

**Systematic studies in the eucalypts. 6. A
revision of the coolibahs, *Eucalyptus* subgenus
Symphyomyrtus section *Adnataria* series
Oliganthae subseries *Microthecosae*
(Myrtaceae)**

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

Abstract

Hill, K.D., & Johnson, L.A.S. (National Herbarium of New South Wales, Royal Botanic Gardens, Mrs Macquaries Road, Sydney N.S.W. 2000 Australia) 1994. *Systematic studies in the eucalypts. 6. A revision of the coolibahs, Eucalyptus subgenus Symphyomyrtus section Adnataria series Oliganthae subseries Microthecosae (Myrtaceae)*. *Telopea* 5(4): 743-771. A taxonomic revision of the coolibah group is presented. Eight species are recognised, five of them described here as new (*Eucalyptus acroleuca* L.A.S. Johnson & K.D. Hill, *E. barklyensis* L.A.S. Johnson & K.D. Hill, *E. helenae* L.A.S. Johnson & K.D. Hill, *E. victrix* L.A.S. Johnson & K.D. Hill, and *E. gymnoteles* L.A.S. Johnson & K.D. Hill). A key is presented.

Introduction

Series *Oliganthae*, the tropical boxes, form a natural group. The series is primarily tropical in distribution, with the exception of several members of the *Eucalyptus microtheca* group (subseries *Microthecosae*, the 'coolibahs') which have apparently relatively recently colonised more southerly regions. We place the *Oliganthae* as a series within the large section *Adnataria*, itself part of the subgenus *Symphyomyrtus* (Pryor & Johnson 1971). Our studies of the eucalypts have defined the coolibahs as a natural group within series *Oliganthae*, and a taxonomic revision of this group is presented herein. Studies in hand address the systematics of the remainder of series *Oliganthae*, but are not yet sufficiently complete for publication.

This revision arises from an overall review of the eucalypts (*Eucalyptus*, including *Angophora*) commenced by us in 1983 and incorporating the studies of the group by one of us (Johnson) over the past 40 years. Our studies address aspects of eucalypt taxonomy from the generic level through infrageneric to specific and infraspecific relationships, and results are being progressively published in this series.

Terminology

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.

Names of 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 were also used by Maiden (op. cit.) in 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 (1971) in ending with '-osae'. This is because '-ineae', previously used, is a subtribal ending (International Code of Botanical Nomenclature, 1988, Art. 19.2).

The term 'stemonophore' 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 homologous 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.

Taxonomic history

The names applied to series and subseries by earlier authors are cited below merely to indicate the way in which those authors grouped the species concerned. Nothing is implied about their standing, since we are using only our extracodical system between genus and species.

The first species of the Coolabah group to be recognised was *E. microtheca*, described by Mueller in 1863. Bentham (1867) recognised the same single species (although mistakenly as *E. brachypoda*, see discussion below), placing it (with other unrelated species) in series *Micrantherae*.

Maiden (Crit. Revis. *Eucalyptus* 6: 529) recognised only one species (*E. microtheca*), which he placed in anther series *Porantheroideae*, together with species from many other groups. Maiden later (Crit. Revis. *Eucalyptus* 7: 121) listed *E. microtheca* in seed series *Striolatae*, again with taxa from very many other groups. Blakely (1934) recognised part of the complexity of the 'microtheca' group, with his recognition of three species and three varieties (*E. microtheca* with var. *cymbaliformis*, *E. cyanoclada*, and *E. coolabah* with var. *arida* and var. *rhodoclada*). Blake (1953), however, took a different view, reducing these to two species only (*E. microtheca*, including *E. coolabah*, and *E. cyanoclada*). He placed these (along with *E. normantonensis*) in series *Buxaeales*. We now regard *E. coolabah* as a distinct species, and accept one of Blakely's varieties, var. *arida*, as a subspecies (Johnson & Hill 1990). The other, var. *rhodoclada*, we herein include in *E. victrix*.

Pryor & Johnson (1971) recognised a series *Oliganthae* with ten species (including *E. rummeryi*, now excluded, and not including *E. pruinosa*). This series was included in the wider group of boxes and ironbarks, section *Adnataria* in subgenus *Symphyomyrtus*. The coolabah group was placed in a subseries *Microthecinae*, together with *E. tectifera*, *E. argillacea* and *E. microneura*. Two of Blakely's three varieties were recognised as informal subspecies of *E. microtheca*, his third variety (var. *cymbaliformis*) was regarded as a probable hybrid, and *E. cyanoclada* was regarded as a doubtful species.

All were placed in a superspecies 'Microtheca'. We later revised the circumscription of the *Oliganthae* to exclude *E. rummeryi* and include *E. pruinosa* (Johnson & Hill unpublished, lists privately circulated as mentioned above).

Chippendale (1988) adopted the series name *Striolatae* from Maiden, using (though without specific reference) our modified circumscription following Pryor & Johnson (Johnson & Hill unpublished), and included 14 species. He accepted *E. microtheca* (with no subordinate taxa) and *E. cyanoclada*.

We now recognise about 32 species in series *Oliganthae*, falling into eight subseries. Most species occur in areas which have until recently been poorly collected, and confusion has surrounded species determination and nomenclature. We recognise nine species in the coolibah group, which we place in a separate subseries, *Microthecosae*. We are acquainted with all the taxa in the field. The collections held by BRI, CANB, DNA and NSW have been examined.

Section *Adnataria*

Bark smooth or partly or fully persistent, shortly fibrous and flaky ('box'), or $\pm$ corky, $\pm$ kino-impregnated ('ironbark'); lacking oil glands. Pith glands present or absent. Cotyledons rounded or shallowly reniform. Seedling leaves petiolate, opposite for few or rarely many nodes. Inflorescences appearing compound, on leafless lateral or apparently terminal shoots, comprising unit axillary umbellasters on short leafless shoots; or simple, axillary umbellasters. Calycine calyptra shed early or persisting to anthesis, $\pm$ free from corolline calyptra; or fused to corolline calyptra. Filaments irregularly flexed or inflexed in bud. Anthers adnate, basifixed, opening by slits or pores.

This section is one of the major components of subgenus *Symphyomyrtus* (see Pryor & Johnson 1971). It is a large and widespread group that occurs through all of Australia except Tasmania and the far south-west of Western Australia (Fig. 1), and is an important part of the landscape and flora of eastern and northern Australia. The group is defined by the combination of adnate anthers and petiolate early seedling leaves. Maximum diversity is reached in eastern Australia, where the greatest infra-sectional variety is found. The section as we recognise it now is little changed from that of Pryor & Johnson (1971), although we now understand some of the internal relationships more clearly. We consequently regard the subdivisions proposed by Pryor & Johnson as requiring reassessment, and would now recognise 14 series in contrast to the 12 recognised by Pryor & Johnson, with a somewhat different placement of some species (a full treatment is in preparation).

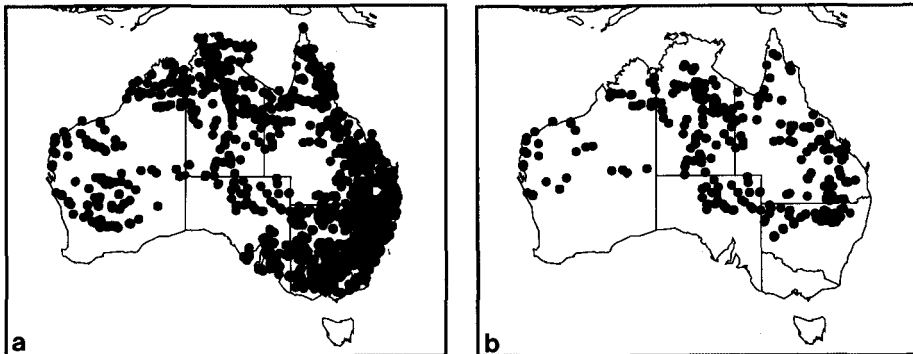


Fig. 1. Distribution of section *Adnataria* (a) and subseries *Microthecosae* (b).

Series *Oliganthae*

Bark persistent, shortly fibrous and flaky ('box'), sometimes shedding on branches or throughout in subseries *Microthecosae*. Seedling leaves petiolate, opposite for few nodes (many in subseries *Pruinorosae*). Adult leaves simlifacial, densely regularly reticulate (tertiary venation complete), lateral veins regular, at 40–60° to midrib. Pith glands absent. Inflorescences axillary or pseudo-terminal, appearing compound, with unit axillary 7-flowered umbellasters or irregular dichasia (penultimate floral internodes not fully suppressed and some buds not developed) on short leafless shoots. Calycine calyptra free from corolla, shed before anthesis. Stamens all fertile, filaments irregularly flexed in bud. Anthers adnate to the filaments, globular to oblong, opening by broad lateral pores or short slits. Fruits persistent or dehiscent immediately on maturing and soon shed. Seeds elliptical, shallowly reticulate; hilum ventral.

Defined within the section by the combination of complete tertiary leaf venation, free calycine calyptra shedding before anthesis, absence of staminodes, and irregularly flexed filaments with more or less globose anthers. Adult leaf venation is also more regular and at a higher angle to the midrib than in many other series in this section. These characters are probably all plesiomorphic within *Adnataria*, but the *Oliganthae* also appear to share a common biogeographic history.

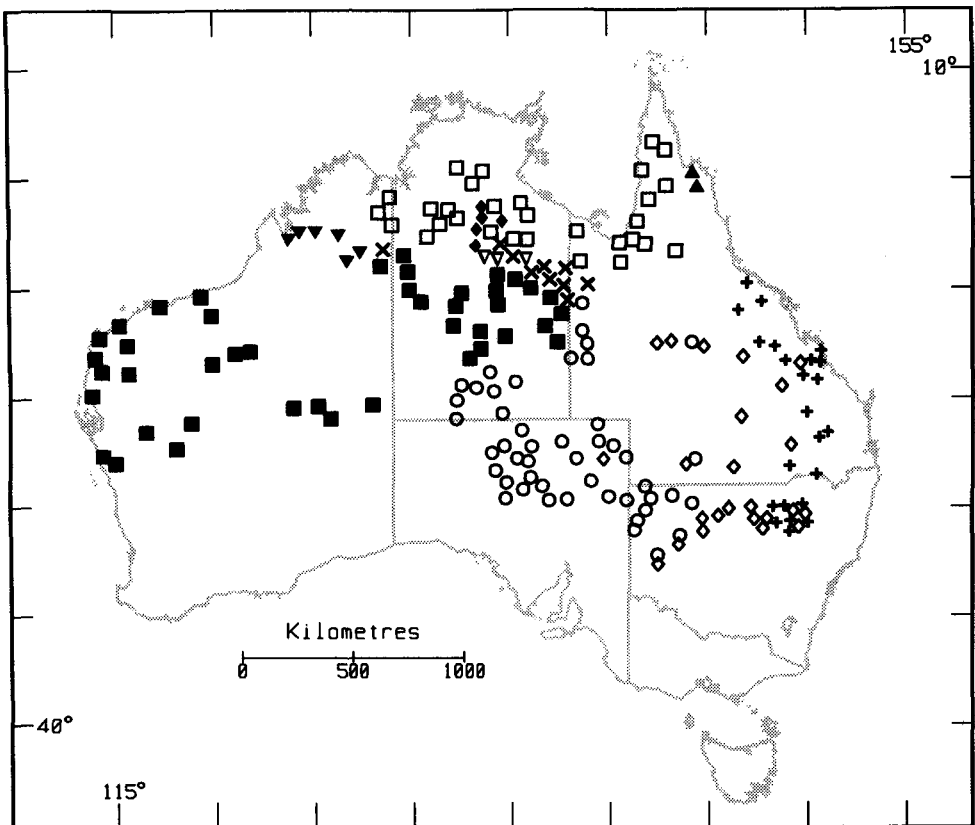


Fig. 2. Distribution of subseries *Microthecosae*. *E. acroleuca* (solid triangle); *E. microtheca* (open square); *E. cyanoclada* (solid diamond); *E. barklyensis* (cross); *E. gymnoteles* (solid inverted triangle); *E. helenae* (open inverted triangle); *E. coolabah* subsp. *coolabah* (open diamond); subsp. *excerata* (plus); subsp. *arida* (open circle); *E. victrix* (solid square).

The series consists of about 32 species, of which all except some of the *E. coolabah* group are tropical in occurrence (Fig. 1). Members of the series may be locally abundant, but tend not to dominate large tracts of country in the manner of, for example, the related *E. albens* (section *Adnataria*, series *Moluccanae*) in New South Wales. Distribution of most species is in fact rather narrowly ecologically controlled. A number of natural groups can be recognised within the series, and we will recognise nine sub-series (in prep.). These are separated by differences in persistence of fruit, inflorescence structure, seed morphology, leaf morphology and cuticle morphology.

Subseries *Microthecosae*

Bark fully persistent, or partly or fully shedding. Adult leaves ± lanceolate, dull. Inflorescences expanded, often appearing terminal, individual buds irregularly arranged and not grouped in clearly defined unit umbellasters (penultimate floral internodes not fully suppressed). Fruits opening and shedding immediately on maturity, old fruits papery. Seeds pale brown.

The following 10 distinguishable but closely related taxa (eight species and 2 additional subspecies) constitute the ‘coolibah’ group. These units form a geographic replacement pattern (Fig. 2) with marginal intergradations. All taxa are included in the super-species *Microtheca*, which then constitutes the whole of the subseries *Microthecosae*.

The ‘coolibah’ group is one of the widest-ranging eucalypt groups in Australia (Fig. 1), occurring throughout the northern parts of the continent, north of about 30°S latitude (and a little further south in central New South Wales). The group is ecologically highly specialised, all taxa occurring in habitats that are seasonally wetter than the surrounding country. Within this broad specialisation, each individual taxon shows a slightly different habitat preference, for example *E. victrix* occurs along slight drainage lines in red earth ‘Mulga’ country, whereas the closely allopatric *E. helenae* occurs around seasonally swampy depressions on heavy grey clay soil ‘Downs’ country, where *E. barklyensis* also occurs on sites with a somewhat different inundation regime.

The apparent closeness of all taxa and their fine geographic and ecological separation suggests that their evolutionary separation was relatively recent. The occurrence of sister taxa at several levels in strictly tropical regions further suggests that this group has relatively recently spread from the tropical north to occupy its present wide range. Intergradation is extensive between the subspecies of *E. coolabah*, and occurs to a more limited extent between some other taxa, as discussed under the species. Other taxa in the subseries have more marked ecological distinctions or spatial gaps in distribution and intergrades are then scarce or absent.

