Notes on the informal subgenus "Monocalyptus" of *Eucalyptus* (Myrtaceae) and the description of three new upland species from south-west Western Australia

M. I. H. Brooker[1] and S. D. Hopper[2]

1 CSIRO, Division of Forest Research, Private Bag, P.O. Wembley, Western Australia 6014
2 W.A. Wildlife Research Centre, P.O. Box 51, Wanneroo, Western Australia 6065

Abstract

Brooker, M.I.H. and Hopper, S.D. Notes on the informal subgenus "Monocalyptus" of *Eucalyptus* (Myrtaceae) and description of three new upland species from south-west Western Australia. Nuytsia 5 (3):341-356 (1986). Introductory notes on the informal subgenus "Monocalyptus" are provided. These include an historical account of the "taxon" from Bentham to Pryor and Johnson. Salient morphological features which define the group are discussed. Three new species *Eucalyptus suberea, E. lateritica* and *E. erectifolia* are described. All belong to the informal "*E.* subgen. *Monocalyptus*" Pryor & Johnson. Keys to these and related species in the proposed Mt Lesueur Nature Reserve and the Stirling Range National Park are given. *E. suberea* has no close relatives, whereas *E. lateritica* is related to *E. todtiana* F. Muell. and *E. erectifolia* is related to *E. pachyloma* Benth. and *E. buprestium* F. Muell. All three species are very rare and warrant gazettal under the Wildlife Conservation Act. Allozyme assays for *E. erectifolia* show that the species can occur in circular clumps to 25 m diameter derived from one genetic individual.

Introduction

The informal "*Eucalyptus* subgen. *Monocalyptus*" (Pryor & Johnson 1971) is based on *E.* ser. *Renantherae* Benth. The group is large, consisting of about 140 species, which have captured the interest of botanists and foresters for many years. They are distributed across temperate southern Australia and northwards along the eastern seaboard as far as the Atherton Tableland in Queensland. The group includes many important timber species such as jarrah *E. marginata* Smith, mountain ash, *E. regnans* F. Muell. and messmate *E. obliqua* L'Hérit. In Western Australia, there are also species of horticultural value including bell-fruited mallee, *E. preissiana* Schau., weeping gum *E. sepulcralis* F. Muell., and several recently discovered very rare taxa (Brooker 1972, 1974; Brooker and Blaxell 1978; Rye and Hopper 1981; Pryor 1981).

The monocalypts are characterised morphologically by a single operculum, trends towards reduced leaf venation compared with *"E.* subgen. *Corymbia"* and *"E.* subgen. *Symphyomyrtus"* of the Pryor & Johnson (1971) classification, the kidney-shaped anther, and anatropous ovules which are situated in 2 vertical rows on the placenta (apart from the imputed reversal condition to 4 rows seen in *E. coccifera* Hook. f. (Ladiges, Humphries and Brooker 1983) and in some forms of *E. pauciflora* Sieber ex Sprengel (Boland, Brooker and Turnbull 1980)). The recognition of this suite of diagnostic characters has emerged only recently in the history of morphological studies in *Eucalyptus*.

To the early morphologists, the kidney-shaped anther was the distinguishing feature of the group. This received expression in the classification of Bentham (1867) with his *E.* ser. *Renantherae* ("anthers reniform --- cells divergent --- confluent at the apex"). Maiden (1922) devised a scheme in which he largely retained Bentham's concept of the *Renantherae* (as a section) but modified by the erection of a new section *Renantheroideae* ("anthers have

some resemblance to --- *Renantherae* --- lobes vary --- sometimes nearly parallel"). With this latter taxon it is debatable whether he intended it to be a natural group by his inclusion of species that are clearly not closely related, e.g. *E. cloeziana* F.Muell., *E. cneorifolia* DC., and *E. oligantha* Schau. among others. Blakely (1934), following Maiden, retained the two sections, and in his diagnoses concurred that the renantheroid anther was morphologically distinct from the renantherous. In assigning species to the two groups, he transferred the non-monocalypts named above to other sections.

Nevertheless, with a greater range of characters considered, opinion prevailed that the two sections had far more affinity with each other than to any other of the sections in Blakely's classification. Pryor (1959) suggested that they composed a single taxonomic group ("subgenus Renanthera") that had developed along different lines in east and west.

It was clear, therefore, that the emphasis on anthers as a unifying character could not stand. In an attempt to find a more suitable name for the whole group (renantheroid and renantherous) Carr and Carr (1959) suggested that "*Monocalyptus*" be applied. The species in both groups have, without exception, a single operculum, although the single opercular structure is not exclusive to "*Monocalyptus*".

In their comprehensive classification, Pryor and Johnson (1971) informally adopted the name *Monocalyptus* for one of their eight subgenera, but placed all species in the one *"E.* sect. *Renantheria"* while stating that "*Renantheria*" need not, conceptually, be the only section in "*Monocalyptus*". In fact, Johnson (1976) explicitly restored the concept of two groups when he erected an informal section, "*Hesperia*" (Greek — west) to accommodate the old *E.* sect. *Renantheroideae* and excluded *E. marginata, E. staeri* (Maiden) Kessell & Gardner, and *E. jacksonii* Maiden, which were retained in the informal "*E.* sect. *Renantheria*".

In the 20 or 30 years before the publication of Pryor and Johnson's classification, only a few new eucalypts had been discovered and named (these include *E. porrecta* Blake (1953) from the Northern Territory, *E. tetrapleura* Johnson (1962) from north coastal New South Wales, *E. mannensis* Boomsma (1964) from central Australia). Since then, with intensive exploration, there has been a minor explosion in the number of eucalypt species discovered. These include many monocalypts. A few are from eastern Australia, but most are from the south-west of the continent (Brooker 1972, 1974; Brooker & Blaxell 1978). One of these belongs to "*E.* sect. *Renantheria" (E. brevistylis* Brooker) and the remainder (8 before this study) are in "*E.* sect. *Hesperia*".

Recently, intensified eucalypt survey work in the south-west has included two regions renowned for their high numbers of local endemics — Mt Lesueur to the north of Perth, and the Stirling Range (Hopper 1979; Hopkins, Keighery and Marchant 1983). Our interest in the eucalypts of these uplands was stimulated when an undescribed species of "*E.* subgen. *Monocalyptus*" from the Mt Lesueur area was brought to our attention by E.A. Griffin. Subsequently another undescribed monocalypt was found by one of us (S.D.H.) in the same area.

In November 1981 we began a series of field excursions in the Stirling Range National Park. These have resulted in the discovery of a new species in the group and a range of putative hybrids which we discuss elsewhere. With the description of these three new monocalypts plus those of the works cited above, the number of species in western "*E.* subgen. *Monocalyptus*" has doubled since Pryor and Johnson (1971).

Because the new species occur in two distinctive and widely separated areas, we include two keys for the benefit of field workers.

