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A revised classification for the predominantly eastern Australian *Eucalyptus* subgenus *Symphyomyrtus* sections *Maidenaria*, *Exsertaria*, *Latoangulatae* and related smaller sections (Myrtaceae).

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Abstract

A revised classification for *Eucalyptus* subgenus *Symphyomyrtus* sections *Maidenaria*, *Exsertaria*, *Latoangulatae* and five related smaller sections (*Liberivalvae*, *Racemus*, *Incognitae*, *Similares* and *Pumilio*) (herein referred to as 'MEL+5' lineage for convenience) is provided, based on evidence from a recent phylogenetic study of this group (Jones *et al.* 2016) and on observations and data from other sources, including our extensive field observations, study of herbarium collections, common garden trials and the findings of other phylogenetic studies. We recognise 153 species and 184 terminal taxa in the 'MEL+5' lineage, and classify this group into 6 sections, 23 series and 8 subseries. This new classification mainly involved the repositioning of various terminal taxa into existing higher-level taxonomic groups (sections, series and subseries), as we have attempted to achieve an accurate and useful classification while minimising taxonomic disruption of existing names. Nevertheless, nine new higher-level taxa (eight series and one subseries) are newly described. A full classification of the 'MEL+5' lineage is provided, which includes all terminal taxa, taxon authorships, type species, the natural distribution of recognised terminal taxa, and taxonomic and nomenclatural synonyms.

Introduction

Eucalypts are iconic features of the Australian landscape, dominating most forest and woodland ecosystems across the continent, where they are often important foundation species. About 850 species (Slee *et al.* 2006; Nicolle 2015) occur in a variety of habitats from desert regions to high rainfall sites, and from sea level to alpine regions, and as a variety of forms from small creeping shrubs such as *Eucalyptus vernicosa* to the tallest flowering plant in the world in *E. regnans*. As well as being ecologically significant, they are important to the economies of many countries, including Australia, since they are the main hardwoods grown in the industrial plantations of the world. Despite the ecological and economic importance of the eucalypts as a group of plants, and the importance of accurate phylogenies as a tool for understanding them, there are still many phylogenetic questions and taxonomic issues within the eucalypts that remain unresolved. At the highest taxonomic level,

the most recent informal classification of the eucalypts (Nicolle 2015), recognises three genera: *Angophora* (12 species), *Corymbia* (about 95 species) and *Eucalyptus* (about 730 species). Within *Eucalyptus,* Nicolle (2015) recognised eight subgenera, namely, the polytypic subgenera *Eudesmia* (25 species), *Symphyomyrtus* (about 470 species), and *Eucalyptus* (about 130 species), and the monotypic subgenera *Acerosa* (*E. curtisii*), *Cruciformes* (*E. guilfoylei*), *Alveolata* (*E. microcorys*), *Cuboidea* (*E. tenuipes*) and *Idiogenes* (*E. cloeziana*). This subgeneric classification largely follows Brooker (2000), the most recent *formal* classification of the eucalypts, although Brooker recognised a further two subgenera: *E.* subg. *Minutifructus* (five species), which was included in *E.* subg. *Symphyomyrtus* by Nicolle (2015), partly on the basis of Whittock *et al.* (2003), and the monotypic *E.* subg. *Primitiva* (*E. rubiginosa*), which was included in *E.* subg. *Eucalyptus* by Nicolle (2015) on the basis of their very similar morphology and previous molecular phylogenies, which indicate that *E. rubiginosa* is nested within *E.* subg. *Eucalyptus* (Steane *et al.* 2002; Ladiges *et al.* 2010).

Within the genus *Eucalyptus*, the largest subgenus, *Symphyomyrtus*, consists of about 470 species belonging to eleven sections (Nicolle 2015). The sections are mostly well-differentiated using molecular markers (Pollock *et al.* 2015; Steane *et al.* 2002, 2011) though there are some discrepancies with morphology-based classifications. The species-rich sections *Exsertaria*, *Latoangulatae* and *Maidenaria*, along with five smaller sections (*Liberivalvae*, *Racemus*, *Incognitae*, *Similares* and *Pumilio*), form a single genetic lineage in *E.* subgenus *Symphyomyrtus* (Steane *et al.* 2011 and see also below), herein referred to as the 'MEL+5' lineage for convenience. The MEL+5 lineage is naturally distributed throughout Australia, extending north to New Guinea and Timor, but with greatest species diversity in the higher-rainfall, more topographically varied parts of eastern Australia, particularly the Great Dividing Range. Most species in the lineage are woodland or forest trees, with some mallee and shrub species. The group includes Australia's most naturally widespread eucalypt, *E. camaldulensis*, and all of the 'Big Nine' species that account for 90–95% of the world's planted eucalypts (*E. tereticornis* and *E. camaldulensis* in *E.* sect. *Exsertaria*; *E. grandis, E. saligna, E. pellita* and *E. urophylla* in *E.* sect. *Latoangulatae*; and *E. dunnii, E. globulus* and *E. nitens* in *E.* sect. *Maidenaria* - Harwood 2011), including the first eucalypt to have its genome sequenced, *E. grandis* (Myburg *et al.* 2014). The group also includes other important forestry species such as *E. benthamii* and *E. viminalis* (Boland *et al.* 2006), ornamental species that have been widely cultivated around the world, such as *E. cinerea, E. gunnii, E. nicholii, E. perriniana, E. pulverulenta, E. robusta, E. scoparia* and *E. vernicosa* (Nicolle 2016a, 2016b), and unusual taxa with controversial taxonomy, including *E. michaeliana* and *E. pumila* (Slee *at al.* 2006). The MEL+5 group also includes numerous conservation-critical taxa, including the critically endangered *E. recurva*, the endangered *E. alligatrix* subsp. *limaensis*, *E. canobolensis, E. crenulata, E. gunnii* subsp. *divaricata, E. imlayensis, E. macarthurii, E. morrisbyi* and *E. paludicola*, and the vulnerable *E. aggregata, E. alligatrix* subsp. *miscella, E. benthamii, E. cadens, E. glaucina, E. hallii, E. infera, E. kabiana, E. kartzoffiana, E. mooreana, E. nicholii, E. parramattensis* subsp. *decadens, E. parvula, E. pulverulenta, E. pumila, E. rubida* subsp. *barbigerorum, E. scoparia* and *E. strzeleckii* (EPBC 1999).

We here include 153 species and 184 terminal taxa (i.e. species, or subspecies within a species) in the 'MEL+5' lineage. The latest formal classification of the eucalypts (Brooker 2000) did not consider the 'MEL+5' lineage to be monophyletic. Instead, Brooker placed the very species-rich *E.* sect. *Bisectae* (about 215 species, Nicolle 2015), *E.* sect. *Dumaria* (about 75 species) and *E.* sect. *Platysperma* (7 species) between *E.* sect. *Maidenaria* and the remainder of the 'MEL+5' lineage, as well as placing the monotypic *E.* sect. *Bolites* (*E. gomphocephala*) and *E.* sect. *Inclusae* (*E. diversicolor*) between the monotypic *E.* sect. *Racemus* (*E. michaeliana*) and the remainder of the 'MEL+5' lineage. Subsequent studies, including Steane *et al.* (2011) suggested that the 'MEL+5' lineage is certainly monophyletic, and that Brooker's (2000) embedding of sections *Bisectae, Dumaria*, *Platysperma*, *Inclusae* and *Bolites* within this lineage was not an accurate reflection of the phylogeny as now understood. Jones *et al.* (2016) used genome-wide markers and an unprecedented scale of sampling to construct a robust phylogeny for this lineage. The study used 3109 DArT markers distributed throughout the genome and 540 samples covering 185 terminal taxa in sections *Maidenaria, Exsertaria, Latoangulatae* and related smaller sections *Racemus* (one species), *Inclusae* (one species), *Similares* (one species), *Incognitae* (two species), *Liberivalvae* (five species), *Platysperma* (seven species) and *Pumilio* (one species), all of which were hypothesised to be sister sections to, or embedded within, the *Exsertaria, Latoangulatae* and *Maidenaria* lineage (Brooker 2000; Nicolle 2015; Steane *et al.* 2007). Of the 153 species that we recognise in the 'MEL+5' lineage, Jones *et al.* (2016) included samples of all species except for *E. cupularis* (a close relative of *E. herbertiana* and *E. gregoriensis*), *E. mooreana* (the sample labeled as *E. mooreana* in Jones *et al.* 2016 is actually the recently named *E. revelata,* see Nicolle and Barrett 2018), and *E.* sp. Arnhem Land (a close relative of *E. bigalerita*). Jones *et al.* (2016) included five samples labeled as *E. urophylla* (an endemic to Timor and the Lesser Sunda Islands north of Australia), but some of these samples possibly represent the closely-related *E. orophila* and *E. wetarensis* (Pryor *et al.* 1995). Jones *et al.* (2016) provided a robust phylogenetic framework for the lineage that can be used for a range of practical and fundamental purposes and revealed taxonomic clades that were, for the most part, concordant with the latest formal classification (Brooker 2000), but with some important disparities where taxonomic

revision is required. Additionally, Jones *et al.* (2016) found that *E.* sect. *Platysperma* and the monotypic *E.* sect. *Inclusae* (*E. diversicolor*) were each a distinct clade and were both basal to the 'MEL+5' lineage rather than embedded within it, although the latter is possibly embedded within the species-rich *E.* sect. *Bisectae* (Steane *et al.* 2011).