Flowering times are not individually recorded here because flowering specimens are very poorly represented in collections. The limited number of such specimens suggests that all species flower in spring-summer months.

Key to the species

- 1 Valves enclosed or rim level, incurved
 - 2 Bark fully persistent
 - 3 Plant parts not glaucous 2. *E. microtheca*
 - 3* Plant parts glaucous 3. *E. cyanoclada*
 - 2* Bark shedding on branches

- 4 Fruits very small (less than 3 mm diam.), valves deeply enclosed 1. ***E. acroleuca***
- 4* Fruits larger (more than 3 mm diam.), valves rim-level
 - 5 Small trees with spreading foliage; leaves often broad-lanceolate 4. ***E. barklyensis***
 - 5* Large trees with drooping foliage; leaves narrow-lanceolate 5. ***E. gymnoteles***
- 1* Valves prominently exerted, spreading
 - 6 Bark persistent on trunk
 - 7 Fruits large (6–8 mm diam.); calyptra shorter than hypanthium 6. ***E. helenae***
 - 7* Fruits small (3–6 mm diam.); calyptra as long as or longer than hypanthium 7. ***E. coolabah***
 - 6* Bark almost wholly smooth 8. ***E. victrix***

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

Similis *E. microthecae* sed combinatione characterum sequentium distinguitur: folia angustiora tenuiaque, fructus semper minuti, cortex trunci superioris et ramorum laevis albisque (cortex trunci inferioris persistens, duriusculus et nigrescens).

TYPE: QUEENSLAND: Cook: 4.3 km from New Laura Homestead on track to Caulders Lagoon (15°11'S, 144°20'E), J.R. Clarkson 5700, 8 Nov 1984 (holo NSW; iso BRI, DNA, CANB, K, MEL, PERTH, QRS).

Tree to 25 m high, often less. Bark persistent for basal 2–4 or 5 m, hard, black or dark grey, tessellated, shortly fibrous ('box' bark); smooth, white above. Adult leaves disjunct, similifacial, narrow-lanceolate to lanceolate, obtuse or acute, 7–17 cm long, 0.6–2.0 cm wide, 0.17–0.24 mm thick (when dry); petioles 0.4–1.5 cm long. Not glaucous. Inflorescences aggregated, pseudo-terminal or axillary; umbellasters irregular, to 7-flowered. Peduncles slender, terete, 0–8 mm long. Pedicels slender, terete, 1–3 mm long. Mature buds ovoid to clavate, 2.5–3.5 mm long, 1.5–2.5 mm diam. Calyptra hemispherical, about 1/2 as long as hypanthium. Fruits cup-shaped, distally constricted, 3-, sometimes 4-locular, 2–3 mm long, 2–3 mm long, 1.5–2.5 mm diam. Calyptra scar and stemonophore flat, < 0.2 mm wide. Disc vertically depressed, < 1 mm wide. Valves broadly triangular, obtuse, deeply enclosed, $\pm$ vertically raised. Figs. 3, 4.

E. acroleuca most closely resembles *E. microtheca*, from which it is distinguished by the narrow, thin-textured leaves, the small fruits and the persistent, hard black basal stocking with smooth, white bark on the upper trunk and branches. Trees are erect and often tall, with a longer and straighter trunk than in *E. microtheca*. Very small-fruited forms of the latter occurring in the west of Cape York Peninsula (see below) are geographically separate from *E. acroleuca* and differ in the bark and habit features mentioned.

The style apparently varies in length in this species, extending from half to three-quarters of the distance from the ovary roof to the calyptra (Fig. 4). This contrasts with other taxa in the coolabah group, in which the style extends almost to the calyptra, or actually touches the inside of the calyptra (Figs. 8, 9, 11, 14).

DISTRIBUTION: Queensland: Cook District, Lakefield National Park (Fig. 2).

ECOLOGY: Locally abundant in often pure stands in woodlands on low, seasonally inundated areas on heavy soils, often around permanent lagoons.

CONSERVATION STATUS: Locally abundant and extensively reserved within Lakefield National Park, not considered to be at risk.

The epithet is from the Greek *acros*, highest, and *leucos*, white, from the white-topped trunk.

SELECTED SPECIMENS (from 6 examined): QUEENSLAND: Cook: 12 km north of Lakefield homestead on Lakefield National Park, 8 km east of Breeza Plains outstation, *Neldner 3807 & Clarkson*, 08 Apr 1992 (BRI, MBA, NSW); 4.8 km N of Lakefield Ranger Station on Lakefield National Park, *Clarkson 5699*, 08 Nov 1984 (BRI, CANB, DNA, K, MEL, NSW, QRS, PERTH); 1.5 km W of New Laura Ranger Station towards Caulders Lagoon, *Hill 1073, Johnson & Blaxell*, 13 Aug 1984 (NSW); Lakefield National Park between New Laura and Caulders Lake c. 3 km W of New Laura, *Clarkson 4840*, 28 June 1983 (BRI, NSW).

2. *Eucalyptus microtheca* F. Mueller

Mueller (1859: 87)

Type citation: 'Hab. In Nova Hollandia tropica non rara, planities fertiliores inhabitans. Anth. vere.'

TYPE: NORTHERN TERRITORY: Victoria River, F. Mueller, Dec 1855 (holo MEL; iso BM, K, NSW).

Tree to 20 m high (usually much less), sometimes with several stems. Bark fully persistent, shortly fibrous and flaky, grey with paler patches ('box' bark). Juvenile leaves disjunct from node 15–20, lanceolate, to 6 cm long, to 0.3 cm wide, apically rounded. Adult leaves disjunct, similifacial, dull green, thin, lanceolate to narrow-lanceolate, obtuse or acute, 5–17 cm long, 0.6–2.6 cm wide, 0.18–0.34 mm thick (when dry); petioles 0.5–1.4 cm long. Inflorescence aggregated, pseudo-terminal or axillary; umbellasters $\pm$ irregular, to c. 11-flowered. Peduncles very slender, terete, 0–8 mm



Fig. 3. *E. acroleuca*, showing straight habit and black basal bark with white upper bark (these have not been affected by fire). *Hill 1073*.

long. Pedicels very slender, usually distinct, 1–4 mm long. Mature buds ovoid, 3.0–3.5 mm long, 1.5–2.5 mm diam. Calyptra conical to hemispherical and distinctly apiculate, $1/3$ – $1/2$ as long as hypanthium. Fruits obconical, distally not or slightly constricted, 3–4-locular, 3–5 mm long, 3–5 mm diam. Calyptra scar and stemonophore

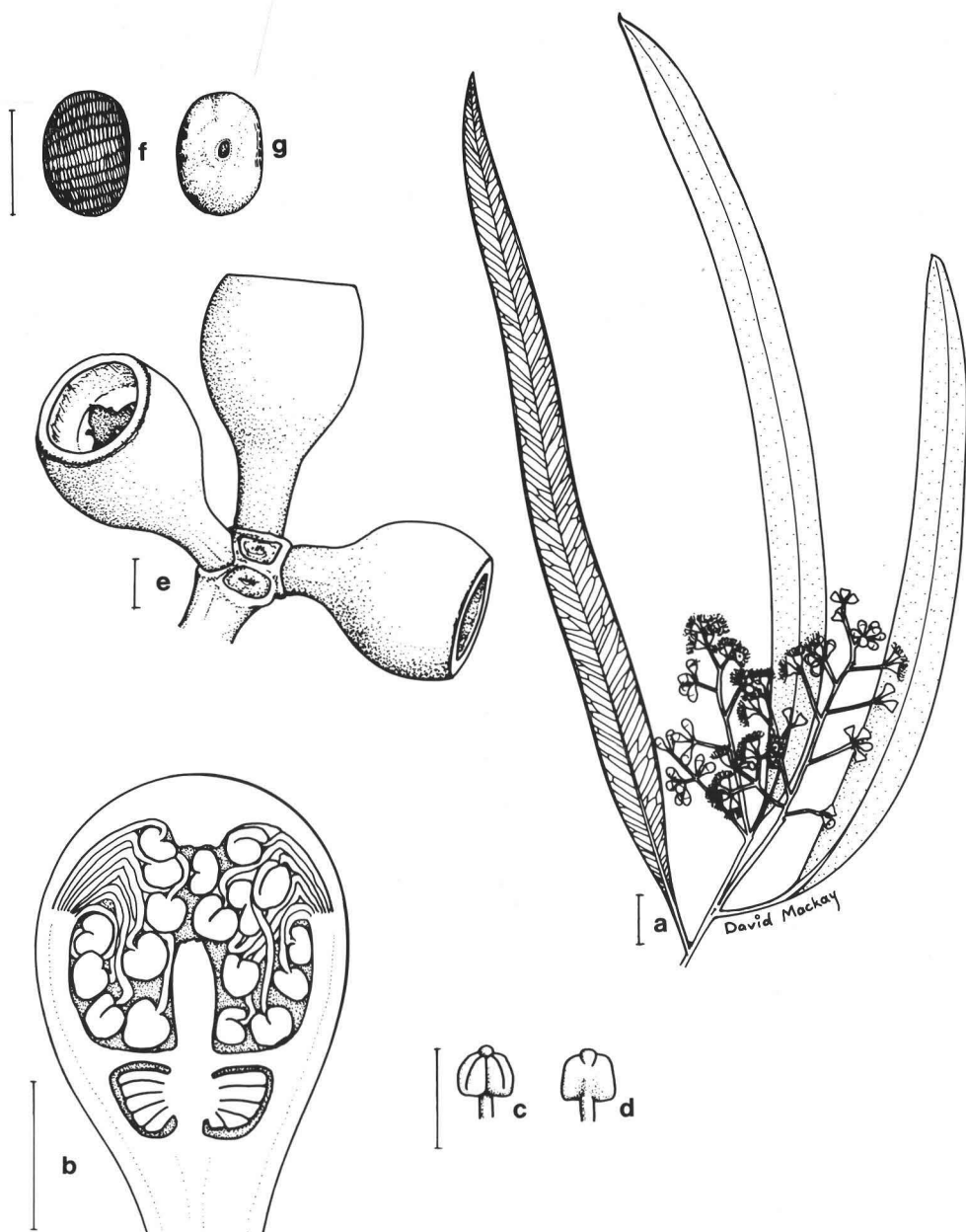


Fig. 4. *E. acroleuca*. a, adult leaves, buds and flower; b, transverse section of bud; c, d, anther; e, fruits; f, g, seed (a, b, c, d from Clarkson 5700, e, f, g from Hill 1073). Scale bar: a = 1 cm, b, e, f, g = 1 mm, c, d = 0.5 mm.

flat, < 0.2 mm wide. Disc $\pm$ vertically depressed, < 0.2 mm wide. Valves broadly triangular, obtuse, almost fully enclosed, sometimes minutely apically exerted, raised at c. 60–90°. Seeds semi-glossy, pale brown, rounded, elliptical, regularly shallowly reticulate (almost smooth); hilum ventral. Chaff pale brown.

Distinguished by the full box bark, the thin, lanceolate or narrow-lanceolate leaves, and the small to medium-sized fruits with mostly enclosed valves and very slender pedicels and peduncles. Fruit size varies geographically, with somewhat smaller fruits occurring in populations along the west coast of Cape York Peninsula, from the Archer River floodplain south to around Normanton.

DISTRIBUTION: *E. microtheca* is a species of the northern rivers, extending from the lower reaches of the Ord River in the west, eastwards across the Northern Territory at about the same latitude (but apparently no further north) on the Victoria River and the rivers around the south of the Gulf of Carpentaria (including the Roper and MacArthur Rivers), into Queensland to the Flinders River around Normanton and north to the Coen and Archer Rivers in western Cape York Peninsula (Figs. 2, 5).

ECOLOGY: Typically a species of heavy soils on floodplains near larger rivers, although quite widespread within its range. This species also forms pure stands, but not as extensive as those of *E. acroleuca*. Trees are often tall and usually more or less erect.

Intergrading populations occur with *E. cyanoclada*, *E. coolabah* subsp. *coolabah* and

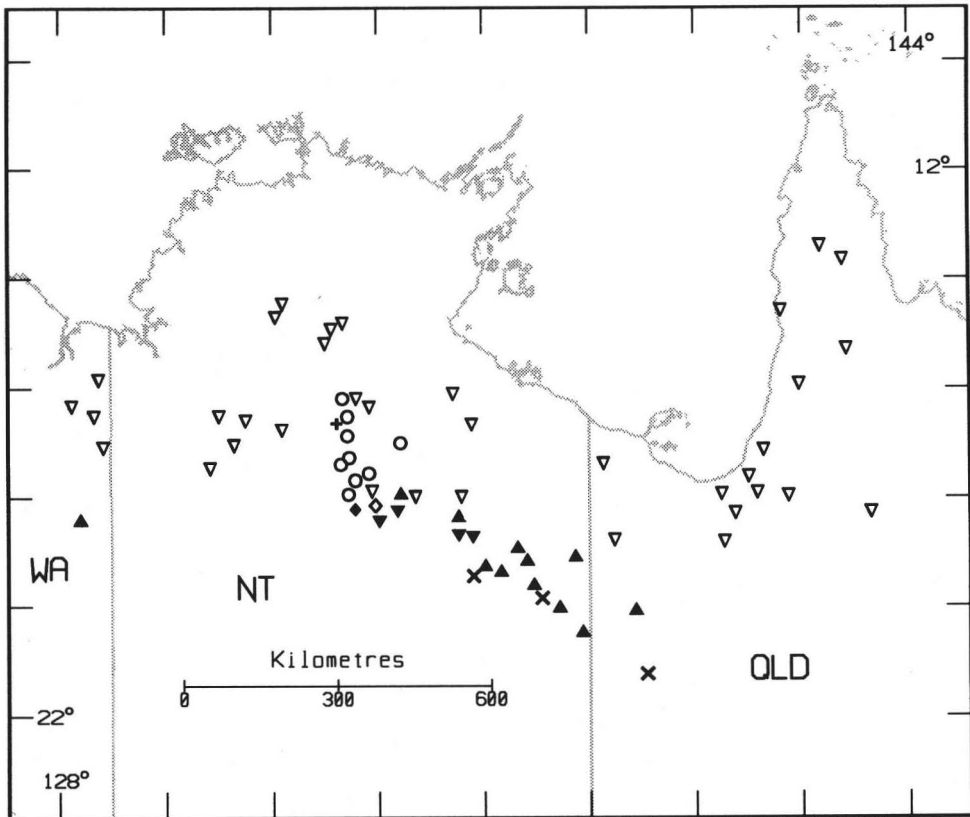


Fig. 5. Distribution of *E. microtheca* (open inverted triangle), *E. cyanoclada* (open circle), *E. barklyensis* (solid triangle), *E. helenae* (solid inverted triangle), *E. cyanoclada-microtheca* intergrades (plus), *E. barklyensis-victrix* intergrades (cross), *E. cyanoclada-helenae* intergrades (open diamond), *E. cyanoclada-victrix* intergrades (solid diamond).

possibly to some extent with *E. barklyensis*. Individual hybrids are known with *E. pruinosa*.

