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Two new subspecific taxa within the *Eucalyptus* Series *Argyrophyllae* for Victoria

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Introduction

The *Eucalyptus* series *Argyrophyllae* Blakeley includes a small number of taxa which share the following features: the habit of a smallish tree; bark that is stringy (outer bark weathered and grey over inner bark reddish brown); juvenile leaves that, for numerous pairs, are opposite, sessile, amplexicaul, glaucous, initially orbicular, emarginate and eventually cordate or ovate; inflorescences that are simple axillary and 3–7-flowered; buds that are ovoid to diamond-shaped and pruinose; and fruits that are obconical, campanulate or sub-cylindrical with a level or an ascending disc.

As well as *E. cinerea* F. Muell. ex Benth., *E. nova-anglica* H. Deane & Maiden and *E. cephalocarpa* Blakely, recently published taxa include *E. triplex* L.A.S. Johnson & K.D. Hill, *E. conspicua* L.A.S. Johnson & K.D. Hill, *E. alligatrix* L.A.S. Johnson & K.D. Hill, *E. alligatrix* subsp. *limaensis* Brooker, A.V. Slee & J.D. Briggs and *E. alligatrix* subsp. *miscella* Brooker, A.V. Slee & J.D. Briggs. *Eucalyptus triplex* was reassessed to *E. cinerea* subsp. *triplex* (L.A.S. Johnson & K.D. Hill) Brooker, A.V. Slee & J.D. Briggs.

Eucalyptus series *Argyrophyllae* was erected to accommodate a range of taxa which shared some glaucous features. Only *E. cinerea*, *E. cephalocarpa* and *E. nova-anglica* are currently recognised as members of the series. *Eucalyptus cinerea* is distinguished by its neotenus habit (crown consisting of glaucous, pre-adult leaves), 3-flowered inflorescences, sessile or shortly

Abstract

Two new taxa of the series *Argyrophyllae*, silver stringybarks, are described; *Eucalyptus conspicua* subsp. *dispara* and *E. cinerea* subsp. *victoriensis*. Their morphologies, distributions, affinities and conservation statuses are discussed. As well, assessments of the taxonomic statuses of *E. triplex*, *E. alligatrix* subsp. *limaensis* and *E. alligatrix* subsp. *miscella* are given, as are occurrences of aberrant bud numbers in *E. cephalocarpa* and *E. alligatrix* subsp. *alligatrix*.

Keywords: taxonomy, Silver stringybark, neoteny, pre-adult leaves, crown structure

pedicellate buds and relatively large fruits. *Eucalyptus cephalocarpa* is distinguished by its mature crown of blue-green adult leaves, 7-flowered inflorescences and sessile or sub-sessile buds and fruits that are slightly smaller than those of *E. cinerea*. *Eucalyptus nova-anglica* also has 7-flowered inflorescences but, in contrast to *E. cephalocarpa*, it differs by its ovoid buds and generally smaller, distinctly pedicellate fruits.

Pryor and Johnson (1971), in an informal classification of the genus, submerged the series *Argyrophyllae* within the series *Viminales* Blakely. They proposed a superspecies *Cinerea* consisting of two species, *E. nova-anglica* and *E. cinerea*, with the latter consisting of four informal subspecies; 'cinerea', 'Beechworth' 'cephalocarpa' and 'East Gippsland/South Coast New South Wales'.

Chippendale (1988), recognised *E. nova-anglica*, *E. cinerea* and *E. cephalocarpa* as three species within the series *Viminales*, but the informal taxa, 'East Gippsland/South Coast New South Wales' and 'Beechworth' sens. Pryor and Johnson (1971), were not mentioned in his account.

More recently, Johnson and Hill (1990) erected *E. triplex* from the Australian Capital Territory and adjacent ranges to the east. The same authors (Hill & Johnson 1991) erected *E. conspicua*, which extends from the Latrobe Valley region of Victoria to the extreme southern coast of NSW, and *E. alligatrix* from north-east Victoria from the Lake Eildon and Beechworth areas. *Eucalyptus triplex* was distinguished from *E. cinerea* by its smaller, mallee-like habit, its crown consisting mostly of relatively small, glaucous, lanceolate adult leaves and its smaller, sessile buds and campanulate fruits. *Eucalyptus conspicua*, although being 7-flowered, was distinguished from *E. cephalocarpa* by its crown consisting of grey-green or sub-glaucous neotenous adult leaves, and from *E. cinerea*, which has 3-flowered inflorescences. *Eucalyptus alligatrix* was distinguished from other 3-flowered members of the series by its crown consisting of mainly of strongly glaucous, mostly adult leaves (some pre-adult leaves were given as being present in the mature crown).