Key to the monocalypts of the proposed Mt Lesueur Nature Reserve and adjacent areas

1. Adult leaves discolorous, bark rough, operculum elongated.....*E. marginata* Smith
1. Adult leaves concolorous, bark rough or smooth, operculum hemispherical or conical
   2. Mallees with smooth slender stems and sparse canopies; branchlets glaucous
      3. Crown prominently drooping; adult leaves 6-12 x 1-2 cm; buds 0.9-1.1 x 0.6-0.8 cm; fruit 1.3-2 x 1.2-2 cm, wrinkled or ribbed .....*E. pendens* Brooker
      3. Crown more or less erect; adult leaves 4-7 x 1-1.4 cm; buds 0.6-0.9 x 0.4-0.5 cm; fruit 1.1-1.5 x 1-1.4 cm, smooth.....*E. exilis* Brooker
   2. Mallees or trees with dense crowns, usually with some rough bark; branchlets not glaucous
      4. Fruit globose with narrow orifice; outer stamens without anthers; crown usually to ground level; inflorescences 7-flowered..... .....*E. johnsoniana* Brooker & Blaxell
      4. Fruit cupular to truncate-globose or urceolate; all stamens fertile; crown not to ground level; inflorescences 7 to more than 20-flowered
         5. Buds smooth, to 0.7 x 0.5 cm; fruit to 0.9 x 1.1 cm; 11 to more than 20-flowered.....*E. suberea* Brooker & Hopper
         5. Buds slightly rough-surfaced, to 1.2 x 0.8 cm; fruit 1.5-2 x 1.5-2.5 cm; 7-15-flowered
            6. Adult leaves to 10 x 1.5 cm, thin, with small glands and sparse lateral venation; fruit to 1.5 x 1.5 cm; bark not rough over whole stems; erect-stemmed mallees.....*E. lateritica* Brooker & Hopper
            6. Adult leaves to 15 x 2.5 cm, thick, not apparently glandular; venation densely reticulate; fruit to 2 x 2.5 cm; bark rough over whole stems; straggly trees or mallees .....*E. todtiana* F.Muell.

Eucalyptus suberea Brooker & Hopper, sp. nov. (Figure 2)

Frutex "mallee" cortice suberoso vel squamoso, canopio plerumque ad terram, foliis falcatis atro-virentibus nitentibus. Alabastra numerosa (ad 25), ad 0.6 x 0.4 cm, rhombea vel globosa, et fructus truncato-sphaerici vel plus minusve urceolati, orificio comparate lato. Semina deltoidea vel aliquantum pyramidalia, brunnea, nitentia.

Typus: Hi Valley farm, Tootbardi road, north of Badgingarra, Western Australia, 24 Jan. 1983, *M.I.H. Brooker* 7930 (holo: PERTH (Figure 1); iso: FRI, NSW, MEL, AD, K)

A mallee up to 3 m tall with grey, corky rough bark at base or to ½ the height of the stems or in large specimens thicker, yellowish and flaky (like a yellow bloodwood, "*E.* ser. *Eximiae*"), lignotuberous. Cotyledons reniform or slightly emarginate, 0.5-1.5 x 0.4-1 cm green above, purple below. Seedling leaves sessile, remaining opposite and held horizontally for up to 7 pairs, elliptical to ovate, up to 12 x 6 cm, edges crinkly and sometimes minutely toothed, dull green to olive green. *Juvenile leaves* shortly petiolate, sub-opposite, turning vertical, lanceolate, up to 18 x 5.5 cm, slightly discolorous, light green, slightly glossy. *Adult leaves* petiolate, alternating, falcate to lanceolate, to 9 x 1.5 cm, dark green, slightly glossy, concolorous. *Inflorescences* axillary, 11 to more than 20 flowered. *Peduncles* up to 1.5 cm long. *Buds* on distinct pedicels, broadly fusiform to clavate, up to 0.7 x 0.5 cm, smooth. *Operculum* single, conical to hemispherical. *Stamens* white, all fertile, partly inflexed, with anthers around the style and appressed to the disc. *Anthers* versatile, dorsifixed, oblong or as long as broad, not truncated, gland obscure,

seen at back, opening by parallel longtitudinal slits, which curve inwards towards the top and are not or scarcely confluent. *Loculi* 3, style long, not smooth due to anther impression, upper part inserted in a tube descending from or formed in the underside of the operculum. *Ovules* in 2 vertical rows. *Fruit* pedicellate, truncate-globose, rarely somewhat urceolate, up to 0.9 x 1.1 cm, with a relatively broad orifice, drying with shallow, irregular wrinkling. *Rim* thick or thin. *Disc* descending vertically. *Seed* up to 0.25 x 0.2 cm, brown, lustrous, D-shaped to slightly pyramidal not or scarcely ribbed, hilum terminal, dorsal side rounded.