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

SELECTED SPECIMENS (from 42 examined): NORTHERN TERRITORY: Darwin & Gulf: Stuart Hwy, near CSIRO Station, Katherine, *Adams 900*, 12 Mar 1964 (CANB, NSW); Elsey station, *Bateman 9*, 11 June 1950 (CANB, NSW); Warloch Ponds, 20 km S of Mataranka on Stuart Hwy, *Wilson 4542*, 11 May 1983 (NSW); Swamp, 5 km SE Alligator Stockyard Waterholes, Bauhinia Downs station, *Wightman 1856 & Leach*, 07 May 1985 (DNA, BRI, CANB, NSW, NT); 50 km E Daly Waters, *Wightman 1514*, 03 July 1984 (DNA, NSW); 5.8 km NE of Cape Crawford junction on Borroloola road, *Hill 1024, Johnson & Benson*, 06 Aug 1984 (NSW). Victoria River: 59 km E of Top Springs on old Murrarji Track, *Hill 1011, Johnson & Benson*, 04 Aug 1984 (NSW); near Wavehill Police Stn, *Perry 2254*, 25 June 1949 (CANB, DNA, NSW). Barkly Tableland: 31 km E Stuart Hwy on Barkly Stock Route, *Hill 886, Johnson & Benson*, 13 July 1984 (NSW); Gidyea Creek, 4.9 km W of Tablelands Hwy on Barkly Stock Route, *Hill 1016, Johnson & Benson*, 05 Aug 1984 (NSW); Rankine River, 63.8 km S of Alexandria Downs, *Hill 3565 & Stanberg*, 03 Dec 1988 (NSW).

QUEENSLAND: Cook: Horsetailer Lagoon, on Archer River floodplain, Archer Bend National Park, *Fell 2366*, 06 June 1991 (BRI, NSW); Rokeby National Park, c. 8 km E of Ranger Station, on the floodplain of Coen River, *Fell DF2355*, 04 June 1991 (BRI, NSW CANB); Edward Aboriginal Reserve 15.5 km from Nutwood Crossing on track to Holroyd R, *Clarkson 3530*, 11 Oct 1980 (BRI, CANB, MO, NSW, NT, QRS, PERTH); Crooked Creek, *Hyland 5106*, 03 June 1971 (QRS, CANB, NSW). Burke: 44.4 km N of Karumba – Normanton road on Delta Downs road, *Hill 1051 & Johnson*, 09 Aug 1984 (NSW); 41.5 km E of Wollgorang HS. on Burketown road, *Hill 1031, Johnson & Benson*, 07 Aug 1984 (NSW); 65.8 km W of Croydon, *Brooker 10421*, 08 Mar 1990 (CANB, BRI, CANB, DNA, MEL, NSW); Lawn Hill Gorge camp area, *Hill 3577 & Stanberg*, 04 Dec 1988 (NSW); 34.8 km N of Burke and Wills roadhouse on Normanton road, *Hill 1046 & Johnson*, 09 Aug 1984 (NSW).

WESTERN AUSTRALIA: Gardner: Ord, Kununurra, *Johnson 2059*, 25 Aug 1967 (NSW); between lower dam and town on Kununurra – Wyndham road, *Brooker 7787*, 05 Nov 1982 (CANB, NSW); 2.5 km W of Kununurra, *Done 637*, 02 Dec 1982 (CANB, NSW). Hall: Ord River, 69 miles S of Kimberley Research Station, *Perry 2968*, 11 July 1952 (CANB, MEL, NSW); near Negri, E Kimberley, *Gittins 1385*, July 1967 (NSW, PERTH, CANB).

3. *Eucalyptus cyanoclada* Blakely

Blakely (1934: 242)

TYPE CITATION: 'N.T. — Newcastle Waters (C.E.F. Allen, No. 636, August, 1922).'

TYPE: holo NSW.

E. microtheca F. Muell. var. *cymbaliformis* Blakely & Jacobs, in Blakely (1934: 245).

TYPE CITATION: 'N.T. — On banks of creek, Newcastle Waters, C.E.F. Allen, and Dr. M.R. Jacobs, No. 141, August, 1933.'

TYPE: holo NSW.

Tree to 15 m high, sometimes with several stems. Bark persistent throughout, shortly fibrous and flaky, grey with paler patches ('box' bark). Juvenile leaves disjunct, ovate. Adult leaves disjunct, simlifacial, dull green, thick, broad to narrow lanceolate, obtuse or acute, 5–16 cm long, 1.0–2.8 cm wide, 0.17–0.26 (rarely to 0.33) mm thick (when dry); petioles 0.6–1.1 cm long. Inflorescences aggregated, pseudo-terminal or axillary; umbellasters ± irregular, to 11-flowered. New shoots, buds and fruits strongly pruinose. Peduncles terete, 0–9 mm long. Pedicels distinct, 1–3 mm long. Mature buds ovoid, 3–5 mm long, 2.0–3.5 mm diam. Calyptra hemispherical, ± apiculate, about 1/2 as long as hypanthium. Fruits obconical, not distally constricted, 3–4-locular, 5–6 mm long, 5–6 mm diam. Calyptra scar and stemonophore flat, <0.3 mm wide. Disc ± vertically depressed, <0.5 mm wide. Valves broadly triangular, obtuse,

basally enclosed, tips sometimes slightly exerted, raised at c. 45–60°. Seeds semi-glossy, pale brown, rounded, elliptical, regularly shallowly reticulate (almost smooth); hilum ventral. Chaff pale brown.

E. cyanoclada is distinguished within the subseries by the fully persistent bark, the pruinose adult leaves, buds and fruit, the short calyptra, the relatively large, obconical fruits with valves enclosed or at rim level, and the short, slender pedicels. Fruits are quite variable in size and shape, but consistently larger than those of *E. microtheca*.

DISTRIBUTION: *E. cyanoclada* is restricted to the closed drainage systems of the Daly Waters — Newcastle Creek complex in the Northern Territory (Figs. 2, 5).

ECOLOGY: A species of river flats on heavy grey cracking clay soils, along major drainage lines. Ecological segregation is evident in some intergradational zones, with individuals more like *E. cyanoclada* nearer to major channels, and segregation more towards *E. microtheca* on floodout flats.

Intergrading populations (showing varying degrees of pruinosity and intermediacy of fruit shape and size, sometimes in a patchy distribution) occur with *E. microtheca* where these species meet at the southern edge of the range of *E. microtheca*. There is also some intergradation, where areas and habitats meet, with *E. barklyensis*, *E. helenae* and *E. victrix*, indicated by smooth smaller branches.

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

SELECTED SPECIMENS (from 17 examined): NORTHERN TERRITORY: Darwin & Gulf: 43.9 km N of Top Springs turnoff on Stuart Hwy, Hill 3269, Johnson & Stanberg, 09 Nov 1988 (NSW); Daly Waters area, Brock 418, 18 July 1988 (DNA, NSW); 7.7 km S of Dunmarra on Stuart Hwy, Hill 888, Johnson & Benson, 13 July 1984 (NSW). Barkly Tableland: 51.3 miles [83 km] NE Beetaloo HS, Chippendale NT 5489, 10 Mar 1959 (NT, NSW); main channel of Newcastle Creek at Stuart Hwy crossing, Hill 887, Johnson & Benson, 13 July 1984 (NSW); c. 19 km S of Elliott on old road near Overland Telegraph Line, Johnson 2012, 21 Aug 1967 (NSW); 30 miles [49 km] ESE Elliott, Swinbourne 731, 27 Mar 1963 (NT, CANB, NSW); Tandidgee Bore [Tanyidgee Waterhole], 29 miles [48 km] SE Elliott, Newton A8, 10 Mar 1964 (NT, NSW); Lake Woods, 22 miles [36 km] SE Elliott, Latz 463, 20 Feb 1969 (NT, CANB, NSW); 11 km W of old Stuart Hwy, turnoff 46 km S of Elliot, Hill 1013, Johnson & Benson, 04 Aug 1984 (NSW).

4. *Eucalyptus barklyensis* L. Johnson & K. Hill, sp. nov.

Ab *E. microtheca* combinatione ramorum minorum laevium, foliorum crassiorum, fructuum valvis minus elevatis et pedicellorum distinctorum tenuium distinguitur.

TYPE: NORTHERN TERRITORY: Barkly Tableland: 18 km from Alroy Downs homestead towards Alexandria Downs, K.D. Hill 1020, L.A.S. Johnson & D. Benson, 6 Aug 1984 (holo NSW, iso CANB).

Tree to 10 m high. Bark persistent to larger branches, grey, shortly fibrous-flaky ('box' bark), smooth, white above. Adult leaves disjunct, similifacial, dull grey-green (not glaucous), lanceolate to broad-lanceolate, obtuse or acute, 5.0–15 cm long, 0.9–2.5 cm wide, 0.33–0.41 mm thick (when dry); petioles thick, to 0.8–1.9 cm long. Inflorescences aggregated, pseudo-terminal or axillary; umbellasters usually 7-flowered. Peduncles terete, 2–6 mm long. Pedicels slender, terete, 1–2 mm long. Mature buds ovoid, c. 3 mm long, c. 2 mm diam. Calyptra hemispherical, sometimes finely apiculate, as long as hypanthium or slightly shorter. Fruits cup-shaped, distally contracted, 3–4-locular, 3–4 mm long, 3–4 mm diam. Calyptra scar and stemonophore continuous, flat, c. 0.2 mm wide. Disc vertically depressed, c. 1 mm wide. Valves broadly triangular, obtuse, basally enclosed, tips $\pm$ rim-level or sometimes slightly exerted, raised at 45° or less. Seeds semi-glossy, light brown, rounded, elliptical, regularly shallowly reticulate (almost smooth); hilum ventral. Chaff light brown. Figs. 6, 8.

E. barklyensis differs from *E. microtheca* in the smooth small branches and the thicker, lanceolate to broad-lanceolate leaves. Trees are smaller, often multi-trunked, with spreading crowns.

Intergradation is known with *E. victrix* where areas and habitats meet.

DISTRIBUTION: Northern Territory: eastern and north-eastern Barkly Tableland, probably extending into Queensland along the eastern edge of the tableland (Figs. 2, 5). An outlying population occurs on similar country at the same latitude near the Northern Territory - Western Australia border (*Hill 1000*, below). The intervening region is higher, stony country with red sandy soils, not providing a suitable habitat for *E. barklyensis*.

ECOLOGY: Locally abundant in low open woodland in low areas, along minor drainage lines and on floodout flats in areas of heavy grey cracking (but often stony) clay soil, bordered by grasslands on surrounding slightly higher areas.

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

The epithet refers to the occurrence on the Barkly Tableland, an area of black soil plains.

SELECTED SPECIMENS (from 13 examined): **NORTHERN TERRITORY:** Barkly Tableland: Creswell Creek, 2 km S of road junction, *Hill 3560 & Stanberg*, 03 Dec 1988 (NSW, AD, BRI, CANB, DNA); 100.6 km E of Stuart Hwy on Barkly Stock Route, *Hill 885, Johnson & Benson*, 13 July 1984 (NSW, BRI, CANB, DNA); 64 miles [104 km] N of Rockhampton Downs HS, *Chippendale NT 3850 & Johnson*, 02 Oct 1957 (NT, NSW); Alexandria station homestead, *Swinbourne 750*, 28 Mar 1963 (NT, NSW); 7 miles [11.3 km] W of Gallipoli station, *Perry 1564*, 15 June 1948 (CANB, NSW). Central North: 22.5 miles [37 km] E of Soudan Outstation, on Barkley [Barkly] Hwy, *Nicholls 867*, 14 June 1968 (NT, NSW); 8 km NE Austral Downs HS, *Henry 275*, 28 July 1971 (NT, NSW).

QUEENSLAND: Burke: 6.2 km N of Barkly Hwy on Burketown road, *Hill 1038, Johnson & Benson*, 08 Aug 1984 (NSW).

WESTERN AUSTRALIA: Hall: Cattle Tank, 101 km NE of Halls Creek on Nicholson road on Cattle Creek, *Hill 1000, Johnson & Benson*, 03 Aug 1984 (NSW).

5. *Eucalyptus gymnoteles* L. Johnson & K. Hill, *sp. nov.*

Ab *E. microtheca* ramorum laevium distinguitur. Ab *E. barklyensi* foliis distincte pendulis tenuioribus et alabastris nunquam glaucis, etiam cortice laevi saepissime plus extensa, differt.

TYPE: WESTERN AUSTRALIA: Dampier: 4.7 km from Gibb River Road on Windjana Gorge road, *K.D. Hill 3440*. *L.A.S. Johnson & L.C. Stanberg*, 23 Nov 1988 (holo NSW, iso AD, CANB, DNA).

Tree to 15 m high. Bark persistent to larger branches, grey, shortly fibrous-flaky ('box' bark), smooth, white above. Smaller branches and foliage pendulous. Adult leaves disjunct, similifacial, dull grey-green (not pruinose), narrow- to broad-lanceolate, obtuse or rounded, 6–18 cm long, 1.0–3.1 cm wide, 0.22–0.31 (rarely to 0.34) mm thick (when dry); petioles to 1.4 cm long. Lateral veins closely spaced, regular, at 40°–50° to midrib; reticulum even; oil glands small, sparse; intramarginal vein continuous, distinct, 0.3–1.0 mm from margin. Inflorescences aggregated, pseudo-terminal or axillary; umbellasters 3–7-flowered. Peduncles slender, terete, 2–8 mm long. Pedicels distinct, slender, 1–3 mm long. Mature buds ovoid, c. 4 mm long, c. 2.5 mm diam. Calyptra hemispherical, $\pm$ apiculate, c. 1/2 as long as hypanthium. Fruits obconical, usually slightly distally constricted, 3–4-locular, 3–4 mm long, 3–4 mm diam. Calyptra scar and stemonophore continuous, flat, c. 0.2 mm wide. Disc depressed at 45° to almost 90°, 0.5–1.0 mm wide. Valves broadly triangular, obtuse, basally enclosed, tips $\pm$ rim level, raised at c. 45°. Figs. 7, 9.



