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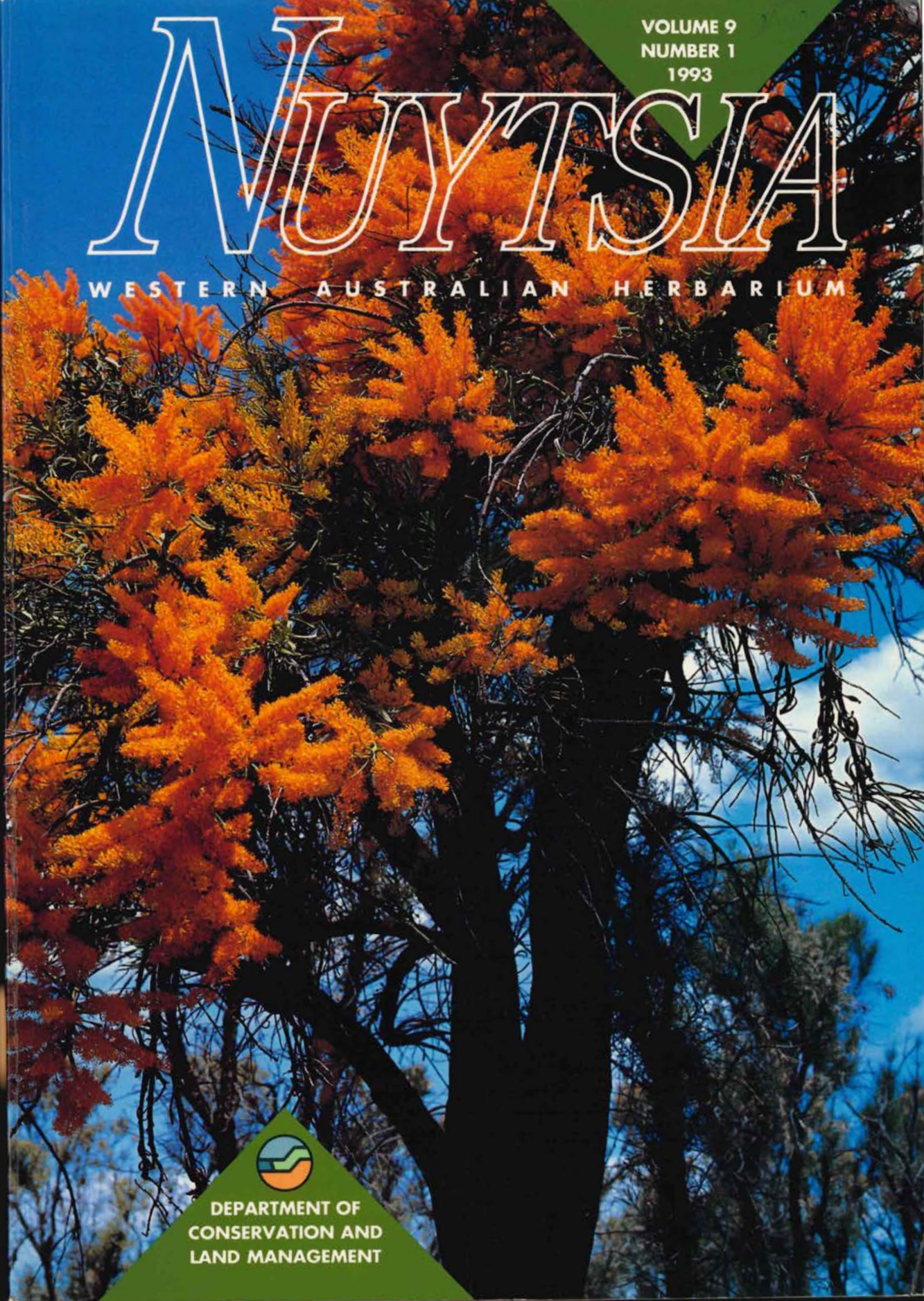

DEPARTMENT OF
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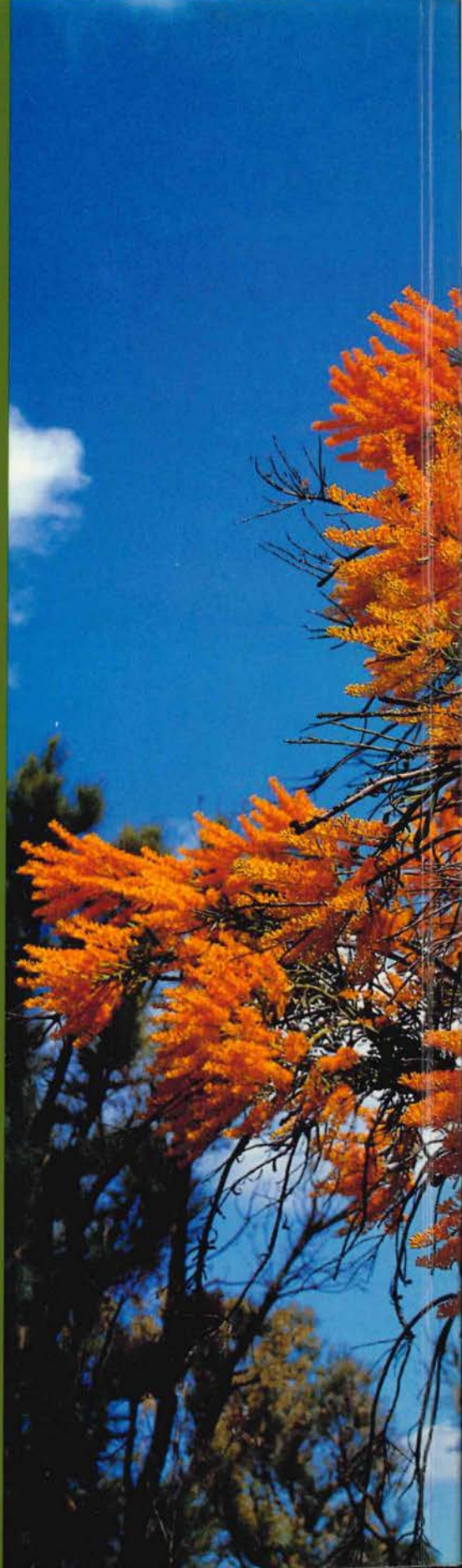

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Western Australian Herbarium
Department of Conservation and Land Management
Como, Western Australia

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Western Australian Herbarium,
Department of Conservation and Land Management,
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Cover

Nuytsia floribunda (Labill.) R. Br. ex Fenzl (Loranthaceae) - the Western Australian Christmas Tree is one of the few aborescent mistletoes in the world. This endemic tree is a semi-parasite common in sandy soil from the Murchison River to Israelite Bay. The journal is named after the plant, which in turn commemorates Pieter Nuijts, an ambassador of the Dutch East India Company, who in 1627 accompanied the "Gulde Zeepard" on one of the first explorations along the south coast of Australia.

Cover design by Sue Marais

Photograph A.S. George

New series, subseries, species and subspecies of *Eucalyptus* (Myrtaceae) from Western Australia and from South Australia

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Abstract

New series, subseries, species and subspecies of *Eucalyptus* (Myrtaceae) from Western Australia and from South Australia. Nuytsia 9 (1): 1-68 (1993). Three new series, six new subseries, twenty-two new species and twenty new subspecies of *Eucalyptus* are described. New taxa are treated in the order and nomenclature of the Flora of Australia Volume 19 (1988) from which we deviate only when we consider an updated treatment necessary. The new series *Falcatae* is erected and divided into two subseries, *Falcatae* and *Decipientes*. The series *Micrantherae s.s.* is expanded to include the new subseries *Bakerianae,* and a new series *Balladonienses* is erected. *E. lane-poolei* of series *Curviptera* is segregated in the new *E.* subseries *Inflexae*, *E. caesia* in the new *E.* series *Caesiae*, while *E.* series *Orbifoliae* comprises the remaining Minni Ritchi species. A new subseries *Cupreanae* is erected in *E.* series *Lucasianae.* Diagnostic notes on each taxonomic series are given at the head of the relevant groups of species throughout the paper. The new taxa are illustrated, except for *E. ebbanoensis* subsp. *photina* and *E. marginata* subsp. *thalassica* for which leaf colour and leaf gloss are the diagnostic characters, *E. marginata* subsp. *elegantella* and *E. macrocarpa* subsp. *elachantha* for which habit, bark characters and leaf, bud and fruit dimensions are the diagnostic characters and *E. decipiens* subspp. *chalara* and *adesmophloia* for which bark characters only are diagnostic. Distribution maps are provided. All the new taxa are endemic to Western Australia except for *E. glomerosa* and *E. kingsmillii* subsp. *alatissima*, both of which extend into the desert region of South Australia.

Introduction

This paper is the second in a series of three major papers in which we describe and classify various new *Eucalyptus* taxa, all but two of which in this paper are endemic to Western Australia. The first of these studies was a revision of *Eucalyptus redunca, E. wandoo* and related species (Brooker & Hopper 1991). A following paper will present a large-scale revision of the species related to *E. cornuta.* This current paper treats a large number of taxa spread over many taxonomic series.

We are not satisfied that any published formal classifications of the genus *Eucalyptus* adequately deal with many groups of species which we treat herein. Hence, we have erected new series and subseries where needed.

Our initial data are derived largely from our extensive field experience, the eucalypt collections in the Western Australian Herbarium (PERTH) and the CSIRO Division of Plant Industry (CANB) and from discussions with colleagues and other collectors. In addition, we have relied to a large extent upon glasshouse trials to complete the comparative morphological studies on seedling morphology.

Many of the new species occur over a relatively wide range and are in sufficient abundance or in protected areas that they are in no danger of extinction. Some are of restricted distribution in agricultural areas but their occurrence on land unsuitable for farming, e.g. lateritic breakaways, may save them and their associated vegetation from being cleared. One of the species of restricted distribution, *E. angularis*, produces apparently healthy buds and flowers but is not known to have set seed. Tests may indicate that the two populations are actually proliferations of single individuals, but its distinctiveness is worthy of taxonomic recognition.

Most of the descriptive terms used in the digests for species are explained and illustrated in Brooker & Kleinig (1990). It is of particular value to recognise the tree/mallet distinction, the latter being a habit form peculiar to Western Australia. For an account of our taxonomic concepts, materials and methods, and background information on studies on Western Australian eucalypts, see Brooker & Hopper (1991).

Taxonomic treatment

Eucalyptus ser. ***Ebbanoenses*** Chippendale, Fl. Australia 19:497 (1988). *Type: E. ebbanoensis* Maiden.

The monotypic *E.* ser. *Ebbanoenses* belongs in the informal *E.* subgen. *Eudesmia* (R. Br.) Pryor & Johnson (1971). The series is diagnosed by the following: smooth-barked mallee, reniform cotyledons, hairy juvenile leaves, adult leaves with prominent side veins and no tertiary veining and with numerous island oil glands, axillary, 3-flowered inflorescences, stamens in 4 bundles, fruits with a broad level disc, 3 valves to rim level and smooth or lacunose black seeds.

Key to taxa of *E.* ser. *Ebbanoenses*

1. Adult leaves dull ..... *E. ebbanoensis* subsp. *ebbanoensis*
1. Adult leaves glossy ..... 1. *E. ebbanoensis* subsp. *photina*

1. Eucalyptus ebbanoensis subsp. **photina** Brooker & Hopper, subsp. nov.

A subspecie typica foliis nitentibus differt.

Typus: Nanson Road, 28°34'S, 114°43'E, 12 Mar. 1986, *M.I.H. Brooker* 9195 & *S.D. Hopper* (holo: PERTH; iso: CANB, NSW, MEL).

It differs from the typical subspecies in the very glossy adult leaves.

Other specimens examined. WESTERN AUSTRALIA: 13 miles E of Eradu Siding, 26 Oct. 1974, *J.S. Beard* 7160 (PERTH); Burma Road Nature Reserve, 26 Jan. 1983, *M.I.H. Brooker* 7944 (CANB, PERTH); breakaway SSE of Mt Horner, 4 Feb. 1985, *M.I.H. Brooker* 8817 (CANB, PERTH); Nanson Road, 12 Mar. 1986, *M.I.H. Brooker* 9195 (CANB); Mt Michael, 12 Mar. 1986, *M.I.H. Brooker* 9196 (CANB); c. 500 m SE of Mt Michael (28°55'S, 114°58'E), 12 Mar. 1986, *M.I.H. Brooker* 9199 & *S.D. Hopper* (CANB, MEL, NSW, PERTH); 17.7 km E of Burma Road on road to Walkaway, 17 Mar. 1986, *M.I.H. Brooker* 9201 (CANB); 3.7 miles E of Eradu Siding, 17 Mar. 1968, *G.M. Chippendale* 323 (CANB, PERTH); 4.4 km NE of Moonyoonooka turn-off from Nanson-Geraldton Road, Heinrich's farm, East Morseby Range, 25 Aug. 1983, *R.J. Cranfield* 2937 (CANB, PERTH); 27 miles E of Walkaway, 4 Sep. 1966, *A.S. George* 7854 (PERTH); Royce's farm, Howatharra, NE of Geraldton, 27 Aug. 1980, *G.J. Keighery* 3208 (PERTH); 4.2 km S of Nanson on Murphy Norris Rd, 28°36'S, 114°46'E, 18 July 1989, *A. Napier & A. Kelly* 508 (CANB, PERTH); Gravel pit on Mullewa Rd opposite Wicherena Water Res., 19 July 1989, *A. Napier & A. Kelly* 510 (PERTH); 11.2 km S down Casuarina Rd from Geraldton-Mullewa Rd, 19 July 1989, *A. Napier, A. Kelly & P. Ryan* (PERTH); 76 miles E of Geraldton, 26 Oct. 1974, *E. Wittwer* W1577 (PERTH).

Distribution. North and east of Geraldton, particularly in the Morseby Range on breakaways, Western Australia (Figure 1).

Conservation status. Uncommon but secure in some conservation reserves, and in need of monitoring (Priority 5 in Hopper *et al.* (1990)).

Flowering period. Unknown.

Etymology. From the Greek *photeinos* - shiny, as descriptive of the leaves compared to the widespread typical form.

Notes. The typical subspecies has a remarkably wide distribution in contrasting environments from near Geraldton eastwards to the Great Victoria Desert while subsp. *photina* is restricted to lateritic breakaways in the vicinity of the Moresby Range and Eradu and south to Walkaway and Mt Michael. It grows with *E. arachnaea* Brooker & Hopper.

Eucalyptus ser. **Occidentales** Blakely,"A Key to the Eucalypts" 40, 171 (1934).

Lectotype (fide Chippendale 1988): *E. marginata* Donn ex Smith

The *E.* series *Occidentales* belongs in the informal *E.* subgenus *Monocalyptus* Pryor & Johnson. In Blakely (1934) the series comprised *E. sepulcralis, E. buprestium, E. staeri* and *E. marginata.* In Chippendale (1988) it is made up of *E. brevistylis, E. jacksonii, E. marginata* (lectotype there chosen) and *E. staeri.* In a recent informal classification of Western Australian *Monocalyptus* (Ladiges *et al.* 1987) these species were divided between different sections. We believe, therefore, that the *Occidentales* as defined by Blakely and by Chippendale are not a natural group and it would be exceeding the purpose of this paper to provide a key to a large, arbitrary group of species. The following two new subspecies are a division of the type species for the series.

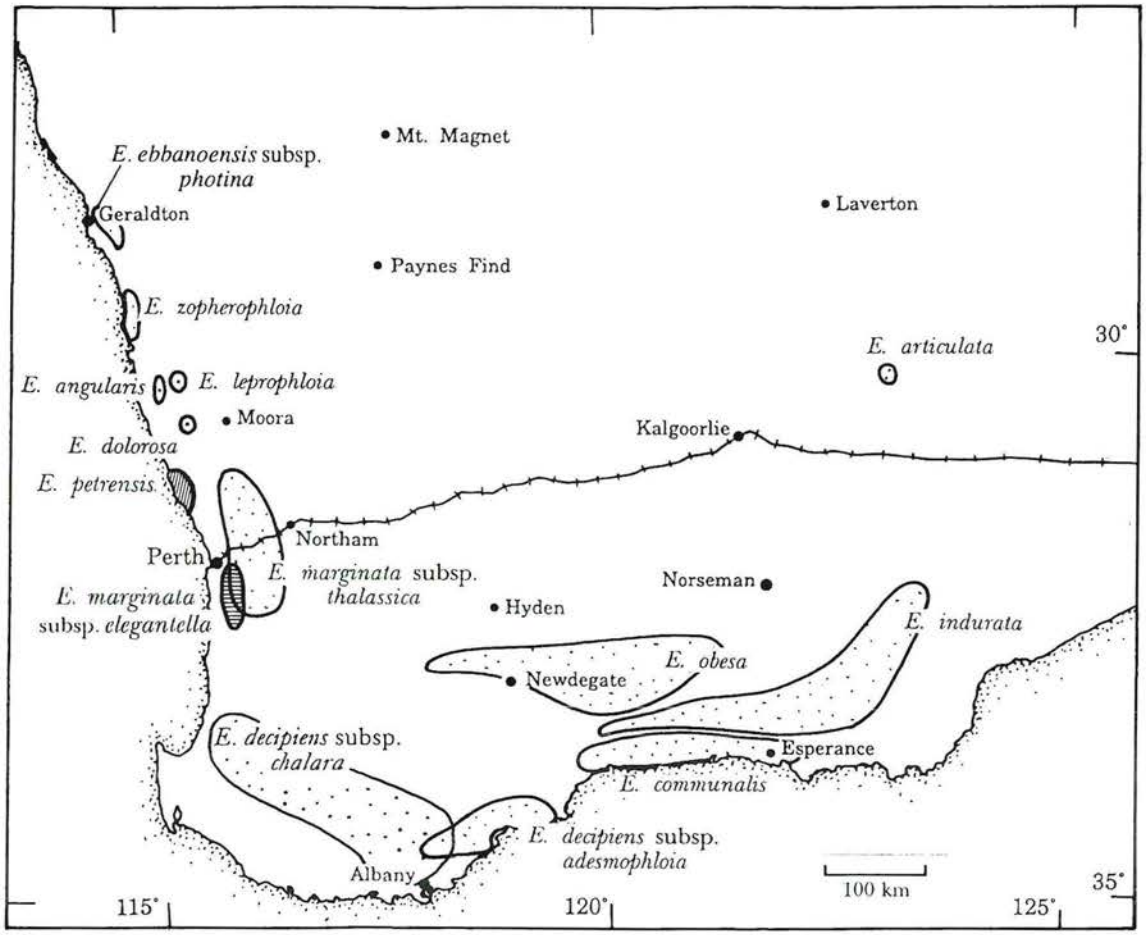

Figure 1. Distribution of taxa Nos 1-13

Key to subspecies of *E. marginata*

1. Adult leaves glossy, green to dark green
   2. Adult leaves broadly lanceolate, >10 x 2 cm ..... *E. marginata* subsp. *marginata*
   2. Adult leaves lanceolate, <10 x 2 cm (often <1.5 cm wide) .. 2. *E. marginata* subsp. *elegantella*
1. Adult leaves dull, grey to bluish ..... 3. *E. marginata* subsp. *thalassica*

2. Eucalyptus marginata Donn ex Smith subsp. **elegantella** Brooker & Hopper, subsp. nov.

A subspecie typica foliis adultis parvioribus angustioribus et habitu parviore compacto differt.

Typus: Darling Scarp, ca. 3 km due west of Jarrahdale, Atkinson's property, 32°20'S, 116°01'E, 30 Mar. 1991, *S.D. Hopper* 7916 (holo: PERTH; iso: CANB, NSW).

It differs from the typical subspecies by the smaller, narrower adult leaves (to 9 x 2 cm but often <1.5 cm wide) and smaller more compact habit.

Other specimens examined. WESTERN AUSTRALIA: Forrestfield, 10 Nov. 1965, *A.S. George s.n.* (PERTH); 4 km SSW of Serpentine, 5 Aug. 1982, *G.J. Keighery* 5043 (PERTH); type locality, 30 Mar. 1991, *S.D. Hopper* 7917 (PERTH).

Distribution. Apparently confined to the foot of the Darling Scarp between Perth and Serpentine on Ridge Hill Shelf lateritic loams (Figure 1).

Conservation status. Poorly known.

Flowering period. Late spring-early summer.

Etymology. The diminutive of the Latin *elegans* (elegant) in reference to the fine leaves and small habit compared with the typical form of jarrah.

Notes. E. marginata subsp. *elegantella* is a compact small tree, usually less than 8 m tall, with characteristically narrow leaves. It is conspicuous along the South West Highway southwards from Byford. It appears to be confined to granitic clays associated with the slope and foot of the Darling Scarp. It often occurs with *E. calophylla* and sometimes with *E. lane-poolei.*

3. Eucalyptus marginata Donn ex Smith subsp. **thalassica** Brooker & Hopper, subsp. nov.

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 100 (1990).

A subspecie typica foliis adultis thalassicis et constanter habitu umbrato differt.

Typus: Baker's Hill, 34°45'S, 116°27'E, 27 Aug. 1979, *M.I.H. Brooker* 6496 & *E. Bettenay* (holo: PERTH; iso: CANB, NSW).

Differing from the typical subspecies in the grey or bluish adult leaves and consistently umbrageous habit.

Other specimens examined. WESTERN AUSTRALIA: type locality, 27 Aug. 1979, *M.I.H. Brooker* 6497, 6498, 6499 (CANB, NSW, PERTH); between Hay Flat and Bindoon, 28 Aug. 1983, *M.I.H. Brooker* 8286 (CANB, PERTH); Kardinya, ± 9 miles S of Perth, 4 Feb. 1969, *A.S. George* 9249 (PERTH); Above S side of McKnoe Creek, 32°54'S, 115°58'E, 24 Oct. 1988, *L. Johnson* 9125 & *B. Briggs* (CANB, NSW, PERTH); 2.5 km W of junction of Great Southern & Great Eastern Hwys, 31°53'S, 116°17'E, 3 Nov. 1988, *L. Johnson* 9211 & *B. Briggs* (CANB, NSW, PERTH); Bartlett's Well, 25 km N of Gin Gin, 27 Jan. 1987, *G. Keighery* 9853 (PERTH); Clackline, 20 km W of Toodyay, 19 Sep. 1988, *G.J. Keighery* 10526 (CANB, PERTH); 22 mile peg Albany Highway, 13 July 1970, *B. Rockel* (FRI 18672) (CANB); Jarrahdale, 8 Feb. 1928, *W.R. Wallace s.n.* (CANB).

Distribution. The northern Darling Range, Western Australia (Figure 1).

Conservation status. Common and widespread.

Flowering period. As for the typical subspecies - early summer.

Etymology. The name refers to the colour of the leaf (Greek *thalassicos* - sea-coloured).

Notes. E. marginata subsp. *thalassica* is the common form of jarrah in most of its northern Darling Range distribution (the new taxon does not occur in the Mt Lesueur area) and is readily seen along the roads to New Norcia and Northam and along the Brookton Highway. In the Bakers Hill area it has a notably pendulous habit of the branches. Despite its abundance, it is poorly represented in herbaria.

Two monocalypts of uncertain affinity

In the most recent classification of the western monocalypts, Chippendale (1988) used seven taxonomic series, three of which are monotypic and the remainder we believe to be heterogeneous. The following two new monocalypts cannot be placed in this classification.

The previous year (1987) Ladiges *et al.* produced an informal system based on a study of 40 characters of the seed, cotyledons, seedlings, habit, adult leaves, flowers and fruit. Because of limited material, we cannot place *E. angularis* in this system. *E. dolorosa,* on the other hand, fits in the weakly resolved clade comprising the informal superseries "*Bupresticae*" and "*Todtianicae*" and, with further material available to us, we elaborate later on its taxonomic relationships.

4. Eucalyptus dolorosa Brooker and Hopper, sp. nov. (Figure 2)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 418 (1990).

Frutex ("mallee") ad 2.5m altus cortice in caulibus maturis fibroso. Folia adulta petiolata, lanceolata vel raro falcata, ad 10 x 2 cm, concoloria, leviter nitentia, viridia; laterinervi costae concatenati visi; reticulum moderate densum venis tertiariis finitis quaterniariis apparenter incompletis; glandulae numerosae discretae. Inflorescentiae axillares atque non ramosae vel fasciculatae in extremitatibus efoliosis ramulorum; pedunculi plus minusve tereti, ad 1.5 cm longi ferentes 7-flores. Alabastra in pedicellis longis, rhomboidea, ad 0.9 x 0.6 cm, operculo leviter rostrato singulo. Stamina numerosissima (circa in quoque alabastro 300), varie inflexa, omnia fertilia; antherae dorsifixae, versatiles, oblongae, rimis longitudinalibus dehiscentes, glande prominenti, terminali. Stylus glandifer; stigma apparenter lobum. Ovula verticaliter 2-seriata. Fructus in pedicellis ad 0.7 cm longis, cupulati vel truncati-globosi, leviter contracti ad summum, latiores quam longiores, ad 1 x 1.4 cm.

Typus: Mt Misery, 30°41'S, 115°37'E, 18 Aug. 1987, *M.I.H. Brooker* 9774 & *P.M.Grayling* (holo: PERTH; iso: AD, CANB, MEL, NSW).

Mallee to 2.5 m tall with thin, outer grey and inner yellowish, rough bark on older stems. *Juvenile leaves* petiolate, alternating, broadly falcate, to 11 x 4.5 cm, dull, conspicuously light bluish grey. *Adult leaves* petiolate, alternating, lanceolate or rarely falcate, up to 10 x 2 cm, concolorous, slightly glossy, green; side veins seen to be linked with the midrib (*cf. E. lateritica*); reticulation moderately dense with finite tertiary and incomplete quaternary veining; oil glands numerous, several per areole, island. *Inflorescences* axillary and unbranched usually clustered at the leafless ends of branchlets; peduncles more or less terete, up to 1.5 cm long with 7 flowers. *Buds* on long pedicels up to 1 cm long, rhomboid, up to 0.9 x 0.6 cm, with a single slightly beaked operculum. *Stamens* very numerous (c. 300 per bud), variously flexed, all fertile; anthers dorsifixed, versatile, oblong, dehiscing by longitudinal slits, with a prominent terminal gland. *Style* glandular; stigma apparently lobed. *Flowers* white. *Ovules* in 2

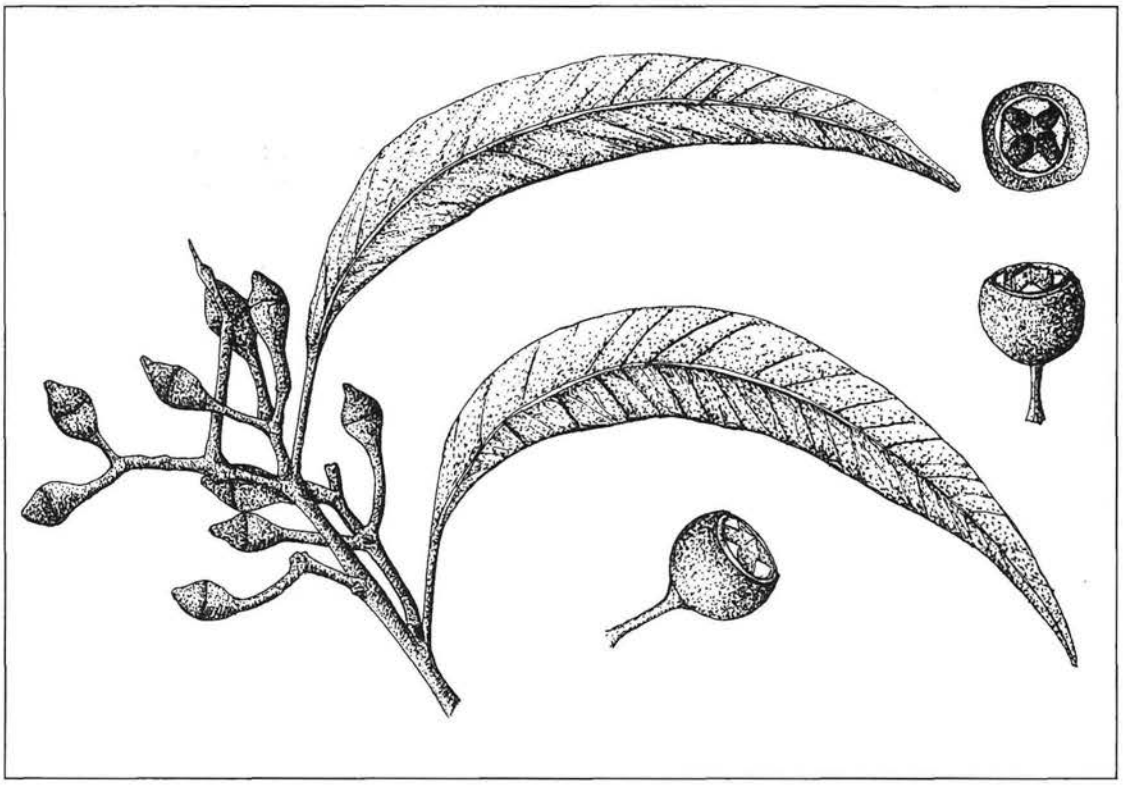

Figure 2. *E. dolorosa*- buds and leaves (*MIHB* 9873), and fruits (*L. Sweedman* 5724)

vertical rows. *Fruit* on pedicels to 0.7 cm long, cupular to truncate-globose and slightly contracted at the rim, wider than long, to 1 x 1.4 cm; valves 4, to rim level. *Seed* brown, pyramidal, winged, with terminal hilum.

