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All enquiries and manuscripts should be directed to:

The Editor – *NUYTSIA*
Western Australian Herbarium
Conservation and Land Management
Locked Bag 104 Bentley Delivery Centre
Western Australia 6983
AUSTRALIA

Telephone: +61 8 9334 0500
Facsimile: +61 8 9334 0515
Email: nuytsia@calm.wa.gov.au
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***Eucalyptus virginea* and *E. relict*a (Myrtaceae), two new rare forest trees from south-western Australia allied to *E. lane-poolei*, and a new phantom hybrid**

Stephen D. Hopper¹ and Grant Wardell-Johnson²

¹School of Plant Biology, The University of Western Australia, Crawley, Western Australia 6907

²School of Natural and Rural Systems Management, The University of Queensland, Gatton, Queensland 4343

Abstract

Hopper, S.D. & Wardell-Johnson, G. *Eucalyptus virginea* and *E. relict*a (Myrtaceae), two new rare forest trees from south-western Australia allied to *E. lane-poolei*, and a new phantom hybrid. *Nuytsia* 15(2): 227–240 (2004). *Eucalyptus virginea* and *E. relict*a are described from Mt Lindesay National Park and from the Whicher Range south-east of Busselton respectively. Both species, together with *E. lane-poolei*, are in the earliest branching clade of *E. ser. Curviptera*, which contains many horticulturally attractive large-flowered mallees from semi-arid and desert regions such as *E. macrocarpa* and *E. youngiana*. The discovery and description of these two rare relictual forest trees so recently highlights the need for ongoing botanical survey of south-western Australia's forests. A phantom hybrid, *Eucalyptus lane-poolei* × *relict*a, is also described for the first time. It occurs close to populations of *E. relict*a in the Whicher Range but 150 km south of the nearest recorded *E. lane-poolei*.

Introduction

Rare species are a feature of the rich endemic flora of south-western Australia (Hopper *et al.* 1990; Brown *et al.* 1998; Coates and Atkins 2001). Over 2000 plant taxa are currently considered rare and poorly known with 357 listed as threatened (Declared Rare Flora) under the Wildlife Conservation Act (1950-1979) of which nearly a third are considered to be critically endangered (Coates and Atkins 2001).

A large number of these rare species have geographically restricted ranges (Hopper 1992, Cowling *et al.* 1994, Wardell-Johnson and Williams 1996; Gibson *et al.* 2000), and many have naturally fragmented disjunct distributions (Coates 2000, Gibson *et al.* 2000). Although these patterns are characteristic of the entire south-west, they are best expressed where average annual rainfall varies from 300 to 800 mm in the wheatbelt or Transitional Rainfall Zone defined by Hopper (1979, 1992; Lamont *et al.* 1984). However, parts of the forested High Rainfall Zone (800-1500 mm p.a.) such as the Tingle Mosaic and Southern Ironstone Communities on the Swan and Scott Coastal Plains are also noteworthy for their rare species (Wardell-Johnson and Williams 1996, Gibson *et al.* 2000).

It is nevertheless surprising to report here the discovery of two new forest eucalypts, one a substantial tree attaining 22 m in height and up to 1 m diameter at breast height. The presence of such large

undescribed plants in the south-west forests, albeit rare and very localised, emphasizes the need for ongoing biological survey to fully document the biodiversity of the High Rainfall Zone of the south-west (Mckenzie *et al.* 1996).

Because of their economic significance, forest eucalypts in south-western Australia have attracted attention since the earliest days of European scientific exploration. However, the diversity and taxonomic complexity of eucalypts hindered the botanical description of even the main south-western timber species until resident Australian botanists were able to study them in the field. Only Yate (*E. cornuta* Labill.), named in 1800, and jarrah (*Eucalyptus marginata* Donn ex Smith), named in 1802, were described prior to European settlement.

Other common tree species were named some time later, e.g. tuart (*E. gomphocephala* DC.) in 1828, flooded gum (*E. rudis* Endl.) in 1837, marri (*Corymbia calophylla* (R. Br. ex Lindley) K.D. Hill & L.A.S. Johnson) in 1841, bullich (*E. megacarpa* F. Muell.) in 1860, karri (*E. diversicolor* F. Muell.) in 1863, yarri or blackbutt (*E. patens* Benth.) in 1867, and wandoo (*E. wandoo* Blakely) as recently as 1934.

The collection and naming of less common forest species has proceeded sporadically right up to the present day, commencing with red flowering gum (*Corymbia ficifolia* (F. Muell.) K.D. Hill & L.A.S. Johnson in 1860, and continuing through to Brooker and Hopper's (1993) description of the mallee *E. aspersa*.

The two new forest eucalypts described from the south-west in this paper are both extremely rare and were confirmed by us as new species only in 1993. They were recognised earlier in the 1970s as unusual trees needing investigation by two very able field officers of the then Forests Department, Barney White and Len Talbot. The rarity of these eucalypts, and the superficial similarity of one of them to wandoo or bullich, have undoubtedly hindered botanical recognition until now.

