm wide; valves broadly triangular, obtuse, apically rim level, flat, with small dorsal protuberances. *Seeds* semiglossy, pale red-brown, flattened, elliptic, regularly very shallowly reticulate (almost smooth); hilum ventral; chaff similar. Figure 19.

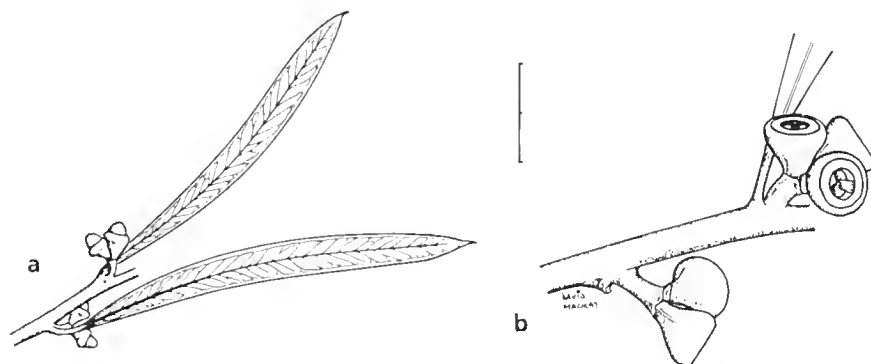


Figure 19. *E. foliosa*. a, adult leaves and buds; b, fruits (all from Hill 2299, Johnson, Blaxell & Brooker). Scale bar = 1 cm.

E. foliosa differs from *E. misella* in the narrower, green and somewhat glossier adult leaves, and the slightly smaller fruits on more slender peduncles. *E. foliosa* also frequently grows taller. Both taxa differ from *E. angustissima* in the broader, more simlifacial leaves, the larger buds and fruits, and the distinctly constricted buds.

DISTRIBUTION: This species is known only from a small area around Scaddan and Gibson, north of Esperance.

ECOLOGY: Locally abundant on often wet and saline low-lying grey or white sandy flats adjacent to salt lakes, with *E. rigens* Brooker, *E. uncinata* Turcz., *E. halophila* D. Carr & S. Carr, and samphires.

CONSERVATION STATUS: 2R.

The epithet is from the Latin *foliosus*, leafy, referring to the dense and often deep leafy crown.

SELECTED SPECIMENS (from 6 examined): WESTERN AUSTRALIA (W to E): 2.0 km N of Gibsons Soak on highway, Hill 2293, Johnson, Blaxell & Brooker, 7 Nov 1986 (NSW); 6.7 km E of Highway on Scaddan Road, Hill 2302, Johnson, Blaxell & Brooker, 7 Nov 1986 (NSW).

18. Eucalyptus angustissima F. Muell., Fragm. 4: 25 (1863).

TYPE CITATION: 'Inter promontoria Point Malcolm et Point Dover. Mxw.'

TYPE: WESTERN AUSTRALIA: between Point Malcolm and Point Dover, G. Maxwell (holo MEL; iso K).

Mallee to 4 m. Bark smooth, dull, pale grey or cream, shedding in partly adherent sheets. Juvenile leaves opposite, becoming disjunct, linear to narrow-lanceolate, grey. Adult leaves disjunct, linear to narrow-lanceolate, 4.5–13 cm long, 2–7 mm wide; petioles 2–5 mm long; lateral veins obscure; oil glands densely packed, spherical. Inflorescences simple, axillary; umbellasters 7-flowered; peduncles terete or angular, 1–4 mm long; pedicels 1–2 mm long. Buds ovoid, 4–6 mm long, 3–5 mm diam.; calyptra as long as hypanthium, hemispherical, apiculate, narrower than hypanthium. Stamens all fertile; filaments regularly inflexed; anthers basifixed, subversatile, flattened globoid, dehiscing through short, angled slits. Fruits hemispherical to broadly obconical, 3–4-locular, 4–7 mm long, 5–8 mm diam.; calyptra scar flat, c. 0.2 mm wide; stemonophore slightly expanded, flat or slightly raised, to 0.5 mm wide; disc flat or slightly raised, 0.5–1.0 mm wide; valves broadly triangular, obtuse, apically rim level, flat, with small dorsal protuberances. Seeds semiglossy, pale red-brown, flattened, elliptic, regularly very shallowly pitted and grooved (almost smooth); hilum ventral; chaff similar.

This taxon is readily distinguished within section *Cneorifoliae* by the extremely narrow adult leaves.

Locally frequent on saline flats in low areas.

Two subspecies are recognised on regional differences in leaf width.

- 1 Adult leaves less than 3 mm wide 18a. subsp. *angustissima*
- 1* Adult leaves more than 4 mm wide 18b. subsp. *quaerenda*

18a. Eucalyptus angustissima F. Muell. subsp. *angustissima*

Adult leaves linear, 7–13 cm long, 2–3 mm wide. Buds 5–6 mm long, 4–5 mm diam. Fruits 5–7 mm long, 5–8 mm diam. Figure 20.

DISTRIBUTION: Two disjunct occurrences are known, one north of Esperance and west of the Scaddan–Grasspatch area, and one near Israelite Bay (Eyre District). Figure 18.

ECOLOGY: This taxon has a patchy and sporadic distribution, forming open shrublands with *Melaleuca* spp. and with grass and sedge understorey on saline flats and around salt pans.

CONSERVATION STATUS: 3RC (Briggs & Leigh 1988: 118).

SELECTED SPECIMENS (from 11 examined): WESTERN AUSTRALIA (W to E): 4.8 km N from end of made road on Fields Road North (33°04'30"S 121°12'E), Brooker 9528, 8 Nov 1986 (CANB, NSW, PERTH); 16.1 km W of highway on Speddingup Road West (Dalyup River), Hill 2296, Johnson, Blaxell & Brooker, 7 Nov 1986 (NSW, PERTH); 10 km SW of Israelite Bay on track, Crisp 4898, 7 Jan 1979 (CBG, CANB, NSW, PERTH).

18b. *Eucalyptus angustissima* F. Muell. subsp. *quaerenda* L. Johnson & K. Hill, subsp. nov.

Ab subspecie typica foliis adultis brevioribus et latioribus etiam planis, alabastris fructibusque minoribus et hypanthio conico praesertim in fructibus differt.

TYPE: WESTERN AUSTRALIA: 100 metres S of the south shore of Lake Chinokup, K.D. Hill 2460, L.A.S. Johnson & D.F. Blaxell, 13 Nov 1986 (holo NSW; iso CANB, CBG, MEL, PERTH).

Adult leaves linear to narrow-lanceolate, 4.5–9 cm long, 4–7 mm wide. Buds 4–5 mm long, 3–4 mm diam. Fruits 4–6 mm long, 5–7 mm diam. Figure 20.

Subspecies *quaerenda* differs from subspecies *angustissima* in the shorter, broader, flat adult leaves, the smaller buds and fruits and the conical hypanthium (especially in fruits).

DISTRIBUTION: The type form is at present known from the type area only, around the southern and western edges of Lake Chinokup (Figure 18). An early collection by Muir is cited from 'towards the Tone River', the exact locality for which is obscure. It seems unlikely that a member of this group would occur in the wetter country where the Tone River joins the Warren River. The Tone River rises to the northeast near Kojonup, in country approaching a more likely range of habitats. This area has suffered widespread and thorough devastation of native flora during the development of the wheat-farming industry, and this subspecies may have suffered severe reduction of range.

ECOLOGY: A taxon of sand-plain heath on poorly drained, somewhat saline substrates.

Intergrading populations occur with subsp. *angustissima* in country north of Ravensthorpe.

CONSERVATION STATUS: 2V-. Known at present only from around the southern and western shore of Lake Chinokup.

The epithet is from the Latin *quaerendus*, to be sought, applied first at a stage in our investigations when only the early Muir collection was known, but still apt since there are few known localities.

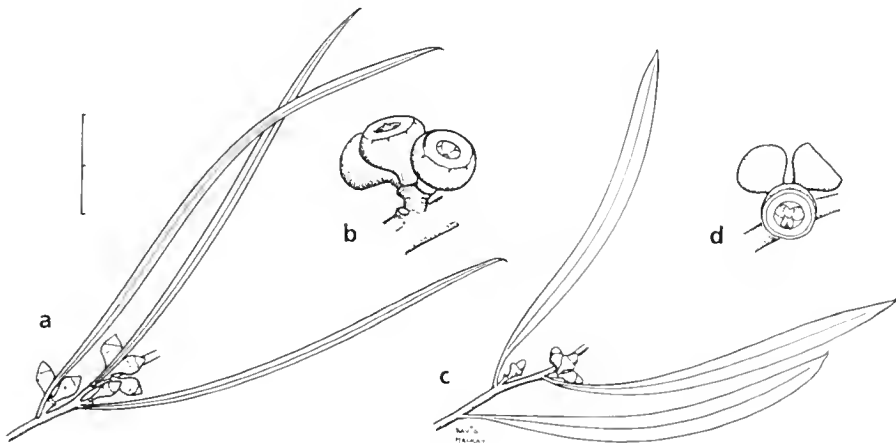


Figure 20. *E. angustissima* subsp. *angustissima*. a, adult leaves and buds; b, fruits (all from Hill 2296 *et al.*). Subsp. *quaerenda*. c, adult leaves and buds; d, fruits (all from Hill 2460 *et al.*).

SELECTED SPECIMENS (from 4 examined): WESTERN AUSTRALIA (W to E): towards the Tone River, Muir, 1880 (NSW, MEL); 8.7 km N of Katanning-Pingrup road on Chinocup Road, Brooker 9566, 27 Jan 1987 (CANB, NSW, PERTH).

Intergrades between subspecies (from 3 examined): Western Australia: 3.1 km from highway on Fitzgerald Road, Brooker 8807, 18 Jan 1985 (CANB, NSW, PERTH).

19. Eucalyptus mannensis *Boomsma*, Trans. & Proc. Roy. Soc. South Australia 88: 115, pl. 1, Figure 1 (1964).

TYPE CITATION: 'Holotypus - Northern Territory, 20.3 miles north of Angas Downs Head Station, 15.x.1957, G. Chippendale and L. Johnson 3986 (AD 95951147). Isotypes in N.T., N.S.W., Canb., Bri., Melb., N.E.K., Perth. [sic]'

Mallee to 7 m, often less, sometimes small tree to 8 m. Bark persistent, fibrous-flaky on lower stems, smooth above, grey, cream or pinkish red. Juvenile leaves disjunct, lanceolate, dull, grey-green, petiolate, 5-10 cm long, 10-25 mm wide. Adult leaves disjunct, lanceolate, acuminate, glossy, with abundant oil glands (oil glands black in dried leaves), 6-15 cm long, 8-19 mm wide; petioles 9-17 mm long; lateral veins moderately closely-spaced, at c. 45° to midrib; reticulum close; oil glands abundant; intramarginal vein distinct, within 1 mm of margin. Umbellasters axillary, 7- to 11-flowered; peduncles terete, 2-13 mm long; pedicels terete, 1-5 mm long. Mature buds ovoid, sometimes elongate, 5-9 mm long, 3-5 mm diam.; calyptra rounded, obtuse or acute, 1-2 times as long as hypanthium. Stamens all fertile, outer whorls erect, inner whorls inflexed in bud; anthers subglobular, dorsifixed (attached very low on connective), subversatile, dehiscing by short angled slits. Fruits cup-shaped, verrucose, 3-locular, 4-7 mm long, 5-9 mm diam.; calyptra scar and stemophore distinct, 0.25-0.5 mm wide, flat or slightly raised; disc 1-1.5 mm wide, flat or shallowly depressed; valves triangular, enclosed at bases, vertically raised, each with two dorsal lobes formed from outgrowths from the disc, tips often exserted; style sometimes persistent, remaining attached to one valve in open fruits. Seeds flattened-ovoid, dull, dark brown, very shallowly regularly pitted, c. 1 mm long; hilum ventral; chaff paler, smaller, linear or blocky.

The closest affinity of *E. mannensis* is with *E. jutsonii* Maiden, and not with the *E. focuuda* group as supposed by Boomsma in the protologue. *E. jutsonii* is distinguished by the linear adult and juvenile leaves.

Two groups of populations are recognised but as subspecies only, despite the lack of intergrades, since the differences are slight.

- 1 Adult leaves always glossy, largest leaves usually more than 12 mm wide 19a. subsp. **mannensis**
- 1* Adult leaves dull on new growth, largest leaves less than 12 mm wide 19b. subsp. **vespertina**

19a. Eucalyptus mannensis *Boomsma* subsp. **mannensis**

Adult leaves lanceolate, glossy, 6-15 cm long, 11-19 mm wide. Peduncles terete, 5-13 mm long. Mature buds 5-9 mm long, 3-4 mm diam. Fruits 4-7 mm long, 5-9 mm diam.

DISTRIBUTION: A taxon of the semidesert country, from the western and south-western edges of the Great Victoria Desert (Wiluna to north of Zanthus) east to north-western South Australia and south-western Northern Territory, to south of Alice Springs. Figure 21.

ECOLOGY: Widespread but sporadic on deep sand on red aeolian desert dunes.

CONSERVATION STATUS: Not considered to be at risk.

SELECTED SPECIMENS (from 40 examined): WESTERN AUSTRALIA (W to E): 29 miles [46 km] S of Wiluna on Sandstone road, *Speck 1452*, 16 Sep 1958 (CANB, NSW); 4.4 km N of Mulga Rock on Lake Minigwal track, *Hill 2670 & Johnson*, 29 Nov 1986 (NSW, PERTH); c. 26 km SE of Giles Meteorological Station, *Lazarides 8322*, 9 May 1977 (CANB, NSW). South Australia: Mann Range, 39 miles [62 km] NE of Mt Davies camp, *Dunlop 2017*, 1 Nov 1970 (DNA, NSW). NORTHERN TERRITORY (W to E): 7 miles [11 km] N of Lake Amadeus, *Chippendale NT 6360*, 28 June 1959 (DNA, NSW); 28.6 km E of Curtin Springs, *Hill 856, Johnson & Benson*, 10 July 1984 (NSW); 50 miles [80 km] S of Tempe Downs, *Forde 186*, 16 June 1956 (DNA, NSW); 116 km N of Kulgera, *Brooker 9438*, 30 Aug 1986 (CANB, NSW); Deep Well road, 34 miles [54 km] S of Alice Springs, *Nelson 1855*, 19 Mar 1969 (DNA, NSW).

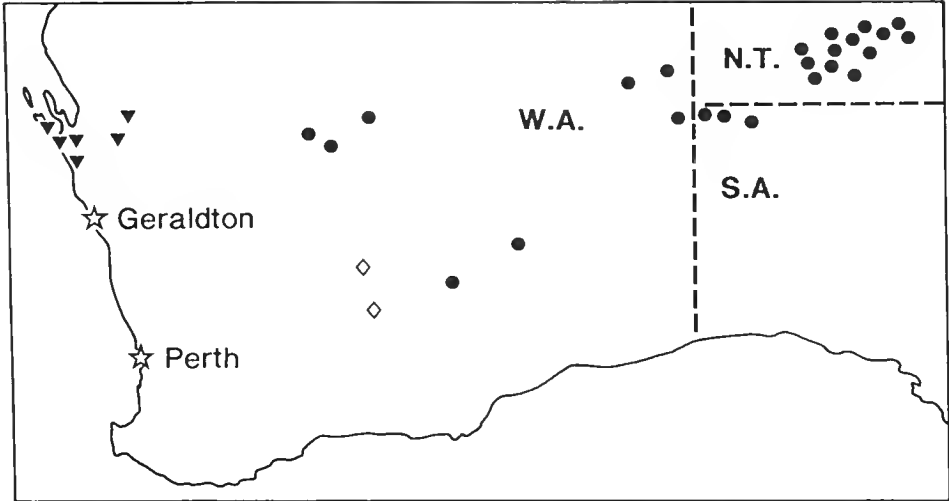


Figure 21. Distribution of *E. mannensis* subsp. *mannensis* (●), subsp. *vespertina* (▼) and *E. jutsonii* (◊).

19b. *Eucalyptus mannensis* Boomsma subsp. *vespertina* L. Johnson & K. Hill, subsp. nov.

Ab subspecie typica foliis adultis non nitentibus eis maximis plerumque angustioribus differt.

TYPE: WESTERN AUSTRALIA: 12 km W of road from 'Coburn' to 'Hamelin', *D.F. Blaxell W75/101 & M.I.H. Brooker*, 8 Oct 1975 (holo NSW; iso CANB, PERTH).

Adult leaves narrow-lanceolate to lanceolate, dull, 7–12 cm long, 8–12 mm wide. Peduncles terete, 2–8 mm long. Fruits 5–6 mm long, 6–8 mm diam. Figure 22.

DISTRIBUTION: Known only from the Shark Bay area. Figure 21.

ECOLOGY: A locally common mallee in red sandhill country.

Subsp. *vespertina* differs from subsp. *mannensis* in the duller and narrower adult leaves.

Subsp. 'western' of Brooker & Kleinig (1990).

CONSERVATION STATUS: Not considered to be at risk.

The epithet is from the Latin *vespertinus*, belonging to the evening or western, in allusion to the subspecies' more westerly distribution.

SELECTED SPECIMENS (from 15 examined): WESTERN AUSTRALIA (W to E): 5 miles [8 km] from Shark Bay road towards Tamala, *Brooker 2394*, 10 Jan 1970 (PERTH, NSW); 6 km N of Wannoo, *Blaxell W75/96 & Brooker*, 8 Oct 1975 (NSW, CANB, PERTH); 65 km S of Wannoo, *Beadle 170*, 2 Oct 1970 (UNE, NSW).

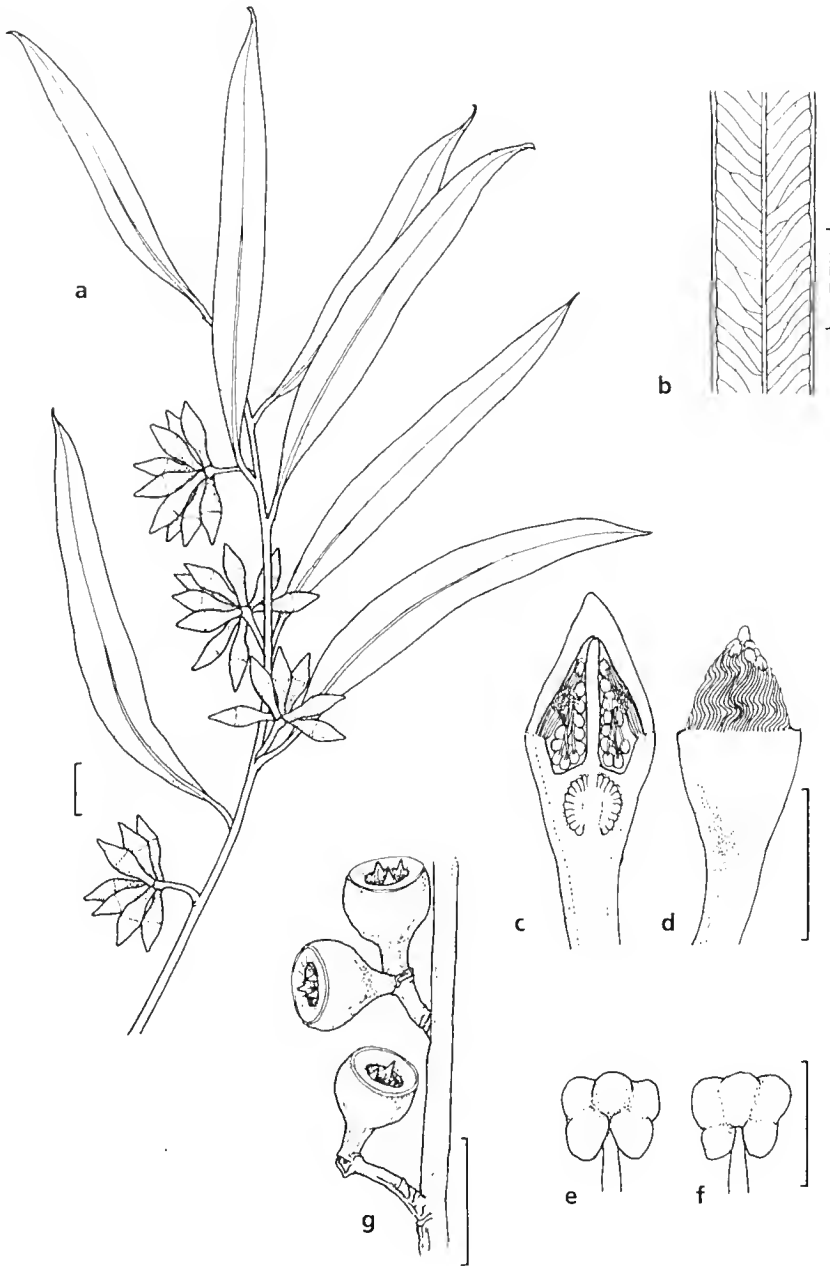


Figure 22. *E. mannensis* subsp. *vespertina*. a, adult leaves and buds; b, part of adult leaf showing venation; c, section of bud; d, bud with calyptra removed, showing filament flexure; e, f, anther; g, fruits (all from Blaxell W75/101). Scale bar: a, b, g = 1 cm; c, d = 5 mm; e, f = 0.5 mm.

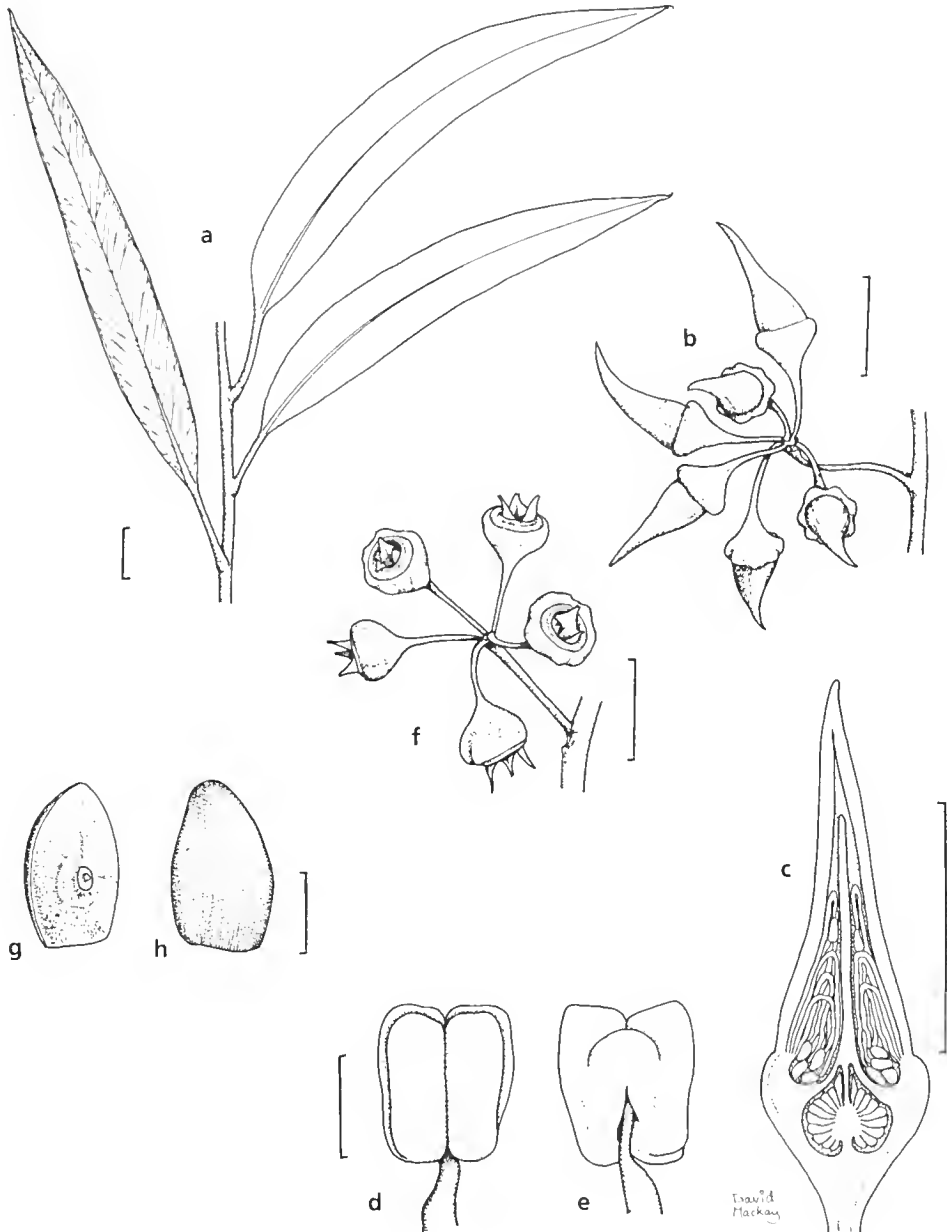


Figure 23. *E. argypha*. a, adult leaves; b, buds; c, section of bud; d, e, anther; f, fruits; g, h, seed (all from Hill 659 *et al.*). Scale bar: a, b, c, f = 1 cm; g, h = 1 mm; d, e = 0.5 mm.

Series *Falcatae*

Species 20 to 26 are placed in series *Falcatae*, defined by the combination: pith glands absent; filaments inflexed or irregularly flexed; anthers oblong to ovoid, basifixed, versatile, dehiscing by broad, angled slits; seeds shallowly reticulately pitted, longitudinally grooved, dorsiventrally compressed.

20. *Eucalyptus argyphaea* L. Johnson & K. Hill, sp. nov.

Affinis *E. ornatae* sed alabastris fructibusque minoribus et minus costatim sculptis distinguitur. Inter species affinitatis *E. falcatae* combinatione sequenti characterum distinguitur: habitus arborescens (forma 'mallet'); cortex argenteo-albus; alabastra parva non vel vix sculpta; fructus parvi non valde sculpti, nitidi. Pedunculi pedicellique longi et graciles sunt.

TYPE: WESTERN AUSTRALIA: 12 km W of Harrismith on road to Wickepin (32°55'S, 117°44'E), K.D. Hill 659, L.A.S. Johnson, D.F. Blaxell, M.I.H. Brooker, S.D. Hopper, 8 Nov 1983 (holo NSW; iso CANB, PERTH).

[*Eucalyptus* sp. J of Brooker & Kleinig (1990)]

Tree (mallet) to 15 m, trunk straight to c. 5 m. Bark smooth, shining pale silver-grey or white. Juvenile leaves opposite for many nodes, elliptic, acute or apiculate, to 4 cm long, 25 mm wide, petioles to 6 mm long. Adult leaves disjunct, lanceolate, usually falcate, acute or acuminate, ± glossy, 5–10 cm long, 11–16 mm wide; petioles 10–16 mm long; lateral veins at 30–40° to midrib, ± closely-spaced, densely reticulate between; intramarginal vein distinct, 0.5–1.0 mm from margin. Umbellasters axillary, 7-flowered; peduncles terete, 9–13 mm long, slender; pedicels terete, 5–8 mm long, slender. Mature buds broad-conical, apically narrow-conical, 16–21 mm long, 5–7 mm diam.; calyptra narrow-conical, narrower than hypanthium, 2.5–3.5 times longer than hypanthium. Fruits globular, sometimes ribbed, 3-locular, apically constricted, 6–8 mm long, 5–7 mm diam.; calyptra scar flat, continuous with hypanthium, c. 0.5 mm wide; stemonophore distinct, flat, c. 1 mm wide; disc flat, c. 1 mm wide, separated from stemonophore by a groove, enclosing valve bases and sometimes breaking apart on dehiscence; style persistent, splitting into 3 on dehiscence and giving valves an attenuate appearance; valves and style remnants vertically exserted. Seeds glossy dark grey, elliptic, shallowly reticulate, 1.5–2.0 mm long; chaff smaller, reddish brown, angular. Figure 23.

Nearest to *E. ornata* Crisp, from which it differs in the generally smaller and less ribbed buds and fruits. Distinguished within the *E. falcata* Turcz. group by the tree (mallet) habit, the silver-white bark, the small, almost smooth buds (16–21 mm long, 5–7 mm diam.), and the small, often smooth, glossy fruits (6–8 mm long, 5–6 mm diam.). Peduncles and pedicels are relatively long (9–13 and 5–8 mm respectively) and slender.

DISTRIBUTION: Restricted to the southern Wheat Belt, from Harrismith to south of Lake King (Avon and Roe Districts). Figure 24.

ECOLOGY: A localised species in mallet woodlands on fairly level, pale sandy loams, but often on slight residual lateritic rises, with *E. gardneri* Maiden and *E. longicornis* (F. Muell.) F. Muell. ex Maiden. Once used for tanbark but now extensively cleared for wheatlands.

CONSERVATION STATUS: 3R. The range of this species lies almost wholly within agricultural country that has been extensively and indiscriminately cleared.

Intergrades are recorded with *E. ornata*.

The specific epithet is from the Greek *argyphēos*, silvery white, in reference to the striking and distinctive silvery bark of the trunk. The stress is on the second syllable, in English contexts pronounced 'jif'.

SELECTED SPECIMENS (from 16 examined): WESTERN AUSTRALIA (W to E): 13.3 km S of Brookton-Corrigin road on Dudinin road, *Hill 2990*, 31 Aug 1988 (NSW); 8.3 km N of Nyabing on Kukerin North Road, *Brooker 9143*, 9 Dec 1985 (CANB, NSW, PERTH); 6.7 km E of Needilup North Road on Ryans Road, *Hill 3135*, 7 Sep 1988 (NSW); 25.0 km W of Lake King towards Newdegate, *Hill 2392*, *Johnson, Blaxell & Brooker*, 9 Nov 1986 (NSW, PERTH); 4.6 km W of Hatters Hill Road on Lake King-Norseman road, *Brooker 8682*, 8 Sep 1984 (CANB, NSW, PERTH).

Intergrades with *E. ornata*: 43.5 km W of Lake King-Hyden road on Holt Rock-Kulin road, *Johnson 9188 & B.G. Briggs*, 1 Nov 1988 (NSW); Hatters Hill, *Mollemans 2710*, 26 May 1990 (NSW, PERTH, CANB).

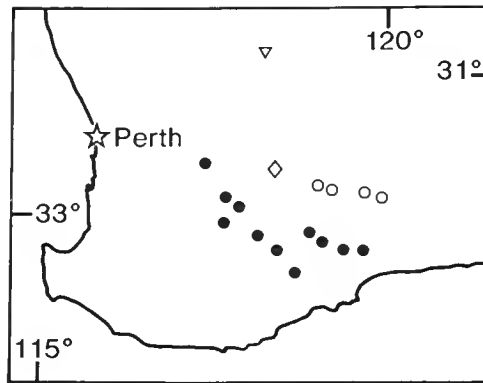


Figure 24. Distribution of *E. argyphaea* (●), *E. recta* (▽), *E. ornata* (◇) and *E. argyphaea*-*E. ornata* intergrades (○).

21. *Eucalyptus recta* L. Johnson & K. Hill, sp. nov.

Inter species affinitatis *E. falcatae* combinatione sequenti characterum distinguitur: habitus arborescens (forma 'mallet'); cortex argenteus vel albus; alabastra magna, sculpti in costas latas et non profundas; calyptra longa, acuta; fructus magna; pedunculi pedicellique longi.

