

## *Eucalyptus expressa* (Myrtaceae): a distinctive new stringybark from the sandstone ranges north-west of Sydney, New South Wales

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### Abstract

*Eucalyptus expressa*, a new tall forest tree species from sheltered gullies in the sandstone ranges north-west of Sydney, is described and illustrated, and notes on affinities, distribution, ecology and conservation status provided. A key to the stringybarks (*E. ser. Pachyphloiae*) of the Sydney Basin is also presented.

### Introduction

During ongoing research into the eucalypts of the Sydney Basin, it became apparent that field specimens of a distinct stringybark could not be adequately attributed to any existing taxon, and warranted further investigation and formal taxonomic recognition. Field studies conducted in heavily forested country to the north-west of Sydney in recent years uncovered new populations of a taxon that had first been collected in the 1990s in Pokolbin State Forest and in Wollemi National Park (Binns 1996; Bell 1997), but had remained un-named. The existence of such an impressively-sized and distinctively-fruited undescribed forest tree species in such close proximity to the State capital seemed to us to be astounding. Given the recent release of a key to the eucalypts of the Sydney region (Klaphake 2010), it is appropriate that this new taxon be formally described, so that other regional botanists may be aware of its existence and appropriate conservation measures can be undertaken.

### Taxonomy

*Eucalyptus expressa* S.A.J.Bell & D.Nicolle, *sp. nov.*

*Eucalypto eugenioidei* affinis sed fructus valvis conspicuis, erectis vel recurvatis, valde exsertis (ad 7 mm super labro), constanter elatiore habitu et foliis adultis marginibus distincte lenticellatis differt.

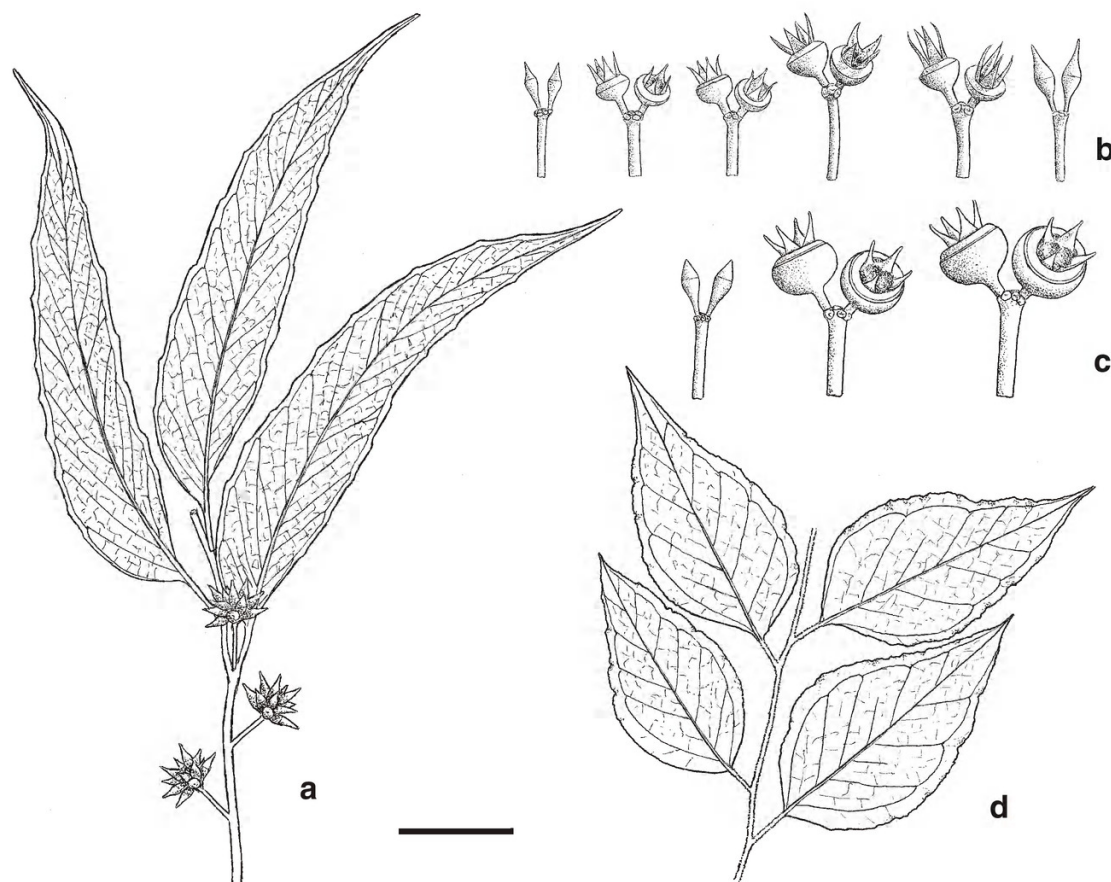
**Type:** New South Wales: North Coast: Parsons Creek, alongside Putty Rd, 14.4km SW of Bulga, New South Wales, 32°45'07"S, 150°55'22"E, 30 Jan. 2009, *D. Nicolle 5265 & S.A.J. Bell* (*holo:* AD; *iso:* CANB, NSW, BRI).

