Four new species of *Eucalyptus* (Myrtaceae) from Western Australia

P.M. Grayling [1] and M.I.H. Brooker [2]

[1] Department of Botany, University of Western Australia, Nedlands, Western Australia 6009
[2] CSIRO Division of Plant Industry, GPO Box 1600, Canberra, Australian Capital Territory 2601

Abstract

Grayling, P.M., & Brooker, M.I.H. Four new species of *Eucalyptus* (Myrtaceae) from Western Australia. Nuytsia 8(2): 209-218 (1992). Four new species from the informal *Eucalyptus* subgenus *Symphyomyrtus* Pryor & Johnson are described and illustrated. *E. absita* is a member of the *E.* series *Porantheroideae* (Maiden) Chippendale; *E. balanites* has similarities to *E. decipiens* Endl. in the *E.* series *Micrantherae* Benth. *sensu* Chippendale (1988); *E. annuliformis* is closely related to *E. drummondii* Benth. in the *E.* series *Curviptera* Maiden; and *E. argutifolia* is a member of the *E.* series *Rufispermae* Maiden. All four species are known only from small populations in coastal and sub-coastal south-western Australia.

Introduction

Many new species of *Eucalyptus* in Western Australia have been discovered and described in the last twenty years. The majority of these have been found in remote or otherwise relatively inaccessible areas. It is somewhat surprising then to find new species of *Eucalyptus* within short distances of Perth. One example is *E. laeliae* Podger & Chippendale which occurs in the foothills of the Darling Range to the immediate east and south-east of Perth and which was published in 1968. *E. laeliae* occurs over a distance of 150 km, a relatively wide range but many of the species discovered since then have a more restricted distribution, e.g. *E. suberea* Brooker & Hopper and *E. lateritica* Brooker & Hopper which occur only in the Badgingarra-Mt Lesueur area.

In this paper we describe four new species of even more restricted distribution. They may be relicts but we cannot know if the recent extensive clearing of vegetation nearby has obliterated other occurrences.

Each of the new species is treated in keys and digests (informally) in Brooker & Kleinig (1990).

E. absita consists of four very small populations within 25 km of each other in the Badgingarra area. *E. annuliformis* is known only from Bidgerabbie Hill (n.b. 'Badgerabbie' in *Anon.* 1986) south-east of Dandaragan and appears to consist of one or possibly two individuals. *E. argutifolia*, which occurs as close to Perth as 11 km north of Wanneroo, is known from this and nine other small populations scattered northwards to the Hill River. *E. balanites* is known only from a single population about 0.5 ha. in area, south of Cadda Road, west of Badgingarra.