Both species are allied to salmonbark wandoo (*E. lane-poolei* Maiden), an uncommon and disjunct small tree known from four areas between Serpentine and Badgingarra National Park (Sampson 1988; Chippendale 1988; Brooker and Kleinig 2001). *E. lane-poolei* is a taxonomically distinct species of the predominantly Western Australian mallee series *E. ser. Curviptera* Maiden. This series contains some of the most horticulturally desirable mallees among the eucalypts, including mottlecah (*E. macrocarpa* Hook.), with the largest flowers in the genus, the extremely rare but beautiful rose mallee (*E. rhodantha* Blakely & Steedman), and the mysterious Giles' mallee (*E. rameliana* F. Muell.), for years regarded as the only extinct eucalypt until its exciting rediscovery in 1991 in a remote part of the Little Sandy Desert (Sampson *et al.* 1995).

Brooker and Hopper (1993) regarded *E. lane-poolei* to be so distinct from all other members of *E. ser. Curviptera* that they placed it in the monotypic *E. subser. Inflexae* Brooker and Hopper. The species was the only one known at the time in *E. ser. Curviptera* with fully inflexed stamens in the bud, with a radially split surface to the disc of the fruit, and with somewhat glossy and narrowly falcate leaves. Subsequently, Brooker (2000) diagnosed *E. subser. Inflexae* on the basis of having inflexed stamens, seeds compressed-ovoid and not flanged, and ovules in 4 vertical rows.

In their discussion of *E. subser. Inflexae*, Brooker and Hopper (1993: 31) gave the range of *E. lane-poolei* as "from south-east of Busselton and near Denmark, northwards on the western scarp of the Darling Range and adjacent plains extending towards Jurien." The southern locations near Busselton

and Denmark were anomalous populations, only one of which had been inspected in the field (near Busselton), and whose identity required further investigation even though obvious differences in fruit and bud size and habit were known between the southern populations and those of typical *E. lane-poolei* from further north.

We have now completed more detailed field and herbarium studies, and Dr Jane Sampson of the Department of Botany, The University of Western Australia has examined allozyme variation in pertinent populations (Sampson 1988; unpubl.). On the basis of data now available, it is clear that Brooker and Hopper's (1993) southern populations of *E. lane-poolei* near Busselton and Denmark are two distinct species, which we name below *E. virginica* and *E. relictica*, together with a presumed phantom hybrid – *E. lane-poolei* × *relictica*.

***Eucalyptus virginica* Hopper & Wardell-Johnson, sp. nov.**

A *Eucalypto lane-poolei* Maiden statura majore (ad 22 m alta), trunco latiore erectiore (ad 1 m dbh), cortice leviter pulvereo, foliis latioribus discoloribus corporibus oleosis numerosioribus, inflorescentiis 7-floribus, alabastris minoribus (ad 7 mm diametro), et fructibus minoribus (ad 12 mm diametro) differt. A *E. relictica* Hopper & Wardell-Johnson statura majore, habitu arboreo, cortice laevi, foliis tenuioribus discoloribus, inflorescentiis 7-floribus et alabastris late ovoideis vel rhomboideis differt.

Differs from *E. lane-poolei* Maiden in its greater stature to 22 m tall, its thicker more erect trunk to 1 m d.b.h., its paler slightly powdery sometimes scribbly bark, its broader (to 25 mm) discolorous leaves with more abundant oil glands, its 7-flowered inflorescences, its smaller floral buds to 7 mm diameter, and its smaller fruits to 12 mm diameter. Differs from *E. relictica* Hopper & Wardell-Johnson in its greater stature to 22 m tall and tree habit, its smooth bark, its thinner strongly discolorous leaves, its 7-flowered inflorescences and its broadly ovoid to rhomboid buds.

Typus: Mount Lindesay National Park, NE of Denmark, 34° 50' 54" S 117° 16' 0" E, Western Australia, 2 June 1993, S.D. Hopper 8309 & A.P. Brown (*holo*: PERTH 06870279, PERTH 06870392; *iso*: AD, CANB, MEL, NSW).

Tree to 22 m tall; lignotuberous, with stems up to 1.6 m apart; individual *stems* erect, slightly sinuous, with d.b.h. to 1m, burls common; wood brittle; *bark* smooth, slightly powdery, thin (to 16 mm thick), white with scattered small patches of old grey-brown persistent, new bark rich yellow to slightly orange, sometimes with scribbles to 5 cm long. *Crown* of thick sinuous spreading branches. *Branchlets* lacking pith glands, usually with dark chocolate-brown adherent old bark over creamy-yellow new bark. *Cotyledons* Y-shaped, to 2 cm long. *Leaves* of the seedling remaining opposite for 7 or 8 pairs, then alternating, linear initially, becoming ovate, to 6 x 3 cm, discolorous, dark green and dull above. *Adult leaves* lanceolate-falcate, to 17 cm x 25 mm, discolorous, dark-green and satin-glossy above, dull and olive green below, oil glands abundant, conspicuous, irregular, intersectional. *Inflorescences* 7-flowered, peduncles terete, to 1.5 cm long. *Buds* pedicellate, broadly ovate to rhomboid, to 11 mm long x 7 mm wide, opercula hemispherical to slightly conical, stamens inflexed, cream. *Fruit* pedicellate, to 6 mm high x 12 mm wide, depressed, cupular, with a flat to slightly ascending broad thick annular rim, valves persistent, prominently ascending to 3-6 mm above rim. (Figure 1).