Brooker et al. (1995) resurrected the series *Argyrophyllae* and reduced *E. triplex* to *E. cinerea* subsp. *triplex* on the basis of the crown compositions of the two being closer than Johnson and Hill had interpreted.

Also, they erected *E. alligatrix* subsp. *limaensis* Brooker, Snee & J.D. Briggs to cater for populations in the Lima-Swanpool area of north-east Victoria. This new taxon was seen to differ from subsp. *alligatrix* by its taller habit, smaller buds and fruits, and its crown consisting only of adult leaves that are smaller than the type subspecies. *E. alligatrix* subsp. *miscella* was also erected to cater for a disjunct population of small woodland trees from near Rylstone in central New South Wales, its defining features given as having a mature crown only of adult leaves and some trees with mixed 3- and 7-flowered inflorescences. Further, they placed the Beechworth populations of *E. alligatrix* under *E. cinerea* on the basis that Hill and Johnson had misinterpreted the composition of its crown. Included in their circumscription of the series the authors made reference to populations of *E. conspicua* with predominantly 3-flowered inflorescences occurring in central Gippsland.

A comprehensive study using cladistic techniques of the entire *Eucalyptus* Section *Maidenaria* L.D. Pryor & L.A.S. Johnson ex Brooker was completed by Chappill and Ladiges (1992). They identified *E. cinerea* as neotenous (the mature crown being dominated by pre-adult leaves) and having more or less cylindrical fruits. In contrast, *E. triplex* was found to differ from *E. cinerea* by its mature crown being dominated by adult leaves and its fruits being campanulate. These authors did not allude to *E. triplex* being potentially a subspecies of *E. cinerea*.

Hill (2002), in the Flora of New South Wales (revised edition), continued to recognise *E. triplex* as a species. While he recognised the presence of *E. alligatrix* subsp. *alligatrix* in New South Wales, he made no reference to *E. alligatrix* subsp. *miscella* as a taxonomic entity.

Nicolle (2006), in an assessment of the silver stringybarks in south-eastern Australia did not recognise either *E. alligatrix* subsp. *limaensis* or *E. triplex*. In the case of the former he noted that differences between it and the type subspecies were minor and insufficient for its recognition. In the case of *E. triplex*, he asserted that differences in crown structure between it and *E. cinerea* were most likely due to environmental influences.

Walsh and Stajsic (2008), recognised all published Victorian taxa within the series, and listed the Beechworth form of *E. cinerea* as an informal taxon.

As is indicated in its history, the series *Argyrophyllae* is

not without controversy, particularly as the taxonomic integrities of *E. triplex* (syn. *E. cinerea* subsp. *triplex*), *E. alligatrix* subsp. *limaensis* and *E. alligatrix* subsp. *miscella*, having been brought into question. It is our view that *E. triplex* (as a subspecies of *E. cinerea*) and *E. alligatrix* subsp. *limaensis* are legitimate taxa, but not so *E. alligatrix* subsp. *miscella* which we view as being only a minor variant within the typical subspecies.

It is our view that *E. triplex* is more appropriately placed as a subspecies of *E. cinerea*, not only because of crown differences being slight, as was demonstrated by Brooker et al. (1995), but also because the campanulate fruits, as a distinguishing feature given by the authors, are not exclusive to the taxon but occur widely throughout *E. cinerea*. Further, in the case of the assertion by Nicolle (2006) regarding differences in crown structure between *E. triplex* and *E. cinerea*, we take the view that such differences are genetically fixed rather than a response to environmental conditions.

In the case of Nicolle's (2006) position regarding the status of *E. alligatrix* subsp. *limaensis*, from our investigations, which took into account numerous trees across its range (the Lima-Swanpool area), we believe that it is sufficiently different from the type subspecies in habit and adult leaf, bud and fruit sizes to warrant its maintenance as a separate taxon.

Regarding *E. alligatrix* subsp. *miscella*, it is our view that the taxon's authors did not adequately demonstrate that it is sufficiently different from the type subspecies. Habit (a small woodland tree to 15 m tall) and some trees in the population with 3- and 7-flowered inflorescences were offered as primary criteria for its segregation. However, given that the type subspecies is also a smallish, spreading tree of similar height, has some trees in the type population having 7-flowered inflorescences and is only slightly different in adult leaves, buds and fruits, it is here regarded as a minor variant.