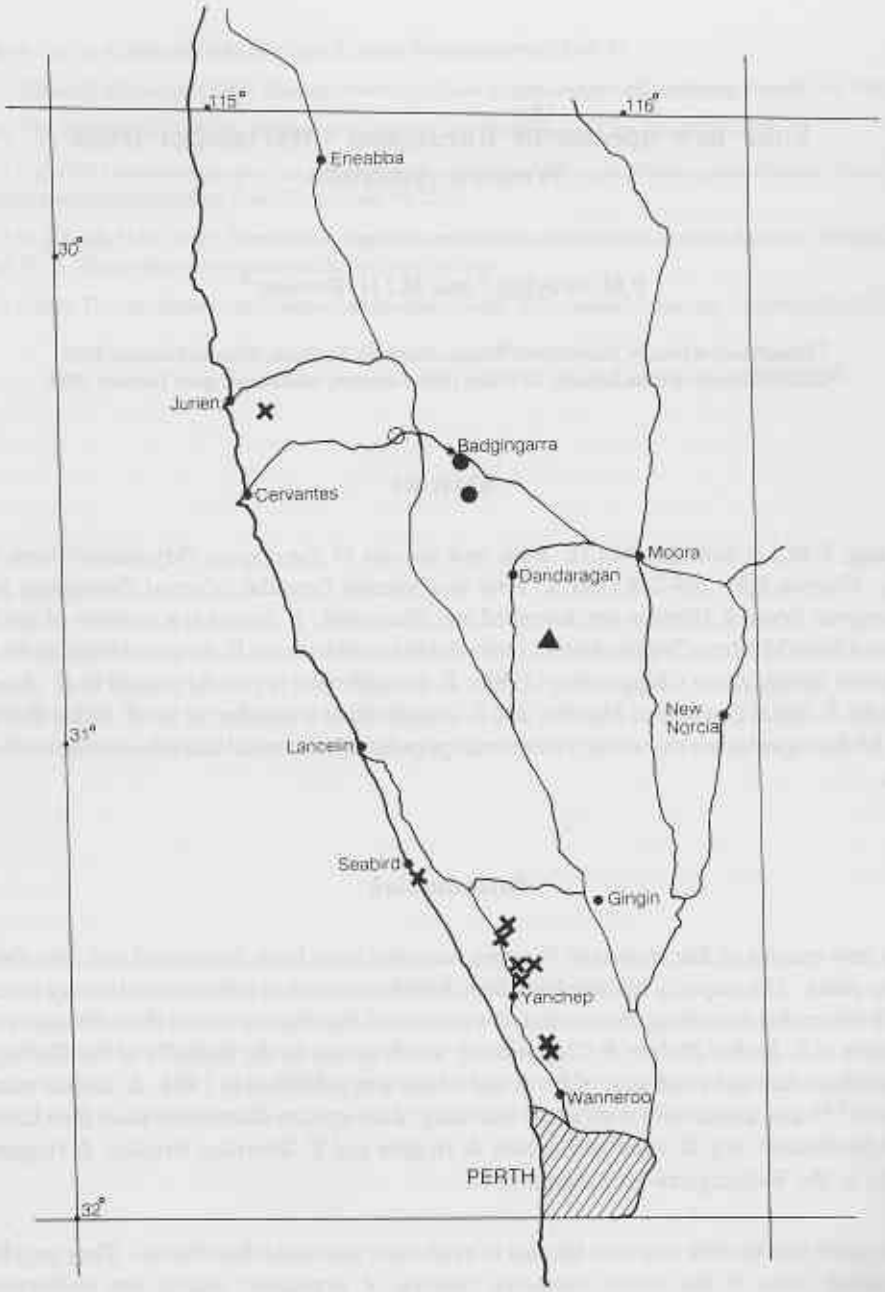

Figure 1. Distribution of *E. absita* (closed circle), *E. annuliformis* (triangle), *E. argutifolia* (cross) and *E. balanites* (open circle).

Descriptions

Eucalyptus absita Grayling & Brooker, sp. nov. (Figures 1 & 2). Brooker, M.I.H. & Kleinig, D.A. "Field Guide to Eucalypts" Vol. 2: 25, 401 (1990).

Frutex "mallee" ad 4 m altus *Eucalypto cupreae* Brooker & Hopper ined. affinis a qua foliis juvenilibus distincte deltoideis glaucisque, ambito fructus tenue, disco fructus conspicue lato depressoque et hieme florenti differt.

Mallee to 4 m tall with affinity to *Eucalyptus cuprea* Brooker & Hopper *ined.* from which it differs in the distinctly deltoid glaucous juvenile leaves, thin-rimmed fruit with the disc conspicuously broad and depressed, and the winter flowering.

Typus: SE of Badgingarra (30° 30' S, 115° 38' E), 10 June 1986, *M.I.H. Brooker* 9349 (holo: PERTH; iso: AD, CANB, MEL, NSW).

Mallee to 10 m tall with fibrous (box-type) grey-brown to yellowish bark for up to 2 m, smooth grey over coppery or greenish above, or whole stems smooth (see *Notes*). *Pith* of branchlets lacking oil glands. *Cotyledons* reniform (see *Notes*). *Seedling leaves* opposite for 2-4 pairs, petiolate, ovate to deltoid, to 4.5 x 3.7 cm, green to blue-grey, dull. *Juvenile leaves* petiolate, alternating, elliptical, to 8 x 6 cm, green to blue-grey, dull. *Adult leaves* on petioles to 2 cm long, alternating, lanceolate to broadly lanceolate, to 10.5 x 3.3 cm, concolorous, green, glossy; intramarginal vein less than 0.2 cm from leaf edge; reticulation very dense; apparently glandless, or with extremely sparse intersectional oil glands, generally situated near the midrib. *Inflorescences* axillary, unbranched, often appearing as terminal panicles due to the presumed early loss of leaves or bracts which subtend the peduncles, 7-flowered; peduncles slightly angular, 0.5-1.1 cm long. *Buds* pedicellate, clavate, 0.4-0.5 x 0.3-0.4 cm; outer operculum abscising early in bud development, but often adhering to the apex of the inner operculum until shortly before flowering; inner operculum hemispherical, apiculate. *Stamens* inflexed, the outer ones without anthers (staminodes), and considerably longer than the inner whorls; anthers subversatile, basifixed, globose, opening by terminal pores; filaments white. *Ovules* in 4 vertical rows. *Fruit* pedicellate, obconical to cupular, 0.4-0.5 x 0.3-0.5 cm; rim thin, disc obliquely descending, valves usually 4 (rarely 3 or 5), enclosed, their tips often fused and shed as a circumscissile lid. *Seed* dark grey-brown, compressed-ovoid, with very shallow reticulum.