TYPE: WESTERN AUSTRALIA: corner of Cadoux-Koorda road and Johnson Road, *K.D. Hill 2504*, L.A.S. *Johnson & D.F. Blaxell*, 16 Nov 1986 (holo NSW; iso CANB, CBG, MEL, PERTH)

Tree (mallet) to 15 m, trunk straight to c. 5 m. Bark smooth, shining pale silver-grey or white. Juvenile leaves opposite for many nodes, elliptic, acute or apiculate, to 4 cm long, 25 mm wide, petioles to 6 mm long. Adult leaves disjunct, lanceolate, usually falcate, acute or acuminate, ± glossy, 5–10 cm long, 11–16 mm wide; petioles 10–16 mm long; lateral veins at 30–40° to midrib, ± closely-spaced, densely reticulate between; intramarginal vein distinct, 0.5–1.0 mm from margin. Umbellasters axillary, 7-flowered; peduncles terete, 15–25 mm long, slender; pedicels terete, 9–18 mm long, slender. Mature buds broad-conical, apically narrow-conical, 22–25 mm long, 8–9 mm diam.; calyptra narrow-conical, narrower than hypanthium, 2.5–3.5 times longer than hypanthium. Fruits depressed-globular, distinctly ribbed, 3-locular, apically con-

stricted, 8–9 mm long, 10–12 mm diam.; calyptra scar flat, continuous with hypanthium, c. 0.5 mm wide; stemonophore distinct, flat, c. 1 mm wide; disc flat, 1–2 mm wide, separated from stemonophore by a groove, enclosing valve bases and sometimes breaking apart on dehiscence; style persistent, splitting into 3 on dehiscence and giving valves an attenuate appearance; valves and style remnants vertically exserted. *Seeds* glossy dark grey, elliptic, shallowly reticulate, 1.5–2.0 mm long; chaff smaller, reddish brown, angular. Figure 25.

Nearest to *E. ornata* Crisp, from which it differs in the larger buds (buds 14–20 mm long in *E. ornata*). Distinguished in the *E. falcata* group by the tree habit, the white bark, the large buds (22–25 mm long, 8–9 mm diam.) which are broadly shallowly ribbed, the long, acute calyptra, the large fruits (8–9 mm long, 10–12 mm diam.). Pedicels and peduncles are relatively long (15–25 and 9–18 mm respectively).

DISTRIBUTION: Known from a small area near Cadoux (Avon District), well separated from the occurrence of *E. ornata*. Figure 24.

ECOLOGY: Locally frequent but very restricted, in mallet woodlands with *E. gardneri* Maiden, slightly above the surrounding country, as in the cases of *E. argyphaea* and *E. ornata*.

CONSERVATION STATUS: 2V. Known only from a restricted area that lies wholly within agricultural country and has been extensively cleared.

The epithet is from Latin *rectus*, straight, referring to the straight trunks.

SELECTED SPECIMENS (from 5 examined): WESTERN AUSTRALIA (N to S): c. 3 miles [5 km] E of Cadoux, *B. Smith 644*, 13 Feb 1986 (MEL, CANB, HO, NSW, PERTH); *Brooker 9381*, 2 July 1986 (CANB, NSW, PERTH); near Manmanning, *B. & M. Smith*, 13 Feb 1985 (CBG 8600356, NSW).

22. *Eucalyptus balanopelex* L. Johnson & K. Hill, *sp. nov.*

Affinis *E. semiglobosae* sed characteribus sequentibus distinguitur: folia adulta minima angustioraque, pedicelli longiores et calyptra major longiorque.

TYPE: WESTERN AUSTRALIA: 0.5 km from Fisheries road on Coolinup Road, *K.D. Hill 2285* & *L.A.S. Johnson*, 6 Nov 1986 (holo NSW; iso CANB, CBG, MEL, PERTH).

Mallee to 4 m. *Bark* smooth throughout, grey or light brown. *Adult leaves* disjunct, simlifacial, broad-lanceolate, acute or acuminate, 5–12 cm long, 7–28 mm wide; petioles 10–23 mm long, flattened; lateral veins moderately spaced, regular, at 30–45° to midrib; reticulum regular; oil glands medium size, sparse; intramarginal vein continuous, distinct, 0.5–1.0 mm from margin. *Inflorescences* simple, axillary; umbellasters 7-flowered; peduncles terete, 10–20 mm long; pedicels terete, 5–11 mm long. *Mature buds* ovoid, smooth or shallowly ribbed, c. 16 mm long, c. 9 mm diam.; calyptra conical, convex, obtuse or rounded, c. 1.5 times longer than hypanthium. *Stamens* all fertile; filaments regularly inflexed; anthers shortly oblong, dorsifixed, versatile, dehiscing through short parallel slits. *Fruit* globular-truncate, usually somewhat ribbed, 3–4-locular, 8–10 mm long, 10–12 mm diam.; calyptra scar flat, 0.3–1.0 mm wide; inner growth zone scar flat, 0.5–1.0 mm wide; stemonophore elevated 0.5–1.0 mm above scar, flat, 0.5–1.0 mm wide; disc \pm vertically depressed, c. 1–2 mm wide; valves narrowly triangular, long apiculate with persistent style remnants, basally deeply enclosed, apically vertically exserted, to 5 mm long. Figure 26.

E. balanopelex differs from *E. semiglobosa* (Brooker) L. Johnson & K. Hill in the larger buds with a larger and longer calyptra, the longer pedicels and the smaller and narrower adult leaves. It occurs in a swampy sandplain habitat in contrast to the granite shelf habitat of *E. semiglobosa*.

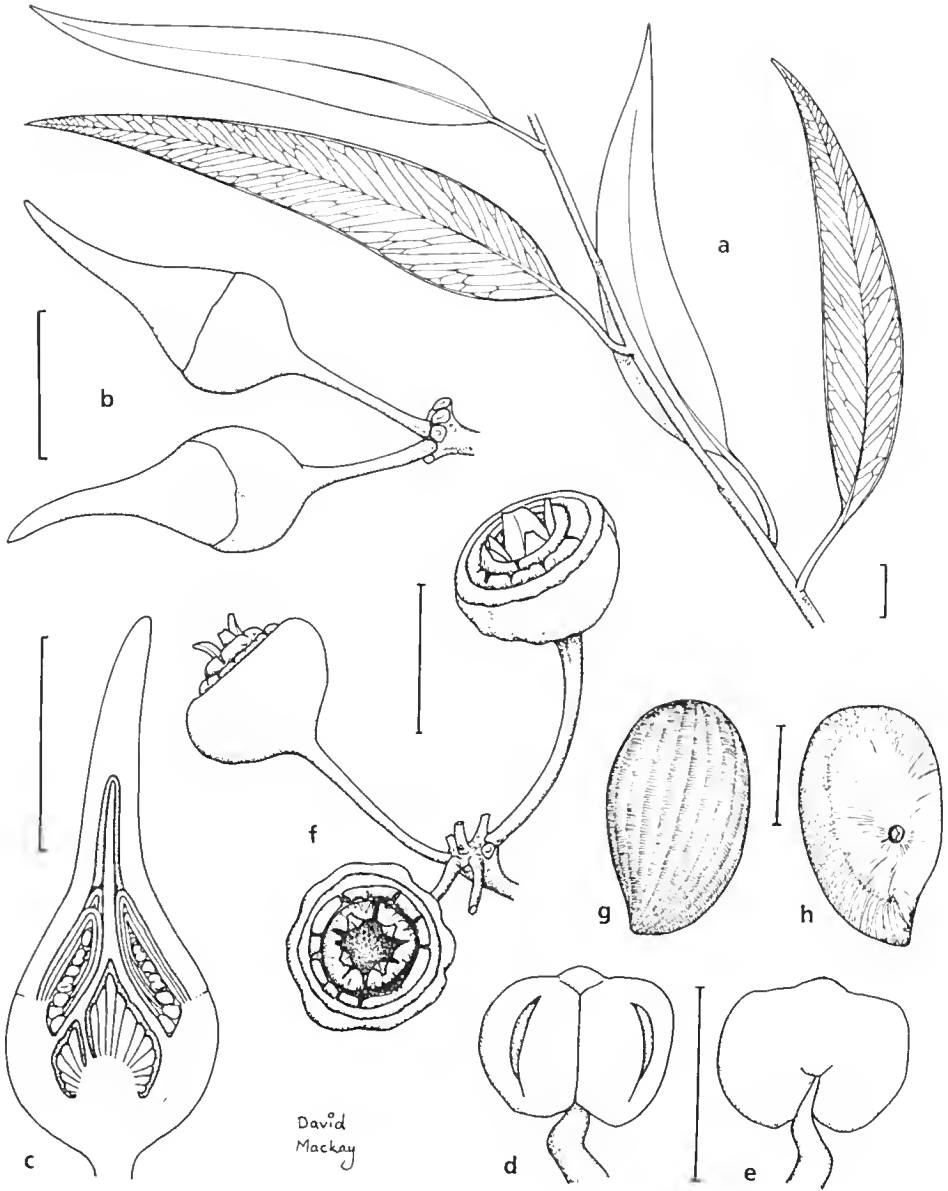


Figure 25. *E. recta*. a, adult leaves; b, buds; c, section of bud; d, e, anther; f, fruits; g, h, seed (a – e from Smith 644, f – h from Brooker 9381). Scale bar: a, b, c, f = 1 cm; d, e, g, h = 1 mm.

DISTRIBUTION: Known only from two populations in the subcoastal area east of Esperance (Eyre District). Figure 27.

ECOLOGY: This is an uncommon species, occurring in small stands in mallee heathland on swampy white or grey sandplain.

CONSERVATION STATUS: 2V. Of restricted occurrence in an area that is suffering active agricultural development.

The epithet is from the Greek *balanos*, an acorn, and *pelex*, a helmet, referring to the shape of the calyptra. The stress is on the penultimate syllable, because of the long 'e' (eta) in the Greek.

SELECTED SPECIMENS (from 5 examined): WESTERN AUSTRALIA: 14 km from Fisheries Road on Merivale Road, L. Johnson 9067 & M. Johnson, 14 May 1988 (NSW, CANB, MEL, PERTH); 30.1 miles [48 km] E of Esperance, Chippendale 400, 25 Mar 1968 (CANB, NSW, PERTH).

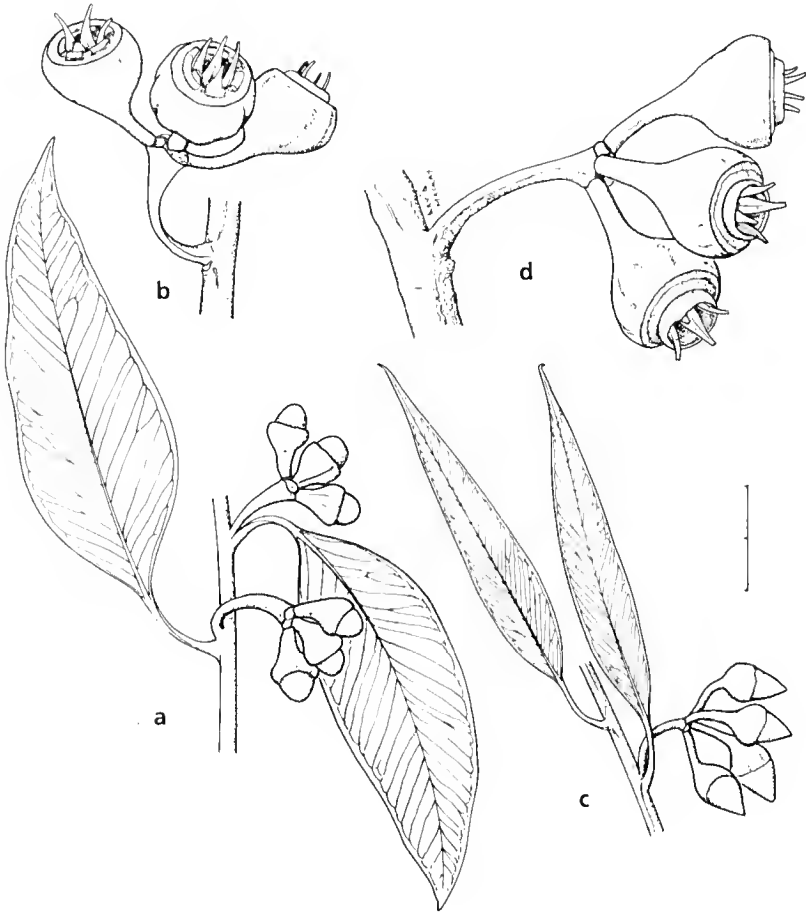


Figure 26. *E. semiglobosa*. a, adult leaves and buds; b, fruits (all from Brooker 3613). *E. balanopelex*. c, adult leaves and buds; d, fruits (all from Hill 2285 & Johnson). Scale bar = 1 cm.

23. *Eucalyptus semiglobosa* (Brooker) L. Johnson & K. Hill, stat. nov.

BASIONYM: *Eucalyptus goniantha* Turcz. subsp. *semiglobosa* Brooker, Nuytsia 2: 110 (1976).

TYPE CITATION: 'Type: Between Mt Le Grand and Frenchmans Peak, Western Australia (33°59'S, 122°08'E) 22 April 1972, M.I.H. Brooker 3613 (holo FRI [now CANB]; iso PERTH, NSW, K, AD, MEL, BRI).'

Mallee to 4 m. Bark smooth throughout, grey or light brown. Adult leaves disjunct, simlifacial, broad-lanceolate, acute or acuminate, 6–12 cm long, 18–38 mm wide; petioles 12–32 mm long, ± quadrangular; lateral veins moderately spaced, regular, at 30–45° to midrib; reticulum regular; oil glands medium size, sparse; intramarginal vein continuous, distinct, 0.5–1.0 mm from margin. Inflorescences simple, axillary; umbellasters 7-flowered; peduncles terete, 9–21 mm long; pedicels terete, 2–8 mm long. Mature buds ovoid, smooth or shallowly broadly ribbed, 9–11 mm long, 7–9 mm diam.; calyptra hemispherical or oblong, rounded, about as long or slightly longer than hypanthium. Stamens all fertile; filaments regularly inflexed; anthers shortly oblong, dorsifixed, versatile, dehiscing through short parallel slits. Fruit globular-truncate, usually somewhat ribbed, 3–4-locular, 8–10 mm long, 10–14 mm diam.; calyptra scar flat, 0.3–1.0 mm wide; inner growth zone scar flat, 0.5–1.0 mm wide; stemophore elevated 0.5–1.0 mm above scar, flat, 0.5–1.0 mm wide; disc ± vertically depressed, c. 1–2 mm wide; valves narrowly triangular, long apiculate with persistent style remnants, basally deeply enclosed, apically vertically exerted, to 5 mm long. Figure 26.

This taxon is distinguished from *E. goniantha* Turcz. by the elongate pedicels and peduncles and the relatively short, broad calyptra. Recent discovery of *E. goniantha* subsp. *notacliles* (see below) within a few hundred metres of the type locality of *E. semiglobosa* indicates that the two are almost sympatric and show little interbreeding. Subspecific status is thus not appropriate. Its sister species is probably *E. balanopelex*, and the two together are then closest to *E. falcata*, with a more distant relationship with *E. goniantha*.

DISTRIBUTION: Scattered and very sporadic, from Cape Le Grand to Cape Arid (Eyre District). Figure 27.

ECOLOGY: Known from a few stands only, on shallow sandy soil on subcoastal granite domes east of Esperance.

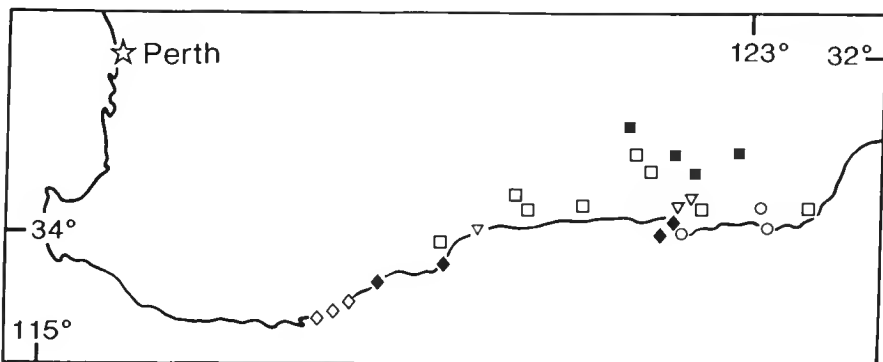


Figure 27. Distribution of *E. goniantha* subsp. *goniantha* (◇), subsp. *notaclites* (◆), *E. kessellii* subsp. *kessellii* (■), subsp. *eugnosta* (□), *E. balanopelex* (▽) and *E. semiglobosa* (○).

CONSERVATION STATUS: 2RC. Stands of this species occur in Cape Le Grand and Cape Arid National Parks.

SELECTED SPECIMENS (from 8 examined): WESTERN AUSTRALIA: Whalebone to Quoin Head, *Brooker 10152*, 13 Dec 1988 (CANB, NSW, PERTH); Boyatup Hill, *Pullen 10085*, 18 Dec 1974 (CANB, NSW); SE side and base of Mt Arid, *Hardie 13*, 23 Nov 1985 (NSW); 300 metres E of old Hill Springs homestead, SE side of Mt Arid, *Hill 3161*, 8 Sep 1988 (NSW, AD, CANB, MEL, PERTH).

24. *Eucalyptus goniantha* Turcz., Bull. Soc. Imp. Nat. Moscou 20(1): 163 (1847).

TYPE CITATION: 'Nova Hollandia, Drum, n. 71.'

TYPE: WESTERN AUSTRALIA: King George Sound, Swan River Colony, *J. Drummond, 3rd collection no. 71*, 1845 (holo LE; iso BM, CGE, E, FI, G, K, W).

≡ *E. incrassata* Labill. var. *goniantha* Maiden, Crit. Revis. *Eucalyptus* 1: 103 (1904).

The name *E. goniantha* was misapplied by Bentham (1867) to the taxon shown to be *E. kessellii* by critical examination of the types (see below). This misapplication was followed by subsequent authors. Both Maiden and Blakely recognised the type form of *E. kessellii* as a distinct taxon (see below), but persisted with the misapplication for the more widespread and less distinctive form discussed below. Brooker & Kleinig (1990) correctly apply the names *E. goniantha* and *E. kessellii*, although they include *E. semiglobosa* (above) in the former, and illustrate fruits of *E. kessellii* as *E. goniantha*.

Mallee to 6 m, rarely a tree. *Bark* smooth, grey to brown or orange, shedding in patchily adherent scales, especially on lower trunk. *Branchlets* winged, glaucous. Juvenile leaves disjunct, petiolate, ovate to orbicular, to 13 cm long, 8 cm wide. *Adult leaves* disjunct, broad-lanceolate to ovate, acute to acuminate, dull, 6–15 cm long, 10–50 mm wide; petioles angular, 9–25 mm long, angles decurrent; lateral veins at 30–45° to midrib, ± closely spaced, regular, densely reticulate between; intramarginal vein distinct, 1–2 mm from margin. *Umbellasters* axillary, 7–11-flowered; peduncles strongly winged, 7–16 mm long, to 7 mm wide apically; pedicels 0–5 mm long, to 3 mm wide. *Mature buds* elongate-ovoid, apically constricted, hypanthium ± 2-winged, 8–17 mm long, 5–7 mm diam.; calyptra conical, obtuse, with a distinct median constriction, 1–1.5 times longer than hypanthium. *Stamens* all fertile; filaments regularly inflexed in bud, kinked at point of flexure; anthers shortly oblong, dorsifixed, versatile; cells divergent, dehiscing by short slits. *Fruits* globular to hemispherical, apically constricted, 3–4-locular, 6–9 mm long, 6–11 mm diam.; calyptra scar distinct, recessed, flat, c. 0.5 mm wide; disc 1.5–2 mm wide, depressed at c. 45°; valves deeply enclosed basally, vertically exerted, long-acuminate with remains of persistent style fused to each valve. *Seeds* semiglossy, dark grey to black, elliptic, shallowly reticulate, 1.5–2.0 mm long; hilum ventral; chaff smaller, angular, glossy red-brown.

Distinguished within the series by the combination: bark smooth; juvenile leaves broad; peduncles and pedicels short, thick; fruits rounded, apically contracted.

Two geographic subspecies are recognised chiefly on differences in pedicel length.

- 1 Pedicels more than 2 mm long 24a. subsp. *goniantha*
 1* Pedicels less than 1 mm long or absent 24b. subsp. *notactites*

24a. *Eucalyptus goniantha* Turcz. subsp. *goniantha*

Branchlets winged, not glaucous. *Adult leaves* disjunct, lanceolate to broad-lanceolate, acute to acuminate, dull, 8–11 cm long, 10–20 mm wide; petioles 9–25 mm long.

7–11-flowered; peduncles 7–10 mm long, to 0.7 mm wide apically. *Pedicels* more than

2 mm long. *Buds* 8–14 mm long, 4–6 mm diam. *Fruits* pedicellate, hemispherical, 6–8 mm long, 6–9 mm diam.

DISTRIBUTION: Known only from a few headlands and subcoastal hills in the Two Peoples Bay area (Menziess District). Figure 27.

ECOLOGY: Locally frequent but very restricted in distribution, in dense coastal shrub heath on shallow sandy soils.

Isolated occurrences of intergrading forms with *E. falcata* Turcz. (sens. lat.) are known.

CONSERVATION STATUS: 2RC.

SELECTED SPECIMENS (from 5 examined): WESTERN AUSTRALIA: walking track on Flinders Peninsula, *Brooker* 9993, 20 July 1988 (CANB, NSW, PERTH); c. 3 km W of Manypeaks, *Brooker* 9822, 26 Nov 1987 (CANB, NSW, PERTH); West Ridge, Two Peoples Bay, *Brooker* 7191, 15 Nov 1981 (CANB, NSW, PERTH).

E. falcata sens. lat. – *E. goniantha* subsp. *goniantha* intergrade: 26 km E of Bakers Junction on road to Manypeaks, *Brooker* 8738, 29 Nov 1984 (CANB, NSW, PERTH).

24b. *Eucalyptus goniantha* Turcz. subsp. *notactites* L. Johnson & K. Hill, subsp. nov.

Ab subspecie typica ramulis novellis et pedunculis valde alatis; foliis longioribus crassioribusque et fructibus plus sessilibus differt.

TYPE: WESTERN AUSTRALIA: Mt Melville garbage tip, 16.5 km from highway, *K.D. Hill* 2429, *L.A.S. Johnson, D.F. Blaxell & M.I.H. Brooker*, 12 Nov 1986 (holo NSW; iso PERTH).

Branchlets winged, glaucous. *Adult leaves* disjunct, broad-lanceolate to ovate, acute to acuminate, dull, 6–15 cm long, 15–50 mm wide; petioles 9–25 mm long. *Umbellasters* 7–11-flowered; peduncles 9–16 mm long, to 0.7 mm wide apically. *Mature buds* sessile or on short pedicels (to 1 mm long), hypanthium \pm 2-winged, 11–17 mm long, 5–7 mm diam. *Fruits* globular, sessile, \pm 2-winged, 6–8 mm long, 8–10 mm diam. Figure 28.

Subsp. *notactites* differs from subsp. *goniantha* in the more sessile buds and fruits, the strongly winged young branchlets and peduncles, and the longer, thicker leaves.

It was referred to as *E. goniantha* subsp. 'sessile fruit', by Brooker & Kleinig (1990).

DISTRIBUTION: This taxon has a very scattered, sporadic distribution from Mt Melville in the Cape Riche area east to Cape Le Grand, with a large disjunction in the range. Figure 27.

ECOLOGY: Locally frequent on shallow sand on laterite or on white sand, known only from sites very near the sea.

CONSERVATION STATUS: 3RC.

The epithet is from the Greek *notos*, the south, and *aktites*, a watcher, from the subspecies' occurrence on the south-facing oceanic coast.

SELECTED SPECIMENS (from 10 examined): WESTERN AUSTRALIA (W to E): Konkoberup Hill (Mt Melville), *Brooker* 8945, 12 Apr 1985 (CANB, NSW, PERTH); Cape Riche, *Diels* 3504, 18 July 1901 (B, NSW); 5.5 km S of Borden–Bremer Bay road on Reef Beach Road, *Brooker* 8872, 2 Mar 1983 (CANB, NSW, PERTH); c. 2 km W of Hood Point, *Brooker* 9918, 9 Mar 1988 (CANB, NSW, PERTH); Cape Le Grand, *Hill* 3156, 8 Sep 1988 (NSW, CANB, PERTH); Sandy Hook Island near Esperance (34°04'S, 122°20'E), *Brooker* 7492, 7493, 1 May 1982 (CANB, NSW, PERTH).

Intergrades between the subspecies: Cheyne Beach, 1 km along track to Mermaid Point, *Brooker* 7170, 14 Nov 1981 (CANB, NSW, PERTH).

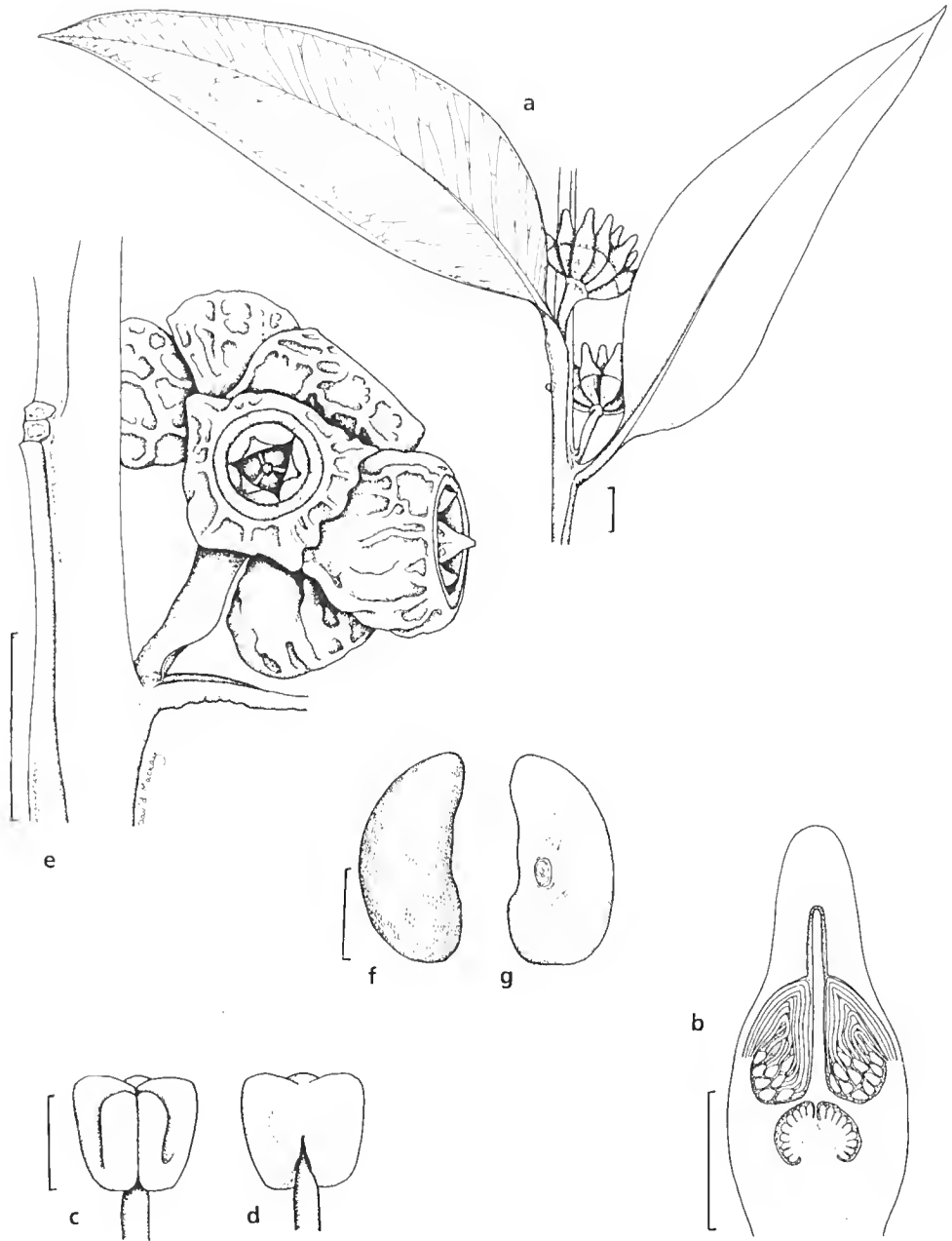


Figure 28. *E. goniantha* subsp. *notactites*. a, adult leaves and buds; b, section of bud; c, d, anther; e, fruits; f, g, seed (a – d from Brooker 7492, e – g from Brooker 7493); Scale bar: a, f = 1 cm; b = 5 mm; g, h = 1 mm; d, e = 0.5 mm.

25. *Eucalyptus kessellii* Maiden & Blakely, J. & Proc. Roy. Soc. New South Wales 59: 187 (1925).

TYPE CITATION: 'Known only from Western Australia. Found in sandy loam in Mallee thickets at a place called Salmon Gums, 66 miles north of Esperance (W.P. Brown per C.A. Gardner, no. 944a; the type).'

TYPE: holo NSW; iso PERTH.

[*E. goniantha* auct. plur. non Turcz.: Bentham (1867); Maiden, Crit. Revis. Eucalyptus 2: 200 (1912); Blakely (1934); Gardner (1960); Chippendale (1973); Chippendale (1988); Brooker & Kleinig (1990: 216, photograph of fruits). Both Maiden and Blakely recognised the type form of *E. kessellii* as a taxon distinct from the less coarse and more widely known form which they regarded incorrectly as *E. goniantha*, and which we separate as a subspecies of *E. kessellii*, below. Gardner (1960) included *E. kessellii* in *E. goniantha*, and was followed by Chippendale (1973, 1988).]

[*E. corrugata* auct. non Luehmann, Victorian Nat. 13: 168 (1897). The binomial *E. corrugata* was also published as a *nomen nudum* by Diels & Pritzel (1905: 443), and that publication was then cited (as *E. corrugata* Luehmann ex Diels) as a synonym of *E. goniantha* (in the incorrect application of the latter name) in Index Kewensis. The Diels publication cites the same specimen as the type in Luehmann's earlier publication, a Sayer collection from near Southern Cross, which is a specimen of *E. corrugata* Luehmann, and collected at a great distance from the nearest occurrence of *E. goniantha*.]

Tree or mallee to 10 m. Bark persistent for basal 0.5–3 m, dark grey, coarsely fibrous, then smooth, grey, pink and pale brown. Juveniles leaves disjunct, ovate to orbicular, to 12 cm long, 8 cm wide, becoming broad-lanceolate. Adult leaves disjunct, lanceolate to broad-lanceolate, acute or acuminate, simlifacial, 7–14 cm long, 22–34 mm wide; petioles 10–22 mm long; lateral veins regular, at 30–40° to midrib; oil glands densely packed. Inflorescences simple, axillary; umbellasters 3–7-flowered; peduncles thick, angular or ± flattened, 12–25 mm long; pedicels angular, 1–4 mm long. Buds broadly ovoid, almost smooth to prominently ribbed, 13–25 mm long, 10–15 mm diam.; calyptra conical, often beaked, smooth to ribbed. Stamens all fertile; filaments regularly inflexed; anthers ovoid, versatile, dorsifixed low on connective gland, dehiscing through lateral pores. Fruits obconical, almost smooth to prominently ribbed, 4–5-locular, 10–18 mm long, 12–18 mm diam.; calyptra scar raised at c. 45°, 1.5–2 mm wide; stemonophore ± raised, 0.5–1.0 mm wide, usually splitting due to greater differential growth in underlying hypanthium; disc flat, ultimately markedly incurved, 2–3 mm wide; valves narrowly triangular, long-apiculate with persistent style remnants, basally deeply enclosed, apically vertically exerted, to 7 mm long.