Further, it was our opinion that, despite the publication of the new taxa since 1990, there were still unresolved issues within the series in Victoria. Thus, it has been the central aim of our studies to assess the taxonomic worth of several anomalous variants which are currently included within existing taxa. Two in particular are the neotenous, predominantly 3-flowered populations of *E. conspicua* in central Gippsland and the populations of *E. cinerea* in the Beechworth area of

north-east Victoria. Also, assessments of four aberrant occurrences of *E. cephalocarpa*, namely trees with 3-flowered inflorescences in the Fryers Range in central Victoria, trees with 7–11-flowered inflorescences near Bengworden in central Gippsland, large-fruited trees on the Mornington Peninsula and trees in central and east Gippsland which resemble *E. ignorabilis* L.A.S. Johnson and K.D. Hill were considered worthy of investigation, as were trees of *E. alligatrix* with 7-flowered inflorescences occurring along the Jamieson Road close to the type locality. From our investigations we were satisfied that all four forms of *E. cephalocarpa* are minor variants within the species, as are the 7-flowered trees of typical *E. alligatrix*. However, from our investigations we found that, in the cases of and the central Gippsland form of *E. conspicua* and the Beechworth form of *E. cinerea*, taxonomic treatments are appropriate. The former is described below as *E. conspicua* subsp. *dispara* and the latter as *E. cinerea* subsp. *victoriensis*.

Methods

Historically, seedling trials involving members of the series *Argyrophyllae* (for example, Brooker et al. 1995) have consistently demonstrated that seed-lots from pure-breeding trees, regardless of the taxa involved, produce seedlings that consistently exhibit orbicular, emarginate, opposite, sessile amplexicaul, glaucous juvenile leaves. The trials conducted for our investigations, which included seed-lots of all the anomalous Victorian entities, were no exception.

In our seedling trials, seed-lots representing the type subspecies of both *E. conspicua* and *E. cinerea* and ones drawn from trees representative of both the central Gippsland form of *E. conspicua* (north-east of Seaton, west of Mt Hedrick and Freestone Creek) and the Beechworth form of *E. cinerea* (Reids Way, NNW of Beechworth, *Rule 0215*) showed uniformity in morphology, as well as consistency with seedlings that typify the series. The same outcomes occurred with seed-lots used to assess each of the forms of *E. cephalocarpa* from Bengworden, the Fryers Range, the Mornington Peninsula (Langwarrin and Bald Hill) and Genoa near Mallacoota, as well as with the 7-flowered trees of *E. alligatrix* subsp. *alligatrix*.

Of greater value were field and herbarium studies where differences between taxa in sapling and adult

morphologies across a wide range of populations of each taxon involving both vegetative and reproductive characters could be examined. Habits, barks, crowns, adult leaves, peduncles, bud numbers, buds and fruits were examined to ascertain whether the erection of the two new taxa could be justified.

Terminology

The descriptions of the leaf stages common to the taxa of the series used by Brooker et al. (1995) are adhered to in this paper except that two stages of juvenility are recognised:

Pre-adult leaves:

- (a) *Juvenile leaves:* Initially, the leaves are orbicular, emarginate, opposite, sessile and amplexicaul. Later, they become cordate, sub-orbicular or broadly lanceolate but remain opposite, sessile and sometimes amplexicaul.
- (b) *Intermediate leaves:* These are opposite and shortly petiolate and usually broadly lanceolate.

Adult leaves: These are disjunct, petiolate and lanceolate

Neotenuous: This describes reproductively mature trees which have a crown dominated by pre-adult leaves.

In this context *E. cinerea* subsp. *cinerea* and the new taxon described here, *E. conspicua* subsp. *dispara*, are considered neotenuous.

Semi-neotenuous: This describes trees that are partially neotenuous, that is, their outer crowns feature adult leaves and their inner crowns consist of pre-adult leaves. *Eucalyptus conspicua* subsp. *conspicua* and *E. cinerea* subsp. *victoriensis*, the new taxon described here, and *E. cinerea* subsp. *triplex* are also considered partially neotenuous. The maintenance of crowns of mixed adult and pre-adult leaves is a curious phenomenon. It would appear axiomatic that once a state of adult foliage has been achieved, the crown would progressively consist of only adult leaves as pre-adult leaves senesce. This is clearly not the case as the crowns of these taxa remain mixed, suggesting that new growth, at least initially of pre-adult leaves, is often initiated sub-apically on branches. These may or may not transition to adult leaves, whereas new apical growth on branches more commonly initiates adult leaves. Flowering occurs in axils of both pre-adult and adult leaves in the semi-neotenuous species discussed in this account.

Non-neotenuous: This term applies to trees with mature canopies consisting entirely of adult leaves.