Other specimens examined. WESTERN AUSTRALIA: Type locality. 18 Aug. 1987, *M.I.H.Brooker* 9741, 9742, 9743 (CANB); 3 Dec. 1987, *M.I.H. Brooker* 9829 (CANB, PERTH); 1 Feb. 1988, *M.I.H. Brooke*r 9873 (CANB), 9874 (MEL), 9875 (NSW); 3 Mar. 1988, *M.I.H. Brooker* 9891 (CANB, PERTH); 14 Feb. 1991, *L. Sweedman* 5724 (KP, PERTH).

Distribution. Mt Misery, between Cataby and Dandaragan, Western Australia, where it occurs within a hectare including the flat mesa top and the southern slope in 5 or 6 clumps, each consisting of several apparent individuals (Figure 1).

Conservation status. Vulnerable, confined to a single remnant of native vegetation on private land left uncleared by the current owners for soil and nature conservation. Declared as Rare Flora (Hopper *et al.* 1990).

Flowering period. March.

Etymology. The specific epithet simply alludes to the only known occurrence of this species, *viz.* Mt Misery (Latin, *dolorosus* - sorrowful).

Notes. In Feb. 1991 *E. dolorosa* was found in fruit for the first time by Luke Sweedman and Roger Fryer of Kings Park and Botanic Garden, having flowered without producing fruit in the previous four years following its discovery. The size and shape of the fruit do not indicate any obvious affinity with other species of western monocalypts. The seed, however, are winged and this feature places *E. dolorosa* with *E. buprestium, E. erectifolia, E. lateritica, E. todtiana,* and *E. johnsoniana* (these making a clade in Ladiges, Humphries and Brooker 1987). Only four seeds were harvested in the recent collection. Germination and seedling study have not yet been made to seek further indications of affinity.

Adult leaf venation and oil gland characters were not studied in Ladiges *et al.*, but they shed some light on this previously unresolved clade. *E. buprestium* and *E. erectifolia* are very similar in these leaf characters (strong tertiary venation and obscure or no oil glands), with *E. todtiana* closely similar to them. The remaining three species, having distinct oil glands in the leaves, are divergent. *E. lateritica* and *E. dolorosa* have many oil glands and the most reduced tertiary venation. *E. johnsoniana*, with a distinct reticulation of tertiary veinlets and distinct oil glands, may lie in between.

E. dolorosa persists on a refugial site similar to species such as *E. suberea* and *E. lateritica* in Mt Lesueur National Park. It is probable that *E. dolorosa* is a relict species barely surviving extinction due to drying climate in the late Pleistocene.

5. Eucalyptus angularis Brooker & Hopper, sp. nov. (Figure 3)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 418 (1990).

Frutex "mallee" ad 3 m altus cortice aspera vel squamea cinerea ad basin vel ad 1 m. Ramulosae exiles angulares. Folia adulta petiolata alternantia, elliptica vel falcata vel lanceolata, attentuata saepe uncinata, 6-10 x 1.5 cm, plus minusve concoloria sed aspectu leviter dorsiventrali marginibus minute recurvatis. Inflorescentiae axillares non ramosae, ad 11-florae. Pedunculi exiles, angulati vel complanati, ad 1.2 cm longi. Alabastra pedicellata, fusiformia, matura non visa. Ovula verticaliter 2-seriata. Fructus seminaque non visa.

Typus: Mt Benia, SW slope, 30°14'S, 115°16'E, 3 Mar. 1983, *M.I.H. Brooker* 8013 & *S.D. Hopper* (holo: PERTH; iso: CANB, NSW).

Mallee to 3 m tall with rough or flaky grey bark at the base only or up to 1 m. *Branchlets* slender, angular. *Juvenile leaves* not seen. *Adult leaves* petiolate, alternating, elliptical to falcate or lanceolate, tapering to a fine point, sometimes uncinate, 6-10 x 1.5 cm, more or less concolorous, but appearing slightly dorsiventral by the minutely recurved edges, glossy, green; reticulation dense with finite tertiary and incomplete quaternary veining, oil glands numerous, small, island and intersectional. *Inflorescences* axillary, unbranched, to 11-flowered. Two principal *bracts* prominent early in inflorescence development by the strongly beaked tips. *Peduncles* slender, angular or flattened, 1-2 cm long. *Buds* pedicellate, fusiform, not seen mature. Some outer *stamens* erect, others variously flexed. *Anthers* probably opening by non-confluent slits. *Flowers* not seen. *Ovules* in 2 vertical rows. *Fruit* and *seed* not seen.

Other specimen examined. WESTERN AUSTRALIA: W side of canyon, NE of Mt Lesueur, 1 Mar. 1983, *M.I.H. Brooker* 7984 & *S.D. Hopper* (CANB, NSW, PERTH).

Distribution. Known only from the two localities cited, both lateritic breakaways, where it consists at both sites as a single clump of mallees emergent in low heath (Figure 1).

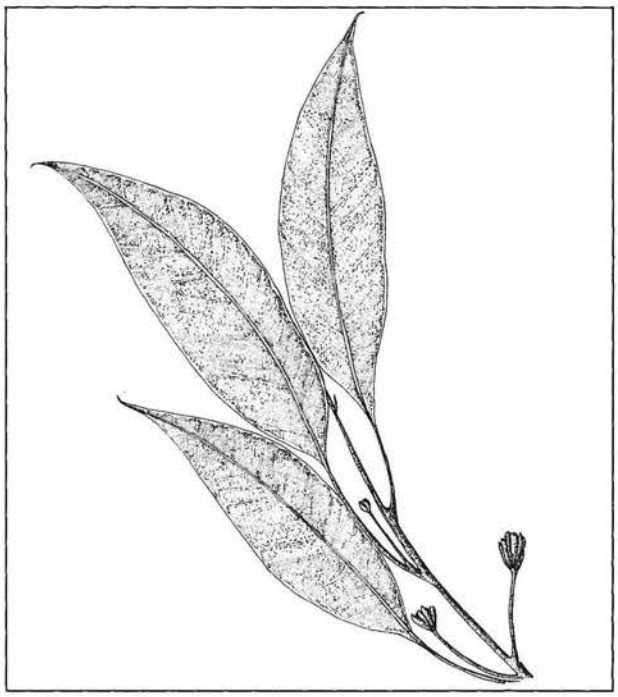

Figure 3. *E. angularis* - adult leaves and young bud clusters (x0.5) (*MIHB* 7984)

Conservation status. Vulnerable, with one clump in Mt Lesueur National Park. Its possible hybrid origin has precluded listing on the schedule of Declared Rare Flora under current Conservation & Land Management policy (Hopper *et al.* 1990).

Flowering period. Unknown.

Etymology. From the Latin *angularis*, angular, referring to the branchlets.

Notes. E. angularis appears to have affinity with no other western monocalypt. The small, slightly dorsiventral, glossy, green, often falcate adult leaves resemble somewhat those of the eastern stringybarks (*E.* ser. *Pachyphloiae*) but the dense veining of the leaves suggests no affinity to these species. There is a possibility that it is an extremely rare hybrid of *E. marginata* and perhaps *E. exilis* or *E. pendens.* However, this hypothesis requires detailed investigation.

Eucalyptus ser. **Accedentes** Chippendale, Fl. Australia 19:495 (1988). *Type: E. accedens* W. Fitzg.

The *E.* ser. *Accedentes* belongs in the informal *E.* subgenus *Symphyomyrtus* (Schauer) Pryor & Johnson. It is diagnosed by the following: cotyledons bisected, pith of branchlets glandular, juvenile leaves petiolate, inflorescences axillary, unbranched, 7 or more flowered, stamens inflexed, anthers versatile, dorsifixed, oblong, opening by longitudinal slits, ovules in 4 vertical rows on placenta, seed grey to grey-brown, compressed-ovoid to flattish, slightly flanged and smooth to slightly reticulate.

Key to species of *E.* ser. *Accedentes*

1. Tree
 2. Bark pink to white; leaves lanceolate to broadly lanceolate, blue-grey to blue-green ..... *E. accedens*
 2. Bark yellow to white; leaves lanceolate to falcate, green ..... *E. laeliae*
1. Mallee
 3. Leaves dull, grey to blue-grey ..... *E. trivalvis*
 3. Leaves glossy green,
  4. Bark rough, tightly held over most of stems ..... 6. *E. zopherophloia*
  4. Bark rough at butt or loosely rough or wholly smooth
   5. Branchlets, buds, fruit glaucous ..... *E. pruiniramis*
   5. Branchlets, buds, fruit not glaucous
    6. Erect-stemmed mallee with loose flaky rough bark; fruit cupular to barrel-shaped (to 0.7x 0.6 cm) ..... 7. *E. leprophloia*
    6. Spreading mallee with mostly smooth stems
     7. Valves of fruit exserted, fruit obconical, to 1.2 x 1.3 cm ..... *E. prominens*
     7. Valves of fruit enclosed; fruit cylindrical, to 1.5 x 0.9 cm ..... *E. pilbarensis*

6. Eucalyptus zopherophloia Brooker & Hopper, sp. nov. (Figure 4)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 127 (1990).

Frutex "mallee" ad *Eucalyptum* seriem *Accedentes* Chippendale pertinens, habitatione calcareo, habitu "mallee" effuso, cortice basi non-decorticato firmo, foliis adultis viridibus nitentibus distinguitur.

Typus: 31.7 km N of Coolimba on Cliff Head Road, 29°33'S, 114°58'E, 2 Nov. 1986, *M.I.H. Brooker* 9560 (holo: PERTH; iso: CANB, NSW).

Spreading *mallee* to 4 m tall with rough, grey-black, firm, fibrous *bark* on lower half or over whole of stems. Forming *lignotubers. Cotyledons* bisected. *Seedling leaves* petiolate, decussate, remaining opposite for 4-6 pairs, lanceolate to broadly lanceolate, to 6 x 3 cm, blue-green, dull. *Adult leaves* petiolate, alternating, narrowly lanceolate, to 10 x 1.3 cm, concolorous, dull to slightly glossy, light green; reticulation sparse to moderate, with numerous, large island oil glands. *Inflorescences* axillary, unbranched, to 11-flowered; peduncles slightly angular to flattened, 0.3-1.3 cm long. *Buds* pedicellate, ovoid to clavate, to 0.8 x 0.4 cm; bi-operculate; inner operculum hemispherical to shallowly conical, slightly shorter than hypanthium. *Flowers* creamy-white. *Ovules* in 4 vertical rows. *Fruits* pedicellate, obconical or less often cupular, to 1 x 1 cm; rim thin; disc descending; valves (3)4, to just below rim level.

Other specimens examined. WESTERN AUSTRALIA: 7.6 km S of Dongara-Mingenew Road on Brand Highway, 20 Aug. 1982, *M.I.H. Brooker* 7575 (CANB, PERTH); Cliff Head Road at rail crossing, 24 Jan. 1983, *M.I.H. Brooker* 7931 (CANB, PERTH); Cliff Head Road, west of Brand Highway (20°28'S, 115°01'E), 23 Jan. 1986, *M.I.H. Brooker* 8403 & *S.D. Hopper* (CANB, NSW, PERTH); Cliff Head Road turn-off on Brand Highway, 28 Aug. 1984, *M.I.H. Brooker* 8634 (CANB,

PERTH); 2.1 km N of Cliff Head Road turn-off on Brand Highway, 4 Feb. 1985, *M.I.H. Brooker* 8821, 8824, 8825 (CANB); Brand Highway, Cliff Head Road turn-off, 3 Feb. 1985, *M.I.H. Brooker* 8826, 8827, 8828, 8829, 8830 (CANB); c. 300 m S of Cliff Head turn-off on Brand Highway, 6 May 1986, *M.I.H. Brooker* 9264 (CANB, PERTH); c. 200 m S of Cliff Head turn-off on Brand Highway, 8 May 1986, *M.I.H. Brooker* 9279 (CANB, PERTH); Brand Highway, 0.4 km S of Cliff Head turn-off, west of road, 21 July 1986, *M.I.H. Brooker* 9394, 9395, 9396, 9397, 9398 (CANB); 28.3 km N of Coolimba on Cliff Head Road, 21 Nov. 1986, *M.I.H. Brooker* 9559 (CANB, PERTH); Cliff Head Road, west of Brand Highway (29°28'S, 115°01'E), 23 Jan. 1984, *M.I.H. Brooker* 8403 and *S.D. Hopper* (CANB, NSW, PERTH); 5 miles from turn-off to Eneabba, W of Three Springs, 15 Mar. 1968, *S.G.M. Carr* 355 (PERTH); 13.9 miles from Eneabba turn-off on Eneabba Road, 15 Mar. 1968, *S.G.M. Carr* 358, 359 (PERTH); 3 km S of junction of Three Springs West Road with Eneabba-Mingenew Rd, 20 Oct. 1982, *J. Coleby-Williams* 271A (PERTH); 5 km on Cliff Head Road, 28 Oct. 1978, *H. Demarz* 7154 (PERTH); 43 mile peg Geraldton-Mullewa (c. 69 km E of Geraldton towards Mullewa, 8 May 1964, *A.R. Fairall* 1481a (PERTH); Cliff Head turn-off, Brand Highway, S of Dongara, 6 Nov. 1975, *A.S. George* 14210 (PERTH); 2.6 km E of Greenhead-Leeman Bodycoat Road, 26 km W of Eneabba, 19 Sep. 1983, *S.D. Hopper* 3386 (PERTH); 1.7 km E of Brand Highway, 20 Sep. 1983, *S.D. Hopper* 3392 (PERTH); 13 km N of Coolimba on road to Cliff Head, 29°44'30" S, 114°58'40" E, 11 May 1989, *A. Napier & A. Kelly* 433 (PERTH); 2 km E of Brand Highway junction along Mt Adams road, 20 Feb. 1989, *P. Roberts* 906 (PERTH); 7 miles along Eneabba Road from Geraldton Highway, 1 Mar. 1966, *E.M. Scrymgeour* 264 and *S.G.M. Carr* (PERTH); 6 miles N of Green Grove-Arrowsmith River, 1952, *N.H. Speck* 7081 (PERTH).

Distribution. Coastal, on calcareous sand between Arrowsmith and White Point, Western Australia (Figure 1) and associated with *E. erythrocorys, E. foecunda, E. obtusiflora, Acacia rostellifera* and *A. xanthina.*

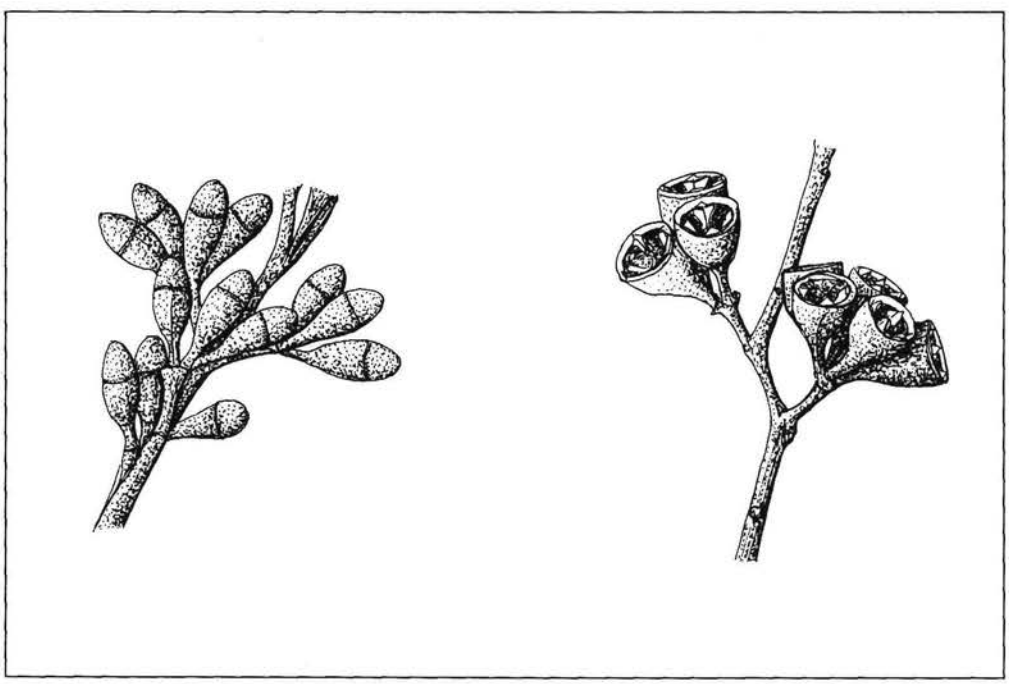

Figure 4. *E. zopherophloia* - buds (*MIHB* 9560) and fruit (*MIHB* 8825)

Conservation status. Uncommon but adequately surveyed and in need of monitoring (Priority 5 in Hopper *et al.* (1990)).

Flowering period. November-January.

Etymology. The name refers to the dark, rough bark (Greek *zopheros* - dusky and *phloia* - bark).

Notes. E. zopherophloia occurs in reasonable abundance south of Cliff Head but is more accessible on the Brand Highway about 200-300 m south of the turn-off to Cliff Head. In the immediate vicinity of this corner, it may be confused with *E. loxophleba* Benth. with which it probably hybridises. *E. loxophleba* always has very glossy leaves with the intramarginal vein remote from the margin. The oil glands in the leaves of *E. loxophleba* are smaller and more numerous.

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

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 128 (1990).

Frutex "mallee" *Eucalypto zopherophloiae* Brooker & Hopper affinis a qua habitatione non calareo, habitu erecto, cortice ad basin laxe squamoso non fibroso, foliis adultis angustis, glandulis oleosis apparenter intersectionibus, et fructibus parvioribus (ad 0.7 x 0.6 cm) saepissime cupulatis differt.

Typus: Hi-Vallee farm, N of Badgingarra, 30°07'S, 115°24'E, 16 July 1986, *M.I.H. Brooker* 9392 (holo: PERTH; iso: CANB, MEL, NSW).

Erect *mallee* to 5 m tall with scaly, curly partly decorticated rough but not fibrous bark to 1 m, smooth grey over pale coppery above. Forming *lignotubers. Cotyledons* bisected. *Seedling leaves* petiolate, decussate, remaining opposite for 4 or 5 pairs, ovate to deltoid, to 8 x 6 cm, light green to bluish green, dull. *Adult leaves* alternating, petiolate, lanceolate, to 14 x 2.5 cm, concolorous, dull; reticulation dense, incomplete, with numerous, mostly intersectional oil glands. *Inflorescences* axillary, unbranched, to 11-flowered; peduncles flattened, to 1 cm long. *Buds* pedicellate, ovoid, to 0.7 x 0.4 cm, bi-operculate; inner operculum hemispherical to obtusely conical, slightly shorter than hypanthium. *Flowers* creamy-white. *Ovules* in 4 vertical rows on placenta. *Fruits* shortly pedicellate, cupular, to 0.7 x 0.6 cm; rim thin to moderately thick; disc descending; valves 3 or 4, to rim level.

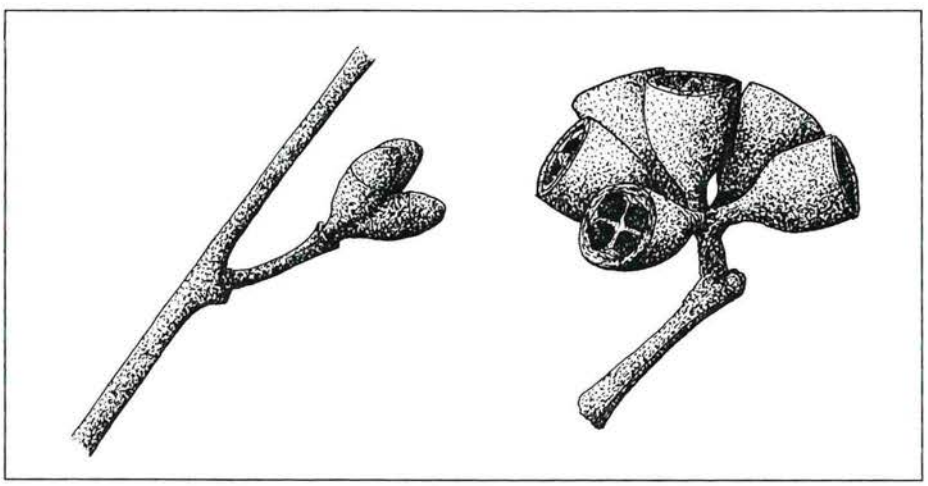

Figure 5. *E. leprophloia* - buds (*MIHB* 9392) and fruit (*MIHB* 8823)

Other specimens examined. WESTERN AUSTRALIA: Type locality, 19 Aug. 1982, *M.I.H. Brooker* 7567 (CANB, PERTH) and 21 Sep. 1982, *M.I.H. Brooker* 7648, 7649 (CANB, PERTH); 4 Feb. 1985, *M.I.H. Brooker* 8823 (CANB, PERTH); Mt Benia - E of Jurien Bay, 2 May 1991, *R.J. Cranfield & P.J. Spencer* 8010 (PERTH); 6 km SE of Mt Adams, 29 km WSW of Yandanooka Siding, 36 km SE of Dongara, 29°24'S, 115°16'E, 15 Nov. 1979, *S.D. Hopper* 1549 (PERTH); Hi Vallee Farm, N of Tootbardi Rd, 28 Feb. 1991, *S. Patrick* 523 & *A. Brown* (PERTH); Hutchinson's property, E side of Natha road, S of Mingenew, Sep. 1989, *P.C. Ryan* 29 (PERTH) and 27 May 1991, *P.C. Ryan s.n.* (CANB, PERTH).

Distribution. Known only from three disjunct stands, one (type locality) of approximately 30 individuals in a valley between lateritic breakaways (Figure 1), and the other of a few clumps on subdued valley slopes in a low woodland of *E. accedens*.

Conservation status. Declared as Rare Flora (Hopper *et al.* 1990). Two populations are on private nature reserves, the other on vacant Crown Land proposed as a Nature Reserve.

Flowering period. August-October.

Etymology. The name refers to the scaly basal bark (Greek *lepros* - scaly and *phloia* - bark).

Notes. While *E. leprophloia* is related to *E. zopherophloia*, the two species do not occur together, occupying lateritic and calcareous soil respectively. They may be distinguished by bark character and the oil gland patterns in the leaves, intersectional in *E. leprophloia* and island in *E. zopherophloia*.

Eucalyptus ser. **Loxophlebae** Chippendale, Fl. Australia 19:500 (1988)

Type: E. loxophleba Benth.

The *E.* ser. *Loxophlebae* belongs in the informal *E.* subgen. *Symphyomyrtus*. It is diagnosed by the following: cotyledons bisected, pith of branchlets glandular, juvenile leaves petiolate, inflorescences forming on leafless ends of branchlets with delayed development of terminal vegetative shoot, unit inflorescences 7 to 11-flowered, stamens inflexed and strongly "elbowed", anthers versatile, basifixed, cuboid, opening by pores, ovules in 4 vertical rows on placenta, style constricted at base, seed grey-brown, compressed-ovoid with shallow distinct reticulum.

Key to species of *E.* ser. *Loxophlebae*

1. Bark rough for 1 m or more on trunk or stems
   2. Style articulate ..... *E.* sp. M*
   2. Style not articulate
      3. Rough bark persistent to small branches ..... *E. loxophleba* subsp. *loxophleba*
      3. Rough bark on lower part of trunk only ..... *E. loxophleba* subsp. *supralaevis*
1. Bark smooth, or rough to 0.5 m

*A recently discovered species near Marymia, north-east of Meekatharra, to be described by others.

4. Intramarginal vein close to leaf edge; tertiary veining absent or obscure; fruit to 0.4 x 0.3 cm ..... *E.blaxellii*
4. Intramarginal vein well removed from leaf edge; tertiary veining distinct; fruit >0.4 x 0.3 cm
   5. Buds to 1.5 x 0.5 cm ..... *E. loxophleba* subsp. *gratiae*
   5. Buds to 0.9 x 0.4 cm
      6. Style articulate ..... 8. *E. articulata*
      6. Style not articulate ..... *E. loxophleba* subsp. *lissophloia*

8. Eucalyptus articulata Brooker & Hopper, sp. nov. (Figure 6)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 418 (1990).

Frutex "mallee" effusus ad *Eucalyptum* seriem *Loxophlebas* Chippendale pertinens, ad 2.5 m altus cortice laevi et caulibus deficienti glaucedinem. Folia plantularum petiolata, opposita per 4 vel 5 nodos, ad 8 x 4 cm, hebetia, thalassica, post demum alternantia, leviter nitentia, viridia. Folia adulta petiolata, alternantia, lanceolata, ad 11 x 1.5 cm, concoloria, nitentia, viridia. Inflorescentiae axillares non ramosae, saepe fasciculatae in extremitatibus ramulorum non foliosis. Pedunculi moderate validi, ad 1.5 longi, alabastra basi in pedicellum validum decrescentia, clavata, ad 0.8 x 0.4 cm. Stamina valde inflexa. Stylus basi decrescens et in fovea insertus, plus minusve articulatus. Fructus pedicellati, obconici, ad 0.9 x 0.7 cm, 3, 4 vel 5 valvis.

Typus: 22 km E of Mulga Rock, Great Victoria Desert, 30°09'S, 123°17'E, 25 June 1987, *M.I.H. Brooker* 9686 & *S.D. Hopper* (holo: PERTH; iso: AD, CANB, MEL, NSW).

Low straggly *mallee* to 2.5 m tall with smooth coppery (in June) stems and non-glaucous branchlets. *Seedling leaves* petiolate, decussate, remaining opposite for 4-5 pairs, ovate, to 8 x 4 cm, dull, blue-green, later leaves alternating, broadly lanceolate, to 10 x 3 cm, slightly glossy, green. *Adult leaves* petiolate, alternating, lanceolate, to 11 x 1.5 cm, concolorous, glossy, green (drying yellowish green); intramarginal vein well in from leaf edge; reticulation sparse, with numerous large island oil glands. *Inflorescences* axillary and unbranched, or clustered at leafless ends of branchlets. *Peduncles* moderately stout, somewhat flattened, to 1.5 cm long, 7-flowered. *Buds* clavate, tapering at the base to stout pedicels, to 0.8 x 0.4 cm; operculum obtusely conical, red, hypanthium green. *Style* contracting at the base and inserted in a cavity of the ovary top, and thereby, more or less articulate. *Flowers* not seen. *Fruits* pedicellate, obconical, to 0.9 x 0.7 cm with 3, 4 or 5 valves.

Other specimen examined. WESTERN AUSTRALIA: Type locality, 11 Aug. 1984, *S.D. Hopper* 3887 (PERTH), 25 June 1987, *S.D. Hopper* 5888 (PERTH).