Two geographic subspecies are recognised on differences in fruit ornamentation.

- 1 Fruits distinctly ribbed, ribs more than 1 mm high 25a. subsp. *kessellii*
 1* Fruits smooth or with ribs less than 1 mm high 25b. subsp. *eugnota*

25a. *Eucalyptus kessellii* Maiden & Blakely subsp. *kessellii*

Bark persistent on lower trunk. Buds and fruits prominently ribbed. Umbellasters sometimes 3-flowered. Figure 29.

DISTRIBUTION: This subspecies occupies a zone to the north and north-east of Esperance, from around Salmon Gums to north-east of Mt Ney. Figure 27.

ECOLOGY: Locally frequent in tall mallee woodland on flat sites on pale sandy often somewhat calcareous clay-loams, often with woodland species such as *E. creta*

L. Johnson & K. Hill and *E. oleosa* F. Muell. ex Miq. (sens. lat.).

CONSERVATION STATUS: Not considered to be at risk.

SELECTED SPECIMENS (from 7 examined): WESTERN AUSTRALIA (W to E): 28 km NE of Mt Ridley on track, *Blaxell 86/091, Johnson, Hill & Brooker*, 5 Nov 1986 (NSW); Mt Ney Road, *Brooker 8928*, 10 Apr 1985 (CANB, NSW, PERTH); 30 miles [50 km] NE of Mt Ney, *Beard 6377*, 17 Sep 1970 (PERTH, NSW).

25b. *Eucalyptus kessellii* Maiden & Blakely subsp. *eugnosta* L. Johnson & K. Hill, subsp. nov.

Ab subspecie typica umbellastris regulariter 7-floris et alabastris fructibusque minoribus et prominenter costatis differt.

TYPE: WESTERN AUSTRALIA: 15.2 km W of highway on Speddingup West Road, *K.D. Hill 2397, L.A.S. Johnson, D.F. Blaxell & M.I.H. Brooker*, 7 Nov 1986 (holo NSW; iso CANB, CBG, MEL, PERTH).

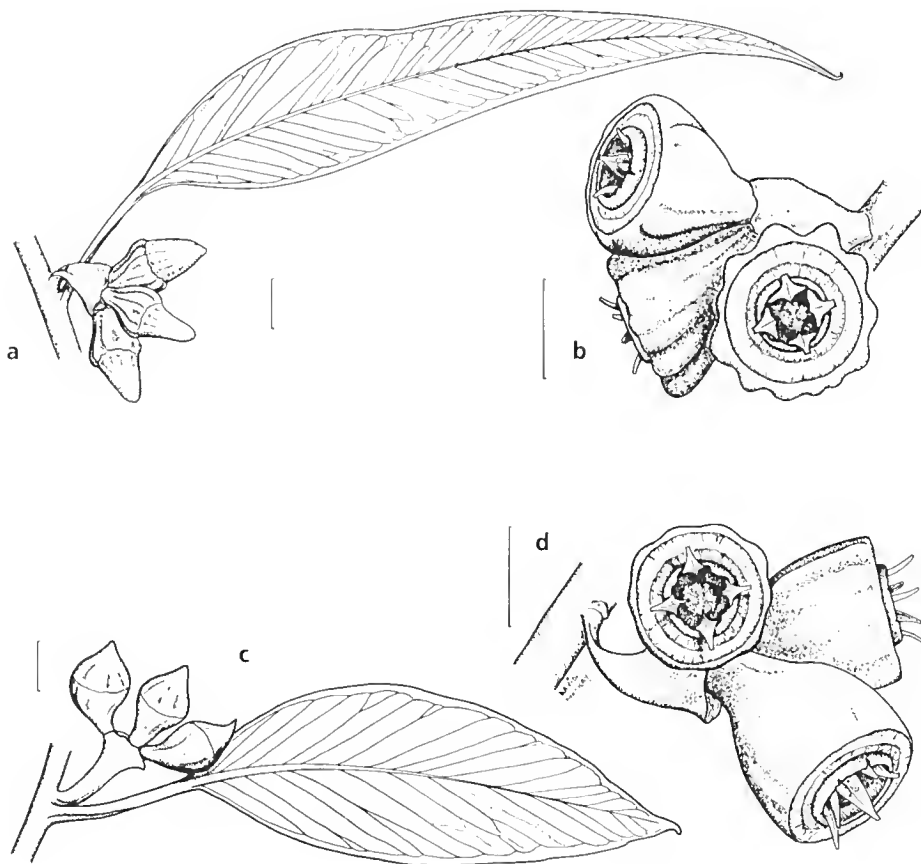


Figure 29. *E. kessellii* subsp. *kessellii*. a, adult leaves and buds; b, fruits (all from *Brooker 8928*). Subsp. *eugnosta*. c, adult leaves and buds; d, fruits (all from *Hill 2297 et al.*). Scale bar = 1 cm.

Bark smooth. *Buds* and fruits smooth to shallowly ribbed. *Umbellasters* 7-flowered. Figure 29.

Distinguished from subsp. *kessellii* by the smooth bark, the consistently 7-flowered umbellasters, and the smooth or less prominently ribbed buds and fruits.

DISTRIBUTION: Subsp. *eugnota* occurs to the south of subsp. *kessellii*, nearer the coast. It also ranges further in both easterly and westerly directions, from about the Hamersley River east almost to Israelite Bay (Eyre District). Figure 27.

ECOLOGY: Locally frequent in mixed mallee scrub on pale sandy soils, often over laterites. This taxon occurs in a more typical 'sand plain mallee' habitat and community than subsp. *kessellii*.

Hybrids are recorded with *E. falcata* Turcz. (sens. lat.).

CONSERVATION STATUS: Not considered to be at risk.

The epithet is from the Greek *eugnotos*, well-known or familiar, this being the better-known race of *E. kessellii*, though not the one that includes the nomenclatural type.

SELECTED SPECIMENS (from 13 examined): WESTERN AUSTRALIA (W to E): 3.5–4 miles [5.5–6.5 km] N of Mt Bland, Fitzgerald River Nat. Park, *Tindale 3854a*, 30 Aug 1973 (NSW, PERTH); 8.8 miles [14 km] SE of Jerdacuttup River crossing on highway, *Tindale 3814*, 28 Aug 1973 (NSW, PERTH); 90 km W of Esperance on Ravensthorpe road, *Blaxell 1687*, 22 June 1978 (NSW, PERTH); 31.2 miles [50 km] E of Esperance, *Chippendale 401*, 25 Mar 1968 (CANB, NSW); c. 2.5 km from Israelite Bay track on Mt Ragged track, *Brooker 8914*, 8 Apr 1985 (CANB, NSW, PERTH).

Intergrades between the subspecies: Western Australia: 45.2 miles [72 km] W of Esperance, *Chippendale 193*, 15 Mar 1967 (CANB, NSW); 29.7 miles [47.5 km] E of Esperance, *Brooker 2506*, 15 Feb 1970 (PERTH, NSW).

E. falcata sens. lat. x *E. kessellii* subsp. *eugnota*: Western Australia: 90 km W of Esperance on Ravensthorpe road, *Blaxell 1691*, 22 June 1978 (NSW, PERTH).

26. *Eucalyptus balladoniensis* Brooker, *Nuytsia* 2(2): 103, Figure 1, 2 (1976).

TYPE CITATION: '80 km by road south of Zanthus towards Balladonia, W.A. (31°37'S, 123°53'E); *M.L.H. Brooker 2471*, 13.2.1970 (holo PERTH; iso FRI [now CANB], NSW).'

TYPE: The Holotype specimen (in PERTH) is from the Balladonia race (subspecies *balladoniensis*, with pedicellate fruit), although the citation refers to a locality where the Zanthus race (subsp. *sedens*, with sessile buds and fruits) is known to occur. All other specimens from the cited locality match the Zanthus race, including supposed duplicates of the Type (cited as distributed to FRI [now CANB] and NSW but actually held in PERTH). The actual Holotype bears no field collection tag, whereas the 'duplicates' bear 'Brooker 2471' tags. The protologue description and illustration are consistent with the Balladonia race, and Brooker (pers. comm.) states that specimens have apparently been mixed, and that the protologue was drawn up from the Balladonia material. The untagged specimen in PERTH is hence regarded as the Holotype. The cited locality and details do not correspond to this specimen, and are regarded as erroneous. The Holotype matches a later collection (*Brooker 3653*) from 20 km W of Balladonia on Highway 1, and this can be regarded as the type locality.

Mallee to 10 m. *Bark* persistent for basal 0.5–3 m, then smooth, grey and pale brown. *Juveniles leaves* disjunct, linear, to 8 cm long, 5 mm wide, becoming lanceolate. *Adult leaves* disjunct, lanceolate, acute or acuminate, similifacial, 7–13 cm long, 12–25 mm wide; petioles 10–22 mm long; lateral veins regular, at 30–40° to midrib; oil glands densely packed. *Inflorescences* simple, axillary; umbellasters 7-flowered; peduncles thick, angular or ± flattened, 6–20 mm long; pedicels angular, 1–9 mm long. *Buds* ovoid,

distinctly broadly beaked, 17–22 mm long, 8–11 mm diam.; calyptra broadly rostrate. *Stamens* all fertile; filaments regularly inflexed; anthers ovoid, versatile, dorsifixed low on connective gland, dehiscing through lateral pores. *Fruits* obconical to cup-shaped or broadly hemispherical, apically ± constricted, 4–5-locular, 7–11 mm long, 8–12 mm diam.; calyptra scar raised at c. 45°, 1.5–2 mm wide; stemonophore ± raised, 0.5–1.0 mm wide, usually splitting due to greater differential growth in underlying hypanthium; disc flat, ultimately markedly incurved, 2–3 mm wide; valves narrowly triangular, long-apiculate with persistent style remnants, basally deeply enclosed, apically vertically exerted, to 7 mm long.

Two subspecies are recognised on differences in pedicel length.

- 1 Pedicels more than 6 mm long 26a. subsp. *balladoniensis*
- 1* Pedicels 0–2 mm long 26b. subsp. *sedens*

26a. *Eucalyptus balladoniensis* Brooker subsp. *balladoniensis*

Mallee to 10 m. *Bark* persistent for basal 0.5–3 m, then smooth, grey. *Adult leaves* 7–13 cm long, 13–25 mm wide; petioles to 22 mm long. *Peduncles* terete or angular, 9–16 mm long; pedicels terete, 6–9 mm long. *Fruits* 7–11 mm long, 8–12 mm diam.

In general, the pedicels are longest in the southern part of the subspecies' range.

DISTRIBUTION: Scattered from Mt Ridley north and east almost to Balladonia (Roe and Coolgardie Districts). Figure 30.

ECOLOGY: Locally frequent in mallee woodland, often as an understorey species, on sandy calcareous soils.

CONSERVATION STATUS: Not considered to be at risk.

SELECTED SPECIMENS (from 11 examined): WESTERN AUSTRALIA (W to E): 7.1 km NE of Mt Ridley turnoff on Dempster Road, *Hill 2251, Johnson, Blaxell & Brooker*, 5 Nov 1986 (NSW, CANB, CBG, MEL, PERTH); 13 km SW of Clyde Rock road on Mt Ney road, *Hill 2276 & Johnson*, 6 Nov 1986 (NSW, CANB, CBG, MEL, PERTH); 28.8 km NW of Balladonia roadhouse on Highway 1, *Hill 708 & Blaxell*, 14 Nov 1983 (NSW, CANB, PERTH).

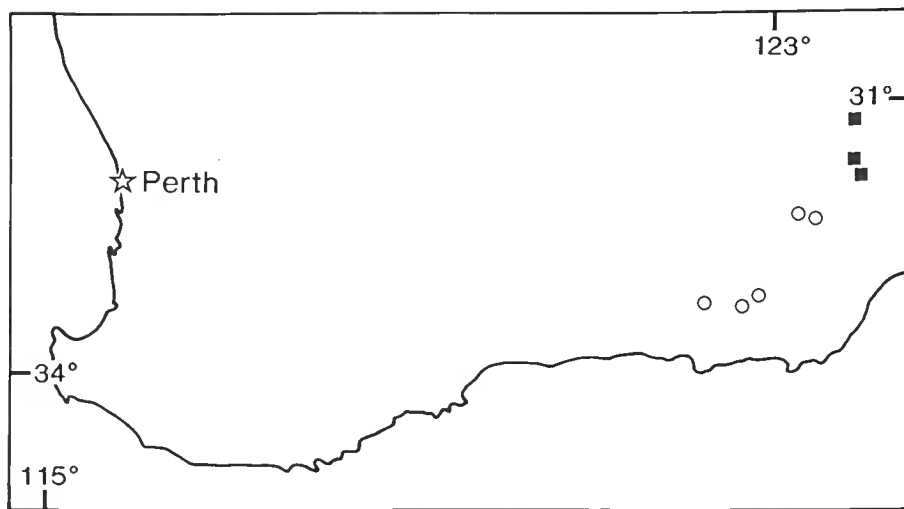


Figure 30. Distribution of *E. balladoniensis* subsp. *balladoniensis* (○) and subsp. *sedens* (■).

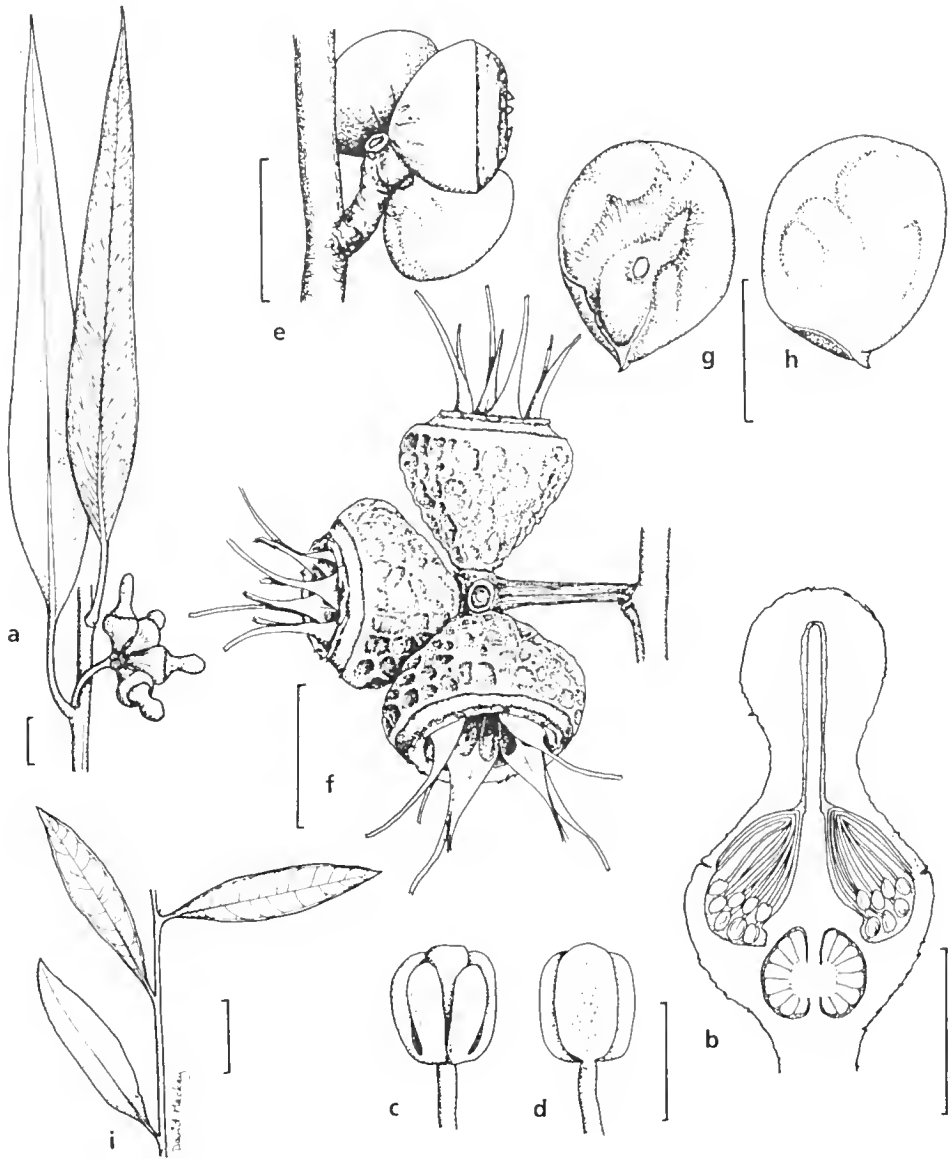


Figure 31. *E. balladoniensis* subsp. *sedens*. a, adult leaves and buds; b, section of bud; c, d, anther; e, f, fruits; g, h, seed; i, juvenile leaves (a, b, c, d, g, h from Pryor & Briggs 168, e from Pryor & Briggs 158, f from Pryor & Briggs 163). Scale bar: a, e, f, i = 1 cm; b = 5 mm; c, d = 0.5 mm; g, h = 1 mm.

26b. *Eucalyptus balladoniensis* Brooker subsp. *sedens* L. Johnson & K. Hill, subsp. nov.

Ab subspecie typica alabastris fructibusque subsessilibus et pedunculis crassioribus brevioribusque differt.

TYPE: WESTERN AUSTRALIA: 2 km E of Zanthus then 80.6 km S on track to Balladonia, J.D. Briggs 168 & L.D. Pryor, 25 Oct 1978 (holo NSW; iso CANB).

Mallee to 6 m. *Bark* persistent for basal 0.5–1.5 m, then smooth, grey. *Adult leaves* 7–12 cm long, 1.2–2.4 cm wide; petioles to 19 mm long. *Peduncles* thick, angular or ± flattened, 6–8 mm long; pedicels ± absent. *Fruits* 8–11 mm long, 9–12 mm diam. Figure 31.

Subspecies *sedens* is distinguished by the subsessile buds and fruits, and the thicker, shorter peduncles.

Subsp. 'sessile fruit' of Brooker & Kleinig (1990).

DISTRIBUTION: Known only from a few populations south of Zanthus (Coolgardie District). Figure 30.

ECOLOGY: A component of eucalypt woodland on flat, calcareous red sand country with a variety of species, including *E. concinna* Maiden & Blakely, *E. flocktoniae* (Maiden) Maiden, *E. gracilis* F. Muell. and *E. platycorys* Maiden & Blakely, with a *Triodia* understorey.

CONSERVATION STATUS: Not considered to be at risk. Although known from a relatively restricted area, this subspecies is likely to be more abundant than is presently known, and occurs in a very remote locality that is secure from disturbance.

The epithet is from the Latin *sedens*, sitting, referring to the subsessile fruits.

SELECTED SPECIMENS (from 4 examined): WESTERN AUSTRALIA (N to S): 27.9 km S of turnoff E of Zanthus on Balladonia track, Hill 2697 & Johnson, 30 Nov 1986 (NSW), 29 km S of same turnoff, Pryor & J. Briggs 158, 24 Oct 1978 (CANB, NSW), 34.8 km S of same turnoff, Pryor & J. Briggs 163, 24 Oct 1978 (CANB, NSW).

Series *Macrocarpae*, subseries *Leptopodosae*

Species 27 to 29 are placed in series *Macrocarpae*, which is defined by the combination: pith glands absent; filaments inflexed or irregularly flexed; anthers oblong to ovoid, dorsifixed, versatile, dehiscing by longitudinal slits; seeds ovoid, shallowly reticulate-pitted. Within this series, all species discussed here are placed in subseries *Leptopodosae*, defined by the non-thickened calyptra.

27. *Eucalyptus leptopoda* Benth., Fl. Austral. 3: 238 (1867).

TYPE CITATION: 'W. Australia, Drummond, 5th Coll. Suppl. n. 33 and 36, also n. 151 and 188 of other sets.'

TYPE: *Drummond 5th Coll. Suppl. no. 33* (lecto K; isolecto BM, CGE, E, FI, K, KW, LE, MEL, NSW, PERTH, W). Crisp (1982) established lectotypification, although Mueller (1878) had already excluded Drummond 151 and 188 from *E. leptopoda*, including them in *E. salmonophloia* F. Muell.

[*E. angustifolia* Turcz., Bull. Cl. Phys.-Math. Acad. Soc. Sci. Saint-Petersbourg 10: 337 (1852), nom. illegit.; non Desf. ex Link, Enum. Hort. Berol. 2: 30 (1822)]

Mallee to 2.5 m, less commonly a tree to 7 m. *Bark* smooth, grey, cream or white and pink or brown, shedding in ribbons, sometimes persistent on lower trunk, thick,

shortly fibrous-flaky. *Juvenile leaves* disjunct, linear to lanceolate, to 12 cm long, 10 mm wide. *Adult leaves* dull, grey-green, disjunct, similifacial, linear to lanceolate, 5–14 cm long, 3–17 mm wide; petioles 3–12 mm long; lateral veins irregular, at 25–45° to midrib; intramarginal vein distinct, 0.5–1.5 mm from margin. Inflorescences simple, axillary; umbellasters 7–11(–15)-flowered; peduncles slender, terete, 5–19 mm long; pedicels slender, terete, 3–11 mm long. *Buds* conical, 7–11 mm long, 4–6 mm diam.; hypanthium hemispherical, calyptra conical, sometimes rostrate. *Stamens* all fertile; filaments variously flexed; anthers dorsifixed low on connective gland, versatile, ovoid, dehiscing through short parallel slits. *Fruits* hemispherical to flattened-globular, 5–8 mm long, 6–11 mm diam.; calyptra and stemonophore scars narrow, depressed; disc level to domed; valves 4–5(–6), triangular, acuminate with persistent tips of style, raised. *Seeds* ovoid, dull, deep red-brown, shallowly pitted; hilum ventral.

Four broadly geographic subspecies are recognised.

- 1 Disc steeply raised in fruit
 - 2 Adult leaves lanceolate 27b. subsp. *elevata*
 - 2* Adult leaves linear 27c. subsp. *arctata*
- 1* Disc flat or rounded in fruit
 - 3 Inflorescences mostly more than 7-flowered; branchlets pruinose 27a. subsp. *leptopoda*
 - 3* Inflorescences all or mostly 7-flowered; branchlets not or weakly pruinose 27d. subsp. *subluta*

27a. *Eucalyptus leptopoda* Benth. subsp. *leptopoda*

Branchlets pruinose. *Leaves* narrow-lanceolate to lanceolate (broader in the east of the range), 7–13 cm long, 6–12 mm wide; petioles 6–11 mm long. *Umbellasters* (7–)11(–15)-flowered; peduncles 6–17 mm long; pedicels 4–8 mm long. *Fruits* 6–7 mm long, 7–11 mm wide; disc flat to slightly domed.

Distinguished by the combination: branchlets pruinose; leaves narrow-lanceolate to lanceolate; umbellasters usually more than 7-flowered, often 11- and sometimes to 15-flowered; pedicels slender; fruits small to medium; disc flat to slightly domed. Figure 32.

Large plants may have a short stocking of persistent bark, but this is not as consistent nor well developed as in the north-western subspecies (below). Plants from the north-east of the range (Bullfinch to Bencubbin, collected near Chiddarcooping) show a strikingly pendulous foliage habit.

DISTRIBUTION: near Tammin and Kellerberrin east to near Southern Cross, extending south to Marble Rocks and north to Chiddarcooping. Figure 33.

ECOLOGY: Usually occurs as scattered plants in low heath on deep sands.

CONSERVATION STATUS: Not considered to be at risk.

SELECTED SPECIMENS (from 12 examined): WESTERN AUSTRALIA (W to E): 6.4 miles [10.5 km] N of Bungalla turnoff on highway, *Tindale* 3716, 26 Aug 1973 (NSW, AD, CANB, K, PERTH); Trayning district, *Steelman* 1, May 1937 (NSW); Kwelkan, *Stoward* 148, 4 May 1917 (NSW); 9.5 miles [16 km] E of Merredin, *Johnson* W 127, 16 Dec 1960 (NSW); 6.8 miles [11 km] E of Carrabin by road, *Coveny* 8362 & *Habersley*, 12 Sep 1976 (NSW, CANB, K, PERTH); firebreak on W side of Chiddarcooping Nature Reserve, *Hill* 2199, *Johnson & Blaxell*, 15 Nov 1986 (NSW, PERTH).

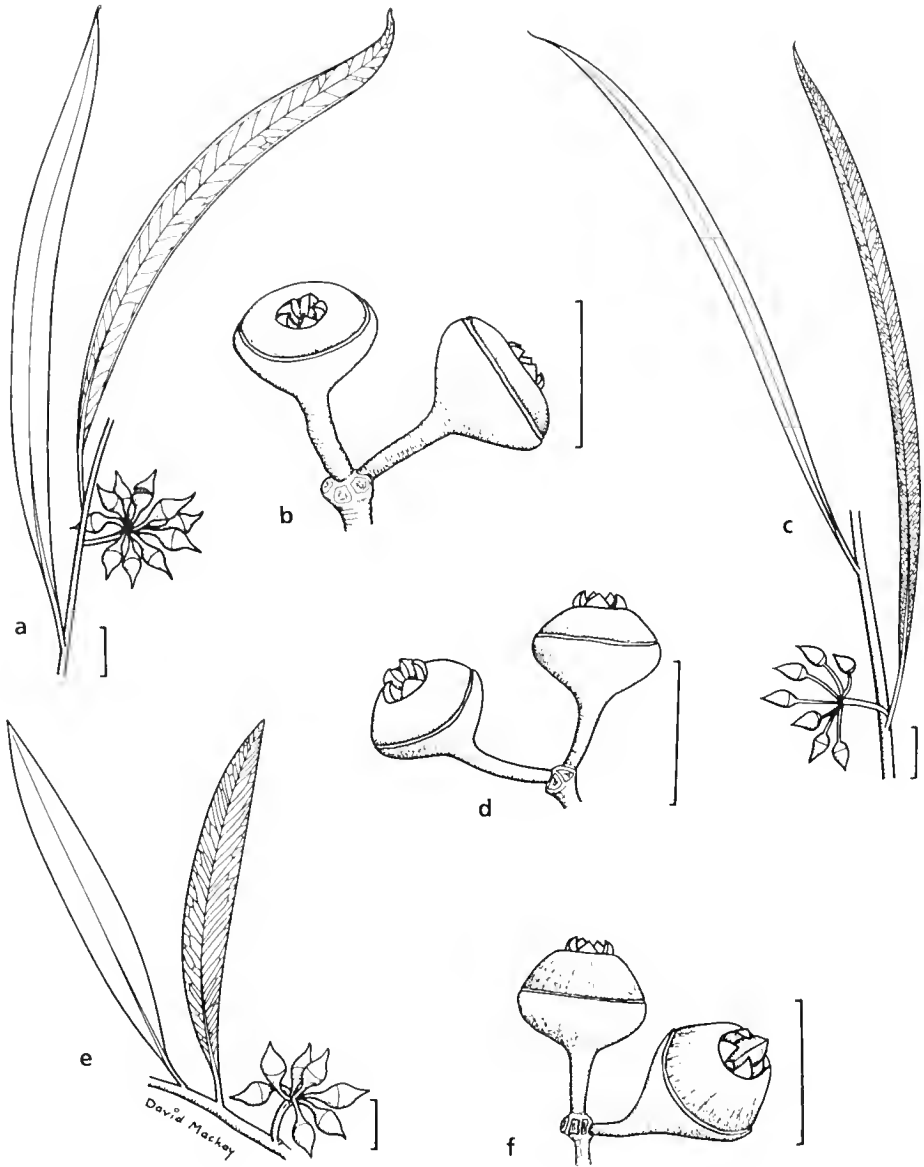


Figure 32. *E. leptopoda* subsp. *leptopoda*. a, adult leaves and buds; b, fruits (from Steedman 1, May 1937). *E. leptopoda* subsp. *arctata*. c, adult leaves and buds; d, fruits (from Brooker 7922). *E. leptopoda* subsp. *elevata*. e, adult leaves and buds; f, fruits (from Brooker 7934). Scale bar = 1 cm.

27b. *Eucalyptus leptopoda* Benth. subsp. *elevata* L. Johnson & K. Hill, sp. nov.

Inter subspecies *E. leptopodae* combinatione sequenti characterum distinguitur: ramuli non pruinosi; folia lanceolata vel latiora; umbellastreae 7-florae; pedicelli crassi; fructus saepissime mediocres vel magni disco valde elevato.

TYPE: WESTERN AUSTRALIA: 16 km from Wiluna – Agnew road on Yeelirrie road, M.I.H. Brooker 9247, 17 Apr 1986 (holo NSW; iso CANB, PERTH).

Branchlets not pruinose. *Leaves* lanceolate to broad-lanceolate, 6–10 cm long, 8–17 mm wide; petioles 8–10 mm long. *Umbellasters* 7-flowered; peduncles 7–13 mm long; pedicels 4–9 mm long. *Fruits* 6–8 mm long, 7–10 mm wide; disc strongly raised. Figure 32.

Distinguished by the combination: branchlets not pruinose; leaves lanceolate or broader; umbellasters 7-flowered; pedicels thick; fruits medium to large; disc strongly domed.

A stocking of persistent ribbony rough bark is commonly found on the lower trunks in taller individuals, chiefly in the western part of the range. Brooker & Kleinig (1990: 419) regard these western forms as a separate subspecies (subsp. *pachyphitra* ined.).

A broad zone of intergradation occurs with subsp. *arctata* in the region between Mullewa and south of Morawa (Figure 33). Hybridisation is also recorded with *E. websteriana* subsp. *websteriana*.

DISTRIBUTION: Locally frequent from Yuna to Morawa and, perhaps with a discontinuity, east to Meekatharra and Wiluna and into the desert almost to 127°E and south to about 29°S. Figure 33.

ECOLOGY: A component of shrub heath on red or yellow sandhill country

CONSERVATION STATUS: Not considered to be at risk.

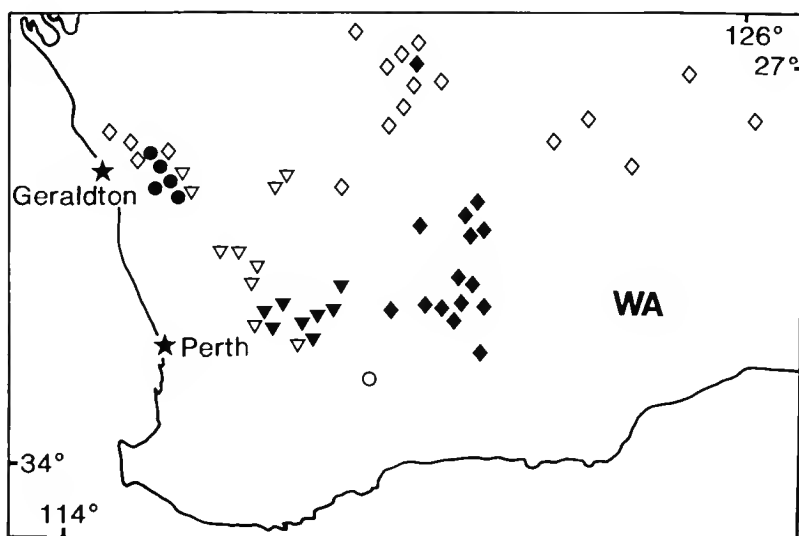


Figure 33. Distribution of *E. leptopoda* subsp. *leptopoda* (▼), *E. leptopoda* subsp. *arctata* (▽), *E. leptopoda* subsp. *elevata* (◇), *E. leptopoda* subsp. *subluta* (◆), *E. leptopoda* subsp. *leptopoda* – subsp. *subluta* intergrade (○) and *E. leptopoda* subsp. *arctata* – subsp. *elevata* intergrades (●).