This paper provides a formal revised classification for *E.* sections *Maidenaria*, *Exsertaria*, *Latoangulatae* and related smaller sections (the 'MEL+5' lineage), based on long-term, extensive morphological and ecological observations of all Australian taxa in the lineage by one of us (DN), in conjunction with the phylogenetic evidence of Jones *et al.* (2016) and observations and data from other sources. In drawing our conclusions, we have considered our extensive field observations, study of herbarium collections, common garden trials (especially at Currency Creek Arboretum, see http://www.dn.com.au/Currency_Creek_Arboretum.html) and the findings of other phylogenetic studies including taxa of the 'MEL+5' lineage. In constructing this classification, we have attempted to achieve an accurate and useful classification while minimising the taxonomic disruption of existing names. As such, we have repositioned terminal taxa into existing higher-level taxonomic groups wherever possible, while avoiding the description of new higher-level taxonomic groups. Nevertheless, nine new higher-level taxa (eight series and one subseries) are described to accommodate well-defined lower-level taxa that could not otherwise be informatively accommodated using previously published names.

New taxa and combinations

1. *Eucalyptus* ser. ***Liberivalvae*** (Blakely) D.Nicolle & R.Jones, ***stat. nov.***

Eucalyptus sect. *Liberivalvae* (Blakely) Brooker, *Aust. Syst. Bot.* 13: 96 (2000).

Eucalyptus subser. *Liberivalvae* Blakely, *Key Eucalypts* 30: 133 (1934).

Type: Eucalyptus bancroftii (Maiden) Maiden

Diagnosis: Trees; bark shedding, mottled, orange when newly exposed; juvenile leaves disjunct, petiolate, ovate to narrow-lanceolate; adult leaves concolorous, dull, pale green, secondary veins mid- to wide-angled, tertiary venation moderate to sparse; inflorescences 7–15-flowered; ovules in 6 vertical rows; opercula rounded to long-conical; stamens mostly erect; fruits cupular, disc annular, free of ovary roof, valves exserted; seeds red-brown, elongated.

2. *Eucalyptus* ser. ***Similares*** (Brooker) D.Nicolle & R.Jones, ***stat. nov.***

Eucalyptus sect. *Similares* Brooker, *Aust. Syst. Bot.* 13: 95 (2000).

Type: Eucalyptus longifolia Link

Diagnosis: Trees; bark non-shedding or irregularly-shedding on trunk; juvenile leaves disjunct, petiolate, ovate; adult leaves concolorous, dull, blue-green, secondary veins mid- to wide-angled, tertiary venation moderate; inflorescences pendulous, 3-flowered; ovules in ≥8 vertical rows; stamens inflexed; fruits disc descending, valves around rim level; seeds pale brown to almost black, pyramidal.

3. *Eucalyptus* ser. ***Robustae*** (Benth.) D.Nicolle & R.Jones, ***stat. nov.***

Eucalyptus subser. *Robustae* Benth., *Fl. Austral.* 3: 194, 228 (1867).

Type: Eucalyptus robusta Sm.

Diagnosis: Trees; bark non-shedding on trunk, thick, fibrous, reddish brown; juvenile leaves disjunct, petiolate, ovate to lanceolate; adult leaves large, lanceolate, strongly discolorous, green, secondary veins widely-angled, tertiary venation dense; inflorescences 7–15-flowered; ovules in 4–8 vertical rows; fruits large, disc descending to ascending, valves exserted; seeds pyramidal.

4. *Eucalyptus* ser. ***Deaneanae*** K.D.Hill & L.A.S.Johnson ex D.Nicolle & R.Jones, ***ser. nov.***

Type: Eucalyptus deanei Maiden

Etymology: From the name of the type species. Hill & Johnson (2000) provided an informal classification of section *Transversaria*, where they used the unpublished series name 'Deaneanae' for *Eucalyptus brunnea* and *E. deanei*.

Diagnosis: Trees; bark annually shedding to ground level; juvenile leaves disjunct, petiolate, ovate to orbicular; adult leaves discolorous, green, secondary veins widely-angled, tertiary venation dense; inflorescences 7–11-flowered; ovules in 4 vertical rows; fruits pedicellate, small, cupular, disc level to slightly ascending, valves not exserted; seeds flattened to shallowly pyramidal.

5. *Eucalyptus* ser. ***Quadrangulatae*** D.Nicolle & R.Jones, ***ser. nov.***

Type: Eucalyptus quadrangulata H.Deane & Maiden

Etymology: From the name of the type species.

Diagnosis: Trees; bark non-shedding on trunk, tightly held; juvenile leaves opposite, sessile, green, stems square in cross section; adult leaves usually denticulate, long-lanceolate, concolorous, green, secondary veins mid-angled, tertiary venation moderate; inflorescences 7-flowered; ovules in 4 vertical rows; stamens variously flexed; fruits small, obconical, disc descending, valves exserted; seeds brown, flattened-ovoid.

6. *Eucalyptus* ser. ***Remanentes*** (Brooker) D.Nicolle & R.Jones, ***stat. nov.***

Eucalyptus subser. *Remanentes* Brooker, *Aust. Syst. Bot.* 13: 115 (2000).

Type: Eucalyptus nitens (H.Deane & Maiden) Maiden

Diagnosis: Trees; bark mostly annually shedding; juvenile leaves opposite, sessile, large, grey-green; adult leaves sometimes denticulate, long-lanceolate, concolorous, green, secondary veins mid-angled, tertiary venation moderate; inflorescences 7-flowered; ovules in 4 vertical rows; stamens inflexed; fruits sessile, small, barrel-shaped, disc descending, valves not exserted; seeds brown, flattened-ovoid.

7. *Eucalyptus* subser. ***Clivosae*** D.Nicolle & R.Jones, ***ser. nov.***

Type: Eucalyptus cypellocarpa L.A.S.Johnson

Etymology: From the Latin *clivosus* (hilly), referring to the natural habitat of all members of the subseries.

Diagnosis: Tree or facultative mallees; juvenile leaves opposite, sessile, large, orbicular to ovate; adult leaves lanceolate, concolorous, secondary veins mid- to acutely-angled, tertiary venation moderate; inflorescences 7-flowered; buds with non-warty opercula, ovules in 4 vertical rows; stamens irregularly flexed; fruit disc inconspicuous, descending; seeds grey to black, ovoid to flattened-ovoid.

8. *Eucalyptus* ser. ***Recurvae*** D.Nicolle & R.Jones, ***ser. nov.***

Type: Eucalyptus recurva Crisp

Etymology: From the name of the type species.

Diagnosis: Mallees; juvenile leaves opposite, sessile, very small, recurved, glossy green; secondary veins acutely-angled, tertiary venation sparse; adult leaves not formed; inflorescences 3-flowered; ovules in 4 vertical rows; stamens inflexed; fruits sessile, small, hemispherical, disc descending, valves not exserted; seeds brown, flattened-ovoid.

9. *Eucalyptus* ser. ***Tasmaniae*** D.Nicolle & R.Jones, ***ser. nov.***

Type: Eucalyptus gunnii Hook.f.

Etymology: From the distribution of the series, which is endemic to Tasmania.

Diagnosis: Trees or mallees; bark annually shedding; juvenile leaves opposite, sessile, orbicular, green to greyish, often present in the mature crown; adult leaves lanceolate, concolorous, green to greyish, secondary veins mid- to acutely-angled, tertiary venation moderate; inflorescences 3-flowered; ovules in 4 vertical rows; stamens inflexed; fruits urceolate to cupular, disc descending, valves not exserted; seeds dark brown, flattened-ovoid.

Classification

This classification of the 'MEL+5' lineage (*Eucalyptus* sections *Maidenaria*, *Exsertaria*, *Latoangulatae* and related sections) includes all terminal taxa (as recognised by us), taxon authorships, type species, natural distribution of recognised terminal taxa, and taxonomic and nomenclatural synonyms. The sequence of the taxa in this classification follows a linear taxonomy, with the most-closely related taxa being adjacent to one another. Groups of closely-related species (equivalent to supraspecies in Brooker 2000) are grouped together, with such groups separated by blank lines ('< >' is used to link closely-related species that are separated by a broken line due to synonyms). Phrase names follow those used in APNI (2018), unless indicated otherwise. An Excel version of this classification, including a comparison with the most recent formal classification (Brooker 2000), is available for download from the authors' websites (www.dn.com.au and www.eucalyptgenetics.com).