=*Eucalyptus* sp. aff. *eugenioides* (**Bees Nest Ridge**); Bell (2008) p. 349; Binns (1996)

Morphologically similar to *E. eugenioides*, differing most conspicuously in the erect to slightly recurved fruit valves which are strongly exserted up to 7 mm above the rim, and also in the consistently taller forest-tree habit and in the consistently 'lenticellate' adult leaves.

Single-stemmed tree of erect habit, 20–40 metres tall, lignotuber present. Bark rough throughout (up to branches 30–50 mm in diameter), thick, finely to moderately-fissured (long-fibrous; stringybark), grey-brown over red-brown. Seedling leaves petiolate, opposite for 1–3 pairs then becoming disjunct, alternate; lamina oblique at base, discolorous, more-or-less glossy, green, ovate with drawn out acuminate tips then later becoming broad-lanceolate, undulate, moderately setose from stellate hairs, margin denticulate with stellate hairs, 50–85 mm long  $\times$  20–40 mm wide. Seedling stems terete, densely setose. Adult branchlets non-pruinose, pith glands absent. Adult leaves petiolate, disjunct, pendulous; petiole 8–15 mm long; lamina oblique at base, concolorous or very slightly discolorous, glossy, green to dark green, lanceolate, weakly falcate to falcate, 90–160 mm long  $\times$  18–48 mm wide, margin with distinct lenticel-like structures when young, and becoming shallowly scalloped with age; vein reticulation sparse, primary veins 30–40° to midrib, intramarginal vein distinct, 1–3 mm from margin; oil glands few and very small, occurring between veins (island-type). Inflorescences axillary, unbranched, held erect, 7–24 flowered; peduncles slightly flattened to angular-terete, 7–15 mm long; pedicels angular, 1–4 mm long. Flower buds shortly pedicellate, narrowly to broadly fusiform, 5–7 mm long  $\times$  2–3 mm wide, no median scar; opercula long-conical to slightly beaked, about as long as or up to twice as long as hypanthia. Flowers not seen. Fruits shortly pedicellate, hemispherical to truncate-globose (excluding disc and valves), 3.5–5 mm long  $\times$  5–8 mm wide; disc broad, 1–1.5 mm wide, level to slightly ascending or somewhat annular; valves 3 or 4, strongly exserted, erect to slightly recurved (outward spreading), up to 7 mm above rim. Seeds brown-black, pyramidal, 1–2 mm long, hilum terminal. Figs 1 & 2.