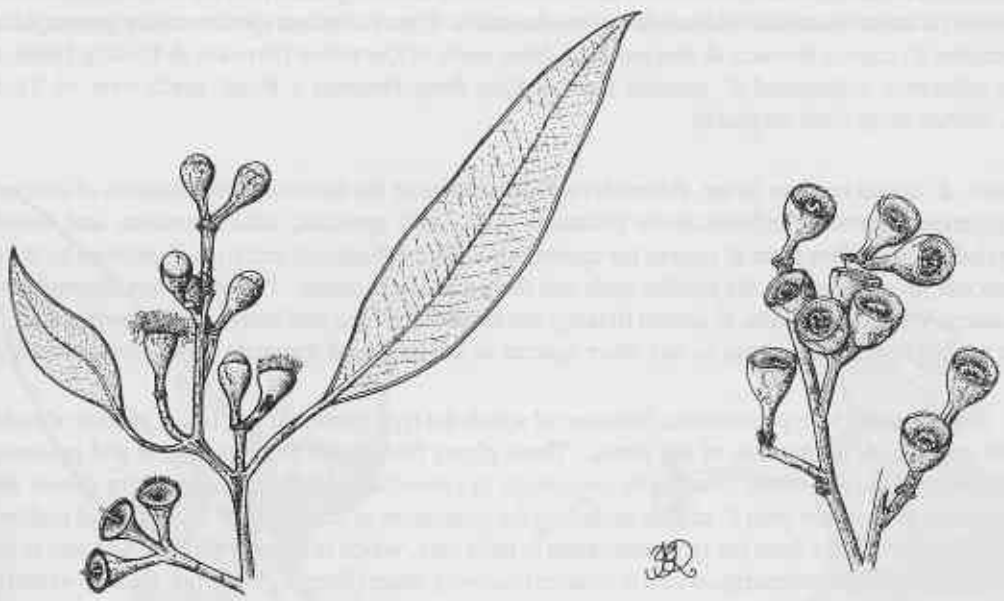

Figure 2. Buds and fruit of *E. absita* (*M.I.H. Brooker* 9349).

Other specimens examined. WESTERN AUSTRALIA: Type locality, 10 June 1986, *M.I.H. Brooker* 9350, juvenile leaves only (AD, CANB, MEL, NSW, PERTH); Type locality, 17 May 1986, *A.H.Popplewell* s.n. (PERTH); Koonah Road, 11 April 1991, *P.M. Grayling* 479 (PERTH, CANB); Badgingarra-Dandaragan Road, 11 April 1991, *P.M. Grayling* 491 (PERTH, CANB). *E. absita* x *E. loxophleba* Benth.: Koonah Road, 11 April 1991, *P.M. Grayling* 475 (PERTH, CANB), *P.M. Grayling* 480 (PERTH, CANB); Badgingarra-Dandaragan Road, 11 April 1991, *P.M. Grayling* 486 (PERTH, CANB).

Distribution & habitat. E. absita, as described, is known only from three small stands approximately 10 km apart between Old Badgingarra and Dandaragan. The type population is on a road verge, and the largest population occurs approximately 1.7 km to the north, in a paddock from which all other vegetation has been cleared apart from some clumps of *E. loxophleba* Benth., and is subjected to browsing by stock. The southernmost population consists of a single plant, also in a paddock. At these localities the soils are white sands and the natural vegetation, where it remains, consists of heath communities dominated by members of Myrtaceae and Proteaceae. A fourth population of somewhat similar mallees (see *Notes*) approximately 15 km to the north-west of the type population, near the Brand Highway north of Badgingarra, is growing in heavier sand, on a floodplain adjacent to the Hill River.

Conservation status. Coded 2VCi (vulnerable and represented in a conservation reserve) in Briggs & Leigh (1988). However as no populations are known by the authors to occur within conservation areas, this coding appears to be in error. We recommend a revised code of 2E (endangered), considering the type population has been partly uprooted in road construction while the larger population, occupying less than 0.25 ha., occurs wholly on private farmland.

Flowering period. April-July.

Etymology. The specific epithet refers to the remoteness of this species from the large numbers of box species (*E.* series *Porantheroideae*) in eastern Australia. The nearest box species are the geographically restricted *E. cuprea* Brooker & Hopper *ined.* from north of Geraldton (Brooker & Kleinig 1990), and the relatively widespread *E. petraea* Carr & Carr from Freeman's Road, north-west of Tardun. (L. *abitus*- away from the place).

Notes. E. absita belongs in ser. *Porantheroideae* because of the following combination of characters - apparently terminal inflorescences (Johnson 1972), two opercula, adnate anthers, and reniform cotyledons. It differs from *E. cuprea* for reasons given in the diagnosis and from *E. petraea* by the dull glaucous juvenile leaves, the smaller buds and fruit, and fewer loculi. The other Porantheroid box in southern Western Australia, *E. lucasii* Blakely, has smooth bark and dull leaves in all growth stages. We are unable to relate *E. absita* to any other species in the large and disparate series *Porantheroideae*.