SELECTED SPECIMENS (from 25 examined): WESTERN AUSTRALIA (W to E): Horan Road, 5.7 km N of Ogilvie East Road (28°07'S 114°48'E), *Brooker 9934, 9935*, 20 Apr 1988 (CANB, NSW, PERTH); 9.5 km N of Yuna road on Wandara road, *Brooker 7934*, 25 Jan 1983 (CANB, NSW, PERTH); 9.4 miles [16 km] W of Pindar, *Clippendale 48*, 20 Oct 1966 (CANB, NSW); 47.0 km S of Youanmi on Bullfinch road, *Hill 2602 & Johnson*, 25 Nov 1986 (NSW); 64.5 km E of Meekatharra on Wiluna road, *Hill 507, Johnson, Blaxell & Brooker*, 2 Nov 1983 (NSW, CANB, PERTH); 67 km from Wiluna–Agnew road on Sandstone road, *Brooker 8650*, 30 Aug 1984 (CANB, NSW, PERTH); 91.3 km W of Wiluna – Agnew road on Sandstone road, *Brooker 8706*, 17 Oct 1984 (CANB, NSW, PERTH); W of Sandstone road, S of Wiluna, *Speck 858*, 20 Sep 1957 (CANB, NSW); 2.4 km N of Albion Downs turnoff on Leonora – Wiluna road, *Hill 516, Johnson, Blaxell & Brooker*, 3 Nov 1983 (NSW, AD, BRI, CANB, K, MEL, MO, PERTH); 21 km E of Cosmo Newbery, *Brooker 8536*, 9 May 1984 (CANB, NSW, PERTH); 242 km S of Warburton towards Neale Junction, *Brooker 8559*, 11 May 1984 (CANB, NSW, PERTH).

27c. *Eucalyptus leptopoda* Benth. subsp. *arctata* L. Johnson & K. Hill, subsp. nov.

Inter subspecies *E. leptopodae* combinatione sequenti characterum distinguitur: ramuli non pruinosi; folia linearia vel anguste linearia, erecta; umbellastra 7-flora; pedicelli graciles; fructus parvi vel mediocres, disco modice elevato vel aliquando planato.

TYPE: WESTERN AUSTRALIA: 20 km E of Dalwallinu towards Kulja, *M.I.H. Brooker 7922*, 12 Jan 1983 (holo NSW; iso CANB, PERTH).

Branchlets not pruinose. *Leaves* linear to narrow-lanceolate, erect, 7–14 cm long, 3–8 mm wide; petioles 3–7 mm long. *Umbellasters* 7-flowered; peduncles 5–9 mm long; pedicels 3–11 mm long. *Fruits* 5–8 mm long, 6–10 mm wide; disc moderately to strongly domed. Figure 32.

Distinguished by the combination: branchlets not pruinose; leaves linear, erect; umbellasters 7-flowered; pedicels slender; fruits small to medium; disc moderately to strongly domed.

Larger individuals usually show a stocking of persistent bark on the lower trunk, as do western occurrences of subsp. *elevata* (above). The two subspecies also intergrade over a broad zone (above).

Although recent collections of this subspecies are from near Cadoux northwards, two older collections indicate an overlap with subsp. *leptopoda*. If these are indeed partly sympatric, the taxonomic rank will require reconsideration. Recent search by one of us (L.J.) in the Merredin–Bruce Rock area has not confirmed the two early vaguely specified collections cited below.

DISTRIBUTION: From Koolanooka to Tammin and perhaps south of Merredin, northeast to Paynes Find. Figure 33.

CONSERVATION STATUS: Not considered to be at risk.

The epithet is from the Latin *arctatus*, narrowed, in reference to the narrow leaves.

SELECTED SPECIMENS (from 11 examined): WESTERN AUSTRALIA (W to E): 4.7 km N of Gutha–Wurarga road on McWhirter Road, *Hill 2579 & Johnson*, 23 Nov 1986 (NSW, PERTH); 44 km NNE of Paynes Find, *Brooker 8713*, 18 Oct 1984 (CANB, NSW); rabbit fence 60 miles [100 km] E of Watheroo, *Koch 1609, 1611*, Oct 1905 (NSW); 10.9 km W of Koorda on Cadoux road, *Hill 2503, Johnson & Blaxell*, 16 Nov 1986 (NSW, PERTH); Tammin, *Maiden*, Oct 1909 (NSW); Bruce Rock, *Stoward 19*, Sep 1916 (NSW).

27d. *Eucalyptus leptopoda* Benth. subsp. *subluta* L. Johnson & K. Hill, subsp. nov.

Inter subspecies *E. leptopodae* combinatione sequenti characterum distinguitur: ramuli saepissime non vel leviter pruinosi; folia linearia vel anguste linearia, erecti; umbellastrae saepissime 7-florae; pedicelli graciles; fructus parvi vel mediocres, disco planato.

TYPE: WESTERN AUSTRALIA: 37 km SE of Coolgardie, *M.I.H. Brooker 7048*, 9 Nov 1981 (holo NSW; iso CANB, PERTH).

Branchlets usually weakly or not pruinose. *Leaves linear to lanceolate*, 5–9 cm long, 6–12 mm wide; petioles 10–12 mm long. *Umbellasters* usually 7-flowered (rarely some with more flowers); peduncles 8–10 mm long; pedicels 4–6 mm long. *Fruits* 5–7 mm long, 7–10 mm wide; disc flat to slightly domed.

Distinguished by the combination: branchlets weakly or not pruinose; leaves linear to lanceolate, erect; umbellasters usually 7-flowered; pedicels slender; fruits small to medium; disc flattened.

DISTRIBUTION: Apart from an apparent outlier sympatric with subsp. *elevata* south of Wiluna, this subspecies occupies the south-east of the range of the species, from somewhat north of Menzies to north-east of Norseman. Figure 33.

Some intergradation occurs with subsp. *leptopoda* where the ranges meet.

CONSERVATION STATUS: Not considered to be at risk.

The epithet is from the Latin *sublutus*, washed beneath, referring to the usually slighter degree of pruinosity of the branchlets, in contrast to those of subsp. *leptopoda*.

SELECTED SPECIMENS (from 22 examined): WESTERN AUSTRALIA (N to S): 16 km from Wiluna – Agnew road on Yeelirrie road, *Brooker 9248*, 17 Apr 1986 (CANB, NSW, PERTH); 36 km N of Menzies towards Leonora, *Hill 532, Johnson, Blavell & Brooker*, 4 Nov 1983 (NSW, AD, CANB, PERTH); 4.2 miles [6 km] N of Menzies towards Leonora, *Baker 91*, 8 Nov 1970 (CANB, NSW); 20 miles [32 km] W of Riverina homestead, *Beard 6514*, 11 Sep 1973 (PERTH, NSW); Comet Vale, *Maiden*, Sep–Nov 1909 (NSW); 0.4 km E of gate, Goongarrie Nat. Reserve, *Brooker 9606, 9607, 9608, 9609*, 6 May 1987 (CANB, NSW, PERTH); 60.3 miles [100 km] W of Coolgardie on highway, *Tindale 59 & Bennett*, 9 Mar 1970 (NSW); 66 km SSW of Coolgardie on road to Queen Victoria Rock, *Crisp 5603*, 31 Jan 1979 (CBG, NSW, PERTH); 39.1 km W of Coolgardie – Norseman road on Hyden road, *Hill 2852*, 25 Aug 1988 (NSW).

Subsp. *arctata* – subsp. *elevata* intergrades (from 8 examined): 5.6 km S of Geraldton–Mullewa road on Mingenew road, *Hill 2574 & Johnson*, 23 Nov 1986 (NSW, PERTH); 8.5 miles [15 km] S of Morawa, *Chippendale 55*, 20 Oct 1966 (CANB, NSW).

Subsp. *leptopoda* – subsp. *subluta* intergrades: c. 50 km E of Hyden, 1 km N of Marble Rocks, *Crisp 5549*, 29 Jan 1979 (CBG, CANB, NSW, PERTH).

***E. leptopoda* subsp. *elevata* x *E. websteriana* subsp. *websteriana*:** 91 km NW of airstrip SE of Lake Rason (28°54'S 124°29'E), *Brooker 8574*, 13 May 1984 (CANB, NSW, PERTH).

28. *Eucalyptus synandra* *Crisp*, *Nuytsia* 4(1): 129 (1982).

TYPE CITATION: '*Typus*: ± 5 km S of Jingymia, 30°31'S, 117°25'E, 2 Jan. 1981, A.S. George 16203, fl., fr., photo, spirit material (holo : PERTH; iso : CBG, FRI [now CANB], K, NSW, PERTH).'

Mallee to 5 m. *Bark* smooth, powdery white over pink and brown, shedding in ribbons. *Juvenile leaves* opposite, lanceolate for about 4 nodes, becoming linear, disjunct, to 8 cm long, 3 mm wide. *Adult crown* thin, pendulous. *Adult leaves* dull, grey-green, disjunct, simlifacial, linear to narrow-lanceolate, 6–18 cm long, 6–15 mm wide; petioles 3–15 mm long; lateral veins irregular, at 25–45° to midrib; intramarginal vein distinct, 0.5–1.5 mm from margin. *Inflorescences* simple, axillary; umbellasters 7-flowered; peduncles slender, terete, 9–18 mm long; pedicels slender, terete, 7–16 mm long. *Buds* conical, 16–24 mm long, 7–8 mm diam.; hypanthium shallowly hemispherical to saucer-shaped, calyptre conical, attenuate. *Stamens* all fertile; filaments variously flexed, cream to pink, united for lower half into a tube; anthers dorsifixed, versatile, ovoid,

dehiscing through short parallel slits. *Fruits* hemispherical to flattened-globular, 6–9 mm long, 9–13 mm diam.; calyptra and stemophore scars narrow, depressed; disc **domed**; valves **triangular, acuminate with persistent tips of style, raised**. *Seals* ovoid, **dull, deep red-brown, shallowly pitted**; *hilum* ventral.

E. synandra is described here under a reduced circumscription to allow comparison with the segregate taxon described below. Both taxa are distinguished within the subseries by the partially coherent filaments. The related *E. beardiana* also has partially coherent filaments, and can be distinguished by the elongate cup-shaped hypanthium in bud and fruit, and the longer fruits (9–11 mm long).

DISTRIBUTION: A rare and localised species of the northeastern Wheat Belt, from near Morawa to near Koorda. Figure 34.

ECOLOGY: This species occurs mostly on shallow sandy soils over gravelly or lateritic rises, in open mallee shrubland with few other eucalypt species.

CONSERVATION STATUS: 3R-. This species is highly localised in distribution, and occurs in country potentially threatened by agricultural activities.

SELECTED SPECIMENS (from 8 examined): WESTERN AUSTRALIA (W to E): 3.5 km N of Gutha–Wurarga road on McWhirter Road, *Hill 2577 & Johnson*, 23 Nov 1986 (NSW, CANB, CBG, MEL, PERTH); 27 km from Bimbijy Road on Emu Fence Road, *Hill 2515, Johnson & Blaxell*, 16 Nov 1986 (NSW, CANB, CBG, MEL, PERTH).

29. *Eucalyptus rosacea* L. Johnson & K. Hill, sp. nov.

Affinis *E. synandrae* sed characteribus sequentibus distinguitur: folia adulta minora, haud pendula; discus minus elevatus; cortex griseus vel roseus.

TYPE: WESTERN AUSTRALIA: 12.0 km S of Queen Victoria Spring on Cundeelee road, *K.D. Hill 2686 & L.A.S. Johnson*, 30 Nov 1986 (holo NSW; iso CANB, CBG, MEL, PERTH).

[*E. elachyphylla* Brooker & Kleinig, Field Guide Eucalypts 2: 419 (1990); nom. illegit.]

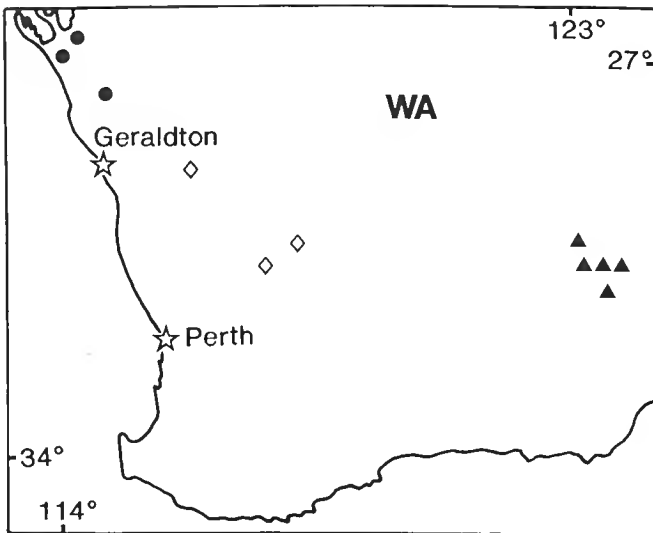


Figure 34. *E. beardiana* (●), *E. synandra* (◇) and *E. rosacea* (▲).

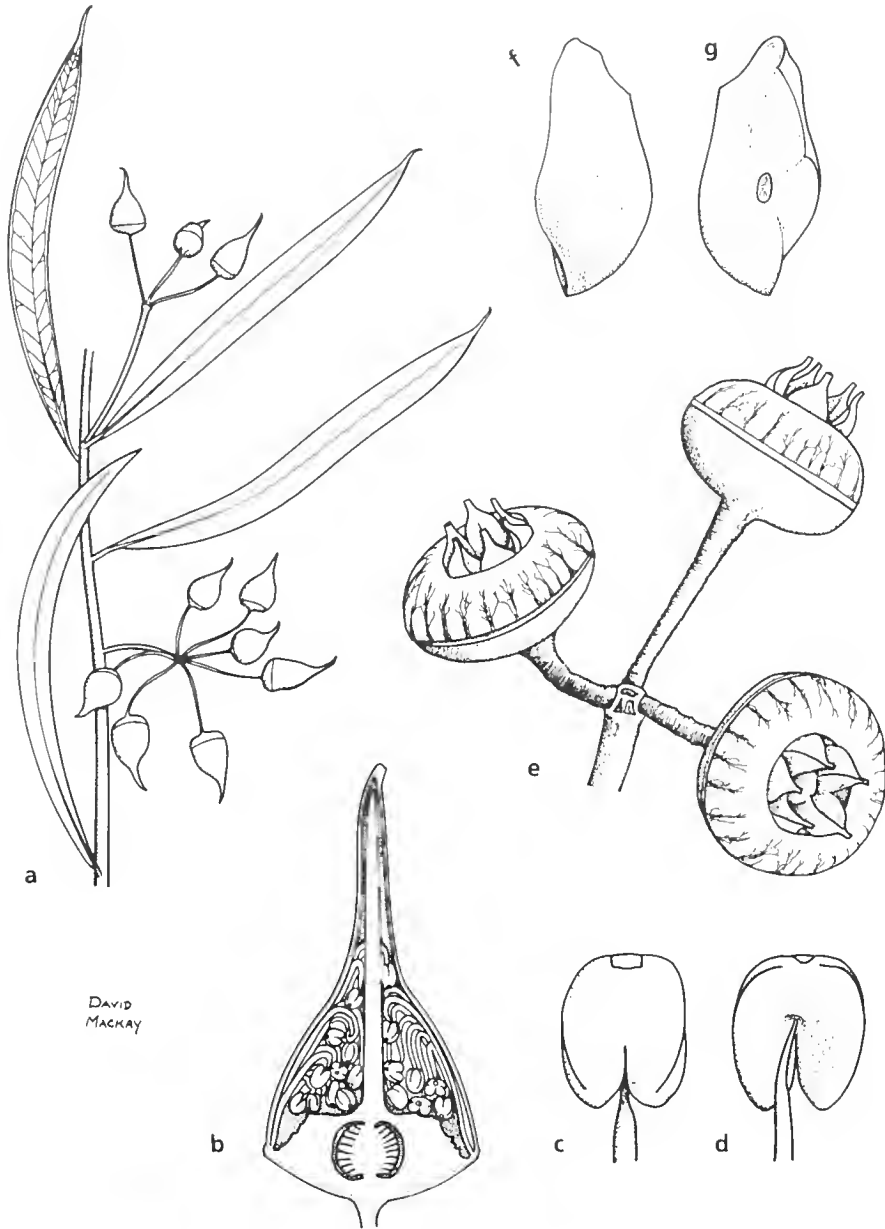


Figure 35. *E. rosacea*. a, adult leaves and buds; b, section of bud; c, d, anther; e, fruits; f, g, seed (all from MacFarlane 1127 & Bedford). Scale bar: a = 1 cm; b, e = 5 mm; c, d, f, g = 0.5 mm.

Mallee to 2.5 m. *Bark* smooth, grey, white and pink, shedding in ribbons. *Juvenile leaves* opposite, lanceolate for about 6 nodes, becoming linear, disjunct, to 8 cm long, 3 mm wide. *Adult leaves* dull, grey-green, disjunct, similifacial, linear to narrow-lanceolate, 6–12 cm long, 6–10 mm wide; petioles 3–10 mm long; lateral veins irregular, at 25–45° to midrib; intramarginal vein distinct, 0.5–1.5 mm from margin. Inflorescences simple, axillary; umbellasters 3–7-flowered; peduncles slender, terete, 10–20 mm long; pedicels slender, terete, 9–16 mm long. *Buds* conical, 16–20 mm long, 7–8 mm diam.; hypanthium shallowly hemispherical to saucer-shaped, calyptra conical, attenuate. *Stamens* all fertile; filaments variously flexed, cream or pink to red, united for lower half into a tube; anthers dorsifixed, versatile, ovoid, dehiscing through short parallel slits. *Fruits* hemispherical to flattened-globular, 6–9 mm long, 9–13 mm diam.; calyptra and stemonophore scars narrow, depressed; disc slightly raised to domed; valves triangular, acuminate with persistent tips of style, raised. *Seeds* ovoid, dull, deep red-brown, shallowly pitted; hilum ventral. Figure 35.

Distinguished from *E. synandra* (with which it shares the partially united stamen filaments) by the mostly smaller, non-pendulous adult leaves, the less raised disc, and the grey or pink bark (rather than powdery white).

DISTRIBUTION: Known from the south-western fringes of the Great Victoria Desert. Figure 34.

ECOLOGY: Locally frequent to dominant in low open mallee shrubland on shallow aeolian sands over siliceous substrates.

CONSERVATION STATUS: At least locally, and probably more widely, abundant in a remote area – not considered to be at risk.

The epithet is from the Latin *rosaceus*, rosy, referring to the frequently pink flowers and pinkish bark.

SELECTED SPECIMENS (from 6 examined): WESTERN AUSTRALIA (W to E): 33.7 km E of Pinjin on PNC road, Hill 2667 & Johnson, 29 Nov 1986 (NSW); 12.2 km S of Queen Victoria Spring on Cundeelee road, Macfarlane 1127 & Bedford, 2 Dec 1982 (PERTH, NSW); 1.3 km N of Zanthus, Hill 2693 & Johnson, 30 Nov 1986 (NSW).

Series *Orbifoliae*

Species 30 to 33 are placed in series *Orbifoliae*, defined by the combination: pith glands absent; bark longitudinally splitting and peeling ('minniritchi' bark, see Brooker & Kleinig 1990); filaments inflexed or irregularly flexed; anthers ovoid, dorsifixed, versatile, dehiscing by short slits; seeds ovoid, shallowly reticulately pitted. The following four species constitute superspecies *Orbifolia*, defined by the obovate, rounded to retuse adult leaves. The early juvenile leaves are lanceolate to ovate, quickly becoming orbicular, and becoming retuse only at a later ontogenetic stage. This suggests that the retuse adult leaves are not merely neotenous (cf. Brooker & Kleinig 1990: 279). The group consists of small isolated occurrences on rocky sites, and minor differences often exist between populations. However, the populations group into consistent assemblages mostly over large total areas, and four species are distinguishable (Figure 37).

Key to the species of superspecies *Orbifolia*

- 1 Calyptra rounded
- 2 Fruits more than 7 mm long; branchlets strongly pruinose; buds and fruits strongly pruinose 33. *E. orbifolia*
- 2* Fruits less than 7 mm long; branchlets, buds and fruits weakly or not pruinose 30. *E. websteriana*
- 1* Calyptra conical
- 3 Calyptra more than 3 times longer than hypanthium; leaves mostly longer than broad 31. *E. educta*
- 3* Calyptra less than 2.5 times longer than hypanthium; leaves broader than long 32. *E. lata*

30. *Eucalyptus websteriana* Maiden, J. & Proc. Roy. Soc. New South Wales 49: 313 (1915).

TYPE CITATION: 'Habitat - Near Coolgardie, Western Australia associated with *E. torquata* Luehmann. (Mr. now Dr. C.L. Webster).'

TYPE: WESTERN AUSTRALIA: Coolgardie, L.C. Webster, 1900 (lecto NSW, here designated). Three specimens in NSW, collected by Webster from Coolgardie in 1898 (forwarded by C. Walter), 1899 and 1900 may be regarded as syntypes. All three have 'Type' labels affixed by Blakely. However, the 1900 collection is the most comprehensive of the three and we therefore designate it the Lectotype. The collector was wrongly cited as 'C.L. Webster' in the protologue.

Mallee to 3 m, of twisted and spreading habit. *Bark* red-brown, splitting longitudinally and peeling partly back to reveal green to brown smooth bark ('minniritchi' bark). *Branchlets* weakly or not pruinose. *Juvenile leaves* disjunct, petiolate, ovate to orbicular. *Adult leaves* disjunct, dull, grey-green, obovate to orbicular, retuse or rounded, 1.5–4.0 cm long, 15–30 mm wide; petioles 10–15 mm long; lateral veins regular, moderately spaced, at 40–50° to midrib; intramarginal vein distinct, more or less looped, 1–3 mm from margin; oil glands angular. *Inflorescences* simple, axillary; umbellasters 7-flowered; peduncles 8–17 mm long; pedicels 3–8 mm long. *Buds* globular to ovoid, 5–8 mm long, 5–6 mm diam.; calyptra hemispherical, as long as hypanthium or slightly longer. *Stamens* all fertile; filaments slender, irregularly flexed; anthers ovoid, dorsifixed near base of connective gland, versatile, dehiscing through lateral pores. *Fruits* hemispherical to flattened hemispherical, 5–8 mm long, 8–11(–13) mm diam.; calyptra and stemophore scars raised at c. 45°; disc flat to slightly raised, 2.5–3.5 mm wide. *Seeds* grey-brown, ovoid, shallowly regularly pitted; chaff red-brown.

Distinguished within the superspecies *Orbifolia* by the following combination of characters: adult leaves longer than broad, rounded or retuse; pedicels medium to long (> 3 mm long); calyptra hemispherical; fruits small to medium (< 11 mm diam.); disc slightly swollen; hypanthium bowl-shaped.

Two geographic subspecies are recognised.

- 1 Branchlets, buds and fruits distinctly pruinose (except when much weathered); pedicels mostly > 5 mm long 30a. subsp. *websteriana*
- 1* Branchlets and buds not pruinose except in very young stages; pedicels mostly < 6 mm long 30b. subsp. *norsemanica*

30a. *Eucalyptus websteriana* Maiden subsp. *websteriana*

Branches, buds and fruits (except when old) distinctly pruinose. *Adult leaves* broad (l:b = 1–1.5:1), retuse or rounded, 1.5–4.0 cm long, 15–30 mm wide; petioles 8–15 mm long. *Pedicels* 5–8 mm long. Figure 36.

Hybrids are recorded with *E. leptopoda* subsp. *elevata* (cited under the latter).

DISTRIBUTION: Sporadic but locally frequent from Coolgardie and Kambalda east to Plumridge Lakes. Figure 37.

ECOLOGY: Found in scleromorphic shrublands on shallow soil on rocky rises.

CONSERVATION STATUS: 3R. Scattered and localised, although probably not under immediate threat.

SELECTED SPECIMENS (from 12 examined): WESTERN AUSTRALIA (W to E): Comet Hill, 11.9 km S of Coolgardie, *Hill 2633 & Johnson*, 26 Nov 1986 (NSW, PERTH); Red Hill, Kambalda, *Coveny 8430 & Habersley*, 14 Sep 1976 (NSW, BRI, CANB, K, L, MEL, PERTH); E slope of Yowie Hill on Pinjin road, *Hill 2663 & Johnson*, 29 Nov 1986 (NSW, PERTH); SE of Lake Rason (28°54'S 124°29'E), *Brooker 8576*, 13 May 1984 (CANB, NSW, PERTH).

30b. *Eucalyptus websteriana* Maiden subsp. *norsemanica* L. Johnson & K. Hill, subsp. nov.

Ab subspecie typica ramulis alabastris et fructibus maturis non pruinosis, foliis adultis aliquanto angustioribus retusisque et petiolis pedicellisque brevibus differt.

TYPE: WESTERN AUSTRALIA: 5.5 miles [8.5 km] N of Norseman, *L.A.S. Johnson W 176*, 18 Dec 1960 (holo NSW 53307; iso PERTH).

Mature branchlets, buds and fruits not pruinose. *Adult leaves* narrowish, mostly retuse, 2.2–4.0 cm long, 14–21 mm wide; petioles 7–11 mm long. *Pedicels* 3–6 mm long. Figure 36.

Distinguished from subsp. *websteriana* by the non-pruinose mature branchlets, buds and fruits, the somewhat narrower, retuse adult leaves, and the often shorter petioles and pedicels.

DISTRIBUTION: Known from a single stand on skeletal soil on a granite outcrop north of Norseman, but an isolated population near Widgiemooltha shows intermediate characters (see below). Figure 37.

CONSERVATION STATUS: 2V-. Known only from the type locality, which is possibly at risk from mineral exploration and mining activities.

The epithet refers to the town of Norseman, near the type locality.

SELECTED SPECIMENS (from 7 examined): WESTERN AUSTRALIA: 8 km N of Norseman, *Hill 591, Johnson, Blaxell, Brooker & Hopper*, 6 Nov 1983 (NSW); 5.7 miles [9.1 km] N of Norseman, *Brooker 4537*, 11 Apr 1974 (CANB, NSW, PERTH).

Intergrades, subsp. *websteriana* – subsp. *norsemanica*: Lake Lefroy, *Larsen*, Sep 1920 (NSW).

31. *Eucalyptus educta* L. Johnson & K. Hill, sp. nov.

Inter species affinitatis *E. orbifoliae* calyptra longa conicaque distinguitur.

TYPE: WESTERN AUSTRALIA: The Dromedaries, north of Beacon, *M.I.H. Brooker 8436*, 25 Jan 1984 (holo NSW; iso AD, CANB, MEL, PERTH).

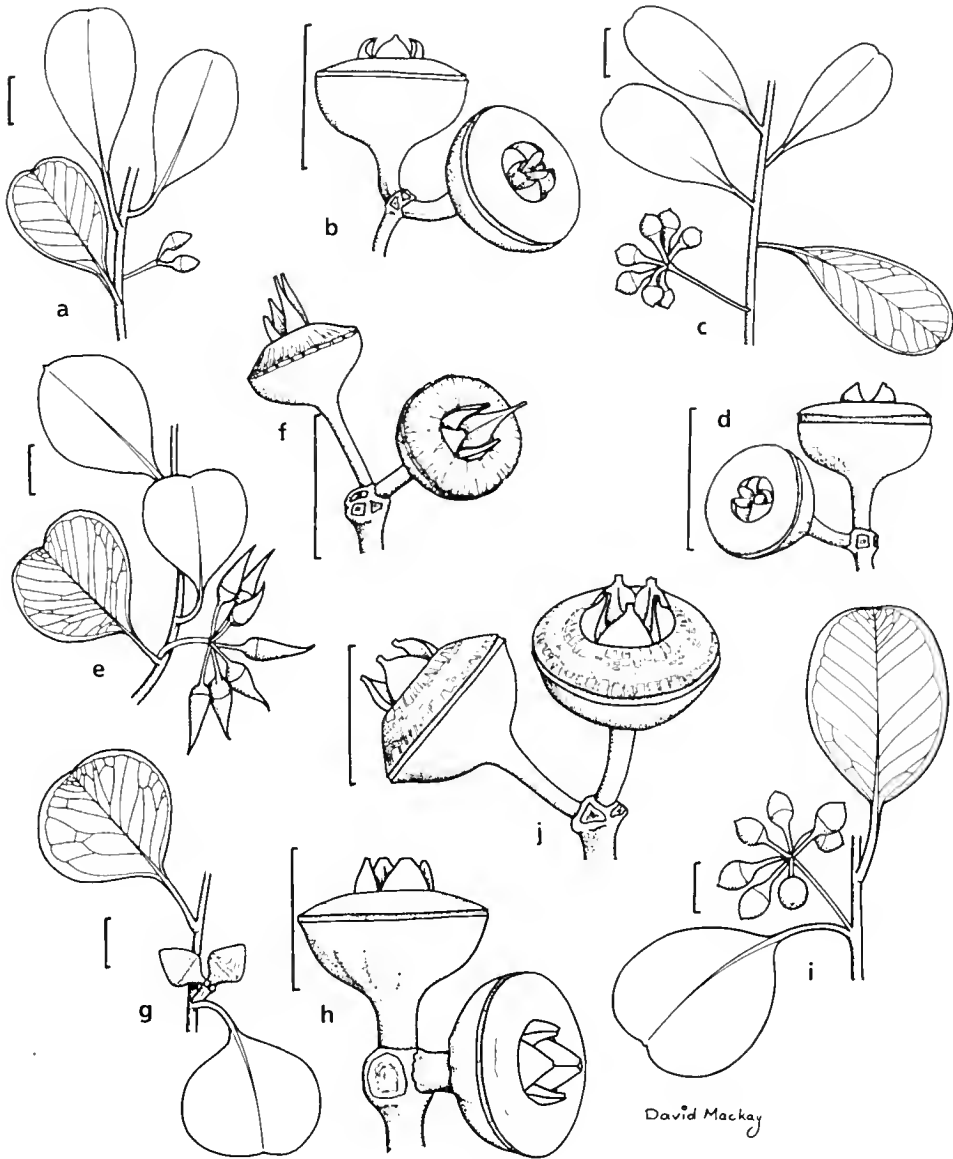


Figure 36. *E. websteriana* subsp. *websteriana*. a, adult leaves and buds; b, fruits (from Coveny 8430 & Habersley). *E. websteriana* subsp. *norsemanica*. c, adult leaves and buds; d, fruits (c from Brooker 4537, d, from NSW 53307). *E. educta*. e, adult leaves and buds; f, fruits (e from Brooker 8494, f from Brooker 8436). *E. lata*. g, adult leaves and buds; h, fruits (g from Cooper, June 1923, h from Fraser, 24 Feb 1922). *E. orbifolia*. i, adult leaves and buds; j, fruits (from Brooker 5114). Scale bars = 1 cm.