**Illustration:** page 28 in, *Eucalypts of the Sydney Region* (Klaphake 2010), as *Eucalyptus* sp. Yengo.



**Fig. 1.** *Eucalyptus expressa*. **a**, habit and inflorescence; **b**, **c** fruit and buds; **d**, coppice leaves. (a from Nicolle 5265 & Bell.; b from Nicolle 5266 & Bell.; c from an unvouchered Wolgan Valley specimen, Barker, 28 Apr 2006; d from coppiced, resprouting leaves near Nicolle 5265 & Bell.). Scale bar: a = 40 mm; b, d = 30 mm; c = 20 mm.





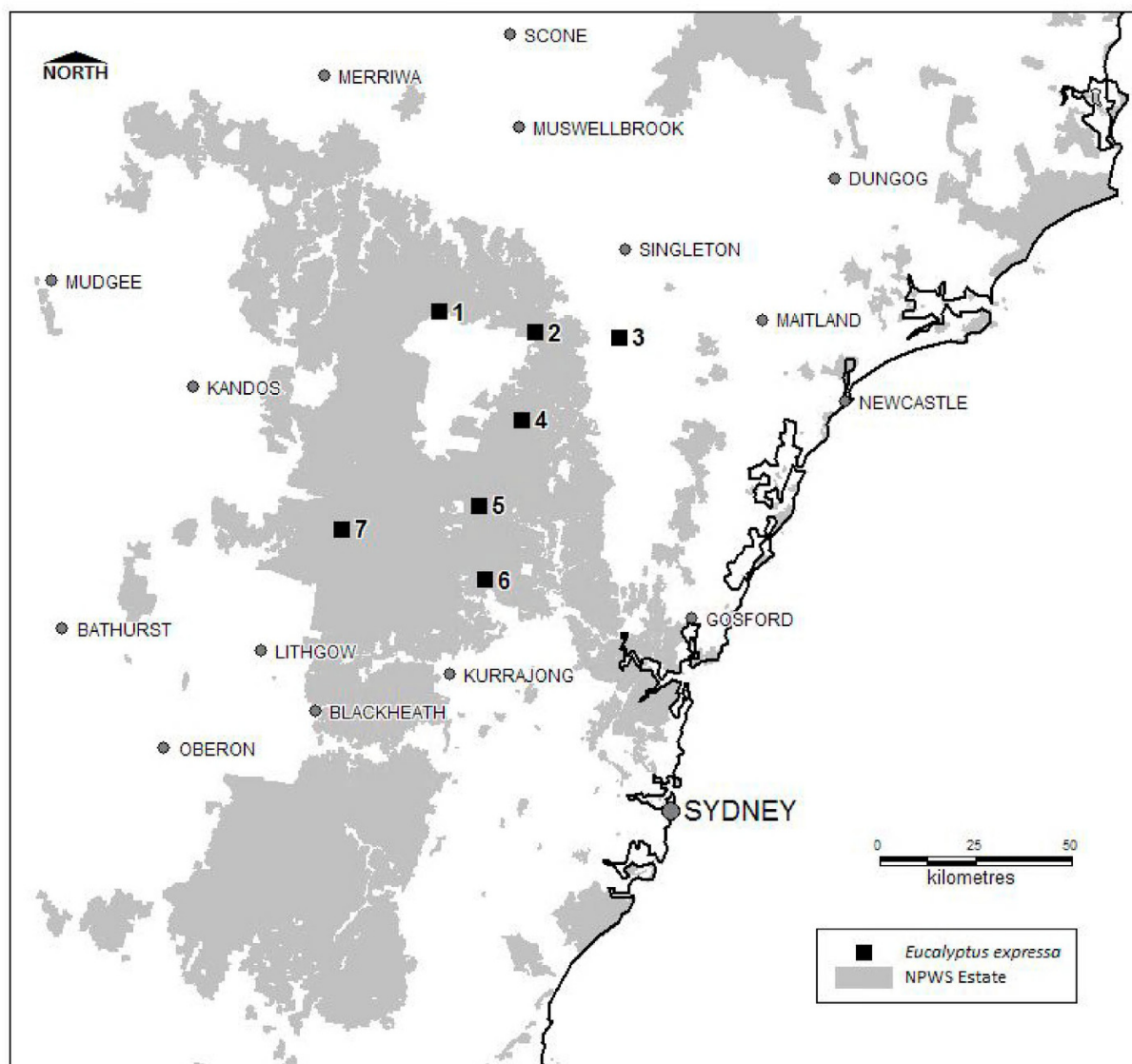
**Fig. 2.** Habitat and habit of *Eucalyptus expressa* (three centre trees; leaning tree in upper left is *E. piperita*) - Parsons Creek alongside Putty Rd, SW of Bulga, 32°45'07"S, 150°55'22"E, 30 Jan 2009, Nicolle 5265 & Bell (AD, CANB, NSW, BRI). Note one of us (SAJB) in image for scale.