Fig. 6. *E. barklyensis*, showing small stature and low, spreading habit. Hill 3565.

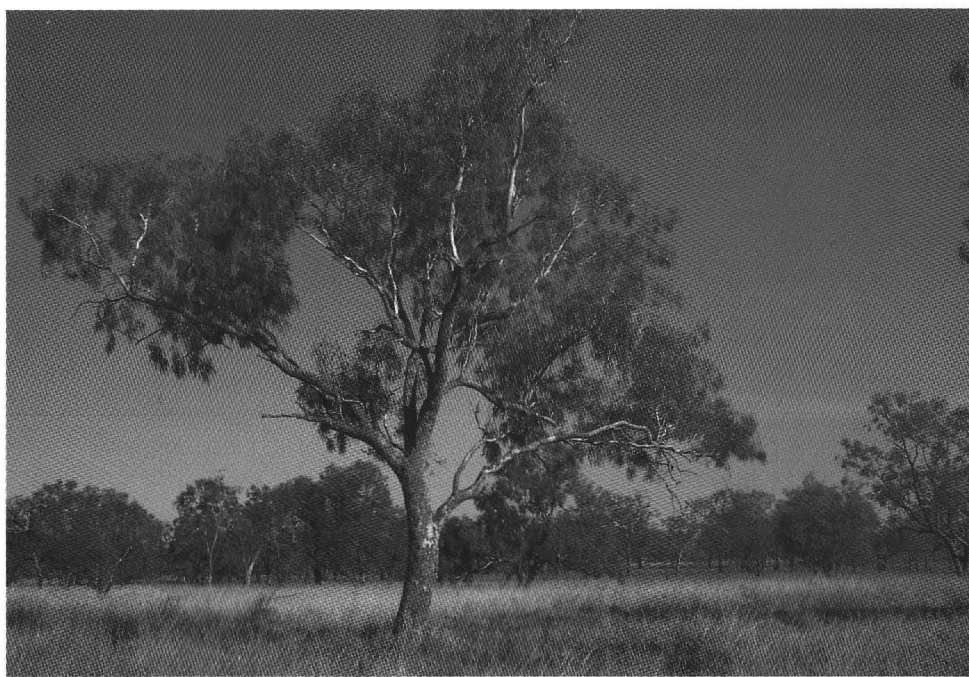


Fig. 7. *E. gymnoteles*, showing large stature, erect smooth limbs and pendulous leaves. Photo K. Hill, Meda River.

E. gymnoteles is distinguished from *E. microtheca* by the smooth branches. It differs from *E. barklyensis* in being a larger tree with distinctly pendulous foliage and thinner leaves. The rough bark is generally darker, and the smooth bark more extensive than in *E. barklyensis*. Buds are also not glaucous, whereas those of *E. barklyensis* may sometimes be glaucous. Habitat differs in that this species occurs mainly on larger rivers and *E. barklyensis* is limited to minor drainage lines and associated floodout flats.

It appears to be separated by a considerable distributional gap from *E. microtheca*, and also apparently from *E. victrix* to the south-west. The range does meet that of *E. victrix* in country to the north of the Great Sandy Desert (south and south-west of

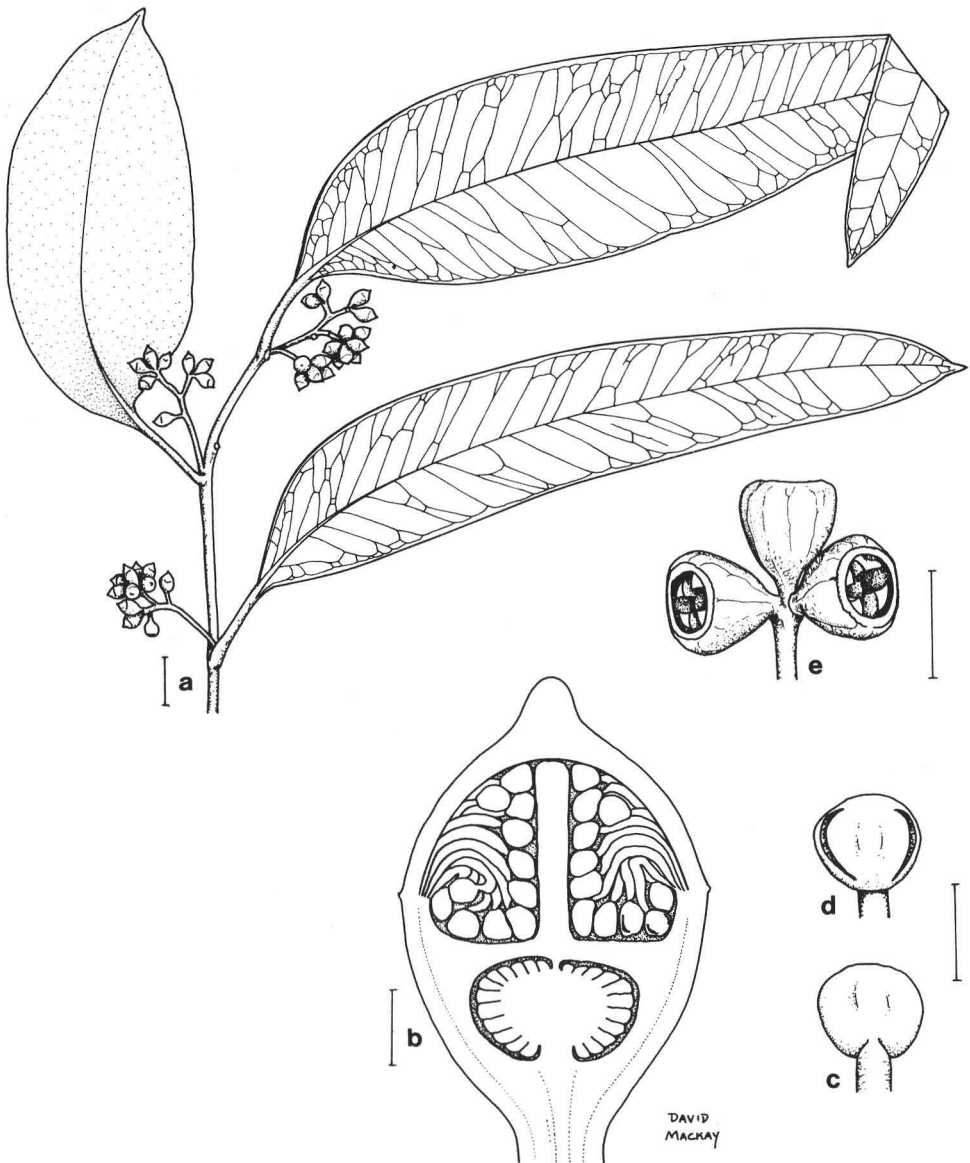


Fig. 8. *E. barklyensis*. a, adult leaves and buds; b, transverse section of bud; c, d, anther; e, fruits (all from Hill 885). Scale bar: a = 1 cm, b = 1 mm, c, d = 0.5 mm, e = 5 mm.

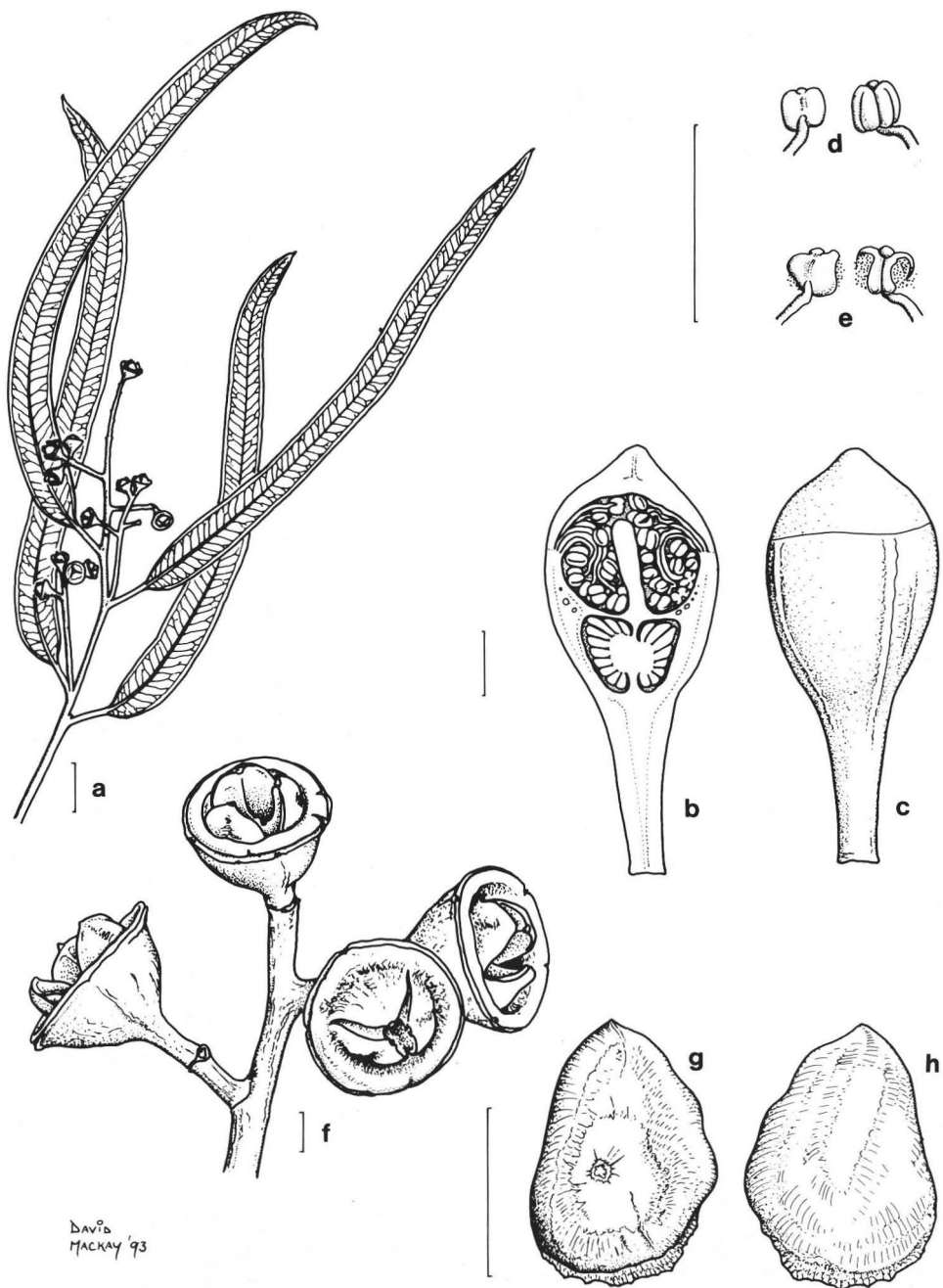


Fig. 9. *E. gymnoteles*. a, adult leaves and fruits; b, bud; c, transverse section of bud; d, e, anther; f, fruits; g, h, seed (a, f, g, h from Blaxell 88/009, b, c, d, e from Edwards & Gardner 1613). Scale bar: a = 1 cm, b, c, e, f, g, h = 1 mm, c, d = 0.5 mm.

Halls Creek), where intergrades are known. Such intergrades have a smaller extent of rough bark than pure *E. gymnoteles*.

E. coolabah shows similar bark to *E. gymnoteles*, but can be distinguished by the longer calyptra and the prominently widely spreading valves in fruit. The ranges are very widely separated, and the bark similarity may be a parallel development.

DISTRIBUTION: Western Australia: southern Kimberley district, on the May, Meda and Fitzroy River systems, from around Derby east at the same latitudes to the Northern Territory border. Northern Territory: Sturt Creek and tributaries, immediately adjacent to the W.A. border (Figs. 2, 10).

ECOLOGY: Locally abundant in savanna woodlands on heavy soils on flood plains of larger rivers.

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

The epithet is from the Greek *gymnos*, naked, and *telos*, *teleos*, an end, referring to the smooth branches. The epithet should be pronounced (in an English context) with the stress on the short 'o', as in the comparably formed name Aristoteles.

SELECTED SPECIMENS (from 10 examined): **WESTERN AUSTRALIA:** Fitzgerald: 7 km E of Mornington HS. towards Fitzroy River, *Brooker* 7753, 28 Oct 1982 (CANB, NSW); Minnie River (Lower Fitzroy), S of Derby, *Brooker* 11000, 18 Apr 1992 (CANB, DNA, NSW, PERTH); W of Fitzroy Bluff, E of river, *Brooker* 7754, 29 Oct 1982 (CANB, NSW); Mary River crossing on Northern Hwy, *Hill* 985, *Johnson & Benson*, 02 Aug 1984 (NSW). **Dampier:** Goody Goody, *Fitzgerald* s.n.,

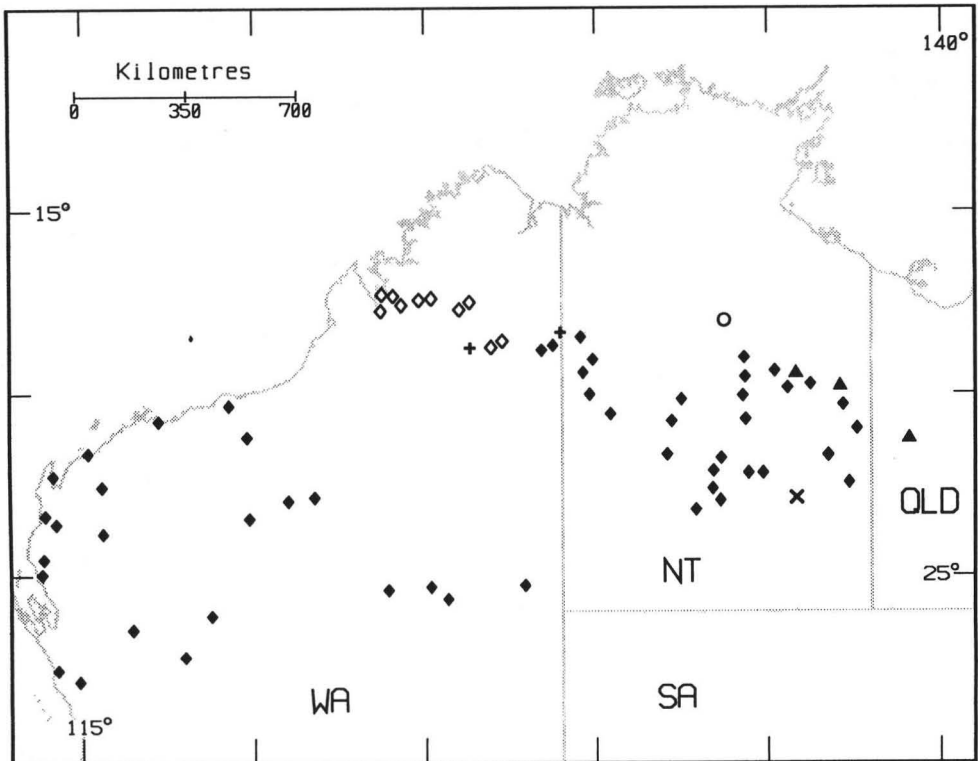


Fig. 10. Distribution of *E. gymnoteles* (open diamond), *E. victrix* (solid diamond), *E. gymnoteles* -*victrix* intergrades (plus), *E. coolabah* subsp. *arida* -*E. victrix* intergrades (cross), *E. barklyensis* -*victrix* intergrades (triangle), *E. cyanoclada* -*victrix* intergrades (circle).