The three southern populations, from one of which the type specimen was taken, consist of mallees with rough bark at the base of the stems. These plants flower profusely each year and produce an abundance of viable seeds. A fourth population in contention, north of Badgingarra shows many characters in common with *E. absita*, including the possession of staminodes. It consists of mallees to 2 m tall, which differ from the type population in their bark, which is entirely smooth, and also in adult leaf characters: the intramarginal vein is situated relatively distant from the leaf edge, the side-veins form a more acute angle with the midrib, and oil glands, although sparse, are more common in the leaves, and are occasionally present in the pith of branchlets, particularly at nodes. The plants in this population produce only a very small number of flowers each year, and although the pollen fertility is similar to that of the other populations (Grayling 1989) no viable seeds have so far been collected. We consider

this population to be closely related to *E. absita*, and a search for possible cytological or genetic explanations for its morphological departures and its failure to produce seeds forms the basis of further studies by the senior author.

In the glasshouse trials so far conducted, reniform cotyledons have been produced by the vast majority of germinating seeds, a result expected from a member of series *Porantheroideae*. However, a small proportion of seeds collected from the fertile populations of *E. absita*, and seeds collected from *E. loxophleba* plants growing in close proximity to *E. absita* produce seedlings with cotyledons intermediate in shape between the reniform of *E. absita* and the bisected of *E. loxophleba*. It is thought that these seedlings are F1 hybrids between the two species. A group of five plants growing with *E.absita* and *E. loxophleba*, and another two plants near the southernmost population of *E. absita*, show many characters intermediate between the two species. These plants produce seed lots of high viability, which when germinated produce cotyledons ranging in shape from reniform to bisected. Further studies using morphometric techniques, electrophoretic examination of isoenzymes and gas chromatographic analysis of leaf-oils (Grayling 1989), have provided additional support for the suggestion that hybridity between these two species is occurring, despite their taxonomic diversity in belonging to different sections (Pryor & Johnson 1971, Griffin *et al.* 1988).

Eucalyptus annuliformis Grayling & Brooker, sp. nov. (Figures 1 & 3). Brooker, M.I.H. & Kleinig, D.A. "Field Guide to Eucalypts" Vol. 2: 28, 261 (1990).

Frutex "mallee" rarissimus, *Eucalypto drummondii* Benth. affinis a qua cortice cinereo, alabastris majoribus (ad 2 x 1.3 cm) deficientibus glaucedinem, operculis rostratis, et margine fructuum plano annuliformique postremo descendenti differt.

Extremely rare mallee with affinity to *Eucalyptus drummondii* Benth. from which it differs in the grey bark, larger non-glaucous buds (to 2 x 1.3 cm), rostrate opercula and disc of fruit flat and annular, finally descending.

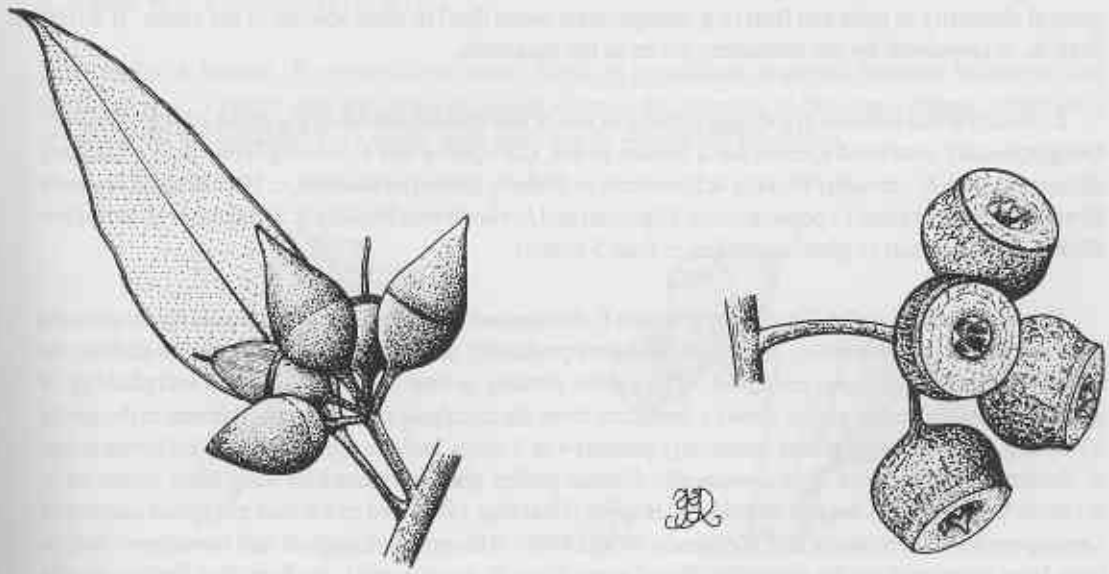

Figure 3. Buds (*P.M.G.* s.n.) and fruit (*M.I.H.B.* 9351) of *E. annuliformis*.