Mallee to 3 m, of twisted and spreading habit. Bark red-brown, splitting longitudinally and peeling partly back to reveal green to brown smooth bark ('minniritchi'). Branchlets glaucous. Juvenile leaves disjunct, petiolate, ovate to orbicular. Adult leaves disjunct, dull, grey-green to strongly glaucous, obovate to orbicular, usually rounded (mostly not retuse), 2.0–4.0 cm long, 15–30 mm wide; petioles 5–8 mm long; lateral veins regular, moderately spaced, at 40–50° to midrib; intramarginal vein distinct, more or less looped, 1–3 mm from margin; oil glands angular. Inflorescences simple, axillary; umbellasters 7-flowered; peduncles 9–14 mm long; pedicels 6–8 mm long. Buds ovoid to fusiform, 15–18 mm long, 5–6 mm diam.; calyptra elongate-conical, more than 3 times as long as hypanthium. Stamens all fertile; filaments slender, irregularly flexed and erect; anthers ovoid, dorsifixed near base of connective gland, versatile, dehiscing through lateral pores. Fruits hemispherical to flattened hemispherical, 6–7 mm long, 9–10 mm diam.; calyptra and stemophore scars raised at c. 45°; disc flat to slightly raised, 2.5–3.5 mm wide. Seeds grey-brown, ovoid, shallowly regularly pitted; chaff red-brown. Figure 36.

Distinguished within the *E. orbifolia* group by the long, conical calyptra, and longer leaves.

DISTRIBUTION: Known only from The Dromedaries. Figure 37.

ECOLOGY: Restricted to scleromorphic shrubland on shallow gritty sand over granite.

CONSERVATION STATUS: 2R-. Known only from the type locality, which is in a remote and relatively undisturbed area.

The epithet is from the Latin *eductus*, drawn out, referring to the long calyptra.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: Gillian Rock, N of Beacon, Hill 2512, Johnson & Blaxell, 16 Nov 1986 (NSW, PERTH); Brooker 8494, 16 Mar 1984 (CANB, NSW, PERTH).

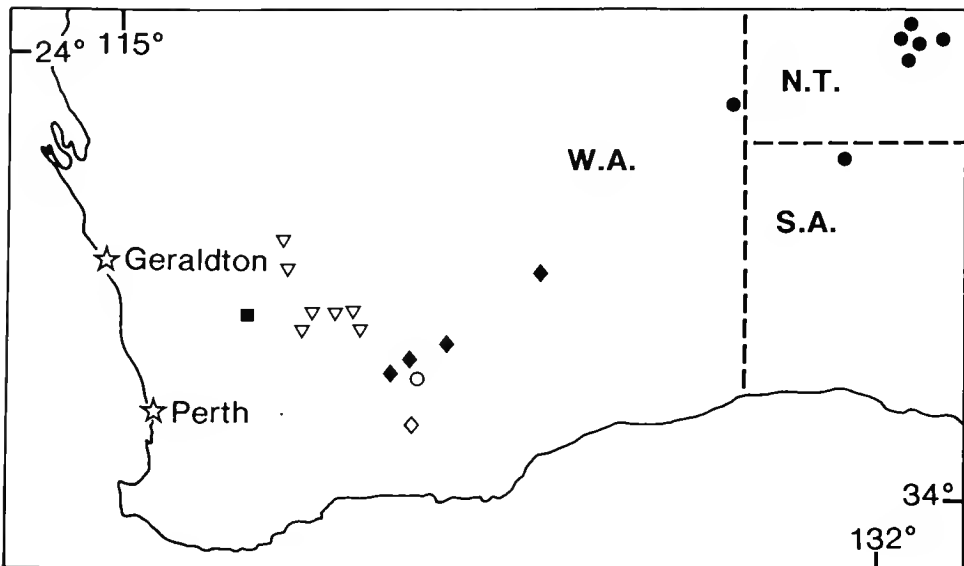


Figure 37. Distribution of *E. websteriana* subsp. *websteriana* (◆), subsp. *norsemanica* (◊), subsp. *websteriana* – subsp. *norsemanica* intergrades (○), *E. lata* (▽), *E. educta* (■) and *E. orbifolia* (●).

32. *Eucalyptus lata* L. Johnson & K. Hill, sp. nov.

Inter species affinitatis *E. orbifoliae* combinatione sequenti characterum distinguitur: folia adulta lata, pedicelli breves, calyptra breviter conica, et fructus magni.

TYPE: WESTERN AUSTRALIA: 13.6 km W of Callion on Mussons Soak road, K.D. Hill 2658 & L.A.S. Johnson, 28 Nov 1986 (holo NSW; iso CANB, CBG, MEL, PERTH).

Mallee to 3 m, of twisted and spreading habit. *Bark* red-brown, splitting longitudinally and peeling partly back to reveal green to brown smooth bark ('minniritchi' bark). *Branchlets* strongly glaucous. Juvenile leaves disjunct, petiolate, ovate to orbicular. *Adult leaves* disjunct, dull, grey-green, orbicular, regularly retuse, 2.5–5.0 cm long, 25–50 mm wide; petioles 8–27 mm long; lateral veins regular, moderately spaced, at 40–50° to midrib; intramarginal vein distinct, more or less looped, 1–4 mm from margin; oil glands angular. Inflorescences simple, axillary; umbellasters 7-flowered; peduncles 5–29 mm long; pedicels 3–6 mm long. *Buds* ovoid, 10–12 mm long, 8–9 mm diam.; calyptra broadly conical, 1.5–2.5 times as long as hypanthium. *Stamens* all fertile; filaments slender, irregularly flexed and erect; anthers ovoid, dorsifixed near base of connective gland, versatile, dehiscing through lateral pores. *Fruits* flattened obconical, 7–9 mm long, 13–15 mm diam.; calyptra and stemophore scars raised at c. 45°; disc flat, 3–5 mm wide. *Seeds* grey-brown, ovoid, shallowly regularly pitted; chaff red-brown. Figure 36.

Distinguished within the *E. orbifolia* group by the broad adult leaves with medium to long petioles, the shortly conical calyptra, and the large fruits with short, thick pedicels.

DISTRIBUTION: Sporadic and localised, from near Youanmi to the Die Hardy Range, and east to near Callion. Figure 37.

ECOLOGY: Restricted to scleromorphic shrublands on shallow sandy soil over granite rocks

CONSERVATION STATUS: Although populations are highly localised, the species is widely scattered over relatively undisturbed country, and not considered to be at risk.

The epithet is from the Latin *latus*, broad, referring to the leaves and fruits.

SELECTED SPECIMENS (from 9 examined): WESTERN AUSTRALIA (W to E): 23.0 km SW of Youanmi on Paynes Find road, Hill 2594 & Johnson, 24 Nov 1986 (NSW, PERTH); Mt Jackson to Lake Barlee, Fraser, 24 Feb 1922 (NSW); Pigeon Rock, 89.7 miles [143 km] N of Bullfinch, Chippendale 358, 21 Mar 1968 (CANB, NSW); 3.5–4 miles [5.6–6.4 km] W of Lake Giles, Cooper, 27 June 1923 (NSW); Hospital Rock, 30 miles [50 km] W of Riverina, Beard 6519, 11 Sep 1973 (PERTH, NSW).

33. *Eucalyptus orbifolia* F. Muell., Fragm. 5: 50 (1865).

TYPE CITATION: 'Ad bases montium graniticorum Novae Hollandiae austro-occidentalis interioris, longitudine 119°25', latitudine 30°47'. C. Harper.'

TYPE: holo MEL; iso K.

Mallee to 3 m, of twisted and spreading habit. *Bark* red-brown, splitting longitudinally and peeling partly back to reveal green to brown smooth bark ('minniritchi' bark). *Branchlets* strongly glaucous. Juvenile leaves disjunct, petiolate, ovate to orbicular, later ones retuse. *Adult leaves* disjunct, dull, strongly glaucous, obovate to orbicular, usually longer than broad, regularly retuse, 2.0–4.5 cm long, 15–40 mm wide; petioles 6–16 mm long; lateral veins regular, moderately spaced, at 40–50° to midrib; intramarginal vein distinct, more or less looped, 1–3 mm from margin; oil glands angular. Inflorescences simple, axillary; umbellasters 7-flowered or rarely 3-flowered; peduncles 8–20 mm long; pedicels 4–10 mm long. *Buds* globular to ovoid,

8–10 mm long, 6–8 mm diam.; calyptra hemispherical, as long as hypanthium or slightly longer. *Stamens* all fertile; filaments slender, irregularly flexed; anthers ovoid, dorsifixed near base of connective gland, versatile, dehiscing through lateral pores. *Fruits* hemispherical to flattened hemispherical, 7–9 mm long, 8–13 mm diam.; calyptra and stemonophore scars raised at c. 45°; disc flat to slightly raised, 3–4 mm wide. *Seeds* grey-brown, ovoid, shallowly regularly pitted; chaff red-brown. Figure 36.

E. orbifolia is described here under a reduced circumscription to allow comparison with segregate taxa described above.

DISTRIBUTION: Sporadic but locally frequent, in ranges of Central Australia; recorded from the Dean Range (Western Australia), Musgrave Range (South Australia) and MacDonnell Range (Northern Territory). Figure 37.

ECOLOGY: Restricted to shallow or skeletal sandy soils on the higher slopes of sandstone ranges.

Hybrids are recorded with *E. sessilis* (Maiden) Blakely.

CONSERVATION STATUS: Widely scattered over relatively undisturbed country, not considered to be at risk.

SELECTED SPECIMENS (from 12 examined): WESTERN AUSTRALIA: S end of Dean Range, *Carolin* 6106, 2 Aug 1967 (NSW). SOUTH AUSTRALIA: upper slopes of Mt Woodroffe, *Symon* 2693, 11 Aug 1962 (AD, NSW). NORTHERN TERRITORY (W to E): Mt Sonder, *Dunlop* 2513, 20 Apr 1972 (DNA, NSW); track to Palm Valley No. 2 gas well, on crest of Krichauff Ra. W of Mt Hermannsburg, *Hill* 865, 866, *Johnson & Benson*, 11 July 1984 (NSW), *Brooker* 5114, 5 Apr 1976 (CANB, NSW, PERTII); Serpentine Gorge, *Maconochie* 1063, 1 July 1970 (DNA, NSW).

E. orbifolia x *E. sessilis*: NORTHERN TERRITORY: Palm Valley No. 2 gas well, on crest of Krichauff Ra W of Mt Hermannsburg, *Hill* 867, *Johnson & Benson*, 11 July 1984 (NSW); Serpentine Gorge, *Maconochie* 1065, 1 July 1970 (DNA, NSW).

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Index

New names and combinations are printed in **boldface**; synonyms are printed in *italics*.

- Eucalyptus section Bisectaria 562
 Eucalyptus series Accedentes 563
 series Astringentes 572
 series Cneorifoliae 591
 series Erythronemae 575
 series Falcatae 603
 series Loxophlebae 563
 series Macrocarpae 617
 series Occidentales 572
 series Orbifoliae 625
 Eucalyptus subgenus Symphyomyrtus 562
 Eucalyptus subseries Leptopodosae 617
 subseries Occidentalosae 572
 Eucalyptus superspecies Orbifolia 625

 Eucalyptus accedens 563
E. amygdalina 567
E. angustifolia 617
E. angustissima 597
 subsp. *angustissima* 597
 subsp. *quaerenda* 598
E. argyphea 603
E. aspratilis 572

E. balanites 591
E. balanopelex 605
E. balladoniensis 614
 subsp. *balladoniensis* 615
 subsp. *sedens* 617
E. beardiana 623
E. blaxellii 564

E. corrugata 612

E. decipiens 591
E. depauperata 587

E. educta 627
E. elachyphylla 623
E. eremophila 584
 var. *grandiflora* 572
E. erythronema var. *roei* 587

E. falcata 603
E. foecunda var. *loxophleba* 565
E. foliosa 595

E. goniantha 609
 subsp. *goniantha* 609
 subsp. **notactites** 610
 subsp. *semiglobosa* 608
E. goniantha 612
E. goniocarpa 582
E. gratiae 571
E. grossa 585

E. incerata 585
E. incrassata var. *goniantha* 609

E. jutsonii 599

E. kessellii 612
 subsp. *eugnosta* 613
 subsp. *kessellii* 612
E. kruseana 571

E. lata 630
E. leptopoda 617
 subsp. *arctata* 621
 subsp. *elevata* 620
 subsp. *leptopoda* 618
 subsp. **subluta** 621

- E. loxophleba* 565
 subsp. lissophloia 569
 subsp. *loxophleba* 567
 subsp. supralaevis 568
 subsp. *gratiae* 571
 var. *fruticosa* 568
- E. mannensis* 599
 subsp. *mannensis* 599
 subsp. **vespertina** 600
- E. misella* 593
- E. occidentalis* 573
 var. *eremophila* 584
 var. *grandiflora* 572
 var. *stenantha* 572
- E. orbifolia* 630
E. ornata 604
- E. phylacis* 591
E. pruiniramis 563
- E. recta* 604
E. rosacea 623
- E. sargentii* 573
 subsp. *sargentii* 574
 subsp. **fallens** 575
E. semiglobosa 608
E. sessilis 631
E. spathulata 575
 subsp. *grandiflora* 580
 var. *grandiflora* 580
E. suggrandis 580
 subsp. **alipes** 581
 subsp. *suggrandis* 581
E. synandra 622
- E. tenera*** 586
E. tephroclada 586
- E. vegrandis* 577
- E. wandoo* 568
E. websteriana 626
 subsp. **norsemanica** 627
 subsp. *websteriana* 627
- E. xanthonema* 579

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New species, lectotypes and synonyms of Australasian *Nymphaea* (Nymphaeaceae)

S.W.L. Jacobs

Abstract

Jacobs, S.W.L. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, NSW, Australia 2000) 1991. *New species, lectotypes and synonyms of Australasian Nymphaea* (Nymphaeaceae). *Telopea* 4(4): 635-641. As a precursor to the forthcoming treatment of Nymphaeaceae for the 'Flora of Australia', *Nymphaea elleniae*, *N. atrans*, *N. immutabilis* and *N. immutabilis* subsp. *kimberleyensis* are described as new taxa; lectotypes are chosen for *N. violacea* and some of its synonyms, namely *N. violacea* var. *caerulea*, *N. holtzei*, *N. rehmeliana* and *N. casparyi*; *N. dictyophlebia* is placed as a synonym under *N. macrosperma*; and some other names are discussed.

Introduction

The following descriptions, lectotypifications, and discussion are provided as precursors to the treatment of Nymphaeaceae for the 'Flora of Australia'. Only those aspects necessary for that treatment are discussed here; it is planned to produce a fuller account on other aspects soon. This fuller account will include scanning electron micrographs of the seeds of at least all the native species.

New species

Nymphaea elleniae S.W.L. Jacobs, sp. nov.

N. violaceae affinis sed filamentis antherarum brevioribus, sepalis brevioribus, floribus semper candidis, floribus foliisque plerumque minoribus, differt.

TYPE: QUEENSLAND: Jardine River, 11° 09' S 142° 20' E, S. Jacobs 5450 & J. Clarkson, 6 Aug 1987 (holo NSW; iso BRI).

Perennial with vertical elongated rhizome. Juvenile submerged leaf blades often retained for several years, sagittate, usually red; mature blade to 22 cm long, 18 cm wide, undersurface often red, especially toward the margin, margins entire to slightly sinuate. Flowers to 20 cm above the water surface. Sepals 4, to 7 cm long, green outside with purple flecks; margins membranous, white; tip acute or occasionally obtuse. Petals to 25, grading into the stamens, lanceolate, white; tip acute to obtuse. Stamens to c. 100; filaments membranous, to 18 mm long; anthers to 8.5 mm long, sometimes slightly apiculate. Ovary lobed; carpels 11-22; fruit globose, c. 2.5 cm diam., with numerous seeds; seeds elliptical, c. 1.75-2.5 mm long, c. 1-1.5 mm diam., glabrous; cells of the testa having a small lumen, occasionally raised relative to the arms, with arms of unequal length, ends neither expanded nor raised.

On Cape York in and north of the Jardine River, Queensland; also in New Guinea. Growing in more or less permanent water to 5 m deep, flowering ?April to December. Flowers open all day, closing at night.

This species is very similar to *N. hastifolia* Domin but, unlike that species, *N. elleniae* grows in more permanent water and usually does not start flowering until after *N. hastifolia* has finished. There is also a difference in the seeds: the cells of the testa appear to have a 'double wall' in *N. hastifolia* with the appearance of an extra line in scanning electron micrographs of the seed.

N. elleniae differs from *N. violacea* in always being white-flowered, having shorter filaments, and the flowers and leaves being generally smaller; *N. elleniae* also often retains its juvenile leaves for much longer.

Named after my daughter, Ellen A. Jacobs.

QUEENSLAND: Burster Ck, 10° 55' S 142° 22' E, *Clarkson 6185*, Aug 1985 (BRI, NSW); c. 20 km W of Karwah Lagoon, 13° 44' S 141° 54' E, *Clarkson 4568*, Oct 1982 (BRI); Skull Ck, 10° 55' S 142° 22' E, *Jacobs 5458 & Clarkson*, Aug 1987 (NSW). PAPUA NEW GUINEA: Western Province: Pongarihi, c. 30 km E of Morehead, road to Arufi, 8° 40' S, 141° 50' E, *Jacobs 5959 & Conn*, Sept 1990 (NSW, LAE, UPNG); Seki village, N of Morehead 8° 21' S 141° 54' E, *Jacobs 5978 & Conn*, Sept 1990 (NSW, LAE, UPNG).

***Nymphaea atrans* S.W.L. Jacobs, sp. nov.**

N. giganteae affinis sed floribus fructibusque ad maturitatem vinosis, basi vaginanti petioli latiora, differt.

TYPE: QUEENSLAND: c. 10 km N of Wakooka, Bathurst Bay road, c. 14° 28' S 144° 33' E, *S. Jacobs 5398 & J. Clarkson*, 31 July 1987 (holo NSW; iso BRI).

Perennial with a short vertical swollen rhizome. Petiole base winged; mature leaf blade to c. 40 cm diam.; margins toothed with few regularly-spaced teeth to 2 mm long. Flowers to 40 cm above the water surface. Sepals 4, to 8 cm long, green outside with purple streaks, darkening to maroon with age; the margins membranous, light pink when young and progressively darkening to maroon with age; tip obtuse. Petals to 33, with a gap between petals and stamens, oblanceolate, white with pink tinge, becoming darker with age; tip obtuse. Stamens to c. 300, filaments membranous to cylindrical, to 14 mm long; anthers to 10 mm long, usually with a small hooked apical appendage. Ovary lobed; carpels 10 to 15; fruit globose, c. 4 cm diam., with numerous seeds; seeds elliptical, c. 4 mm long, c. 2.5 mm diam. with discontinuous or disorganised rows of very short hairs; cells of the testa having an elongated lumen with arms of equal length, the ends usually expanded but not raised.

Cape York, Queensland, in Lakefield National Park and its vicinity. Billabongs, lakes and old pastoral dams on floodplains. Flowering ?July to November; flowers open during the morning (and at night?).

Similar to other species in the '*gigantea*' group but differing in the apparent night-flowering, the more developed sheathing base of the petiole, and the petals and sepals darkening with age. The sepals, as well as the fruit, become almost deep maroon as the fruit is drawn beneath the surface. The hairs on the seed are shorter than those on other species in this group. *N. atrans* hybridises with *N. inmutabilis* and the hybrids are obvious from the pink older flowers, the flowers of the hybrid never becoming as dark as those of *N. atrans*. The hybrids, unlike both parent species, do not have a good seed-set.

Named from the Latin *atrans*, meaning darkening, referring to the flower darkening with maturity.

QUEENSLAND: Romeo Lagoon, Lakefield National Park, 15° 09' S 144° 15' E, *Jacobs 5414 & Clarkson*, Aug 1987 (NSW, BRI); Low Lake, Lakefield National Park, 14° 38' S 144° 55' E, *Jacobs 5442 & Clarkson*, Aug 1987 (NSW, BRI); 'Bizant', Lakefield National Park, 14° 41' S 144° 12' E, *Williams 85259*, Oct 1985 (BRI).

Nymphaea immutabilis S.W.L. *Jacobs*, sp. nov.

N. giganteae affinis sed antheris longioribus, petalis ad maturitatem nonpalescentibus, ciliis seminum seriatum dispositis sed minus ordinatis, differt.

TYPE: QUEENSLAND: c. 1 km SW of Emerald Ck, nr Mareeba, 17° 01' S 145° 30' E, *S. Jacobs 5338 & J. Clarkson*, 26 July 1987 (holo NSW; iso BRI).

Annual or perennial with vertical globular rhizome. Mature leaf blade to c. 70 cm diam.; margins toothed with regularly-spaced teeth to 4.5 mm long. Flowers to 50 cm above the water surface. Sepals 4, to 12.5 cm long, green on the outside with purple flecks; margins membranous and coloured as the outer petals; tip obtuse. Petals to 34, with a gap between petals and stamens, oblanceolate to spatulate, white, sometimes with a blue tinge, or blue, usually not fading with age; tip obtuse. Stamens to c. 400; filaments membranous to cylindrical, to 32 mm long; anthers to 15 mm long, often apiculate. Ovary lobed; carpels 9 to 20; fruit globose, c. 5 cm diam., with numerous seeds; seeds elliptical, c. 4 mm long, c. 2.5 mm diam., with discontinuous or disorganised rows of short, sparse to dense, sometimes almost scattered, hairs, rarely glabrous; cells of the testa having an elongated lumen with arms of equal to unequal length, ends sometimes slightly expanded but not raised.

Widespread in the monsoonal parts of the Australian tropics from the Kimberley, Western Australia to about the Tropic of Capricorn in coastal Queensland. In permanent or ephemeral waterholes. Flowering March to November; flowers open during the day and close at night.

At various times this species has been included in *N. gigantea* or incorrectly known as *N. dictyophlebia* (a synonym of *N. macrosperma*, see below). The distributions of *N. gigantea* and *N. immutabilis* overlap around Rockhampton on the Queensland coast and specimens from this area can be difficult to identify unless collected with seeds, information on flower colour, and whether there is any sign of petal colour fading with maturity. There is presumably some intergradation between the two species in this area.

From the Latin *immutabilis*, not changing, referring to the petals, which usually do not change colour with maturity in this species, unlike *N. gigantea* where those flowers that are originally coloured usually fade, or *N. atrans* where they darken.

There are two subspecies.

- 1 Petals mostly white, outer whorls often tinged blue, or the petals all white or all blue, not fading with age; sepals to 10.5 cm long; stamens to c. 400; anthers without a gland at the base; leaf blade margin with teeth to 4.5 mm long; carpels 9–19; seeds pubescent subsp. *immutabilis*
- 1* Petals blue with white at base, fading slightly with age; sepals to 12.5 cm long; stamens to c. 200; anthers with purple gland at base; blade margin with teeth to 3 mm long; carpels 15–20; seeds apparently glabrous subsp. *kimberleyensis*

Nymphaea immutabilis* S.W.L. Jacobs subsp. *immutabilis*N. lotus* var. *australis* Bailey (1899: 38)

LECTOTYPE (here designated): QUEENSLAND: Kamerunga, Barron R., E. Cowley 7, Aug 1891 (BRI).

In the work cited above, Bailey refers the publication of his variety to an earlier work (Bailey 1883); however, while the 1883 publication mentions a variety it offers neither name nor specimen. The name first appears in Bailey (1899) with a somewhat vague specimen citation 'Hab.: Still waters off the Barron River.' The specimen at BRI is clearly labelled by Bailey.

Rhizome swollen and vertical, usually less than 8 cm long. Mature leaf blade with teeth to 4.5 mm long on margin. Sepals to 10.5 cm long. Petals white, with outer whorls often tinged blue, less commonly the petals all white or all blue, not fading with age. Stamens to c. 400; filaments to 28 mm long; anthers to 15 mm long, without a gland at the base. Carpels 9 to 19; fruit globose, c. 5 cm diam.; seeds with discontinuous or disorganised rows of short hairs that sometimes almost appear scattered.

Distribution, habitat, flowering months and flowering times as given for the species.

WESTERN AUSTRALIA: 'Mt House', E of Derby, 17° 12' S 126° 15' E, *Jacobs* 4334, May 1982 (NSW). NORTHERN TERRITORY: 'Singleton' Station, 20° 48' S 134° 16' E, *Henshall* 1047, June 1975 (MEL). QUEENSLAND: Normanton to Karumba road between Normanton and Maggieville, 17° 03' S 141° 00' E, *Clarkson* 2697, Nov 1979 (BRI); 'Westmoreland' homestead lagoon, 17° 16' S 138° 15' E, *Jacobs* 1551, May 1974 (NSW); Camooweal, 19° 35' S 138° 07' E, *Jacobs* 5531 & P. Wilson, May 1988 (NSW).

***Nymphaea immutabilis* subsp. *kimberleyensis* S.W.L. Jacobs, subsp. nov.**

Subsp. *immutabili* affinis sed petalis plerumque ad inum candidis apicem versus violaceis, sepalis longioribus, staminibus paucioribus, differt.

TYPE: WESTERN AUSTRALIA: Kimberley region, S. *Jacobs* 5706 & P. Wilson 23 May 1988 (holo NSW; iso PERTH).

Rhizome swollen and vertical, to 12 cm long. Mature leaf blade with teeth to 3 mm long on margin. Sepals to 12.5 cm long. Petals blue with white at base, fading slightly with age. Stamens to c. 200; filaments to 32 mm long; anthers to 13 mm long, with a purple gland at the base of the anther. Carpels 15 to 20; only immature seeds seen, apparently glabrous.

Known from only one population in the Kimberley, from a lagoon that dries out each year. Flowers open during the day and presumably close at night; flowering from ?March to June. Because of the apparent rarity of this subspecies I have not published precise locality information although this information has been passed on to relevant Government conservation authorities.

WESTERN AUSTRALIA: Kimberley region, *Jacobs* 5707 & P. Wilson, 23 May 1988 (NSW).

Nymphaea violacea and synonyms

Nymphaea violacea Lehm. (1853: 218).

N. gigantea var. *violacea* (Lehm.) Conard (1905: 130–131)

LECTOTYPE (here designated): QUEENSLAND: Cape York, *Macgillivray Voyage of Rattlesnake*, Bot. 410, 10 October 1848 (K).

N. violacea var. *caerulea* Lehm. (1853: 218), as 'coerulea'.

LECTOTYPE (here designated): QUEENSLAND: Cape York, *Macgillivray Voyage of the Rattlesnake*, Bot. 410 β , 27 October 1849 (lecto K; isolecto B).

Lehmann (1853) described two varieties of *N. violacea*, the type variety as α and var. *caerulea* as β . He cited only one specimen from Macgillivray as the type for β and two specimens for α , one collected by Macgillivray and one by Anderson. I have been unable to find any specimens collected by Anderson but found both specimens from Macgillivray clearly labelled at K and a duplicate of one of these at B. Lehmann's herbarium was dispersed after his death, the Nymphaeaceae being purchased by Caspary (Nordenstam 1980). Caspary's herbarium was mostly deposited at B where many specimens were destroyed during World War II, but there are some duplicates at K (Stafleu & Cowan 1976). A search at B revealed a Macgillivray specimen of β that had been damaged by insects, and a substantial collection of Caspary's 'hybrids'. The hybrids were derived from artificially pollinated specimens of what, at that time, were regarded as separate species; nearly all of the parents are now treated by Verdcourt (1989) as synonyms of *N. nouchali* Burm. f. The label of the Macgillivray specimen at B has been altered in an attempt to change the collection date from that for β to that of α , presumably in ignorance of there having been two specimens from the same 'locality' at different dates. Royen (1962) cites the Anderson collection as being in HBG. A search there failed to locate any Australian *Nymphaea* specimens, although there are Anderson collections in other families; there seems no evidence of Caspary's herbarium in HBG. The two specimens at K are in good condition, have the advantage of being in the same herbarium, have been seen and annotated by Lehmann, do not seem to have had their labels altered, and match their relevant descriptions. I am therefore choosing these specimens as lectotypes for Lehmann's two varieties of *N. violacea*.

N. holtzei Rehnelt & Henkel ex Henkel, Rehnelt & Dittman (1907: 67).

TYPE CITATION: 'Gesammelt von Direktor M. Holtze auf den Melville-Inseln, 40 engl. Meilen von Port Darwin'.

LECTOTYPE (here designated): Lefthand figure accompanying the description (Henkel et al. 1907: 67).

I have been unable to find a Holtze specimen labelled with these details. If one existed it was possibly destroyed in B. There are two unnumbered figures accompanying the description. The unnumbered figure on the left is clearly *N. violacea*. *N. stellata* F. Muell. (non Willd.) is a *nomen nudum* cited as a synonym of *N. holtzei* in the protologue, and Mueller used his name for what is now recognized as *N. violacea*. The description of *N. holtzei* is a good match for *N. violacea*. I here designate the lefthand

figure accompanying the description on p. 67 as the lectotype. The unnumbered figure on the right is of the tubers and could belong to a young plant of nearly any Australian species.

N. holtzei var. *albiflora* Rehnelt & Henkel ex Henkel, Rehnelt & Dittman (1907: 67).

TYPE CITATION: 'Eleonorae hort.'

The distinguishing feature of this variety, 'Floribus niveis' is added after the diagnostic description of the species. Flower colour alone is an unreliable character for distinguishing species of *Nymphaea*; this variety *albiflora* presumably consists of common white-flowered plants of *N. violacea*. There is no indication of any specimen or drawing that could be used in lectotypification.

N. rehneliana Henkel (1910: 154–156).

LECTOTYPE (here designated): Fig. 11 on p. 155 of the protologue.

There is no indication in the original description of a specimen existing other than the statement that the species was cultivated at the Botanic Garden in Giessen. The description matches *N. violacea* and there is an awkward but perfectly adequate and diagnostic drawing in the protologue that I now select as the lectotype.

N. casparyi Rehnelt & Henkel ex Henkel, Rehnelt & Dittman (1907: 66) nom. illeg.; non *N. casparyi* Carrière (1879).

TYPE CITATION: 'Im Herbar Kew liegen Blätter von ihr, gesammelt von Ferd. v. Müller, bezeichnet als *versicolor*, *repanda* und *serrata*. Eines derselben ist mit *Banksii* Cunn. bezeichnet.'

LECTOTYPE (here designated): 'N. repanda', Head of Sturts Creek, *F. Mueller* (K).

Although it is not necessary to lectotypify illegitimate names there is some value in doing so for this case. Rehnelt and Henkel's name has been used in the literature, sometimes cited as a *nom. illeg.*, and the unnumbered drawing with the protologue has also been referred to. The problem springs from their name being based on collections of two different species. There are four specimens listed by Rehnelt and Henkel, all from K; three of the specimens have been labelled by Mueller as either 'versicolor', 'repanda' or 'serrata' and one labelled as 'banksii' by Allan Cunningham. All the names are *nomina nuda*; the specimens labelled *versicolor*, *repanda*, and *banksii* are all *N. violacea* and the specimen labelled *serrata* belongs to a species near *N. gigantea* Hook., possibly *N. macrosperma*. The figure with the type description is a composite of the two species, as is the description. In order to reduce confusion I have selected as lectotype the specimen designated above.

New synonym

Nymphaea macrosperma Merrill & Perry (1942: 389).

TYPE: PAPUA NEW GUINEA: Lake Daviumbu, Middle Fly River, *L. Brass* 7608, Aug 1936 (holo A; iso BM, BRI).