Specimens examined. WESTERN AUSTRALIA: Denmark River, 34°50'54" S 117°16' 00" E, 28 January 1993, A.R. Annelis 3112, 3167 (PERTH 04293908, 03344835); 5.5 km W of Denmark off Lapkos Rd, 34°58'30" S 117°17' 42" E, 8 July 1993, A.R. Annelis 3415, 3416, 3417, 3418 (PERTH



Figure 1. *Eucalyptus virginea* at the type location (Wardell-Johnson s.n.): (A) largest tree known, 22m tall and 87 cm d.b.h.; (B) buds and flower; (C) fruits; (D) trunks and bark of a resprouting individual in amongst granite boulders. Photos G. Wardell-Johnson.

04533038, 04533046, 04533062, 04535499); W side of Denmark River, WNW of Mt Lindsey (*sic*), 34°50'36" S 117°16' 07" E, 3 September 2000, *M.I.H. Brooker* 13192 (PERTH 05749174, AD, CANB, MEL, NSW, BRI, HO); Denmark River, vicinity of Mt Lindsay (*sic*), 22 November 1960, *B.J. White s.n.* (PERTH 01335596); edge of granite outcrop, midslope, 500 m E of Denmark River, 200m N of Mt Lindsay walk track, 34°50'54" S 117°16' 00" E, 27 December 2001, *G. Wardell-Johnson* 12001 (PERTH 05894646).

Distribution and habitat. *E. virginea* is known to occur in two main populations separated by less than a kilometre on the western slopes of Mt Lindsay about 15 km north-west of Denmark. A third population occurs 14 km to the south-west of the main populations and about 5.5 km west of Denmark. The habitat occupied by *E. virginea* is transitional between moist loams in creeklines where karri dominates, drier upland lateritic and clayey soils where marri and jarrah dominate, and shrubland on granite outcrops.

The Mt Lindsay populations occur in the narrow V-shaped valley of the Denmark River and along a small, steeply sloping, narrowly incised, tributary originating on Mt Lindsay. In these areas, the landscape includes considerable outcropping granite. Stands of *E. virginea* do not extend into the gently sloping lateritic terrain beyond. The third population occurs in shallow soils on slight rises in otherwise swampy terrain at the confluence of two gullies. The surrounds of this area include brown and yellow loams occupied by karri forest, and laterite occupied by jarrah/marri forest.

The forest stand structure is notable for occasional large specimens of *E. virginea* with abundant smaller trees of each of *Corymbia calophylla*, *Eucalyptus marginata*, and *E. virginea* (Figure 2). Largest trees tended to be in deep soils between rock outcrops in sheltered sites where they were the dominant eucalypt. *E. virginea* is of small stature where it occurs in pure stands adjacent exposed granite outcrop.

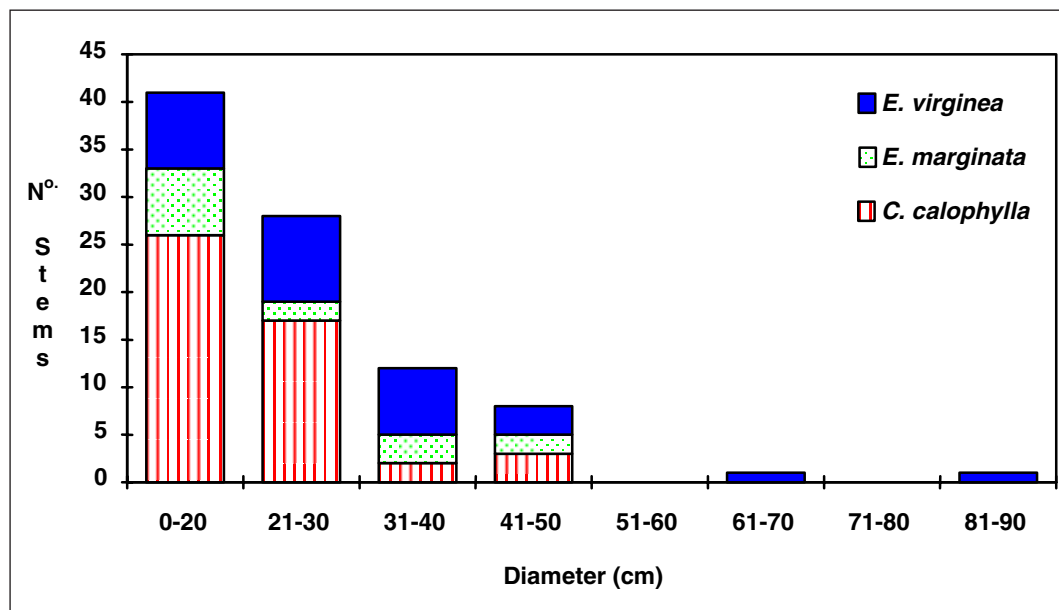


Figure 2. Size class distribution and stand structure of trees occurring in four 20m² quadrats including *Eucalyptus virginea* near Mt Lindsay. The diameter at breast height of all trees > 10 cm DBH was measured.