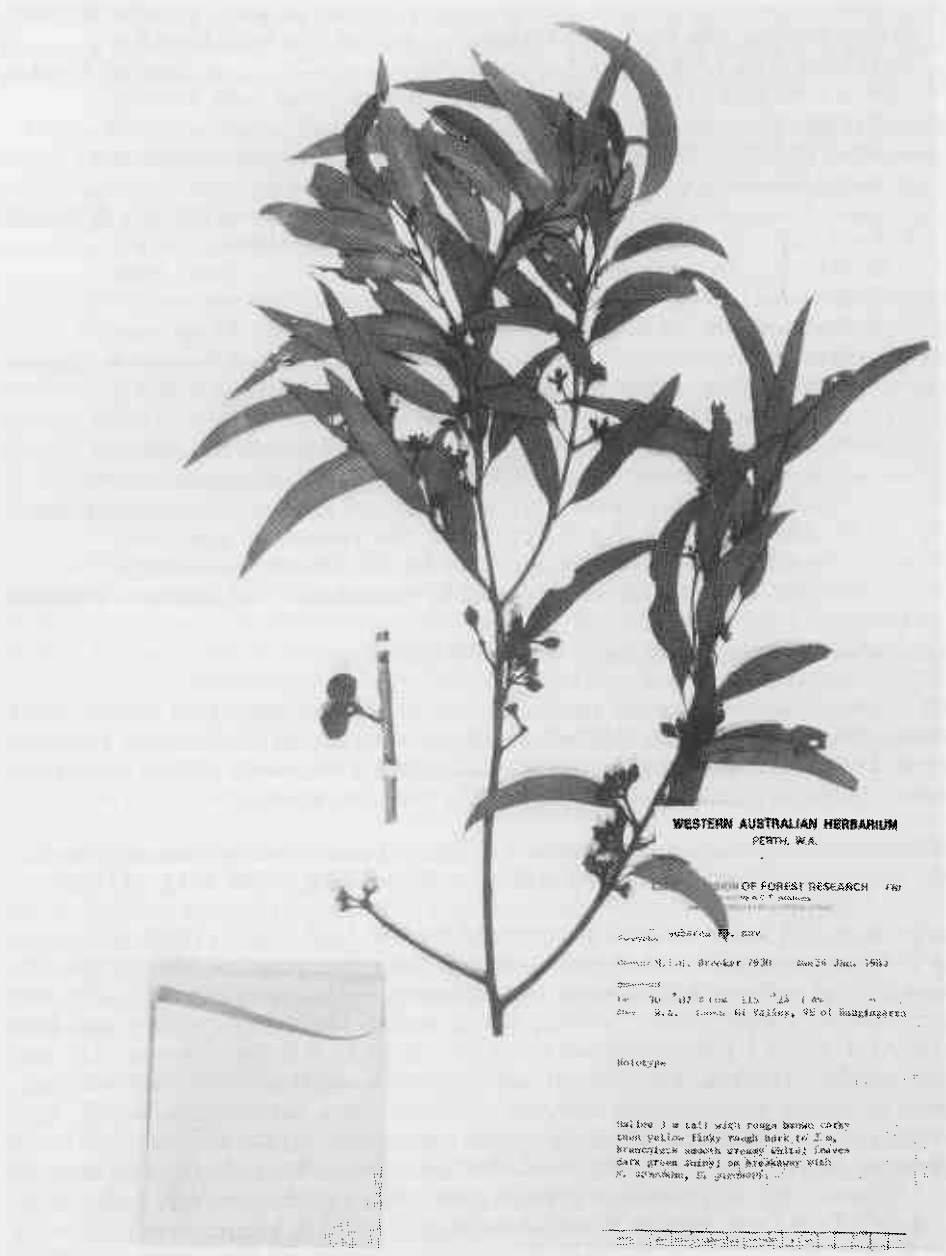

Figure 1. Holotype of *Eucalyptus suberea*.

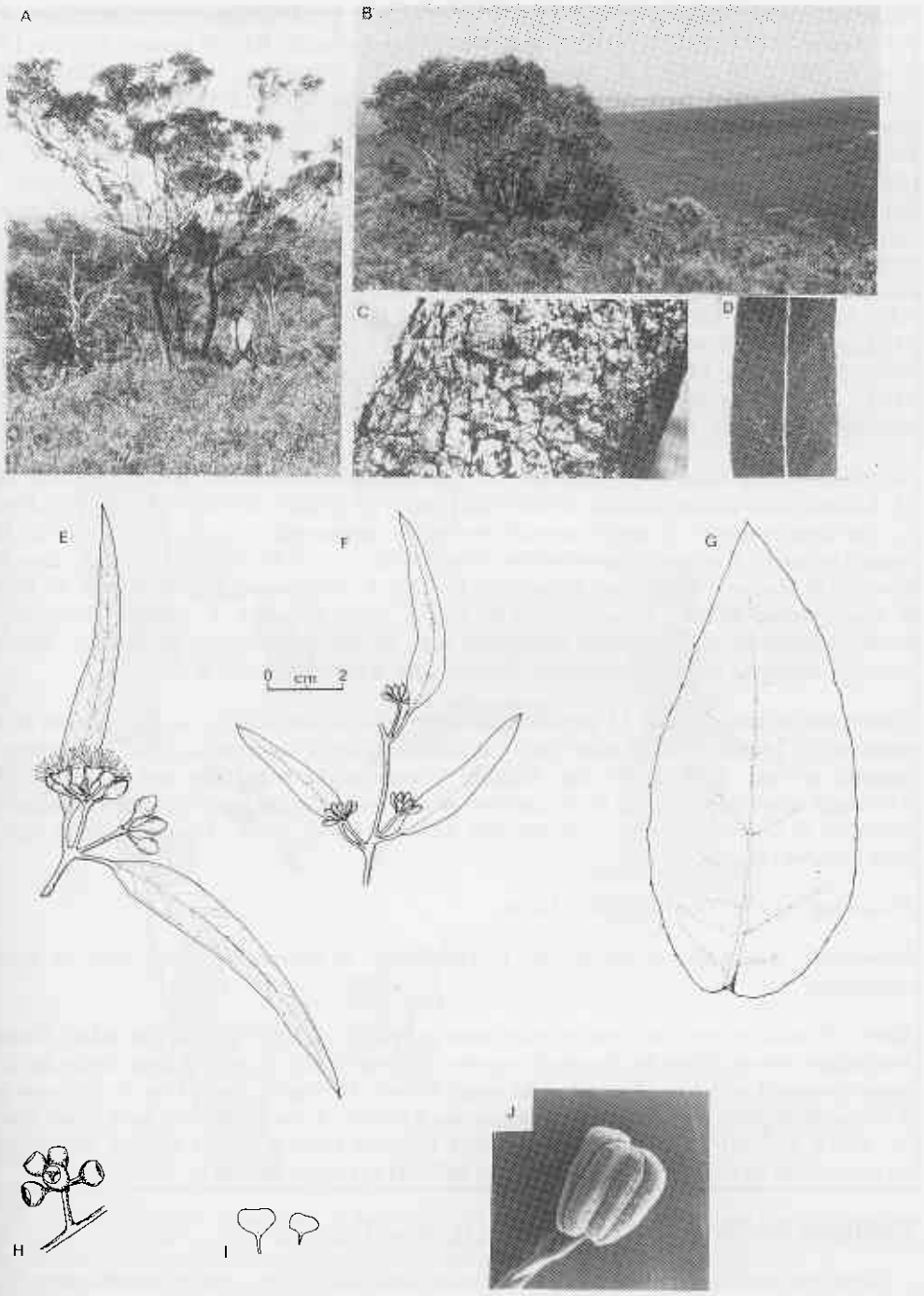

Figure 2. *Eucalyptus suberea.* (A) small tree 6 m tall, NE of Mt Lesueur; (B) mallee 2 m tall, emergent from dense low heath on a small lateritic mesa south of Mt Peron; (C) mature bark on tree shown in (A) above; (D) transmitted sunlight photograph of an adult leaf showing numerous oil glands and inconspicuous secondary venation; (E) adult leaves, buds and flowers; (F) young leaves and buds; (G) a node 5 seedling leaf (from *M.I.H. Brooker* 7992); (H) mature fruit; (I) cotyledons (from *M.I.H. Brooker* 7566); (J) anthers (from *M.I.H. Brooker* 7930). Drawings of E, F, and H are by *S.J. Patrick,* E-H from *E.A. Griffin* 2575. Drawings E-I same scale. Jx40.

Other specimens examined. WESTERN AUSTRALIA: Mt Lesueur, 16 September 1976, *J.S. Beard* 7814 (PERTH); Hill 1 km NW of Mt Lesueur, NE of Jurien, 17 July 1979, *E.A. Griffin* 1956 (PERTH); base of Mt Peron, 23 November 1979, *E.A. Griffin* 2575 (PERTH); Hi Valley farm, 26 August 1980, *G.J. Keighery* 3274 (PERTH); Hi Valley farm, Tootbardi road, north of Badgingarra, 19 August 1982, *M.I.H. Brooker* 7560,7566 (FRI, PERTH, NSW, MEL, AD); Mt Michaud, 21 September 1982, *M.I.H. Brooker* 7638,7639 (FRI, PERTH, NSW); Hi Valley farm, Tootbardi road, north of Badgingarra, 21 September 1982, *M.I.H. Brooker* 7645, 7650 (FRI, PERTH, NSW, MEL, AD) and 24 January 1983, *M.I.H. Brooker* 7930 (FRI, PERTH, NSW, MEL, AD); hill c. 5 km NE of Mt Lesueur, 1 March 1983, *M.I.H. Brooker* 7988 (FRI, PERTH, NSW, MEL, AD); mesa S of Mt Peron, 2 March 1983, *M.I.H. Brooker* 7992 (FRI, NSW, PERTH, MEL, AD); hill ENE of Mt Peron, 2 March 1983, *M.I.H. Brooker* 8005 (FRI, PERTH, NSW, MEL, AD); mesa NW of Mt Michaud, 3 March 1983, *M.I.H. Brooker* 8007 (FRI, PERTH, NSW, MEL, AD); Mt Benia, 3 March 1983, *M.I.H. Brooker* 8014 (FRI, PERTH, NSW, MEL, AD); scarp W of Coomallo Creek, NW of Badgingarra, 3 March 1983, *M.I.H. Brooker* 8016 (FRI, PERTH, NSW, MEL, AD).