N. dictyophlebia Merrill & Perry (1942: 390), **syn. nov.**

TYPE: PAPUA NEW GUINEA: Penzara, between Morehead and Wassi Kussa Rivers, L. Brass 8437, Dec 1936 (holo A; iso BM, BRI).

The names *Nymphaea macrosperma* and *Nymphaea dictyophlebia* were both published in the same paper but are referable to the same species. Understandably there has been some confusion in the application of these names although *N. macrosperma* has been used correctly more frequently than *N. dictyophlebia*, the latter name sometimes being used for the species described here as *N. immutabilis*. To minimise changes to current usage I have selected *N. macrosperma* as the name for this taxon.

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Many thanks to Geoff Sainty, John Clarkson and Ian Cowie who, among others, were effective crocodile decoys and collectors of valuable specimens. Thanks also to Carolyn Porter and Sue Chambers for invaluable technical assistance, Joy Everett, Roger Carolin and Helen Aston for their comments on the manuscript, Terry Macfarlane and Greg Leach for help while Australian Botanical Liaison Officers, Karen Wilson for the Latin diagnoses and help while Liaison Officer, and to The Royal Geographical Society and The Linnean Society of London for supporting my participation in the Kimberley Research Project, 1988.

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New species of *Plectranthus* and *Westringia* (Labiatae) from New South Wales

Barry J. Conn

Abstract

Conn, Barry J. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000). New species of *Plectranthus* and *Westringia* (Labiatae) from New South Wales. *Telopea* 4(4): 643–648. *Plectranthus crennus* and *Westringia kydrensis* from eastern New South Wales are described.

Introduction

During the preparation of an account of the labiates (Lamiaceae) for the 'Flora of New South Wales' project, two undescribed species were discovered. Although the conservation status is unknown, both appear to be rare and possibly vulnerable. The publication of these two names will enable the species to be formally recognized by the appropriate management authorities.

Terminology and presentation follows that used in Conn (1984 & 1987).

Taxonomy

Plectranthus crennus Conn, sp. nov.

TYPE: NEW SOUTH WALES: Sawtell area, Conn 3478, 20 February 1990 (holo NSW 224791; iso MEL).

Herba prostrata usque decumbens. *Rami et ramuli* basi subteretes, apicem versus quadrangulatum, moderate usque dense tomentosi, pilis albis brevibus etiam pilis longissimis multicellularibus patentibus eglanduligeris. *Folia* decussata, moderate usque dense tomentosa; *petiolus* 15–20 mm longus; *lamina* depresso ovata usque latissime ovata, 35–40 mm longa, 45–50 mm lata, basi subtruncata, margine bicrenata, apice obtuso usque rotundato. *Verticillastri* quinqueflori. *Bractea* late ovatae, 1.5–1.6 mm longae, 1.5–1.6 mm latae, deciduae. *Pedicellus floris* 3.5–5 mm longus. *Calyx* marroninus vel in partibus viridis, extra sparsim usque moderate tomentosus, intra glaber; *tubus* circa 0.4 mm longus; *lobus abaxiali–medianus* circa 1 mm longis, apice profunde diviso; *lobi laterales* late deltoidei, 0.6–0.8 mm longi; *par lorum adaxiali–medianorum* latissime obovatum usque transverse late ellipticum, circa 0.6 mm longum. *Corolla* 6 mm longa, lobis indicis, extra in partibus sparsim tomentosa, intra glaber; *tubus* 4.4 mm longus, leviter curvus; *lobus abaxiali–medianus* transverse late ellipticus usque circularis, circa 4.5 mm longus; *lobi laterales* oblique deltoidei, 1–1.3 mm longi; *par lorum adaxiali–medianum* transverse truncato-ellipticum, circa 2 mm longum, apice profunde diviso. *Filamenta staminum* 3.5–4.5 mm longa; *antherae* circa 0.4 mm longae. *Ovarium* 0.2–0.3 mm longum; *stylus* 7.5–8.2 mm longus; *stigma* 0.6–0.8 mm longa. *Mericarpia* compresso–globularia, 0.8–1 mm diametro, latitudine non nisi 0.5–0.6 mm lata; calyx fructifer accrescens.

Prostrate to decumbent herb, pleasantly aromatic with a *Geranium*-like odour. *Branches* basally subterete, distally ridged and appearing quadrangular, moderately to densely hairy [65–80 hairs/mm²]; indumentum consisting of short (to c. 0.6 mm long) and long (to 6 mm long) hairs; hairs multicellular, patent, white, with shorter hairs slightly curved with apex directed antrorsely; glandular hairs absent. *Leaves* green, decussate, in pairs, moderately to densely hairy [as for branches]; hairs [as for branches]; *petiole* 15–25 mm long; *lamina* depressed to very broadly ovate, 35–40 mm long, 45–50 mm wide [lamina length to width ratio 0.7–0.8, length of maximum width from base to total lamina length ratio 0.3–0.4], base subtruncate, margin bicrenate with 7–10 rounded teeth (each with 1 or 2 secondary teeth), apex obtuse to rounded; venation strongly raised abaxially, sunken adaxially. *Inflorescence* an open spike-like confluence, moderately to densely hairy [as for branches]; uniflorescences appearing verticillate, with each uniflorescence a reduced 5-flowered dichasium. *Bracts* broadly ovate, 1.5–1.6 mm long, 1.5–1.6 mm wide [length to width ratio 1], soon deciduous. *Pedicel* (anthopodium+ a_2 axis [ultimate internode basal to anthopodium]) 3.5–5 mm long. *Calyx* with outer surface maroon throughout, or lateral and abaxial lobes green (at least in part), inner surface \pm green; outer surface sparsely to moderately hairy [c. 30 hairs/mm²]; inner surface glabrous; *tube* c. 0.4 mm long; *abaxial median lobes* c. 1 mm long, c. 1.1 mm wide [length to width ratio 0.9], deeply divided (sinus 0.8 mm long, 0.9 mm wide distally) with each lobe narrowly triangular and apex acute; *lateral lobes* broadly triangular, 0.6–0.8 mm long, 0.6–0.8 mm wide [length to width ratio 1], apex acute; *adaxial median lobe-pair* very broadly obovate to transversely broad-elliptic, 0.6 mm long, 0.8 mm wide [length to width ratio 0.7–0.8], apex rounded. *Corolla* 6 mm long, with tube white and lobes bright blue with purple tinge; outer surface glabrous basally, sparsely hairy on lobes; inner surface glabrous; *tube* 4.4 mm long, tubular, slightly inflated adaxially, slightly curved at c. 2 mm from base at an angle of c. 30°; *abaxial median lobe* transversely broad-elliptic to circular, c. 4.5 mm long, 4.5–5 mm wide, with apex rounded; *lateral lobes* obliquely triangular, 1–1.3 mm long, 1–1.5 mm wide [length to width ratio 1–1.5], with apex obtuse; *adaxial median lobe-pair* transversely truncate-elliptic, c. 2 mm long, 3.7 mm wide distally [length to width ratio 0.4–0.5], deeply bilobed (sinus 1 mm long, 0.3 mm wide distally, each lobe transversely broad-elliptic, c. 1.5 mm long, c. 2 mm wide). *Staminal filaments* with purple tinge, inserted c. 2 mm above base of corolla, 3.5–4.5 mm long, glabrous; *anthers* c. 0.4 mm long, c. 0.3 mm wide. *Disk* 0.5 mm long. *Gynoeceium* glabrous; *ovary* 0.2–0.3 mm long; *style* 7.5–8.2 mm long; *stigma lobes* 0.6–0.8 mm long. *Mericarps* compressed-spherical, 0.8–1 \times 0.8–1 \times 0.5–0.6 mm, smooth, glossy dark brown; *calyx* enlarging in fruit and lobes \pm enclosing developing seed, with abaxial lobes incurved, c. 2.2 mm long, 1.5 mm wide, lateral lobes incurved, c. 1.7 mm long, c. 1 mm wide, adaxial lobe-pairs c. 2.1 mm long, c. 2.6 mm wide. Fig. 1 (a–c).

DISTRIBUTION: Only known from Evans Head, Lennox Head and Sawtell, North Coast, New South Wales.

HABITAT: A rare herb growing in shallow sandy soil that has been deposited by wind into the crevices of the bare basaltic outcrops of coastal headlands.

AFFINITIES: The affinities of this species are not known and must await the conclusions of a detailed phylogenetic evaluation of the genus. Unfortunately, the most recent account of the Australian species (Blake 1971) does not comment on infrageneric relationships. It is superficially similar to *P. graveolens*, however it can be distinguished from this latter species by having 3–5 pairs of teeth (total of 7–10 teeth) on the margin of the leaf (cf. 10–23 pairs of teeth in *P. graveolens*), being pleasantly aromatic (cf. *P. graveolens*, which is strongly and unpleasantly aromatic) and this species is prostrate (cf. the latter, which is suberect to erect). It can be distinguished from the

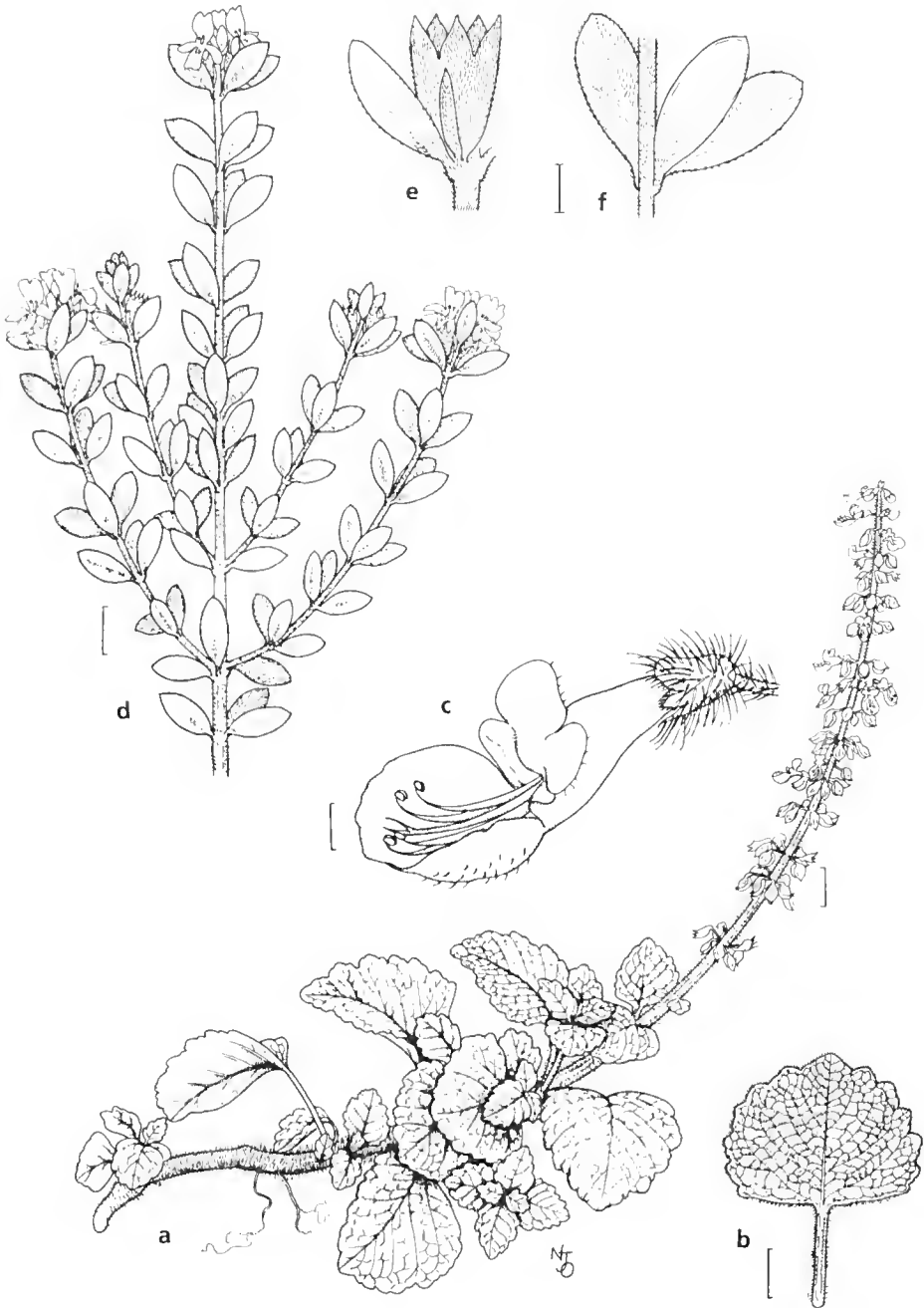


Figure 1. *Plectranthus crennus*. a, branch and inflorescence; b, leaf; c, flower (all from Conn 3478). *Westringia kydrensis*. d flowering branchlet; e calyx and prophyll in leaf axil; f whorl of three leaves (all from Rodd 2652). Scale bar: a = 5 mm; b, c = 2 mm; d, e = 1 cm; f = 1 mm.

P. parviflorus/*P. suaveolens* group by the absence of glands and by the presence of \pm patent hairs (cf. the latter group, which has \pm appressed, retrorse hairs).

ETYMOLOGY: The specific epithet refers to the occurrence of this species on coastal rocky cliffs.

CONSERVATION STATUS: Although the conservation status of this species is uncertain, it is very rare at Evans Head and Sawtell (Conn 3478). At Lennox Head it is relatively common locally (R. Miller, pers. comm.). However, this species is vulnerable at all known localities. Risk Code = 3V (*sensu* Briggs & Leigh 1988).

NOTES: In horticulture, this species is a vigorously growing ground cover, which flowers throughout the year. It has been successfully cultivated at the Royal Botanic Gardens, Sydney and is commonly referred to as *Plectranthus graveolens* 'Headland Form'.

OTHER SPECIMENS EXAMINED: NEW SOUTH WALES:(NORTH COAST): Kendall, *F.M. Bailey s.n.*, Sep 1929 (NSW 31978); Lennox Head, *R. Miller s.n.*, 11 June 1991 (MEL, NSW 240476); Sawtell Headland, *P. Wilson s.n.*, - (NSW 241355); (cultivated at Frenchs Forest) ex Sawtell, *D. Blaxell s.n.*, 15 Jan 1969 (NSW).

Westringia kydrensis Conn, sp. nov.

TYPE: NEW SOUTH WALES: Kydra Reefs, *Rodd 2652*, 22 Mar 1974 (holo NSW 216148; iso CANB, MEL).

Frutices usque ad circa 0.4 m. alti. *Rami et ramuli* subteretes, dense tomentosi usque glabrescenti. *Folia* verticillata terna, moderate usque sparsim tomentosa; *petiobus* 1–1.5 mm longus; *lamina* obovata usque elliptica, 5.5–7 mm longa, 2.2–3 mm lata, basi cuneata, margine integro et plano, apice obtuso. *Pedicellus floris* circa 0.5 mm longus, dense tomentosus; *prophyllis* anguste ellipticis usque anguste oblongis, 3–4 mm longis, 0.5–0.7 mm latis, dense tomentosus. *Calyx* probabiliter viridis, extra moderate usque dense tomentosus; *tubus* 2.5–3.2 mm longus, intra glaber; *lobi* deltoidei, 2.5–4.8 mm longi, 1.2–1.7 mm lati, intra moderate tomentosi, apice acuto. *Corolla* 8–10 mm longa, alba, extra in partibus distalibus moderate tomentosa, intra sparsim usque moderate tomentosa; *tubus* 3.5–4.5 mm longus; *lobus abaxiali-medianus* late usque latissime spatulatus, 3.5–4 mm longus, 3–5 mm latus; *lobi laterales* oblongi, 3 mm longi, 1.5 mm lati; *par lorum adaxiali-medianorum* late oblongum usque latissime obovatum, 4.5–6 mm longum, 4–8.5 mm latum. *Androecium* in ore corollae insertum; filamenta staminum 0.8–1 mm longa; antherae circa 1 mm longae; filamenta staminodiorum 0.8–1 mm longa; *lobi staminodiorum* 0.2–0.3 mm longi. *Pistillum* 8.4–9.5 mm longum; ovarium circa 1 mm longum; stylus 7–8 mm longus; stigma 0.4–0.6 mm longa. *Mericarpi* incognita.

Erect shrub to c. 0.4 m high. *Branches* subterete (internodes with slightly raised undulate ridge-pairs from axil of leaf to next more distal node), moderately to densely hairy distally and between ridge-pairs [to c. 70 hairs/mm²], otherwise sparsely hairy to glabrescent; hairs simple, \pm straight, subappressed, antrorse, 0.1–0.2 mm long, white. *Leaves* in 3-leafed whorls, spreading to ascending, sparsely to moderately hairy [to 25 hairs/mm²], soon glabrescent with the hair bases persistent; hairs simple, \pm straight, appressed, antrorse; *petiole* 1–1.5 mm long; *lamina* obovate to elliptic, 5–8 mm long, 2.2–3 mm wide [lamina length to width ratio 2–2.5, length of maximum width from base to total lamina length ratio 0.5–0.7], base cuneate, margin entire and flat, apex obtuse; venation not visible, midrib with only basal part slightly raised on abaxial surface. *Inflorescence* a frondose racemiform conflorescence, uniflorescence monadic, up to c. 6 flowers per conflorescence. *Pedicel* c. 0.5 mm long,

densely hairy [as for distal parts of branches]; *prophylls* inserted at base of calyx, narrowly elliptic to narrowly oblong, 3–4 mm long, 0.5–0.7 mm wide [length to width ratio 4.3–6.7, length of maximum width from base to total lamina length ratio 0.5–0.6], densely hairy [90–96 hairs/mm²], base cuneate, margin incurved, apex tapering. *Calyx* ? green; outer surface moderately to densely hairy [70–80 hairs/mm²], often glabrescent basally; *tube* 2.5–3.2 mm long, inner surface glabrous; *lobes* triangular, 1.6–2 mm long, 1.2–1.7 mm wide [length to width ratio 1.2–1.3], inner surface moderately hairy, apex acute; [calyx lobes to tube ratio 0.6–0.7]. *Corolla* 8–10 mm long, white, with a few small reddish dots at base of abaxial lobes; outer surface glabrous basally, moderately hairy on distal part of tube and on lobes [45–55 hairs/mm²], with hairs 0.2–0.4 mm long, \pm appressed; inner surface sparsely to moderately hairy [20–40 hairs/mm²], 0.2–0.4 mm long, appressed to subpatent, straight to variously bent; *tube* 3.5–4.5 mm long, tubular, diameter at mouth 2–3 mm; *abaxial median lobe* broadly to very broadly spatulate, 3.5–4 mm long, 3–5 mm wide distally, deeply bilobed (sinus to 3 mm long), with apex irregularly truncate and/or lobed; *lateral lobes* oblong, sometimes narrowly so, 3–3.5 mm long, 0.7–2 mm wide [length to width ratio 1.7–4], with apex rounded and slightly irregular, often shortly bilobed; *adaxial median lobe-pair* broadly oblong to very broadly obovate, 4.5–6 mm long, 4–8.5 mm wide distally (length to width ratio 0.7–1.1), with apex \pm irregularly subtruncate, deeply bilobed (sinus 2–3.5 mm long). *Androecium* inserted in mouth of corolla. *Staminal filaments* 1.8–2 mm long, glabrous or hairy at base; anthers c. 1 mm long. *Staminodal filaments* 0.8–1 mm long, glabrous; staminodal lobes white, 0.2–0.3 mm long. *Disc* 0.4–0.5 mm high. *Pistil* 8.4–9.5 mm long; ovary c. 1 mm long; style 7–8 mm long, glabrous; stigma lobes 0.4–0.6 mm long. *Mericarps* immature. Fig. 1 (d–f).

DISTRIBUTION: Kydra Reefs, c. 23 km SE of Cooma, Southern Tablelands, New South Wales.

HABITAT: Frequent in heath, amongst larger shrubs of *Allocasuarina nana* and *Banksia canei*. Occurring on rocky granite or quartzite hillside (Rodd 2652).

AFFINITIES: The affinities of this species are not fully understood; however, it appears to belong to the group that has relatively large prophylls. Of this group, it is most similar to *W. davidii* from which it can be distinguished by its appressed antrorse indumentum (cf. *W. davidii*, which has subpatent and more or less tangled hairs).

ETYMOLOGY: The specific epithet refers to the occurrence of this species in the Kydra Reefs area of New South Wales.

CONSERVATION STATUS: This new species of *Westringia* is only known from the type collection, from the Kydra Reefs area of New South Wales. Since the distribution of this species is not known, it is difficult to comment on its conservation status. However, the only known population does not occur in a conservation reserve. Risk Code = 2K (Briggs & Leigh 1988).

Acknowledgments

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Status of the genus *Eichlerago* (Labiatae)

Barry J. Conn

Abstract

Conn, Barry J. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, NSW, Australia 2000). Status of the genus *Eichlerago* (Labiatae). *Telopea* 4(4): 649–651. *Eichlerago* is reduced to a synonym of *Prostanthera* and the new combination *Prostanthera tysoniana* (Carrick) Conn is made. This species is regarded as belonging to *Prostanthera* section *Prostanthera*. Notes on the habitat, distribution and conservation status are included.

Introduction

Eichlerago was described by Carrick (1977) as a new genus of the Lamiaceae, with close affinities to *Prostanthera*. He concluded that the genus was sufficiently distinct from other labiate genera to be placed in his new monotypic tribe Eichleragineae (within the subfamily Prostantheroideae *sensu* Briquet 1895). However, the features that Carrick used to distinguish this genus from *Prostanthera* are either plesiomorphic or (it is believed) incorrectly interpreted.

The infrafamilial classification used in this paper is based on that of Bentham in Bentham & Hooker (1876), as modified by Erdtman (1945). Hence, the Prostantheroideae *sensu* Briquet (1895) is referred to as the tribe Prostanthereae *sensu* Bentham in Bentham & Hooker (1876), of the subfamily Lamiioideae *sensu* Erdtman (1945).

Discussion of Characters

Carrick concluded that the shape of the corolla in *Eichlerago* could be used to distinguish this genus from *Prostanthera*. However, contrary to his interpretation, the 3-lobed abaxial (lower) corolla lip in *Eichlerago* is typical of most species of *Prostanthera* (particularly in *Prostanthera* section *Prostanthera*). Of the fruiting characters that Carrick regarded as diagnostic, only the reduced distal lobing is apomorphic. However, this condition is a convergence that is also found in *Prostanthera queenslandica*. The other fruiting characters that he used include 'fruits dry' and 'fruits indehiscent'. The 'dry' rather than fleshy, fruit condition is a plesiomorphy, characteristic of all Labiatae. It is not known whether the fruits of *Eichlerago* are indehiscent or dehiscent. It is possible that they are a foraminose schizocarp, not dissimilar to those of the Prostanthereae (Conn 1984). Finally, Carrick regarded the position of the style as a diagnostic character. However, the terminal style is also a plesiomorphy. This character distinguishes the Prostanthereae and Ajugeae from the other Labiatae which have a gynobasic style (Conn 1984, Sharma & Singh 1982).

In an evaluation of relationships within the tribe Prostanthereae (Labiatae), *Eichlerago* and *Prostanthera* formed a clade characterised by four synapomorphies (Conn, in press). These characters were: the anther connective extended into a basal appendage, or if appendage absent (in some species of *Prostanthera*) then regarded as a secondary loss; the anther connective cristate with triangular trichomes; the leaves aromatic, or if non-aromatic (in a few species of *Prostanthera*) then regarded as a

secondary loss; and the anther lobe terminating in a basal acumen. *Eichlerago* and *Prostanthera* section *Prostanthera* form the sister group to *Prostanthera* section *Klanderia*. The former clade is characterised by the adaxial lip of the calyx enlarging (often significantly) as the fruit matures. Some enlargement of the calyx has been noted in fruiting material of *E. tysoniana* (Payne 107 & 126).

Discussion of Infratribal Classification

Although it is premature to formally recognize infratribal groupings within the Prostanthereae, the current evaluation of the phylogeny of this tribe (Conn, in press) does not support Carrick's interpretation that all genera (apart from *Eichlerago*, which he placed in Eichleragineae) belong in one group (Prostanthereae *sensu* Carrick 1977). Within the Prostanthereae, Conn (in press) recognizes two main groups. One group (the *Prostanthera* clade) consists of *Prostanthera* (including *Eichlerago* and both sections of *Prostanthera*) and *Wrixonia*, with the other group (the *Microcorys* clade) consisting of *Hemiandra*, *Hemigenia*, *Microcorys* and *Westringia*. Therefore, there is even less support for the 'Eichleragineae' than there is for *Eichlerago*.

Conclusion

It is concluded that *Eichlerago* cannot be maintained as a distinct monotypic genus and it is here proposed that it become part of *Prostanthera* section *Prostanthera*.

Taxonomy

***Prostanthera* Labill.**, Nov. Holl. Pl. Spec. 2: 18, t. 157 (1806).

TYPE SPECIES: *Prostanthera lasianthos* Labill.

TYPE: 'Van-Diemen', Labillardière s.n., - (n.v.).

***Eichlerago* Carrick**, J. Adelaide Bot. Gard. 1: 115 (1977).

TYPE SPECIES: *Eichlerago tysoniana* Carrick

TYPE: *Tyson* 25 (for details refer below).

***Prostanthera tysoniana* (Carrick) Conn, comb. nov.**

BASIONYM: *Eichlerago tysoniana* Carrick, J. Adelaide Bot. Gard. 1: 115, fig. 1 (1977).

HOLOTYPE: WESTERN AUSTRALIA: 'Mt Narryer, Murchison River', I. *Tyson* 25, 1898 (PERTH); iso K.

DESCRIPTION: Refer Carrick (1977).

HABITAT: Open *Acacia brachystachya*-dominated shrubland on shallow (0.5–0.7 m deep) red sandy soils of the sandplain, overlying Permian lateritic-rich plains.

DISTRIBUTION: This rare species is endemic to the Byro–Mt Narryer area of Western Australia.

CONSERVATION STATUS: The Rangeland Survey Team of the Department of Agriculture, Western Australia, have located this species on the Byro, Curbur, Mt Narryer and Muggon pastoral properties (Ray Cranfield pers. comm., 10 June 1991). Its distribution reflects the very geographically restricted interzone of Permian and wash plains, which only occurs on three or four properties in this area (P. Curry in Cranfield pers. comm., 6 September 1991). Therefore the species is confined to an area of about 300 km². Although the distribution of this species is restricted, the known populations contain several hundred plants, with seedlings reported as either very common (Conn 2083, Conn 2091–2096 and Cranfield pers. comm., 10 June 1991) or none seen (P. Curry in Cranfield pers. comm., 6 September 1991). Irrespective of the number of seedlings, the percentage that mature in this harsh environment may be very low, particularly because it is heavily grazed by stock and kangaroos.

Although more information about the distribution of this species is now available, the Western Australian Department of Conservation and Land Management consider it to be a 'Priority 1' species. That is, a species under immediate threat and under consideration for declaration as rare flora, but in need of urgent high priority further survey. Therefore, the risk code of 2K (applied by Briggs & Leigh 1988) should be changed to 2V.

OTHER SPECIMENS EXAMINED: WESTERN AUSTRALIA: Austin: 'Upper Murchison R. [River]', *I. Tyson* 4, 1892 (MEL 41916); Byro Station, c. 28 km NW of Mullewa–Gascoyne Junction Road, on road to Woodleigh Station, Conn 2083, 11 Sep 1985 (MEL, PERTH), Conn 2091, 12 Sep 1985, (AD, CANB, MEL, PERTH), Conn 2092 [this and all following specimens collected on same day as Conn 2091] (BRI, MEL, PERTH), Conn 2093 (MEL, PERTH), Conn 2094 (MEL, NSW, PERTH, RSA), Conn 2095 (CANB, MEL, PERTH), Conn 2096 (AD, CHR, MEL, MO, PERTH), Conn 2098 (CANB, MEL, NSW, PERTH), Cranfield 5162, 21 June 1985 (PERTH); Curbur Station, Payne 107, 31 Oct 1985 (PERTH), Payne 126, Oct 1985 (PERTH).

Acknowledgments

Mr Ray Cranfield (PERTH) provided additional distribution information, incorporating data obtained by the Rangeland Survey Team (Department of Agriculture, Western Australia) and information from the Western Australian Department of Conservation and Land Management. This study was supported by an Australian Biological Resources Study Grant.

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New taxa and a new combination in *Triodia* (Poaceae)

S.W.L. Jacobs

Abstract

Jacobs, S.W.L. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, N.S.W., Australia, 2000) 1992. New taxa and a new combination in *Triodia* (Poaceae). *Telopea* 4(4): 653–659. The *Triodia irritans* complex is reassessed. *T. irritans* var. *laxispicata* is treated as a synonym of *T. scariosa*; a new combination is made for *T. compacta*; and *T. scariosa* subsp. *bimicola*, *T. scariosa* subsp. *yclarhonensis*, *T. truncata*, *T. tomentosa* and *T. radonensis* are described as new. All but the last species belong to the *T. irritans* group.

Introduction

Burbidge (1953) treated the *Triodia irritans* complex by recognising *T. irritans*, *T. scariosa*, *T. laevata* and three varieties within *T. irritans*: var. *irritans*, var. *compacta* and var. *laxispicata*. Three informal forms (designated A, B and C) were described in *T. irritans* var. *laxispicata*. Unfortunately, the type of *T. irritans* var. *laxispicata* is conspecific with *T. scariosa*. Rectifying this problem for the 'Flora of New South Wales' presents an opportunity for a reassessment of the *T. irritans* complex and the description of some new taxa.

The *T. irritans* complex

Two of the forms of *T. irritans* var. *laxispicata* ('B' and 'C') are geographically isolated and show little character overlap, can be recognised in the field, and are as distinct as varieties recognised in *T. mitchellii* and *T. pungens* (Burbidge 1953, 1960). *T. irritans* var. *compacta* is distinct from both *T. scariosa* and *T. irritans* and, if anything, is more closely related to the former than to the latter. *T. irritans* var. *compacta* is here recognised at the species level as *T. compacta*. *T. compacta* differs from both in the shorter rhachilla segments and denser-flowered spikelets with almost twice the number of florets per spikelet. Similar relative glume lengths and emarginate lemmas are shared by *T. compacta* and *T. scariosa*. To reflect the taxonomic situation and to simplify communication by changing the present subspecific classification from two formal levels and one informal level to a system of two formal levels, I propose to recognise *T. irritans* var. *compacta* at the species level, treat *T. irritans* var. *laxispicata* form 'A' as a synonym of *T. scariosa* and to recognise forms 'B' and 'C' of *T. irritans* var. *laxispicata* as subspecies of *T. scariosa*.

Triodia compacta (N.T. Burbidge) S.W.L. Jacobs, **comb. et stat. nov.**

BASIONYM: *Triodia irritans* var. *compacta* N.T. Burbidge (1953: 169).

LECTOTYPE (here designated): SOUTH AUSTRALIA: Elliston Beach, Eyre Peninsula, J.H. Willis, 26 Aug 1947 (CANB); isolecto MEL.

Burbidge designated both specimens as the 'holotype'; I have selected the specimen at CANB where she worked as lectotype.

***Triodia scariosa* N.T. Burbidge (1953: 173).**

HOLOTYPE: WESTERN AUSTRALIA: Pioneer Rock, N of Lake Cowan, N.T. Burbidge 2675 (CANB).