Understorey species associated with *E. virginea* reflect the transitional nature of the sites occupied by this eucalypt. They include species associated with granite outcrops (e.g. *Agonis marginata*, *Lepidosperma effusum*, *Borya longiscapa*, *Hakea undulata*, *Dodonaea ceratocarpa*, *Daviesia horrida* and *Andersonia sprengelioides*), sands (e.g. *Podocarpus drouynianus*, *Agonis parviceps*, *Agonis hypericifolia*, *Hypocalymna angustifolia* and *Leucopogon australis*), loams (e.g. *Hovea elliptica*, *Xanthosia rotundifolia*, *Leucopogon verticillatus*, *Tetrarrhena laevis* and *Loxocarya flexuosa*) and laterite (e.g. *Hibbertia cunninghamii*, *Lepidosperma angustifolia* and *Bossiaea ornata*).

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Four. The species, although highly geographically restricted, occupies half a square kilometre, and numbers hundreds of individuals most within a national park. However, it has very thin bark and is susceptible to recurrent or intense fire even though it is lignotuberous (Figure 1) and has epicormic sprouts following low intensity fire. It also occurs low in the landscape profile and would be affected through dam construction. Regular monitoring is therefore recommended.

The two stands on Mt Lindesay are in a secure conservation reserve and both include a wide range of size and age classes including lignotuberous advanced growth. A lack of seedlings observed two years following the 1991 fire may not be of concern in the medium term as individuals of this species are clearly very long-lived and seedling establishment occasional. Nevertheless this species is relictual in both habitat and distribution, and may be at risk in the longer term without management intervention.

The third population occurs as a remnant in partially cleared agricultural land. This stand now consists of several trees scattered over three hectares. No seedlings, saplings, or lignotuberous advanced growth of this species is present at this site. This stand is unlikely to have been much larger in historic times, as the surrounds are predominantly karri forest on brown to yellow loams and jarrah/marri forest. Nevertheless the current landholder has taken steps to protect *E. virginea*. As this stand is clearly well separated from the main distribution of the species at Mt Lindesay, it is deserving of the highest priority for conservation.

Of course, if the stand were planted rather than natural, such priority conservation action would be unnecessary. We sought to confirm the origin of the stand by determining the age of a tree. However, *E. virginea* often occurs as individuals with several stems from the same rootstock, preventing the aging of all but individual stems by dendrochronological means. We therefore obtained a sample of the rootstock, both from as near the center of the clump and as near the soil surface as possible from the largest diameter clump (1.6 m) in the stand that could be readily attributed to a common rootstock. This material was aged using carbon dating techniques at the Waikato University radio-carbon laboratory. The sample was analysed using 3 LKB/WALLAC 1220 Quantulus liquid scintillation spectrometers to achieve a high level of both accuracy and precision in dating (Alan Hogg, pers. comm.). The sample was aged at 330 ± 30 years, suggesting that the stand was indeed natural rather than planted.

Flowering period. January. Flowered prolifically in 2002 four years after moderate intensity fire in 1998 but not in the intervening period.

Etymology. The specific epithet refers to the bark (Latin *virgineus*, pure white), and also alludes to the original collector, Barney White, forester, in recognition of his contribution to the conservation and management of the southern forests of Western Australia.

Notes. The discovery and eventual description of such a large forest tree as *E. virginea* so recently is remarkable given the public attention focussed on forest conservation and management over the past few decades. From a distance, *E. virginea* resembles *E. wandoo*, which has its most south-westerly occurrence near Mt Lindesay to the north-east on alluvial loams associated with a small creek crossing on Denbarker Road (Brooker and Hopper 1991). Another population has also been located immediately north of Mt Lindesay (Wardell-Johnson and Williams 1996). However, *E. wandoo* is in the *E. series Levispermae* of *E. sect. Bisectaria*, and a cursory examination of buds, fruits and seeds reveals it is quite unrelated to taxa of *E. ser. Curviptera* to which *E. virginea* belongs.

The first collection of *E. virginea* was made by forester Barney White in November 1960, who submitted it to the Western Australian Herbarium where it was determined as *E. lane-poolei*, possibly by Government Botanist C.A. Gardner. This specimen was recognised as a possibly new taxon allied to *E. lane-poolei* but with smaller fruit when examined by SDH in the early 1990s. Discussion with M.I.H. Brooker and a joint examination of White's specimen at the time led to the view that its status required field investigation, and it was obscurely referred to by including reference to an occurrence of *E. lane-poolei* "near Denmark" in a subsequent paper (Brooker and Hopper 1993).

Independently, while undertaking a comprehensive floristic survey of the southern high rainfall tingle mosaic, GW-J in 1992 came across White's specimen and contacted Barney White for more accurate details of the location. Subsequent field work in January 1993 led to relocation of the species by GW-J and its collection by Technical Officer Tony Annels. Details of the precise location were communicated to SDH in May 1993. On June 2, accompanied by Technical Officer Andrew Brown, SDH investigated the Mt Lindesay site, confirmed that the species was indeed new, and made the type collection. He was also provided with seedlings of *E. virginea* grown by Denmark environmental educator Basil Schur from seed collected off private property on Lapkos Road. For a number of years Mr Schur had been aware of this unusual eucalypt and considered that it might be something new. Subsequently, a joint field inspection of this population occurred, and independent collections were made on July 8 1993 by Tony Annels. Together the present authors resolved to describe the species as new, a view subsequently affirmed by M.I.H. Brooker (pers. comm., 2001) after he had collected the species from the type location in 2000.