Key to taxa of the Series *Argyrophyllae*

1	Crown dominated by adult leaves.....	2
1:	Crown consisting entirely of pre-adult leaves or a mixture of adult and pre-adult leaves.....	6
2	Inflorescences predominantly 3-flowered.....	3
2:	Inflorescences predominantly 7-flowered.....	5
3	Erect trees to 30 m tall; fruits 4-5 mm diam.	<i>E. alligatrix</i> subsp. <i>limaensis</i>
3:	Trees to 15 m tall, either robust and spreading or small and mallee-like; fruits 5-7 mm diam.	4
4	Spreading trees; fruits cup-shaped or broadly conical.....	<i>E. alligatrix</i> subsp. <i>alligatrix</i>
4:	Stunted trees (rarely to 15 m tall) or mallees; fruits campanulate	<i>E. cinerea</i> subsp. <i>triplex</i>
5	Buds ovoid, distinctly pedicellate; fruits 4-6 mm diam.....	<i>E. nova-anglica</i>
5:	Buds diamond-shaped, sessile or sub-sessile, fruits 5-8 mm diam.....	<i>E. cephalocarpa</i>
6	Crown dominated by pre-adult leaves	7
6:	Inner crown containing pre-adult leaves; adult leaves present in the outer crown.....	8
7	Spindly trees to 8 m tall; crown open and dominated by sub-orbicular pre-adult leaves; buds sessile.....	<i>E. conspicua</i> subsp. <i>dispara</i>
7:	Spreading trees to 15 m tall; crown dense and dominated by ovate, opposite and sessile pre-adult leaves; buds shortly pedicellate.....	<i>E. cinerea</i> subsp. <i>cinerea</i>
8	Inflorescences 7-flowered	<i>E. conspicua</i> subsp. <i>conspicua</i>
8:	Inflorescences 3-flowered	9
9	Small mallee-like trees to 15 m tall; fruits 5-7 mm diam.....	<i>E. cinerea</i> subsp. <i>triplex</i>
9:	Upright trees to 30 m tall; fruits 3-5 mm diam.....	<i>E. cinerea</i> subsp. <i>victoriensis</i>

E. cephalocarpa, *E. nova-anglica* and the subspecies of *E. alligatrix* are regarded as non-neotenus taxa.

Glaucous: This is (often erroneously) regarded as being synonymous with pruinose and waxy but is used here to describe leaf colour (silvery to grey-green) whereas pruinose is used to describe structures (stems, petioles, buds and immature fruits) covered with a waxy bloom.

Taxonomy

Eucalyptus conspicua subsp. *dispara* Rule & N.G. Walsh subsp. nov.

Type: VICTORIA. c. 2 km NW of Bulldog Junction towards Ben Cruachan, *G. Sutter s.n.*, 9. xi. 2010 (holo: MEL 2418185; iso: CANB, NSW).

A subspecies of *E. conspicua* differing from the typical subspecies by its spindly habit, a crown dominated by pre-adult leaves; inflorescences mostly 3-flowered, buds sessile and fruits tightly sessile.

Trees, small and spindly, to 8 m tall. *Stems* to 40 cm diam. at the base. *Bark* light grey, stringy, persistent throughout; inner layers of bark red-brown. *Juvenile leaves* orbicular, amplexicaul, emarginate, opposite, sessile, glaucous, slightly discolorous, 2.5–6 cm long, 2.5–6 cm wide; advanced juvenile leaves cordate or sub-orbicular, longer than wide, apiculate and sometimes often basally rounded, dominating the mature crown; nodes relatively sparse. *Seedlings* with heavily pruinose stems. *Intermediate leaves* broadly lanceolate or ovate, opposite, sessile or shortly petiolate, glaucous, sometimes present in the crown of mature trees. *Adult leaves* lanceolate, slightly falcate, petiolate, disjunct, acuminate, densely reticulate, concolorous, glaucous, 8–15 cm long, 1.7–3 cm wide, infrequently present in the mature crown; petioles 0.4–1.2 cm long, intramarginal vein c. 2 mm from margin; oil glands regular, small, island. *Inflorescences* simple, axillary, 3(–7)-flowered, rarely paired in the axis; peduncles slightly angular, 2–6 mm long, contracting with age, often causing mature infructescences to appear sessile. *Floral buds* diamond-shaped, sessile, operculum scar present (outer operculum shed in early bud development), 3- or 4- (rarely 5-)loculed, pruinose, 5–7 mm long, 3–4 mm wide; operculum obtuse-conical, 2.5–3.5 mm long,