**Distribution:** *Eucalyptus expressa* is currently known from seven populations in wilderness areas of the Yengo/ Wollemi National Park and Pokolbin State Forest areas, within the North Coast and Central Coast divisions of New South Wales (Fig. 3). One population in the Wolgan Valley, in the south-west of Wollemi National Park has not been visited by us, but fruit collected by Clive Barker have been viewed, and the habitat description is consistent with other stands. Surprisingly, easily accessible trees are present along parts of the Putty Road, a major road link between Sydney and the Hunter Valley which passes through Wollemi and Yengo National Parks. Although the bases of trees are easily accessible, live leaf, bud and fruit specimens are more difficult to procure due to their tall habit. However, dislodged branchlets including the distinctive fruits can be found in the leaf litter beneath trees.

**Flowering:** immature buds have been collected in Spring and mid to late Summer; flowers not seen.

**Habitat:** at all locations, the species occurs in moist gullies or on slopes with a sheltered aspect, on soils derived from Triassic Narrabeen geology. Common canopy associates in the Yengo-Wollemi area include *Eucalyptus deanei*, *Angophora floribunda*, *Eucalyptus piperita*, and *Syncarpia glomulifera*, with *Eucalyptus sparsifolia* and *Eucalyptus beyeriana* on slightly higher, adjacent sites. Bell (2008) documented mid-layer species at one site as including *Backhousia myrtifolia*, *Acmena smithii*, *Acacia prominens*, *Acacia parvipinnula*, *Notelaea longifolia*



**Fig. 3.** Location of *Eucalyptus expressa* populations north-west of Sydney, showing existing conservation reserves. 1 = Martindale Ck (Wollemi NP), 2 = Parsons Ck (Yengo/ Wollemi NPs), 3 = Bees Nest Ridge (Pokolbin SF), 4 = Blue Gum Gully (Yengo NP), 5 = Melon Ck (Yengo NP), 6 = Rush Ck (Parr SCA), 7 = Wolgan Valley (Wollemi NP).

forma *intermedia*, *Pittosporum revolutum*, *Cyathea australis*, and *Ficus coronata*, over a dense ground layer of *Calochlaena dubia*, *Blechnum cartilagineum*, *Adiantum aethiopicum*, *Polystichum australiense*, *Doodia aspera*, *Oplismenus imbecillus*, *Dichondra repens*, *Commelina cyanea*, *Echinopogon ovatus*, *Microlaena stipoides*, and *Viola hederacea*. Vines such as *Sarcopetalum harveyanum* and *Marsdenia rostrata*, and epiphytic orchids such as *Plectorrhiza tridentata* are also present.

At Bees Nest Ridge, *E. expressa* occurs on an upper slope with *Allocasuarina torulosa* and scattered *Syncarpia glomulifera*, *Eucalyptus deanei* and *Eucalyptus piperita*. Understorey vegetation includes *Persoonia linearis*, *Notelaea longifolia*, *Acacia irrorata*, *Ozothamnus rufescens*, *Podolobium ilicifolium*, *Bursaria spinosa* and *Leucopogon lanceolatus*, over a ground layer of *Poa affinis*, *Oplismenus imbecillus*, *Hibbertia dentata*, *Hydrocotyle laxiflora*, *Dianella caerulea*, *Plantago debilis*, *Microlaena stipoides*, *Viola hederacea*, *Doodia aspera*, *Lepidosperma laterale*, *Lomandra longifolia*, *Eustrephus latifolius* and *Cissus antarctica*. Immediately upslope on the ridgetop is a dryer forest of *Eucalyptus racemosa*, *E. agglomerata*, *E. eugenioides* and *E. punctata*.