Thus, as with many recent exciting novelties named from the south-western flora, the present description of *E. virginea* owes much to a combination of astute observation by able field workers and ecologists, together with historical and botanical knowledge of taxonomists sufficient to confirm that the species was new after examination of relevant herbarium collections, literature, and, most importantly, seeing plants in the field. The delay of four decades between first herbarium collection and final description reflects how long it can take for the above combination of circumstances to occur given the paucity of taxonomists working on the south-western flora, and the remarkable richness of material awaiting description or still undiscovered. Based on present rates of discovery, we are still decades away from a near-complete inventory of this flora, even among trees such as eucalypts (Hopper 2003).

E. virginea is allied to *E. lane-poolei* and to *E. relictata*, all three species which we place in the *E. subseries Inflexae*. Work on allozyme variation in *E. ser. Curviptera* by Jane Sampson (pers. comm.) has affirmed the close relationship of *E. virginea* and *E. lane-poolei*, and suggests that these taxa are sister to the other species in the series found in drier inland country of the wheatbelt and desert. These relationships mirror those found in Western Australian monocalypts (Ladiges *et al.* 1987), where the tingles *E. jacksonii* and *E. brevistylis* confined to high rainfall south-coastal forests are basal to a major

radiation of drier country trees and mallees, as predicted from reviews of the ecological biogeography of the south-west (Hopper 1979, 1992; Hopper *et al.* 1996).

E. virginea differs from *E. lane-poolei* Maiden in its taller stature to 22 m, its thicker more erect trunk, its paler sometimes scribbly bark, its broader discolorous leaves with more abundant oil glands, its 7-flowered inflorescences, and its smaller ovoid to rhomboid floral buds to 7 mm diameter and smaller fruits to 12 mm diameter on shorter peduncles to 1.5 cm long. *E. lane-poolei* is a smaller tree to 10 m tall, with trunks rarely attaining 50 cm d.b.h., its bark salmon-brown weathering to greyish-white and never scribbly, its leaves concolorous, slightly glossy, with relatively fewer oil glands, its inflorescences to 11-flowered, its buds ovoid to globose and to 12 mm diameter, its fruits to 14 mm diameter, and its peduncles to 3 cm long (Brooker and Kleinig 2001). It also grows in massive laterite or clay-loam associated with the Darling and Dandaragan Scarps. *E. lane-poolei* has not been recorded from granite outcrops.

E. virginea differs from *E. relictata* Hopper & Wardell-Johnson in its greater stature to 22 m tall and tree habit, its smooth bark, its thinner strongly discolorous leaves, its 7-flowered inflorescences and its broadly ovoid to rhomboid buds.

The discovery and naming of *E. virginea* reinforces the importance of the Mt Lindesay granite inselberg as a moderate centre of endemism within the tingle mosaic of the highest rainfall south coast forests (Wardell-Johnson and Williams 1996). Some 29 rare or locally endemic taxa occur within 10 km of Mt Lindesay. Strict endemics of the Mt Lindesay inselberg include *Grevillea fuscolutea*, *Laxmannia grandiflora* subsp. *brendae* Keighery ms, *Cryptandra congesta* and *Andersonia hammersleyana* Lemson ms. District local endemics, mainly confined to the Mt Lindesay inselberg but with one or two populations close by, include *Borya longiscapa*, *Andersonia virolens* Lemson ms, *Calothamnus* sp. Mt Lindesay (B.G. Hammersley 439) and *Lasiopetalum cordifolium* subsp. *acuminatum* E.M. Benn. & K. Shepherd ms. The recency of the discovery/description of many of these endemics highlights the view that the granite outcrop flora of south-western Australia deserves ongoing survey and special conservation attention, even in such well travelled and explored regions as the forests of the High Rainfall Zone (Hopper *et al.* 1997).

Mt Lindesay is high enough (459 m a.s.l.) to have remained as an island during early-mid Tertiary marine transgressions of the south coast. Consequently, it provides a classic example of an old south-west terrestrial landform affording insular habitat suitable for the evolution of local endemics over tens of millions of years (Hopper 1979, 1992; Hopper *et al.* 1996). The early branching position of *E. virginea* and allies in the phylogeny of *E. ser. Curviptera* suggests that they are derivatives of a palaeoendemic lineage (*E. subseries Inflexae*) with origins possibly dating back well into the Tertiary. It would be interesting to further test this hypothesis through DNA sequence analysis as has occurred, for example, for the rhamnaceous shrub *Granitites* which is endemic to granite inselbergs in the eastern wheatbelt and adjacent goldfields (Fay *et al.* 2001).