3–4 mm diam.; stamens inflexed, all fertile; filaments white; anthers dorsifixed, versatile, oblong, dehiscing through longitudinal slits; ovules in 4 vertical rows. *Fruits* obconical to sub-campanulate, sessile, pruinose when immature, tightly clustered, 5–7 mm long, 5–8 mm diam.; staminal ring conspicuous, vertically-oriented; disc slightly ascending or less often flat; valves 3 or 4 (rarely 5), level with disc or slightly exerted. *Fertile seeds* blackish, irregularly elongated or oblong, lacunose; hilum ventral. *Flowering period* Autumn. (Fig. 1)

Additional specimens examined: VICTORIA: Freestone Creek, c. 15 km NE of Briagolong, c. 100 m N of Bullockhead Creek Track, *N.G. Walsh 6282* and *A. Messina 24.iii.2005* (MEL); 5.4 km WNW from Seaton on McEvoy's Track, *V. Stajcs 3722* (MEL), 1.xii.2005. Just west of Marathon Road, 15.5 km NNW of Briagolong by road, *A. Green s.n. 25.i.2001* (MEL 2089878); Mitchell River N.P., Billy Goat Bend Road, c. 5 km from Dargo Road, *J.A. Jeanes 3036*, *D. Roberts* and *N.G. Walsh, 5.xii.2013* (CANB, MEL, NSW).

Distribution and habitat: The taxon has been located in four discrete localities in the foothills to the north of the Latrobe Valley in central Gippsland, from near Seaton in the west to the Mitchell River in the east, where it occurs on clay loam, often stony soils derived from Ordovician sandstones and siltstones. The annual rainfall of the area is between 600 and 700 mm fairly evenly distributed throughout the year. (Fig. 2)

Associated species: *Eucalyptus conspicua* subsp. *dispara* often grows as an understory plant with taller forest species including *E. sieberi* L.A.S. Johnson, *E. muelleriana* A.W.Howitt, *E. ignorabilis* L.A.S. Johnson & K.D. Hill, *E. obliqua* L'Herit., *E. consideniana* Maiden, *E. cypellocarpa* L.A.S. Johnson, *E. polyanthemos* subsp. *vestita* L.A.S. Johnson & K.D. Hill and *E. bridgesiana* R.T. Baker.

Etymology: The epithet is derived from the Latin *dispar* 'different', and alludes to it being morphologically and environmentally separable from the type subspecies of *E. conspicua*.

Conservation status: The area of occupancy is estimated at less than 20 km² and it is known from no more than five sites. Consequently *E. conspicua* subsp. *dispara* is regarded as Vulnerable (VU D2) *sensu* IUCN (2012) One population occurs in a national park, but the others are not within conservation reserves. Recent roadworks in the Seaton area population have destroyed about a dozen trees.



Figure 1. *Eucalyptus conspicua* subsp. *dispara* (a, b from N.G.Walsh 6282, MEL 2276236; c from V.Stajsic 3722, MEL 2283842); **a** habit, in forest with taller trees of *E. muelleriana* and *E. polyanthemos* subsp. *vestita*; **b** branchlets with buds and young fruit; **c** mature fruit.



Figure 2. Distribution of *Eucalyptus conspicua* subsp. *dispara* (triangles); *E. cinerea* subsp. *victoriensis* (circles).

Notes: Morphological, geographical and, to a large extent, ecological grounds support the erection of *E. conspicua* subsp. *dispara* as a distinct taxon. During the course of our investigations we examined populations to the north-west of Seaton and to the west of Mt. Hedrick, along the valley of Freestone Creek near Briagolong, and in the Mitchell River National Park. All these populations occur in forest communities in rather stony soils thinly overlaying Ordovician sediments in hilly country to the north of the western extremity of the range of typical *E. conspicua*. In contrast, the type subspecies tends to favour sandy soils associated with swamps, watercourses and at least seasonally moist depressions where it is usually associated with wet, heathy vegetation. An occurrence at Bullumwaal, about 20 km north of Bairnsdale, represented by a sheet at MEL (2369564, *Norris s.n.* 14.ix.2012) appears to be of hybrid origin or intermediate between subsp. *dispara* and subsp. *conspicua*. Despite most plants being 3-flowered, we found 7-flowered individuals, as well as obvious variation in habit and subtle variation in peduncle length, bud structure, fruit size, pedicel length and crown structure, all of which we regarded as being intermediate between the two entities. A population of *E. conspicua* occurring to the north-east of Bruthen, which Brooker et al. (1995) noted as containing some trees with 3-flowered inflorescences, was also visited. The trees observed were consistent with subsp. *conspicua* in all characters and no trees with 3-flowered inflorescences were located by us, although a specimen at MEL (0258592, *J.D. Briggs 2652*, 28.vii.1992) supports Brooker's observation. This population may represent a similar situation to that at Bullumwaal.