Distribution. Known only from the type locality where it occurs on red sand dunes with arkose rubble (Figure 1).

Conservation status. Vulnerable, occurring on vacant Crown Land. Declared as Rare Flora. (Species no. 152 in Hopper *et al.* (1990).

Flowering period. Unknown.

Etymology. From the Latin *articulatus* - articulate, referring to the loose attachment of the style base.

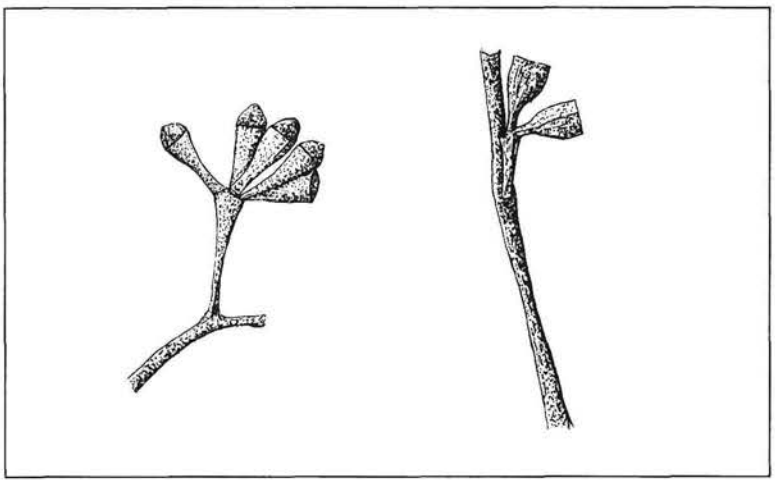

Figure 6. *E. articulata* - buds and fruit (*MIHB* 9686)

Notes. The *E.* series *Loxophlebae* is notable for the widespread taxon *E. loxophleba* subsp. *loxophleba,* (York Gum) which is distributed from west of Northampton to east of Ongerup. Its well known eastern, inland related taxon, the recently published *E. loxophleba* subsp. *lissophloia,* is a smooth-barked mallee which has glaucous branchlets, buds and fruits. Both taxa grow on heavy, often water-logged sites. However, the style in these taxa, although constricted at the base, is not inserted in a cavity. The style base character was given prominence by Carr & Carr (1985) for bloodwoods and has been seen in other species, *viz. E. leucoxylon* F. Muell. and *E. melliodora* A. Cunn. ex Schau. The other published taxon in the series is *E. loxophleba* subsp. *gratiae* Brooker which has smooth bark and larger leaves, buds and fruit than the typical subspecies.

In a recent publication on Western Australian taxa, Hill & Johnson (1992) raised subsp. *gratiae* to species, *E. gratiae.* We prefer to maintain the subspecies status for the present, pending the studies of P. Grayling (University of Western Australia) who believes that the closest affinity of the taxon, *gratiae*, is with *E. loxophleba* subsp. *lissophloia* and is of equal taxonomic status. A further revision is therefore expected of the *E.* ser. *Loxophlebae*, in which the intergradation, referred to by Hill & Johnson, of the closely related *gratiae* and *lissophloia* will be demonstrated.

E. blaxellii is endemic to the Morseby Range and differs from York Gum in the low mallee habit, the smooth bark, intramarginal vein close to leaf edge, lack of tertiary veining, small buds and fruits, the upland lateritic stony habitat, and articulate style. In contrast to these species, *E. articulata* grows on red sand dunes with arkose rubble in much drier country than the others apart from the eastern glaucous mallee form of York Gum. It has much larger buds and fruit than *E. blaxellii* but shares the articulate style character.

Eucalyptus ser. **Falcatae** Brooker & Hopper, ser. nov.

Arbores "mallets" vel frutices "mallees". Cotyledones bisectae. Medulla ramulorum non glandulifera. Folia juvenilia petiolata, adulta petiolata, nitentia, venis secundariis numerosissimis et arte parallelis, reticulo finito et glandulis omnibus oleosis ad intersectiones. Inflorescentiae axillares, non ramosae, erectae vel decurvae et laxe vel rigide. Fructus latiores quam longiores orificio comparate parvo. Vestigia styli exilia saepe persistentia.

Typus: E. falcata Turcz.

Mallets or mallees. Cotyledons bisected. Pith of branchlets not glandular. Juvenile leaves petiolate and finally held vertically. Adult leaves petiolate, glossy, with very numerous parallel secondary veins, finite reticulation and numerous oil glands each of which appear at the veinlet intersections. Inflorescences axillary, unbranched, erect in one species, in remainder down-curved either loosely or rigidly. Ovary roof conical, lacking protuberances. Fruits wider than long with relatively small orifice. Style remnants slender, often persistent.

Key to subseries of *E.* ser. *Falcatae*

1. Buds pedicellate, inflorescences loosely or rigidly down-curved, rarely erect, hypanthium often wider than operculum; seedling leaves linear; juvenile leaves distinctly petiolate, early leaves opposite, later leaves alternating, held vertically; leaf bases truncate; trees, mallets or mallees ..... *E.* subser. *Falcatae*
1. Buds sessile or nearly so, inflorescences erect, buds often fusiform in stellate clusters; seedling leaves ovate; juvenile leaves shortly petiolate, opposite, held horizontally; leaf bases tapering to petiole; mallees ..... *E.* subser. *Decipientes*

Key to species of *E.* subser. *Falcatae*

1. Inflorescences rigidly down-curved ..... *E. kessellii*
1. Inflorescences pendulous, or erect in one species
2. Mallet
3. Buds and fruits strongly ribbed ..... *E. ornata*
3. Buds and fruits smooth to slightly ribbed
4. Fruit to 0.8 x 0.7 cm ..... *E. argyphea*
4. Fruit to 0.9 x 1.2 cm ..... *E. recta*
2. Mallee
5. Buds and fruits always erect; mallee on coastal limestone ..... 9. *E.petrensis*
5. Buds and fruits down-curved; mallee not on limestone
6. Operculum conical
7. Pedicels stout, buds and fruits slightly ribbed
8. Pedicels >2 mm long ..... *E. goniantha* subsp. *goniantha*
8. Pedicels <2 mm long ..... *E. goniantha* subsp. *notactites*
7. Pedicels slender, buds and fruits smooth or ribbed. ..... *E. falcata*
6. Operculum rounded ..... *E. semiglobosa*

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

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 418 (1990).

Frutex "mallee" *Eucalypto falcatae* Turcz. affinis a qua habitatione petroso calcareo, habitu effuso, inflorescentiis semper non pendulis, pedicellis brevioribus, operculo breviore rostrato, alabastris fructibusque vix costatis et fructibus aggregatis differt.

Typus: c. 1.5 km SSE of Seabird, 31°17'S, 115°26'E, 2 Nov. 1988, *M.I.H. Brooker* 10139 (holo: PERTH; iso: AD, CANB, MEL, NSW).

Straggly *mallee* to 4 m tall with smooth bark. Forming *lignotubers. Cotyledons* bisected. *Seedling leaves* sessile, opposite for about 4 pairs, linear, to 0.4 x 0.3 cm. *Juvenile leaves* at first shortly petiolate, opposite, then on petioles to 2 cm long, alternating, held vertically, ovate, to 9 x 6 cm, dull, blue-green to light green. *Adult leaves* petiolate, alternating, lanceolate to slightly falcate, to 12 x 2 cm, concolorous, slightly glossy, green; many side veins; reticulation dense, with numerous intersectional oil glands. *Inflorescences* axillary, unbranched, to 13-flowered; *peduncles* erect or scarcely curved, strongly flattened and angular, to 1.5 cm long. *Buds* pedicellate, hypanthium truncate-spherical or cupular and scarcely ribbed, operculum beaked, to 1.2 x 0.5 cm. *Stamens* inflexed, all fertile; anthers versatile, dorsifixed, cuboid, opening by longitudinal slits. *Flowers* not seen. *Ovules* in 4 vertical rows. *Fruits* pedicellate, truncate-spherical, aggregated, to 0.7 x 0.9 cm; rim thick; disc annular or sloping inwards; valves 3, slightly exserted. *Seed* grey-black, flattened-ovoid with a very shallow reticulum, hilum ventral.

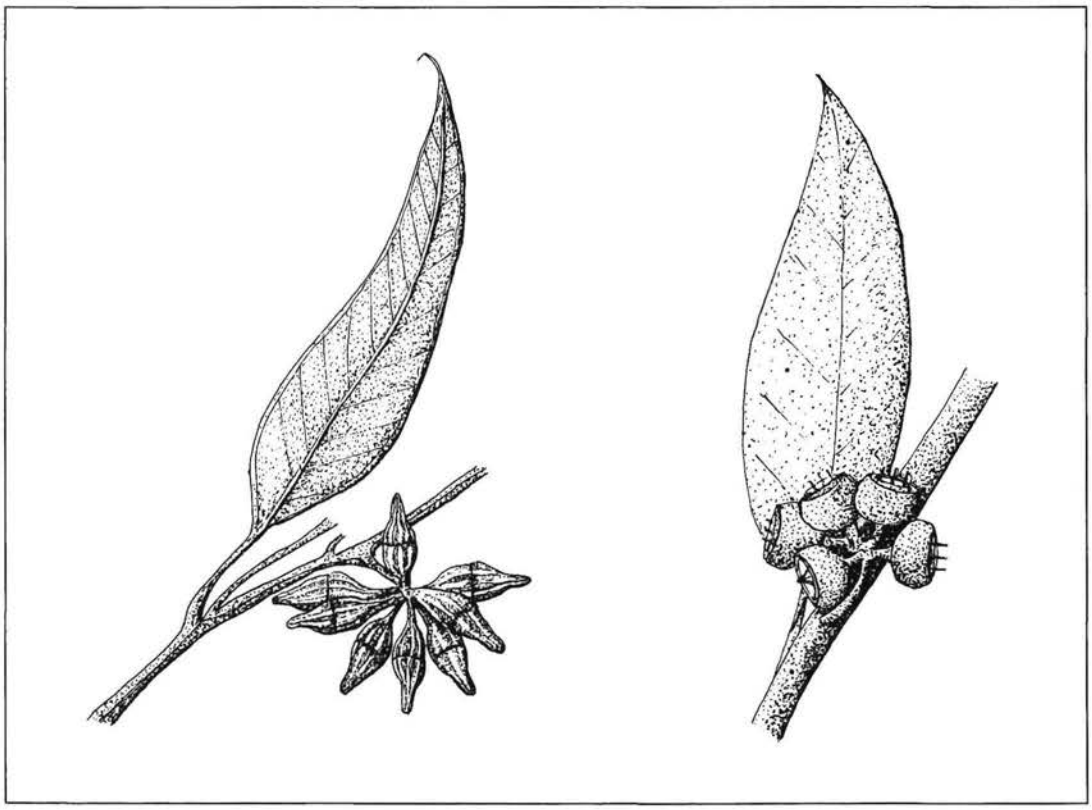

Figure 7. *E. petrensis* - buds and fruits (*MIHB* 9583)

Figure 7. *E. petrensis* - buds and fruits (*MIHB* 9583)

Other specimens examined. WESTERN AUSTRALIA: Fremantle, Aug. 1902, *C. Andrews s.n.* (PERTH); Wesco Rd, NE of Quinn's Rocks, 9 Apr. 1987, *M.I.H. Brooker* 9583 (CANB, PERTH); c. 16 km E of Yerramulla Road, 14 Aug. 1987, *M.I.H. Brooker* 9738 and *S.D. Hopper* (AD, CANB, MEL, NSW, PERTH); Seabird, along "Ambulance" Road, 31°16'S, 115°26'E, 13 Apr. 1988, *M.I.H. Brooker* 9930, 9931 (AD, CANB, MEL, NSW, PERTH); Type locality, 24 Jan. 1989, *M.I.H. Brooker* 10159 (AD, CANB, MEL, NSW, PERTH); c. 1.5 km SSE of Seabird, 24 Jan. 1989, *M.I.H. Brooker* 10160 (CANB, PERTH); Mindarie Keys, 31°41'10"S, 115°42'15"E, 2 July 1989, *A. Brown s.n.* (PERTH) ; c. 50 km S of Mandurah, near Preston Lodge, east side of lake, 10 Dec. 1989, *O.M. Green* SI and SII (PERTH); Ocean Farm, Lancelin, 10 June 1981, *R.J. Cranfield* 1689 (PERTH); Private Property, 4.4 km at 48° from Seabird and 4 km at 51° from Seabird, 5 Sep. 1980, *E.A. Griffin* 5701, 5702A (PERTH); c. 20 m S of Quinn's Rock Road, 500 m upslope from ocean, 15 Mar. 1987, *S.D. Hopper* 5853 (PERTH); NE of Quinn's Rock, 31°38'20"S, 115°45'30"E, 6 July 1988, *A. Kelly* 264 and *A. Napier* (PERTH); Yanchep Nat. Pk, 1.7 km N along W boundary from Yanchep Beach Road, 31°32'S, 115°40'E, 6 July 1988, *A. Kelly* 266, 267 and *A. Napier* (CANB, PERTH); c. 600 m S of Seabird, 31°17'10"S, 115°26'45"E, 11 Nov. 1988, *A. Kelly* 356 and *A. Napier* (PERTH); 600 m E of Burns Beach kiosk, 31°43'45"S, 115°43'35"E, 18 Aug. 1988, *A Napier & A. Kelly* 297 (PERTH); 15 km SW of Wedge Island, 30°52'30"S, 115°20'30"E, 10 May 1989, *A. Napier & A. Kelly* 426 (PERTH); corner of Cowper and Raleigh Streets, Sorrento, 31°50'S, 115°45'E, 28 June 1989, *A. Napier & A. Kelly* 464 (PERTH); 8.3 km ESE of Two Rocks, off Bailey Road, W of Yanchep Nat. Pk, 31°30'40"S, 115°40'10"E, 26 May 1988, *R. McKay s.n.* (PERTH); Yalgorup Nat. Pk, 20 Oct. 1972, *S. Paust* 1348 (PERTH); Yanchep National Park, 12 July 1987, *N. McQuoid* YN16 no. 6 (PERTH); Lake Preston, 6 Dec. 1960, *Mr Ross* 3698 (PERTH).

Distribution. From Yalgorup National Park to Seabird on near-coastal limestone, Western Australia (Figure 1).

Conservation status. Uncommon and in need of further survey. Priority 3 in Hopper *et al.* (1990) - reserve flora list.

Flowering period. Not known.

Etymology. The name refers to the site where the type was collected (Latin *petrensis* - on a stony site).

Notes. E. petrensis has only been found on sites with outcropping limestone. It is similar to *E. falcata,* differing in its more effuse habit and much shorter pedicels and peduncles. It differs from *E. decipiens* in its smooth bark, smaller stature, and larger buds and fruits on longer pedicels. Rare hybrids with *E. decipiens* have been collected (*Brooker* 10161, 10162).

Eucalyptus subser. **Decipientes** Brooker & Hopper, subser. nov.

A subserie typica foliis juvenilibus horizontaliter dispositis, inflorescentiis saepe erectis, alabastris aggregatis plus minusve sessilibus, fusiformibus vel ovoideis, et fructibus aggregatis saepe compressis differt.

Typus: E. decipiens Endl.

Key to species of *E.* subser. *Decipientes*

1. Buds fusiform, operculum narrowly conical or slightly beaked; juvenile leaves emarginate
   2. Bark rough
      3. Bark hard, tightly held over whole trunk or stems; tree or mallee ..... *E. decipiens* subsp. *decipiens*
      3. Bark loose, on whole or part of stems; mallee
         4. Bark ribbony; straggly mallee ..... 12a. *E. decipiens* subsp. *adesmophloia*
         4. Bark flaky, erect mallee ..... 12b. *E. decipiens* subsp. *chalara*
   2. Bark smooth; mallee ..... 10. *E. communalis*
1. Buds ovoid or diamond-shaped; juvenile leaves entire
   5. Buds ovoid
      6. Buds <0.4 cm wide; fruit crowded, sides often flattened ..... 11. *E.obesa*
      6. Buds >0.4 cm wide, acornlike ..... *E. balanites*
   5. Buds diamond-shaped, distinctly pedicellate ..... *E. phylacis*

10. Eucalyptus communalis Brooker & Hopper, sp. nov. (Figure 8)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 418 (1990).

Eucalypto decipienti Endl. affinis a qua statura parviore, cortice laevi, et alabastris operculo rostrato differt.

Typus: 20 km SE of Hamersley River Bridge, 14.9 km S down Hamersley Drive (in Fitzgerald River National Park), 33°50'S, 119°43'E, *S.D. Hopper* 2413A (holo: PERTH).

Mallee to 4 m tall. *Bark* smooth. *Seedling leaves* sessile to very shortly petiolate (<0.2 cm long), opposite, orbicular. *Juvenile leaves* on short petioles to 0.5 cm long, opposite then alternating, held horizontally, obovate, emarginate, to 3 x 3 cm, dull, blue-green. *Adult leaves* petiolate, alternating, narrowly lanceolate to lanceolate, 6-9 x 1-1.5 cm, concolorous, glossy, green, intramarginal vein sometimes removed from edge, reticulation dense, with numerous intersectional oil glands. *Inflorescences* axillary, unbranched, > 7-flowered; peduncles 0.5-1.2 cm long. *Buds* sessile to very shortly pedicellate, fusiform to ovoid, to 1 x 0.4 cm; operculum conical to beaked. *Stamens* inflexed, all fertile; anthers, slightly versatile, basifixed, on abruptly narrowed filament tip, cuboid to reniform, opening by broad pores or oblique slits. *Flowers* creamy white. *Ovules* in 4 vertical rows. *Fruits* sessile or very shortly pedicellate, crowded, hemispherical, broader than long, to 0.7 x 0.9 cm; rim thick; disc broad, flat; valves 3 or 4, slightly exserted. *Seed* grey, compressed-ovoid, smooth, with some longitudinal furrows.

Other specimens examined. WESTERN AUSTRALIA: 14 miles W of Hamersley River Crossing, 7 Nov. 1969, *M.I.H. Brooker* 2320,2321 (PERTH); near Rabbit Proof Fence, c. 2 miles N of West Mount Barren, 5 Aug. 1970, *M.I.H. Brooker* 2735a (PERTH); 15.6 miles S of Fitzgerald Crossing towards Fitzgerald Reserve, 28 Aug. 1975, *M.I.H. Brooker* 4437 (CANB, PERTH); Cheadanup Reserve, 33°27'S, 120°37'E, 12 Nov. 1981, *M.I.H. Brooker* 7139 (CANB, NSW, PERTH); Fitzgerald National Park, 33°50'S, 119°50'E, 13 Nov. 1981, *M.I.H. Brooker* 7158 (CANB, NSW, PERTH); 6 km

SW along Savages Rd from E.L.D. road, 33°39'S, 122°20'E, 12 Aug. 1982, *M.I.H. Brooker* 7556 (CANB, NSW, PERTH); 4.5 km SW of Lanes Rd on Backmans Rd, NE of Esperance, 33°39'S, 122°14'E, 12 Aug. 1982, *M.I.H. Brooker* 7557 (CANB, NSW, PERTH); 15 km along Hamersley Drive, 33°47'S, 119°51'E, 25 Nov. 1987, *M.I.H. Brooker* 9817 (CANB, NSW, PERTH); Middle Rd, McDougal's eastern paddock to S of road, 10 Mar. 1988, *M.I.H. Brooker* 9925 (CANB, PERTH); 48 km NNW of Mt Melville, 34°33'30"S, 118°42'40"E, 31 Jan. 1988, *A. Napier & A. Taylor* 225 (PERTH).

Distribution and habitat. Very common on the eastern plains of the Fitzgerald National Park, extending north-east towards Cheadanup Reserve and eastwards to Esperance, Western Australia. Usually on lateritic white sands (Figure 1).

Conservation status. Common though sporadic, and well represented in conservation reserves such as Fitzgerald River National Park.

Flowering period. Unknown.

Etymology. From the Latin *communalis* - communal, alluding to its characteristic occurrence in clumps isolated by heath from similar neighbouring clumps.

Notes. E. communalis occurs characteristically in communities of many apparent individuals, together up to 15 m across and generally emergent above the surrounding vegetation. It is common along Hamersley Drive in Fitzgerald National Park. It is similar to *E. obesa*, differing in its fusiform buds and emarginate juvenile leaves. It may be confused with *E. decipiens* but differs in its smooth bark, more robust buds and fruits and its erect-stemmed habit with the canopy confined to the uppermost branches.

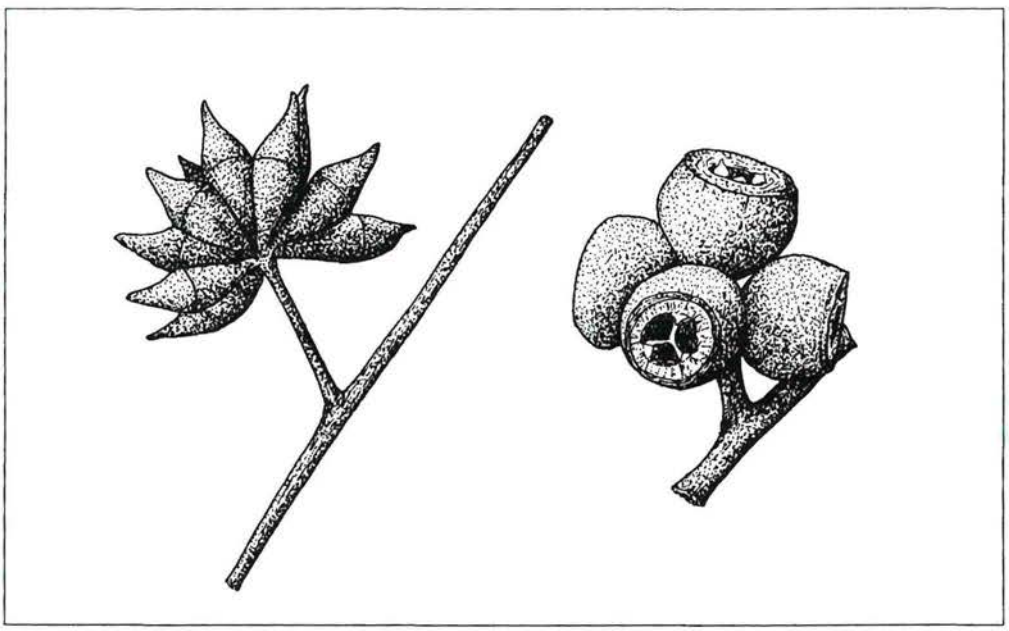

Figure 8. *E. communalis* - buds (*SDH* 2413A) and fruit (*MIHB* 9817) (x2)

11. Eucalyptus obesa Brooker & Hopper, sp. nov. (Figure 9)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 418 (1990).

Frutex "mallee" *Eucalypto decipienti* Endl. affinis a qua habitu, cortice laevi, foliis parvioribus, floribus paucioribus et alabastris cylindricis vel interdum ovoideis differt.

Typus: 7.9 km W of Hill's Road on Tarin Rock Road, 33°04'S, 118°08'E, 16 Dec. 1987, *M.I.H. Brooker* 9832 (holo: PERTH; iso: AD, CANB, MEL, NSW).

Mallee to 2.5 m tall, effuse in habit with canopy to near ground, with smooth, grey bark or with loose ribbons of dead bark. *Seedling leaves* sessile to very shortly petiolate (<0.2 cm long), opposite, orbicular. *Juvenile leaves* on short petioles to 0.5 cm long, opposite then alternating, held horizontally, ovate to orbicular, to 3.5 x 3 cm, dull, blue-green to light green. *Adult leaves* petiolate, alternating, lanceolate, often uncinate, to 10 x 1.5 cm, concolorous, glossy, green; side veins very numerous; reticulation dense, with numerous intersectional oil glands. *Inflorescences* axillary, unbranched, to 11-flowered; peduncles terete, to 1 cm long. *Buds* sessile, crowded, cylindrical over most of their length, to 0.7 x 0.5 cm; operculum hemispherical, apiculate. *Stamens* inflexed, all fertile; anthers slightly versatile, basifixed on abruptly narrowed filament tip, cuboid to reniform, opening by broad pores or oblique slits. *Flowers* creamy white. *Ovules* in 4 vertical rows. *Fruits* sessile, crowded and often laterally compressed, truncately depressed-spherical, to 0.6 x 1 cm; rim thick; disc level, valves (3) 4, often slightly exserted. *Seed* grey, compressed-ovoid, very shallowly reticulate and with shallow longitudinal grooves.

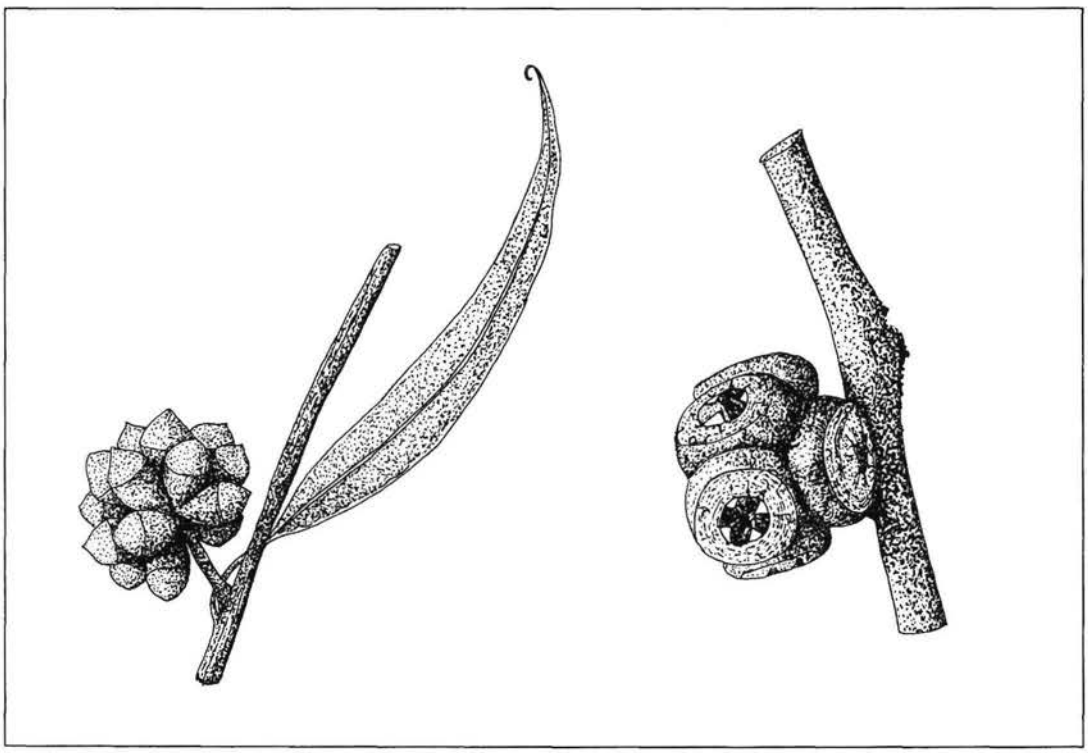

Figure 9. *E. obesa* - buds (*MIHB* 9810) and fruit (*MIHB* 9809) (x2)

Other specimens examined. WESTERN AUSTRALIA: 125 km E of Hyden, 3 Oct. 1975, *D.F. Blaxell* DFB/W75/40 & *M.I.H. Brooker* (CANB, K, NSW, PERTH); 90 mile tank, W of Norseman-Esperance Road, 16 Feb. 1970, *M.I.H. Brooker* 2516,2517 (PERTH); 125 km east of Hyden on Norseman track, 32°20'S, 119°03'E, 3 Oct. 1975, *M.I.H. Brooker* 4986 (CANB, NSW, PERTH); Peak Charles, 2 May 1982, *M.I.H. Brooker* 7506 (CANB, NSW, PERTH); 80 km SE of Wickepin towards Lake Grace, 33°03'S, 118°09'E, 17 Dec. 1984, *M.I.H. Brooker* 8756 (AD, CANB, MEL, PERTH); Type locality, 24 Nov. 1987, *M.I.H. Brooker* 9809,9810 (AD, CANB, MEL, NSW, PERTH); 22.75 km SE of Muckinwobert Rock, 2.8 km NE of Rawlinson Road, 33°29'27"S, 120°36'03"E, 15 Aug. 1983, *M.A. Burgman* 2105 (PERTH); 24.5 km due ESE of Muckinwobert Rock, 11.1 km SW of Melaleuca Rd, 1 Oct. 1984, *M.A. Burgman* 4045 (PERTH); Peak Charles, 32°50'S, 121°25'E, 14 Jan. 1972, *H. Demarz* 3645 (PERTH); 32 km W of Lake Grace on Tarin Rock Road, 23 Oct. 1987, *J.W. Green* 5582 (PERTH); Ninety Mile Tank, 14 km SSW of Mt Classe, Bremer Range, 32°41'S, 120°41'E, 6 Sep. 1982, *S.D. Hopper* 2494 (PERTH), North Tarin Rock Reserve 29857, 23 km NW of Lake Grace, 13 Sep. 1975, *B.G. Muir* 410 (PERTH); 90 Mile Tank, Lake King-Norseman Rd, 21 July 1979, *K.R. Newbey* 5388 (PERTH); Peak Charles, c. 45 km W of Salmon Gums, 9 Nov. 1979, *K. Newbey* 6435 (PERTH), 2 km NW of 90 Mile Tank, Norseman-Lake King Road, 12 Nov. 1979, *K. Newbey* 6491 (PERTH).