Typus: SE of Dandaragan (30° 49' S, 115° 47' E), 10 June 1986, *M.I.H. Brooker* 9351, *A.H. Popplewell & B.A. Rockel,* (holo: PERTH; iso: MEL, NSW).

Mallee to 3 m tall with smooth grey bark. *Cotyledons* and *seedling leaves* not seen. *Juvenile leaves* petiolate, alternating, broadly elliptical to ovate, apiculate, 5-7 x 2-3.5 cm, grey-green, dull. *Adult leaves* petiolate, alternating, elliptical to broadly lanceolate, to 6.5 x 2.2 cm, concolorous, green, dull; side veins very numerous; reticulation dense with scattered, intersectional oil glands. *Inflorescences* axillary, unbranched, 7-flowered; peduncles slender, terete, to 1.7 cm long. *Buds* pedicellate, ovoid, to 2 x 1.3 cm; outer operculum shed early in bud development; inner operculum conical, slightly beaked. Outer *stamens* erect, inner ones inflexed, all fertile; anthers versatile, dorsifixed, ovoid, opening by longitudinal slits; filaments white. *Ovules* in 4 vertical rows. *Fruit* pedicellate, hemispherical, to 1.1 x 1.4 cm; rim thick, disc broad, to 0.3 cm across, annular and finally inward-sloping. *Seed* not seen.

Other specimen examined. WESTERN AUSTRALIA: Type locality, 9 July 1987, *M.I.H. Brooker* 9701 (CANB, MEL, NSW, PERTH).

Distribution & habitat. The species is known only from 1 or 2 plants on Bidgerabbie Hill. This is a rocky laterite slope with a shallow white sandy soil and associated vegetation consists of open *Eucalyptus calophylla* woodland with a dense low shrub layer dominated by Proteaceae species and *Macrozamia riedlei.*

Conservation status. Endangered, coded 2E, according to the criteria of Briggs & Leigh (1988).

Flowering period. May-September.

Etymology. The specific epithet refers to the disc of the fruit, which when compared to that of *E.drummondii,* is relatively broad and flat (L. *annulus* - ring, *formis* - form).

Notes. E. annuliformis belongs in ser. *Curviptera* because of the following combination of characters - axillary inflorescences, two opercula, leaves with dense reticulation and intersectional oil glands, and general similarity in buds and fruit (e.g. conspicuous broad disc) to other species in the series. It differs from *E. drummondii* by the characters given in the diagnosis.

E. annuliformis consists of a straggly clump of one or two individuals covering about 10 m in diameter. Geographically restricted species are a feature of ser. *Curviptera* and *E. annuliformis* is in a category of rareness with *E. carnabyi* Blakely & Steedman ex Blakely (three populations, c. 10 plants), *E. impensa* Brooker & Hopper *ined.* (1 population, c. 10 plants) and *E. rhodantha* Blakely & Steedman var. *petiolaris* Blakely & Steedman (1 population, fewer than 5 plants).

E. annuliformis may be of hybrid origin with *E. drummondii* as a parent but on morphological grounds no other parent is discernible. Although it flowers profusely, and produces a large number of fruit, no viable seeds have yet been collected. The pollen fertility is low (20-40%), and the morphology of apparently fertile pollen grains shows a departure from the tricolpate morphology common in the genus (Grayling 1989). Fertile grains commonly possess 4 or 5 colpi, and are approximately 1.5 times larger in diameter than those of *E. drummondii.* Similar pollen grain irregularities have been observed in *E.caesia* Benth. subsp. *magna* Brooker & Hopper (Grayling 1989) and in various polyploid species of *Leptospermum, Verticordia* and *Melaleuca* (Rye 1980). Although cytological and isoenzyme studies have been hampered by the unavailability of seeds from *E. annuliformis,* we hope that further studies using pollen and vegetative material will give us some idea of its genetic integrity.

Eucalyptus argutifolia Grayling & Brooker sp. nov. (Figures 1 & 4). Brooker, M.I.H. & Kleinig, D.A. "Field Guide to Eucalypts" Vol. 2: 24, 27, 317 (1990).

Frutex "mallee" ad *E.* seriem *Rufispermas* pertinens. Cortex laevis. Folia adulta viridia nitentiaque. Inflorescentiae axillares, non-ramosae; pedunculi crassi leviter complanati, ad 0.8 cm longi. Alabastra subsessilia vel breviter pedicellata, ovoidea, ad 0.8 x 0.4 cm; opercula interiora hemisphaerica; stamina inflexa, omnia fertilia; antherae versatiles oblongae. Fructus plus minusve sessiles, cylindrici. Semina nitentia rubra.