Brooker et al. (1995) recognised the 3-flowered form's distinctiveness and, while alluding to its possible links with *E. cinerea*, chose to include it with the typical 7-flowered *E. conspicua*. With reference to the population to the north-west of Seaton, they noted that, while some trees are completely neotenous, others possess crowns with a mixture of juvenile and falcate, attenuate adult leaves. However, we have surveyed this population and, whilst we located very few trees with crowns containing what could be construed as adult leaves, we found an overwhelming number of trees with crowns consisting entirely of sessile, cordate or sub-orbicular juvenile leaves. At the other sites where

the new taxon occurs, only completely neotenous trees were observed. While we concur with Brooker et al. that the new taxon is closer to *E. conspicua* than *E. cinerea* we contend that it is as distinctive in a range of other adult characters and, thus, worthy of taxonomic recognition.

The strength of our case for the erection of the new taxon is based on its distinctive spindly habit, its sparse, neotenous crown, its predominately 3-flowered inflorescences, its short peduncles and its tightly sessile fruits. However, we also believe that it is appropriate to place it as a subspecies within *E. conspicua* as its saplings are inseparable from those of typical *E. conspicua*, as it has a distribution adjacent to the western extremity of typical *E. conspicua* and that small numbers of 7-flowered inflorescences occur in some of its populations. In making our taxonomic decision that the new taxon is a part of *E. conspicua* we concede that future (e.g. molecular) studies may further clarify its relationships.

E. conspicua subsp. *dispara*, being predominantly 3-flowered has obvious links with *E. cinerea* and its subspecies, all of which occur on the inland side of the Great Dividing Range. The typical subspecies of *E. cinerea*, which occurs between Bathurst and Tumut in the Central and Southern Tablelands of New South Wales, differs from *E. conspicua* subsp. *dispara* by being a spreading robust, large-trunked tree with a crown dominated by smaller, densely packed pre-adult leaves and inflorescences that are completely 3-flowered. The Beechworth occurrence of *E. cinerea* (described below as a new subspecies) differs from this new subspecies by its taller habit, its dense crown with outer adult leaves, its consistent three-flowered inflorescences and its smaller buds and fruits (see Table 1).

***Eucalyptus cinerea* subsp. *victoriensis* Rule & N.G. Walsh subsp. nov.**

Type: VICTORIA: NNE of Beechworth, McFeeter's Road, E of Beechworth-Chiltern Road, adjacent to the turn-off to Woolshed Falls, *K. Rule 0315*, 16.v.2015 (holo: MEL 2418187; iso: CANB, NSW).

Eucalyptus aff. *cinerea* (Beechworth) *sensu* VicFlora (VicFlora (2016). Flora of Victoria, Royal Botanic Gardens Victoria, <<https://vicflora.rbgs.vic.gov.au>>, last accessed 7 Mar. 2018).

Eucalyptus cinerea subsp. Beechworth (J.D. Briggs 2607) *sensu* APC (CHAH (2006), *Australian Plant Census* <https://id.biodiversity.org.au/reference/apni/42942>, last accessed 7 Mar. 2018).

A subspecies of *E. cinerea* differing from the type subspecies in its taller, more upright habit, its outer crown containing lanceolate, pendulous adult leaves and its smaller buds and fruits.

Small to medium-sized, erect trees to 30 m tall. Inner crown containing cordate to broadly lanceolate, opposite, sessile pre-adult leaves; outer crown dominated by lanceolate, disjunct, pendulous adult leaves. *Bark* light grey, rough, stringy, thick, deeply furrowed, extending to secondary branches; inner layers of bark red-brown. *Juvenile leaves* orbicular, emarginate, opposite, sessile and amplexicaul for numerous pairs, slightly discoloured, glaucous, 2–3 cm long, 2–3 cm wide; advanced juvenile leaves cordate, ovate or broadly lanceolate; nodes relatively crowded. *Seedlings* with heavily pruinose stems. *Intermediate leaves* ovate-lanceolate or broadly lanceolate, opposite, sessile or shortly petiolate, acuminate or apiculate. *Adult leaves* lanceolate, petiolate,