Distribution. From north-west of Lake Grace eastwards to 90-mile Tank and Peak Charles, Western Australia (Figure 1).

Conservation status. Sporadic but common and represented in conservation reserves such as Frank Hann National Park.

Flowering period. December-January.

Etymology. The specific name alludes to the buds in comparison with the fusiform buds of *E. decipiens*, Latin *obesus* - fat.

Notes. E. obesa is clearly related to *E. decipiens* which is typically a rough-barked mallee or tree on coastal and subcoastal south-western plains and nearby hills. *E. obesa* is not a coastal species. Its furthest inland occurrence is around the 90-mile Tank north-east of Lake King. The inland distribution, stubby ovoid buds and tightly aggregated fruit distinguish it in the subseries *Decipientes*. It grows on white sand with *E. falcata* Turcz. at the type locality.

12a. Eucalyptus decipiens Endl. subsp. **adesmophloia** Brooker & Hopper, subsp. nov.

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 418 (1990).

A subspecie typica cortice fibroso laxo pallidiore taeniaformi et habitu effusiore differt.

Typus: 8.2 km S along Carlawillup Road, 34°07'S, 119°03'E, 9 Mar. 1988, *M.I.H. Brooker* 9907 (holo: PERTH; iso: AD, CANB, MEL, NSW).

It differs from the typical subspecies in the more straggly habit and loose, paler, ribbony rough bark.

Specimens examined. WESTERN AUSTRALIA: Pallinup River, Jan. 1964, *G.E. Brockway s.n.* (PERTH); c. 30 km N of Albany on road to Borden, 16 Aug. 1979, *M.I.H. Brooker* 6364 (CANB, NSW,

PERTH); 8 km S of highway towards Gairdner, 14 Nov. 1981, *M.I.H. Brooker* 7161 (CANB, PERTH); 3 km NE of Sth Stirling School, 14 Nov. 1981, *M.I.H. Brooker* 7180 (CANB, NSW, PERTH); Chillinup Road, E of highway, 14 Nov. 1981, *M.I.H. Brooker* 7181 (CANB, NSW, PERTH); Gairdner River crossing near Qualup, 34°11'S, 119°19'E, 9 Mar. 1988, *M.I.H. Brooker* 9915 (CANB, PERTH); 12.3 km N of Bremer Bay-Borden Road on Jerramungup Road, 34°47'S, 118°47'E, 25 Nov. 1987, *M.I.H. Brooker* 9819 (CANB, PERTH); Bremer Bay, March 1958, *D.M. Churchill s.n.* (PERTH); Qualup, 28 Nov. 1960, *A.S. George* 1762, 1763 (PERTH); 1.7 km S of Warramurrup Hill, 34°26'S, 119°10'E, 9 Mar. 1988, *S.D. Hopper* 6337 (PERTH); Bremer Bay area, Aug. 1971, *A. Kessell* 962, 976 (PERTH); 1.7 km S of Warramurrup Hill, Aug. 1971, *A. Kessell* 976 (PERTH); junction of Swamp Road and Gordon Inlet Road, NW of Bremer Bay, 34°25'S, 119°25'E, 17 Nov. 1985, *A.N. Rodd* 5029 & *J. McCarthy* (CANB, NSW, PERTH); Fitzgerald River National Park, by Collett's road, c. 8 km WNW of West Mount Barren, 23 Oct. 1982, *A. Strid* 20977 (PERTH); 3 km W of Bremer Bay township, 1 Oct. 1966, *P.G. Wilson* 4323 (PERTH); c. 35 km SSE of Jerramungup-Ravensthorpe Road along No.2 Vermin Proof Fence, 2 Oct. 1966, *P.G. Wilson* 4370 (PERTH).

Distribution. From the southern and eastern part of the Stirling Range to Bremer Bay, Western Australia (Figure 1).

Conservation status. One of the most common eucalypts of the South Stirling sandplain. Well represented in conservation reserves.

Flowering period. Unknown.

Etymology. From the Greek *adesmos* - unfettered and *phloia* - bark.

Notes. E. decipiens subsp. *decipiens* which has a western coastal distribution is distinct from the new subspecies by its very tight, hard rough bark. Previously the name *E. decipiens* has been applied to a wide range of related mallees with various morphological distinctions from north of Perth to the Esperance district (Gardner 1952-1966, Chippendale 1973). Current research and field studies show there are the typical western coastal taxon (subsp. *decipiens*), the southern coastal and subcoastal taxon (subsp. *adesmophloia*), and the inland, intervening taxon (subsp. *chalara*), as treated below.

12b. Eucalyptus decipiens Endl. subsp. **chalara** Brooker & Hopper, subsp. nov.

A subspecie typica cortice laxiore pallidiore et a subspecie *adesmophloia* statura altiore et cortice squamata differt.

Typus: WESTERN AUSTRALIA. Stirling Range Caravan Park, near Bluff Knoll, 6 May 1979, *G.J. Keighery* 2292 (holo: PERTH; iso: CANB, NSW).

It differs from the typical subspecies in the more erect habit, looser, paler, rough bark decorticating in flakes, and preference for acidic sands; from subspecies *adesmophloia*, it differs in the taller, more erect habit, thinner stems, with the flaky rough bark over most of stems compared with the ribbony rough bark of the sinuous stems of the eastern subspecies.

Specimens examined. WESTERN AUSTRALIA: Stirling Range National Park, along the Cranbrook Rd, 26 Sep. 1975, *J.S. Beard* 7491 (PERTH); Mt Barker, 16 Oct. 1975, *J.S. Beard* 7700 (PERTH); c. 10 miles from Capel on the Donnybrook Rd, 18 Apr. 1972, *M.I.H. Brooker* 3573 (PERTH); Stirling

Range Caravan Park, Chester Pass Road, 5 May 1982, *M.I.H. Brooker* 7654 (CANB, PERTH); 9.6 km W of Yetermerup Road, N of Stirling Range, 19 July 1988, *M.I.H. Brooker* 9982 (CANB, PERTH); 3.6 km W of Bluff Knoll Lookout, 27 Mar. 1968, *G.M. Chippendale* 431 (CANB, PERTH); Cranbrook, 18 Feb. ?, *C.A. Gardner* 329 (PERTH); Sukey's Peak, Stirling Range near Cranbrook, 7 Mar. 1922, *C.A. Gardner* 808/1308 (PERTH); Toll's Pass, Stirling Range, 23 Apr. 1923, *C.A. Gardner* 1431/1931 (PERTH); Toll's Pass, Stirling Range, 23 Apr. 1923, *C.A. Gardner* 1434 (PERTH); Borden-Chester Pass, 30 Oct. 1953, *C.A. Gardner s.n.* (PERTH); Tambellup, 3 May 1964, *C.A. Gardner* 14702, 14706 (PERTH); N of Condinup (*sic*) (Wellington Location 5016, *fide* A.S.G.), NE of Boyup Brook, 19 Feb. 1969, *A.S. George* 9251 (PERTH); Mt Barker, Oct. 1900, *Colonel Goadby* B1250 (PERTH); 1 mile SW of Tenterden, 12 Mar. 1957, *J.W. Green* 1149 (PERTH); 1 mile E of Cranbrook, 12 Mar. 1957, *J.W. Green* 1151 (PERTH); 13.2 miles SE of Kojonup (0.6 miles S of Tambellup turnoff), 30 Sep. 1975, *J.W. Green* 4538 (PERTH); Granite Hill, road 40 km E of Mt Barker within 1 km of Kalgan River, 15 Mar. 1983, *J.W. Green* 4984 (PERTH); 500 m along Fisher Rd from intersection with Kojonup-Frankland Road, 21 Oct. 1985, *N. Hoyle* 1013 (PERTH); Mt Barker Hill, 3 km due SW of Mount Barker township, 22 Nov. 1985, *N. Hoyle* 1032 (PERTH); 2 miles S of Mount Barker-Manjimup Rd, W of Frankland River, 11 Apr. 1962, *E.A. Jenkins s.n.* (PERTH); 4 miles S of Mount Barker on C. Milton's property, 8 June 1973, *K.F. Kenneally* 1224 (PERTH); Slopes Red Gum Hill, Red Gum Springs, Stirling Ranges, 26 Feb. 1983, *G.J. Keighery* 5911 (PERTH); Gee Kabee Hill, W of Cranbrook, 8 Dec. 1987, *G.J. Keighery* 9800 (PERTH); Greenbushes, Oct. 1921, *M. Koch s.n.* (PERTH); Cranbrook, 18 Feb. 1918, *C.E. Lane-poole* 329 (PERTH); Stirling Range Headquarters, 27 Feb. 1975, *O.W. Loneragan* L239 (PERTH); Road N of Stirlings, 28 Feb. 1962, *K.R. Newbey* 149 (PERTH); W of Broomehill, 14 Jan. 1954, *R.D. Royce* 4806 (PERTH); 2.75 miles NNE of Boyanup, 5 Mar. 1954, *G.M. Storr s.n.* (PERTH).

Distribution. East of the Darling scarp, from about Boyup Brook to the Stirling Range (Figure 1).

Conservation status. Common and well represented in conservation reserves.

Flowering period. August-September.

Etymology. From the Greek *chalaros* - loose, slack, referring to the rough bark.

Notes. In the Stirling Range this subspecies occurs on the northern slopes and foothills, while subsp. *adesmophloia* occurs on the southern side of the range and further eastwards.

Eucalyptus ser. **Micrantherae** Benth., Fl. Austral. 3: 192, 217 (1867).

Type: E. micranthera F. Muell.

The *E.* ser. *Micrantherae* belongs in the informal subgenus *Symphyomyrtus*. The series is characterised by the following: tree or mallee, bisected cotyledons, pith of branchlets without oil glands, glossy adult leaves with very numerous parallel secondary veins and with dense, finite reticulation and numerous oil glands each of which appears at veinlet intersections, stamens inflexed, anthers reniform, opening by oblique slits, flowers creamy white, ovary roof 3-lobed with style base inserted, ovules in 4 vertical rows, fruits contracted at rim, rim thick; valves 3-partite by insertion of style base between halves of torn lobes either side.

We assign many of the species of *E.* ser. *Micrantherae* Benth. *sensu* Chippendale (1988) to the new series *Falcatae* while the remainder, *E. angustissima, E. halophila* and *E. cneorifolia,* do not belong to either series. *E. angustissima* and *E. cneorifolia* lack the grossly lobed ovary roof and the regularly pinnate secondary venation of the series *Micrantherae,* while *E. halophila* is isolated from all species in contention and has leaf architecture resembling the unrelated *E. annulata.*

Key to subseries of *E.* ser. *Micrantherae*

1. Bark smooth; adult leaves to 2.7 cm wide; fruit ± sessile; subcoastal distribution, on white sand ..... *E.* subser. *Micrantherae*
1. Bark rough; adult leaves to 1.7 cm wide; fruit shortly pedicellate; inland distribution, on red sand ..... *E.* subser. *Bakerianae*

Eucalyptus subser. **Bakerianae** (Chippendale) Brooker & Hopper, subser. nov.

E. ser. *Bakerianae* Chippendale, Fl. Australia 19: 496 (1988). *Type: E. bakeri* Maiden.

The *E.* subser. *Bakerianae* is included in the *E.* series *Micrantherae* because of various unifying characters (see above) and particularly by the recognition of the modified ovary roof. This structure appears nowhere else in the genus. The monotypic subser. *Micrantherae* occurs on white, subcoastal sandplains from west of Mt Maxwell in Fitzgerald National Park eastwards to Israelite Bay. The subser. *Bakerianae*, comprising *E. mannensis, E. jutsonii* and *E. bakeri*, occurs from near Shark Bay across the continent to south-eastern Queensland.

Eucalyptus ser. **Balladonienses** Brooker & Hopper, ser. nov.

Arbores vel frutices. Cortex fibrosa. Cotyledones bisectae. Medulla non glandulifera. Folia viridia nitentia, reticulo finito et glandulis oleosis numeris conspicuis et pro parte maxima ad intersectiones. Inflorescentiae axillares, non ramosae. Opercula rostrata. Stamina inflexa. Flores citrini.

Typus: E. balladoniensis Brooker

Trees or mallees. Bark rough. Cotyledons bisected. Pith of branchlets not glandular. Leaves green, glossy, with finite reticulation and oil glands appearing mostly at intersections of veinlets, some "island". Inflorescences axillary, unbranched. Opercula beaked. Stamens inflexed. Flowers pale yellow.

Key to species of *E.* ser. *Balladonienses*

1. Bark rough, flaky; fruit to 1 x 1.3 cm; inflorescences often pendulous
   2. Pedicels > 6 mm long ..... *E. balladoniensis* subsp. *balladoniensis*
   2. Pedicels 0-2 mm long ..... *E. balladoniensis* subsp. *sedens*
1. Bark rough, hard; fruit to 0.8 x 0.9 cm; inflorescences erect ..... 13. *E. indurata*

13. Eucalyptus indurata Brooker & Hopper, sp. nov. (Figure 10)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 214 (1990).

Arbor vel frutex "mallee" *Eucalyptum micrantheram* F. Muell. ex Benth. simulans a qua statura superiore, cortice indurato non-decorticato operculo rostrato, et floribus flavidis differt. Potens in terra erit semen eius.

Typus: 3.4 km N of Grigg's Road on Belgian Road, N of Dalyup, 33°23'S, 121°28'E, 6 June 1983, *M.I.H. Brooker* 8167, *L.A.S. Johnson* and *D.F. Blaxell* (holo: PERTH; iso: CANB, NSW).

Small *tree* or *mallee* to 10 m with hard, furrowed, grey-black rough bark over whole trunk or stems, smooth grey above. Forming *lignotubers. Cotyledons* bisected. *Seedling leaves* sessile, decussate, remaining opposite for more than 10 pairs, some slightly decurrent, ovate to deltoid, to 3 x 2 cm, blue-green, dull. *Adult leaves* alternating, petiolate, narrowly lanceolate to lanceolate, to 12 x 2 cm, concolorous, slightly glossy, green to greyish green; reticulation dense, with numerous mostly intersectional oil glands. *Inflorescences* axillary, simple, 7-flowered; peduncles slightly angular, to 1 cm long. *Buds* pedicellate, to 1.8 x 0.7 cm, bi-operculate; hypanthium cupular, inner operculum strongly beaked and longer than hypanthium. *Stamens* inflexed in bud, all fertile; anthers versatile, sub-basifixed, oblong, opening by longitudinal slits. *Flowers* pale yellow. *Ovules* in 4 vertical rows on placenta. *Fruits* pedicellate, hemispherical and slightly constricted at rim, to 0.8 x 0.9 cm; rim thick; disc annular; 4 slender style remnants often persisting and exserted. *Seed* grey, shiny, compressed-ovoid, almost smooth, with a few shallow longitudinal grooves.

Other specimens examined. WESTERN AUSTRALIA: Grasspatch, north side opposite Kent's Rd turnoff, 33°14'S, 121°11'E, 30 Dec. 1979, *M.I.H. Brooker* 6723 (CANB, PERTH); 28 km W of Balladonia, 28 Apr. 1982, *M.I.H. Brooker* 7482 (CANB, NSW, PERTH); 118.4 km S of Norseman, 29 Apr. 1982, *M.I.H. Brooker* 7489 (CANB, PERTH); 26 km N of Ravensthorpe-Esperance Road *via* Lauriana and Boydell's Roads, 2 May 1982, *M.I.H.Brooker* 7418 (CANB); 4 km along Mt Ney Road, NE of Kau Rock Road turnoff, 33°24'S, 121°24'E, 12 Aug. 1982, *M.I.H. Brooker* 7551 (CANB, PERTH) and 5 Sep. 1983, *M.I.H. Brooker* 8163 (CANB, PERTH); 2.7 km W of Grasspatch on Grasspatch Road, 33°13'S, 121°40'E, 9 Apr. 1983, *M.I.H. Brooker* 8073 (CANB, PERTH); 4 km along Mt Ney road, NE of Kau Rock Rd t/o, NE of Esperance, 33°24'S, 122°24'E, 5 June 1983, *M.I.H. Brooker* 8163 (CANB, PERTH); 3.4 km N of Grigg's Road on Belgian Road, N of Dalyup, 121°28'E, 6 June 1983, *M.I.H. Brooker* 8166, (CANB, PERTH); 24.5 km NW of Balladonia, 12 Mar. 1984, *M.I.H. Brooker* 8486 (CANB, PERTH); 9 km up track N of Edwards Road, S of Pyramid Lake, 33°13'S, 120°54'E, 17 Jan. 1985, *M.I.H. Brooker* 8801 (CANB, NSW, PERTH); 13.9 km E of Ravensthorpe on Esperance Road, 33°36'S, 120°08'E, 17 Jan. 1985, *M.I.H. Brooker* 8803 (CANB, NSW, PERTH); 8.6 km along road 11, west of Ravensthorpe-Hopetoun Road, 33°42'S, 120°05'E, 20 Feb. 1985, *M.I.H. Brooker* 8854 (AD, CANB, NSW, PERTH); 29.3 km NE of Mt Ridley t/o on Dempster Road, 33°04'S, 122°16'E, 9 Apr. 1985, *M.I.H. Brooker* 8924 (AD, CANB, MEL, PERTH); corner of Griffith's and Dalyup Roads, 33°28'S, 121°36'E, 7 Nov. 1986, *M.I.H. Brooker* 9520 (CANB, NSW, PERTH); 34 km NNE of Mt Heywood, *M.A. Burgman* 1419 and *S. McNee* (PERTH); 41.5 km NNE of Mt Ney, 33°03'36"S, 122°38'40"E, 22 June 1983, *M.A. Burgman* 1430 and *S. McNee* (PERTH); 7 km NW of Clyde Hill, 33°17'49"S, 122°55'42"E, 6 Aug. 1983, *M.A. Burgman* 1794 and *S. McNee* (CANB, PERTH); 12 km NNW of Clyde Hill, 33°17'49"S, 122°55'42"E, 6 Aug. 1983, *M.A. Burgman* 1800 and *S. McNee* (PERTH); 40 km NW of Clyde Hill, 33°03'S, 122°45'E, 7 Aug. 1983, *M.A. Burgman* 1835 and *S. McNee* (CANB, PERTH); 32 km N of Mt Ney, 33°05'56"S, 122°25'31"E, 8 Aug. 1983, *M.A. Burgman* 1844 and *S. McNee* (PERTH); 34.5 km SSE of Peak Eleanor, 0.1 km W of Ned's Corner Road and Rollands

Road, crossroads, 33°15'16"S, 121°06'30"E, *M.A. Burgman* 1915 and *S. McNee* (CANB); 34 km NNE of Mt Heywood, 16.08 km NW of Mt Ney Road or Clyde Rock Road, 33°02'30"S, 122°36'52"E, *M.A. Burgman* 3019 and *C. Layman* (PERTH); Salmon Gums, 25 Oct. 1988, *D. Collins s.n.* (PERTH); (Lort?) River, Dec. 1940, *C.A. Gardner s.n.* (PERTH); 20.2 km W of Balladonia Road House on highway, 32°15'S, 123°26'E, 19 Oct. 1983, *K. Hill* 217, *L.A.S. Johnson* and *D. Blaxell;* 16 km W of Grasspatch on Grasspatch Road, 33°14'S, 121°32'E, 22 Oct. 1983, *K. Hill* 300, *L.A.S. Johnson* and *D. Blaxell* (NSW, PERTH); Dundas Nature Reserve, 14 Dec. 1990, *G.J. Keighery* 12610 (PERTH); 42 km W of Grasspatch, 15 Nov. 1980, *K. Newbey* 8139 (PERTH); Grasspatch, 1973, *P. Richmond* R100 (PERTH).

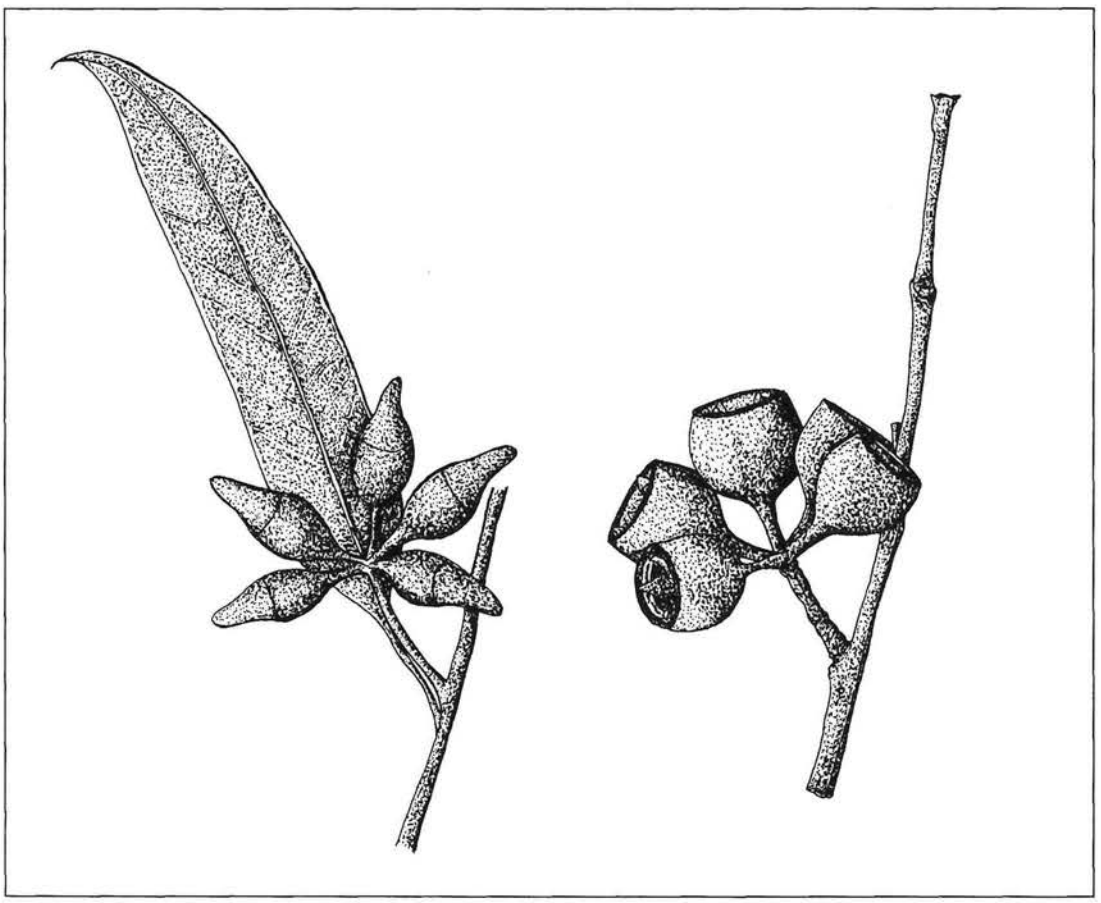

Figure 10. *E. indurata* - buds (*MIHB* 8486) and fruit (*MIHB* 8924) (x1.7)

Distribution. From south-west of Ravensthorpe to Balladonia and particularly common inland from Esperance, Western Australia (Figure 1).

Conservation status. Common and well represented in conservation reserves.

Flowering period. June-September.

Etymology. The name refers to the hard rough bark (Latin *induratus* - hard).

Notes. Habitat preference has not been noted over much of the range, but in the centre of the distribution (the Esperance hinterland), the species invariably occurs on slight rises in otherwise plain country or between salt lakes. The species is not readily confused with any other.

Eucalyptus ser. **Subulatae** Blakely, "A Key to the Eucalypts" 64, 267 (1934).

Type: *E. oleosa* F. Muell. ex Miq.

The *E.* series *Subulatae* belongs in the informal *E.* subgenus *Symphyomyrtus*. It is diagnosed by: mallee, mallet or tree, bark smooth or rough, cotyledons bisected, pith of branchlets not glandular, anthers cuboid or globoid, fruits with persistent fragile style remnants surmounting valves, seed grey, shiny, compressed-ovoid, smooth with shallow longitudinal furrows on dorsal side.

The series consists of about 50 taxa (L.A.S. Johnson, unpublished) more than half of which are unpublished, so a key to the published remainder would merely be an academic exercise of little application as so many of the new taxa are frequently encountered in the field.

14. Eucalyptus aspersa Brooker & Hopper, sp. nov. (Figure 12)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 246 (1990).

Frutex "mallee" ad *Eucalyptum* seriem *Subulatas* Blakely pertinens ad 5 m altus, cortice testaceo vel pallido-cinereo laxo, foliis plantularum et juvenilibus decussatis, ellipticis, ad 3.5 x 1 cm, hebetibus, viridibus, foliis adultis viridis leviter nitidis, fructibus parvis (ad 0.7 x 0.6 cm), et opercula rostrata differt.

Typus: 2 km N of Serpentine River along Albany Highway, 32°31'S, 116°21'E, 9 Oct. 1985, *M.I.H. Brooker* 9047 (holo: PERTH; iso: CANB, NSW).

Mallee to 4 m tall with light yellowish brown to light grey rough bark loosely held on lower half of stems, or of long smooth strips partly detached. Forming *lignotubers*. *Seedling leaves* sessile, decussate, remaining opposite for 5-7 pairs, elliptical, to 3.5 x 1 cm, dull, green. *Adult leaves* alternating, petiolate, narrowly lanceolate to lanceolate, to 9 x 1.5 cm, concolorous, slightly glossy, green; reticulation dense, with very numerous intersectional oil glands. *Inflorescences* axillary, unbranched, to 13-flowered; peduncles slightly flattened, to 0.8 cm long. *Buds* pedicellate, to 1.2 x 0.3 cm, bi-operculate; hypanthium cupular, inner operculum beaked and much longer than hypanthium. *Stamens* mostly inflexed with anthers around style; all fertile. *Flowers* not seen. *Ovules* in 4 vertical rows on placenta. *Fruits* pedicellate, cupular to slightly urceolate, to 0.7 x 0.6 cm; 4 persistent style remnants may emerge. *Seed* flattened ovoid, grey-brown, almost smooth, with a few shallow longitudinal grooves, hilum ventral.