Triodia scariosa* subsp. *scariosa

Triodia irritans var. *laxispicata* N.T. Burbidge (1953: 171), **syn. nov.**

LECTOYPE (here designated): NEW SOUTH WALES: South Far Western Plains: Tooleybuc, J. Vickery, 14 Oct 1949 (CANB); isolecto NSW.

Burbidge designated both specimens as the 'holotype'; I have selected the specimen at CANB, where she worked, as lectotype.

T. irritans var. *laxispicata* N.T. Burbidge 'forma A' belongs here.

***Triodia scariosa* subsp. *bunicola* S.W.L. Jacobs, subsp. nov.**

Subsp. *scariosae* affinis, sed lemmatibus glumisque longioribus, spiculis longioribus latioribusque, differt.

HOLOTYPE: SOUTH AUSTRALIA: Flinders Ranges N of Hawker, S. Jacobs, 19 Aug 1966 (SYD).

Hummock-forming perennial. Leaf sheath, orifice and blade glabrous, blade pungent-pointed. Inflorescence paniculate, contracted, 15–30 cm long. Spikelets 12–20 mm long, 7–10 mm wide when lemmas divergent. Glumes 8–12 mm long. Lowest lemma 8–10 mm long; lemma apex emarginate, mucro usually absent. Palea shorter than to subequal to its subtending lemma.

Based more or less on *T. irritans* var. *laxispicata* N.T. Burbidge 'forma B' but with a 'type' different to that indicated in the informal publication of that form and excluding those of the originally cited specimens not from the southern Flinders Range.

From the Greek *bounos* (Latinised to *bunus*), hill or mound, and the Latin *-cola*, dweller, i.e. hill-dweller.

HABITAT: On hill slopes and once-wooded areas now often cleared for grazing.

DISTRIBUTION: On slopes of the Flinders Ranges and adjacent areas, South Australia.

SELECTED SPECIMENS: SOUTH AUSTRALIA: Port Germein Pass, Blake 16856, 29 Aug 1946 (NSW, BRI); between 'Yednalue' and Flinders Ranges, Jacobs, 22 Aug 1966 (SYD); N of Hawker on main road, Jacobs, 20 May 1966 (SYD); Flinders Range, Koch, Oct 1901 (NSW).

***Triodia scariosa* subsp. *yelarbonensis* S.W.L. Jacobs, subsp. nov.**

Subsp. *scariosae* affinis, sed spiculis angustioribus, lemmatibus villosioribus brevioribus latioribusque, differt.

HOLOTYPE: NEW SOUTH WALES: North Western Slopes: on New South Wales–Queensland border, P. Vickery, c. 1933 (NSW).

Hummock-forming perennial. Leaf sheath, orifice and blade glabrous, blade pungent-pointed. Inflorescence paniculate, contracted, 10–25 cm long. Spikelets 7–18 mm long, 3–5 mm wide when lemmas divergent. Glumes 5.5–7 mm long, often lightly scabrous. Lowest lemma 4.5–6 mm long, comparatively shorter and with longer hairs (to 1.5 mm long) than in the other subspecies; apex emarginate, usually with a short mucro.

Based on *T. irritans* var. *laxispicata* N.T. Burbidge 'forma C'.

Named after a small town, Yelarbon, near the centre of its distribution.

HABITAT: Poor alluvial soils along the Dumaresq River and some of its northern tributaries.

DISTRIBUTION: Both sides of the Queensland–New South Wales border from about Inglewood to Goondiwindi.

SPECIMENS EXAMINED: QUEENSLAND: Goondiwindi, *Shirley 4525/19*, Nov 1919 (NSW); Inglewood–Texas road, 4 km from Inglewood, *Simon 2864A, Pedley & McDonald*, 3 Sept 1975 (BRI, NSW); c. 2 km S of Yelarbon, Keetah Bridge–Yetman road, *Wilson 1367*, Oct 1975 (NSW).

***Triodia truncata* S.W.L. Jacobs, sp. nov.**

T. scariosae affinis sed apice lemmatis lacerato truncatoque, costa lemmatis excurrente, lemmatibus 3-nervibus brevioribus latioribusque, differt.

HOLOTYPE: SOUTH AUSTRALIA: 56 miles [90 km] WNW of Emu, *N. Forde 537*, 14 Sept 1956 (NSW); iso CANB.

Hummock-forming perennial. Leaf sheaths glabrous, smooth, 2–3 mm wide, the margins with a few hairs to 0.5 mm long near the top; orifice with a few hairs to 0.5 mm long that become woolly with age, ligule a ciliate rim; blade to c. 12 cm long, permanently folded, pungent-pointed. Inflorescence paniculate, contracted, 10–15 cm long. Spikelets 4–6-flowered, 10–12 mm long. Glumes equal, c. 7 mm long, broadly lanceolate, acute, scabrid along the midrib. Lowest lemma c. 7 mm long, 3 mm wide, 3-nerved, hairy in the lower half with hairs to 2 mm long; apex raggedly truncate, very shortly ciliate, with the midnerve excurrent as a scabrid mucro 0.25–0.5 mm long. Palea c. 5 mm long, with a few tangled hairs to 1 mm long at the base; apex minutely 2-lobed. Stamens 3, c. 3 mm long. Caryopsis not seen. Fig. 1.

HABITAT: Reportedly in interdune areas with *Acacia aneura*.

DISTRIBUTION: Known only from the type.

Named for the characteristically truncate lemmas.

***Triodia tomentosa* S.W.L. Jacobs, sp. nov.**

T. lanatae affinis sed glumis longioribus glabrisque, lemmatibus longioribus acutisque, differt.

HOLOTYPE: WESTERN AUSTRALIA: Great Northern Highway, 6 km SW of Paynes Find, 29°18'S 117°36'E, *M.G. Corrick 9324*, 24 Oct 1984 (NSW); iso MEL.

Hummock-forming perennial to c. 40 cm diam. Sheaths 2–3 mm wide, woolly-hairy with hairs c. 1 mm long; the orifice with similar tangled hairs and these extending

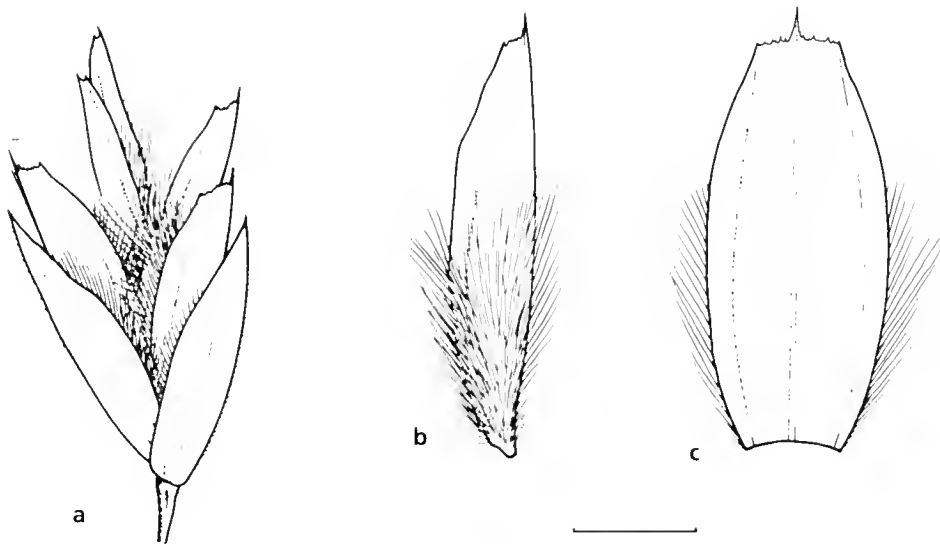


Fig. 1. *Triodia truncata* a, whole spikelet; b, lateral view of lemma; c, adaxial view of lemma. Scale bar = 3 mm for a, = 2 mm for b & c. Drawn from *N. Forde* 537 (NSW) by David Mackay.

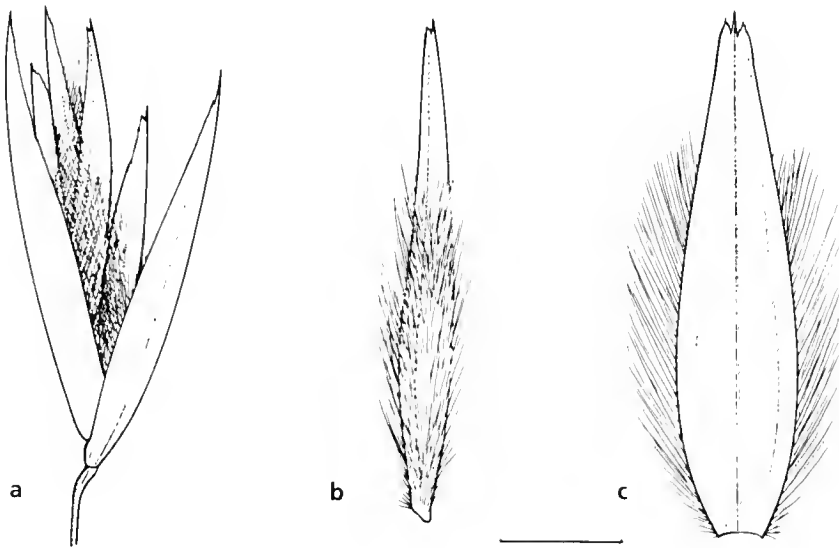


Fig. 2. *Triodia tomentosa* a, whole spikelet; b, lateral view of lemma; c, adaxial view of lemma. Scale bar = 3 mm for a, = 2 mm for b & c. Drawn from *M.G. Corrick* 9324 (NSW) by David Mackay.

5–15 mm up the adaxial surface of the blade; blades to c. 10 cm long, permanently folded, pungent-pointed, glabrous except near the orifice. Inflorescence paniculate, contracted, 10–15 cm long. Spikelets 12–14 mm long, 4–5-flowered. Glumes equal, lanceolate, scarios, acute to aristate, 11–12 mm long, glabrous. Lowest lemma 3-nerved, 9–10 mm long, with hairs c. 2 mm long over the lower 60%; the apex acute, emarginate, with the midnerve excurrent as a mucro 0.25–0.5 mm long. Palea acute, entire, c. 90% the length of the lemma, with scattered hairs c. 1 mm long at the base. Stamens 3, c. 4 mm long. Mature caryopsis not seen, immature caryopses typically chloridoid. Fig. 2.

HABITAT: Reportedly from an open woodland of *Melaleuca* and *Acacia*.

DISTRIBUTION: Only known from the type.

Named from the tomentose hairs of the sheath, orifice and lower blade.

Key to the *T. irritans* group

- 1 Leaf sheath and orifice glabrous or almost so 2
- 1* Leaf sheath and orifice with woolly hairs 7
- 2 Lemma apex raggedly truncate, the midnerve excurrent as a mucro **T. truncata**
- 2* Lemma apex emarginate, obtuse or acute; if the midnerve excurrent then between lobes 3
- 3 Midnerve excurrent as a short awn between and longer than the stiff lobes; glumes subequal to the spikelet **T. irritans**
- 3* Lemma apex emarginate, sometimes with a mucro shorter than the lobes; glumes usually shorter than the spikelet 4
- 4 Spikelets 8–12-flowered; lemmas closely distichous, lower rhachilla segments usually <1 mm long **T. compacta**
- 4* Spikelets mostly less than 8-flowered; lemmas loosely distichous, lower rhachilla segments usually >1 mm long **T. scariosa** and subspp. 5
- 5 Mature spikelets with divergent lemmas usually <5 mm wide; lowest lemma 4.5–6 mm long **T. scariosa** subsp. **yelarbonensis**
- 5* Mature spikelets with divergent lemmas usually >5 mm wide; lowest lemma 6 mm long or more 6
- 6 Glumes 5.5–9 mm long; lowest lemma 6–7 mm long **T. scariosa** subsp. **scariosa**
- 6* Glumes 8–12 mm long; lowest lemma 8–10 mm long ... **T. scariosa** subsp. **bunicola**
- 7 Glumes glabrous, 11–12 mm long; lowest lemma 9–10 mm long **T. tomentosa**
- 7* Glumes hairy, 7–10 mm long; lowest lemma 6–8 mm long **T. lanata**

Triodia pungens group

Triodia radonensis S.W.L. Jacobs, sp. nov.

T. microstachyae affinis sed glumis emarginatis vel 2-lobis, paleis alatis, lemmatibus tumidis induratisque, lobis lemmatis minutis membranaceisque, differt.

HOLOTYPE: NORTHERN TERRITORY: Radon Creek, Brockman Range, P.K. Latz 7676, 10 June 1978 (NSW); iso BRI, CANB, DNA, PERTH, K.

Viscid perennial forming loose hummocks to c. 5 m diam. Sheaths loose, to 15 mm wide; orifice with a few hairs to 0.5 mm long matted with resin; blades loosely folded, to c. 60 cm long, curved, not pungent-pointed. Inflorescence paniculate, open, 15–25 cm long. Spikelets 4–6-flowered, 6–8 mm long, c. 4 mm wide when the lemmas divergent, appearing open with rhachilla segments c. 1 mm long. Glumes subequal, membranous, c. 2 mm long, emarginate or 2-lobed, the lobes obtuse. Lowest lemma 2–3 mm long, 3-nerved, glabrous or the margins with very few scattered hairs, shiny, swollen and indurated; apex membranous, minutely 3-lobed. Palea subequal to the lemma, winged and the wings visible in the spikelet and ciliate. Stamens 3, 2 mm long. Mature caryopses not seen. Fig. 3.

HABITAT: Sandy levee banks.

DISTRIBUTION: Known only from the type locality.

Named from the locality, Radon Creek in the Brockman Range, Northern Territory.

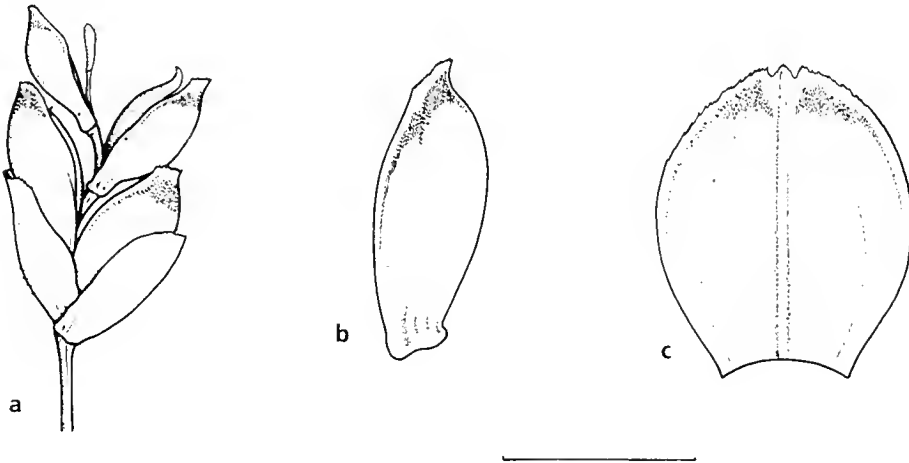


Fig. 3. *Triodia radonensis* a, whole spikelet; b, lateral view of lemma; c, adaxial view of lemma. Scale bar = 3 mm for a, = 2 mm for b & c. Drawn from P.K. Latz 7676 (NSW) by David Mackay

Acknowledgments

Many thanks to Karen Wilson for the Latin diagnoses, to Ken Hill for his helpful comments on the manuscript, and to David Mackay for his excellent art work.

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Additions to the lichen flora of Tasmania

G. Kantvilas¹ and A. Vězda²

Abstract

Kantvilas, G.¹ & Vězda, A.² (¹Tasmanian Herbarium, G.P.O. Box 252C, Hobart, Tasmania, Australia 7001; ²Botanical Institute, Czechoslovak Academy of Sciences, 602 00 Brno, Tábora 28a, Czechoslovakia) 1992. Additions to the lichen flora of Tasmania. *Telopea* 4(4): 661–670. Five new lichens are described. *Arthonia tasmanica* Kantvilas & Vězda, *A. sagenidii* Vězda & Kantvilas and *Arthothelium subspectabile* Vězda & Kantvilas are known only from cool temperate rainforest in Tasmania; *Gyalideopsis graminicola* Vězda & Kantvilas is an endemic Tasmanian alpine lichen and the first record of the genus from Tasmania; *Lecanactis subpremea* Kantvilas & Vězda is described from the rainforests of Tasmania and Victoria.

1. *Arthonia sagenidii* Vězda & Kantvilas, sp. nov.

Mycelium in thallo lichenis (*Sagenidium molle* Stirton) parasitice vel parasymbiotice vigens, haud visibile. Ascocarpia copiosa, minutissima, lentiformia, 0.1–0.15 mm lata, circa 30 µm alta, dispersa vel aggregata, atrofusca. Stratum hypotheciodeum usque ad 10 µm altum, pallide fuscum vel fere incoloratum. Stratum ascigerum circa 25–30 µm altum, plus minusve hyalinum, strato epitheciodeo atrofusco, in KOH decolorato. Paraphysoides ramosae anastomosantesque, circa 0.8 µm crassae, apicibus capitatis, nigrofuscis, colore in KOH griseo viridi. Asci clavati, octospori. Ascospores oblongo-ellipsoideae, incoloratae, 1-septatae, 6–8.5(–9) µm longae, 2–2.2 µm latae.

TYPE: AUSTRALIA: TASMANIA: Scotts Peak Road, north of Huon River, on thalli of *Sagenidium molle* on dry trunk of *Nothofagus cunninghamii* in rainforest, 560 m, G. Kantvilas 525/88 p.p., 23 November 1988 (holo HO; iso GZU, herb. Vězda). The type material of *Arthonia sagenidii* has been separated from specimens of *Sagenidium molle* that were distributed as *Lichenes Selecti Exsiccati*: 2368.

Thallus not apparent or absent, mycelium entirely within the thallus of the lichen *Sagenidium molle* as a parasite or parasymbiont. Ascocarps numerous, scattered or crowded, ± roundish and lens-shaped, minute, 0.1–0.15 mm wide, c. 30 µm high, dark brown. Hypothecial layer to 10 µm thick, pale brown to almost colourless. Ascigerous layer, c. 25–30 µm thick, ± hyaline. Epithecoid layer dark brown, fading in KOH. Paraphysoids branched, anastomosing, c. 0.8 µm thick, with capitate, blackish apices, persistently greyish green in KOH. Asci broadly clavate, eight-spored, 20–30 × 8–13 µm. Ascospores colourless, oblong-ellipsoid, consistently 1-septate, 6–8.5(–9) × 2–2.2 µm, the upper cell somewhat larger. Figure 1 (anatomy).

REMARKS: *Arthonia sagenidii* is well-characterised by the combination of tiny ascocarps and short, 1-septate ascospores. It occurs exclusively as an apparent parasite or parasymbiont on the thallus of *Sagenidium molle*, a common and widespread lichen in Tasmanian rainforests. The byssoid thallus of *Sagenidium* forms extensive colonies to 60 cm wide in locally dry, sheltered habitats, mostly on the undersides of mature, leaning trees of *Nothofagus cunninghamii*. The new species is very inconspicuous, being visible only as tiny, clustered blackish specks on the surface of the pale greyish *Sagenidium* substrate. It is apparently rare: neither extensive field work nor a search of numerous herbarium specimens of *Sagenidium* revealed more than a

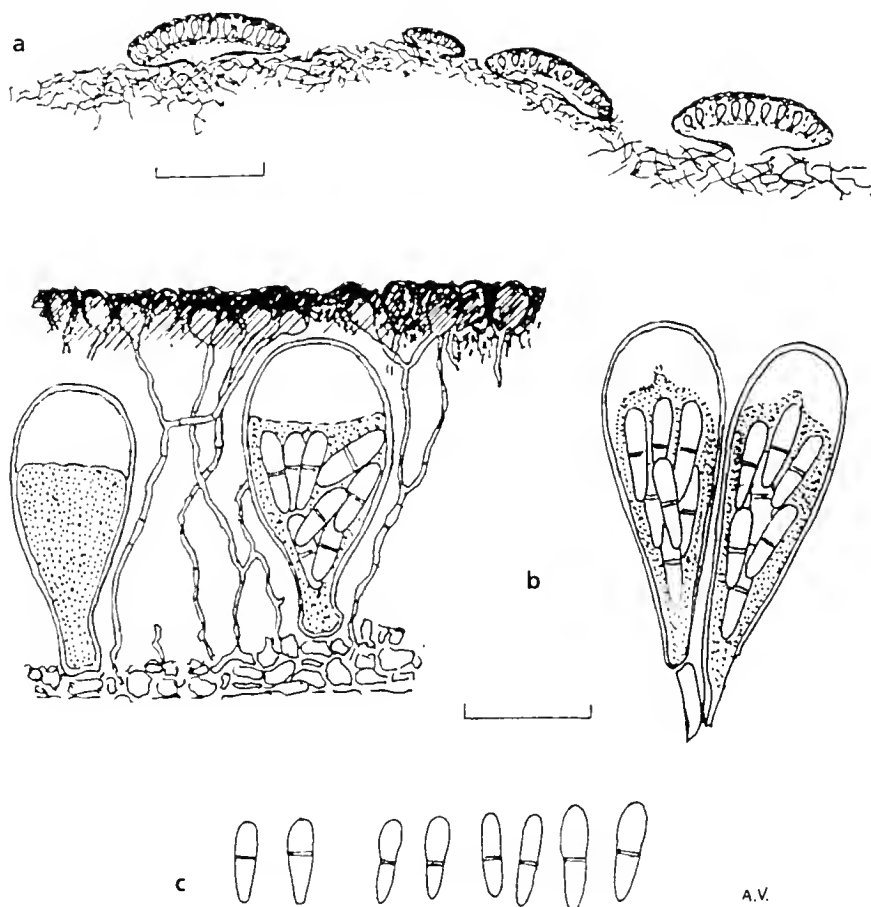


Figure 1. *Arthonia sagenidii*. a, Vertical section of four ascocarps (scale = 0.1 mm); b, Asci with paraphysoids; c, Spores. (scale = 10 μ m).

few localities. *Arthonia sagenidii* is frequently associated with *Chaenothecopsis sagenidii*, which shares the same unique habitat and host.

SPECIMENS EXAMINED: AUSTRALIA: TASMANIA: Forest track below Mt Victoria, G.C. Bratt 73/1225, 24 November 1973 (HO); Mt Mangana, 420 m, G.C. Bratt 71/1096, 7 August 1971 (HO); Hartz Mts National Park, on *Sagenidium molle* on *Nothofagus cunninghamii* in mixed forest, 680 m, M. Wedin 3006, 28 January 1990 (HO, UPS); Scotts Peak Road, 2.5 km from Gordon River Road, on *Sagenidium molle* on trunk of *Nothofagus cunninghamii* in rainforest, 550 m, M. Wedin 3046, 29 January 1990, (HO, UPS).

2. *Arthonia tasmanica* Kantvilas & Vězda, sp. nov.

Thallus crustaceus, epi- et hypophloeodes, tenuissimus, sordide cinereus, laevis vel paulo furfuraceus. Ascocarpia copiosa, rotunda, convexa, atra vel atrofusca, epruinosa, 0.2–0.5 mm lata, 100–130 μ m crassa. Stratum hypothecioideum hyalinum

vel pallide fuscum, circa 25–30 μm crassum. Stratum ascigerum hyalinum, usque ad circa 70 μm crassum, strato epithecioideo rufofusco, olivaceo vel immutato in KOH. Paraphysoides sparsae, ramosae anastomosantesque, circa 1 μm crassae. Ascii subglobosi, octospori, 40–68 μm longi, 36–56 μm lati. Ascosporae (28–)30–40 x (12–)15–18 μm , ellipsoideae vel parum clavatae, rectae vel interdum curvatae, diu hyalinae, in aetate atrofuscae, leviter constrictae praecipue ad septum medium, persaepe triseptatae, rarissime uni vel quadrisepatae, loculis apicalibus quam centralibus valde minoribus, membranibus et septis usque ad 2 μm crassis.

TYPE: AUSTRALIA: TASMANIA: Little Fisher River, on *Telopea truncata* and *Atherosperma moschatum* in rainforest, 820 m, G. Kantvilas 708/84C, 20 October 1984 (holo HO; iso herb. Vězda).

Thallus crustose, epi- and hypophloeodal, dull dingy grey, very thin, smooth to rather scurfy, forming irregular patches mostly less than 3 cm wide, occasionally delimited by a thin black line. Ascocarps numerous, roundish, convex, black to blackish brown, 0.2–0.5 mm wide, 100–130 μm thick, becoming somewhat larger, flatter and irregular in outline with age. Hypothecial layer hyaline to pale brown, c. 25–30 μm thick. Ascigerous layer hyaline, to c. 70 μm thick. Epithecioid layer reddish brown to brown, olivaceous or unchanged in KOH. Paraphysoids sparse, branched and anastomosing, c. 1 μm thick. Ascii subglobose, eight-spored, 40–68 x 36–56 μm . Ascospores (28–)30–40 x (12–)15–18 μm , ellipsoid to slightly clavate, straight or occasionally curved, hyaline, becoming grey-brown to dark brown with age, contents mostly greyish and granular, especially in KOH, slightly constricted (mostly across the central septum) almost invariably 3-septate, very rarely 1 or 4 septate with the apical locules markedly smaller than the central ones; walls and septa to 2 μm thick. Figure 2 (anatomy).

REMARKS: *Arthonia lasmanica* is an uncommon and easily overlooked species, known from several widely scattered localities in cool temperate rainforest in Tasmania. It occurs on the smooth bark of various phorophytes (as seen in the case of the type collection) in open or semi-shaded conditions such as on young trees in clearings or on canopy twigs. Associated lichens include *Arthothelium ilicinum*, *Catillaria* spp., *Parmelia salcrambidiocarpi*, *Menegazzia weindorferi*, *Sarrameana lasmanica*, *Porina leptalei*mi, *Sphaerophorus tener*, *Rimodina dissu* and *Thelotrema lepadinum*.

The new species is characterised by its rather large, three-septate spores. Although most specimens possessed abundant ascocarps, many sections examined revealed only empty asci or asci with very old, collapsed or heavily brown-pigmented spores with thick walls and septa. The KOH+ olivaceous green reaction of the epithecium, a common feature of many taxa of Arthoniaceae, is variable and intermittent in this species and appears to be of only limited taxonomic value. In gross morphology, *Arthonia lasmanica* is rather similar to *Arthothelium ilicinum*, a relatively common species in Tasmanian rainforests with which it frequently co-occurs; *A. ilicinum* has spores of similar overall size but with up to 8 transverse septa and with a significantly enlarged terminal cell.

SPECIMENS EXAMINED: AUSTRALIA: TASMANIA: Balts Spur, Tasman Peninsula, on canopy twigs of *Nothofagus cunninghamii* in rainforest, 420 m, G. Kantvilas 162/83, July 1983 (HO); Adamsons Falls track, on dead *Anodopetalum biglandulosum* in rainforest, G. Kantvilas 976/81, 26 September 1981 (HO); Mt Victoria track, on *Pittosporum bicolor* in rainforest, 950 m, G. Kantvilas 1190/81, 8 December 1981 (HO); Weindorfers Forest, on *Nothofagus cunninghamii* in rainforest, 920 m, G. Kantvilas 614/88, 6 March 1988 (HO); Anthony Road, on twigs of *Atherosperma moschatum* in rainforest, 580 m, G. Kantvilas 214/91, 13 May 1991 (HO); Eastern Arthur Range, c. 1 km south of East Portal, on *Nothofagus cunninghamii* in rainforest, 780 m, G. Kantvilas 125/91, 25 March 1991, (HO); Rebecca Road, south of Arthur River, on fallen branch of *Nothofagus cunninghamii*, J. Glennie 191, 24 February 1991 (HO).

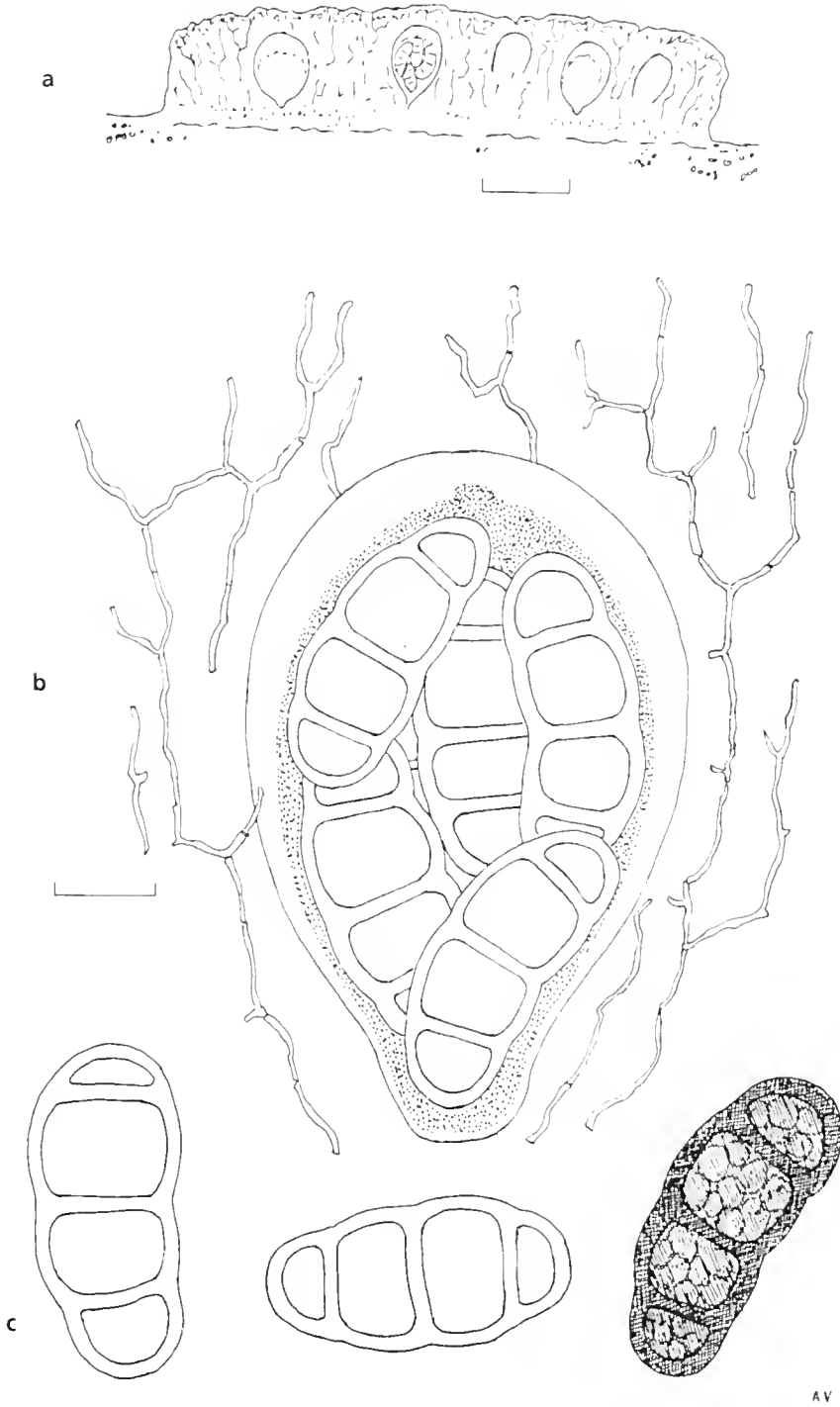


Figure 2. *Arthonia tasmanica*. a, Vertical section of ascocarp (scale = 0.1 mm); b, Ascus with paraphysoids; c, Spores (scale = 10 μ m).