disjunct, pendulous, acuminate, moderately reticulate, concolorous, glaucous, 6–10 cm long, 1–2.3 cm wide; crown dense; petioles 2–16 mm long; intramarginal vein c. 1 mm from margin; oil glands regular, small, numerous, mostly island. *Branchlets* pruinose. *Inflorescences* simple, axillary, 3-flowered; peduncles slender, 2–7 mm long. *Floral buds* diamond-shaped, sub-sessile on short thick pedicels to 2 mm long, scarred, 3- or 4-loculed, pruinose, 5–7 mm long (excluding pedicel), 3–4 mm wide; operculum obtuse-conical, 2.5–3.5 mm long, 3–4 mm wide; stamens inflexed, all fertile, filaments white; anthers dorsifixed, versatile, oblong, dehiscing through longitudinal slits; ovules in 4 vertical rows. *Fruits* obconical to campanulate, pruinose when immature, 4–5 mm long, 3–5 mm wide; pedicels 0–2 mm long; staminal ring, narrow, ascending vertically; disc narrow, flat or slightly ascending; valves 3 or 4, exserted. *Fertile seeds* blackish, dull, cuboid to oblong, lacunose; hilum ventral. *Flowering period* Autumn. (Fig. 3)

Table 1. Comparison of the morphologies of *E. cinerea* and *E. conspicua*.

Taxon	<i>E. cinerea</i> subsp. <i>cinerea</i>	<i>E. cinerea</i> subsp. <i>triplex</i>	<i>E. cinerea</i> subsp. <i>victoriensis</i>	<i>E. conspicua</i> subsp. <i>conspicua</i>	<i>E. conspicua</i> subsp. <i>dispara</i>
Habit	spreading tree to 15 m tall	small tree or mallee to 15 m tall	small to medium erect tree to 30 m tall	Small, spreading tree to 15 m tall	small spindly tree to 8 m tall
Crown composition	dominated by pre-adult leaves, adult leaves rarely present	consisting entirely or mostly of adult leaves	inner crown of pre-adult leaves, outer crown containing adult leaves	Inner crown of pre-adult leaves, outer crown of adult leaves	crown consisting of pre-adult leaves, adult leaves rarely present
Adult leaves shape	lanceolate, slightly falcate, rarely present	lanceolate, slightly falcate, dominating the crown	lanceolate, slightly falcate, abundantly present	Lanceolate, slightly falcate	lanceolate, slightly falcate, rarely present
size (cm)	to 10 x 3.5	to 12 x 4.5	to 10 x 2.3	to 14 x 3	to 15 x 3
petiole length (cm)	to 1	to 1.4	to 1.6	to 2	to 1.2
Inflorescences bud number	3-flowered	3-flowered	3-flowered	7-flowered	3(7)-flowered
peduncle length (mm)	3–8	3–5	2–7	4–8	2–6
floral buds size (mm)	6–11 x 4–5	6–8 x 3–4	5–7 x 3–4	5–8 x 3–5	5–7 x 3–4
operculum length (mm)	3–5	c. 3	2.5–3.5	3–5	2.5–3.5
pedicel length (mm)	0–2	0–2	0–2	1–3	0
Fruits shape	campanulate, obconical, sub-cylindrical	campanulate	campanulate, obconical	campanulate, obconical	obconical to sub-campanulate
size (mm)	5–8 x 5–8	5–7 x 6–8	4–5 x 3–5	5–8 x 4–7	5–7 x 5–8
disc orientation	ascending	ascending	flat or slightly ascending	flat or ascending	flat or slightly ascending
pedicel length (mm)	0–2	0–2	0–2	0–2	0

Additional specimens examined: 8 km from Beechworth along the Chiltern Road, *M.D. Crisp* 7101, 9.ii.2007 (MEL); c. 2.4 km S of Mt Pilot, c. 9.6 km N of Beechworth, *A.C. Beauglehole* 43595, 23.xi.1973 (MEL); McGuinness Lane at Corner of Chiltern-Mt Pilot N.P., *G. Earl* s.n. 24.vi.2004 (MEL); Reid's Way, N of Beechworth, adjacent to Beechworth-Wodonga Road, *K.Rule* 0215, 16.v.2015 (MEL); N of Beechworth-Yackandandah Road, *N.G.Walsh* 8155 13.iii.2014 (CANB, K, MEL); Road to Woolshed Creek Falls, 1 km W of Beechworth-Chiltern Road, *N.G.Walsh* 3304, 19.xi.1992 (CANB, MEL)

Distribution and habitat: The new subspecies occurs in hilly country to the north and north-east of Beechworth where it favours clay loam soils derived from Devonian granites. Beechworth has a mean annual rainfall of approximately 700 mm, most of which falls in winter. (Fig. 2)

Associated species: Commonly associated species include *E. blakelyi* Maiden, *E. bridgesiana*, *E. nortonii* L.A.S.Johnson and *E. macrorhyncha* F.Muell. ex Benth.