Taxon (T = type species)	Natural distribution	Synonyms
Eucalyptus L'Hér. (T = *E. obliqua* L'Hér)		
subg. *Symphyomyrtus* (Schauer) Brooker (T = *E. lehmannii* (Schauer) Benth.)		
sect. *Pumilio* Brooker (T = *E. pumila*)		
ser. *Pumilae* Chippend. (T = *E. pumila*)		
E. pumila Cambage	NSW	
ser. *Lepidotae-Fimbriatia* Maiden (T = *E. canaliculata*)		
E. canaliculata Maiden	NSW	
E. punctata DC.	NSW,Qld	*E. biturbinata* L.A.S.Johnson & K.D.Hill
E. grisea L.A.S.Johnson & K.D.Hill	Qld	
E. longirostrata (Blakely) L.A.S.Johnson & K.D.Hill	Qld	*E. punctata* var. *longirostrata* Blakely
sect. *Exsertaria* L.D.Pryor & L.A.S.Johnson ex Brooker (T = *E. exserta*)		
ser. *Connexentes* Brooker (T = *E. hallii*)	NSW,Qld	
E. hallii Brooker	Qld	
E. broviniensis A.R.Bean	Qld	*E.* sp. Brovinia *(A.R.Bean 11911)*
E. major (Maiden) Blakely	Qld,NSW	*E. propinqua* var. *major* Maiden
E. propinqua H.Deane & Maiden	NSW,Qld	
ser. *Liberivalvae* (Blakely) D.Nicolle & R.Jones (T = *E. bancroftii*)		*E.* sect. *Liberivalvae* (Blakely) Brooker (T = *E. bancroftii*), *E.* subser. *Liberivalvae* Blakely (T = *E. bancroftii*)
E. prava L.A.S.Johnson & K.D.Hill	NSW,Qld	
E. bancroftii (Maiden) Maiden	NSW,Qld	
E. disclusa L.A.S.Johnson & Blaxell	Qld	
E. interstans L.A.S.Johnson & K.D.Hill	NSW,Qld	
E. seeana Maiden	NSW,Qld	
E. parramattensis E.C.Hall		
subsp. *decadens* L.A.S.Johnson & Blaxell	NSW	
subsp. *parramattensis*	NSW	*E. parramattensis* var. *sphaerocalyx* Blakely
ser. *Exsertae* Blakely (T = *E. exserta*)		*E.* ser. *Phaeoxylon* (Blakely) Brooker (T = *E. exserta*), *E.* ser. *Erythroxylon* (Blakely) Brooker (T = *E. tereticornis*)
subser. *Exsertae* Benth. (T = *E. exserta)*		
E. brassiana S.T.Blake	Qld,PNG	
E. lockyeri Blaxell & K.D.Hill	Qld	
E. insulana F.M.Bailey	Qld	*E. lockyeri* subsp. *exuta* Brooker & Kleinig
E. ammophila Brooker & Slee	Qld	
E. exserta F.Muell.	Qld,NSW	
E. nudicaulis A.R.Bean	Qld	
E. gillenii Ewart & L.R.Kerr	NT,WA,SA	*E. incurva* Boomsma
E. morrisii FR.T.Baker	NSW	
subser. *Erythroxylon* Blakely (T = *E. tereticornis*)		
E. infera A.R.Bean	Qld	*E. dealbata* var. *populnea* Blakely
E. kabiana L.A.S.Johnson & K.D.Hill	Qld	*E.* sp. TT in Brooker & Kleinig 1994
E. amplifolia Naudin		
subsp. *sessiliflora* (Blakely) L.A.S.Johnson & K.D.Hill	NSW, Qld	
subsp. *amplifolia*	NSW	
***E.* sp. Consuelo Tableland** (*A.R.Bean 25804*)	Qld	*E. tereticornis* subsp. *rotunda* A.R.Bean
E. tereticornis Sm.		
subsp. *mediana* Brooker & Slee	Vic	*E. tereticornis* var. *media* (Blakely) Cameron
subsp. *tereticornis*	Qld,NSW,PNG	
subsp. *basaltica* A.R.Bean	Qld	
E. glaucina (Blakely) L.A.S.Johnson	NSW	*E. tereticornis* var. *glaucina* (Blakely) Cameron
E. chloroclada (Blakely) L.A.S.Johnson & K.D.Hill	NSW, Qld	*E. dealbata* var. *chloroclada* Blakely
E. terrica A.R.Bean	Qld	
E. blakelyi Maiden	NSW,Vic,Qld	
E. dealbata A.Cunn. ex Schauer	NSW,Qld	
E. nandewarica L.A.S.Johnson & K.D.Hill	NSW	
E. vicina L.A.S.Johnson & K.D.Hill	NSW	*E.* sp. X in Brooker & Kleinig 1990
E. dwyeri Maiden & Blakely	NSW	
E. flindersii Boomsma	SA	
subser. *Rostratae* Blakely (T = *E. camaldulensis*)		*E.* ser. *Rostratae* (Blakely) Brooker (T = *E. camaldulensis*), *E.* ser. *Singulares* Brooker (T = *E. rudis*)
E. rudis Endl.		
subsp. *rudis*	WA	
subsp. *cratyantha* Brooker & Hopper	WA	
E. camaldulensis Dehnh.		
subsp. *refulgens* Brooker & M.W.McDonald	WA	*E.* sp. 'Pilbara' in Butcher *et al.* 2009
subsp. *obtusa* (Blakely) Brooker & M.W.McDonald	Qld,NT,WA	*E. camaldulensis* var. *obtusa* Blakely
subsp. *arida* Brooker & M.W.McDonald	WA,NT,Qld,SA,NSW	*E. camaldulensis* var. *subcinerea* Blakely, *E. camaldulensis* var. *pendula* Blakely & Jacobs
<>		

subsp. *minima* Brooker & M.W.McDonald	SA	
subsp. *camaldulensis*	Vic,NSW,SA,Qld	*E. camaldulensis* var. *brevistostris* (Miq.) Blakely, *E. rostrata* Schltdl.
<>		
subsp. *acuta* Brooker & M.W.McDonald	Qld,NSW	*E. camaldulensis* var. *acuminata* (Hook.) Blakely
subsp. *simulata* Brooker & Kleinig	Qld	
subser. *Subexsertae* Benth. (T = *E. alba*)		*E.* ser. *Subexsertae* (Benth.) Blakely (T = *E. alba*) *E.* subser. *Applanatae* Brooker (T = *E. alba*) *E.* subser. *Pyramidales* Brooker (T = *E. herbertiana*)
E. glomericassis L.A.S.Johnson & K.D.Hill	NT,WA?	*E.* sp. SS in Brooker and Kleinig 1994
E. herbertiana Maiden	NT,WA,Qld	*E.* sp. Pitta Creek *(R.L.Barrett 1677 & M.D.Barrett)*
E. gregoriensis N.G.Walsh & Albr.	NT	
E. cupularis C.A.Gardner	WA,NT	
E. revelata D.Nicolle & R.L.Barrett	WA	
E. mooreana W.Fitzg. ex Maiden	WA	
E. pantoleuca L.A.S.Johnson & K.D.Hill	WA	*E.* sp. RR in Brooker and Kleinig 1994, *E.* sp. I in Rye *et al.* 1992
<>		
E. apodophylla Blakely & Jacobs	NT,WA	
E. houseana W.Fitzg. ex Maiden	WA	
E. alba Reinw. ex Blume	NT,Timor,Indo	
var. *alba*	ET,Indo	
var. *australasica* Blakely & Jacobs	NT	
***E.* sp. Melville Island** in Nicolle & Barrett (2018)	NT,WA	
E. tintinnans (Blakely & Jacobs) L.A.S.Johnson & K.D.Hill	NT	*E. platyphylla* var. *tintinnans* Blakely & Jacobs
E. bigalerita F.Muell.	WA,NT	
***E.* sp. Arnhem Land** in Nicolle & Barrett (2018)	NT	
***E.* sp. Port Moresby** in Nicolle & Barrett (2018)	PNG	
E. platyphylla F.Muell.	Qld,NT	
sect. *Incognitae* (D.Nicolle) Brooker (T = *E. cosmophylla*)		*E.* sect. *Similares* Brooker (T = *E. longifolia*)
ser. *Similares* (Brooker) D.Nicolle & R.Jones (T = *E. longifolia*)		
E. longifolia Link	NSW	
ser. *Incognitae* D.Nicolle (T = *E. cosmophylla*)		
E. cosmophylla F.Muell.	SA	
E. paludicola D.Nicolle	SA	
sect. *Latoangulatae* Brooker (T = *E. saligna*)		
ser. *Robustae* (Benth.) D.Nicolle & R.Jones (T = *E. robusta*)	*E.* subser. *Robustae* Benth. (T = *E. robusta*)	
E. orophila L.D.Pryor	Indo	
E. urophylla S.T.Blake	Timor,Indo	
E. wetarensis L.D.Pryor	Timor,Indo?	
E. biterranea L.A.S.Johnson & K.D.Hill	Qld,PNG,Indo	
E. pellita F.Muell.	Qld	
E. robusta Sm.	NSW,Qld	
ser. *Annulares* (Blakely) Chippend. (T = *E. resinifera*)		*E.* subser. *Annulares* Blakely (T = *E. resinifera*)
E. resinifera Sm.		
subsp. *resinifera*	NSW	
subsp. *hemilampra* (F.Muell.) L.A.S.Johnson & K.D.Hill	Qld,NSW	*E. hemilampra* F.Muell.
E. macta L.A.S.Johnson & K.D.Hill	Qld	
E. notabilis Maiden	NSW,Qld	
E. scias L.A.S.Johnson & K.D.Hill		
subsp. *callimastha* L.A.S.Johnson & K.D.Hill	NSW	
subsp. *scias*	NSW	
subsp. *apoda* L.A.S.Johnson & K.D.Hill	NSW	
ser. *Transversae* Blakely (T = *E. saligna*)		*E.* subser. *Leptocarpae* Blakely (T = *E. saligna*)
E. botryoides Sm.	NSW,Vic	*E. saligna* subsp. *botryoides* (Sm.) Passioura & J.E.Ash
<>		
E. saligna Sm.	NSW,Qld	
E. grandis W.Hill		
subsp. North Queensland *(Nicolle 2524)*	Qld	
subsp. *grandis*	NSW,Qld	
sect. *Racemus* Brooker. (T = *E. michaeliana*)		*E.* ser. *Michaelianae* Chippend. (T = *E. michaeliana*)
E. michaeliana Blakely	NSW,Qld	
sect. *Maidenaria* L.D.Pryor & L.A.S.Johnson ex Brooker (T = *E. viminalis*)		*E.* subsect. *Triangulares* Brooker (T = *E. ovata*), *E.* subsect. *Euryotae* Brooker (T = *E. viminalis*), *E.* subsect. *Obscurae* Brooker (T = *E. parvula*)
ser. *Deaneanae* K.D.Hill & L.A.S.Johnson ex D.Nicolle & R.Jones (T = *E. deanei*)		
E. deanei Maiden	NSW	
E. brunnea L.A.S.Johnson & K.D.Hill	NSW,Qld	
ser. *Quadrangulatae* D.Nicolle & R.Jones (T = *E. quadrangulata*)		
E. quadrangulata H.Deane & Maiden	NSW,Qld	