Another question deserving further investigation is why the Mt Lindesay inselberg is so rich in endemics compared to other similarly high inselbergs to the west such as Mt Frankland, Mt Roe, Mt Mitchell and Granite Peak. Neither *E. virginea* nor any other of the Mt Lindesay endemics has been found on these granite eminences, but each has some endemics, varying from peak to peak. Perhaps the smaller areal extent of the western peaks provided insufficient wet habitat during arid periods for mesic palaeoendemics to resist extinction. Elsewhere we explore in greater detail ecological aspects of the

refugial forest habitat occupied by *E. virginea* compared with adjacent habitats not so occupied (Wardell-Johnson and Hopper, *in prep.*)

Eucalyptus relicta Hopper & Wardell-Johnson, *sp. nov.*

A *E. virginea* Hopper & Wardell-Johnson et *E. lane-poolei* Maiden statura majore (ad 7 m alta), habitu arboreo vel 'mallee', cortice aspero, et foliis crassioribus tantum leviter discoloribus differt. Insuper ab *E. lane-poolei* Maiden foliis latioribus (ad 30 mm latis) corporibus numerosioribus, alabastris minoribus ad 7 mm diametro, et fructibus minoribus ad 10 mm diametro differt.

Differs from *E. virginea* Hopper & Wardell-Johnson and *E. lane-poolei* Maiden in its smaller stature to 7 m tall and tree-mallee habit, its rough bark, and its thicker only slightly discoloured leaves. Also differs from *E. lane-poolei* Maiden in its broader leaves to 30 mm wide with more abundant oil glands, its smaller floral buds to 7 mm diameter, and its smaller fruits to 10 mm diameter.

Typus: 3.0 km E of Sabina Road, 33° 46' 11" S, 115° 27' 53" E, Western Australia, 21 January 1993, G. Wardell-Johnson 3180 (*holo*: PERTH 02657503).

Tree or tree-mallee to 7m tall; lignotuberous, individual stems erect, slightly sinuous, with d.b.h. to 0.5 m, wood not brittle, rich mahogany red; *bark* rough all the way to branchlets, thick, grey. *Branchlets* lacking pith glands. *Seedlings* not seen. *Coppice leaves* ovate, acute. *Canopy* yellowish green. *Adult leaves* lanceolate-falcate, to 12 cm x 30 mm, slightly discoloured, dark-olive-green and satin-glossy above, dull and paler green below; oil glands intersectional, not translucent, brownish-faintly opaque. *Inflorescences* to 13-flowered; peduncles terete, to 1.5 cm long. *Buds* pedicellate, rhomboid, to 10 mm long x 7 mm wide, opercula conical, stamens inflexed, cream. *Fruit* pedicellate, to 5 mm high x 10 mm wide, depressed, cupular, with a flat to slightly ascending broad thick annular rim, valves persistent, prominently ascending to 3-4 mm above rim. (Figure 3).

Specimens examined. WESTERN AUSTRALIA: 2.1 km S of Sabina Rd on track, Whicher Range, 33°46'28" S 115°29'06", 3 November 2000, D. Nicolle 3550 & M. French (PERTH 05744296, CANB); Vasse Highway, SE of Busselton, 33°45'18" S 115°31'06", 3 November 2000, D. Nicolle 3551 & M. French (PERTH 05744318, AD, CANB); 2.8 km E of Sabina Road along small track, 33°46'11" S 115°27'50", 21 January 1993, G. Wardell-Johnson 3178 (PERTH 02657473); 3.1 km E of Sabina Road along small track, 33°46'11" S 115°27'55", 21 January 1993, G. Wardell-Johnson 3179 (PERTH 02657481); 3.4 km E of Sabina Road along small track, 33°46'12" S 115°28'00", 21 January 1993, G. Wardell-Johnson 3183 (PERTH 02657546); Corner of Sabina River track and Whicher Rd, 33°46'15" S 115°29'04", 21 January 1993, G. Wardell-Johnson 3184 (PERTH 02657554); Vasse Highway, 40 km from Nannup, 33°45'18" S 115°31'06", 2 January 2002, G. Wardell-Johnson 12002 (PERTH 05894654).

Distribution and habitat. *E. relicta* occurs in two known populations within four kilometres of one another in minor valleys in the Whicher Range about 17 km south-east of Busselton. The known range area and geographic extent of this species is 0.15 km² and 2 km². The topography of the area is generally undulating, with the known populations on upper slopes (100-140 m a.s.l.) close to the highest elevation in the Whicher Range (205 m). Soil is grey clay-loam.



Figure 3. *Eucalyptus relicta* at the type location (Wardell-Johnson s.n.): (A) habit; (B) buds; (C) fruits; (D) trunks and bark of a resprouting individual. Photos G. Wardell-Johnson.

Associated dominant overstorey species include *Corymbia haemotoxylon*, *C. calophylla*, *Eucalyptus marginata*, and *Allocasuarina fraseriana*. Common understorey species include *Acacia pulchella*, *A. browniana*, *Grevillea brevicuspis*, *Xanthorrhoea preissii*, *Hypocalymma angustifolium*, *Hakea lissocarpha*, *H. amplexicaulis*, *Dryandra* sp., *Leucopogon australis*, *Calothamnus sanguineus*, *C. pallidus*, *Hibbertia hypericoides*, *Adenanthos barbigera*, and *Kingia australis*.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two. *E. relictata* is highly geographically restricted. One population consists of six individual clumps separated by 20–300 m along a small branch of the Sabina River. The other population comprises less than 100 clumps, and straddles the Vasse Highway, with most clumps extending from the west verge for c. 500 m along the headwaters of a subdued creekline. There may be a third population on the south side of Margaret Road (L. Talbot pers. comm., 1994), but this has not been confirmed in subsequent searches. The known range area, consequently, is 0.15 km² and the geographic extent is 2 km².