At the Wolgan Valley site, *E. expressa* grows on deep alluvial soil on an embankment above a river (C. Barker, pers. comm.).

**Conservation status:** given the remoteness and rugged topography of most of the known populations within existing conservation reserves, there is no immediate threat to *Eucalyptus expressa*. The passive management method practised in much of the national park system in New South Wales is adequate for the species' requirements. Bell (2008) proposed a conservation risk code (ROTAP: Briggs & Leigh 1996) of 3KC for this taxon, and an IUCN (2001) code of DD, Data Deficient. However, after reviewing the locations of all known stands of this taxon, a conservation risk code of 2KC is considered more appropriate. Under IUCN criteria, a code of DD is still appropriate as detailed assessments of all populations have not been undertaken. *Eucalyptus expressa* is known from Parr State Conservation Area, Yengo National Park and Wollemi National Park. The Bees Nest Ridge population occurs on private lands immediately adjacent to Pokolbin State Forest, within which it is also likely to occur.

**Comparison with similar species:** *Eucalyptus expressa* can be distinguished from other stringybarks in the region by the erect to recurved, narrow and strongly exerted valves to the fruits. In morphology, *Eucalyptus expressa* most closely resembles *E. eugenioides*, differing most conspicuously in the erect to slightly recurved fruit valves, which are strongly exerted up to 7 mm above the rim, and in the consistently 'lenticellate' adult leaves (Table 1). *Eucalyptus expressa* is also a consistently taller forest-tree habit than *E. eugenioides*. A key to all known species of *E. ser. Pachyphloiae* within the Sydney Basin is presented below.

**Etymology:** the specific epithet *expressa* is from the Latin *expressus*, meaning prominent and clearly exhibited, and is in reference to the long, narrow and prominently exerted valves of the fruit, a characteristic otherwise unknown in *E. ser. Pachyphloiae* (the stringybarks) and indeed within *E. subg. Eucalyptus* (the monocalypts).

**Additional specimens:** New South Wales: North Coast: Parsons Creek alongside Putty Rd SW of Bulga, 32°45'07"S, 150°55'22"E, 30 Jan. 2009, D. Nicolle 5265 & S.A.J. Bell (AD, CANB, NSW, BRI); Central Coast: Above Melon Creek, Yengo National Park, 800 m W of 33°08'57"S, 150°45'46"E, 30 Jan. 2009, D. Nicolle 5266 & S.A.J. Bell (AD, CANB, NSW, BRI); Above Oakey Arm, Wollemi National Park, 32°37'58"S, 150°50'56"E, 8 Sep. 2010, S.A.J. Bell s.n., (NSW).

**Table 1. Comparison of *Eucalyptus expressa* and *Eucalyptus eugenioides***

Character	<i>E. expressa</i>	<i>E. eugenioides</i>
<b>Habit</b>	erect tree 20 to 40 metres tall	tree 15 to 30 metres tall
<b>Adult leaves</b>	shallowly scalloped; lenticel-like structures present along margin	entire; lenticel-like structures absent
<b>Bud shape</b>	acute to elongate acute, opercula as long as to twice as long as hypanthia	acute, opercula half as long as to as long as hypanthia
<b>Fruit valves</b>	erect to recurved and strongly exerted, from half to as long as fruit hypanthia	incurved to erect and enclosed or extending to less than half the height of the fruit hypanthia
<b>Habitat</b>	more mesic sites in gullies and below south-facing escarpments	less mesic sites on hillslopes