Other specimens examined. WESTERN AUSTRALIA: Summit of Mt Saddleback, 32°58'S, 116°27'E, 26 July 1983, *M.I.H. Brooker* 8249,8250 (CANB, NSW, PERTH), 20 Oct. 1983, *M.I.H. Brooker* 8291,8292 (CANB, NSW, PERTH); Metro Road, 1.6 km S of Pike's Road, 7.9 km N of Wearne Road, North Bannister, 32°30'S, 116°31'E, 9 Oct. 1985, *M.I.H. Brooker* 9043 (CANB, PERTH); 0.6 km S of Pike's Road, 32°29'S, 116°31'E, 9 Oct. 1985, *M.I.H. Brooker* 9044 (CANB, PERTH); 9.6 km E of Metro Road, 32°32'S, 116°36'E, 27 Nov. 1985, *M.I.H. Brooker* 9128 (CANB, NSW, PERTH); Rick's Road, E of N Bannister, 32°33'S, 116°40'E, 4 June 1986, *M.I.H. Brooker* 9341

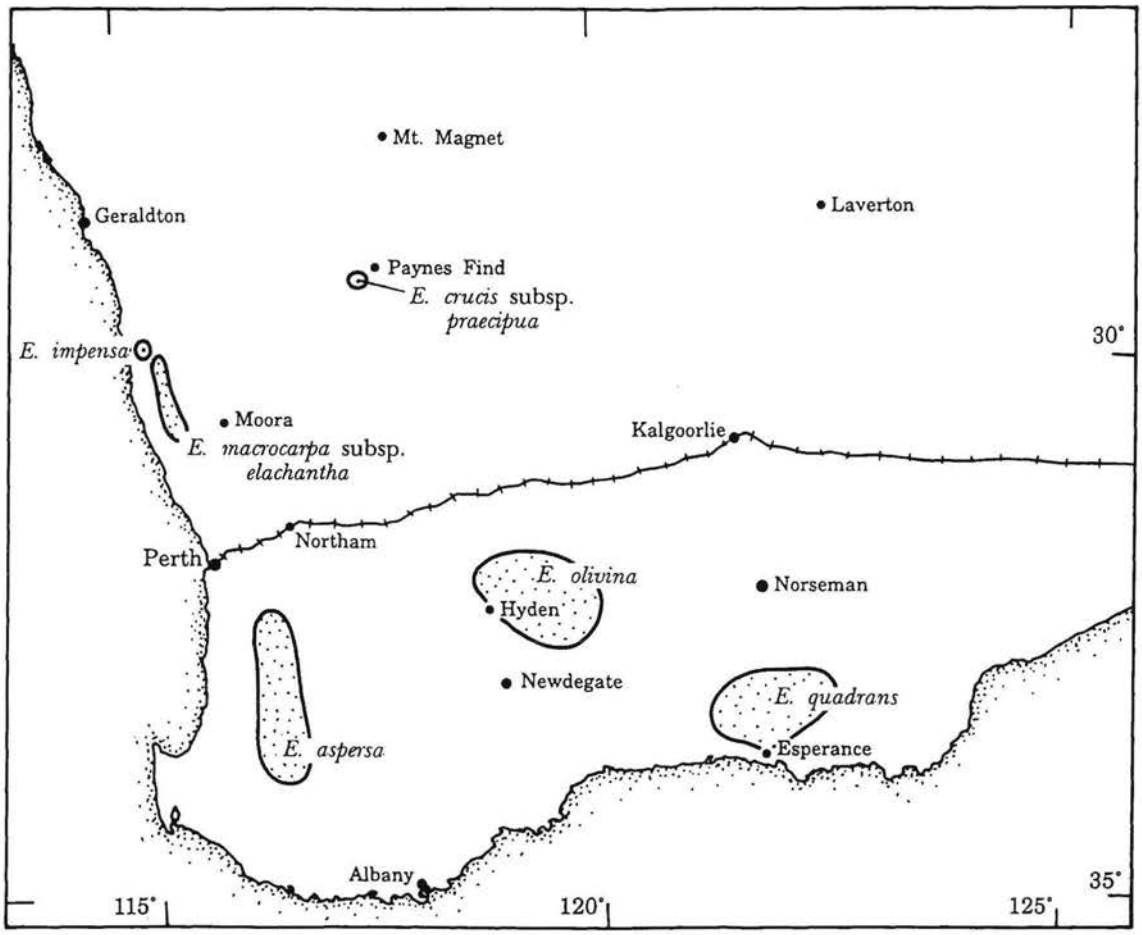

Figure 11. Distribution of taxa Nos 14, 16, 17, 19-21.

(CANB, NSW, PERTH); N of Crossman, E of Albany Highway, 31 Mar. 1987, *M.I.H. Brooker* 9578a (CANB, PERTH); Tohl's farm, SW of Kojonup, 33°54'S, 117°02'E, 26 Nov. 1987, *M.I.H. Brooker* 9827 (AD, CANB, MEL, NSW, PERTH); 2.1 km S on Metro Road, S of Brookton Highway, 13 June 1988, *M.I.H. Brooker* 9961, 9962 (AD, CANB, MEL, NSW, PERTH); Godfry Block, S of Williams, May 1973, *R. Edmiston* 363 (PERTH); 9 km N of Frankland townsite, *F. Haynes s.n.* (PERTH); Top of Mt Saddleback, 24 Oct. 1983, *K. Hill* 363, *L.A.S. Johnson & D. Blaxell* (NSW, PERTH); Boyup Brook area, July 1986, *E.M. Knapp s.n.* (PERTH); E of Boyup Brook Shire, Oct. 1986, *E. Knapp s.n.* (PERTH); Wahkinup Reserve, 28 Feb. 1989, *G.S. McCutcheon* 2001 (PERTH); Dobaderry Reserve, N of Brookton Hwy, 23 Feb. 1990, *S. Patrick* 460 (CANB, K, PERTH); Stockyard Block, Harvery (*sic*) district, 23°07'10"S, 116°24'12"E, 9 Aug. 1988, *J.L. Robson* 89 (PERTH); Wandering Forest Block, June 1989, *J.L. Robson* 368 (PERTH); Lane Poole Reserve, 29 June 1989, *J.L. Robson s.n.* (PERTH); 1.3 km S down South Rd from Wearne Rd Junction, Wearne Forest Block, 1990, *J.L. Robson s.n.* (PERTH); 2.1 km N up Link Rd, from junction of Wearne road and 150 m west, 28 Feb. 1990, *J.L. Robson s.n.* (PERTH); Mt Saddleback, 32°57'S, 116°27'E, 28 Aug. 1980, *A. Weston* 12614 (PERTH); Narrogin, 5 Nov. 1927, *C.J. White* 5299 (PERTH); Julimar State Forest, map ref. MX7754, 30 Aug. 1978, *C.W. (sic) s.n.* (PERTH).

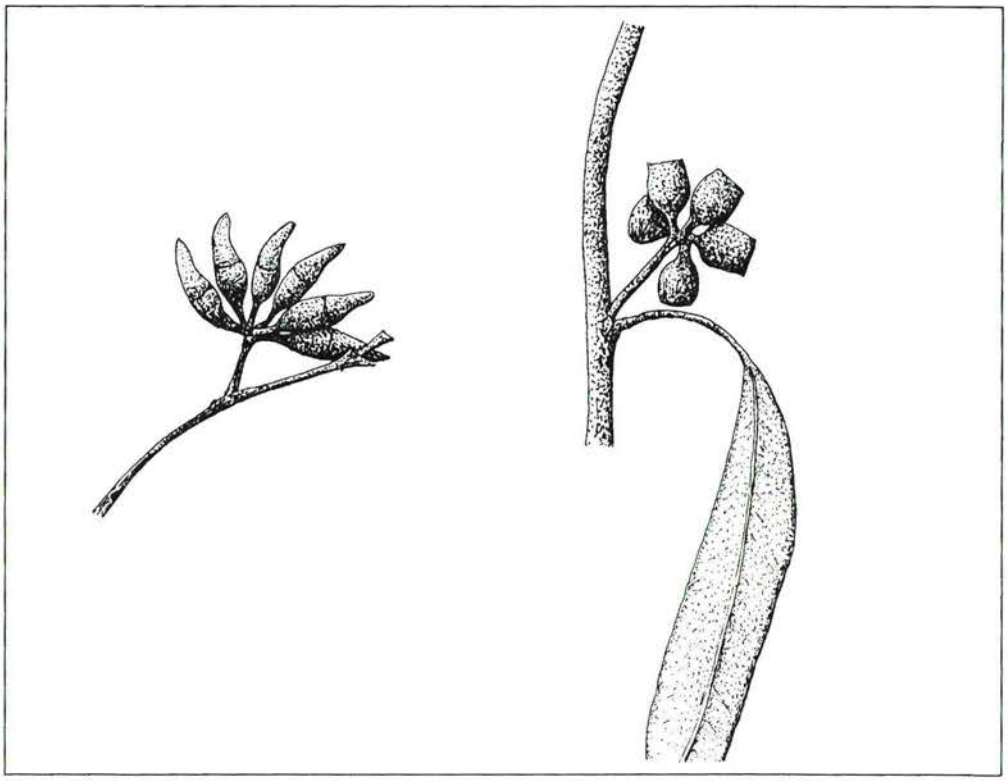

Figure 12. *E. aspersa* - buds and fruit (x1.2) (*MIHB* 9128)

Distribution. From the vicinity of Boyup Brook and Kojonup northwards through the Darling Range to about the Brookton Highway west of Westdale, Western Australia (Figure 11).

Flowering period. Not known.

Conservation status. Widespread in the eastern jarrah forest but sporadic and locally rare. In need of monitoring (Priority 5 in Hopper *et al.* 1990).

Etymology. The name refers to the scattered occurrence of the populations in the jarrah forest (Latin *aspersus* - scattered).

Notes. E. aspersa occurs in small, more or less pure stands in open forest. There are many occurrences between North Bannister and Westdale on flat country between low hills. It occurs notably at one elevated site. This is a stand on the summit of Mt Saddleback south of Boddington. While forming fruits, this population has been found to be sterile unlike all other stands examined.

Eucalyptus ser. **Curviptera** Maiden, "Crit. Revis. Gen. *Eucalyptus*" 7:117 (1925).

Type: E. burracoppinensis Maiden & Blakely

The *E.* ser. *Curviptera* belongs in the informal *E.* subgenus *Symphyomyrtus.* The series is diagnosed by the following: mallee rarely tree, decorticated bark often ribbony and held loosely over most of

stems, rough in one species, cotyledons bisected, pith of branchlets not glandular, leaves moderately thick; buds and fruit relatively large and include the largest in the genus, buds few in number (two species with single buds, several with three, few with seven), ovules in 4-10 vertical rows, disc of fruit prominent and in some species massive, concave, ascending to vertical.

The series comprises two subseries, easily identified by the arrangement of the stamens.

Key to subseries of *E.* ser. *Curviptera*

1. Stamens inflexed ..... *E.* subser. *Inflexae*
1. Stamens erect, oblique or variously curved ..... *E.* subser. *Curviptera*

Eucalyptus subser. **Inflexae** Brooker & Hopper, subser. nov.

Arbor parva rare fruticosa, cortice laevi aurantiaco vel aurantiaco-brunneo vetere saepe laxe tenenti atroporphyreo. Folia adulta falcata, viridia, leviter nitentia. Inflorescentiae 7-florae. Alabastra ovoidea vel globosa. Stamina inflexa. Fructus haemispherici disco lato annulato, saepe rimis radiatis.

Typus: E. lane-poolei Maiden

Notes. E. lane-poolei occurs in small scattered communities from south-east of Busselton and near Denmark, northwards on the western scarp of the Darling Range and adjacent plains extending towards Jurien. In habit it is often a crooked tree. The bark is usually bright orange in season. The leaves are glossy, a rare feature in series *Curviptera*, and characteristically falcate. The inflexed staminal filaments and radially split surface of the disc distinguish it in the series.

Eucalyptus subser. **Curviptera**

Key to species of *E.* subser. *Curviptera*

1. Inflorescences single-flowered
  2. Leaves on mature plant glaucous
    3. Inflorescences with long, down-curving peduncle ..... *E. rhodantha*
    3. Inflorescences without peduncles or peduncles very short
      4. Leaves on mature plant to 24 x 11 cm; fruit to 7 cm wide ..... *E. macrocarpa* subsp. *macrocarpa*
      4. Leaves on mature plant to 10 x 7 cm; fruit to 5 cm wide ..... 17. *E. macrocarpa* subsp. *elachantha*
  2. Leaves not glaucous, petiolate
    5. Leaves on mature plant pale green to yellow green on short, stout petioles to 1 cm long ..... 16. *E. impensa*
    5. Leaves (adult) blue-green to grey-green, petioles to 3 cm long ..... *E. rameliana*
1. Inflorescences >1-flowered

6. Leaves on mature plant shortly petiolate, opposite to sub-opposite, ovate, to 13 x 10 cm, dull, grey-green; inflorescences 3- or 7-flowered; flowers cream or pale pink ..... *E. carnabyi*
6. Without the above combination of characters
7. Inflorescences 3-flowered
8. Buds smooth ..... *E. oldfieldii*
8. Buds ribbed
9. Peduncles to 8 cm long; fruits to 5.5 cm wide ..... *E. pyriformis*
9. Peduncles to 4 cm long
10. Adult leaves maturing glossy green; inflorescences erect ..... *E. burracoppinensis*
10. Adult leaves dull; inflorescences pendulous
11. Buds to 5 x 5 cm ..... *E. youngiana*
11. Buds to 4.5 x 3.5 cm
12. Fruits to 3 x 4 cm, ribs sharp
13. Flowers yellow; branchlets, buds, fruit not glaucous ..... *E. kingsmillii* subsp. *kingsmillii*
13. Flowers pink to red; branchlets, buds fruit glaucous ..... 18. *E. kingsmillii* subsp. *alatissima*
12. Fruits to 2 x 3.3 cm; ribs rounded ..... *E. pachyphylla*
7. Inflorescences 7-flowered
14. Bark rough ..... 15. *E. glomerosa*
14. Bark smooth
15. Buds ribbed, red ..... *E. sessilis*
15. Buds smooth
16. Operculum beaked ..... *E. oxymitra*
16. Operculum conical
17. Disc of fruit broad, ascending ..... *E. drummondii*
17. Disc of fruit annular ..... *E. annuliformis*

15. Eucalyptus glomerosa Brooker & Hopper, sp. nov. (Figure 13)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 262 (1990).

Misapplied name: "*E. ewartiana*" auct. div. non Maiden, e.g. Black in "Flora of South Australia" 632 (1952), Chippendale in "Flora of Central Australia" 243 (1981).

Frutex "mallee" ad 5 (raro 10) m alta, cortice inferiore laxa, squamata, brunnea vel flavo-brunnea, superiore laevi, grisea, vel vivide cuprina. Folia adulta alternantia, petiolata, elliptica vel lanceolata, ad 9 x 1.8 cm, hebetia pallido-viridia. Inflorescentiae axillares; alabastra globosa pedicellata, fructus pedicellati, globosi discum includens, ad 1 x 1.5 cm, disco elevato, valvis exsertis.

Typus: 180 km NE of Cosmo Newberry, 9 May 1984, *M.I.H. Brooker* 8538 & *S.D. Hopper* (holo: PERTH; iso: CANB, NSW).

Mallee to 5 m tall with flaky, loose, brown to yellow-brown rough bark for 1-3 m, smooth grey over salmon pink to bright coppery above; branchlets sometimes glaucous. Forming *lignotubers. Cotyledons* bisected. *Seedling leaves* petiolate, decussate, remaining opposite for 5-7 pairs, orbicular to ovate, to 4 x 4 cm, glaucous. *Adult leaves* petiolate, alternating, elliptical to lanceolate, to 9 x 1.8 cm, dull light green; side veins numerous; reticulation dense, with scattered intersectional oil glands. *Inflorescences* axillary, unbranched; 7(9)-flowered; peduncles terete, to 1.7 cm long. *Buds* on long pedicels to 1 cm long, globular, to 0.4 x 0.4 cm, bi-operculate; inner operculum hemispherical. *Stamens* oblique, all fertile. Mature anthers not seen. *Flowers* not seen. *Ovules* in 4 vertical rows. *Fruits* pedicellate, globose (including the disc), to 1 x 1.5 cm; rim thick; disc broad, ascending; valves (3)4(5), exserted to 0.4 cm. *Seed* yellow-brown, somewhat boat-shaped or asymmetrical with a wing-like extension at one end.

Other specimens examined. WESTERN AUSTRALIA: 0.9 km E of Warburton t/o on track to Neale Junction, 10 May 1984, *M.I.H. Brooker* 8550 & *S.D. Hopper* (AD, CANB, MEL, PERTH); 10 km E of Duketon on Bandya Stn, 27°38'S, 122°25'E, 7 June 1988, *R.J. Cranfield* 6886 (CANB, PERTH); 23 km S of Neale Junction, 28°28S, 125°48'E, 16 July 1974, *A.S. George* 11955 (PERTH); 244 km SW of Warburton, 14 km SW of Terhan Rockhole on Laverton Road, 27°08'S, 121°41'E, 16 June 1983, *S.D. Hopper* 2915 (CANB, PERTH); 297 km SW of Warburton, 36.5 km NNE of Beegull Waterholes on Laverton Road, 27°25'S, 124°20'E, 16 June 1983, *S.D. Hopper* 2920 (PERTH); 16 km S of Neale Junction, 28°24'S, 125°47'E, 9 Jan. 1987, *D.J. Pearson* 146 (PERTH).
SOUTH AUSTRALIA: 2 km west of Vokes Hill Junction, 22 Aug. 1980, *C.R. Alcock* 8132 (AD); 72 km west of Vokes Corner, 4 June 1969, *C.D. Boomsma* 403 (AD); 25 km NE of Churina Well, 213 km N of Cook, 28°56'S, 130° 26'E, 28 Aug. 1986, *M.I.H. Brooker* 9424 & *D. Kleinig* (AD, CANB, MEL, NSW, PERTH); 105.6 km E of Voke's Junction, 28°33'S, 131°41'E, 29 Aug. 1986, *M.I.H. Brooker* 9434 & *D. Kleinig* (AD, CANB, MEL, NSW, PERTH); south of Mt Lindsay, 5 July 1961, *J.B. Cleland s.n.* (AD); west of Serpentine Lakes, 20 July 1979, *T. Dennis* 20 (AD); 30 km west of Vokes Junction, 8 Feb. 1978, *T. Dennis* 98 (AD); 252 km north of Cook, 16 July 1977, *T. Dennis* 102 (AD); 30 km south on Kintore Avenue, 13 Aug. 1979, *T. Dennis* 176 (AD, CANB); south-east of Mt Cheeseman Peak Jn, c. 135 km south of Mann Range, 15 Aug. 1979, *T. Dennis* 178 (AD); west of Serpentine Lakes, 20 July 1979, *T. Dennis* 201 (AD); east of Serpentine Lakes, 19 July 1980, *T. Dennis* 208 (AD); c. 242 km west of Mabel Creek H.S., 16 July 1972, *N. Donner* 3888 (AD); c. 32 km west of Vokes Corner, 17 July 1972, *N. Donner* 3916 (AD); 2 km east of Vokes Corner, 22 Aug. 1980, *N. Donner* 7334 (AD, CANB); 80 km west of Vokes Corner, 27 Aug. 1980, *N. Donner* 7454 (AD, CANB); Victoria Desert, 18 Mar. 1969, *B. Forbes s.n.* (AD); 37 miles west of Emu, 8 Sep. 1956, *N. Forde* 507 (AD); north side of road running west from Vokes, 22 Aug. 1980, *C. Jackson* 1339 (AD); north of Lake Wyola, 1 June 1970, *J. Johnson & S. Reid* 5 (AD); station 24, western bank of Serpentine Lake, 27 June 1967, *J. Johnson s.*n. (AD); station 45, c. 7 km north of Lake Meramangye, 5 July 1967, *J. Johnson s.n.* (AD); 6.35 km north up lakes from Camp 1, 21 Jan. 1979, *V.J. Levitzke* 36 (AD, CANB); Serpentine Lakes, 22 July 1979, *V. Levitzke* 52 (AD); 15 miles north of Emu, 1 July 1967, *T.R.N. Lothian s.n.* (AD); c. 20 km west of Emu, 31 May 1967, *T.R.N. Lothian* 3910 (AD); 12 miles north-west of Emu, 31 May 1967, *D. Scoles s.n.* (AD); few miles north of Mt Lindsay, 6 Aug. 1962, *D.E. Symon* 2583, 2586 (AD); 47 miles south-east of Cheeseman's Peak Road, 6 Aug. 1962, *D.E. Symon* 2601 (AD); 8 km south of Waldana Well, 21 Aug. 1980, *D.E. Symon* 12382 (AD); 6 km west of Vokes Hill, 22 Aug. 1980, *D.E. Symon* 12419 (AD); ± 28 km west of Vokes Hill, 23 Aug. 1980, *D.E. Symon* 12493 (AD); c. 110 km north of Emu-Giles Road, 20 July 1961, *H. Turner* (AD); c. 10.5 km north-east of Moolapinna Hill, c. 4.5 km east-south-east of Ampeinna Hills, 26 Aug. 1978, *D. Whibley* 6381 (AD, CANB); 16 miles south of Mt Davies airstrip on road to Mt Lindsay, 5 Aug. 1962, *P.G. Wilson* 2472 (AD).

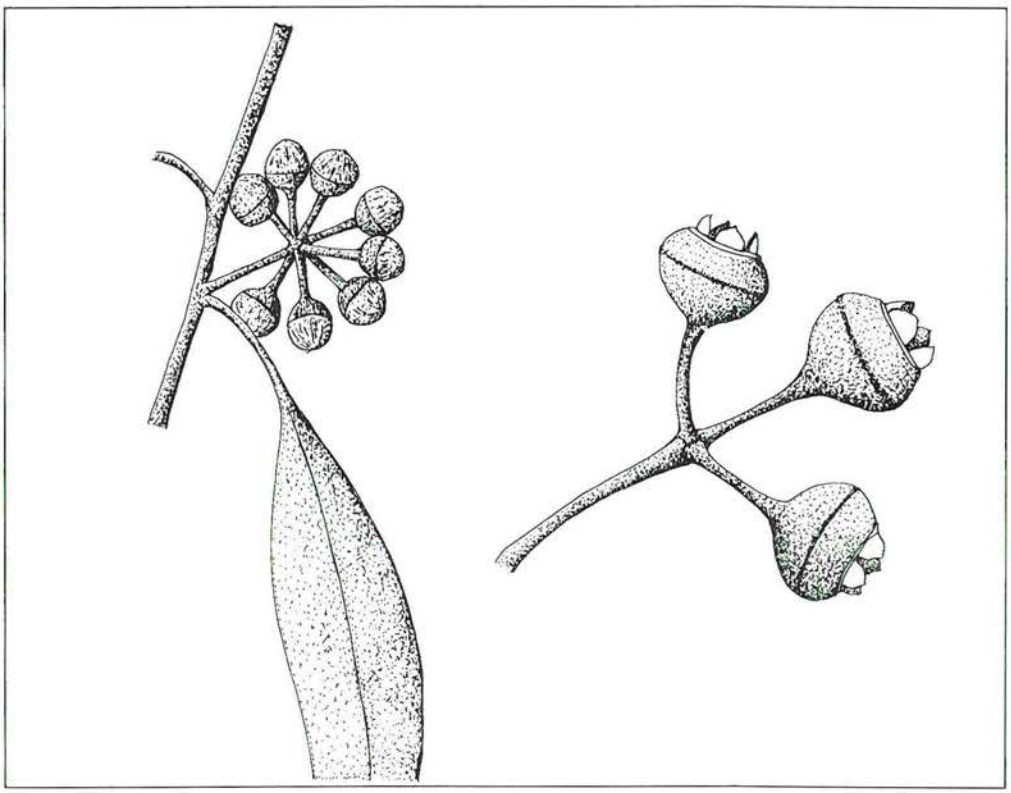

Figure 13. *E. glomerosa* - buds (*MIHB* 8550) and fruit (*MIHB* 9434)

Distribution. The Great Victoria Desert in both Western and South Australia, from south-west of Warburton east to south of Mt Davies and south-east to Emu, always north of the Nullarbor Plain, apparently restricted to red sand. This area is largely unexplored botanically and nothing is known of the continuity of occurrence of this new species (Figure 14).

Conservation status. Widespread and represented in desert conservation reserves.

Flowering period. Not known.

Etymology. The name refers to the globular buds (Latin *glomerosus* - globular).

Notes. E. glomerosa has been mistaken for *E. ewartiana* for many years (e.g. Chippendale 1973, 1988). This has probably been due to the similarity of the buds and fruit as seen on herbarium specimens. The fruits of *E. glomerosa* are similar in shape though larger but the bark of the two species is quite different. *E. ewartiana* has the distinctive minniritchi bark while that of *E. glomerosa* is more formless, being thick, loose and flaky. The pedicel of the fruit of *E. ewartiana* is stout, quadrangular in cross-section and widens towards the attachment with the hypanthium. In *E. glomerosa*, the pedicel is more slender, terete, and attaches to the ± flat underside of the hypanthium.

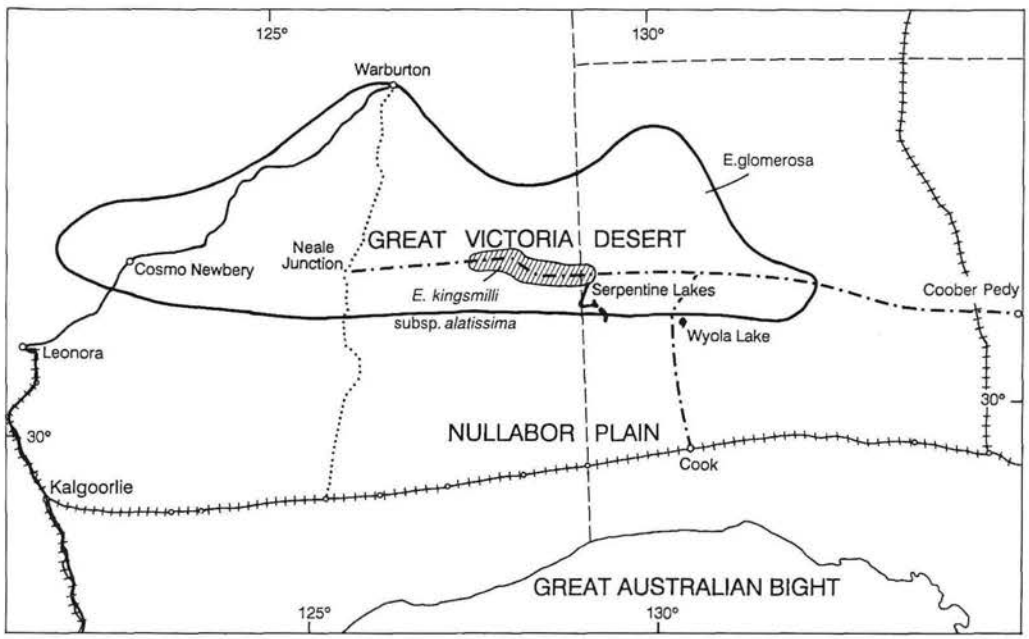

Figure 14. Distribution of *E. glomerosa* and *E. kingsmillii* subsp. *alatissima*

16. Eucalyptus impensa Brooker & Hopper, sp. nov. (Figure 15)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 419 (1990).

Frutex "mallee" ad 1.5 m altus, effusus, cortice laevi cinereo vel pallido-cupreo. Surculi virides non glauci. Folia plantae maturae breviter petiolata, opposita vel sub opposita, ovata, ad 14 x 8 cm, hebetia, pallido-viridia vel flavido-viridia, rigida. Inflorescentiae axillares, flore solitario. Alabastra valde rostrata. Fructus sessiles hemisphaerici disco excluso, ad 2.5 x 6 cm, pedunculo crasso ad 2 cm longo, disco conspicuo ascendenti et valvis (5) exsertae. Semina pyramidalia, inaequilatera, brunnea, ventraliter costatis.

Typus: NW of Warradarge, 30°00'S, 115°15'E, 13 Aug. 1987, *M.I.H. Brooker* 9736 (holo: PERTH; iso: AD, CANB, MEL, NSW).