Distribution and habitat. E. suberea is a localised endemic of the lateritic uplands near Mt Lesueur and further inland. It has a maximum geographical range of c. 30 km (Figure 3). The species occurs in small populations on the edges and scree slopes of lateritic flat-topped uplands. It grows in open mallee communities over dense low heath with *E. lateritica* Brooker & Hopper, *E. gittinsii* Brooker & Blaxell, *E. marginata, E. accedens* W.V. Fitzg., *E. drummondii* Benth., *E. calophylla* R. Br., *E. exilis* Brooker, *E. pendens* Brooker, *E. gardneri* Maiden, and scattered emergents such as *Hakea neurophylla* Meissn., *Banksia tricuspis* Meissn., *Daviesia epiphylla* Meissn. and *Kingia australis* R.Br.

Conservation status. Only 11 populations of *E. suberea* are known, and all consist of low numbers of plants. The species' rarity alone qualifies it for special legal protection by gazettal as rare flora under the Wildlife Conservation Act (Rye and Hopper 1981). Although most populations of *E. suberea* occur on unvested reserves recommended for inclusion in proposed nature reserves and national parks, none of these reserves has yet been created (Figure 3).

Flowering period. December to March.

Etymology. The Latin name alludes to the nature of the rough corky bark in mature specimens.

Notes. E. suberea has no close relative and is readily distinguished from other Western Australian monocalypts by its small truncate-globose fruit, its grey-yellow corky bark, its many-flowered inflorescences, and its small brown D-shaped seed. Like *E. johnsoniana* Brooker & Blaxell and *Hakea megalosperma* Meissn., *E. suberea* may be a relict species for which the Mt Lesueur region appears to have been a refuge during the climatic perturbations of the Quaternary (Hopper 1979; Hopkins *et al.* 1983).

Eucalyptus lateritica Brooker & Hopper, sp. nov. (Figure 5)

Eucalypto todtianae affinis a qua constanter statura inferiore, cortice minus aspera, foliis adultis viridioribus, parvioribus et tenuioribus, minus reticulatis et glandulis manifestis, et fructibus plerumque parvioribus differt. Semina anguste pyramidalia, brunnea, alis lateralibus latis.

Typus: Mt. Michaud, c. 1 km NW of Mt. Lesueur (30° 15'S, 115° 12'E) 22 April 1982, *S.D. Hopper* 2232 (holo: PERTH (Figure 4); iso: FRI, NSW, MEL, AD, K).

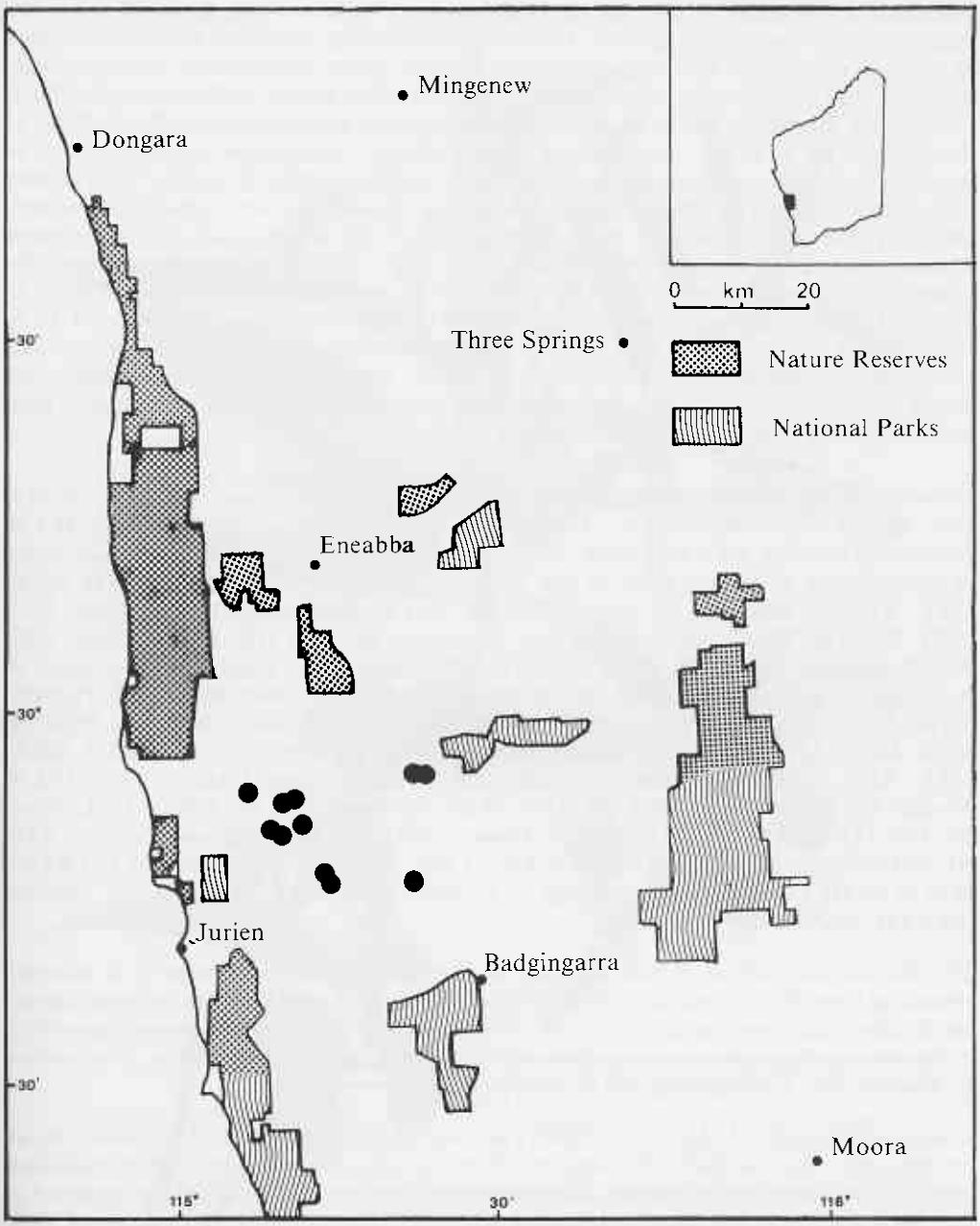

Figure 3. Distribution of *E. suberea* and *E. lateritica* in the Jurien Bay-Eneabba region of Western Australia. Both species occur at all locations designated by ● . Boundaries of Nature Reserves and National Parks greater than 2000 ha in area are shown to highlight the poor reservation status of both new species.