Typus: Parrot Ridge, N of Yanchep, Western Australia (31° 29' S, 115° 44' E), 9 April 1987, *M.I.H. Brooker* 9581 & *S.D. Hopper* (holo: PERTH; iso: AD, CANB, MEL, NSW).

Mallee to 4 m tall, with smooth, grey to pale coppery bark. *Pith* of branchlets glandular. *Cotyledons* reniform. *Seedling leaves* opposite for 2-4 pairs, petiolate, ovate to oblong, to 3 x 2 cm, green, dull. *Juvenile leaves* petiolate, alternating, broadly elliptical to orbicular, apiculate, to 7 x 6 cm, green, glossy. *Adult leaves* petiolate, alternating, ovate to broadly lanceolate, apiculate, 6-10 x 2-4 cm, concolorous, green, glossy; reticulation very dense, veinlets fine, with scattered intersectional oil glands. *Inflorescences* axillary, unbranched, 7(11)-flowered; peduncles stout, terete or flattened, 0.5-0.8 cm long. *Buds* shortly pedicellate, ovoid to cylindrical, 0.8-1.2 x 0.5-0.6 cm, outer operculum shed early in bud development, inner operculum hemispherical, slightly ribbed. *Stamens* inflexed, all fertile; anthers versatile, oblong, opening by longitudinal slits; filaments white. *Ovules* in 4 vertical rows. *Fruit* sessile or shortly pedicellate, cupular to cylindrical, often with longitudinal ridges extending to the pedicel, 0.7-1.2 x 0.6-0.8 cm; rim thin to moderately thick; disc obliquely descending; valves 4 or 5, to rim level. *Seed* lustrous ruby-red to red-brown, flattish, with shallow reticulum.

Other specimens examined. WESTERN AUSTRALIA: Wabling Hill (31° 25' S, 115° 40' E), 16 May 1984, *M.I.H. Brooker* 8608 & *P.M. Grayling* (CANB, PERTH), 16 May 1984, *M.I.H. Brooker* 8613 (CANB, PERTH), 27 July 1984, *M.I.H. Brooker* 9461, 9462 (AD, CANB, MEL, NSW, PERTH); Type locality, 9 April 1987, *M.I.H. Brooker* 9582 & *S.D. Hopper* (AD, CANB, MEL, PERTH); SSE of Seabird (31° 17' S, 115° 26' W), 2 November 1988, *M.I.H. Brooker* 10140 & *I.J. Foster* (AD, CANB, MEL, NSW, PERTH), *A. Napier* & *A. Kelly* 355(1) (PERTH).

Distribution & habitat. E. argutifolia is known from ten populations scattered between Wanneroo and the Hill River. Typical sites are slopes or gullies close to the summits of limestone ridges, where soils are shallow, well-drained grey sands with outcrops of weathered limestone.

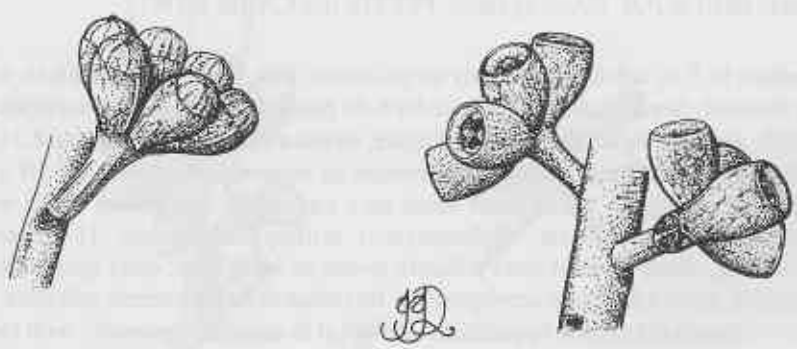

Figure 4. Buds and fruit of *E. argutifolia* (*M.I.H. Brooker* 9581).

Conservation status. Coded 2VCi (vulnerable and represented in a conservation reserve) in Briggs & Leigh (1988). However as no populations are known by the authors to occur within conservation areas, this coding appears to be in error. We recommend a revised code of 2E (endangered), considering that the two patches of *E. argutifolia* on Wabling Hill have been damaged by road-making, and that six of the ten known populations occur on limestone mining leases.

Flowering period. March-April.

Etymology. The specific epithet refers to the contrasting appearance of the few specimens intermixed with *E. foecunda* Schauer when first seen on Wabling Hill. (L. *argutus* - clear, bright, sharp).