### Key to *Eucalyptus* ser. *Pachyphloiae* of the Sydney Basin

1. Adult leaves discolorous ..... *E. muelleriana*
- 1: Adult leaves concolorous
  2. Flower buds  $\pm$  pedicellate; fruits pedicellate
    3. Fruit valves half to twice as long as fruit hypanthium, erect to recurved ..... *E. expressa*
    - 3: Fruit valves less than half the height of the fruit hypanthium, incurved to erect
      4. Opercula rostrate
        5. Flower buds angular; fruits distinctly flared at rim ..... *E. cannonii*
        - 5: Flower buds not angular; fruits not distinctly flared at rim ..... *E. macrorhyncha*
      - 4: Opercula hemispherical to conical
        6. Flower buds angular ..... *E. prominula*
        - 6: Flower buds not angular
          7. Bark smooth, white on small / medium-sized branches; fruits 7–12 mm diameter ..... *E. laevopinea*
          - 7: Bark rough to smaller branches; fruits 5–9 mm diameter..... *E. eugenioides*
    - 2: Flower buds  $\pm$  sessile; fruits sessile and crowded
      8. Adult leaves mostly <16 mm wide
        9. Adult leaves 60–150 mm long, 6–18 mm wide ..... *E. sparsifolia*\*
        - 9: Adult leaves 40–90 mm long, 6–13 mm wide
          10. Juvenile leaves narrow-lanceolate..... *E. tenella*\*
          - 10: Juvenile leaves broad-lanceolate to ovate..... *E. ligustrina*
      - 8: Adult leaves mostly >16 mm wide
        11. Flower buds fusiform
          - 12: Fruits clustered but not flat-sided towards base
            13. Adult leaves relatively thin, length:breadth ratio < 3:1 ..... *E. globoidea*
            - 13: Adult leaves relatively thick, length:breadth ratio >3:1..... *E. oblonga*
          - 12: Fruits tightly clustered and flat-sided towards base due to crowding
            14. Adult leaves with a bluish sheen ..... *E. agglomerata*
            - 14: Adult leaves green ..... *E. capitellata*
        - 11: Flower buds ovoid to clavate
          15. Fruit valves prominently exserted; tree to 30 m tall ..... *E. blaxlandii*
          - 15: Fruit valves around rim level but not prominently exserted; tree or mallee to 10 m tall
            16. Fruits 7–9 mm long, 8–12 mm wide; western Wollemi area ..... *E. bensonii*
            - 16: Fruits 4–7 mm long, 6–9 mm wide; Sydney and Nowra areas
              17. Fruits tightly clustered & flat-sided towards base; Sydney area..... *E. camfieldii*
              - 17: Fruits not flat-sided towards base; Nowra area ..... *E. imitans*

\* We are uncertain as to the status of populations referable to *E. ralla* from west of Nowra, as these populations appear to be morphologically very similar to both *E. sparsifolia* and *E. tenella*.

### Discussion

*Eucalyptus expressa* is morphologically similar to *E. eugenioides*, from which the former differs in the erect to slightly recurved (outward spreading) fruit valves that are strongly exserted up to 7 mm above the rim (short, incurved valves to around rim level in *E. eugenioides*), the frequently taller forest-tree habit (woodland or forest trees 15 to 30 m tall in *E. eugenioides*), the operculum up to twice the length of the hypanthium (half as long to as long in *E. eugenioides*) and in the consistent presence of lenticel-like structures along the margins of the adult leaves (such structures not recorded in *E. eugenioides*, see below).

The habitat of *E. expressa* is also different from *E. eugenioides*, being generally restricted to more mesic sites in gullies and below south-facing escarpments of sandstone origin (hillslopes on richer soils for *E. eugenioides*).



At Melon Creek, *E. expressa* occurs along gully lines within hills of Narrabeen Sandstone geology, while *E. eugenioides* dominates in a nearby basalt diatrema. *E. eugenioides* is also present in the same general area at the Bees Nest Ridge locality, but the two have not been observed growing together.