ser. *Remanentes* (Brooker) D.Nicolle & R.Jones (T = *E. nitens*)		*E.* subser. *Remanentes* Brooker (T = *E. nitens*)
E. nitens (H.Deane & Maiden) Maiden	Vic,NSW	
E. denticulata I.O.Cook & Ladiges	Vic,NSW	
ser. *Neglectae* L.A.S.Johnson ex Brooker & Slee (T = *E. neglecta*)		
E. neglecta Maiden	Vic	
ser. *Bridgesianae* Brooker & Slee (T = *E. bridgesiana*)		
E. dunnii Maiden	N,Qld	
E. angophoroides R.T.Baker	Vic,NSW	
E. bridgesiana R.T.Baker	NSW,Vic,Qld	*E. saxicola* J.T.Hunter
E. malacoxylon Blakely	NSW	
ser. *Globulares* Blakely (T = *E. globulus*)		
subser. *Clivosae* D.Nicolle & R.Jones (T = *E. cypellocarpa*)		
E. nortonii (Blakely) L.A.S.Johnson	NSW,Vic	
E. goniocalyx F.Muell. ex Miq.		
subsp. *viridissima* Rule	Vic	*E.* sp. Mt Arapiles in Nicolle (2006b)
subsp. *goniocalyx*	Vic, NSW,SA	
subsp. *exposa* D.Nicolle	SA	
E. banksii Maiden	NSW,Qld	
E. volcanica L.A.S.Johnson & K.D.Hill	NSW	*E. retinens* L.A.S.Johnson & K.D.Hill
E. litoralis Rule	Vic	
E. alaticaulis R.J.Watson & Ladiges	Vic	*E. pyrenea* Rule
E. cypellocarpa L.A.S.Johnson	Vic,NSW	*E. quinniorum* J.T.Hunter & J.J.Bruhl, *E. oresbia* J.T.Hunter & J.J.Bruhl
subser. *Euglobulares* Blakely (T = *E. globulus*)		
E. globulus Labill.	T,Vic	
E. bicostata Maiden, Blakely & Simmonds	Vic,NSW,SA	*E. globulus* subsp. *bicostata* (Maiden, Blakely & Simmonds) J.B.Kirkp.
<>		
E. pseudoglobulus Naudin	Vic,NSW,Tas	*E. globulus* subsp. *pseudoglobulus* (Naudin) J.B.Kirkp., *E. stjohnii* (R.T.Baker) R.T.Baker
<>		
E. maidenii F.Muell.	NSW,Vic	*E. globulus* subsp. *maidenii* (F.Muell.) J.B.Kirkp.
ser. *Foveolatae* Maiden (T = *E. aggregata*)		
E. camphora R.T.Baker		
subsp. *humeana* L.A.S.Johnson & K.D.Hill	Vic,NSW	
subsp. *camphora*	NSW,Qld	*E. aquatica* (Blakely) L.A.S.Johnson & K.D.Hill, *E. camphora* subsp. *relicta* L.A.S.Johnson & K.D.Hill
<>		
<>		
E. yarraensis Maiden & Cambage	Vic	
E. ovata Labill.		
subsp. *ovata*	Vic,Tas,NSW,SA	
subsp. *grandiflora* (Maiden) D.Nicolle	SA,Vic	*E. ovata* var. *grandiflora* Maiden
E. strzeleckii Rule	Vic	
E. brookeriana A.M.Gray	Tas,Vic	
E. cadens J.D.Briggs & Crisp	Vic	
E. aggregata H.Deane & Maiden	NSW,Vic	
E. rodwayi R.T.Baker & H.G.Sm.	Tas	
E. barberi L.A.S.Johnson & Blaxell	Tas	
ser. *Crenulatae* Brooker & Slee (T = *E. crenulata)*		
E. crenulata Blakely & Beuzev.	Vic	
ser. *Tasmaniae* D.Nicolle & R.Jones (T = *E. gunnii*)		
E. archeri Maiden & Blakely	Tas	
E. gunnii Hook.f.		
subsp. *divaricata* (McAulay & Brett) B.M.Potts	Tas	*E. divaricata* McAulay & Brett
subsp. *gunnii*	Tas	
E. urnigera Hook.f.	Tas	
E. morrisbyi Brett	Tas	
E. cordata Labill.		
subsp. *quadrangulosa* D.Nicolle, B.M.Potts & McKinnon	Tas	*E. cordata* subsp. western in Nicolle (2006b)
subsp. *cordata*	Tas	
ser. *Semiunicolores* Blakely (T = *E. johnstonii)*		
E. vernicosa Hook.f.	Tas	
E. subcrenulata Maiden & Blakely	Tas	
E. johnstonii Maiden	Tas	
ser. *Recurvae* D.Nicolle & R.Jones (T = *E. recurva*)		
E. recurva Crisp	NSW	

ser. *Sturgissianae* L.A.S.Johnson ex Brooker (T = *E. sturgissiana*)		
E. sturgissiana L.A.S.Johnson & Blaxell	NSW	
ser. *Viminales* Blakely (T = *E. viminalis*)		*E.* ser. *Acaciiformes* L.A.S.Johnson ex Brooker & Slee (T = *E. acaciiformis*), *E.* ser. *Argyrophyllae* Blakely (T = *E. cinerea*), *E.* ser. *Benthamianae* Brooker (T = *E. benthamii*), *E.* ser. *Compactae* Brooker (T = *E. badjensis*), *E.* ser. *Confines* Brooker (T = *E. kartzoffiana*), *E.* ser. *Kitsonianae* L.A.S.Johnson ex Brooker & Slee (T = *E. kitsoniana*), *E.* ser. *Microcarpae* Blakely (T = *E. scoparia*), *E.* ser. *Orbiculares* Brooker & Slee (T = *E. perriniana*), *E.* ser. *Saxicola* Brooker (T = *E. baeuerlenii*)
subser. *Circulares* Brooker (T = *E. rubida*)		
E. perriniana F.Muell. ex Rodway	Vic,NSW,Tas	
E. pulverulenta Sims	NSW	
E. glaucescens Maiden & Blakely	Vic,NSW	
E. saxatilis J.B.Kirkp. & Brooker	Vic,NSW	
E. rubida H.Deane & Maiden		
subsp. *canobolensis* L.A.S.Johnson & K.D.Hill	NSW	*E. canobolensis* (L.A.S.Johnson & K.D.Hill) J.T.Hunter
<>		
subsp. *rubida*	NSW,Vic,Tas	*E. rubida* subsp. *septemflora* L.A.S.Johnson & K.D.Hill
<>		
subsp. *barbigerorum* L.A.S.Johnson & K.D.Hill	NSW	
E. dalrympleana Maiden		
subsp. Howmans Gap (*N.G.Walsh 5293*)	Vic	*E. dalrympleana* subsp. Alpine in Nicolle (2006b)
subsp. *heptantha* L.A.S.Johnson	NSW,Qld	
subsp. *dalrympleana*	Vic, NSW,SA	
subsp. Tasmania (*Nicolle 4923,* here nominated)	Tas	*E. dalrympleana* subsp. Tasmania in Nicolle (2006b)
E. chapmaniana Cameron	Vic,NSW	
E. lactea R.T.Baker	NSW	*E. mannifera* subsp. *praecox* (Maiden) L.A.S.Johnson, *E. praecox* Maiden
<>		
E. elliptica (Blakely & McKie) L.A.S.Johnson & K.D.Hill	NSW	*E. mannifera* subsp. *elliptica* (Blakely & McKie) L.A.S.Johnson
E. cinerea F.Muell. ex Benth.		
subsp. *cinerea*	NSW	
subsp. *triplex* (L.A.S.Johnson & K.D.Hill) Brooker, Slee & J.D.Briggs	NSW,Vic	*E. triplex* L.A.S.Johnson & K.D.Hill
E. alligatrix L.A.S.Johnson & K.D.Hill	Vic, NSW	
subsp. *alligatrix*	Vic	*E. alligatrix* subsp. *limaensis* Brooker, Slee & J.D.Briggs
<>		
subsp. *miscella* Brooker, Slee & J.D.Briggs	NSW	
E. conspicua L.A.S.Johnson & K.D.Hill	Vic,NSW	
E. cephalocarpa Blakely	Vic,NSW	
subser. *Lanceolatae* Brooker (T = *E. viminalis*)		*E.* subser. *Ambitae* Brooker (T = *E. badjensis*), *E.* subser. *Arrectae* Brooker (T = *E. smithii*)
E. parvula L.A.S.Johnson & K.D.Hill	NSW	
E. kartzoffiana L.A.S.Johnson & Blaxell	NSW	
E. badjensis Beuzev. & M.B.Welch	NSW	
E. smithii R.T.Baker	NSW,Vic	
E. wilcoxii Boland & Kleinig	NSW	
E. baeuerlenii F.Muell.	NSW	
E. imlayensis Crisp & Brooker	NSW	
E. elaeophloia Chappill, Crisp & Prober	Vic	
E. kitsoniana Maiden	Vic	
E. viminalis Labill.		
subsp. *viminalis*	Vic,Tas,NSW,SA	*E. viminalis* subsp. *hentyensis* Brooker & Slee
subsp. *pryoriana* (L.A.S.Johnson) Brooker & Slee	Vic	*E. pryoriana* L.A.S.Johnson
subsp. *cygnetensis* Boomsma	SA,Vic	*E. huberiana* Naudin
subsp. *siliceana* Rule	Vic	
E. nobilis L.A.S.Johnson & K.D.Hill	NSW,Qld	
E. splendens Rule	Vic	
E. arcana (D.Nicolle) Rule	SA,Vic	*E. splendens* subsp. *arcana* D.Nicolle, *E.* sp. Carpenter Rocks in Nicolle (1997)
<>		
E. aromaphloia L.D.Pryor & J.H.Willis	Vic	
E. sabulosa Rule	Vic	*E. aromaphloia* subsp. *sabulosa* (Rule) Slee & Brooker
<>		
E. corticosa L.A.S.Johnson	Vic,NSW	*E. ignorabilis* L.A.S.Johnson & K.D.Hill, *E. conferta* Rule
<>		
E. fulgens Rule	Vic	
E. acaciiformis H.Deane & Maiden	NSW	
E. nicholii Maiden & Blakely	NSW	
E. nova-anglica H.Deane & Maiden	NSW,Qld	