The area has been searched thoroughly by vehicle on all accessible tracks as well as by foot traverse over a number of years by L. Talbot and G. Wardell-Johnson. *E. relictata* occurs within the boundaries of a proposed national park. However, its numbers are so low and the placement of the main population on and adjacent to road verges require special management attention, as does the potential impact of dieback disease on the species and/or associated communities.

Flowering period. January – February.

Etymology. The specific epithet refers to the phylogenetic and landscape position of the species. It appears to be a classic wet-country relict comparable to the tingles (*E. guilfoylei*, *E. jacksonii*, *E. brevistylis* – Wardell-Johnson and Coates 1996), being an early branching lineage together with *E. virginea* and *E. lane-polei* of the *E. series Curviptera*.

Notes. *E. relictata* is a remarkable discovery first identified as new by Len Talbot in the 1970s when, as a field officer of the then Forests Department, he was involved in road survey and construction for the Whicher Range (Donnybrook Sunklands) pine plantation project. Although it occurs on a major highway at one location, it has probably been confused with the superficially similar *E. decipiens* subsp. *chalara* or *Corymbia haemotoxylon*, both of which have a similar bark and habit.

E. relictata is allied to *E. virginea*, from which it differs in its smaller stature (to 7 m tall) and tree-mallee habit, its rough bark, and its thicker only slightly discoloured leaves. It is also related to *E. lane-polei*, from which it differs in its rougher bark, its broader leaves to 30 mm wide with more abundant oil glands, its smaller more rhomboid floral buds to 7 mm diameter, and its smaller fruits to 10 mm diameter.

Eucalyptus lane-polei* × *relictata

Straggly small *tree* or mallee to 3 m tall, thick trunked, *bark* easily rubbed off, light grey-brown, rough like bloodwoods. *Branchlets* lacking pith glands. Seedlings not seen. Coppice leaves not seen. *Canopy* yellowish green. *Adult leaves* lanceolate-falcate, to 11 cm x 20 mm, slightly discoloured. *Inflorescences* to 11-flowered; peduncles terete, to 2.0 cm long. *Buds* pedicellate, ovoid, to 10 x 8 mm, opercula hemispherical, stamens inflexed. *Fruit* pedicellate, to 5 mm high x 9 mm wide, depressed, cupular, with a flat to slightly ascending broad thick annular rim, valves persistent, prominently ascending to 5 mm above rim. (Figure 4).

Specimens examined. WESTERN AUSTRALIA: SE of Busselton on tributary of Sabina River, 33°46'S 115°28' E, 6 November 1987, *M.I.H. Brooker* 9805 (PERTH 01396293, CANB); Whicher Block 5.5 km SE of Yoongarillup on Sabina River, 33°45' S 115°27' E, 6 November 1987, *S. D. Hopper* 6316 (PERTH 01101315).

Distribution and habitat. The only known stand of this hybrid, from which the above two specimens were collected, consists of a single clump 8-10 m across along a major tributary of the Sabina River at an elevation of 90 m a.s.l. Soil is grey clay-loam.

Associated dominant overstorey species include *Corymbia haemotoxylon*, *C. calophylla*, and *Eucalyptus marginata*. Common understorey species include *Acacia myrtifolia*, *Grevillea quercifolia*, *G. manglesioides*, *Hibbertia quadricolor*, *Melaleuca thymoides*, *Persoonia longifolia*, *Gastrolobium polymorphum* and *Petrophile serruiae*.

Conservation status. This is an extremely rare taxon known only from one clump and would normally be recommended as critically endangered and warranting declaration as Rare Flora. However, because it is a hybrid, and we have yet to obtain viable seed from it, further research on its ability to reproduce is needed for it to qualify for consideration for special protection.

Flowering period. Probably January – February.



Figure 4. *Eucalyptus lane-poolei* × *relicta* – the only known clump. (A) habit; (B) buds; (C) flower; (D) fruit. Photos G. Wardell-Johnson.

Notes. *E. lane-poolei* × *relicta* occurs in a single stand within two kilometres of the nearest *E. relicta* and 150 kilometres south of the nearest *E. lane-poolei*. It is thus a classic phantom hybrid, arguably of considerable antiquity given the long distance it occurs away from *E. lane-poolei*. Its features are intermediate in all respects between its parents.