Lenticel-like structures, occurring as pustular glands along the margin of the leaf and giving the appearance of irregular rounded teeth or a shallowly scalloped leaf margin, are a feature of *E. expressa* (Fig. 1), and have been observed in a number of morphologically dissimilar eucalypt species of *E. subg. Eucalyptus* and *Symphyomyrtus* from southern and eastern Australia. The occurrence of these lenticel-like structures in the eucalypts has been poorly studied. Neish et al. (1995) recorded them in five species in eastern Australia (incorrectly calling them leaf-lenticels: see Pinkard et al. 2006), including two stringybark species, viz. *E. laevopinea* (also a tall forest species of stringybark, occurring to the east and north of *E. expressa* on more fertile sites on plateaux and ridges) and “Carnarvon stringybark”, later named *E. erosa* (Bean 2005) from central Queensland. Bean (2005) noted that leaf-margin lenticels (viz lenticel-like structures) are a consistent and distinctive feature of *E. erosa*, and are associated with irregularities in the leaf margin that are conspicuous to the naked eye. It is thought that as leaves mature, the pustular glands erupt from the margin surface, leaving a slightly sunken elliptical structure. Their function appears to be for the deterrence of insect herbivores that commence consumption from the leaf margins, whose progress is hindered by the accumulation of toxic substances in these structures (Neish et al. 1995). The extent and consistency of lenticel-like structures in *E. laevopinea* is not known, and Bean (2005) suspects that this character is more widespread elsewhere in the genus than currently recognised. It is interesting to note that all three stringybarks with lenticel-like structures (*E. expressa*, *E. laevopinea* and *E. erosa*) are relatively tall forest species inhabiting relatively mesic sites (for stringybarks), and it may be hypothesised that lenticel-like structures are either a relic characteristic of, or an adaptive characteristic for, wetter sites. *Eucalyptus expressa* can be most easily distinguished from both *E. laevopinea* and *E. erosa* by the strongly exerted valves of the fruits (valves at or below rim level in *E. laevopinea* and *E. erosa*).

It appears likely that lenticel-like structures have evolved independently several times in the eucalypts. Examples include several mallee species of *E. subg. Symphyomyrtus* from the south coast of Australia, such as *E. incrassata* (Neish et al. 1995), and *E. mcquoidii* and *E. sinuosa* (Nicolle et al. 2008); several forest species of *E. subg. Symphyomyrtus* from south-eastern Australia, namely *E. denticulata* and *E. quadrangulata* (Neish et al. 1995); and in the three forenamed stringybark species of *E. subg. Eucalyptus* from eastern Australia (*E. expressa*, *E. laevopinea* and *E. erosa*). The comparative anatomy of lenticel-like structures in these relatively unrelated species from vastly different habitats remains largely unstudied.

Seedlings have been grown from the Putty Road and Melon Creek populations of *E. expressa* (Fig. 4). The seedling morphology within and between these populations is consistent, providing further evidence that the new species is not of recent hybrid origin. In general, the seedlings are morphologically similar to *E. eugenioides*.



**Fig. 4.** Four seedlings (from many grown) of *Eucalyptus expressa*, ex Melon Creek, Yengo National Park (Nicolle 5266 & Bell).

## Acknowledgments

Several of the new populations of this species have been discovered during NPWS-funded vegetation surveys conducted in Wollemi and Yengo National Parks and Parr State Conservation Area in recent years. Thanks are extended to Van Klaphake for discussions on the new taxon and for preparing the line drawings, and to Clive Barker for advising of the most westerly known population in the Wolgan Valley. Doug Binns provided location details for the original Bees Nest Ridge population, and Max Elliott assisted with relocating this population. We thank Ian Roberts of Blyth in South Australia, for growing seedlings of the new species. The directors of AD and NSW are thanked for allowing access to herbarium specimens of *Eucalyptus*. Van Klaphake reviewed an earlier draft of this paper and provided many useful insights into this and other Sydney region eucalypts. Review comments made by Ian Brooker and Peter Wilson are greatly appreciated.

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