Straggly *mallee* to 1.5 m tall with grey over pale coppery smooth stems. *Juvenile leaves* petiolate, opposite for many pairs, ovate, to 11 x 6 cm, blue-green to glaucous. Shoots of new growth green, not glaucous. *Leaves* on mature plant on short stout petioles, opposite to sub-opposite, ovate, to 14 x 8 cm, concolorous, pale green to yellow-green, stiff. *Inflorescences* axillary with a single flower on a thick peduncle to 2 cm long. *Bud* on stout pedicel, hypathium hemispherical, operculum strongly beaked, slightly ribbed, to 5 x 2.5 cm including pedicel. *Stamens* all fertile; anthers versatile, dorsifixed, oblong, opening by broad lateral slits. *Flowers* pink. *Fruits* sessile, on thick pedicels to 2 cm long, hemispherical (not including the disc), to 2.5 x 6 cm; disc conspicuous, ascending; valves 5, exserted. *Seed* brown, pyramidal though asymmetrical, with ribs ascending to the ventral hilum.

Other specimens examined. WESTERN AUSTRALIA: Type locality, 7 Aug. 1988, *M.I.H. Brooker s.n.* (fruit and seed collection only, in CANB); and 13 Nov. 1991, *M.I.H. Brooker* 10865 (coppice, regrowth after fire) (CANB); 17 km NW of Moora, 3.4 km N along Agaton Rd from Moora-Badgingarra Rd, 30°03'30"S, 115°05'60"E, 30 July 1980, *S.D. Hopper* 1645 (PERTH); type locality, 29 May 1991, *A. Popplewell s.n.* (CANB) and 2 July 1991, *A. Popplewell s.n.* (CANB).

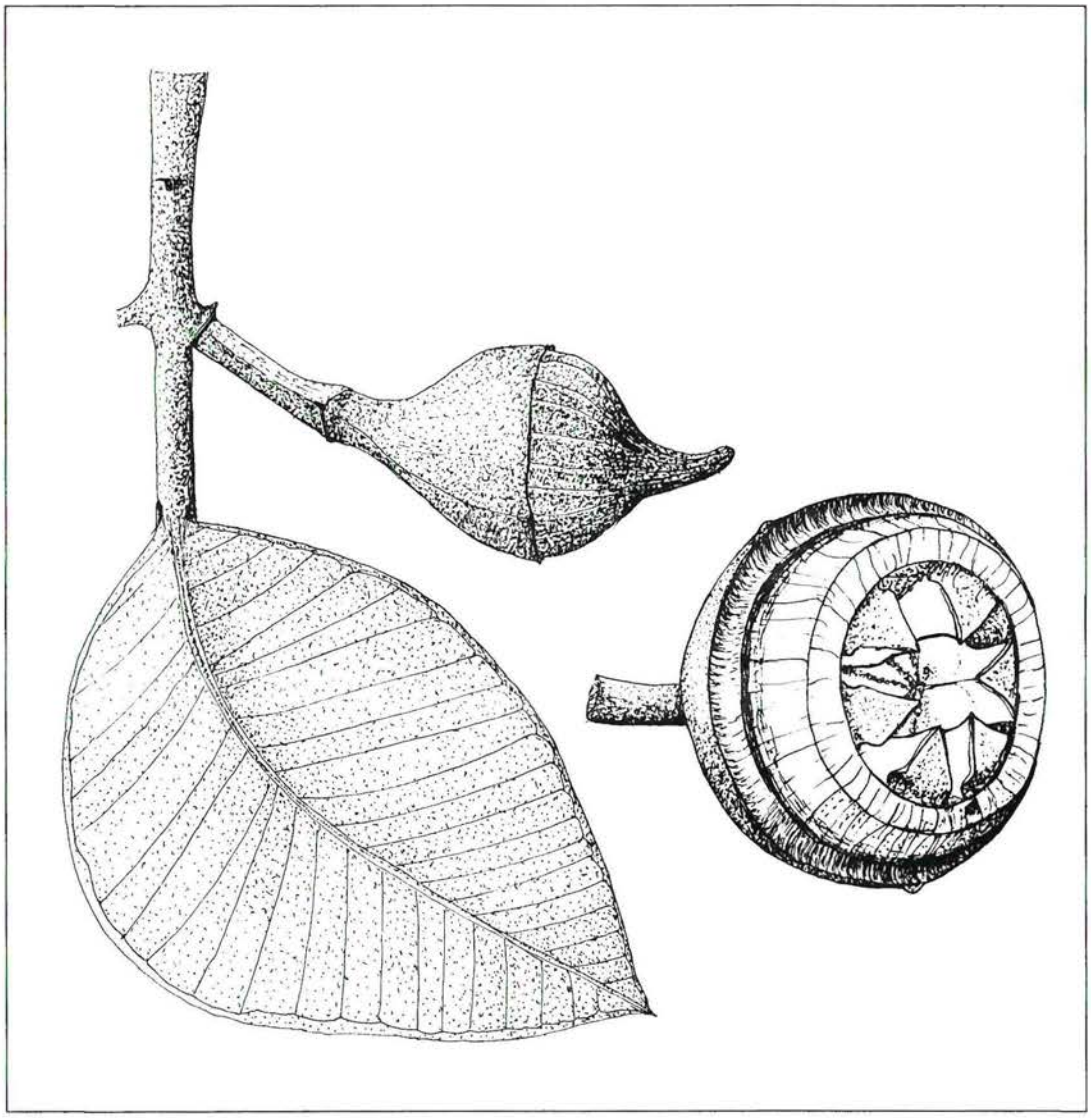

Figure 15. *E. impensa* - bud (*Popplewell s.n.*) and fruit (*MIHB* 9736) (x1.1)

Distribution. Known only from the type locality (Figure 11) and another near Moora.

Conservation status. Endangered. Declared as Rare Flora (species no. 151 in Hopper *et al.* (1990)).

Flowering period. June-July. The type population was not seen between Aug. 1988 and Sep. 1990 during which time the plants flowered and produced fruit and seed. It was first seen in flower on 2 July 1991 (*Popplewell s.n.* in CANB).

Etymology. From the Latin *impensus* - large, strong alluding to the leaves and fruit.

Notes. E. impensa at the type locality consists of about 10 plants on a sandplain south-west of Eneabba. The large fruit are reminiscent of *E. macrocarpa* but the shortly petiolate, non-glaucous leaves, both juvenile and adult, are distinctive. It occurs in association with *E. tetragona* (R. Br.) F. Muell. and *E. macrocarpa* Hook. subsp. *macrocarpa*, both of which exceed the depauperate *E. impensa* in stature. Following a fire that destroyed the above-ground specimens, the mallees are regenerating from the lignotubers and producing coppice of light green, petiolate leaves.

17. Eucalyptus macrocarpa Hook. subsp. **elachantha** Brooker & Hopper, subsp. nov.

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 266 (1990).

A subspecie typica foliis alabastris fructibusque brevioribus differt.

Typus: Cnr. Yandan Road and Brand Highway, 30°46'S, 115°34'E, 23 Jan. 1984, *M.I.H. Brooker* 8402 & *S.D. Hopper* (holo: PERTH; iso: CANB, NSW).

It differs from the typical subspecies in the smaller leaves (to 10 x 7 cm), buds (to 5.5 x 3 cm) and fruits (to 3 x 5cm).

Other specimens examined. WESTERN AUSTRALIA: 48 miles NNW of Gin Gin, 2 Sep. 1970, *T.E.H. Aplin & R. Coveny* 3120 (CANB, PERTH); Mimegarra Road T/O on highway I, 2.2 km S of Ampol Roadhouse at Cataby, 18 Oct. 1978, *J. Briggs* 300 (CANB); 4 miles SW of Mount Lesueur, 23 July 1969, *M.I.H. Brooker* 1927 (PERTH); Yandanooka West Road, N/S section W of Mt Adams, 4 Feb. 1985, *M.I.H. Brooker* 8820 (CANB, PERTH); North West Road, SE of Badgingarra, 10 June1986, *M.I.H. Brooker* 9348 (CANB, PERTH); NW of Warradarge on NS track, 4.3 km W of Brand Highway, 7 Aug. 1988, *M.I.H. Brooker* 10295 (CANB, PERTH); 2.6 km S of Gillingarra Road on Capitella Road, S of Dandaragan, 18 Aug. 1988, *M.I.H. Brooker* 10034 (CANB, PERTH); c. 7 miles NNE of Badgingarra, 18 Oct. 1966, *G.M. Chippendale* 25 (CANB, PERTH); 12 km N of Green Head Road along Eneabba South Road, 24 Jan. 1979, *M.D. Crisp* 5440 (CBG, PERTH); upper reaches of Hill River, 24 Aug. 1948, *C.A. Gardner* 9038 (PERTH); 30 km E of Eneabba, Aug. 1982, *N.J. Davidson s.n.* (PERTH); Allied Eneabba Sand Mine, 18 June 1979, *B. Dixon* S4495 (PERTH); New Geraldton Road, 7 miles N of the Watheroo-Jurien Bay crossroad, 2 Sep. 1966, *R. Filson* 8480 (PERTH); 6.6 km E of Badgingarra, 18 May 1967, *E. Holm s.n.* (CANB); 5 km S of Cataby Roadhouse on Brand Highway, 13 Nov. 1979, *S.D. Hopper* 1492 (PERTH); 22 km SSW of Eneabba, 13 Nov. 1979, *S.D. Hopper* 1499 (PERTH); 5.5 km SW of Mount Adams, 15 Nov. 1979, *S.D. Hopper* 1539 (PERTH); 43 km NW of Mingenew, 9 Sep. 1980, *S.D. Hopper* 1673 (PERTH); 30 km SSW of Mingenew, 10 Sep. 1980, *S.D. Hopper* 1673 (PERTH); 34 km ENE of Eneabba, 10 Sep. 1980, *S.D. Hopper* 1679 (PERTH); 16 km SW of Dandaragan, 5 km SE of Cataby, 11 Aug. 1983, *S.D. Hopper* 3121 (CANB, PERTH); 3 km S of junction of Mimegarra Road and Brand Highway, 5 June 1984, *S.D. Hopper* 3765 (PERTH); intersection of Mimegarra Road and Brand Highway, 5 June 1984, *S.D. Hopper* 3774 (PERTH); 0.8 km SSW of Yandanooka Hill, 3.5 km W on Lovegrove Road from Sundalara Road, 23 Nov. 1989, *A. Kelly & A. Napier* 551 (PERTH); along Brand Highway between Badgingarra and Gin Gin, c. 3 km SE of Cataby, 5 Dec. 1982, *A Strid* 21710 (PERTH).

Distribution. From south of Cataby north almost to Badgingarra, Western Australia (Figure 11).

Conservation status. Uncommon but represented in conservation reserves and in need of monitoring. Priority 3 in Hopper *et al.* (1990) - reserve flora list.

Flowering period. August-September.

Etymology. The name refers to the smaller leaves, buds and fruit (Greek *elachys* - small and *anthos* - flower) compared with the typical subspecies.

Notes. This subspecies became evident after a study of *E. macrocarpa sens. lat.* by Hopper *et al.* (unpublished). It occurs towards the north-west of the distribution for *E. macrocarpa* and occurs within the overall distribution while not being actually sympatric.

18. Eucalyptus kingsmillii subsp. **alatissima** Brooker & Hopper, subsp.nov. (Figure 16).

A subspecie typica ramulis alabastris fructibusque plus valde alatis differt.

Typus: Halfway between Neale Jctn and Serpentine Lakes, Great Victoria Desert (28 20'S, 127 00'E), Western Australia, 18 Apr. 1991, *D. Nicolle* 7 (holo: CANB; iso: PERTH).

Mallee to 8 m tall with dark grey rough bark on stems to c. 10 cm diam. *Stems* and *branches* smooth grey over cream. *Branchlets* glaucous. Crown with predominance of short, ovate intermediate leaves. *Adult leaves* petiolate, alternating, ovate to lanceolate, 6-10 x 1.5-2 cm, concolorous, dull, blue-green to grey-green. *Inflorescences* axillary, unbranched, 3-flowered; *peduncles* down-turned, 1.5-5 cm long. *Buds* on angular pedicels to 2 cm long, glaucous, hypanthium obpyramidal, operculum pyramidal tapering to long straight or curved point, both with wide longitudinal wings (to 0.5 cm), to 3.5 x 2 cm; *stamens* oblique, all fertile; anthers versatile, sub-basifixed, with prominent terminal gland, opening by broad lateral slits; *flowers* pink to red. *Fruits* winged, to 1.5 x 2.5 cm; disc broad, ascending; valves 4, exserted.

Other specimens examined. WESTERN AUSTRALIA: Eastern Division. Victoria Desert, July 1972, *G. Brooks s.n.* (AD, CANB); Eastern Division. c. 92 km W of Serpentine Lakes, 18 July 1972, *N.N. Donner* 3950 (AD, CANB); N of Nullarbor, 1969, *J. Forde* (PERTH); Great Victoria Desert, Connie Sue Highway, 27 Aug. 1980, *D.E. Symon* 12753 (ADW, CANB).
SOUTH AUSTRALIA: Region 1: North-western (28°31½'S, 129°57'E), 25 July 1979, *J. Douglas* 66 (AD, CANB); 75 km west of Vokes Corner, track to Serpentine Lakes (28°32'S, 129°58'E), 24 Aug. 1980, *J.S. Weber* 6443 (AD, CANB).

Distribution. Known only along the track in the Great Victoria Desert east of Neale Junction in Western Australia towards Vokes Junction north of Cook in South Australia. The northerly and southerly distributions are not known (Figure 14).

Conservation status. Common and well represented in desert conservation reserves.

Flowering period. April-May.

Etymology. The name refers to the very prominent wings on the buds and fruit compared with those of the typical subspecies (Latin *alatus* - winged, in the superlative).

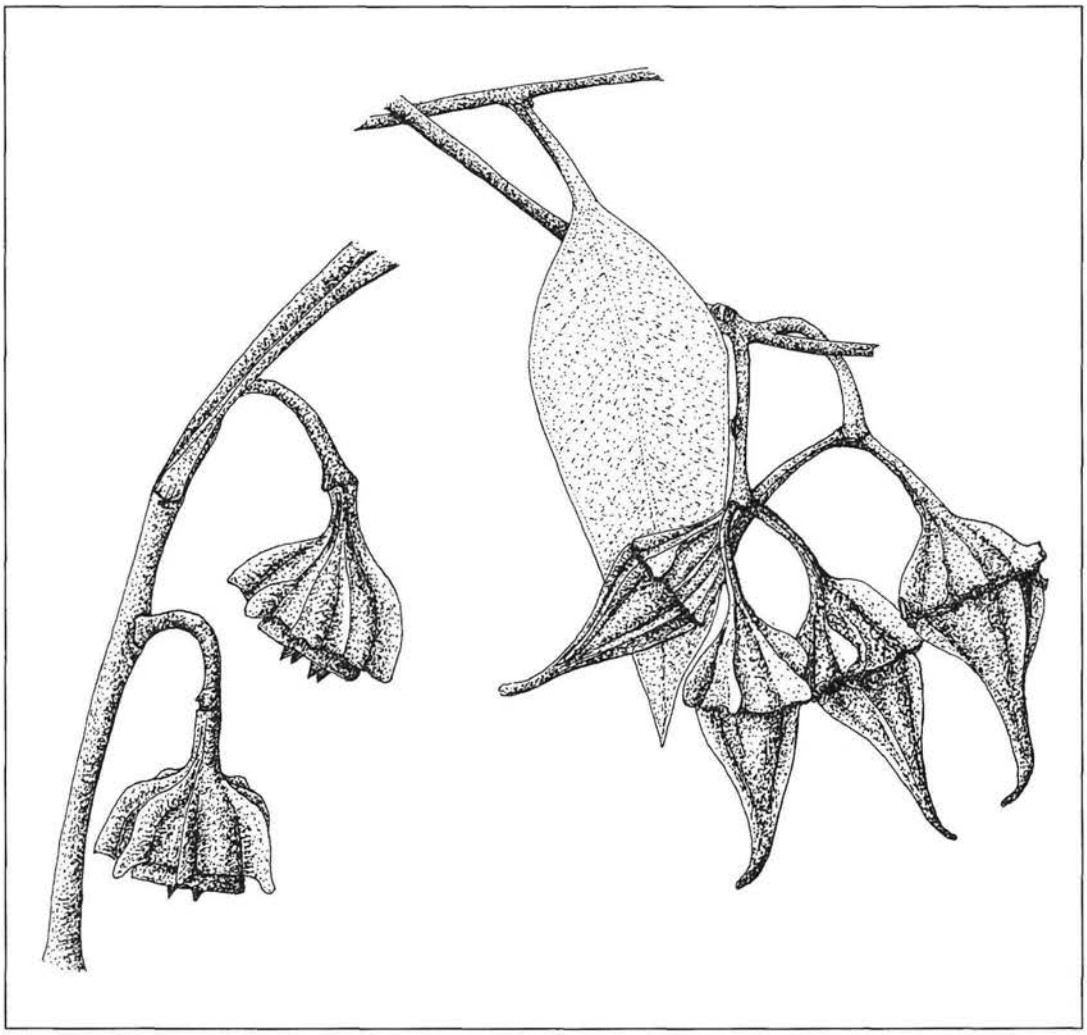

Figure 16. *E. kingsmillii* subsp. *alatissima* - fruit and buds (*Nicolle* 7).

Notes. E. kingsmillii subsp. *alatissima* differs from the typical subspecies and from *E. pachyphylla* in the glaucous branchlets, the long attenuate opercula, and the deep wings of the buds and fruit. From *E. kingsmillii* subsp. *kingsmillii* it differs in the red or pink flowers. Pink or red flowers occur (rarely) in some *E. pachyphylla* but the buds and fruits are usually smaller than those of *E. kingsmillii* subsp. *alatissima* and the peduncles much shorter.

All three taxa grow in relatively remote areas. *E. kingsmillii* subsp. *kingsmillii* and *E. pachyphylla* appear to overlap in distribution and morphology, and while the distribution for *E. kingsmillii* subsp. *alatissima* is the least known, it is possible that it occurs to the south and east and in isolation of these other two. With its brilliantly coloured flowers and the grossly sculptured buds and fruit, *E. kingsmillii* subsp. *alatissima* has considerable horticultural merit.

Eucalyptus ser. **Orbifoliae** Brooker & Hopper, ser. nov.

Arbores parvae vel fructices "mallees" cortice characteristica Minni Ritchi inflorescentiis 7-floribus, operculo exteriori vero, et disco fructus ascendenti.

Typus: *E. orbifolia* F. Muell.

Small trees or mallees with minniritchi bark, 7-flowered inflorescences, a true outer operculum, and ascending disc to the fruit.

Key to species and subspecies of the *E.* ser. *Orbifoliae*

1. Operculum shorter than or equal to hypanthium, rounded or pileate with buds constricted, pedicels stout and often angular; leaves of the seedling petiolate, dull green ..... *E. ewartiana*
1. Operculum longer than hypanthium, pointed, buds not constricted, pedicels not strongly angular; leaves of the seedling petiolate or sessile, glaucous
   2. Leaves of mature plant lanceolate or narrowly lanceolate, petiolate, entire
      3. Leaves to 15 x 2.5 cm, buds to 1.5 x 1 cm, fruits to 1.3 x 2 cm; basal bark thick amorphous, minniritchii above ..... 19. *E. crucis* subsp. *praecipua*
      3. Leaves to 8 x 1.5 cm, buds to 0.7 x 0.5 cm, fruits to 0.8 x 1.4 cm; minniritchi bark from base up ..... *E. crucis* subsp. *lanceolata*
   2. Leaves of mature plant orbicular or elliptical or ovate, sessile or petiolate, entire or emarginate
      4. Leaves of mature plant glaucous, sessile and orbicular or broader than long, or shortly petiolate and ovate, entire; seedling leaves sessile; tree or mallee ..... *E. crucis* subsp. *crucis*
      4. Leaves of mature plant green or glaucous, petioles to 2 cm long, elliptical or ovate to orbicular, emarginate; seedling leaves petiolate; usually a mallee
         5. Leaves ovate or orbicular, glaucous
            6. Operculum rounded ..... *E. orbifolia* subsp. *orbifolia*
            6. Operculum conical
               7. Operculum more than 3 times longer than hypanthium ..... *E. educta*
               7. Operculum less than 2.5 x longer than hypanthium ..... *E. lata*
         5. Leaves longer than broad, green or yellow-green ..... *E. orbifolia* subsp. *websteriana*

19. Eucalyptus crucis Maiden subsp. **praecipua** Brooker & Hopper, subsp. nov. (Figure 17)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 419 (1990).

A *Eucalypto crucis* subspecie *lanceolata* foliis adultis, alabastris fructibusque majoribus et cortice ad basin aspero crasso amorpho non "minniritchi" differt

Typus: Wardagga Hill, Ninghan Station, 22 km SW of Paynes Find, 29°23'S, 117°30'E, 27 Aug. 1991, *S.D. Hopper* 8132 & *A.P. Brown* (holo: PERTH; iso: AD, CANB, NSW).

It differs from subspecies *lanceolata* in the larger adult leaves, buds and fruits.

Other specimens examined. WESTERN AUSTRALIA: Type locality, 2 Aug. 1986, *R. Peakall s.n.* (*J. Sampson* 0088 and 0091) (PERTH); south of Paynes Find, 12 Aug. 1981, *S.D. Hopper* 1842 (PERTH); Wardagga Hill, 25 km SW of Paynes Find, 13 Jan. 1979, *A. Southcott s.n.* (PERTH); Wardagga Hill on Ninghan Stn, 60 miles NE of Wubin, 2 November 1982, *A. Southcott s.n.* (CANB).

Distribution. Only known from the type locality (Figure 11).

Conservation status. Vulnerable, declared as Rare Flora (species no. 134 in Hopper *et al.* (1990)).

Flowering period. Not known.

Etymology. From the Latin *praecipua* - special, in allusion to its distinct morphology and isozyme constituents.

Notes. Apart from the morphological distinction of the new subspecies, a study by Sampson *et al.* (1988) on isozymes showed that the maximum genetic distance between the morphologically similar subsp. *lanceolata* and subsp. *praecipua* was much larger than the distance of subsp. *lanceolata* from the morphologically dissimilar subsp. *crucis.*

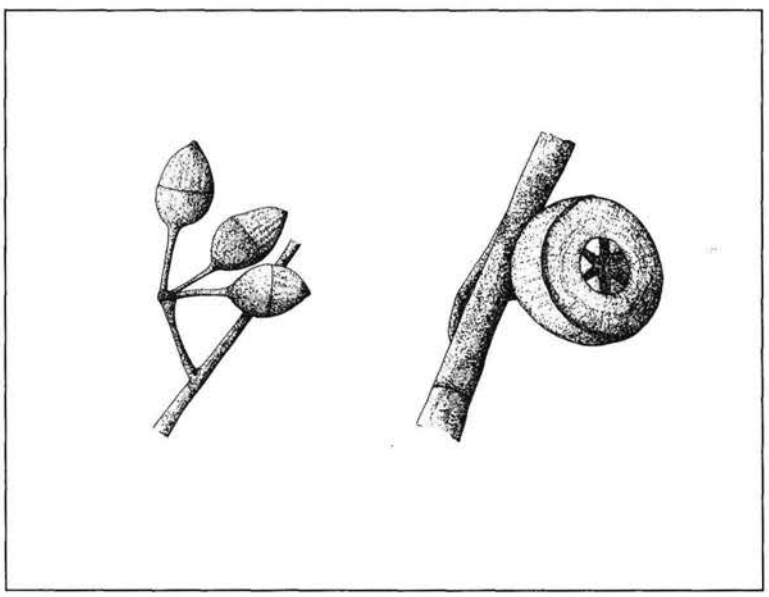

Figure 17. *E. crucis* subsp. *praecipua* - buds and fruit (*Southcott s.n.*)

Eucalyptus ser. **Caesiae** Brooker & Hopper, ser. nov.

Dum corticem "minniritchee" conjunctim *E.* ser. *Orbifoliis* habens, *E.* ser. *Caesiae* inflorescentiis 3-floribus, structura dissimili operculi et disco fructus verticaliter descendenti differt.

Typus: E. caesia Benth.

While having minniritchee bark in common with *E.* ser. *Orbifoliae, E.* ser. *Caesiae* differs by the 3-flowered inflorescences, the vertically descending disc of the fruit and the different structure of the operculum which is formed by the upgrowth from the hypanthium of a ring of tissue which is itself surmounted by the true corolline operculum, the minute sepaline structures having aborted early (Drinnan & Ladiges 1989). This results in a "flange" (Brooker & Kleinig 1990) part way up the whole opercular structure which can be seen as well in *E. sturgissiana* Johnson & Blaxell of southern New South Wales. In fact, specimens of *E. caesia* lacking bark would not be recognised as having any resemblances to *E.* ser. *Orbifoliae*.

Eucalyptus ser. **Heterostemones** Benth., Fl. Austral. 3: 190, 209 (1867).

Type: E.gracilis F. Muell.

The series *Heterostemones* Benth. belongs in the informal *E.* subgenus *Symphyomyrtus* and is diagnosed by the following: mallee rarely tree, bark smooth or when rough typically tessellated, cotyledons bisected, pith of branchlets not glandular, adult leaves glossy with very acute basal venation, flowers with outer staminodes, ovules in 4 vertical rows, seeds with smooth coat and shallow longitudinal furrows.

Key to the species of the *E.* ser. *Heterostemones*

1. Buds and fruit square in cross-section
   2. Hypanthium obconical in outline ..... 20. *E. quadrans*
   2. Hypanthium oblong or urceolate in outline
      3. Buds 4-sided, i.e. square in cross-section ..... *E. calycogona* var. *calycogona*
      3. Buds strongly 4- or 5-sided with angles very prominent (almost winged) ..... *E. calycogona* var. *spaffordii*
1. Buds and fruits round in cross-section
   4. Pedicels very slender, equal to or longer than pyriform bud ..... *E. yilgarnensis*
   4. Pedicels shorter than bud
      5. Adult leaves greyish or bluish green; branchlets glaucous; buds and fruits often glaucous ..... *E. celastroides* subsp. *celastroides*
      5. Adult leaves green; buds, fruits and branchlets not glaucous
         6. Fruits urceolate or contracted at the rim ..... *E. celastroides* subsp. *virella*
         6. Fruits cupular or barrel-shaped or slightly campanulate
            7. Peduncles 0.3-0.5 cm long; opercula conical to slightly beaked ..... *E. brevipes*
            7. Peduncles >0.5 cm long; opercula patelliform or conical ..... *E. gracilis*

20. Eucalyptus quadrans Brooker & Hopper, sp. nov. (Figure 18)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 292 (1990).

Frutex "mallee" *Eucalypto gracili* F. Muell. affinis a qua cortice laevi, foliis juvenilibus tenuibus subtilibusque, alabastris fructibusque majoribus, et hypanthiis ad basin quadrangularibus in sectione transversali differt.

Typus: 3.3 km W of highway, SW of Truslove (Hawkey Road), 33°20'S, 121°40'E, 7 September 1984, *M.I.H. Brooker* 8670 (holo: PERTH; iso: CANB, NSW).

Mallee with affinity to *Eucalyptus gracilis* F. Muell. from which it differs in the smooth stems, thin, delicate juvenile leaves, larger buds and fruit, and hypanthium which is 4-sided in cross-section towards the base.

Mallee to 5 m tall with grey, creamy, greenish or coppery smooth bark. *Juvenile leaves* shortly petiolate, crowded, linear to narrowly lanceolate, to 6 x 0.6 cm, dull, glaucous. *Adult leaves* petiolate, alternating, narrowly lanceolate, to 10 x 1.3 cm, concolorous, glossy, green; side veins acute; reticulation dense, with numerous relatively large intersectional oil glands. *Inflorescences* axillary, unbranched, 7-flowered; peduncles more or less slender, angular in cross-section or somewhat flattened, to 1.5 cm long. *Buds* pedicellate, to 0.7 x 0.5 cm, hypanthium obconical in outline, 4-sided in cross-section, operculum variable, patelliform, pyramidal or slightly beaked. *Stamens* inflexed with outer long filaments barren, inner short filaments with anthers. *Fertile filaments* narrowing sharply at summit and anthers basifixed, cuboid to globose, opening by terminal pores. *Staminodes* much twisted in flower. *Flowers* creamy white. *Style* narrowed at base. *Ovules* in 4 vertical rows. *Fruits* pedicellate, obconical or oblong in outline, 4-sided in cross-section, to 0.7 x 0.7 cm; rim thin; disc broad, descending, often spreading inwards to the deeply sunken ovary roof; valves 4(5), included. *Seed* pale reddish brown, flattened ellipsoidal, smooth.