Notes. E. argutifolia belongs in ser. *Rufispermae* Maiden because of the following combination of characters - axillary inflorescences, two opercula, oil glands in pith, reniform cotyledons, inflexed stamens, cuboid versatile anthers, and flattish lustrous ruby-red seeds. It differs from *E. obtusiflora* DC. (syn. *E. dongarraensis* Maiden & Blakely) in the rounder juvenile leaves, broader glossy green adult leaves with fewer oil glands, and non-glaucous buds and fruit with shorter, stouter pedicels. From *E.anceps auct. pl.* it differs in the rounder juvenile leaves, broader, glossier adult leaves, blunt opercula and larger buds and fruit. *E. anceps* (R.Br. ex Maiden) Blakely, as to type, is probably *E. rugosa* R.Br. ex Blakely which belongs in another series (Brooker & Kleinig 1990).

The Wabling Hill population consists of two clumps separated by about 20 m. While the plants bear large numbers of flower buds and flower profusely, no seeds have ever been obtained. This is in contrast to most of the other sites where viable seeds are set in reasonable abundance.

Eucalyptus balanites Grayling & Brooker, sp. nov. (Figures 1 & 5). Brooker, M.I.H. & Kleinig, D.A. "Field Guide to Eucalypts" Vol. 2: 27, 223 (1990).

Frutex "mallee" erectus ad 5 m altus *Eucalypto decipienti* Endl. affinis a qua cortice incohaerenti aspero, foliis juvenilibus ellipticis, raro emarginatis, alabastris balanoideis operculis majoribus hemisphaericis, antheris globoideis, et fructibus majoribus cupulatis differt.

Erect mallee to 5 m tall with affinity to *Eucalyptus decipiens* Endl. from which it differs by the loose rough bark, the elliptical juvenile leaves which are rarely emarginate, the acorn-like buds with the usually rounded opercula, the globoid anthers, and the usually cupular fruit.

Typus: 11 km W of Brand Highway on Cadda Road (30° 24' S, 115° 23' E), 3 February 1985, *M.I.H.Brooker* 8810 & *P.M. Grayling* (holo: PERTH; iso: CANB, NSW).

Erect mallee to 5 m tall with pale grey to yellowish, thin, flaky, rough bark to small branches. *Cotyledons* bisected. *Seedling leaves* opposite for 6-10 pairs, petiolate, oblong to elliptical, to 4.5 x 2.5 cm, green, dull. *Juvenile leaves* alternating, petiolate, elliptical, rarely emarginate, to 6.3 x 3.5 cm, green, dull. *Adult leaves* alternating, petiolate, lanceolate to narrowly lanceolate, to 10 x 2 cm, green, concolorous, dull or slightly glossy; side veins very numerous; reticulation dense with numerous, irregular, intersectional oil glands. *Inflorescences* axillary, unbranched, 11-flowered, peduncles terete, 1-2 cm long. *Buds* on short stout pedicels, ovoid, to 1 x 0.7 cm; outer operculum shed early in bud development; inner operculum hemispherical, less often obtusely conical, apiculate, narrower than hypanthium or constricted at join; hypanthium obconical to cupular, commonly with two longitudinal ridges extending to pedicel. *Stamens* inflexed, all fertile; anthers versatile, basifixed, globoid, opening by broad lateral slits; filaments white. *Style* twisted near base. *Ovules* in 4 vertical rows. *Fruit* very shortly

pedicellate, hemispherical, less often cupular, to 0.9 x 0.9 cm; rim thick, disc annular, valves usually 4, slightly exserted. *Seed* dark grey, compressed-ovoid, with very shallow reticulum, with longitudinal grooves.

Other specimens examined. WESTERN AUSTRALIA: Type locality, 2 June 1985, *M.I.H. Brooker* 9025 (CANB, MEL, NSW, PERTH), 4 November 1985, *M.I.H. Brooker* 9064 (CANB, NSW, PERTH), 10 July 1986, *M.I.H. Brooker* 9385 (CANB), 10 July 1986, *M.I.H. Brooker* 9390 (CANB, MEL, NSW, PERTH).

Distribution & habitat. The species is known only from one stand of 50-100 plants on the northern edge of Badgingarra National Park. The site is in gently sloping sandy heathland, with much surface laterite gravel. Associated eucalypt species are *E. lane-poolei* Maiden and *E. todtiana* F.Muell.