A mallee up to 3 m tall with grey-brown rough bark up to 1.5 m or mostly smooth, lignotuberous. *Cotyledons* reniform, emarginate, 1-1.4 x 0.7-0.9 cm, green above, purple below. *Early internodes* short and leaf pairs relatively crowded. *Seedling leaves* sessile, remaining opposite and held horizontally for up to 10 pairs, oblong to elliptical, up to 15 x 6 cm, slightly toothed, obtuse and minutely apiculate, dull blue-green. *Juvenile leaves*

petiolate, sub-opposite to alternating, held horizontally, lanceolate, up to 18 x 3.5 cm, slightly discolorous, slightly glossy. *Adult leaves* alternating, petiolate, narrow-lanceolate to lanceolate, up to 10 x 1.5 cm, thin, green to dark green, concolorous, slightly glossy, reticulate only to secondary veins, with many small discrete glands. *Inflorescences* axillary, 11-flowered. Peduncles up to 1.7 cm, long. *Buds* shortly pedicellate, broadly fusiform to clavate, up to 1 x 0.7 cm, slightly rough-surfaced. *Operculum* single, conical to hemispherical, more or less equal to hypanthium. *Stamens* white, all fertile, inflexed with anthers basal, resting on green, glandular disc or top of ovary. *Anthers* versatile, dorsifixed, oblong, gland obscure, seen at back, opening by parallel longitudinal slits which curve inwards towards the top and are not or scarcely confluent. *Loculi* 3, style long, smooth, upper part inserted in underside of operculum or in tube descending from it. *Ovules* in 2 vertical rows. *Fruit* shortly pedicellate, cupular to truncate-globose, up to 1.5 x 1.5 cm, with a broad orifice, drying with shallow longitudinal ribbing. *Rim* thick. *Disc* annular or descending obliquely. *Seed* 0.5 x 0.3 cm, brown, lustrous, narrowly pyramidal, with strong lateral ribs ascending to the terminal hilum, dorsal side curved and broader than body of seed by extension into lateral wings.

Other specimens examined. WESTERN AUSTRALIA: Mt Lesueur, NE slope, 20 May 1982, *M.I.H. Brooker* 7514 (FRI, PERTH, NSW); Mt Michaud, 20 May 1982, *M.I.H. Brooker* 7516 (FRI, PERTH, NSW, MEL, AD); Hi Valley farm, Tootbardi road, north of Badgingarra, 19 August 1982, *M.I.H. Brooker* 7563, 7564, 7567 (FRI, PERTH, NSW, MEL, AD); Mt Michaud, 21 September 1982, *M.I.H. Brooker* 7634, 7635, 7636, 7637, (FRI, PERTH, NSW); Mt Michaud, top NE corner, 30° 11'S 115° 11'E, 21 Sept. 1982, *M.I.H. Brooker* 7636 (FRI, NSW, PERTH); Hi Valley farm, Tootbardi road, north of Badgingarra, 21 September 1982, *M.I.H. Brooker* 7646, 7647, 7648, 7649 (FRI, PERTH, NSW); hill c. 5 km NE of Mt Lesueur, 1 March 1983, *M.I.H. Brooker* 7987 (FRI, PERTH, NSW, MEL, AD); Mt Benia, 3 March 1983, *M.I.H. Brooker* 8015 (FRI, PERTH, NSW, MEL, AD); scarp W of Coomallo Creek, NW of Badgingarra, 3 March 1983, *M.I.H. Brooker* 8017 (FRI, NSW, PERTH, MEL, AD); Mt Michaud, 2 km NW of Mt Lesueur, 30° 11'S 115° 12'E, 22 April 1982, *S.D. Hopper* 2231 (PERTH); Williams' farm, ca 5 km NE of Coomallo Hill, N of Tootbardi Rd, 23 Oct. 1984, *S.D. Hopper* 4362 (PERTH); Hills N of Mt Lesueur, Gardner Range — Coomallo district, 16 July 1980, *D. Lievense* (PERTH, CANB).

Distribution and habitat. E. lateritica has an identical geographical range to *E. suberea*, extending from Mt Lesueur some 30 km inland (Figure 3). It also grows in the same habitat on the edges and upper breakaway slopes of dissected lateritic uplands. Common associates in the open mallee communities at these sites include *E. gittinsii, E. suberea, E. accedens, E. drummondii, E. marginata* and *E. gardneri*.

Conservation status. E. lateritica is both rare and, until the creation of proposed nature reserves and national parks, endangered. It occurs in c. 10 small isolated populations, usually of less than 20 individuals. We recommend that the species should be gazetted as rare flora under the Wildlife Conservation Act.

Flowering period. April to September, peaking in May.

Etymology. The specific epithet alludes to the lateritic gravel which dominates the upland soils of the Mt Lesueur region, and which contrasts with the deep sands occupied by *E. todtiana* F. Muell., the species with the closest apparent affinity to *E. lateritica*.

Notes. E. lateritica can be distinguished from *E. todtiana* by its glandular leaves with reduced (not densely reticulate) venation, its longer pedicels, its winter flowering season,

Figure 4. Holotype of *Eucalyptus laterítica*.