Apr 1905 (NSW304371); May (near Derby), *Fitzgerald* 633, May 1905 (NSW); Meda homestead, May R, *Johnson* 2101, 27 Aug 1967 (NSW); 55.5 km NE of Derby on Gibb River road, at the May River, *Blaxell* 88/009 & *Wrigley*, 14 July 1988 (NSW, PERTH); Lennard River, Kimberley, *Gardner & Edwards* 1613, 1921 (PERTH, NSW).

6. *Eucalyptus helenae* L. Johnson & K. Hill, sp. nov.

Inter species subsectionis *Microthecosarum* combinatione characterum sequentium distinguitur: fructus magni distaliter late expansi in pedicellis longis, discus latus, folia magna crassaque, rami secundarii et aliquando primarii laeves.

TYPE: NORTHERN TERRITORY: Barkly Tableland: 26.2 km from Brunette Downs homestead on Rockhampton Downs road, *K.D. Hill* 1017, *L.A.S. Johnson & D. Benson*, 05 Aug 1984 (holo NSW, iso CANB, DNA, PERTH)

Tree to 8 m high. Bark persistent for lower 2/3 or to larger branches, dark grey, shortly fibrous-flaky ('box' bark), smooth, white above. Adult leaves disjunct, simifacial, thick, dull green, broad-lanceolate, obtuse or acute, 8–18 cm long, 1.2–4.5 cm wide, 0.33–0.40 mm thick (when dry); petioles thick, 0.6–1.5 cm long. Usually not pruinose. Inflorescences aggregated, pseudo-terminal or axillary; umbellasters irregular, to 11-flowered. Peduncles terete, 0–16 mm long. Pedicels terete, 2–5 mm long. Mature buds pyriform to ovoid, 4–6 mm long, 3–4 cm diam. Calyptra hemispherical, sometimes apiculate, 1/3 to 1/2 as long as hypanthium. Fruits broadly campanulate, 3–5-locular, 4–5 mm long, 6–8 mm diam.; hypanthium distally incurved but splitting and spreading as fruit opens at maturity. Calyptra scar flat, 0.2–0.4 mm wide. Stemonophore flat, 0.2–0.4 mm wide. Disc depressed at $\pm 45^\circ$, 1.5–2.5 mm wide. Valves broadly triangular, obtuse, basally $\pm$ enclosed, tips exerted, raised at 45° – 60° . Seeds glossy, yellow-brown or pale brown, rounded, elliptical, regularly shallowly reticulate (almost smooth); hilum ventral. Chaff pale brown. Fig. 11.

E. helenae is distinguished by the large, flared fruits with long pedicels, the broad disc, the large buds, the large thick leaves, and the smooth outer branches. Blake (1953) confused this species with *E. cyanoclada*, which occurs on different sites to the west and north of *E. helenae*, and differs in the entirely rough bark (except in occasional, possibly hybrid, individuals), thinner leaves, and pruinosity.

DISTRIBUTION: Northern Territory: This species is restricted to the small, closed drainage systems of the western and central Barkly Tableland (Figs. 2, 5), not, however, occurring on the Lake Woods drainage system. Some intergradation with *E. cyanoclada* occurs to the south and east of Lake Woods.

ECOLOGY: Locally abundant in heavy, grey cracking clay soils around semi-permanently wet areas, forming woodland patches in otherwise grassland country.

CONSERVATION STATUS: Locally abundant, not presently considered to be at risk.

The epithet is from the Latinised Greek *Helena*, in reference to the old pastoral station name 'Helen Springs'. Being thus derived, no 'i' is to be inserted before the genitive termination '-ae'. The stress is on the first syllable.

SELECTED SPECIMENS (from 7 examined): NORTHERN TERRITORY: Barkly Tableland: Helen Springs station, 41.8 km NE of homestead on Barkly Stock Route, *Hill* 883, *Johnson & Benson*, 13 Aug 1984 (NSW); 3 miles [4.9 km] E of Helen Springs boundary, Barkly Stock Route, *Newton* A6, 19 Feb 1964 (NT, NSW); halfway between Brunette Downs and Rockhampton Downs, ($18^\circ 42'S$, $135^\circ 30'E$), *S.T. Blake* 17836, 18 May 1947 (NSW, BRI). 51.1 km from Brunette Downs homestead on Rockhampton Downs road, *Hill* 1018, *Johnson & Benson*, 05 Aug 1984 (NSW).

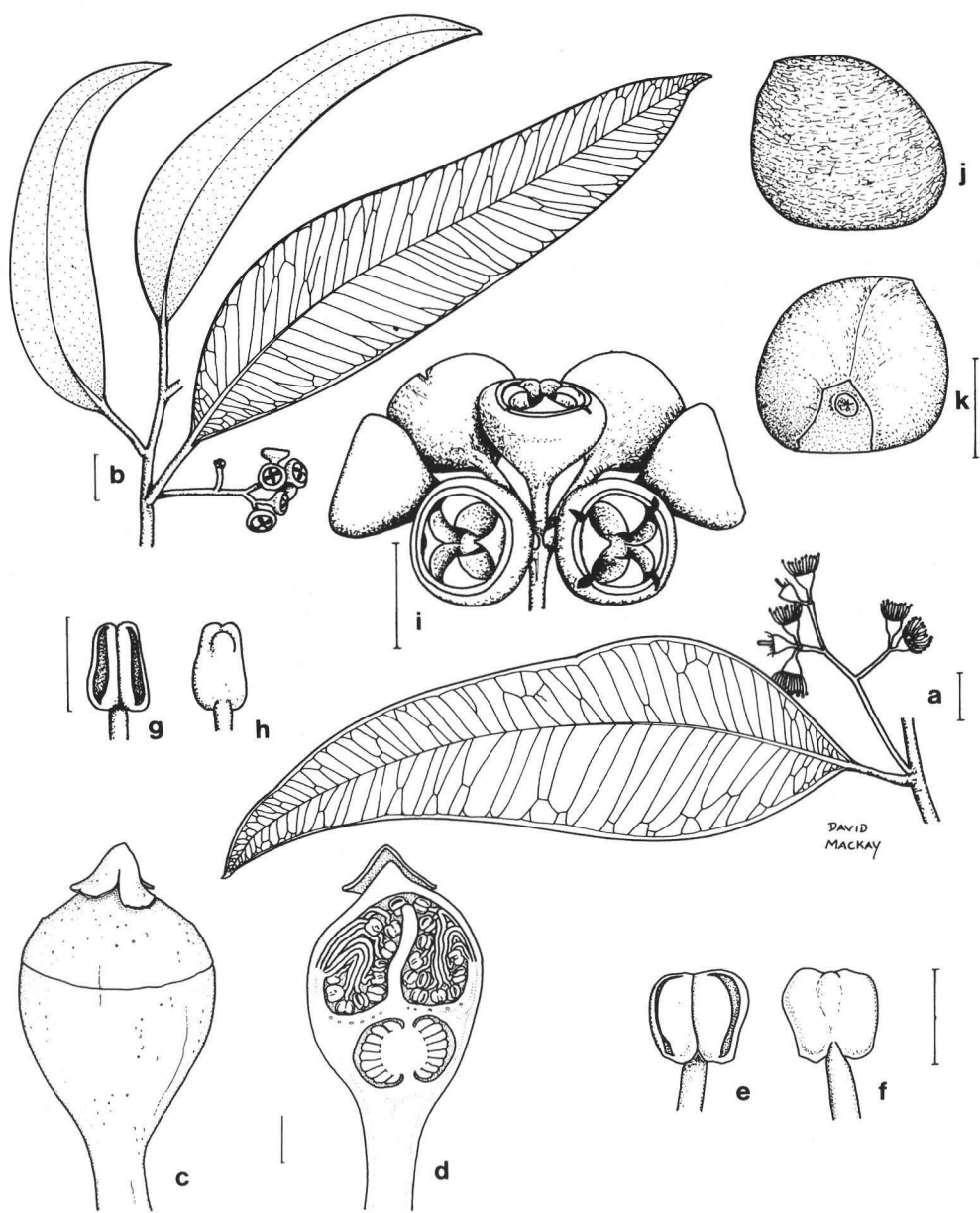


Fig. 11. *E. helenae*. a, adult leaves, buds and flowers; b, adult leaves and fruits; c, bud; d, transverse section of bud; e, f, g, h, anthers; i, fruits; j, k, seed (a, b, g, h, i, j, k from Hill 1018, c, d, e, f from Hill 1017). Scale bar: a, b = 1 cm, c, d, j, k = 1 mm, e, f, g, h = 0.5 mm, i = 5 mm.

7. *Eucalyptus coolabah* Blakely & Jacobs

Blakely & Jacobs in Blakely (1934: 245)

TYPE CITATION: Blakely cites several figures from Maiden (Crit. Revis. *Eucalyptus* 2, Plate 52), and a number of localities in N.S.W., Qld, S.A., N.T. and W.A.

TYPE: NEW SOUTH WALES: Bogan R., near Coolabah, J.H. Maiden & J.L. Boorman, 26 Mar 1904 (Lecto: NSW 33887, designated by Johnson & Hill, 1990). Illustrated by Maiden (Crit. Revis. *Eucalyptus* 2, Plate 52, fig 18c). This specimen best illustrates the diagnostic features of the species, and was cited by Blake (1953) as the type, although he did not formally designate it the type.

Tree to 18 m high, often less, sometimes with several stems. Bark persistent on trunk and often on lower branches, shortly fibrous and flaky, grey with paler patches ('box' bark), smooth, white above. Juvenile leaves disjunct, narrow-to broad-lanceolate, c. 5 cm long, 0.5–1.5 cm wide, petioles 0.4–0.6 cm long. Adult leaves disjunct, simlifacial, dull green to strongly glaucous, thin to thick, broad to narrow-lanceolate, obtuse or acute, 5–18 cm long, 0.5–2.7 cm wide, 0.15–0.40 mm thick (when dry); petioles 0.5–1.7 cm long. Inflorescence aggregated, pseudo-terminal or axillary; umbellasters ± irregular, to 11-flowered. Peduncles terete, 0–8 mm long. Pedicels 1–5 mm long. Mature buds ovoid, ± apiculate, 3–5 mm long, 2–4 mm diam. Calyptra conical or hemispherical and apiculate, 1–2 times as long as hypanthium. Fruits obconical or campanulate, distally ± constricted, 3–4-locular, 3–5 mm long, 3–6 mm diam. Calyptra scar and stemonophore flat, <0.2 mm wide. Disc ± vertically depressed, < 0.3 mm wide. Valves broadly triangular, obtuse, basally enclosed, tips usually prominently exerted, raised at c. 60–90°. Seeds semi-glossy, pale brown, rounded, elliptical, regularly shallowly reticulate (almost smooth); hilum ventral. Chaff pale brown.

E. coolabah is distinguished within the series by the persistent bark on the trunk and lower branches, with smooth, white middle and outer branches. The calyptra is relatively long and conical, pedicels are medium to long and relatively robust, and fruits are hemispherical with valves strongly exerted and spreading.

Three subspecies may be distinguished on the basis of adult leaf morphology. Intergradation is extensive between subspecies *coolabah* and both subsp. *excerata* and subsp. *arida*, and limited intergradation is known between subsp. *arida* and subsp. *excerata* (Fig. 12). Intergrading populations frequently show extensive segregation, yielding a full range of variation between the limits imposed by the parent taxa. In all subspecies, such segregation is absent in populations in areas away from the broad contact zones.

DISTRIBUTION: *E. coolabah* is the south-eastern 'coolibah', extending south, east and north-east of Alice Springs. It is the only member of the group in South Australia, New South Wales and the major part of Queensland, extending north to the divide between the inland and Gulf river systems.

The spelling 'coolabah' must be retained for the epithet, although 'coolibah' is now commonly used for the word as adopted into English.

Key to the subspecies

- 1 Buds, fruits and twigs pruinose 7B. subsp. **coolabah**
- 1* Buds, fruits and twigs not pruinose
 - 2 Calyptra conical, acute; leaves thin (less than 0.27 mm thick when dry) 7A. subsp. **excerata**
 - 2* Calyptra rounded, obtuse; leaves thick (more than 0.29 mm thick when dry) 7C. subsp. **arida**

7A. *Eucalyptus coolabah* Blakely subsp. *excerata* L. Johnson & K. Hill
Johnson & Hill (1990: 66)

TYPE: QUEENSLAND: South Kennedy: Blowhard Creek, Charters Towers to Clermont road, K.D. Hill 1185 & L.A.S. Johnson, 21 Aug 1984 (holo NSW, iso BRI, CANB MEL).

Adult leaves thin (0.15–0.27 mm thick when dry), green, non-glaucous (i.e. without pruinosity, although they may be dull and greyish). Buds and fruits non-glaucous. Calyptra acute, slightly longer than hypanthium. Anthers small.

Distinguished from subsp. *coolabah* by the non-glaucous leaves, buds and fruit, and from subsp. *arida* by the thin-textured adult leaves and the acute calyptra.

DISTRIBUTION: Restricted to the east of the species' range, from the upper Darling River system (Moree to Goondiwindi) north through the western Darling Downs into the Fitzroy River system north of Rockhampton, and on to east of Einasleigh (Figs. 2, 12).

ECOLOGY: Restricted to eastern drainage systems for the most part in the north of the range, although extending into some western headwaters. In these areas, this subspecies occurs in rolling country with narrower, somewhat sandier floodplains, and subspecies *coolabah* occurs on the flat, heavy soil plains.