Conservation status. Coded 2VCi (vulnerable, and represented in a conservation reserve) in Briggs & Leigh (1988). The only known population occurs along the boundary of, but entirely within

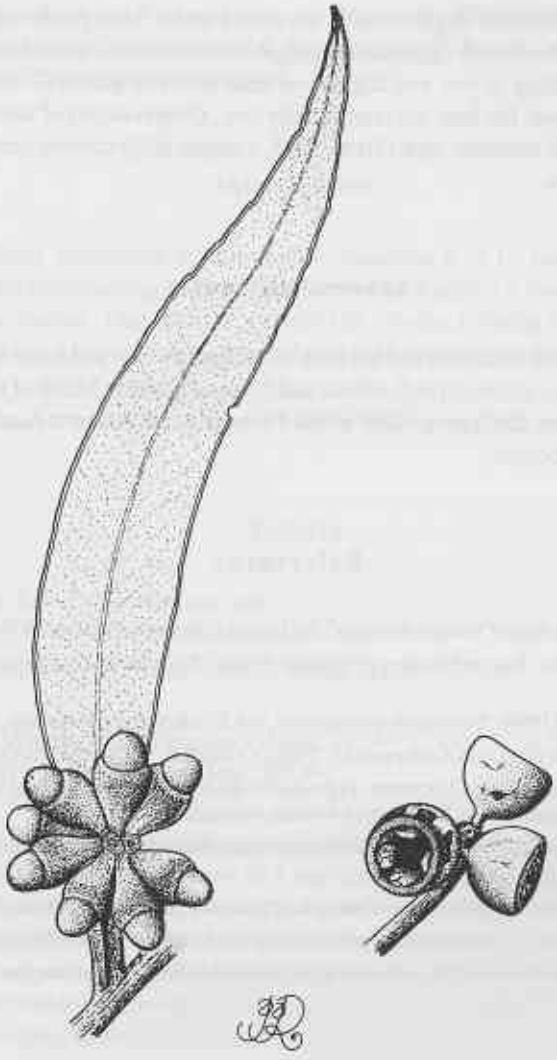

Figure 5. Buds (*M.I.H.B.* 9025) and fruit (*M.I.H.B.* s.n.) of *E. balanites*.

Badgingarra National Park. It is not considered to be in danger but will inevitably suffer temporarily from periodic bushfires. Its conservation coding could be amended to 2VCit.

Flowering period. October-February.

Etymology. The specific epithet refers to the shape of the buds, which resemble acorns (Greek *balanites* - like an acorn).

Notes. E. balanites belongs in ser. *Micrantherae* Benth. *sensu* Chippendale (1988). The species has affinity with *E. decipiens* Endl. from which it differs by the characters given in the diagnosis, and in its edaphic preference, *E. decipiens* generally being found on calcareous soils. *E. decipiens* is to be segregated in another series, the circumscription of which is in preparation (Brooker & Hopper unpublished). It will be of little value to outline the new series as the study is incomplete. We do, however, anticipate the separation of the *E. falcata* and *E. decipiens* groups of species, and *E. balanites* will be placed in the latter group.

The species may be of hybrid origin, with *E. decipiens* and *E. lane-poolei* as the most likely parents (Grayling 1989), but if so there is no significant segregation in the seedlings and it appears to be stabilized. The degree of pollen fertility is low and highly variable between plants (2-40%), and relative to the number of flowers produced, the fruit-set is extremely low. Observations of the contents of mature fruit have shown that each fruit contains, apart from chaff, a single fully-formed seed coat which in 60% of cases contains no embryo.

Acknowledgements

We are grateful to John Rainbird for his line drawings, to Garry Brown for the map, and to Alf Popplewell for drawing our attention to *E. absita* and *E. annuliformis*. Much of the work was the subject of the senior author's post-graduate studies at the University of Western Australia, and we thank Dr S.H. James for his contribution.

References

Anonymous (1986). "Travellers Atlas of Western Australia", 3rd Edition. (Department of Lands & Surveys, Western Australia.)

Briggs, J.D. & Leigh, J.H. (1988). "Rare or Threatened Australian Plants". Revised edn. (Australian National Parks and Wildlife Service, Canberra.)

Brooker, M.I.H & Kleinig, D.A. (1990). "Field Guide to Eucalypts", Vol. 2. (Inkata Press, Melbourne.)

Chippendale, G.M. (1988). *Eucalyptus. In* A.S. George (ed.), "Flora of Australia", Vol. 19. (AGPS, Canberra.)

Grayling, P.M. (1989). "An Investigation of Taxonomy, Reproductive Biology & Hybridity in Four Taxa of *Eucalyptus* of Extreme Rarity." Post-Graduate Diploma Thesis, University of Western Australia.

Griffin, A.R., Burgess, I.P. & Wolf, L. (1988). Patterns of natural and manipulated hybridisation in the genus *Eucalyptus* L'Herit. - a review. Austral. J. Bot. 36:41-66.

Johnson, L.A.S. (1972). Evolution and classification in *Eucalyptus*. Proc. Linn. Soc. New South Wales 97: 11-29.

Pryor, L.D. & Johnson, L.A.S. (1971). "A Classification of the Eucalypts." (Australian National University, Canberra.)

Rye, B.L. (1980). "Chromosome Numbers, Reproductive Biology and Evolution in the Myrtaceae." Ph. D. Thesis, University of Western Australia.