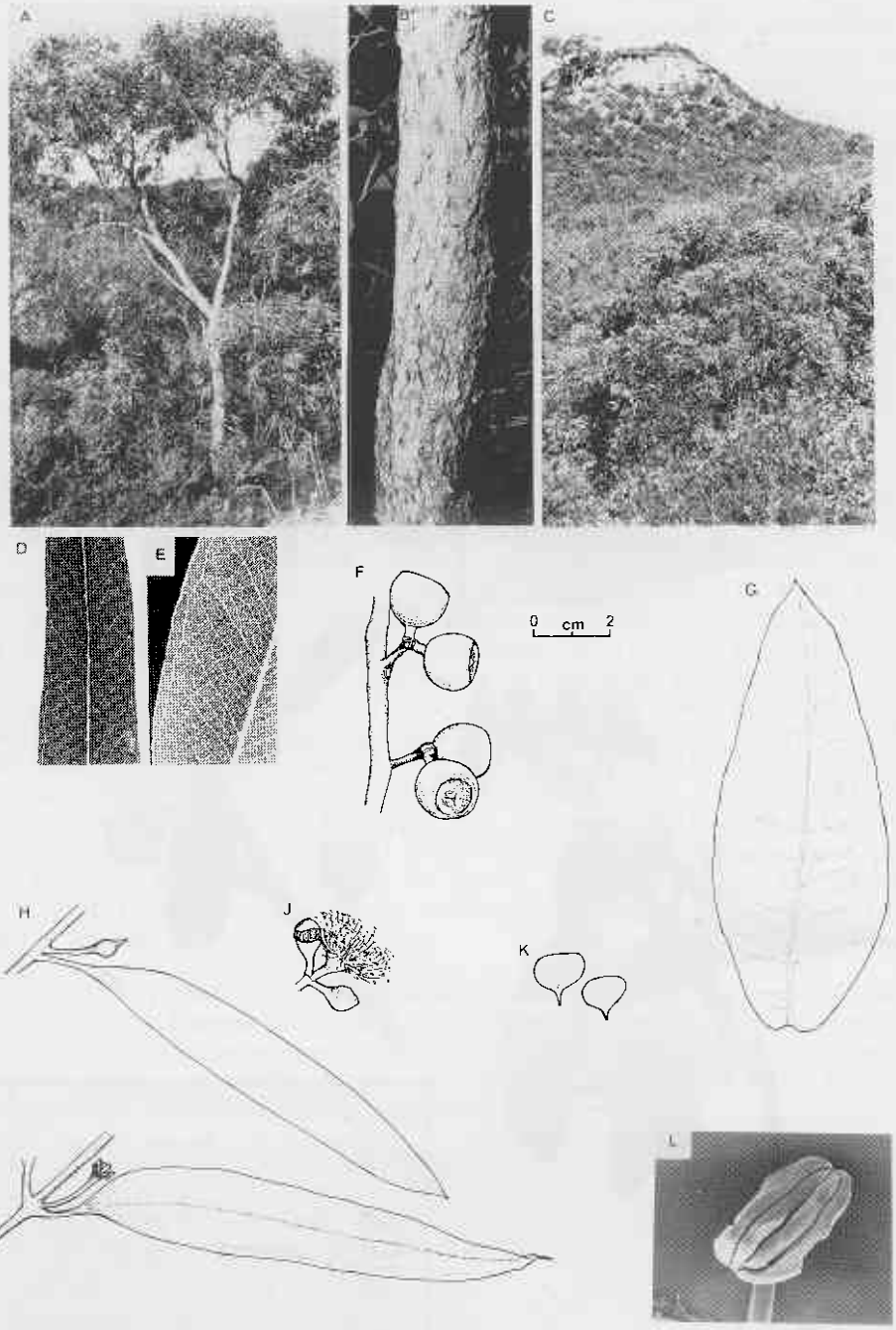

Figure 5. *Eucalyptus lateritica*. (A) small tree 4 m tall NE of Mt Lesueur; (B) trunk of tree in (A) showing mature bark; (C) low mallee 1.5 m tall NE of Mt Lesueur; (D) transmitted sunlight photograph of an adult leaf showing numerous oil glands and simple lateral venation; (E) transmitted sunlight photograph of an adult leaf of *E. todtiana* showing absence of visible oil glands and densely reticulate venation; (F) mature fruit; (G) a node 5 seedling leaf (from *M.I.H. Brooker* 8017); (H) adult leaf and young inflorescence still enclosed in bracts; (I) adult leaf and young buds; (J) mature buds and a flower; (K) cotyledons (from *M.I.H. Brooker* 7564); (L) anthers (from *M.I.H. Brooker* 7564). All drawings same scale; F, H, I, and J by *S.J. Patrick* from holotype. Lx40.

its erect stems and finer bark. The differences in leaf venation between these two species serve as useful field characters for identification. They also pose an interesting evolutionary problem because most close relatives in Western Australian eucalypts do not differ in their leaf venation. It may be that the similarities between *E. lateritica* and *E. todtiana* are due to convergence, and that *E. lateritica* has a closer affinity to other species such as *E. erectifolia*. This hypothesis will be investigated in a forthcoming cladistic analysis of W.A. monocalypts by Dr P.Y. Ladiges and ourselves.

Key to the monocalypts of the Stirling Range National Park

1. Bark rough over whole trunk or stems
   2. Adult leaves distinctly discolorous, with distinct oil glands and moderately reticulate venation, thin ..... *E. marginata* Smith
   2. Adult leaves not or scarcely discolorous, without apparent oil glands and with densely reticulate venation, thick ..... *E. staeri* (Maiden) Kessell & Gardner
1. Bark smooth
   3. Buds and fruits in 3's
      4. Erect mallee or tree; adult leaves lanceolate or falcate; flowers white ..... *E. megacarpa* F.Muell.
      4. Effuse mallee; adult leaves elliptical to broad-lanceolate; flowers yellow ..... *E. preissiana* Schauer
   3. Buds and fruits in 7's or more
      5. Fruit almost globular, often clustered on old wood towards middle of crown, up to 2.5 x 2.5 cm; disc steeply descending; orifice narrow ..... *E. buprestium* F. Muell.
      5. Fruit hemispherical, cupular or truncate-globose, up to 1.6 x 1.8 cm; if disc descending vertically, orifice broad
         6. Peduncles stout, terete, up to 1 cm long; disc broad ascending ..... *E. pachyloma* Benth.
         6. Peduncles slender, terete or flattened, up to 2.5 cm long; disc annular, level or sloping inwards
            7. Buds smooth; fruit up to 1.6 x 1.8 cm ..... *E. erectifolia* Brooker & Hopper
            7. Buds ribbed; fruit up to 1 x 0.9 cm ..... *E. ligulata* Brooker

Eucalyptus erectifolia Brooker & Hopper, sp. nov. (Figure 7)

Frutex "mallee" ad 3 m altus, cortice laevi, foliis adultis erectis ferentibus. Inflorescentiae axillares, 7-11 florae, pedunculis ad 2 cm longis et alabastris pedicellatis, late fusiformibus, ad 1 x 0.6 cm. Fructus breviter pedicellati vel subsessiles cupulares, ad 1.6 x 1.8 cm. Semina pyramidalia, brunnea, alis lateralibus.

Typus: road to Mt. Trio, Stirling Range National Park, Western Australia, Nov. 1981, *M.I.H. Brooker* 7184 (holo: PERTH: iso: FRI (Figure 6), NSW, MEL, K).

A mallee up to 3 m tall with smooth, grey stems, steeply branching. *Cotyledons* reniform or slightly emarginate, 1.2-2 x 0.8-1.5 cm, green above, purple below, tapering to petioles arising well above ground level. *Seedling leaves* sessile, amplexicaul, remaining opposite and held horizontally for up to 4 pairs, elliptical, sometimes apiculate, up to 10 x 6 cm, dull blue-green. *Juvenile leaves* petiolate, sub-opposite to alternating, turning vertical, elliptical to ovate, up to 12 x 6 cm, dull, light green. *Adult leaves* alternating, petiolate, narrow-lanceolate to lanceolate, up to 6 x 1.3 cm, dark green, slightly glossy, concolorous, held erect. *Inflorescences* axillary, 7-13-flowered. *Peduncles* up to 2 cm long. *Buds*

Figure 6. Holotype of *E erectifolia*.

pedicellate, broadly fusiform to ovoid, up to 1 x 0.6 cm. *Operculum* single, conical. *Stamens* white, all fertile, mostly inflexed or irregularly flexed. *Anthers* versatile, dorsifixed, oblong or slightly reniform, gland obscure, opening by parallel longitudinal slits which curve inwards toward the top, not or scarcely confluent. *Loculi* 3 or 4. *Style* tapering with tip enclosed in tube formed in underside of operculum. *Ovules* in 2 vertical rows. *Fruit* shortly pedicellate to subsessile, cupular, up to 1.6 x 1.8 cm. *Rim* thick. *Disc* sloping inwards or descending vertically. *Seed* up to 0.5 x 0.3 cm, brown, pyramidal, dorsal side rounded, extending into lateral wings, ventral side with 2 main ribs ascending to the terminal hilum.