Hybrids are known with *E. conica*, *E. crebra*, *E. largiflorens*, *E. melanophloia*, *E. pilligaensis* and *E. populnea* subsp. *populnea*.

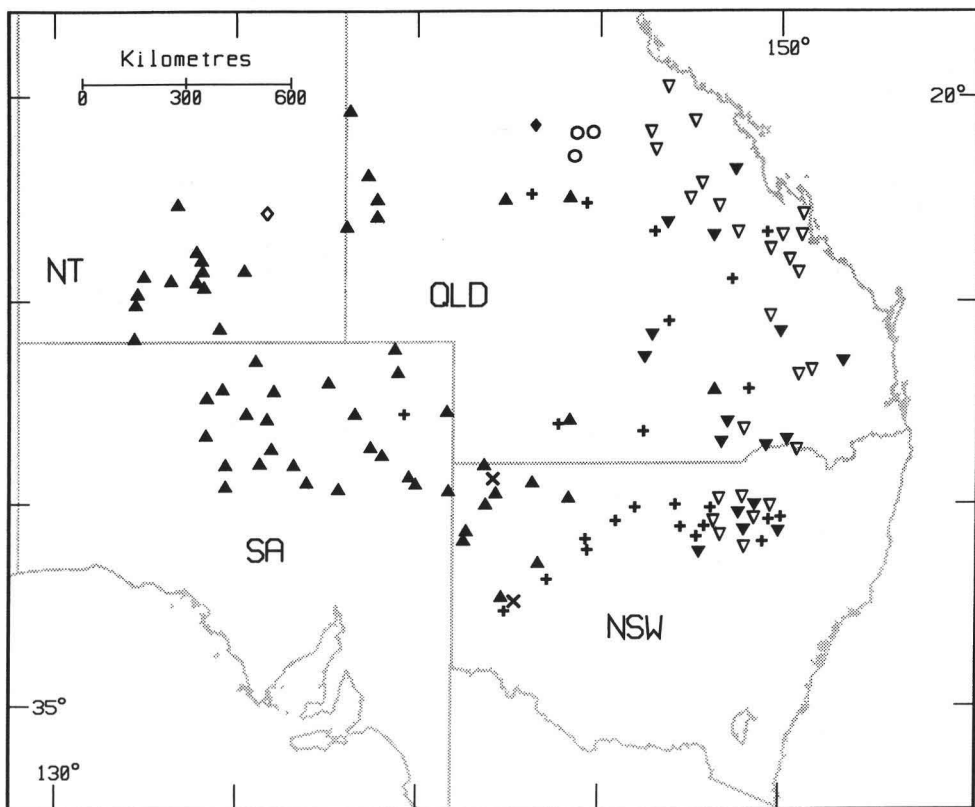


Fig. 12. Distribution of *E. coolabah* subsp. *coolabah* (plus), subsp. *excerata* (inverted open triangle), subsp. *arida* (triangle), subspp. *arida-excerata* intergrades (circle), subspp. *coolabah-excerata* intergrades (inverted solid triangle), subspp. *arida-coolabah* intergrades (cross), *E. coolabah* subsp. *arida*-*E. victrix* intergrades (open diamond), *E. coolabah* subsp. *arida*-*E. microtheca* intergrades (solid diamond).

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

SELECTED SPECIMENS (from 41 examined): NEW SOUTH WALES: North Western Plains: New Angle-dool, *Paddison s.n.*, Feb 1900 (NSW304391); near McIntyre River, Boggabilla, *Johnson & Constable*, 09 Nov 1954 (NSW); Mookoo, [near] Mungindi, *Cabbage 4370*, 19 Sep 1922 (NSW); 16 km S of Burren Junction on road to Pilliga, *Waterhouse 1748*, 05 Jan 1973 (UNSW, NSW); Collarenebri to Walgett, *Wynne s.n.*, 07 Aug 1954 (NSW304394).

QUEENSLAND: North Kennedy: Reid, [30 miles S] Townsville, *Daley 5*, 24 Feb 1912 (NSW); near Bowen, *Blake 18527*, 24 Sep 1950 (BRI, NSW). South Kennedy: 1 km S of Cape River crossing on Charters Towers – Clermont road, *Rodd 4556 & Hardie*, 25 Apr 1985 (NSW, BRI, CANB); 128 km S of Flinders Hwy on Clermont road, *Brooker 5313*, 29 July 1976 (CANB, NSW). Leichhardt: c. 50 miles [82 km] NNE of Capella Township, Leichhardt District, *Story 63 & Yapp*, 23 June 1962 (CANB, NSW); 3 miles [4.9 km] N of Cooroorah homestead, Leichhardt District, *Story 201 & Yapp*, 22 July 1962 (CANB, NSW); 3 km N of Duaringa on road to Marlborough, *Rodd 4400 & Hardie*, 15 Apr 1985 (NSW, BRI); Palm Tree Creek, 20 km N of Taroom along road to Glenhaughton, Leichhardt District, *Crisp 2880*, 07 June 1977 (CBG, BRI, CANB, NSW); Dawson at Taroom, Leichhardt District, *Speck 1956*, 25 Apr 1964 (CANB, NSW). Port Curtis: Byfield, 40 miles [65 km] NE of Rockhampton, *Flecker 11359*, 01 June 1947 (NSW); Rockhampton, *Maiden*, May 1909 (NSW); 4 miles [6.5 km] S of Wowan, Port Curtis District, *Speck 2013*, 18 May 1964 (CANB, NSW); Callide Creek, 31 km NNW of Biloela on Mt Morgan road, *Rodd 4379 & Hardie*, 14 Apr 1985 (NSW, BRI, CANB). Maranoa: Bumble station, 70 miles [113 km] N of Mungindi, *Cabbage 4401*, 21 Sep 1922 (NSW). Darling Downs: 9.4 miles [15.1 km] ENE of Chinchilla, *Chippendale 586 & Johnston*, 10 June 1968 (CANB, NSW); 28.5 W of t/o to Chinchilla from intersection N of Jandowie, *Brooker 7312*, 06 Mar 1982 (CANB, NSW); Goondiwindi, *Mcintyre s.n.*, 18 Jan 1912 (NSW301275).

7B. *Eucalyptus coolabah* Blakely & Jacobs subsp. *coolabah*

E. raveretiana F. Mueller var. *jerichoensis* Domin (1928: 464).

TYPE CITATION: 'Queensland: bei Jericho bestandbildend, besonders in den Savannenwäldern längs des Baches (Domin iii. 1910)'.

TYPE: *Domin 9183* (holo PR).

Adult leaves thin (0.18–0.28 mm thick when dry), glaucous. Calyptra pointed, about as long as or slightly longer than hypanthium. Twigs, buds and fruits pruinose.

DISTRIBUTION: This subspecies occupies the centre of the range, from around Wilcannia and east to the Macquarie Marshes, north through the black soil plains country of the Warrego, Bulloo and Barcoo river systems to Winton (Figs. 2, 12). Usually on flat sites on heavy, grey cracking soils. Some specimens (e.g. *Crisp 550* from Cooper Creek) agreeing with subsp. *coolabah* are from localities within the general areas of the other subspecies. This may result from recent or earlier transport of seed along river courses.

Many hybrids are recorded between subsp. *coolabah* and other species. A number of these were named as separate species or varieties in the past, and the identities of many of these were resolved by Pryor & Johnson (1971). Names are listed here with their hybrid parents. Hybrids are known with *E. intertexta*, *E. largiflorens*, *E. melanophloia* (*E. X bucknellii* Cabbage; *E. X rivularis* Blakely; *E. X yagobiei* Maiden), *E. ochrophloia* and *E. populnea* subsp. *populnea* (*E. populnea* F. Muell. var. *obconica* (Blakely) Cameron).

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

SELECTED SPECIMENS (from 38 examined): NEW SOUTH WALES: North Western Plains: Bogan River, *Maiden & Boorman s.n.*, 26 Mar 1904 (NSW33887); Bourke, next to cemetery, beside Cobar road, *Rodd 4581 & Hardie*, 29 Apr 1985 (NSW, BRI, CANB); Darling near E Toorale, *Wells 60 & Curtis*, 25 Mar 1973 (CANB, NSW); Macquarie Marshes – Peter McLellans property, Blue Light, 40 km S of Carinda, *Ramm s.n.*, 28 May 1987 (NSW340056); Sandy Camp Stn 10 miles W of Quambone, *Chippendale NSW 19216 & Constable*, 22 May 1951 (NSW); Boolcarrol [c. 20 miles N of Wee Waa],

Hay 25, Dec 1911 (NSW). North Far Western Plains: Nangara, Acres Billabong, 17 km E of Tilpa, *Ferguson s.n.*, 22 Dec 1974 (NSW301285); 10 km E of main Darling Crossing at Wilcannia, *Hill 825, Johnson & Benson*, 06 July 1984 (NSW, AD, CANB, PERTH). South Far Western Plains: Kinchega National Park, [W of] Menindee, *Ryan 150 & Everley*, 02 June 1969 (NSW); Darling River, near old Kinchega homestead site, Kinchega National Park, Menindee, *Wannan 11479 & Waterhouse*, 27 Jan 1981 (UNSW, AD, NSW).

QUEENSLAND: Gregory North: creek near Winton, *Jackson 6 A*, Aug 1918 (NSW); Diamantina, *Bailey s.n.*, June 1892 (NSW301289). Mitchell: Muttaborra, *White s.n.*, Apr 1919 (NSW301290). South Kennedy: Native Companion Creek, 65.3 km N of Alpha, *Martensz s.n.*, 24 Apr 1978 (CANB, BRI, NSW319431). Leichhardt: Mackenzie crossing on Duaringa – Marlborough road, *Rodd 4405 & Hardie*, 15 Apr 1985 (NSW, BRI); Rolleston at Injune turn-off, *Brooker 10446*, 12 Mar 1990 (CANB, BRI, DNA, MEL, NSW). Warrego: Burenda Creek, tributary of the Warrego River, 4.1 km S of Charleville, *Martensz s.n.*, 29 Apr 1978 (BRI, CANB, NSW319430); Gilruth Plains [homestead c. 30 miles, 49 km ESE of] Cunnamulla, *Roe 419*, Feb 1941 (NSW). Maranoa: N of Surat, Waroo Shire, *Warrian 916*, 12 Apr 1991 (BRI, NSW).

SOUTH AUSTRALIA: Lake Eyre: Lake Perigunda, Cooper Creek, Lake Eyre District, *Crisp 550*, 03 June 1979 (CBG, NSW).

7C. *Eucalyptus coolabah* Blakely & Jacobs subsp. *arida* (Blakely) L. Johnson & K. Hill
Johnson & Hill (1990: 66)

BASIONYM: *Eucalyptus coolabah* Blakely & Jacobs var. *arida* Blakely (1934: 246).

TYPE CITATION: 'Desert country from Cooper's Creek, S.A., to Doraminna, N.T.' ('Doraminna' is a typographical misinterpretation of Ooraminna).

TYPE: SOUTH AUSTRALIA: Kopperamana, Cooper Creek, *H. Basedow 17*, Nov 1919 (holo NSW 10046, iso BRI).

Although not so designated in the protologue, this specimen was selected and annotated as type by Blakely at NSW.

Adult leaves thick (0.29–0.40 mm thick when dry), non-glaucous. Buds and fruits non-glaucous. Calyptra rounded or broadly pointed, as long as hypanthium. Adult and juvenile leaves are also often relatively broader in subsp. *arida* than in the other subspecies.

Some intergradation with *E. victrix* appears to occur to the east and north-east of Alice Springs. Hybrids are known with *E. intertexta*.

DISTRIBUTION: The western subspecies, widespread in northeastern South Australia, extending into far north-western New South Wales, south-eastern Northern Territory and western Queensland (Figs. 2, 12).

ECOLOGY: This subspecies is often on sandy or gravelly creek lines through stony or sandy desert country, and is abundant through the 'Channel Country' along Coopers Creek.

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

SELECTED SPECIMENS (from 68 examined): NEW SOUTH WALES: North Far Western Plains: Sandy Creek, 10.2 km S of Olive Downs homestead on Jump Up Loop Road, NNW of Tibooburra in, *Coveny 13462, Savio & Wiecek*, 02 Sep 1989 (NSW, AD, CANB); 9.5 km S Delalah House – Dribbling Bore, *Pickard 2051*, 25 Mar 1973 (NSW); Paroo floodplain, Nocoleche Nature Reserve, 15 km S of Wanaaring, *Porter 025*, 03 Dec 1988 (NSW); c. 123 km N of Yanco Glen between Joulmie and Tindara, *Brooker 6160*, 24 Mar 1979 (CANB, NSW); Wilcannia, *Morris 1073*, 27 Jan 1924 (NSW). South Far Western Plains: Menindee, *Blake s.n.*, 02 Aug 1950 (BRI, MO, NSW208795).

NORTHERN TERRITORY: Central South: Heath Road, Alice Springs, *Hill 3238, Johnson & Stanberg*, 07 Nov 1988 (NSW); Deep Well Road 12 miles [19.7 km] S Alice Springs, *Nelson 1611*, 21 Dec 1967

(NT, NSW); Ooraminna rockhole, *Chippendale* NT 3216, 04 July 1955 (NT, NSW); 40 miles [65 km] SSE Ringwood homestead, *Taylor* 1, 23 Feb 1971 (NT, NSW); Tempe Downs, c. 170 km WSW of Alice Springs, *Schneider s.n.*, July 1968 (AD, NSW301395); 59.8 km E of Curtin Springs on Alice Springs – Ayers Rock road, *Hill* 857, *Johnson & Benson*, 10 July 1984 (NSW); 57.6 km W of Stuart Hwy on Victory Downs road, *Hill* 3203 & *Stanberg*, 05 Nov 1988 (NSW, DNA).

QUEENSLAND: Gregory North: on Carandotta, SE from Urandangie, Gregory North District, *Blake* 10195, 16 Nov 1935 (BRI, CANB, NSW); Glenormiston [Georgina, W of Boulia], Gregory N District, *Boyle s.n.*, 28 Jan 1935 (BRI, NSW301356). Mitchell: 83 km E of Winton – Hughend [? Hughenden] road towards Muttaborra, *Brooker* 7860, 07 Dec 1982 (CANB, NSW). Warrego: 108 km S Quilpie on the Thargomindah road, *Turner* 461, 08 Mar 1981 (CANB, CBG, NSW).