E. mannifera Mudie		
subsp. Alpine Victoria *(Nicolle 2066*, here nominated)	Vic,NSW	
subsp. *gullickii* (R.T.Baker & H.G.Sm.) L.A.S.Johnson	NSW	*E. gullickii* R.T.Baker & H.G.Sm.
subsp. *mannifera*	NSW	*E. mannifera* subsp. *maculosa* (R.T.Baker) L.A.S.Johnson
<>		
E. scoparia Maiden	Qld,NSW	
E. benthamii Maiden & Cambage	NSW	
E. dorrigoensis (Blakely) L.A.S.Johnson & K.D.Hill	NSW	*E. benthamii* var. *dorrigoensis* Blakely
E. macarthurii H.Deane & Maiden	NSW	

Summary of higher-level taxa

Brooker (2000) divided the 'MEL+5' lineage (*Eucalyptus* sections *Maidenaria*, *Exsertaria*, *Latoangulatae* and five related smaller sections) into 8 sections with 3 subsections, 26 series and 8 subseries. Here, we divide the same lineage into 6 sections with no subsections, 23 series and 8 subseries. We believe that Brooker (2000) over-ranked many taxa in the 'MEL+5' lineage, particularly in *E.* sect. *Maidenaria*, dividing it into 3 subsections with 17 series and 6 subseries. Here, we recognise no subsections in *E.* sect. *Maidenaria* but distinguish 12 series and 4 subseries.

Only morphological characters that distinguish the taxon from closely-related taxa are provided below. Taxon authorships are not provided in the summary descriptions below to avoid text cluttering and therefore assist in the readability of the text. Taxon authorships are instead provided for all taxa of the 'MEL+5' lineage in the classification above. Likewise, the type taxon for all higher-level taxa is not provided in the summary descriptions below, again to aid readability, but is instead provided in the classification.

E. sect. *Pumilio*

Five species (*E. pumila, E. canaliculata, E. punctata, E. grisea* and *E. longirostrata*). Distributed in subtropical eastern Australia, from the Nowra area on the south coast of New South Wales north to Expedition Range in central Queensland. Distinguished by its combination of annually decorticating, non-powdery bark, its petiolate juvenile leaves, its ovules in 4 (rarely 6) vertical rows, its fruits with prominently exserted valves, and its black, toothed or ridged seeds. Brooker (2000) considered this section to be monotypic (*E. pumila* only), but there are few morphological characters that differentiate it from the 'large-fruited grey gums' (*E. canaliculata, E. punctata, E. grisea* and *E. longirostrata*), which Brooker (2000) included in *E.* sect. *Latoangulatae*. In particular, the seedling, flower bud, flower, fruit and seed morphology of *E. pumila* and 'large-fruited grey gums' is very similar. In Jones *et al.* (2016), *E. pumila* individuals formed a clade which, together with a sister clade corresponding to the 'large-fruited grey gums' was sister to all other MEL+5 taxa. *Eucalyptus pumila* was also basal to all other MEL+5 taxa that were included in the study of Steane *et al.* (2011), however no 'large-fruited grey gums' were included in that study. Here, we group *E. pumila* and the large-fruited grey gums together into *E.* sect. *Pumilio* and recognise two series within this section, on the basis of differences in their habit (and particularly their vegetative-regeneration strategy) and in bark and adult leaf morphology.

- ***E.* ser. *Pumilae***. Monotypic (*E. pumila*). Restricted to the Broken Back Range on the central coast of NSW. Lignotuber-resprouting mallees, bark shiny and uniformly-shedding, adult leaves concolorous, with moderate to sparsely reticulate tertiary venation.
- ***E.* ser. *Lepidotae-Fimbriatia*** (the 'large-fruited grey gums'). Four species (*E. canaliculata, E. punctata, E. grisea* and *E. longirostrata*). We agree with the treatment of *E. biturbinata* by Slee *et al.* (2006), who considered it to be synonymous with *E. punctata* on the basis its morphology. Distributed from the Nowra area on the south coast of New South Wales north to Expedition Range in central Queensland. Stem-resprouting trees, bark dull, somewhat granular in texture and irregularly-shedding, adult leaves discolorous, with densely reticulate tertiary venation. These four species are not known to develop typical lignotubers, but seedlings do develop a swollen, bottle-shaped lower stem, the anatomy and function of which is unknown (see Nicolle 2006a). Brooker (2000) also included the 'small-fruited grey gums' - *E. major* and *E. propinqua* - in this series, however we have placed the 'small-fruited grey gums' in *E.* sect. *Exsertaria* (ser. *Connexentes*) on the basis of their distinction in Jones *et al.* (2016) and their quite different morphology, especially with regard to their development of lignotubers, their smaller buds and fruits, and their smooth, brown seeds.

E.* sect. *Exsertaria

50 species, collectively known as the 'red gums'. Distributed in temperate to tropical regions throughout most of mainland Australia (notably excluding Tasmania) and in southern New Guinea, with greatest diversity in the Great Dividing Range in eastern Australia. Distinguished by its combination of petiolate juvenile leaves, its concolorous adult leaves (except in *E. major* and *E. propinqua*, which are discolorous), and its ovules in 6 or 8 (rarely 4) vertical rows. Three series are recognised:

- ***E.* ser. *Connexentes*** (the 'small-fruited grey gums'). Four species (*E. hallii, E. broviniensis, E. major* and *E. propinqua*). Distributed from the central coast of NSW northwards to the Blackdown Tableland in central Queensland. Bark somewhat granular in texture, newly decorticated bark often orange, adult leaves with densely reticulate tertiary venation, inflorescence unbranched, most stamens inflexed, seeds with a +/- ventral hilum. Brooker (2000) considered *E.* ser. *Connexentes* to be monotypic (*E. hallii*), with the very closely related *E. broviniensis* not yet described at the time (Bean 2001). We agree with Brooker's (2000) inclusion of the series within *E.* sect. *Exsertaria* rather than in *E.* sect. *Latoangulatae* (Nicolle 2015), as supported by Jones *et al.* (2016). However unlike Brooker (2000), we include *E. major* and *E. propinqua* in *E.* ser. *Connexentes* based on their morphology, which is similar to other species in the series (Slee *et al.* 2006) and the findings of Jones *et al.* (2016). Although *E. hallii, E. broviniensis, E. major* and *E. propinqua* are morphologically very similar in most respects, *E. major* and *E. propinqua* differ conspicuously from *E. hallii* and *E. broviniensis* (and all other species in *E.* sect. *Exsertaria*) in their discolorous adult leaves, which is generally regarded as a plesiomorphic character state in *Eucalyptus* (Slee *et al.* 2006).
- ***E.* ser. *Liberivalvae***. Six species (*E. prava, E. bancroftii, E. disclusa, E. interstans, E. seeana* and *E. parramattensis*). Distributed from the central coast of NSW northwards to the Hervey Bay area on the central coast of Queensland. Bark somewhat granular in texture, newly decorticated bark often orange, inflorescence unbranched, fruit disc annular and free of ovary roof, adult leaves with moderate to sparsely reticulate tertiary venation, most stamens erect, seeds with a terminal hilum. Brooker (2000) recognised this group at sectional level, as *E.* sect. *Liberivalvae*. The findings of Jones *et al.* (2016) indicate that the group is monophyletic but embedded within *E.* sect. *Exsertaria*. The only morphological characteristic that readily distinguishes these five species from the remainder of *E.* sect. *Exsertaria* is the consistently annular fruit disc. We have therefore recognised these five species as a series within *E.* sect. *Exsertaria*. The morphology of *E.* ser. *Liberivalvae* is similar to that of *E.* ser. *Connexentes*, especially in their bark texture and fruit disc morphology, however the two series are readily distinguished by their floral and seed morphology, and their distinction is well supported by Jones *et al.* (2016). The taxonomic status and relationships of *E. disclusa* are less clear. Jones *et al.* (2016) included only a single sample of the species, and while it did group with *Liberivalvae* in the phylogeny, this relationship was not well supported. Hill and Johnson (1991) named the species from a few small populations on the Blackdown Tableland in central Queensland, and considered it most closely related to *E. seeana*. Slee *at al.* (2006) considered *E. disclusa* to be synonymous with *E. interstans*, but noted that *E. disclusa* tends to have a 'flatter disc' that *E. interstans* – this may be indicative of a closer relationship to *E.* ser. *Exsertae* or a hybrid origin for the species (*E.* ser. *Liberivalvae* x *E.* ser. *Exsertae*, which is supported by Jones *et al.* (2016, Fig. 6)). Furthermore, the relationship between *E. interstans* and *E. parramattensis* is not clear, and these two species may be conspecific. Considering the uncertainty regarding the taxonomic status and relationships of *E. disclusa*, we have tentatively included the species here pending further sampling and study of the species.
- ***E.* ser. *Exsertae***. 40 species. Distributed throughout most of mainland Australia and in southern New Guinea. Newly decorticated bark less colourful (compared to *E.* ser. *Liberivalvae*), inflorescence unbranched, stamens erect to inflexed, fruit disc steeply raised or annular. Within *E.* ser. *Exsertae,* four subseries are recognised. Brooker (2000) recognised these four subseries as distinct series, along with other series in *E.* sect. *Exsertaria*. On the basis of their morphological differences, we believe that this part of *E.* sect. *Exsertaria* was over-ranked, which is supported by genetic evidence (Jones *et al.* 2016), and is the reason we have made the changes of rank here.
  - ***E.* subser. *Exsertae*** (the 'Queensland red gums'). Eight species. Distributed from inland and northern NSW northwards to southern New Guinea, including central Australia. Bark persistent or annually decorticating, smooth bark not powdery, juvenile leaves linear to lanceolate, adult leaves with moderate to sparsely reticulate tertiary venation, most stamens erect, fruits robust, seeds with a terminal hilum. Brooker (2000) recognised the 'Queensland red gums' at series level as *E.* ser. *Phaeoxylon*. Brooker did not include *E. gillenii* and *E. nudicaulis* in the 'Queensland red gums', instead placing them with the 'eastern red gums'. However, we believe their morphology more closely fits with the 'Queensland red gums', and this view appears to be shared by others (Bean 1991, Hill and Johnson 2000). Phylogenetic evidence also places *E. gillenii* and *E. nudicaulis* with the other 'Queensland red gums' (Jones *et al.* 2016).