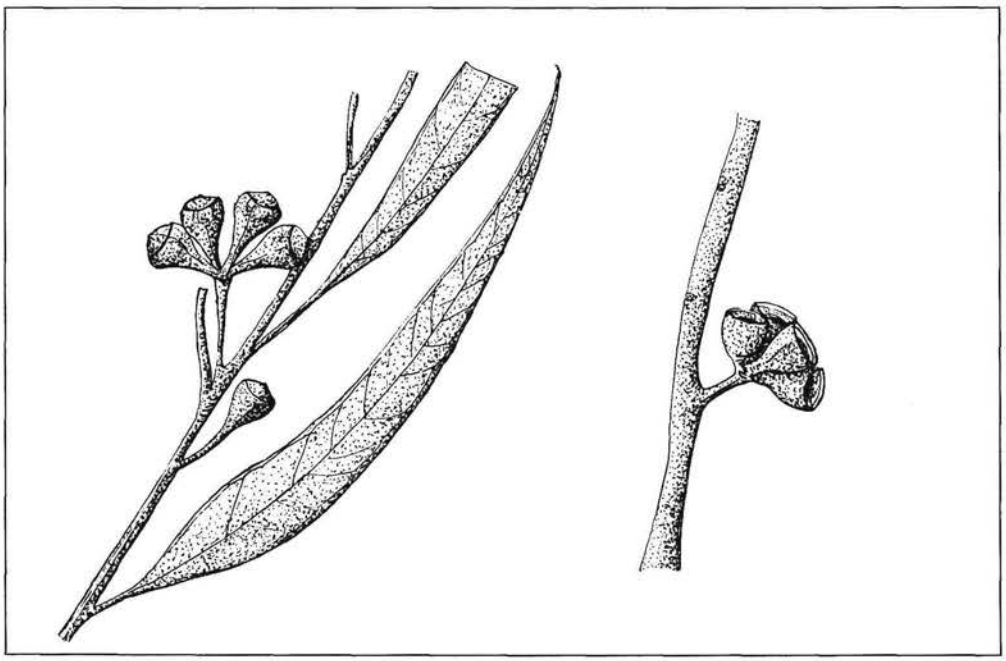

Figure 18. *E. quadrans* - buds (x1.2) and fruit (x1.1) (*MIHB* 8670)

Other specimens examined. WESTERN AUSTRALIA: 6 miles W of Norseman-Esperance Road on road to Lake King, 18 September 1971, *K. Allan* 769 (PERTH); 2½ miles E of Circle Valley, 25 April 1952, *P.H. Barrett* 8 (PERTH); 6 miles S of Salmon Gums, 16 September 1952, *P.H. Barrett* 42 (PERTH); 4 km along Mt Ney Road, NE of Kau Rock Road, 12 August 1982, *M.I.H. Brooker* 7553 (CANB, PERTH); NE of Esperance, 5 May 1984, *M.I.H. Brooker* 8663 (CANB, PERTH); c. 7 km along Kau Rock Road towards NW, 16 January 1983, *M.I.H. Brooker* 8791 (CANB, PERTH); 2 km NE of Mt Ridley t/o on Dempster Road, 9 April 1985, *M.I.H. Brooker* 8925 (CANB, PERTH); 7.2 km from Mt Ridley t/o going N, 5 November 1986, *M.I.H. Brooker* 9507 (CANB, MEL, NSW, PERTH); c. 10 km N of Grasspatch, 7 November 1986, *M.I.H. Brooker* 9523 (CANB, PERTH); 3.6 km from end of made road up Field's Road to N, 8 November 1986, *M.I.H. Brooker* 9526 (CANB, MEL, NSW, PERTH); NE of Esperance, 5 September 1984, *M.I.H. Brooker* 9663 (AD, CANB, NSW, PERTH); 3 km E of Geordie Rock, 27 March 1983, *M.A. Burgman* 1066 & *S. McNee* (PERTH); 17 km NW of Clyde Hill, 4 May 1983, *M.A. Burgmann* 1237 & *S. McNee* (PERTH); 3.5 km WNW of Mt Burdett on Norwoods Road, 1 October 1983, *M.A. Burgman* 2563 & *S. McNee* (PERTH; 21 km NW of Clyde Rock, 13.4 km SE of Mt Ney Road on Clyde Rock Road, *M.A. Burgman* 3146 & *C. Layman* (PERTH); between Norseman and Salmon Gums at 520.6 m.p., 29 March 1968, *S.G.M. Carr* 624a (PERTH); Grasspatch, 31 March 1968, *S.G.M. Carr* 626 (PERTH); 0.9 miles S of Kumarl, 24 March 1968, *G.M. Chippendale* 390 (PERTH); 516 mile post on Norseman-Esperance Road, July 1972, *R.J. Edmiston* E30 (PERTH); Salmon Gums, 12 September 1964, *R.H. Kuchel* 1738 (AD); Scaddan, June 1973, *O. Loneragan* 50 (PERTH); 12 km E of Scaddan, 14 October 1982, *P. van der Moezel* 197 (PERTH); 16 km NE of Scaddan on Truslove Road, 13 September 1984, *P. van der Moezel* 483 (PERTH); 50 km E of Ravensthorpe, 22 February 1983, *K. Newbey* 9719 (PERTH); Young River c. 40 km from the coast, 16 December 1974, *R. Pullen* 10061 (CANB, PERTH); Pine Hills Rock-hole, between Mt Ragged and Balladonia, 18 December 1974, *R. Pullen* 10090 (PERTH); 4 miles S of Salmon Gums, 18 April 1953, *R.D. Royce* 4053 (PERTH); S of Circle Valley, Norseman-Esperance Road, 15 September 1962, *F.G. Smith* 1571 (PERTH).

Distribution. The hinterland of Esperance, at least as far as Mt Heywood to the north-east, and Salmon Gums in the north, Western Australia (Figure 11).

Conservation status. Common and widespread. Not considered to be endangered.

Flowering period. August-November.

Etymology. The name refers to the 4-sided lower part of the hypanthium (Latin *quadrans*).

Notes. As implied, the distribution limits of *E. quadrans* are not known as it occurs in relatively, unexplored country. To the west, i.e. towards Ravensthorpe, it appears to grade into a related, delicate small-budded and small-fruited form, again with the crowded feathery fine juvenile leaves. This taxon is being treated by others.

Eucalyptus ser. **Porantherae** Benth., Fl. Austral. 3:191, 213 (1867). *Type: E. uncinata* Turcz. lectotype, *fide* G.M. Chippendale, "Fl. Australia" 19: 503 (1988).
E. ser. *Normales* Benth., *op. cit.* 193, 223. p.p. *Type:* not designated.
E. sect. *Terminales* Maiden, "Crit. Rev. Gen. *Eucalyptus*" 6: 530 (1924). p.p. *Type:* not designated.
E. ser. *Fruticosae* Blakely, "Key to the Eucalypts" 53: 221 (1934). *Type:* not designated.
[*E.* ser. *Foecundae* Pryor & Johnson, "Class. of the Eucalypts" 47: (1971), *nom. inval. Type: E. foecunda* Schauer].

The *E.* ser. *Porantherae* belongs in the informal *E.* subgenus *Symphyomyrtus* and is diagnosed by the following: tree or mallee, bark smooth rarely rough, cotyledons bisected, pith of branchlets not glandular, adult leaves glossy green with dense reticulation, stamens inflexed, clavate towards top with completely adnate anthers, ovules in 4 vertical rows, rim of fruit thick with whitish disc, seeds with smooth coat and shallow longitudinal furrows.

The *Porantherae* were recently treated by Brooker (1988) (as "*E.* ser. *Foecundae*") and this single new species may be entered in the key as follows:

9. Bark smooth
"10" Crown of adult leaves somewhat olive-green, leaf edges slightly crenulate; juvenile leaves linear-oblong, glaucous ..... 21. *E. olivina*
"10" Crown of adult leaves green, leaf edges entire; juvenile leaves linear to orbicular, green to glaucous
10 etc.

21. Eucalyptus olivina Brooker & Hopper, sp. nov. (Figure 19)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 419 (1990).

Arbor vel frutex "mallee" ad *Eucalyptum* seriem *Porantheras* Benth. pertinens ad 4 m altus cortice laevi cinereo. Folia adulta petiolata, alternantia, angusto-lanceolata vel falcata, ad 8 x 0.8 cm, marginibus interdum plus minusve crenatis, leviter nitentia, pallido-viridia vel olivacea. Inflorescentiae axillares, non ramosae, pedunculis ad 0.7 cm longis. Alabastra fusiformia. Fructus pedicellati quadrangules, cupulati, ad 0.4 x 0.4 cm, disco annulato rimosis radiatis, vel descendentibus, albido.

Typus: At turn-off to Lake Cronin between Cross Roads and Mt Holland, E of Hyden, 32°23'S, 119°45'E, 22 July 1988, *M.I.H. Brooker* 10011 & *C.J. Ranford* (holo: PERTH; iso: AD, CANB, MEL, NSW).

Tree or *mallee* to 4 m tall with smooth grey bark. *Seedling axis* verruculose. *Seedling* and *juvenile leaves*, sessile, remaining decussate for many pairs, linear-oblong, boat-shaped, to 3.5 x 0.8 cm, glaucous. *Adult leaves* petiolate, alternating, narrowly lanceolate or sometimes falcate, to 8 x 0.8 cm, concolorous, slightly glossy, light green to olive green, with margins more or less crenulate; reticulation dense, with numerous intersectional oil glands. *Inflorescences* axillary, unbranched, 7-11 flowered; peduncles to 0.7 cm long. *Buds* fusiform, to 0.7 x 0.3 cm; operculum conical to slightly beaked. *Stamens* inflexed, all fertile; anthers adnate, basifixed, opening by terminal pores. *Flowers* not seen. *Ovules* in 4 vertical rows. *Fruits* shortly pedicellate, cupular, to 0.4 x 0.4 cm; rim thick; disc annular with radial splits, or descending, whitish; valves 3, just exserted. *Seed* grey, compressed-ovoid, smooth, with shallow longitudinal furrows.

Other specimens examined. WESTERN AUSTRALIA: 16.4 miles W of Coolgardie-Norseman road on Hyden track, 19 Sep. 1971, *K.M. Allan* 774 (PERTH); 291 mile peg on Hyden-Norseman track, 20 Sep. 1971, *K.M. Allan* 788 (PERTH); 283 m.p. on Hyden-Norseman track, 20 September 1971, *K. Allan* 790 (PERTH); 2.3 miles N of Hyden-Norseman track on RPF, 22 September 1971, *K. Allan* 812 (PERTH); 26 miles N of Lake Grace, 4 May 1959, *T.E.H. Aplin* 478 (PERTH); 40 miles SW of Peak Charles, 29 Mar. 1970, *J.S. Beard* 5866 (PERTH); 16.2 km NNW of Hyden towards Narambeen,

4 October 1975, *M.I.H. Brooker* 4995 (CANB, PERTH); 2 km S of Hyden-Norseman Road, 6 km W of Cross Roads, 11 August 1979, *M.I.H. Brooker* 6319 (CANB, PERTH); 34 km from Narambeen on Hyden Road, 12 August 1979, *M.I.H. Brooker* 6327, 6328 (CANB, PERTH); road from The Humps to Mt Walker, 31 December 1979, *M.I.H. Brooker* 6742 (CANB, PERTH); 17.7 km E of grid in RPF east of Hyden, 9 August 1984, *M.I.H. Brooker* 8624 (PERTH); 1.6 km N of Hyden track, 9 Aug. 1984, *M.I.H. Brooker* 8630 (CANB, PERTH); N of Hyden, 32°15'S, 118°55'E, 19 December 1984, *M.I.H. Brooker* 8767 (CANB, NSW, PERTH); between road and Dragon Rock, 21 Oct. 1986, *M.I.H. Brooker* 9477 (PERTH); 21.1 km SE from E Hyden Bin Road on Lake King Road, W of Hurlstone, 21 July 1988, *M.I.H. Brooker* 10010 (CANB, PERTH); 26.6 km S of Cross Roads, E of Hyden (32°40'S, 119°47'E), 22 July 1988, *M.I.H. Brooker* 10015 & *C.J. Ranford* (AD, CANB, MEL, NSW, PERTH); 1.2 km W of gate on Lake Varley Road, 22 July 1988, *M.I.H. Brooker* 10020 (CANB, PERTH); W of N Ironcap, E of Hyden, 24 August 1988, *M.I.H. Brooker* 10051 (CANB, PERTH); 16 km N of Moolyall Rocks, on Hayes Road, 25 Mar. 1983, *M.A. Burgman* 1033 & *S. McNee* (PERTH); R. Smith's NE site, Lake Cronin, 8 December 1966, *S. Chambers* 177 (PERTH); site 68 along State Vermin Fence No 7, 100 km SE of Southern Cross, 8 October 1986, *J. Dodd* 314 (PERTH); Harrismith, 5 Mar. 1924, *C.A. Gardner* 2106 (PERTH); Lake Cronin, 85.7 km E of Hyden, ENE side of Lake Cronin, 23 September 1989, *N. Gibson* 3 (PERTH); 20 km N of Hyden, 19 Oct. 1987, *J.W. Green* 5528 (PERTH); E of North Ironcap on Forrestania-Southern Cross Road, 20 October 1987, *J.W. Green* 5555 (PERTH); 69 km E of Hyden, 20 Oct. 1987, *J.W. Green* 5562 (PERTH); 19 km N of Holt Rock, 17 September 1976, *R. Hnatiuk* 760846 (PERTH); 16 km SE of Kulin, 5 July 1977, *R.J. Hnatiuk* 770079 (PERTH); 6.3 km SW of McDermid Rock, 13 February 1981, *G.J. Keighery* 3814 (PERTH); Frank Hann Nat. Park, 7 Aug. 1978, *D. Monk* 300 (PERTH); Frank Hann Nat. Park, 12 October 1978, *D. Monk* 392 (PERTH); 305 mile peg on Norseman-Hyden Road, 7 Sep. 1973, *E.C. Nelson* ANU 17336 (PERTH); 65 km E of Lake King on road to Daniell, 12 Sep. 1973, *E.C. Nelson* ANU 17259 (PERTH); 5 miles NE of Lake King, 4 December 1970, *K. Newbey* 3335 (PERTH); 35 km SW of McDermid Rock, 15 July 1979, *K.R. Newbey* 5300 (PERTH); 2 km W of Sunday Soak, ca. 65 km NNW of Norseman, 17 July 1979, *K.R. Newbey* 5335 (PERTH); 0.5 miles E of Newdegate on road to Lake King, 28 Aug. 1973, *M.T. Tindale* 3765 (NSW, PERTH); Lake King Road, 15 miles E of Newdegate, 27 Nov. 1974, *E.W. Wittwer* 1479 (PERTH).

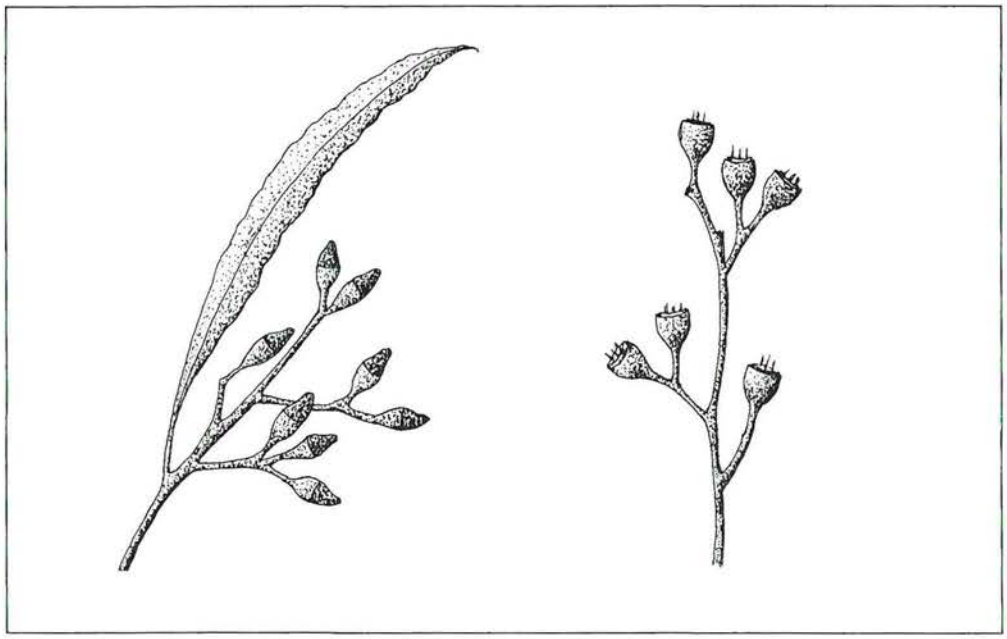

Figure 19. *E. olivina* - buds and fruit (*MIHB* 4995)

Distribution. South-eastern wheatbelt to well east of Hyden (Figure 11).

Conservation status. Common and widespread. Not considered to be endangered.

Flowering period. Not known.

Etymology. From the Latin *olivinus* - olive-coloured, referring to the leaves.

Notes. E. olivina favours deep reddish sands. It may be recognised by the mallee habit, smooth stems, slightly olive-green crown and crenulate leaves. The pedicels of the fruit are often angular with the angles extending just to the base of the hypanthium, showing a probable relationship to *E. kumarlensis* Brooker to the east and which has green juvenile leaves. Of other species in the series, it is replaced by *E. rigidula* Maiden in the north, *E. hypochlamydea* Brooker to the west and *E. perangusta* Brooker to the south.

Eucalyptus ser. **Rufispermae** Maiden, "Crit. Revis. Gen. *Eucalyptus*" 7:152 (1929).

Type: E. woodwardii Maiden

The *E.* ser. *Rufispermae* belongs in the informal *E.* subgenus *Symphyomyrtus* and is diagnosed as follows: tree, mallet or mallee, bark rough or smooth, cotyledons reniform, pith of branchlets glandular, juvenile leaves petiolate, adult leaves dull or glossy with veins and veinlets somewhat repand, inflorescences 3- or 7-flowered (rarely more), stamens inflexed, all fertile, anthers versatile, sub-basifixed, cuboid, opening by longitudinal slits, ovules in 4 vertical rows, seed lustrous ruby red, flattened, with shallow reticulum, hilum ventral.

The series *Rufispermae* is probably the largest in the genus with more than 50 taxa. As the majority are yet to be described it would be of little value, as for the *Subulatae* earlier, to provide a key to the published species only.

22. Eucalyptus georgei Brooker & Blaxell subsp. **fulgida** Brooker & Hopper, subsp. nov. (Figure 20)

Brooker & Kleinig, "Field Guide to *Eucalypts*" 2: 419 (1990) as *E. fulgida.*

A subspecie typica foliis adultis non glaucis et viridibus nitentibus et fructibus minoribus brevioribus differt.

Typus: 8.2 km E of Cross Roads, E of Hyden, 32°24'S, 119°50'E, 21 October 1986, *M.I.H. Brooker* 9482 (holo: PERTH; iso: AD, CANB, MEL, NSW).

It differs from the typical subspecies by the non-glaucous, shiny green leaves and the smaller, shorter fruits.

Tree to 20 m tall with completely smooth pale coppery bark with much ribboning in season. Forming *lignotubers. Juvenile leaves* petiolate, alternating, ovate, to 12 x 6 cm, dull, glaucous. *Adult leaves* petiolate (petioles to 3.5 cm long, minutely warty), alternating, lanceolate or falcate, to 15 x 2.5 cm, glossy, green; reticulation very dense, veinlets sinuate, with numerous very irregular intersectional

oil glands. *Inflorescences* axillary, unbranched, glaucous, 7-flowered; peduncles stout, angular, to 1 cm long. *Buds* on short, stout angular pedicels, shortly clavate, to 1 x 0.7 cm; operculum hemispherical. *Flowers* creamy white. *Fruits* subsessile to shortly pedicellate, obconical, to 1 x 1.2 cm; rim thick with broad ascending, inner operculum scar; valves 5, not exserted.

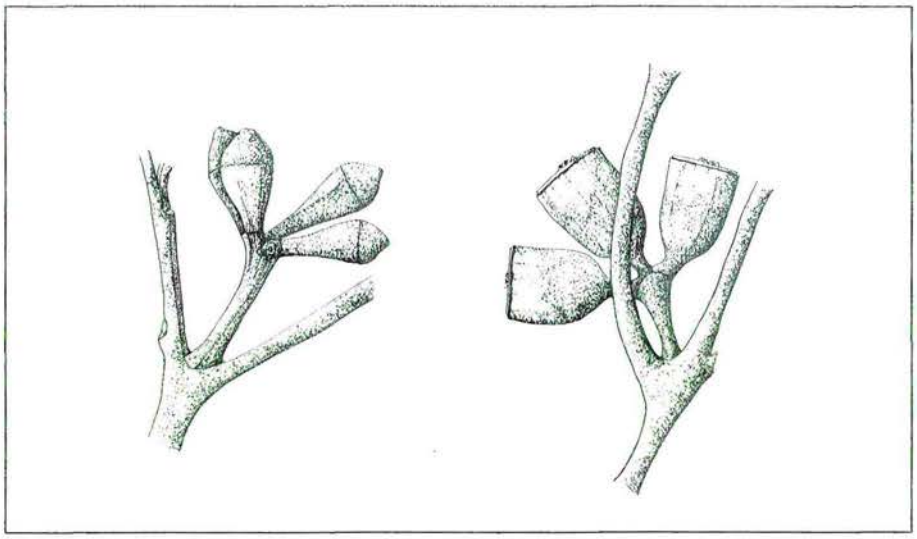

Figure 20. *E. georgei* subsp. *fulgida* - buds (*MIHB* 10069) and fruit (*MIHB* 10071)

Other specimens examined. WESTERN AUSTRALIA: 1.5 and 4.7 km N of Hyden-Norseman track from 8.6 km E of Cross Roads, 24 August 1988, *M.I.H. Brooker* 10069, 10071 (AD, CANB, MEL, NSW, PERTH); E of Mount Holland, July 1930, *C.A. Gardner s.n.* (PERTH); 6 Feb. 1981, *G.J. Keighery* 3771 (PERTH); Mt Holland area, 16 Aug. 1966, *A. Kessell* 408 (PERTH); near Lake Cronin, 4 July 1979, *K.R. Newbey* 5205 (PERTH); 6.5 km E of Lake Cronin, 21 July 1981, *K.R. Newbey* 8332 (PERTH); 62 km ENE of Lake King, 23 Aug. 1982, *K.R. Newbey* 9711 (PERTH).

Distribution. East of Hyden in uncleared vegetation (Figure 21).

Conservation status. Poorly known and in need of further survey (Priority 2 (as *E.* aff. *georgei*) in Hopper *et al.* (1990)) on reserve flora list.

Flowering period. Not known.

Etymology. From the Latin *fulgidus* - shining.

Notes. E. georgei subsp. *fulgida* is easily recognised in the field by the slender smooth erect trunks, and the crown of large thick glossy green leaves. The buds and fruits may or may not be glaucous. It occurs in more or less pure stands and is notable in season, because of its stature compared with most other taxa in the series *Rufispermae,* and for the long ribbons of partly shed bark.

23. Eucalyptus tenuis Brooker & Hopper, sp. nov. (Figure 22)

Brooker & Kleinig, "Field Guide to *Eucalypts*" 2: 330 (1990).

Arbor parva ("mallet") ad 8 m alta *Eucalypto pileatae* Blakely affinis a qua constanter habitu arboreo, caulibus gracilibus, inflorescentiis 3 vel 7-floribus, pedicellis longioribus et fructibus obconicis vel campanulatis differt.

Typus: 15.2 km south of Nepean Mine on Burra Rock Road, 31°18'S, 121°08'E, 12 Nov. 1983, *M.I.H. Brooker* 9075 (holo: PERTH; iso: CANB, NSW).

Mallet or rarely mallee to 8 m tall with affinity to *Eucalyptus pileata* Blakely from which it differs in the constant tree (mallet) form, slender stems, 3- or 7-flowered inflorescences, longer pedicels, and obconical to campanulate fruits.

Whipstick mallet or more rarely erect-stemmed *mallee* to 8 m tall with grey over pale salmon-coloured smooth bark, often partly shed and hanging in ribbons. *Juvenile leaves* petiolate, alternating, narrowly lanceolate to lanceolate, to 12 x 1.5 cm, concolorous, glossy, bright green, ovate, to 7 x 4.5 cm. *Adult leaves* petiolate, alternating, reticulation dense with numerous large, irregular, intersectional oil glands. *Inflorescences* axillary, unbranched, 3 or 7-flowered; peduncles terete or slightly flattened, 0.8-5 cm long, often pendulous. *Buds* on distinct, often long pedicels, ribbed, clavate, to 1.1 x 0.8 cm; operculum conical. *Flowers* not seen. *Fruits* pedicellate, obconical, to 1 x 1 cm; rim thick; disc level to obliquely descending; valves 4(5), to rim level.

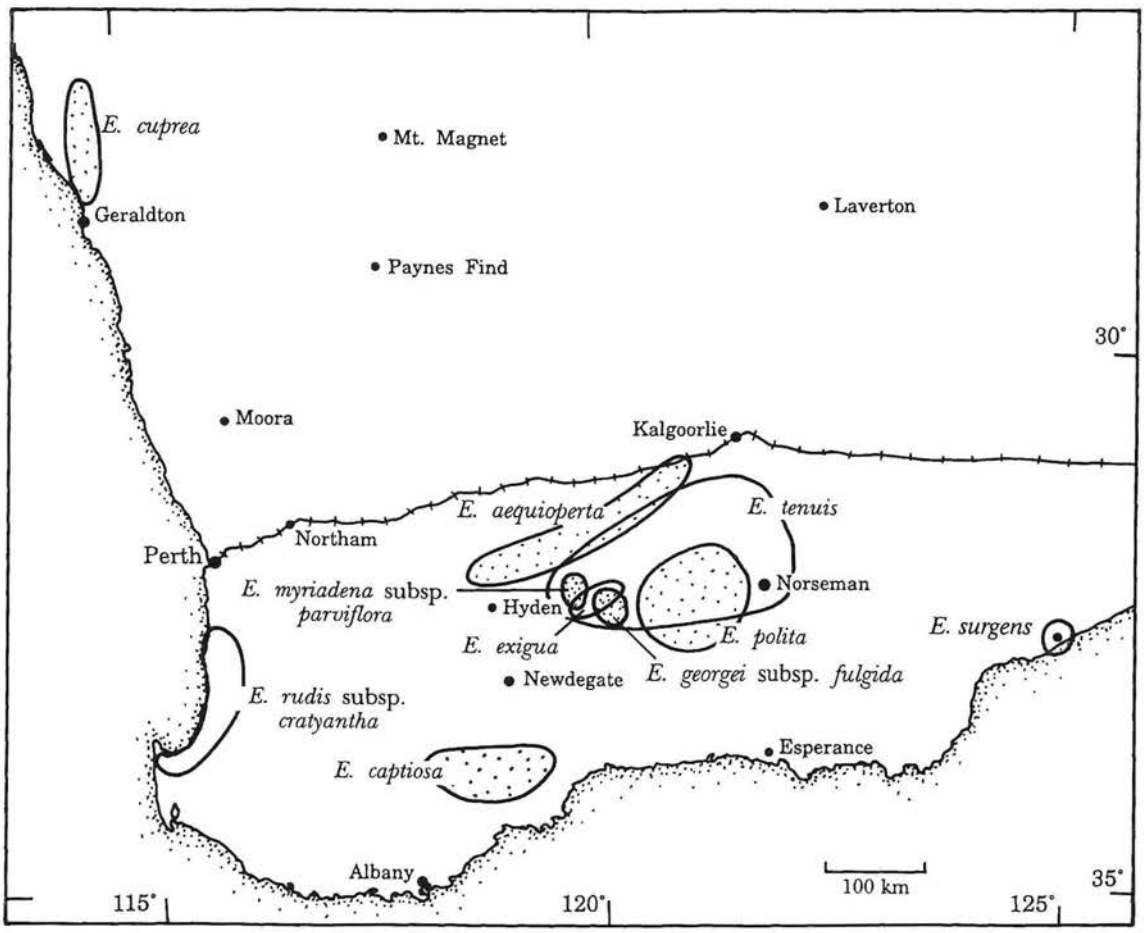

Figure 21. Distribution of taxa Nos 22-26, 28-32.