SOUTH AUSTRALIA: Eyre: on one of the springs near Springs Hut (on a spring with Palms) Dalhousie Springs 77 mls [123 km] N of Oodnadatta, *Symon* 3273, 12 June 1965 (AD, K, NSW); 34 km along track to Moomba from turn off Birdsville Track 132 km S of Birdsville past Koonchera Dune, *O'Leary s.n.*, Oct 1985 (NSW301361); Poonina waterhole, Lake Eyre Basin, *Weber* 9136, 05 Sep 1986 (AD, NSW); creekline S of Welbourn Hill Stn, 35 miles [57 km] N of Mt Willoughby Stn, *Symon* 3354, 18 Feb 1965 (AD, K, NSW); rocky valley, 16 miles [26.5 km] W of the SA – QLD border, N of the Cooper and between Innamincka and Nappa Merrie Stn, *Symon* 5764, 19 Aug 1968 (AD, CANB, NSW); Neales, at Oodnadatta road crossing, *Hill* 845, 846, *Johnson & Benson*, 08 July 1984 (NSW); Paisley Creek, c. 50 km S of William Creek on Marree road, *Hill* 842, *Johnson & Benson*, 08 July 1984 (NSW); along creek line 35 miles [57 km] N of Moolawatana Stn, *Symon* 5866, 21 Aug 1968 (AD, NSW); c. 15 km SE of Coward Springs Railway Station along Margaret R, *Chorney* 971, 02 Oct 1978 (AD, NSW); Pole Creek, 42 km W of Marree on Oodnadatta road, *Hill* 840, *Johnson & Benson*, 08 July 1984 (NSW).

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

Inter species subsectionis *Microthecosarum* combinatione foliorum crassorum non pruinorum, fructuum sessilium vel subsessilium valvis exsertis angulatim incurvis et corticis laevis basi aliquando excepto distinguitur.

TYPE: NORTHERN TERRITORY: 16.3 km N of Tea Tree Well roadhouse on Stuart Highway, (22°00'S, 133°30'E), *K. Hill* 870, *L. Johnson & D. Benson*, 12 July 1984 (holo NSW; iso DNA, FRI, PERTH).

Eucalyptus coolabah Blakely & Jacobs var. *rhodoclada* Blakely (1934: 246).

TYPE: cited as 'W.A. — Milly's Soak, near Cue, W.F. (sic) Fitzgerald, 9/03.' The holotype is NSW 33881.

Spreading tree to 18 m high, sometimes with several stems. Bark smooth, white, sometimes with a persistent grey shortly fibrous-flaky ('box' bark) stocking to 1, rarely 3 m. Juvenile leaves disjunct after about node 15, lanceolate to broad-lanceolate, to 7 cm long, to 1.2 cm wide; petioles 4–6 mm long. Adult leaves disjunct, simlifacial, dull green, thick, broad to narrow lanceolate, obtuse to acute, 6–18 cm long, 0.8–3.6 cm wide, 0.31–0.44 mm thick (when dry); petioles 0.7–1.8 cm long. Inflorescence aggregated, pseudo-terminal or axillary; umbellasters ± irregular, to 11-flowered. Peduncles terete, 0–10 mm long. Buds and fruits sessile, rarely on slender pedicels to c. 2 mm long, sometimes glaucous. Mature buds ovoid, apiculate, 4–5 mm long, 2–3 mm diam. Calyptra conical or rarely hemispherical and apiculate, 2/3 as long to as long as hypanthium. Fruits obconical or campanulate, variably distally constricted, 3–4-locular, 3–6 mm long, 3–6 mm diam. Calyptra scar and stemonophore flat, to 0.2 mm wide. Disc ± vertically depressed, to 0.5 mm wide. Valves broadly triangular, obtuse, basally enclosed, tips exserted, raised at c. 45–60°. Seeds semi-glossy, pale brown, rounded, elliptical, regularly shallowly reticulate (almost smooth); hilum ventral. Chaff pale brown. Figs. 13, 14.

E. victrix is distinguished within the coolibah group by the fully smooth, white bark, the thick, green leaves, the sessile or shortly pedicellate fruits, and the rim-level or

more often partly exerted valves that are angled strongly inward. A short stocking of rough bark is occasionally present, but usually only in areas where the range adjoins that of a rough-barked taxon. Examples occur near Gordon Downs to the south-east of Halls Creek (near *E. gymnoteles*), and near Aileron (near *E. coolabah* subsp. *arida*). The rough bark may represent genetic influence from the other taxon, although the specimens, in all other respects, match *E. victrix*. There is also some geographic variation within *E. victrix*, larger trees with somewhat narrower leaves, longer petioles and more frequently glaucous buds occurring in the west of the range.

DISTRIBUTION: Central regions of the Northern Territory, from south of Tea Tree Well to north of Tennant Creek, and from the Western Australian border almost to and perhaps across (see under *E. barklyensis* – *E. victrix* intergrades, p. 644) the Queensland border. Extending west into Western Australia, from the northern edges of the Great Sandy Desert, south to the central Gibson Desert, west to North-west Cape and south to the Murchison River (Figs. 2, 10).

ECOLOGY: Locally abundant on flat low areas, usually on red loamy soils, often in seasonally flooded areas in mulga country, occurring more in gallery woodlands along watercourses in the far west of the range. Usually on red clay-loams but sometimes on heavier, grey clays, again more in the west of the range.

Limited intergradation occurs with *E. coolabah* subsp. *arida* around Alice Springs and with *E. gymnoteles* south of Halls Creek. Occasional hybrids are known with *E. xerothermica* in the Pilbara region.

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

The epithet is from the Latin *victrix*, the feminine of *victor*, one who conquers, in reference to the species' success under a very harsh climate.

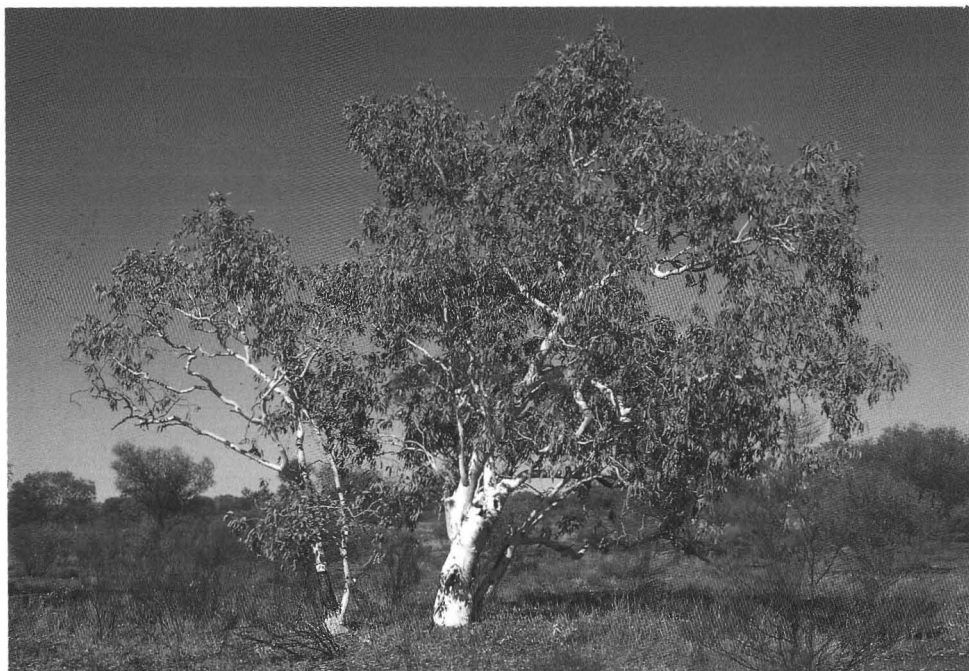


Fig. 13. *E. victrix*, showing small stature and smooth, white bark. Hill 3245.

SELECTED SPECIMENS (from 72 examined): NORTHERN TERRITORY: Victoria River: 7 miles [11.3 km] SE of Birrindudu station, *Perry* 2367, 06 July 1949 (CANB, MEL, NSW); 40 km W of Supplejack homestead, *Latz* 8123, 29 Sep 1978 (NT, NSW). Barkly Tableland: 10 km N of Meerie Waterhole, Phillip Creek station, *Strong* 53, 12 Feb 1984 (NT, NSW); 25 miles [41 km] N of Tennant Creek township, *Perry* 648, 26 Apr 1948 (CANB, NSW); 17 miles [28 km] S Alroy Downs HS, *Latz* 1819, 13 Nov 1971 (NT, NSW). Central North: 3 miles [4.9 km] S of Tanami Bore on road to Rabbit Flat & Alice Springs, *Carolin* 7925, 23 Aug 1970 (SYD, NSW); near Soudan station, *Perry* 685, 30 Apr 1948 (CANB, NSW); 47.8 km S of Tennant Creek on Stuart Hwy, *Wannan* 11448 & *Waterhouse*, 18 Jan 1981 (UNSW, DNA, NSW); Singleton, 240 miles [384 km] N of Alice Springs, *Everist* 4236, 28 Jan 1950 (BRI, NSW); 42 miles [68 km] NW Willowra HS., Boomerang WH, Lander R, *Chippendale* NT 4831, 30 July 1958 (NT, NSW); Sandover Hwy, 5 km N of No. 9 Bore,

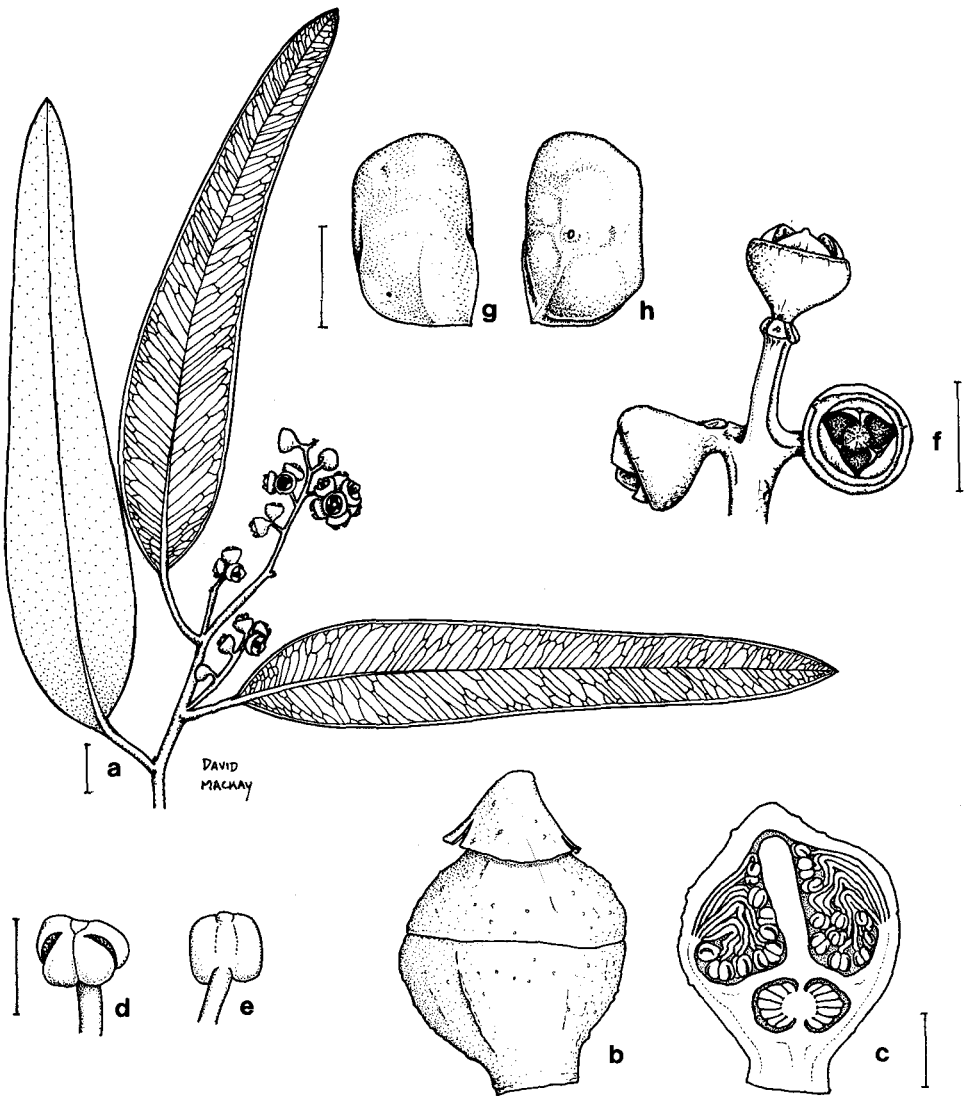


Fig. 14. *E. victrix*. a, adult leaves and fruits; b, bud; c, transverse section of bud; d, e, anther; f, fruits; g, h, seed (a, f, g, h from *Hill* 870, b, c, d, e from *Latz* 1819). Scale bar: a = 1 cm, f = 5 mm, b, c, g, h = 1 mm, d, e = 0.5 mm.

Georgina Downs station, *Strong* 597, 01 Sep 1984 (NT, NSW); Argadargada HS. paddock, *Chippendale* NT 328, 19 Sep 1954 (NT, DNA, NSW); 16.3 km N of Tea Tree Well roadhouse on Stuart Hwy, Hill 870, 871 A, B, C, *Johnson & Benson*, 12 July 1984 (NSW); 0.9 km S of Tea Tree, Hill 3245, *Johnson & Stanberg*, 08 Nov 1988 (NSW); 60 miles [96 km] from Manners Creek HS. – Tarlton Downs, *Gittins* 1967, Sep 1969 (NSW, BRI); Aileron, 133 km N of Alice Springs on Stuart Hwy, Hill 868, *Johnson & Benson*, 12 July 1984 (NSW, BRI, CANB, DNA). Central South: 142 km NW of the Stuart Hwy toward Yuendumu, *Gittins* 2232, July 1971 (NSW, BRI).