- ***E.* subser. *Erythroxylon*** (the 'eastern red gums'). 14 species. Distributed from the Great Dividing Range in eastern Australia, westwards to the Flinders Ranges in SA and northwards to southern New Guinea. Bark persistent or annually decorticating, smooth bark not powdery, juvenile leaves linear to orbicular, adult leaves with moderate to sparsely reticulate tertiary venation, most stamens erect, seeds with a terminal hilum. Brooker (2000) recognised the 'eastern red gums' at series level as *E.* ser. *Erythroxylon*, also including *E. gillenii* and *E. nudicaulis* in the series.
- ***E.* subser. *Rostratae*** (the 'river red gums'). Two species (*E. camaldulensis* and *E. rudis*). Distributed throughout most of mainland Australia, where it is mainly restricted to permanent streams, ephemeral watercourses and floodplains. Bark persistent or annually decorticating, juvenile leaves lanceolate to orbicular, adult leaves with moderate to densely reticulate tertiary venation, stamens erect to inflexed, seeds with a terminal hilum. Brooker (2000) included one of these species (*E. camaldulensis*) in his monotypic *E.* ser. *Rostratae* and the other (*E. rudis*) in his monotypic *E.* ser. *Singulares*. We have included these two species in the same series and subseries considering that they intergrade extensively where their distributions adjoin on the west coast of Australia (Butcher *et al.* 2009, McDonald *et al.* 2009). *Eucalyptus rudis* is embedded within *E. camaldulensis* in the molecular study of Jones *et al.* (2016). *Eucalyptus* subser. *Rostratae* is polyphyletic in Jones *et al.* (2016), with the monophyletic *E.* subser. *Subexsertae* embedded within *E.* subser. *Rostratae*, and three samples of *E. vicina* and two samples of *E. chloroclada* (both species of *E.* subser. *Erythroxylon*) also embedded in the subseries. The samples of *E. vicina* and *E. chloroclada* embedded in *E.* subser. *Rostratae* could be explained by hybridisation between each of these species and *E. camaldulensis*. The samples of *E. camaldulensis* subsp. *simulata* formed a clade with some samples of *E. tereticornis* (of *E.* subser. *Erythroxylon*), separate from the other subspecies of *E. camaldulensis*, which supports the suggested hybrid origin for this subspecies (McDonald *et al.* 2009; Slee *at al.* 2006). Because of the lack of molecular support for *E.* subser. *Rostratae* in Jones *et al.* (2016), we have reduced its status from a series (as in Brooker 2000) to a subseries. However, because of its distinct biogeography, ecology and morphology, we believe that its recognition as a subseries is appropriate.
- ***E.* subser. *Subexsertae*** (the 'tropical red gums'). 16 species. Restricted to tropical northern Australia and the islands to the north including New Guinea and Timor. Bark annually decorticating throughout and seasonally powdery white, juvenile leaves lanceolate to orbicular, adult leaves with dense to extremely densely reticulate tertiary venation, stamens inflexed, seeds with a ventral hilum.

E.* sect. *Incognitae

Three species (*E. longifolia, E. cosmophylla* and *E. paludicola*). Distributed in the temperate, high-rainfall region of south-eastern Australia, from Kangaroo Island in South Australia eastwards to the central and south coasts of New South Wales. Distinguished by its combination of petiolate, ovate to orbicular juvenile leaves, its concolorous adult leaves with moderately reticulate tertiary venation, its 3-flowered inflorescences (except in *E. paludicola*, see below), its ovules in 8 or 10 vertical rows, and its fruit valves at or below rim level. Two series are recognised:

- ***E.* ser. *Similares***. Monotypic (*E. longifolia*). Restricted to the east coast of NSW, between Eden and Newcastle. Forest trees, inflorescences pendulous, peduncles and pedicels long. Brooker (2000) placed this species in a monotypic section (*E.* sect. *Similares*). We believe this placement is over-ranked, and the species is better placed in a monotypic series to indicate it sister-relationship to *E.* ser. *Incognitae*.
- ***E.* ser. *Incognitae***. Two species (*E. cosmophylla* and *E. paludicola*). Restricted to Kangaroo Island and the southern Mount Lofty Ranges in SA. Poor-formed trees or mallees, inflorescences held erect, peduncles and pedicels short. *Eucalyptus paludicola* is included here, but is hypothesised to be a stabilised intersectional hybrid of relatively recent origin (*E. cosmophylla* of *E.* sect. *Incognatae* x *E. ovata* subsp. *ovata* of *E.* sect. *Maidenaria*; Nicolle 2013, Jones *et al.* 2016) and therefore does not neatly fit this classification.

E.* sect. *Latoangulatae

13 species. Distributed in the higher-rainfall, tropical and subtropical regions of eastern and north-eastern Australia and the islands to the north, from the Lesser Sunda Islands south-eastwards to Gippsland in Victoria. Distinguished by its persistent (non-decorticating) bark (at least on the lower trunk), its petiolate, lanceolate to ovate juvenile leaves, its strongly discolorous adult leaves with dense to extremely densely reticulate tertiary venation, its 3 or 7 or more-flowered inflorescences, its prominently flattened peduncles, and its ovules in 4–8 vertical rows. Three polytypic series are recognised:

- ***E.* ser. *Robustae***. Six species (*E. orophila, E. urophylla, E. wetarensis, E. biterranea, E. pellita* and *E. robusta*). Distributed in the higher-rainfall regions of north-eastern Australia, from the central coast of NSW northwards, as well as the islands to the north including New Guinea and Timor. Bark partly or fully persistent, adult leaves large, peduncles and pedicels relatively long, fruits relatively large. Brooker (2000) included three of these species in *E.* ser. *Annulares* (*E. urophylla*, *E. pellita* and *E. robusta* - the other three not being mentioned at all in his classification, presumably because he took a broader view of *E. urophylla*, including *E. orophila* and *E. wetarensis*), but these species formed a monophyletic group sister to *E.* ser. *Transversae* rather than other *E.* ser. *Annulares* taxa which were in a separate well-supported clade (Jones *et al.* 2016). The distinct morphological characteristics and the biogeography of the group also support the recognition of *E.* ser. *Robustae*. Neither of us has seen *E. orophila* and *E. wetarensis* in the wild, so we have taken a conservative approach and maintained all three names, following Pryor *et al.* (1995).
- ***E.* ser. *Annulares*** (the 'red mahoganies'). Four species (*E. resinifera, E. macta, E. notabilis* and *E. scias*). Restricted to eastern Australia, from south coast of NSW northwards to eastern Cape York Peninsula in Queensland. Bark fully persistent, adult leaves relatively small, peduncles and pedicels relatively short, fruit disc conspicuous. These four species form a monophyletic group in Jones *et al.* (2016), with the exception of one sample of *E. scias* (an F1 of *D.Nicolle 600*, from near Batemans Bay, NSW), which grouped with our *E.* ser. *Transversae*, perhaps indicating a hybrid origin of this sample or the past hybridisation of *E. scias* and a species from *E.* ser. *Transversae* (*E. botryoides* or *E. saligna*) at the site.
- ***E.* ser. *Transversae***. Three species (*E. botryoides, E. saligna* and *E. grandis*). Restricted to the higher-rainfall parts of eastern Australia, from Gippsland in Victoria northwards to the Windsor Tableland in far north Queensland. Bark mostly or partly annually decorticating, adult leaves relatively small, peduncles and pedicels relatively short, fruits relatively small, with disc inconspicuous. Brooker (2000) also included *E. deanei* (and presumably *E. brunnea*, which he considered synonymous with *E. deanei*, see Brooker and Kleinig 2006) in *E.* ser. *Transversae* but genetic evidence indicates that *E. deanei* and *E. brunnea* have a closer relationship to *E.* sect. *Maidenaria* than *E.* sect. *Latoangulatae* (Jones *et al.* 2016). Some of the morphological characters of *E. deanei* and *E. brunnea* also suggest a closer relationship with *E.* sect. *Maidenaria* rather than *E.* sect. *Latoangulatae* (see description under *E.* ser. *Deaneanae*, below). Brooker (2000) did not include *E. botryoides* in *E.* ser. *Transversae*, and instead placed the species in *E.* ser. *Annulares.* We believe *E. botryoides* is better placed in *E.* ser. *Transversae* with *E. saligna*, based on the evidence in Jones *et al.* (2016), especially considering the two species intergrade extensively where their distributions adjoin (Passioura and Ash 1993).