3. *Arthothelium subspectabile* Vězda & Kantvilas, sp. nov.

Thallus crustaceus, epiphloeodes, pro parte etiam hypophloeodes, cinereo-albidus vel sordide olivaceo-cinereus, laevigatus. Alga ad *Trentepohlium* pertinens. Ascocarpia plus minusve orbicularia, semi-immersa, basin versus constricta, convexa, 0.25–0.4 (–0.6) mm lata, 0.2–0.25 mm alta, nigra, opaca, juniora albopruinosa (pruina grosse granulosa), in aetate nuda. Stratum ascigerum 180–200 μ m crassum, incoloratum vel dilute rufofuscum, superne atrofuscum et granulis copiosis inspersum. Paraphysoides ramosae anastomosantesque, circa 1–1.2 μ m crassae. Asci subglobosi, 60–70 μ m longi, 45–55 μ m lati, (2–6)–8-sporei. Ascosporeae ellipsoideae vel fere ovoideae, muriformes, primum hyalinae, demum atrofuscae, (28–)30–35(–44) μ m longae, (14–)15–20 (–24) μ m latae.

TYPE: AUSTRALIA: TASMANIA: 3 km south-east of Mt Agnew, on dry trunk of mature *Nothofagus cunninghamii* in rainforest, 190 m, G. Kantvilas 135/89, 6 April 1989 (holo HO; iso herb. Vězda).

Thallus crustose, epiphloeodal and in part hypophloeodal, greyish white to dingy olive-grey, smooth. Photobiont *Trentepohlia*. Ascocarps \pm rounded, semi-immersed, constricted at the base, convex, 0.25–0.4(–0.6) mm wide, 0.2–0.25 mm thick, black, opaque, very coarsely granular whitish pruinose when young, soon becoming epruinose. Hypothecial layer poorly developed, \pm pale red-brown to colourless. Ascigerous layer 180–200 μ m thick, colourless to pale reddish brown, I+ red, in the upper part dark brown, K+ olive-grey and densely inspersed with numerous \pm angular granules; granules mostly to 8 μ m wide, dissolving in K. Paraphysoids branched and anastomosing, 1–1.2 μ m thick. Asci subglobose, 60–70 μ m long, 45–55 μ m wide, (2–6)–8-spored. Ascospores ellipsoid to almost ovoid, densely muriform with c. 7–11 transverse and 2–5 longitudinal septa, hyaline at first, becoming dark brown, (28–)30–35 (–44) \times (14–)15–20 (–24) μ m. Figure 3 (anatomy).

REMARKS: *Arthothelium subspectabile* is closely related to the western European species, *A. spectabile* Flotow ex Massal. (see Tehler 1990 for a full description), but differs by its densely granular-white-pruinose young apothecia, by the numerous granules inspersed in the upper part of the hymenium, and by the grey to dark brown mature ascospores. The I+ persistent blue reaction of thalline and subapothecial hyphae, regarded as diagnostic for *A. spectabile* by Coppins & James (1979) was also not observed in the new species. The two species may also differ chemically: Huneck & Follmann (1969) report three unidentified substances in *A. spectabile* but no chemical constituents at all were detected by t.l.c. in the new species.

In Tasmania, there are no species easily confused with *A. subspectabile* which is well-characterised by its relatively small, convex, pruinose apothecia and densely muriform, \pm ovate spores. Its micro-habitat (see below) is also not shared by any other known species of *Arthothelium*, although it could well co-occur with several species of the genus *Arthonia*, particularly *A. apteropteridis*.

Arthothelium subspectabile is a rare, easily overlooked species, known from only three localities in cool temperate rainforest in western Tasmania. It occurs on the dry, sheltered and deeply shaded trunks of old mature trees (*Nothofagus cunninghamii* and *Lagarostrobos franklinii*) and grows on rough, fissured bark or on decorticated wood. It is found in the microhabitats typically colonised by the *Lecanactis abietina* – *Sagenidium molle* community (Kantvilas 1988: 400) and additional lichens with which it can be associated include *Lepraria* spp., *Bactrospora dryina*, *Chaenotheca brunneola* and species of *Chaenothecopsis*.

SPECIMENS EXAMINED: AUSTRALIA: TASMANIA: approximately 3 km south of Teepookana, on *Lagarostrobos franklinii* in rainforest, 220 m, G. Kantvilas 663/90, 7 November 1990 (HO, herb. Vězda); Badger Creek, c. 2.5 km south of Greystone Bluff, on trunk of mature *Lagarostrobos franklinii* in rainforest, 280 m, G. Kantvilas 78/89, 17 February 1989 (HO).

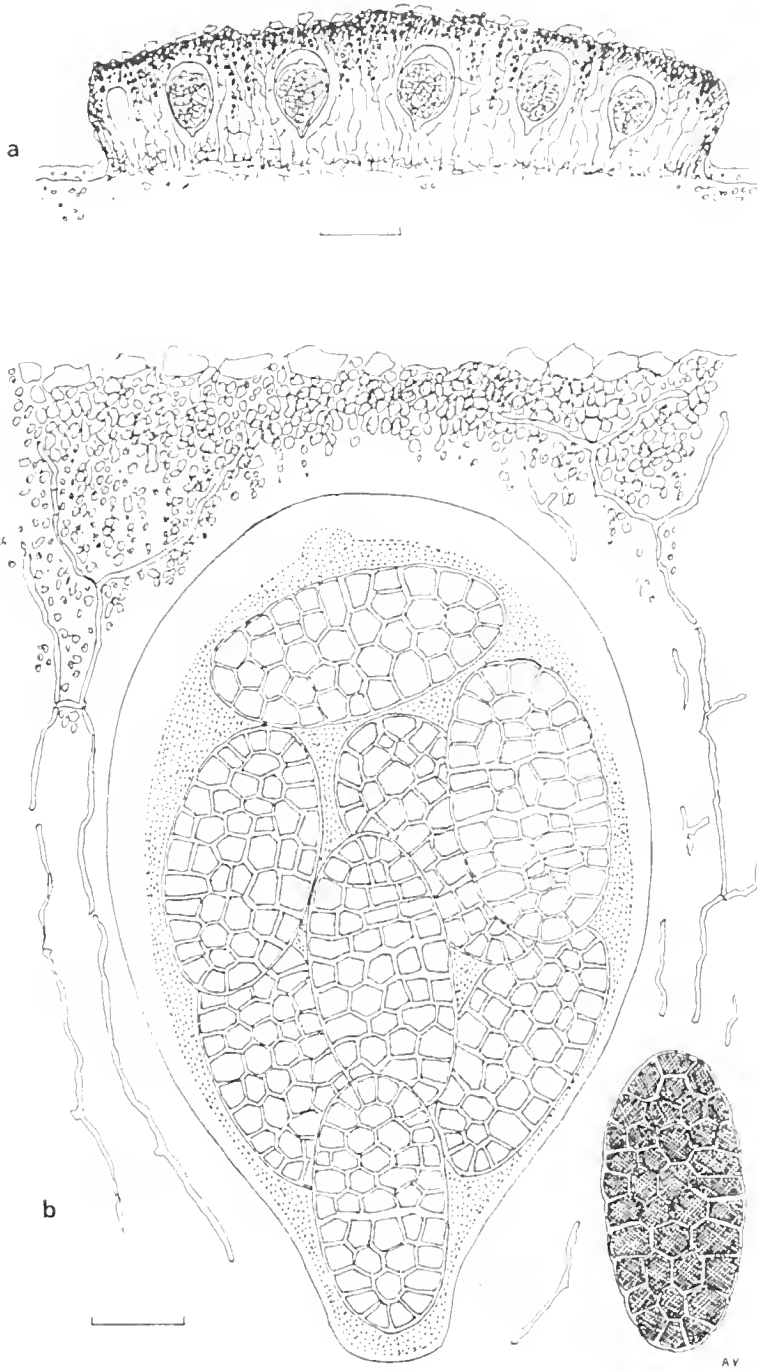


Figure 3. *Arthothelium subspectabile*. a, Vertical section of ascocarp (scale = 1 mm). b, Ascus with paraphysoids and single, aged, free spore (scale = 10 µm).

4. *Gyalideopsis graminicola* Vězda & Kantvilas, sp. nov.

Thallus haud visibilis, in textura foliorum graminis emortui vigen. Algae globosae, virides, insulatum agglomeratae. Hyphophori nulli inventi. Apothecia orbicularia, 0.3–0.5 mm lata, circa 0.1 mm alta, late adnata, basin versus constricta, gyalectoidea, discis concavis vel planis, nigrofuscis, in statu sicco papillis minutissimis nigris munitis, in statu madido fuscis vel rufofuscis subpellucidisque, marginibus persistenter elevatis, integris, nigris, pro parte nitidis. Excipulum 50–60 μm crassum, fuscum vel subhyalinum. Hypothecium circa 40 μm altum, hyalinum. Hymenium (100–)120–150 μm altum, incoloratum. Paraphyses sparsae, anastomosantes, tubulis circa 0.8 μm crassis. Asci clavati, non-amyloidei, octospori. Ascospores ellipsoideae, hyalinae, 35–50 μm longae, 15–22 μm latae, muriformes, cellulis numerosis, 2–5 μm crassis, mox tamen in cellulas liberas decompositae, conidia singula, bacillaria, 2–2.2 μm longa, 0.5 μm lata producentes.

TYPE: AUSTRALIA: TASMANIA: northern slopes of Mt Jerusalem, on dead *Poa* tussock in alpine grassland, 1280 m, G. Kantvilas 114/87, 8 December 1987 (holo HO; iso herb. Vězda).

Thallus not apparent to absent, growing within the tissue of dead grass leaves. Photobiont green, unicellular, cells subglobose and clustered in colonies. Hyphophores not found. Apothecia circular, 0.3–0.5 mm wide, c. 0.1 mm tall, broadly adnate, constricted at the base, gyalectoid; disc concave to plane, blackish brown, with minute black papillae when dry, brown to reddish brown and subpellucid when moist, especially in younger apothecia; margins persistently raised, entire, black, partly glossy. Excipulum 50–60 μm thick, brown to subhyaline. Hypothecium c. 40 μm thick, hyaline. Hymenium (100–)120–150 μm thick, colourless; paraphyses sparse, anastomosing, 0.8 μm thick; asci clavate, non-amyloid, eight-spored. Ascospores ellipsoid, hyaline, 35–50 \times 15–22 μm , strongly muriform with numerous cells to 2–5 μm wide, with age becoming rather greyish-brown and soon disintegrating into free cells, each producing a single bacillar conidium, 2–2.2 \times 0.5 μm . Figure 4–5 (anatomy).

REMARKS: *Gyalideopsis* is a genus of the Gomphillaceae and currently comprises over 30 species [see James (1975), Galloway (1985) and Vězda & Poelt (1987) for generic characteristics]. The genus is widely distributed and ranges from cool to tropical climates, with an apparent concentration of taxa in tropical America (Kalb & Vězda 1988). Three species are known from subtropical rainforest in Australia, including two corticolous taxa (Vězda & Hlaffelner 1988) and one as yet undescribed foliicolous species. A further species, also undetermined, is recorded from mosses in New Zealand by Galloway (1985).

The new species is characterised by the absence of a visible thallus, the gyalectoid, plane apothecia and the eight-spored asci with muriform spores. The typically minutely papillose apothecial disc arises from the gradual protrusion of mature asci: the outermost cells of the uppermost spore form a paraplechtenchymatous cortex whilst the remainder of the spore disintegrates into conidia (Figure 5). Such a means of conidial formation from muriform spores is a relatively frequent phenomenon in some foliicolous and corticolous lichens, especially in the families Gomphillaceae and Ectolechiaceae (Santesson 1952: 29).

Gyalideopsis graminicola is a very rare species known only from the type locality, a steep, exposed, badly eroded slope with alpine grassland – heathland mosaic over dolerite, burnt by wildfire approximately 30 years ago. Alpine grassland tends to be an uncommon vegetation formation in Tasmania and usually supports only a depauperate lichen flora of species of *Cladonia* and *Cladia*, and *Lecanora brocchia*. The new species was locally common on dead, weather-bleached *Poa* tussocks and mats of dried leaves, and was not associated with any other lichens.

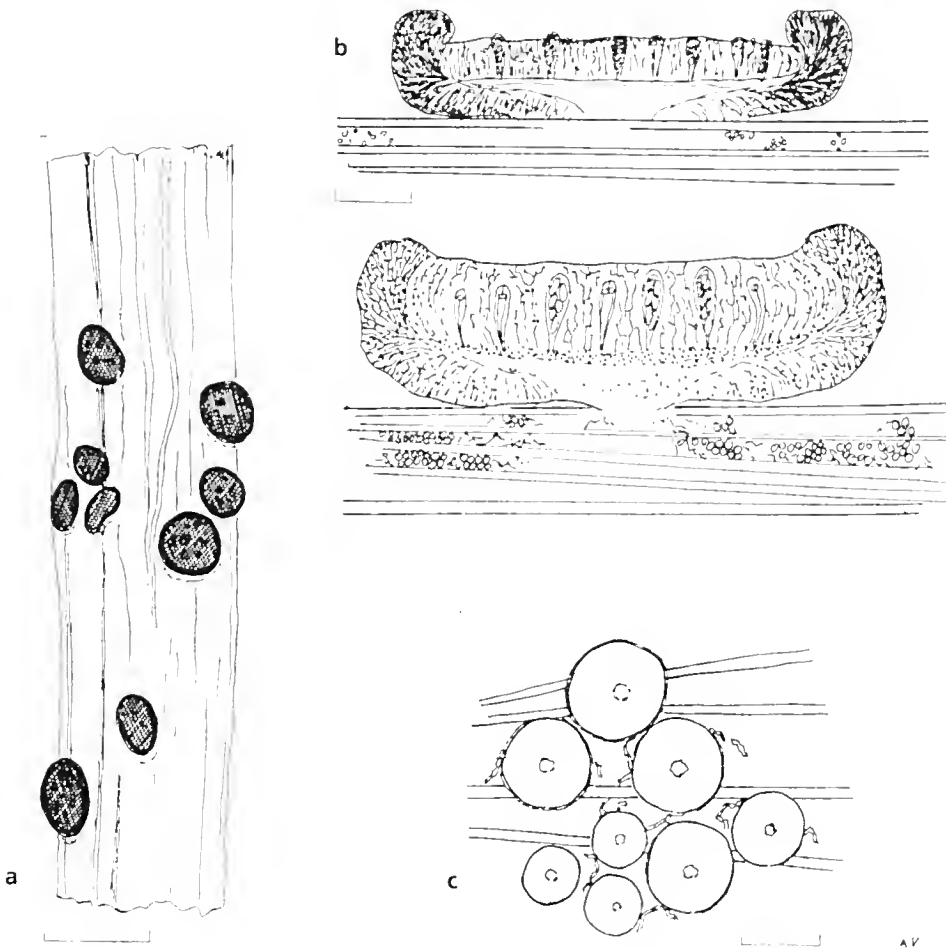


Figure 4. *Gyalideopsis graminicola*. a, Habit (scale = 1 mm). b, Vertical section of apothecium in dry state (above) and in moist state (below) (scale = 0.1 mm). c, Algal cells with mycelial hyphae (scale = 10 μ m).

5. *Lecanactis subpremnea* Kantvilas & Vězda, sp. nov.

Ex affinitate *Lecanactidis premneae* (Ach.) Arnold a qua differt paraphysisibus in apicibus haud nigrofuscis in KOH, sporisque valde majoribus, 30–52 μ m longis.

TYPE: AUSTRALIA: TASMANIA: Corinna Road, c. 6 km west of Waratah, on old trunk of *Nothofagus cunninghamii* in rainforest, 600 m, G. Kantvilas 71/82, 9 February 1982 (holo HO; iso BM, herb. Vězda, GZU, WELT).

Thallus effuse, rather scurfy, dull olivaceous grey-green, very thin to \pm absent. Apothecia black, matt, lecideine, to 1.7 mm diameter; margin prominent, persistent, inrolled and lightly greyish pruinose on the inner edge in very young apothecia; disc concave and \pm pruinose only when very young, soon becoming epruinose, plane or

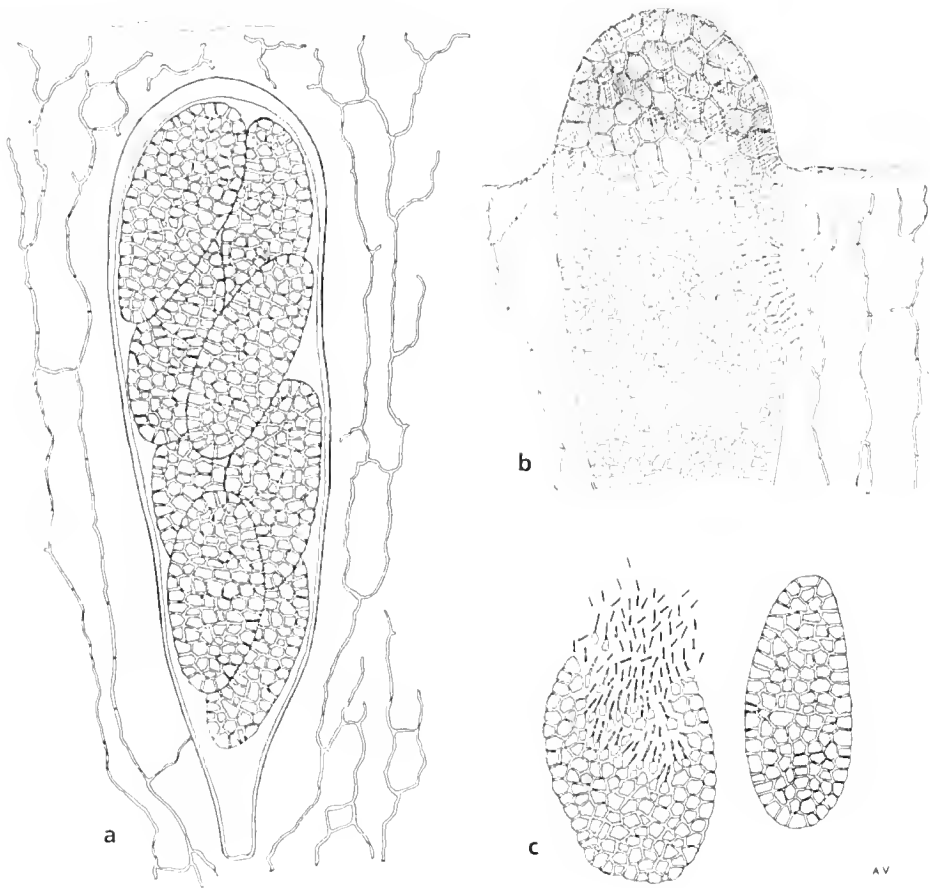


Figure 5 *Gyalidopsis graminicola*. a, Ascus with paraphyses; b, Old ascus with paraplectenchymatous cortex and decomposed spores, with cells producing conidia; c, Spores, LHS producing conidia. (scale = 10 μm).

undulate, sometimes \pm excavate when very old. Exciple opaque dark brown to brownish black, slightly paler brown at the inner edges, (80–)85–110 μm thick laterally, K+ olivaceous green, mainly at the edges. Epithecium (6–)10–20 μm thick, dark yellow-brown, colourless to very pale yellow brown in KOH. Hymenium colourless, 90–120 (–130) μm thick. Hypothecium colourless, (60–)80–110 μm thick. Paraphyses numerous, flexuous, 1.2–1.5 μm thick, simple to sparingly branched towards the apices; apices pigmented yellow-brown, colourless in KOH, usually swollen to c. 2.5 μm . Asci narrow cylindrical, non-amyloid, eight-spored, (65–)80–100 x (13–)16–18 μm . Ascospores fusiform, straight or occasionally curved, with rounded apices, (30–)34–52 x 4–7.5 μm , 7–9 (–10) septate, walls to 0.8 μm thick.

SPECIMENS EXAMINED: AUSTRALIA: TASMANIA: Near Granville Harbour, on *Atherosperma moschatum* in rainforest, 140 m, *G. Kantvilas s.n.*, 4 March 1982 (HO); Anthony Road, on dry trunk of *Dicksonia antarctica* in rainforest, 450 m, *G. Kantvilas* 215/91, 10 May 1991 (HO, LSU, herb. Vězda). VICTORIA: Cement Creek, 37° 42' S, 145° 44' E, on *Nothofagus cunninghamii* in rainforest, *G. Kantvilas s.n.*, 6 October 1983 (HO).

REMARKS: *Lecanactis subpremea* is closely related to the western European species, *L. premea*, from which it differs chiefly by the pigmentation of the paraphyses (these remain apically black in KOH in *L. premea*) and the significantly larger spores ($17\text{--}27 \times 4\text{--}7 \mu\text{m}$ in *L. premea*). The new species is conspicuous but very rare. It is known from cool temperate rainforest in Victoria and western Tasmania where it forms widespreading colonies to c. 20 cm wide on the shaded, dry trunks of mature trees, as well as on the dry fibrous trunks of tree ferns (*Dicksonia antarctica*). *Lecanactis premea* occupies an analogous niche on old trees in Europe (James et al. 1977).

Acknowledgments

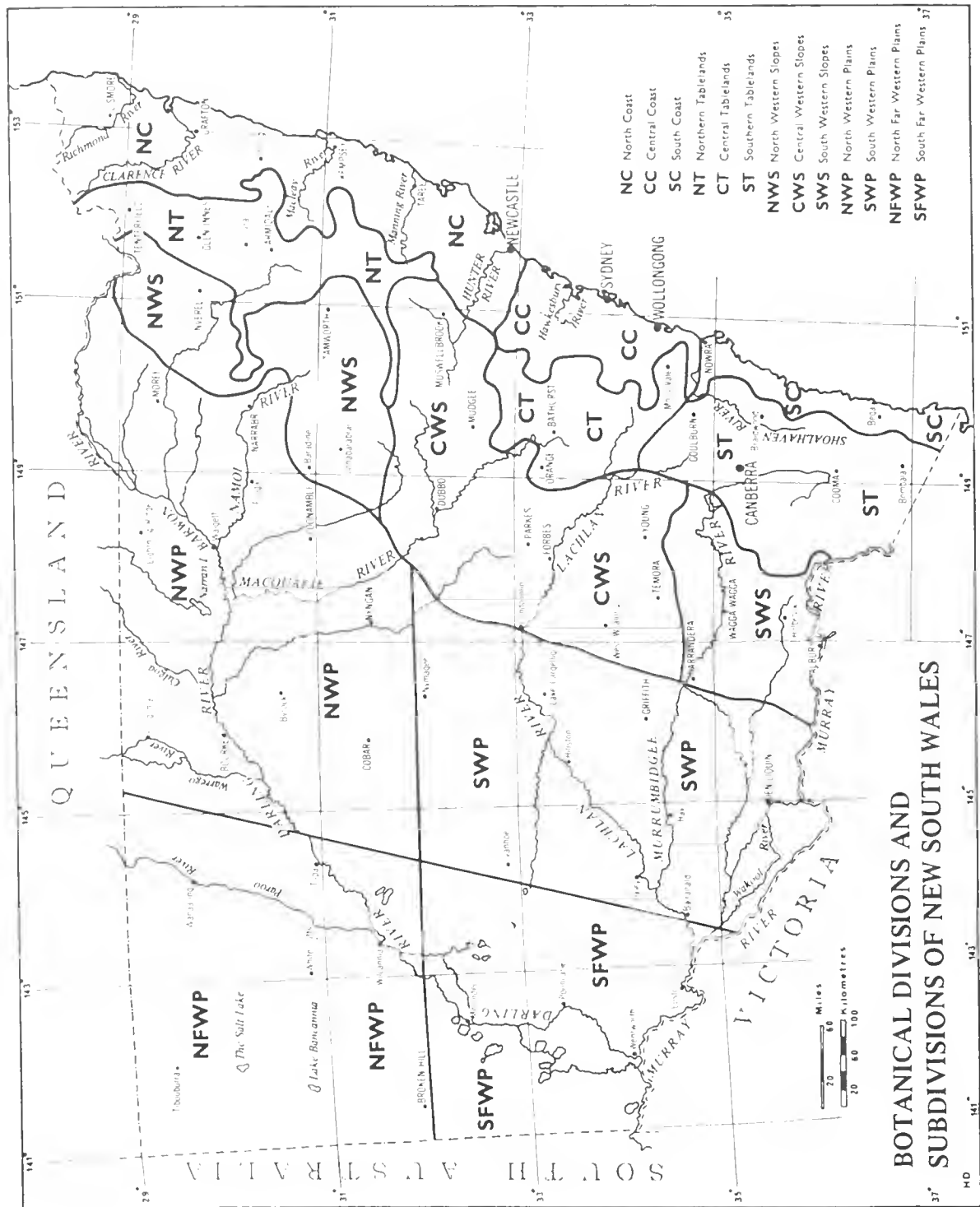
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For explanation and description of the Botanical Divisions and Subdivisions of New South Wales see Anderson, R. H. (1961). Introduction. *Contr. New South Wales Natl. Herb. Fl. New South Wales* Nos 1-18, pp. 1-15.

CONSERVATION CODES APPLIED TO RARE AND THREATENED SPECIES

The codes used in this journal follow J. Briggs & J. Leigh (1988) *Rare or threatened Australian plants* 1988 Revised Edition. Australian National Parks & Wildlife Service, Special Publication no. 14.

Distribution categories

- 1 species known from type collection only
- 2 species with a very restricted distribution in Australia and with a maximum geographic range of less than 100 km
- 3 species with a geographic range of at least 100 km but occurring only in small populations (often restricted to highly specific and localised habitats)
- + species also occurs naturally outside Australia

Conservation categories

- X presumed extinct (not found in recent years)
- x presumed extinct within a particular region
- E endangered: species in serious risk of disappearing from the wild within 10–20 years
- V vulnerable: species not presently endangered but at risk over 20–50 years
- R rare: species that are rare in Australia but not endangered or vulnerable
- K poorly known: species that are suspected of being at risk but data are inadequate;
- k poorly known in Western Australia by the criteria of the Western Australian Dept of Conservation and Land Management

Reservation categories

- C species known to be present within a national park or other proclaimed reserve;
- a adequately reserved, with at least 1000 plants known to occur in reserves;
- i inadequately reserved, with fewer than 1000 plants known from reserves;
- adequacy of reservation unknown
- t total known populations are in reserves

Taxonomic category

- ? taxonomic status is uncertain

NOTICE TO AUTHORS

Telopoa is published twice-yearly, in March and September. Preference will be given to papers relating to the flora of New South Wales. Brief papers may be published as Short Communications (see previous issues for format).

Deadlines for the submission of papers are **1 June** (for the March issue the following year) and **1 November** (for the following September issue). Authors are expected to have had their papers peer-reviewed before submission. All papers will be refereed. Two copies of the manuscript should be submitted along with originals of photographs and clear photocopies of all other figures. The full postal address (plus telephone and fax numbers) of the author who will check the proofs and receive correspondence should be included. Once a paper has been accepted for publication the author should provide the paper on a computer disk along with final artwork. The disk should be in IBM compatible (MS-DOS) or Macintosh format and clearly labelled with the word processing program used and the file name(s).

General formatting requirements • Text should be flush left. This applies also for abstracts, headings, keys and reference lists. Headings should be in upper and lower case, and not underlined. • Use only a single space after *all* punctuation marks including fullstops. • Insert a space between a numeral and unit of measurement, e.g. 3 mm, but no space between initials, e.g. L.A.R. Haegi, or between a hyphen and associated numerals, e.g. 5.2-6 mm or between extreme measurements and ranges e.g. (10-)25-35(-90). • Do not use the spacebar to indent or tabulate. Underline, in preference to italics, and use single quote marks before double.

Organisation of the paper The title should be explicit and descriptive of the content. Include the family name and broad geographic region where appropriate. Abstracts (except for Short Communications) should be included. Check most recent issue for format. Bracketed keys are preferable especially for long keys, but indented keys are acceptable. Long indented keys should be divided into groups. When giving authors of botanical names follow the forms in the Kew Draft Index of Author Abbreviations. But note unabbreviated use in references below.

Types Cite details in full, giving details from protologue and from specimen label separately if there are important differences. Type citations should be in a consistent format, e.g. Type: New South Wales: North Western Plains: 10 km W of Moree (29°08' S 129°48' E), *B. Wieck* 1250, 2 Jan 1989; lecto NSW (Weston 1990: 21); isolecto K, MO.

Selected specimens Cite no more than 20 (except for very widely distributed species) and arrange by Botanical Divisions. Use accepted format: locality, collector & number, date (herbarium code plus institutional number if there is no collector's number) and omit the initials of collectors, unless confusion is likely. Only latitudes and longitudes on the original labels should be included. Give dates in the following format: 12 Jan 1987, 2 June, 30 July, 10 Dec etc.

References In formal taxonomic citations use the fully abbreviated (Harvard) form: author (year: page) e.g. Bentham (1878: 234). The traditional \pm abbreviated form, e.g. Bentham, Fl. Austral. 7: 234 (1878), may be used in shorter papers. Authors' names in these citations should be given unabbreviated. References to books published before 1900 need not include the publisher and place of publication, but be consistent.

Index to taxa This is useful if the paper is large and deals with many species and synonyms. The author should prepare the basic alphabetic listing including all names in recent use.

Illustrations/maps/photos • In general figures should be drawn one and a half times the final printed size. Check that line thickness and evenness, and labelling size are suitable for the final reproduction size and that maps show their context clearly (by lat/longs or an inset map) and that relevant place names in the text (but not for cited specimens) are shown. • Submit line drawings as bromide (Repromaster) copies with the final manuscript. • Photos should be unmounted, good-quality gloss prints. Do not label photos. • Labelling that is part of an illustration, e.g. place names on a map, should be added in Helvetica font by the person preparing the illustration. • Bar scales on the figure are preferable to numerical scales in the caption. Any magnification levels in the caption should refer to the size of the submitted original figure (not anticipated final size). • Bear in mind the shape of the final printed page and that the maximum final size of the illustration is 205 mm high x 125 mm wide, but preferably less to leave space for a caption on the same page.

Captions Use lower case letters for the parts of a figure e.g. Figure 1. *Jacksonia michaeliana*. a, stem tissue (x 10); b, calyx lobes (x 0.5). (a from holotype; b from *Barson* 234.)

Tables should preferably be portrait rather than landscape shape. They should be typed as separate files. More detailed instructions are available on request from the editors.

Contents

Systematic studies in the eucalypts. 5. New taxa and combinations in <i>Eucalyptus</i> (Myrtaceae) in Western Australia <i>K.D. Hill & L.A.S. Johnson</i>	561
New species, lectotypes and synonyms of Australasian <i>Nymphaea</i> (Nymphaeaceae) <i>S.W.L. Jacobs</i>	635
New species of <i>Plectranthus</i> and <i>Westringia</i> (Labiatae) from New South Wales <i>Barry J. Conn</i>	643
Status of the genus <i>Eichlerago</i> (Labiatae) <i>Barry J. Conn</i>	649
New taxa and a new combination in <i>Triodia</i> (Poaceae) <i>S.W.L. Jacobs</i>	653
Additions to the lichen flora of Tasmania <i>G. Kantvilas & A. Vězda</i>	661