WESTERN AUSTRALIA: Hall: 6 miles NE of Gordon Downs station, *Perry* 2445, 13 July 1949 (CANB, NSW). Mueller: 17 miles [28 km] SW of Gordon Downs station, *Perry* 3187, 21 Aug 1952 (CANB, NSW). Fortescue: Highway 1 at West Strelley River, *Johnson* 9284 & *Briggs*, 26 July 1991 (NSW, CANB, PERTH); Coongan River at The Marble Bar, 4.8 km from Marble Bar township, *Johnson* 2121, 27 Aug 1967 (NSW); 30 km E of Newman – Nullagine road on Jiggalong road, *Pryor s.n.*, 20 Aug 1985 (NSW303984). Carnarvon: creek between Exmouth and Waroora HS, *Brooker* 5699, 15 Apr 1977 (CANB, AD, NSW); 27 km NE of Minilya Roadhouse on Highway 1, *Johnson* 9352 & *Briggs*, 05 Aug 1991 (NSW, PERTH); towards 'Mangaroon' at 48.0 km SE of turn off near Lyndon on Mt Augustus Road, *Johnson* 9345 & *Briggs*, 02 Aug 1991 (NSW); 12 km S of Carnarvon on hwy, Hill 395, *Johnson & Brooker*, 27 Oct 1983 (NSW). Ashburton: Fortescue, hwy from Newman to Capricornia, *Pryor*, 19 Aug 1985 (NSW). Keartland: c. 116 km E of Walgun on Lake Disappointment road, *Pryor s.n.*, 21 Aug 1985 (NSW303983); 27.6 km W of Mungilli Corner, Gunbarrel Hwy, *Brooker* 10709, 15 Apr 1991 (CANB, DNA, NSW, PERTH). Giles: c. 90 km from Warburton towards Giles, *Brooker* 10797, 17 May 1991 (CANB, AD, NSW, PERTH). Carnegie: Lake Gruszka, S side, at creek crossing, *Brooker* 10684 A, 12 Apr 1991 (CANB, AD, NSW, PERTH); between Notabilis Hill and dunes to SE; at bore, *Brooker* 10677, 12 Apr 1991 (CANB, NSW, PERTH). Austin: 54 km N of Meekatharra, upper reaches of Yalgur R, *Brooker* 9232, 16 Apr 1986 (CANB, NSW); Mt Narryer, [upper] Murchison [R], *Tyson & Helms*, Feb 1903 (NSW303991); Millys Soak, c. 19 km N of Cue, *Johnson* 2131, 30 Aug 1967 (NSW). Irwin: Murchison crossing, c. 35 miles [57 km] N of Northampton, *Johnson* 37, 10 Dec 1960 (NSW).

Intergrades

E. barklyensis – *E. victrix* (3 specimens examined):

NORTHERN TERRITORY: Barkly Tableland: 92.6 km S of Alexandria Downs, Hill 3566 & *Stanberg*, 03 Dec 1988 (NSW); 22 miles [36 km] E [or SE] of Frewina [Frewena] station, *Perry* 673, 29 Apr 1948 (CANB, NSW).

QUEENSLAND: Gregory North: 2.7 miles [4.3 km] NW of Oban station, *Perry* 796, 10 Apr 1948 (BRI).

E. coolabah subsp. *arida* – *E. coolabah* subsp. *coolabah* (4 specimens examined):

NEW SOUTH WALES: North Far Western Plains: Tibooburra district, *Couch s.n.*, Feb 1913 (NSW301405). South Far Western Plains: 16 km S of Menindee near Darling, *Perrin s.n.*, (NSW301404); flats S of Merindee [Menindee] Billabong, E side of Darling River, *Brooker* 6155, 23 Mar 1979 (CANB, NSW).

E. coolabah subsp. *arida* – *E. coolabah* subsp. *excerata* (3 specimens examined):

QUEENSLAND: Burke: 7 miles [11.3 km] E of Hughenden, *Birch* 1449 & *Correll*, 06 July 1969 (NSW). Mitchell: Prairie, 30 miles [49 km] E of Hughenden, *Cambage* 3956, 01 Sep 1913 (NSW); c. 67 km S of Hughenden on road to Muttaborra, *Clarkson* 219, 16 May 1975 (BRI, NSW).

E. coolabah subsp. *coolabah* – *E. coolabah* subsp. *excerata* (20 specimens examined):

NEW SOUTH WALES: North Western Plains: 20 miles [33 km] S of Mungindi on Moree road, *Blaxell* 1004, 29 June 1972 (NSW); 2 km NW of Pilliga on the Burren Junction road, *Turner* 419 & *Johnston*, 04 Mar 1981 (CANB, NSW); Sandy Camp station 10 miles [16 km] W of Quambone, *Chippendale & Constable*, 22 May 1957 (NSW); Namoi, Wee Waa, *Norton s.n.*, 03 July 1938 (NSW3011332).

QUEENSLAND: South Kennedy: Belyando or tributary, 82 km NNE of Alpha on road to Clermont, Rodd 4561, *Hardie & Kennedy*, 26 Apr 1985 (NSW, BRI, CANB). Leichhardt: c. 14 km S of Nebo on the Nebo – Clermont road 300 m W of Nebo Creek in a shallow drainage line, *J. Briggs* 384, 22 May 1979 (CANB, NSW). Burnett: S of Chinchilla, near Condamine River, *Blake* 19175, 27 Mar 1953 (BRI, CANB, NSW). Warrego: Mitchell Hwy 3 km SE of Augathella, Rodd 4570 & *Hardie*, 28 Apr 1985 (NSW, BRI, CANB). Maranoa: St George, Balonne, Maranoa District, *Blake* 10773, 13 Mar 1936 (BRI, NSW). Darling Downs: Goondiwindi, *Blake* 10521, 28 Feb 1936 (BRI, NSW); Talwood – Boomi road crossing of Barwon, N side, *Brooker* 7291, 04 Mar 1982 (CANB, NSW).

E. coolabah subsp. *coolabah* – *E. microtheca* (1 specimen examined):

QUEENSLAND: Burke: Flinders crossing on Richmond – Croydon road, *Hill* 1173 & *Johnson*, 20 Aug 1984 (NSW).

E. coolabah subsp. *arida* – *E. victrix* (1 specimen examined):

NORTHERN TERRITORY: Central North: Marshall Creek [Marshall River, a tributary of Hay R] c. 200 miles [330 km] E of Alice Springs, *Carolyn* 6309, 02 Aug 1967 (NSW).

E. cyanoclada – *E. helenae* (1 specimen examined):

NORTHERN TERRITORY: Barkly Tableland: 35 miles [57 km] N of Helen Springs station, *Perry* 1896, 15 Aug 1948 (CANB, NSW).

E. cyanoclada – *E. microtheca* (2 specimens examined):

NORTHERN TERRITORY: Barkly Tableland: Edwards Creek, 60 km N of Brunette Downs home-
stead, on Tablelands Hwy, *Hill* 1021, *Johnson & Benson*, 06 Aug 1984 (NSW). Darwin & Gulf:
Buchanan Hwy 20 km W of Stuart Hwy intersection, *Benson* 906, 29 June 1974 (NSW).

E. cyanoclada – *E. victrix* (1 specimen examined):

NORTHERN TERRITORY: Barkly Tableland: 34.5 miles [56 km] SE of Elliott, *Chippendale* NT 3853, 03 Oct 1957 (NT, NSW).

E. gymnoteles – *E. victrix* (2 specimens examined):

WESTERN AUSTRALIA: Hall: 20 miles [33 km] S of Nicholson station, *Perry* 2433, 13 July 1949 (CANB, NSW); 109.3 km SE of Fitzroy Crossing towards Halls Creek, *Brooker* 10783, 24 Apr 1991 (CANB, NSW, PERTH).

Hybrids

E. conica X *E. coolabah* subsp. *excerata* :

QUEENSLAND: Darling Downs: 6.4 km E of Goondiwindi on road to Yelarbon, *Johnson* 7224 & *Briggs*, 04 June 1971 (NSW).

E. coolabah subsp. *arida* X *E. intertexta* (1 specimen examined):

NORTHERN TERRITORY: Central South: Finke [without definite locality], *Kempe s.n.*, 1880 (MEL, NSW301402).

E. coolabah subsp. *coolabah* X *E. intertexta* (6 specimens examined):

NEW SOUTH WALES: North Far Western Plains: Acres Billabong, Nungara, 17 km E of Tilpa, *Ferguson s.n.*, 22 Dec 1974 (NSW301296); growing near homestead, 11 miles [17.7 km] E of Darling, Nangara, near Tilpa, *Ferguson s.n.*, Apr 1974 (NSW301297).

E. coolabah subsp. *coolabah* X *E. largiflorens* (2 specimens examined)

NEW SOUTH WALES: North Western Plains: Macquarie Marshes, 'Blue Light', 40 km S of Carinda, *Ramm s.n.*, 28 May 1987 (NSW340057). South Far Western Plains: Menindee – Darling R, *Johnson 692*, 01 Sep 1946 (NSW).

E. coolabah subsp. *coolabah* X *E. melanophloia* (14 specimens examined):

QUEENSLAND: Mitchell: Jericho, *Deane 36*, (NSW). Maranoa: Bumble Station, 70 miles [112 km] south of Mungindi, *Cabbage 4400*, 21 Sep 1922 (NSW). Warrego: Charleville, *Blake 11050*, 04 Apr 1936 (BRI, NSW).

E. coolabah subsp. *coolabah* X *E. ochrophloia* (1 specimen examined):

NEW SOUTH WALES: North Far Western Plains: Paroo, between White Cliffs and Wanaaring, *Boyd s.n.*, May 1965 (NSW301303).

E. coolabah subsp. *coolabah* X *E. populnea* subsp. *populnea* (2 specimens examined):

QUEENSLAND: Leichhardt: c. 200 m along Banana station turnoff from Moura road, 1 km SW of Moura, *Johnson 8649 & Blaxell*, 04 May 1981 (NSW). Maranoa: Roma, *Blake 10890*, 29 Mar 1936 (BRI, CANB, MO, NSW).

E. coolabah subsp. *excerata* X *E. crebra* (1 specimen examined):

QUEENSLAND: Leichhardt: near Wandoan, *Hubbard 5062*, 17 Oct 1930 (BRI, NSW).

E. coolabah subsp. *excerata* X *E. largiflorens* (1 specimen examined):

QUEENSLAND: Maranoa: Thallon, *Blake 10747 A*, 10 Mar 1936 (BRI, NSW).

E. coolabah subsp. *excerata* X *E. melanophloia* (22 specimens examined):

NEW SOUTH WALES: North Western Plains: Mookoo near Mungindi, *Cabbage 4364*, 18 Sep 1922 (NSW); 10.5 km S of Angledool on Walgett road, *Johnson 389 & Blaxell*, 08 Apr 1970 (NSW).

QUEENSLAND: Mitchell: Jericho, *Blake 10276*, 28 Nov 1935 (NSW); Bank of Barcoo River, *Blake 6750*, 14 July 1934 (NSW). Leichhardt: Mackenzie (Rockhampton to Emerald), *Leichhardt s.n.*, Mar 1847 (MEL, NSW301309). Port Curtis: west Rockhampton, *Jaggard s.n.*, 28 Nov 1911 (NSW331562). Maranoa: Thallon, *Blake 10746*, 10 Mar 1936 (BRI, CANB, NSW).

E. coolabah subsp. *excerata* X *E. pilligaensis* (2 specimens examined):

NEW SOUTH WALES: North Western Plains: Namoi River, Wee Waa, *Norton s.n.*, 03 July 1938 (NSW301305); Cuttabri, Pilliga Scrub, *Boorman s.n.*, 26 Aug 1913 (NSW301304).

E. coolabah subsp. *excerata* X *E. populnea* subsp. *populnea* (1 specimen examined):

QUEENSLAND: Darling Downs: Chinchilla, *Beasley s.n.*, July 1933 (NSW301306).

E. cyanoclada X *E. pruinosa* (1 specimen examined):

NORTHERN TERRITORY: Barkly Tableland: c. 19 km S of Elliott on old road near Overland Telegraph Line, *Johnson 2011*, 21 Aug 1967 (NSW).

E. microtheca X *E. pruinosa* (3 specimens examined):

NORTHERN TERRITORY: Darwin & Gulf: 23 km WSW of Tanumbirini homestead, *Latz 10591*, 19 Feb 1988 (DNA, BRI, NSW, PERTH). Victoria River: 59 km E of Top Springs on old Murrarji track, *Hill 1012*, *Johnson & Benson*, 04 Aug 1984 (NSW).

QUEENSLAND: Burke: Granada, about 50 miles N of Cloncurry, *Everist 5226*, 11 Apr 1954 (BRI, NSW).

E. normantonensis X *E. victrix* (1 specimen examined):

NORTHERN TERRITORY: Central North: 28.1 km S of Barrow Creek, *Hill 3247*, *Johnson & Stanberg*, 08 Nov 1988 (NSW).

E. sp. aff. argillacea X *E. victrix* (3 specimens examined):

WESTERN AUSTRALIA: Carnarvon: c. 1 km W of main road, on S boundary of Learmonth airforce base, Hill 405 & Johnson, 28 Oct 1983 (NSW, AD, CANB, MEL, PERTH)

Acknowledgements

Thanks are due to Leonie Stanberg, who has provided essential assistance through the project. David Mackay prepared the illustrations with his usual skill and accuracy. Our colleague in the overall project, Don Blaxell, has contributed helpful discussions on many points. Ian Brooker is thanked for helpful comment on the manuscript.

References

- Bentham, G. (1867) *Flora Australiensis*, vol. 3 (L. Reeve: London).
- Blake, S.T. (1953) Botanical contributions of the northern Australia regional survey — I. Studies on northern Australian species of *Eucalyptus*. *Austral. J. Bot.* 1: 185–352.
- Blakely, W.F. (1934) *A Key to the Eucalypts* (Workers Press: Sydney).
- Chippendale, G.M. (1988) *Eucalyptus*, in A.S. George, ed., *Flora of Australia*, vol. 19 (AGPS: Canberra).
- Domin, K. (1928) Beiträge zur Flora und Pflanzengeographie Australiens. *Biblioth. Bot.* 89.
- Johnson, L.A.S. & Briggs, B.G. (1984) Myrtales and Myrtaceae — a phylogenetic analysis. *Ann. Missouri Bot. Gard.* 71: 700–756.
- Johnson, L.A.S. & Hill, K.D. (1990) New taxa and combinations in *Eucalyptus* and *Angophora* (Myrtaceae). *Telopea* 4(1): 37–108.
- Johnson, L.A.S. & Hill, K.D. (unpublished) Draft revisions of the Pryor & Johnson classification, circulated to eucalypt workers for information and discussion.
- Maiden, J.H. (1903–33) *A Critical Revision of the Genus Eucalyptus* (Govt. Printer: Sydney).
- McVaugh, R. (1968) The Genera of American Myrtaceae — an interim report. *Taxon* 17: 354–418.
- Mueller, F. (1859) Monograph of the *Eucalypti* of tropical Australia. *J. Linn. Soc., Bot.* 3: 81–103.
- Pryor, L.D. & Johnson, L.A.S. (1971) *A Classification of the Eucalypts* (ANU Press: Canberra).

Manuscript received 4 November 1993

Manuscript accepted 14 February 1994