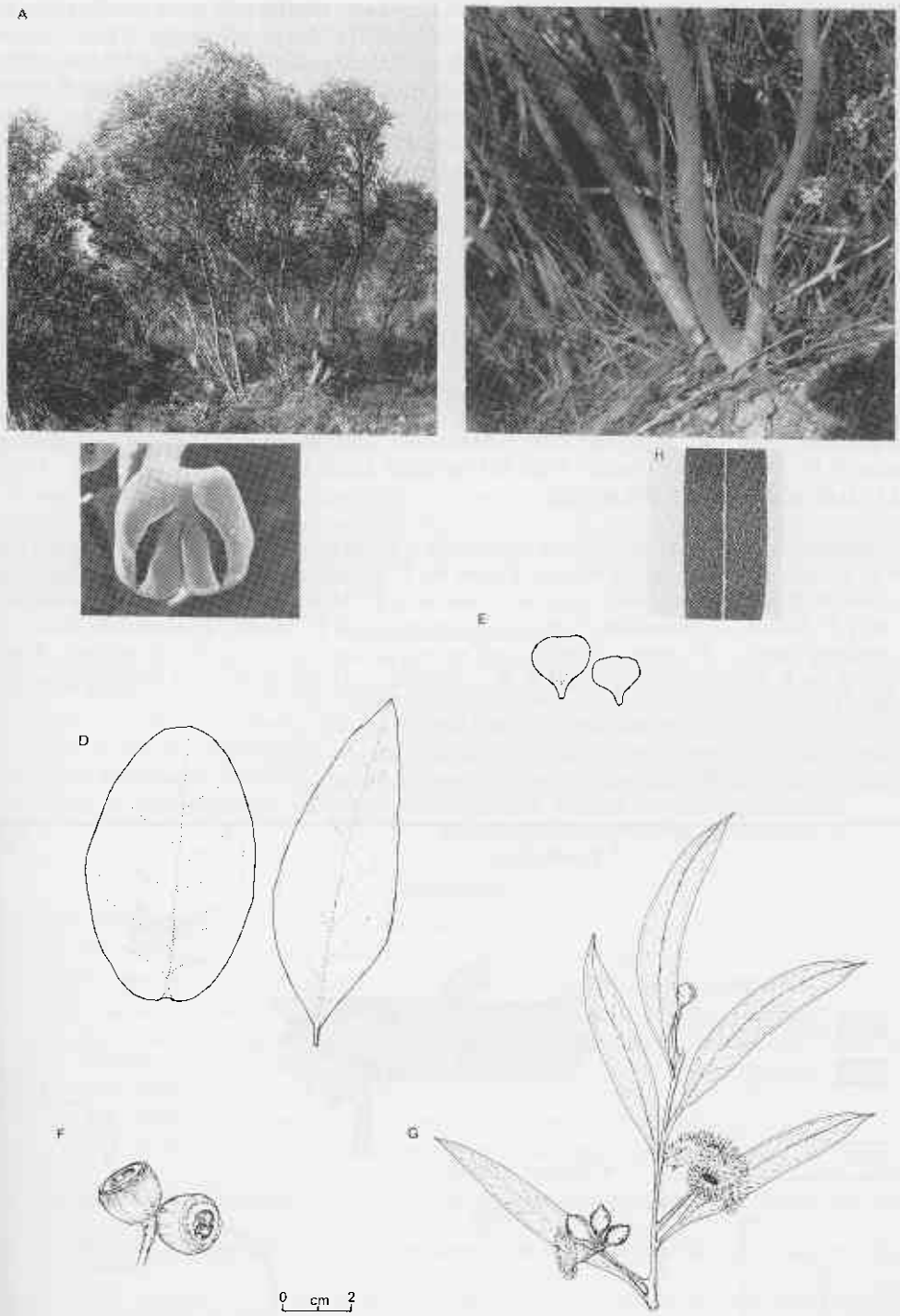

Figure 7. *Eucalyptus erectifolia*. (A) mallee, Bluff Knoll road; (B) stems showing smooth bark; (C) anthers (*M.I.H. Brooker* 8031); (D) juvenile leaves; (E) cotyledons; (F) mature fruit; (G) adult leaves with buds and flowers; (H) transmitted sunlight photograph of an adult leaf showing venation and glands. All drawings same scale; D, E, F and G by *S.J. Patrick*. Cx80.

Other specimens examined. WESTERN AUSTRALIA: Bluff Knoll road, Stirling Range, 5 October 1982, *M.I.H. Brooker* 7661 (FRI, PERTH, NSW); firetrack SW corner of Stirling Range National Park, 9 October 1982, *M.I.H. Brooker* 7723 (FRI, PERTH, NSW, MEL, AD); 1 km SE of Chester Pass road on Bluff Knoll road, Stirling Range N.P., 21 March 1983, *M.I.H. Brooker* 8028, 8031 (FRI, PERTH, NSW, MEL, AD); 5.8 km W of Chester Pass road on Scenic Drive, Stirling Range N.P., 24 November 1983, *M.I.H. Brooker* 8379 (FRI, PERTH, NSW, MEL, AD); 4 km NE of Donnelly Peak, N boundary fire break, W of Chester Pass Rd, 34° 19′S 117° 46′E, 25 March 1982, *S.D. Hopper* 2164 (PERTH); 11.5 km E of Mt Gog, 5.3 km E on East Pillenorup Track, 34° 27′S 118° 08′E, 26 March 1982, *S.D. Hopper* 2166 (PERTH); 1 km E of Wedge Hill, Stirling Range National Park, 34° 26′S 118° 13′E, 26 March 1982, *S.D. Hopper* 2172 (PERTH); 6.5 km SE of Bluff Knoll, Stirling Range National Park, 34° 25′S 118° 19′E, 26 March 1982, *S.D. Hopper* 2175 (PERTH); 4 km SSE of Ross Peak, 4.5 km N of park boundary, Red Gum Pass Rd, 34° 24′S 117° 45′E, 27 March 1982, *S.D. Hopper* 2189 (PERTH); 8 km WNW of Bluff Knoll, 3 km SW of Bluff Knoll Rd, 34° 19′S 118° 11′E, 5 May 1982, *S.D. Hopper* 2296 (PERTH); 5 km ESE of Yungermere Peak, 0.2 km S of East Pillenorup track, Yungermere Cres., 34° 26′S 118° 12′E, 5 May 1982, *S.D. Hopper* 2315 (PERTH); Stirling Range N.P., 1 km SE of Chester Pass Rd on Bluff Knoll Rd, 34° 20′S 118° 12′E, 5 Oct. 1982, *S.D. Hopper* 2625 (PERTH);

Distribution and habitat. Eucalyptus erectifolia is known only from the lower slopes (160-300 m altitude) of the Stirling Range (Figure 8). It usually grows in small isolated clumps in open mallee with associates such as *E. decurva* F. Muell., *E. marginata, E. tetragona* (R.Br.) F. Muell., *E. preissiana* Schauer, *E. buprestium* F. Muell., *E. decipiens* Endl., *E. pachyloma* Benth., *E. falcata* Turcz., and emergent shrubs of *Lambertia inermis* R.Br., *L. ericifolia* R.Br., *Hakea cucullata* R.Br., *Banksia coccinea* R.Br. and *Dryandra sessilis* (R.Br.) Druce.