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References

- Brooker, M.I.H. (2000). A new classification of the genus *Eucalyptus* L'Her. (Myrtaceae). *Australian Systematic Botany* 13: 79-148.
- Brooker, M.I.H. & Hopper, S.D. (1991). A taxonomic revision of *Eucalyptus wandoo*, *E. redunca*, and allied species (*Eucalyptus* series *Levispermae* Maiden – Myrtaceae) in Western Australia. *Nuytsia* 7: 1–189.
- Brooker, M.I.H. & Hopper, S.D. (1993). New series, subseries, species and subspecies of *Eucalyptus* (Myrtaceae) from Western Australia and from South Australia. *Nuytsia* 9 (1): 1-68.
- Brooker, M.I.H. & Kleinig, D.A. (2001). "Field Guide to Eucalypts. South-western and Southern Australia" Vol. 2, 2nd ed. (Blooming Books: Melbourne.)
- Brown, A., Thomson-Dans, C., & Marchant, N., eds. (1998). *Western Australia's Threatened Flora*. (Department of Conservation and Land Management, Como.)
- Chippendale, G.M. (1988). "*Eucalyptus*, *Angophora* (Myrtaceae), Flora of Australia. Vol. 19." (Australian Government Publishing Service: Canberra).
- Coates, D.J. (2000). Defining conservation units in a rich and fragmented flora: implications for the management of genetic resources and evolutionary processes in south-west Australian plants. *Australian Journal of Botany* 48: 329-339.
- Coates, D.J. & Atkins, K.A. (2001). Priority setting and the conservation of Western Australia's diverse and highly endemic flora. *Biological Conservation* 97: 252-263.
- Cowling, R.M., Witkowski, E.T.F., Milewski, A.V. & Newbey, K.R. (1994). Taxonomic, edaphic and biological aspects of narrow plant endemism on matched sites in mediterranean South Africa and Australia. *Journal of Biogeography* 21: 651-664.
- Fay, M.F., Lledo, M.D., Richardson, J.E., Rye, B.L., & Hopper, S.D. (2001). Molecular data confirm the affinities of *Granitites* with *Alphitonia* (Rhamnaceae). *Kew Bulletin* 56: 669-675.
- Gibson, N., Keighery, G. & Keighery, B. (2000). Threatened plant communities of Western Australia. 1. The ironstone communities of the Swan and Scott Coastal Plains. *Journal of the Royal Society of Western Australia* 83: 1-11.
- Hopper, S.D. (2003). South western Australia – Cinderella of the world's temperate floristic regions. *Curtis Botanical Magazine*, in press.
- Hopper, S.D. (1979). Biogeographical aspects of speciation in the south west Australian flora. *Annual Review of Ecology and Systematics* 10, 399-422.
- Hopper, S.D. (1992). Patterns of diversity at the population and species levels in south-west Australian mediterranean ecosystems. In: R.J. Hobbs (ed) "Biodiversity of Mediterranean Ecosystems in Australia", pp. 27-46. (Surrey Beatty & Sons: Sydney.)
- Hopper, S.D., Brown, A.P. and Marchant, N.G. (1997). Plants of Western Australian granite outcrops. In: Withers, P.C. & Hopper, S.D. (eds) "Granite Outcrops Symposium". *Journal of the Royal Society of Western Australia* 80: 141-158.

- Hopper, S.D., Harvey, M.S., Chappill, J.A., Main, A.R. & Main, B.Y. (1996). The Western Australian biota as Gondwanan Heritage - a review. *In*: Hopper, S.D., Chappill, J.A., Harvey, M.S. & George, A.S. (eds) "Gondwanan Heritage: Past, present and future of the Western Australian Biota", pp. 1-46. (Surrey Beatty & Sons: Chipping Norton, NSW.)
- Hopper, S.D., van Leeuwen, S. Brown, A.P. & Patrick, S.J. (1990). "Western Australia's Endangered Flora". (Department Conservation and Land Management: Perth.)
- Ladiges, P.Y., Humphries, C.J. and Brooker, M.I.H. (1987). Cladistic and biogeographic analysis of Western Australian species of *Eucalyptus* L'Herit. Informal Subgenus *Monocalyptus* Pryor & Johnson. *Australian Journal of Botany* 35: 251-81.
- McKenzie, N.L., Hopper, S.D., Wardell-Johnson, G. & Gibson, N. (1996). Assessing the conservation reserve system in the Jarrah Forest Bioregion. *Journal of the Royal Society of Western Australia* 79: 241-248.
- Sampson, J.F. (1988). "Population genetic structure of *Eucalyptus rhodantha* Blakely & Steedman and its allies *Eucalyptus crucis* Maiden and *Eucalyptus lane-poolei* Maiden". PhD thesis. (University of Western Australia: Nedlands.)
- Sampson, J.F., Hopper, S.D. & James, S.H. (1995). The mating system and genetic diversity of the arid zone mallee, *Eucalyptus rameliana* F. Muell. *Australian Journal of Botany* 43: 461-474.
- Wardell-Johnson, G. & Coates, D. (1996). Links to the past: local endemism in four species of forest eucalypts in southwestern Australia. *In*: Hopper S.D., Chappill J.A., Harvey M.S. & George A.S. (eds.) "Gondwanan Heritage Past Present and Future of the Western Australian Biota", pp. 137-154. (Surrey Beatty and Sons: Chipping Norton.)
- Wardell-Johnson, G. & Williams, M. (1996). A floristic survey of the Tingle Mosaic, south-western Australia: applications in land management and planning. *Journal of the Royal Society of Western Australia* 79: 249-276.