E.* sect. *Racemus

Monotypic (*E. michaeliana*). Restricted to very scattered populations on the central coast of NSW northwards to the NSW/Qld border region. Adult leaves with very densely reticulate tertiary venation, inflorescence branched (compound), stamens irregularly-flexed, seeds with a ventral hilum. Chippendale (1988) placed *E. michaeliana* in a monotypic series, *E.* ser. *Michaelianae* (Chippendale did not use sections), while Brooker (2000) placed it in a monotypic section. The molecular studies of Steane *et al.* (2002), which utilised ITS sequence data, and Steane *et al.* (2011), which utilised DArT marker data, each included a single sample of *E. michaeliana*, an F1 plant at Currency Creek Arboretum (CCA) grown from seed of *D.Nicolle 650*, collected near Hillgrove NSW. The molecular study of Jones *et al.* (2016), which also used DArT marker data, initially included two samples of *E. michaeliana* (one, *D.Nicolle 6247*, collected near Wollombi NSW, and the other from the same tree at CCA as used in the Steane *et al.* 2002 and 2011 studies). Both Steane *et al.* (2002) and Steane *et al.* (2011) placed the single sample of *E. michaeliana* as a sister taxon to *E.* sect. *Maidenaria*, while the two samples used in Jones *et al.* (2016) did not form a monophyletic group under either a cladistic- nor a distance-based analysis and were placed in larger clades with *E.* sect. *Latoangulatae* (CCA/Hillgrove sample) or *E.* sect. *Exsertaria* (Wollombi sample). Both the tree at CCA used in all three molecular studies and the Wollombi specimen used in Jones *et al.* 2016 are certainly *E. michaeliana* based on their morphology, so their differing placement in the molecular studies is puzzling. Due to the lack of reliable molecular data for *E. michaeliana* we have decided to maintain the status assigned by Brooker (2000) by retaining it in a monotypic section, and have tentatively placed the section between *E.* sect. *Latoangulatae* and *E.* sect. *Maidenaria,* pending further sampling and data.

E.* sect. *Maidenaria

81 species. Distributed in the higher-rainfall parts of south-eastern Australia, especially in the temperate to alpine regions, from Eyre Peninsula and Kangaroo Island in South Australia in the west, to west of Brisbane in far southern Queensland in the north, and including most of the higher-rainfall regions of New South Wales, Victoria and Tasmania. Distinguished by its combination of tree or mallee habit, completely annually decorticating to mostly persistent bark, its strongly dimorphic foliage, its sessile or petiolate juvenile leaves, its concolorous or sometimes discolorous adult leaves, its ovules in 4 vertical rows, its singular, 3- or 7-flowered inflorescences (to 11-flowered in *E. crenulata* and to 15-flowered *E. neglecta*), and its seeds with a ventral hilum. Except for the inclusion of *E.* ser. *Deaneanae*, the circumscription of *E.* sect. *Maidenaria*, in terms of species included, matches that in Brooker (2000). However, based on the paucity and/or weakness and/or variability of morphological differences between many of Brooker's infra-sectional taxa within *E.* sect. *Maidenaria*, we believe that he has over-ranked the infra-sectional taxa, and this view is supported by the phylogenetic evidence (Jones *et al.* 2016). Brooker divided *E.* sect. *Maidenaria* into 3 subsections, 17 series and 6 subseries. We recognise no subsections and the following 13 series and 4 subseries within *E.* sect. *Maidenaria*:

- ***E.* ser. *Deaneanae***. Two species (*E. deanei* and *E. brunnea*). Distributed from the Blue Mountains in NSW northwards to the Stanthorpe area in southern Queensland. Trees, bark annually decorticating throughout, juvenile leaves petiolate and orbicular to ovate, adult leaves strongly discolorous, inflorescences 7-flowered, fruit valves at or above rim level. Brooker (2000) and other earlier eucalypt taxonomies placed *E. deanei* (including *E. brunnea*, Johnson and Hill 1990) in *E.* sect. *Latoangulatae*, closest to *E. grandis* and *E. saligna*. The molecular phylogenies of Jones *et al.* (2016) suggest that *E. deanei* and *E. brunnea* are not part of *E.* sect. *Latoangulatae*, but form a monophyletic group that is sister to the remainder of *E.* sect. *Maidenaria* as recognised here. Some of the morphological characters of *E. deanei* and *E. brunnea* also suggest that they are better placed within *E.* sect. *Maidenaria* than within *E.* sect. *Latoangulatae*, such as their fully decorticating bark (some non-shedding bark on the trunks of *Latoangulatae* taxa) and their fruits with a level to descending disc and valves at or below rim level (fruits usually with a raised disc and valves exserted above rim level in *Latoangulatae* taxa).
- ***E.* ser. *Quadrangulatae***. Monotypic (*E. quadrangulata*). Distributed from the central tablelands of NSW northwards to far south-eastern Queensland. Trees, lignotubers formed, persistent bark often tessellated, juvenile leaves sessile and non-pruinose, juvenile stems quadrangular in cross section, adult leaves concolorous and with lenticels, inflorescences 7-flowered, fruits obconic, valves exserted above the rim. Brooker (2000) included this species in *E.* subser. *Remanentes* along with seven other species. *Eucalyptus quadrangulata* is a morphologically distinctive species, and the findings of Jones *et al.* (2016) indicate that *E. quadrangulata* is monophyletic and sister to all *E.* sect. *Maidenaria* taxa except *E.* ser. *Deaneanae*. If the following series are to be recognised in *E.* sect. *Maidenaria*, then *E. quadrangulata* should be treated at the same rank, as a monotypic series.
- ***E.* ser. *Remanentes*** (the 'shining gums'). Two species (*E. nitens* and *E. denticulata*). Restricted to mountainous areas in central Victoria northwards to near Ebor on the northern Tablelands of NSW. Trees, lignotubers reportedly not formed (Jacobs 1955; Slee *et al.* 2006), bark mostly annually decorticating, juvenile leaves large, sessile, ovate and pruinose, adult leaves concolorous and with or without lenticels, inflorescences 7-flowered, fruits sessile, cupular to barrel-shaped, fruit valves at rim level. Brooker (2000) included these two species in *E.* subser. *Remanentes* along with six other species that we here include in *E.* ser. *Globulares* subser. *Clivosae*. Jones *et al.* (2016) demonstrated that *E. nitens* and *E. denticulata* form a monophyletic group that is separate from and not sister to the remainder of Brooker's (2000) *E.* ser. *Remanentes*, and the distinctive juvenile morphology, variably lenticulate adult leaves, and small buds and fruits of *E. nitens* and *E. denticulata* also distinguishes them from the other species. Because *E. nitens* is the type species for *E.* subser. *Remanentes*, it and *E. denticulata* are retained in that series, and we place the other species in *E.* ser. *Globulares* subser. *Clivosae.* The vegetative regeneration strategy of *E. nitens* and *E. denticulata* (i.e. *E.* subser. *Remanentes* as circumscribed here) is unclear. The two species are reported to not form lignotubers (lignotubers, if present, are most conspicuous at the seedling stage) but they appear to survive even intense wildfire via epicormic shoots in the trunk and branches (B.Mifsud pers. comm.), and thus are not obligate seeders.
- ***E.* ser. *Neglectae***. Monotypic (*E. neglecta*). Restricted to scattered populations along swampy streams in mountainous areas of eastern Victoria, often growing as an understorey to larger *Eucalyptus* species. Poor-formed trees, lignotubers formed, bark persistent on trunk, juvenile leaves large, sessile, often persisting in reproductively mature crown, juvenile stems strongly quadrangular in cross section, inflorescences 7–15-flowered, fruits sessile and crowded.