Figure 3. *Eucalyptus cinerea* subsp. *victoriensis* (all from N.G.Walsh 8155, MEL 2379871); **a** habit; **b**. pre-adult leaves; **c**. adult leaves and buds; **d**. fruits.

Etymology: The name alludes to the new subspecies being an endemic Victorian taxon.

Conservation status: Originally, stands of *E. cinerea* subsp. *victoriensis* would have occupied an area of several square kilometres but now the taxon is estimated to comprise less than a thousand individuals in the Chiltern-Pilot National Park and on nearby farms and roadsides, with the area of occupation calculated at less than 1 km². In accordance with IUCN (2012) guidelines, a status of Endangered is recommended (E B1ab, 2ab) While it is capable of regeneration after bushfires, further clearing along roadsides and on private property may threaten its numbers. Additionally, little recruitment has been observed, particularly in roadside stands.

Notes: *Eucalyptus cinerea* subsp. *victoriensis* differs from typical *E. cinerea* by its taller habit, its capacity to consistently produce adult leaves in its outer crown in its mature form and its smaller buds and fruits. It is also our contention that its erection offers clarification in the face of confusion and misreporting regarding its morphology. For example, Brooker et al. (1995), whilst taking into account the smallness of its buds and fruits, gave descriptions of habit and crown composition consistent with New South Wales populations of *E. cinerea* and not the Beechworth form. Further, Brooker and Slee (1997), in the *Flora of Victoria*, gave descriptions for habit, crown composition and bud and fruit sizes that were consistent only with the typical subspecies. Further still, Nicolle (2006), in his account of the Beechworth form, noted that its crown is composed entirely or partly of juvenile leaves, which describes both immature and mature trees of the form. As well, his descriptions of fruit sizes were incorrect as he, like the above authors, gave the dimensions of typical *E. cinerea*.

We agree with Brooker et al. (1995) that the Beechworth form should not be included with *E. alligatrix* on the bases of both crown composition and fruit structure. Mature trees of *E. alligatrix* and its subspecies, unlike the partial neoteny of the Beechworth trees, have crowns consisting entirely of adult leaves. References to *E. alligatrix* subsp. *alligatrix* having a crown of adult leaves with some pre-adult leaves present in the inner crown appear to be based on observations of immature trees. At the type locality, for example, trees with crowns consisting entirely of adult leaves grow on the banks of the Big River adjacent to smaller, somewhat less mature

trees with crowns containing a small proportion of inner pre-adult leaves. With regard to fruits, there are subtle differences in structure. Those of *E. alligatrix* have a prominently ascending disc, giving the fruit a globoid shape, whereas the fruits of the Beechworth trees have discs that are more or less flat.

It is important to note that in *E. cinerea* subsp. *victoriensis* the production of outer adult leaves occurs in the crowns of mature trees. In contrast, the crowns of saplings and young trees consist entirely of opposite, sessile, ovate or lanceolate pre-adult leaves.

It is our view that the erection of the new taxon as a subspecies of *E. cinerea* is justified as it differs from the type subspecies by its taller, more erect habit (subsp. *cinerea* being a spreading tree to 15 m tall), the outer crown containing disjunct, petiolate, lanceolate adult leaves, and its smaller buds (to 1.1 cm long, 0.5 cm wide in subsp. *cinerea*) and smaller fruits (0.5–0.8 cm long, 0.5–0.9 cm wide in subsp. *cinerea*).

The new taxon differs from both the recognised subspecies of *E. alligatrix* which have crowns that consist of entirely adult leaves and fruits that are more or less globoid and non-pruinose branchlets, buds and fruits. *Eucalyptus alligatrix* subsp. *alligatrix* further differs from the new taxon by its larger buds and fruits (fruits 5–7 mm long, 5–8 mm diam.). *E. alligatrix* subsp. *limaensis* also differs from the new taxon by its narrow-lanceolate blue-green adult leaves.

The mature trees of *E. cinerea* subsp. *victoriensis* differ from *E. cinerea* subsp. *triplex* in crown composition, with the latter having a somewhat sparse crown entirely or mostly of adult leaves whereas the former has an appreciably dense crown containing mostly pre-adult leaves with adult leaves present in the outer crown. Subsp. *victoriensis* further differs from subsp. *triplex* by its taller habit and its smaller buds and fruits (fruits of subsp. *triplex* 5–7 mm diam.). (see Table 1)

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