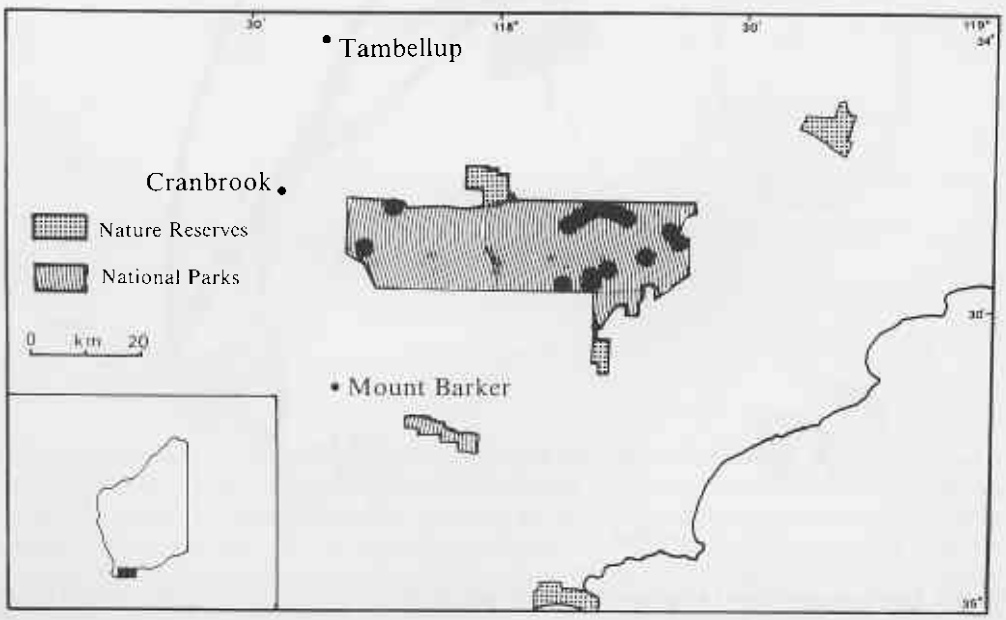

Figure 8. Distribution of *Eucalyptus erectifolia* (●).

Conservation status. The species is very rare, being known from only c. 10 populations each of very few individuals. We recommend that gazettal as rare under the Wildlife Conservation Act would be appropriate. All known populations occur within Stirling Range National Park.

Flowering period. March.

Etymology. The Latin name alludes to the erect manner in which the leaves are held in the crown.

Notes. The close affinities of *E. erectifolia* are not yet clear, although relationships with *E. pachyloma* and *E. buprestium* are evident in the large brown winged seeds of *E. erectifolia*, and its juvenile foliage. The cupular fruit, large pedicellate buds and broader leaves distinguish *E. erectifolia* from *E. pachyloma* and *E. buprestium*.

Instances of sporadic hybridization based on morphology of field specimens and progeny tests between *E. erectifolia* and both *E. buprestium* and *E. marginata* have been documented (unpublished data).

E. erectifolia forms circular clumps up to 25 m in diameter at some locations. Allozyme assays of such clumps have demonstrated that they consist of one genetic individual (G.F. Moran, pers. comm.). The mode of reproduction of such individuals warrants further investigation.

Acknowledgements

We are grateful to E.A. Griffin, G.F. Moran, L.A.S. Johnson, D.F. Blaxell, P.Y. Ladiges and A.R. Griffin for stimulating discussions of the new species in the field. The Director and staff of the National Parks Authority and the Williams family of Badgingarra kindly provided access to populations on their land. We thank the Curator of the Western Australian Herbarium for access to the herbarium research facilities, B. Rockel for raising seedlings in a comprehensive monocalypt trial, and S. Patrick for the illustrations.

References

Bentham, G. (1867). "Flora Australiensis." (L. Reeve & Co: London.)

Blake, S.T. (1953). Studies in Northern Australian species of *Eucalyptus*. Austral. J. Bot. 1: 185-353.

Blakely, W.F. (1934). "A Key to the Eucalypts." (The Workers Trustees: Sydney.)

Boland, D.J., Brooker, M.I.H. and Turnbull, J.W. (1980). "Eucalyptus Seed." (CSIRO: Australia.)

Boomsma, C.D. (1964). A description of a new mallee species of *Eucalyptus* from Central Australia. Trans. Roy. Soc. S. Aust. 88: 115-117.

Brooker, M.I.H. (1972). Four new taxa of *Eucalyptus* from Western Australia. Nuytsia 1: 242-253.

Brooker, M.I.H. (1974). Six new species of *Eucalyptus* from Western Australia. Nuytsia 1: 297-314.

Brooker, M.I.H. and Blaxell, D.F. (1978). Five new species of *Eucalyptus* from Western Australia. Nuytsia 2: 220-231.

Carr, D.J. and Carr, S.G.M. (1959). Floral morphology and the taxonomy of *Eucalyptus*. Nature 184: 1549-1552.

Hopper, S.D. (1979). Biogeographical aspects of speciation in the south-west Australian flora. Ann. Rev. Ecol. Syst. 10: 399-422.

Hopkins, A.J.M., Keighery, G.J. and Marchant, N.G. (1983). Species-rich uplands of south-western Australia. Proc. Ecol. Soc. Aust. 12: 15-26.

Johnson, L.A.S. (1962). Studies in the taxonomy of *Eucalyptus*. Contrib. New South Wales Natl. Herb. 3: 103-126.

Johnson, L.A.S. (1976). Problems of species and genera in *Eucalyptus* (Myrtaceae). Plant Syst. Evol. 125: 155-167.

Ladiges, Pauline, Y., Humphries, C.J. and Brooker, M.I.H. (1983). Cladistic relationships and biogeographic patterns in the peppermint group of *Eucalyptus* (Informal Subseries *Amygdalininae*, Subgenus *Monocalyptus*) and the description of a new species, *E. willisii*. Austral. J. Bot. 31: 565-584.

Maiden, J.H. (1922). "A Critical Revision of the genus *Eucalyptus*." Vol. 6. (Govt. Printer: Sydney.)

Pryor, L.D. (1959). Evolution in *Eucalyptus*. Austral. J. Sc. 22: 45-49.

Pryor, L.D. and Johnson, L.A.S. (1971). "A Classification of the Eucalypts." (Austral. Natl. Univ.: Canberra.)

Pryor, L.D. (1981). "Australian endangered species: Eucalypts." (Austral. Natl. Parks Wildl. Serv., Special. Publ. 5: [Canberra].)

Rye, Barbara L. and Hopper, S.D. (1981). A guide to gazetted rare flora of Western Australia. Dept. of Fisheries and Wildlife, Western Australia, Report No 42.