- ***E.* ser. *Bridgesianae*** (the 'apple boxes'). Four species (*E. dunnii, E. angophoroides, E. bridgesiana* and *E. malacoxylon*). Distributed from central Victoria northwards to far southern Queensland. Trees, persistent bark often tessellated, juvenile leaves sessile, ovate and crenulate, adult leaves concolorous or weakly discolorous, inflorescences 7-flowered, fruits obconic to hemispherical, fruit valves exserted above rim.
- ***E.* ser. *Globulares***. Eleven species. Widespread in south-eastern Australia, including Tasmania, from the Flinders Ranges and Mount Lofty Ranges in SA to far south-eastern Queensland. Trees or facultative mallees, bark annually decorticating throughout to mostly persistent, juvenile leaves large, sessile and ovate to orbicular, adult leaves concolorous, inflorescences singular, 3- or 7-flowered, peduncles flattened. Within *E.* ser. *Globulares* two subseries are recognised:
  - ***E.* subser. *Clivosae***. Seven species. Widespread in south-eastern mainland Australia (i.e. excluding Tasmania), from the Flinders Ranges and Mount Lofty Ranges in SA to far south-eastern Queensland. Juvenile leaves pruinose or not, juvenile stems terete to quadrangular in cross section, inflorescences 7-flowered, opercula not warty, fruit disc inconspicuous and descending. These species were included in *E.* ser. *Remanentes* (type = *E. nitens*) by Brooker (2000), along with *E. nitens* and *E. denticulata*. Jones *et al.* (2016) demonstrated that *E. nitens* and *E. denticulata* formed a well-supported monophyletic group that is divergent from the remainder of Brooker's (2000) *E.* ser. *Remanentes*, and these taxa are also morphologically differentiated, justifying their inclusion in a separate series (see above). *Eucalyptus* ser. *Globulares* subser. *Clivosae* formed a monophyletic group, albeit weakly supported, in Jones *et al.* (2016), with the exception of a single sample of *E. volcanica* from *E.* ser. *Bridgesianae* (labelled as *E. retinens* in Jones *et al.* 2016) collected from the Warrumbungles in N.S.W. (*D.Nicolle* 6150). This specimen may have a closer relationship to *E.* ser. *Bridgesianae* due to misidentification or hybridisation between *E. volcanica* and *E. bridgesiana* (of *E.* ser. *Bridgesianae*), however, more detailed sampling and analysis of the Warrumbungles population is required to determine its status and origin.
  - ***E.* subser. *Euglobulares***. Four species (*E. globulus, E. bicostata, E. pseudoglobulus* and *E. maidenii*). Widespread in south-eastern Australia, including Tasmania, from the Mount Lofty Ranges in SA to the central tablelands of NSW. Juvenile leaves pruinose, juvenile stems strongly quadrangular in cross section, inflorescences 1-, 3- or 7-flowered, opercula warty, fruit disc prominent and level to ascending.
- ***E.* ser. *Foveolatae*** (the 'swamp gums'). Nine species. Distributed in the wetter parts of south-eastern Australia, including Tasmania, from Kangaroo Island in SA to the NSW/Qld border region. Trees or mallees, bark annually decorticating throughout to partly persistent, juvenile leaves becoming petiolate early and often crenulate, juvenile stems terete in cross section, adult leaves concolorous to weakly discolorous and often undulate, inflorescences 7-flowered, fruits obconic to cupular, fruit valves around rim level. As well as the nine species included here, Brooker (2000) also included *E. macarthurii* in the series. Based on its morphology (especially its sessile juvenile leaves) and the findings of Jones *et al.* (2016), we have placed *E. macarthurii* in *E.* ser. *Viminales* subser. *Lanceolatae*. *Eucalyptus barberi* is included in the series, following Brooker (2000), due to its morphology, which is consistent with other members of ser. *Foveolatae*, but the species does not neatly fit this classification in the phylogeny of Jones *et al.* (2016). It was suggested that the species may be of interserial hybrid origin (*E.* ser. *Foveolatae* x *E.* ser. *Tasmaniae*) or is an ancestral taxon from which these two series evolved.
- ***E.* ser. *Crenulatae***. Monotypic (*E. crenulata*). Restricted to a few populations on swampy sites near streams in central Victoria, usually growing as an understorey to taller *Eucalyptus* species. Poor-formed trees, bark persistent on trunk, juvenile leaves small, sessile, ovate, crenulate and pruinose, and forming the reproductively mature crown, juvenile stems terete in cross section, adult leaves not formed, inflorescences 7–11-flowered, fruits small, pruinose. The finding of Jones *et al.* (2016) place *E. crenulata* as a monophyletic species that is distinct from, but sister to, *E.* ser. *Foveolatae* (the 'swamp gums'), excluding the anomalous *E. barberi*. Although *E. crenulata* shares its swampy habitat and biogeography with the 'swamp gums', and is known to hybridise with a species of *E.* ser. *Foveolatae* in the wild (Simmons and Parsons 1976), we have retained its placement in a monotypic series, following its classification in Brooker (2000), due to its distinctive and unique morphology and its support in Jones *et al.* (2016).
- ***E.* ser. *Tasmaniae*** (the 'alpine white gums') Five species (*E. archeri, E. gunnii, E. urnigera, E. morrisbyi* and *E. cordata*). Endemic to Tasmania. Trees or facultative mallees, bark mostly annually decorticating, juvenile leaves sessile and orbicular, adult leaves concolorous, inflorescences 3-flowered, fruit disc descending, fruit valves at or below rim level. These five Tasmanian-endemic species were included in *E.* ser. *Orbiculares* by Brooker (2000), along with another four species endemic to mainland Australia and one species shared between the mainland and Tasmania (*E. perriniana*, the type species for the series). *Eucalyptus perriniana* and the four mainland-endemic species are here included in *E.* ser. *Viminales*

subser. *Circulares* based on their shared morphology and the findings of Jones *et al.* (2016), while the five Tasmanian-endemic species are retained as a separate series, with a closer relationship to *E.* ser. *Semiunicolores* and *E.* ser. *Foveolatae*.

- ***E.* ser. *Semiunicolores*** (the 'Tasmanian yellow gums'). Three species (*E. vernicosa, E. subcrenulata* and *E. johnstonii*). Endemic to Tasmania. Trees or mallees, bark annually decorticating throughout, shiny and seasonally colourful, juvenile leaves sessile, orbicular to ovate, crenulate, shiny and green, adult leaves concolorous, inflorescences 3-flowered, fruit disc level to descending, fruit valves at or above rim level. As well as these three Tasmanian-endemic species, Brooker (2000) also included *E. imlayensis* in the series. *Eucalyptus imlayensis* is known from a single mountain-top population in NSW, and although it shows some morphological convergence towards the other species of *E.* ser. *Semiunicolores* (such as its greenish newly exposed bark), its morphology is generally very similar to that of *E. elaeophloia* (not included in Brooker 2000), *E. wilcoxii* and *E. baeuerlenii* (the latter two species forming Brooker's *E.* ser. *Saxicola*). Although being defined as 'rock dwellers', *E.* ser. *Saxicola* has no morphological characters that distinguish it from *E.* ser. *Viminales* subser. *Lanceolatae*, and as such, *E.* ser. *Saxicola, E. imlayensis* and *E. elaeophloia* are included in *E.* ser. *Viminales* subser. *Lanceolatae* here (see below). The findings of Jones *et al.* (2016) show weak support for maintaining *E.* ser. *Semiunicolores* (with *E. johnstonii, E. subcrenulata* and *E. vernicosa* only), but it is here maintained because of the morphological distinctiveness of the series.
- ***E.* ser. *Recurvae***. Monotypic (*E. recurva*). Restricted to a few presumably relict individuals on the central tablelands of NSW. Whipstick mallees, bark annually decorticating throughout, juvenile leaves sessile, opposite, small, elliptical, recurved, shiny, green, and forming crown of reproductively mature plant, juvenile stems terete in cross section, inflorescences 3-flowered, fruits sessile, small (relative to other taxa in *E.* sect. *Maidenaria*). Brooker (2000) included *E. recurva* in *E.* subser. *Obscurae*, along with *E. parvula* (the latter species being the type for the subseries). Morphologically, *E. recurva* is a very distinctive species, and does not have morphology in common with any others, including *E. parvula*. These two species do not have a close relationship in Jones *et al.* (2016), and placement of *E. recurva* in a monotypic series is appropriate for this unique and apparently relictual species.
- ***E.* ser. *Sturgissianae***. Monotypic (*E. sturgissiana*). Restricted to the Nowra area on the south coast of NSW. Slender mallees, bark annually decorticating throughout, juvenile leaves sessile and connate, often persisting in the reproductively mature crown, adult leaves concolorous, inflorescences 7-flowered, outer opercula not shedding, fruit valves at rim level. On the basis of its unique combination of morphological characters and its distinctiveness in the analyses of Jones *et al.* (2016), the placement of *E. sturgissiana* in a monotypic series, following Brooker (2000), is appropriate.
- ***E.* ser. *Viminales***. 40 species. Widespread in south-eastern Australia, from Eyre Peninsula and Kangaroo Island in SA to far south-eastern Queensland, including most of eastern NSW, southern and eastern Victoria, and most of Tasmania. Trees or mallees, bark annually decorticating throughout to mostly persistent, juvenile leaves sessile or shortly petiolate, adult leaves concolorous, inflorescences 1-, 3- or 7-flowered, fruit disc level to ascending, fruit valves at or above rim level. Within *E.* ser. *Viminales,* two subseries are recognised (see below). Brooker (2000) recognised ten series in our circumscription *E.* ser. *Viminales*, including three monotypic series, which spanned all three of his subsections recognised in *E.* sect. *Maidenaria*. However, based on the paucity and/or weakness of morphological differences between Brooker's series, we believe he has significantly over-ranked this group. Further, these series are mostly poorly resolved in the molecular study of Jones *et al.* (2016). This genetic evidence does not support the retention of *E.* ser. *Saxicola,* since *E. wilcoxii* and *E. baeuerlenii*, as well as *E. imlayensis* and *E. elaeophloia* each formed monophyletic groups (as species) but within the larger *E.* ser. *Viminales* clade. Within *E.* ser. *Viminales*, the morphological distinction between the two subseries recognised by Brooker (2000) is weak and they are not supported in Jones *et al.* (2016). Nevertheless, they are here retained pending further research, and on the basis of their morphological and ecological distinction, as described below.
  - ***E.* subser. *Circulares***. 14 species. Distributed in south-eastern Australia, including Tasmania, from the Mount Lofty Ranges in SA to far south-eastern Queensland, often (but not always) on locally colder sites compared to *E.* subser. *Lanceolatae*. Juvenile leaves orbicular to elliptical in shape.
  - ***E.* subser. *Lanceolatae***. 26 species. Widespread in south-eastern Australia, including Tasmania, from Eyre Peninsula and Kangaroo Island in SA to far south-eastern Queensland. Juvenile leaves linear to lanceolate to elliptical in shape.

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