Other specimens examined. WESTERN AUSTRALIA: 5 km NE of Norseman PO, ± 1 km N of Eyre Highway, 29 August 1974, *A.C. Beauglehole* 49392 (PERTH); 9 km N of Hyden-Norseman track on Mt Day Road, 7 November 1983, *M.I.H. Brooker* 8356 (CANB, NSW, PERTH); NE of Mt Day, 32°07'S, 120°31'E, 6 April 1985, *M.I.H. Brooker* 8901 (PERTH); NW of North Ironcap, 24 August 1988, *M.I.H. Brooker* 10053 (AD, CANB, MEL, NSW, PERTH); between Boorabbin and Bullabulling, 21 Nov. 1991, *M.I.H. Brooker* 10891 (AD, CANB, MEL, NSW, PERTH); 10.4 km N of BP petrol station on Kambalda East and West road, on road to Kalgoorlie, 23 Nov. 1991, *M.I.H. Brooker* 10898 (AD, CANB, MEL, NSW, PERTH); 12 km ENE of Mt Thirsty in the Norseman district, July 1985, *N. Caporn s.n.* (PERTH); 8.8 km N of Hyden-Norseman track along Mt Day track, 7 Nov. 1983, *K. Hill* 624, *L. Johnson, D. Blaxell, I. Brooker & S. Hopper* (CANB, NSW, PERTH); 315-332 mile pegs on Hyden-Norseman track, 16 Aug. 1966, *A. Kessell* 425 (PERTH); 3 miles E of Hatters Hill, 9 Dec. 1964, *F. Lullfitz* 3981 (PERTH); 1 mile W of Lake Cronin, 4 December 1970, *K. Newbey* 3326 (CANB, PERTH): 1 km N of Mt Day, c. 121 km W of Norseman, 14 July 1979, *K. Newbey* 5269 (PERTH); 32 km SW of McDermid Rock, c. 116 km W of Norseman, 15 July 1979, *K.R. Newbey* 5301 (PERTH); 20 km SW of McDermid Rock, 26 Mar. 1980, *K.R. Newbey* 6776 (PERTH); 6 km SSE of Boorabbin, c. 96 km E of Southern Cross, 25 July 1981, *K.R. Newbey* 8351 (PERTH); 4.8 km S of Boorabbin, c. 90 km E of Southern Cross, 26 Sep. 1982, *K.R. Newbey* 9619 (PERTH).

Distribution. Sporadically but widely distributed in the scrub between Hyden and Norseman and north towards Coolgardie, Western Australia (Figure 21).

Conservation status. Common and under no major threat.

Flowering period. Not known.

Etymology. The name refers to the notably slender stems of the species at the type locality (Latin *tenuis* - slender).

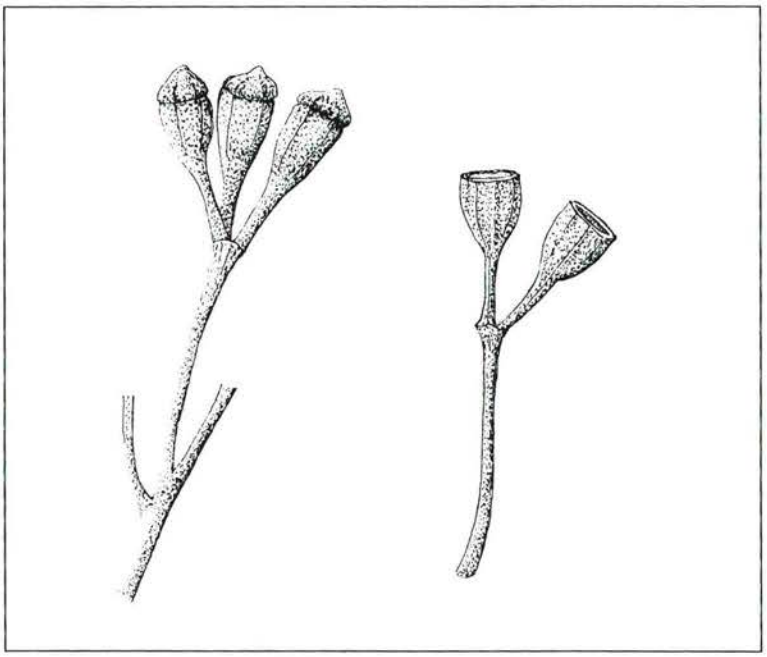

Figure 22. *E. tenuis* - buds and fruit (*MIHB* 10053) (x1.2)

Notes. E. tenuis is usually an attractive mallet, a habit form rare in the series. It is also unusual in the series *Rufispermae* for the occurrence of 3-flowered inflorescences. The peduncles are often pendulous. It is very variable in the pedicels which can be the longest in the series.

24. Eucalyptus polita Brooker & Hopper, sp. nov. (Figure 23)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 338 (1990).

Arbor parva ad 9 m alta cortice laevi. Ramuli leviter glauci. Folia adulta anguste lanceolata, ad 13 x 1.3 cm, hebetia vel leviter nitentia, viridia. Inflorescentiae axillares, non ramosae, 7-florae. Alabastra pedicellis brevibus crassis, vel plus minusve sessilia, ad 0.8 x 0.4 cm, operculo conico vel leviter rostrato costatoque. Fructus obconici vel cupulati, ad 0.5 x 0.4 cm.

Typus: 62.7 km west of Mt Day Road on Hyden-Norseman track, 32°21'S, 119°54'E, 7 November 1983, *M.I.H. Brooker* 8361 (holo: PERTH; iso: AD, CANB, MEL, NSW).

Small tree to 9 m tall or rarely mallee, with grey, whitish grey, yellow-green or pinkish grey smooth bark becoming salmon pink to coppery. *Branching habit* sometimes steep. *Branchlets* red, slightly glaucous. *Juvenile leaves* petiolate, alternating, ovate, to 10 x 6 cm, dull, blue-green to glaucous. *Adult leaves* petiolate, alternating, narrowly lanceolate, to 13 x 1.3 cm, concolorous, at first dull, maturing slightly glossy green; reticulation dense, with scattered intersectional oil glands. *Inflorescences* axillary, unbranched, 7-flowered; peduncles slightly angular, 0.6 - 0.9 cm long. *Buds* shortly, thickly pedicellate or more or less sessile, ovoid, 0.6-0.8 x 0.3-0.4 cm; operculum conical to slightly beaked, slightly ribbed. *Flowers* not seen. *Fruits* subsessile to shortly pedicellate, obconical to cupular, 0.4-0.5 x 0.3-0.4 cm; disc obliquely descending, often whitish; valves 3 or 4, slender, often slightly exserted.

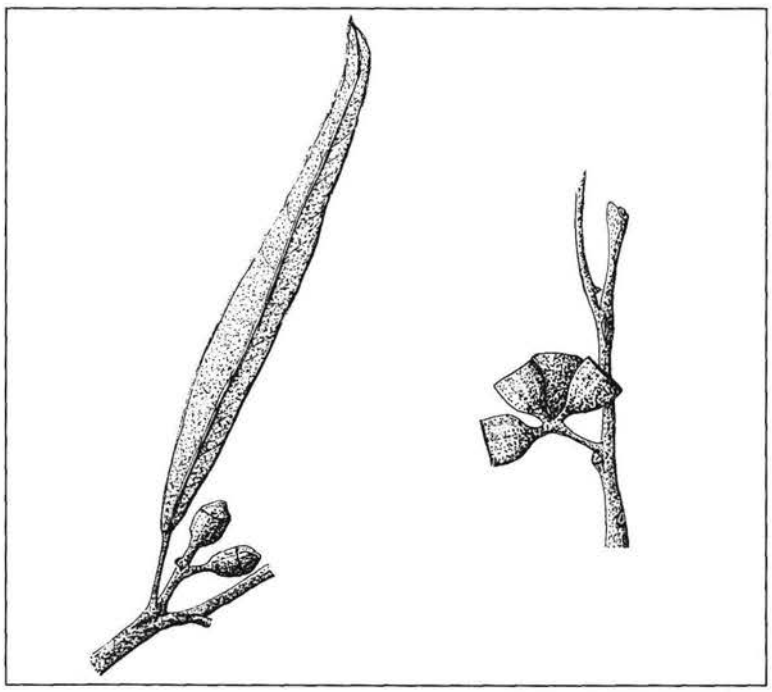

Figure 23. *E. polita* - buds (*MIHB* 7060) and fruit (*MIHB* 8361) (x1.2)

Specimens examined. WESTERN AUSTRALIA: Eyre Highway, 2.8 miles N of Daniell Siding, 16 Nov. 1970, *J. Baker* 81 (CANB, PERTH); 1.5 miles S of Daniell Siding, 23 Apr. 1952, *P.H. Barrett* 1 (PERTH); 90 mile tank/Kumarl Road, E of Bremer Range, Mar. 1983, *K. Brady* 18 (PERTH); 1.5 miles S of Daniell Siding, 17 July 1952, *P.H. Barrett* 12 (PERTH); 11 miles NW of 90 mile tank, NW of Salmon Gums, 17 Dec. 1970, *M.I.H. Brooker* 2518 (PERTH); c. 6 miles by road from Norseman-Coolgardie Road, 6.6 km from Norseman, 6 April 1974, *M.I.H. Brooker* 4539 (CANB, PERTH); 5.5 km W of highway on track 15 km S of Hyden t/o, 9 Nov. 1981, *M.I.H. Brooker* 7060 (CANB, PERTH); 5.6 km W of Coolgardie-Norseman Road, 32°09'S, 121°37'E, 6 Nov. 1983, *M.I.H. Brooker* 8349 (AD, CANB, MEL, NSW, PERTH); 34 km WNW of Salmon Gums, 11 May 1983, *M.A. Burgman* 1316 & *S. McNee* (PERTH); 16.4 km W of Peak Charles turn-off on Lake King Road, 8 Nov. 1986, *M.I.H. Brooker* 9536 (CANB, PERTH); c. 55 km SSW of Norseman, 5 km from highway towards Peak Charles, 20 Sep. 1979, *M.D. Crisp* 5954 (PERTH); 8 miles north westward from Norseman, 6 Nov. 1953, *C.A. Gardner* 11153 (PERTH); 5.6 km W of highway on track turning off 11 km N of Norseman, 6 Nov. 1983, *K. Hill* 589, *L.A.S. Johnson, D.F. Blaxell* (NSW, PERTH); 17 km WNW of 90 Mile Tank, 21 km SW of Mt Glasse, Bremer Range, 6 Sep. 1982, *S.D. Hopper* 2497 (PERTH); Kumarl, Apr. 1938, *L. Horbury s.n.* (PERTH); Woodline, c. 85 km ENE of Norseman, 7 Aug. 1980, *G.J. Keighery* 2979 (PERTH); 31 miles E of 90 mile tank, 24 May 1955, *A.R. Main* 04746 (PERTH); Woolyeener Hill, 6 km S of Norseman, 14 Mar. 1980, *K.R. Newbey* 6742 (PERTH); 2 km NE of Peak Charles, c. 46 km WNW of Salmon Gums, 21 Mar. 1980, *K.R. Newbey* 6762 (PERTH); Peak Charles Nat. Park, 23 Mar. 1980, *K. Newbey* 6769 (PERTH); 30 km ESE of Sinclair Soak, c. 75 km NE of Norseman, 6 Aug. 1980, *K. Newbey* 6959 (PERTH); 19 km ENE of Norseman, 21 Sep. 1980, K. Newbey 7534 (PERTH); 75 km NE of Norseman, 21 Aug. 1982, *K. Newbey* 9710 (PERTH); Brockway Timber Reserve near Norseman, Jan. 1989 *L.M. Sandiford s.n.* (PERTH); between Lake King and Norseman, *A. Stewart s.n.* (PERTH).

Distribution. North-west of Norseman, the Johnston Lakes area and south towards Peak Charles, Western Australia (Figure 21).

Conservation status. Common and widespread.

Flowering period. Not known.

Etymology. From the Latin *politus* - polished, smooth, in reference to the bark compared with the related rough-barked species, *E. kondininensis* Maiden & Blakely and *E. clelandii* Maiden.

Notes. E. polita has been confused with *E. clelandii* (Maiden) Maiden but is distinguished by the completely smooth stems or trunk, glossy leaves and shortly pedicellate or sessile smaller buds and fruit.

Eucalyptus ser. **Torquatae** Chippendale, Fl. Australia 19: 506 (1988).

Type: E. torquata Luehm.

The *E.* ser. *Torquatae* belongs in the informal *E.* subgen. *Symphyomyrtus*. It is diagnosed by the following: tree or mallee, bark rough or smooth, cotyledons reniform, pith of branchlets glandular, juvenile leaves petiolate, adult leaves glossy except for one species, inflorescences 3-, 7-, or 11-flowered, stamens inflexed, all fertile except in one species, anthers versatile, sub-basifixed, oblong, opening by longitudinal slits, ovules in 4 vertical rows, seed grey to grey-brown, compressed-ovoid, deeply pitted on the dorsal side and toothed around the edges, hilum ventral.

Key to species of *E.* ser. *Torquatae*

1. Leaves dull ..... *E. torquata*
1. Leaves glossy
 2. Inflorescences 3-flowered
  3. Tree ..... *E. corrugata*
  3. Mallee ..... *E. griffithsii*
 2. Inflorescences 7- to 11-flowered
  4. Operculum narrower than hypanthium
   5. Fruit to 0.8 x 0.8 cm ..... *E. brachycalyx*
   5. Fruit to 1.5 x 1 cm ..... *E. rugosa*
  4. Operculum equal to or wider than hypanthium
   6. Operculum conical, as wide as hypanthium
    7. Fruit obconical with exserted, out-turned valves ..... *E. melanoxylon*
    7. Fruit barrel-shaped or cylindrical with valves to rim level ..... *E.* sp.W*
   6. Operculum hemispherical to flattened or cap-shaped and beaked
    8. Operculum hemispherical to flattened; peduncle >0.5 cm long ..... *E. concinna*
    8. Operculum cap-shaped, beaked; peduncle to 0.5 cm long ..... 25. *E. surgens*

* This taxon is to be described by others. The letter code is that used in Brooker & Kleinig (1988).

25. Eucalyptus surgens Brooker & Hopper, sp. nov. (Figure 24)

Inter species seriei *Torquatarum* distinguitur pedunculis brevis crassis (ad 5mm longis), alabastris hypanthio campanulato et operculo rostrato, staminodiis, et fructibus sessilis, cupulatis vel cylindricis, cicatrice prominenti ad apicem.

Typus: Toolinna Cove, ca. 1 km north of coastal cliffs, 20 August 1989, *S.D. Hopper* 7340 (holo: PERTH; iso: CANB, NSW).

Spreading *mallee* to 2.5 m tall with rough bark near base of trunks. Forming *lignotubers. Cotyledons* reniform. *Seedling leaves* petiolate, opposite for 2-4 pairs, then alternating, elliptical then broadly lanceolate to ovate, 5.5-6 x 2.5-3.5 cm, dull, blue-green. *Adult leaves* petiolate, alternating, lanceolate to broadly lanceolate, to 10 x 2 cm, concolorous, glossy, light green. Inflorescences axillary, unbranched, 7-flowered; peduncles short, thick, slightly angular, terete, 0.3 - 0.5 cm long. *Buds* shortly pedicellate, hypanthium campanulate, operculum cap-shaped and beaked, shorter than hypanthium, 1.5 x 0.8 cm, outer operculum shed early; *stamens* inflexed, outer filaments without anthers; anthers versatile, dorsifixed,oblong, opening by longitudinal slits; *flowers* creamy yellow. *Ovules* in 4 vertical rows. *Fruits* more or less sessile, cupular to cylindrical, to 1.2 x 0.9 cm; rim with prominent vertical operculum scar; disc descending; valves 4, below rim level. *Seed* dark brown, compressed-ovoid, pitted.

Distribution. Known only from the type locality on the coastal edge of the Nullarbor Plain. The type population grows with *E. angulosa* Schau., *E. discreta* Brooker and *E. brachycalyx* Blakely on

gradually rising ground adjacent to a flat on the edge of coastal sand-ridges in powdery brown loam and scattered limestone (Figure 21).

Conservation status. Poorly known and in need of further survey.

Flowering period. August-?November.

Etymology. From the Latin *surgens* (rising) alluding to the conspicuous vertical scar on the rim of the fruit.

Notes. The buds and fruits of *E. surgens* resemble those of *E. platycorys* but the two species belong to different taxonomic series based on seed morphology. The series for the latter species has not been formally published. The most striking distinction of the new species in relation to all other species in the informal section *Dumaria* is the presence of staminodes. Staminodes throughout the genus *Eucalyptus* are a strong diagnostic feature for taxonomic series, for example, *E.* ser. *Heterostemones* (*E. gracilis* and related species). The existence of a species in *Dumaria* with unique qualitive character, although seen elsewhere in the eucalypts, can be seen also with *E. pimpiniana* which has unique leaf architecture for the section. These instances emphasise the independent accession of characters of no recognised adaptive value in series throughout the genus.

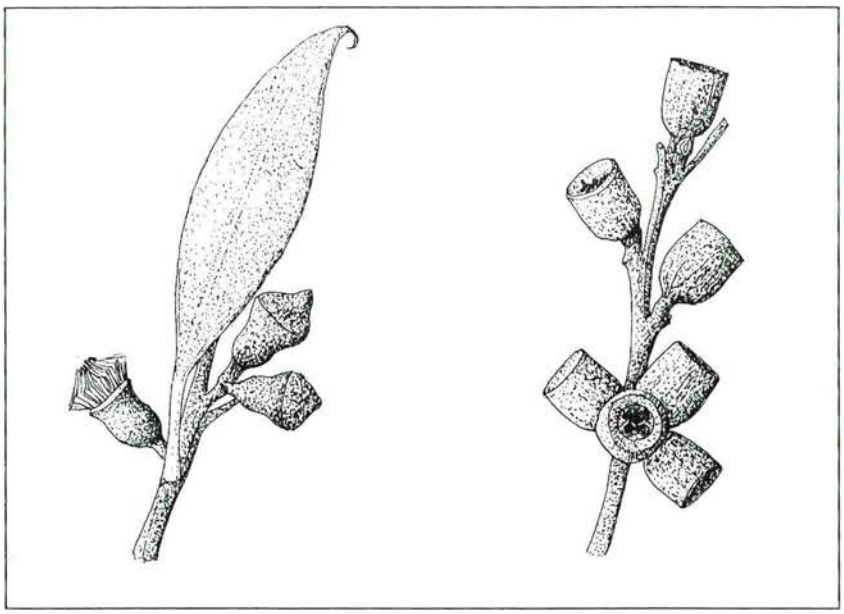

Figure 24. *E. surgens* - buds and fruit (*SDH* 7430)

Eucalyptus ser. **Tetrapterae** Blakely, "A Key to the Eucalypts" 15: 73 (1934).

Type: E. tetraptera Turcz.

The *E.* ser. *Tetrapterae* belongs to the informal *E.* subgen. *Symphyomyrtus* and is diagnosed as follows: tree, mallet, mallee or shrub, bark smooth, pith of branchlets with or without oil glands, cotyledons reniform, juvenile leaves petiolate, adult leaves glossy green or olive-green, firm to very

thick, inflorescences 1-, 3-, or 7-flowered, stamens inflexed, ovules in 4-8 vertical rows, seeds usually black, flanged and shallowly pyramidal, with ventral side ribbed.

Key to species of *E.* ser. *Tetrapterae*

1. Inflorescences 1-flowered
   2. Straggly shrub with very thick adult leaves to 25 x 7 cm; buds and fruit very big, square in cross-section, rigidly down-turned ..... *E. tetraptera*
   2. Erect mallet; adult leaves to 10 cm long; buds and fruit pendulous
      3. Buds and fruits square in cross-section
         4. Operculum to 1 cm long, pyramidal or hemispherical or flattened, usually wider than long ..... *E. forrestiana*
         4. Operculum, >1.2 cm long, beaked, longer than wide ..... 27. *E. dolichorhyncha*
      3. Buds and fruits round in cross-section apart from strong multiple ribbing ..... *E. stoatei*
1. Inflorescences 3- or 7-flowered
   5. Buds and fruits square in cross-section; buds to 2.8 x 1.3 cm; fruit to 2.6 x 1.8 cm ..... *E. erythrandra*
   5. Buds and fruits round in cross-section
      6. Adult leaves to 1 cm wide ..... 26. *E. captiosa*
      6. Adult leaves >1 cm wide
         7. Fruits to 1.3 x 1.3 cm, smooth or slightly ribbed ..... *E. incrassata*
         7. Fruits to 2 x 2 cm, coarsely ribbed
            8. Fruits contracted around middle; inland on red sand ..... *E. ceratocorys*
            8. Fruits not contracted around middle; coastal ..... *E. angulosa*

26. Eucalyptus captiosa Brooker & Hopper, sp. nov. (Figure 25)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 419 (1990).

Frutex "mallee" vel arbor "mallet" ad *Eucalyptum* seriem *Tetrapteras* Blakely pertinens, ad 4 m alta cortice praecipue laeviinterdum taeniformi. Folia adulta parva, angusta, ferentia erecta. Inflorescentiae axillares, erectae vel pendulae, 3 vel 7-florae, alabastris pedicellatis. Alabastra fructusque aliquantam leviter costati.

Typus: 1.8 km W of Jerramungup North Road on Rabbit Proof Fence Road, 33°50'S, 118°55'E, 21 July 1988, *M.I.H. Brooker* 10000 & *C.J. Ranford* (holo: PERTH; iso: AD, CANB, MEL, NSW).

Mallee or mallet to 4 m tall usually with grey, creamy white or pale coppery smooth bark, occasionally ribbony on the stems. *Pith* glandular at some nodes, i.e. variable in this character. *Seedling leaves* petiolate, opposite for 1(2) nodes. *Juvenile leaves* petiolate, alternating, ovate to lanceolate, to 7 x 2.5 cm, dull, blue-green. *Adult leaves* petiolate, alternating, narrowly lanceolate, 5-7 x 0.8-1 cm, concolorous, glossy, green; reticulation dense or sometimes obscure and broken, with numerous

irregular, apparently intersectional oil glands. *Inflorescences* axillary, unbranched, 3- or 7-flowered; peduncles slightly flattened, widening towards the top, to 1.5 cm long. *Buds* pedicellate, usually slightly ribbed, hypanthium truncate-pyriform or cylindrical, operculum strongly beaked with narrow often curved extension, to 1.4 x 0.5 cm. *Stamens* inflexed, all fertile; anthers versatile, dorsifixed, oblong, opening by longitudinal slits. *Flowers* pale yellow. *Fruits* pedicellate, cupular, to 1 x 0.9 cm, often slightly contracted at rim; disc descending; valves 3(4), to rim level. *Seed* greyish black, irregularly flattened with a prominent flange all around, slightly ribbed on the ventral side, hilum ventral.

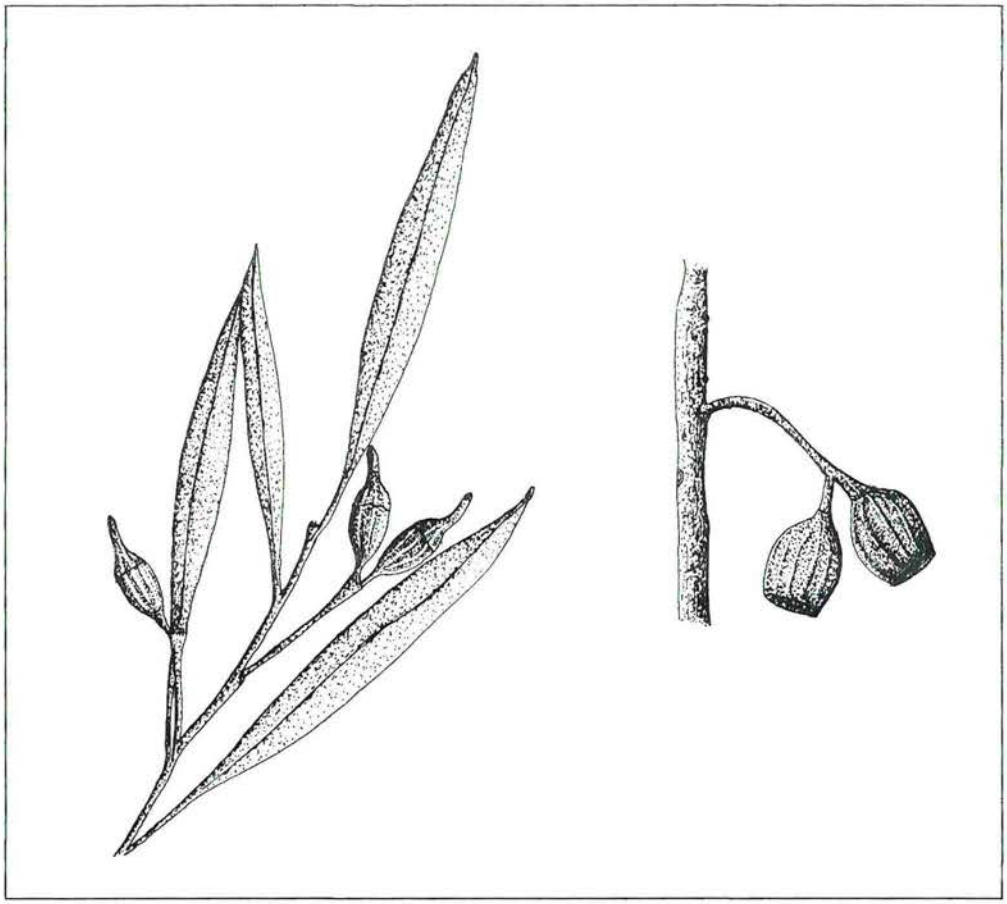

Figure 25. *E. captiosa* - buds, fruit and leaves (*MIHB* 10001)

Other specimens examined. WESTERN AUSTRALIA: 10 miles E of Jerramungup, Oct. 1969, *A.M. Baird s.n.* (PERTH); 39 km SW of Fitzgerald, Ravensthorpe-Ongerup road, 27 Aug. 1974, *A.C. Beauglehole* 49227 (PERTH); 9.2 km W of Ravensthorpe-Lake King Road on Aerodrome Road, 16 July 1987, *M.I.H. Brooker* 9721 (AD, CANB, MEL, NSW, PERTH); Mallee Road, 1.8 km NE of Lake North Road, 16 July 1987, *M.I.H. Brooker* 9723, 9724 (AD, CANB, MEL, NSW, PERTH); type locality, 21 July 1988, *M.I.H. Brooker* 10001 (AD, CANB, MEL, NSW, PERTH); 100 km W of Ravensthorpe, 4 Nov. 1978, *R.J. Cranfield* 992 (PERTH); 7 miles E of Ongerup, 22 Aug. 1969, *H. Demarz* 1565 (PERTH); 12 miles W of Ongerup, 13 Mar. 1957, *J.W. Green* 1178 (PERTH); 14 miles E of Ongerup, 3 Aug. 1957, *J.W. Green* (PERTH); 10.2 miles E of Jerramungup on road to Ravensthorpe, 21 Mar. 1970, *M.D. Tindale* & *B.R. Maslin* T252 (PERTH).

Distribution. Tambellup to Ravensthorpe, particularly the upper Gairdner River catchment, Western Australia (Figure 21).

Conservation status. Common and widespread.

Flowering period. July.

Etymology. From the Latin *captiosus* - deceptive, in reference to the fine-leaved crown appearance which is quite unlike that of the related *E. incrassata* Labill.

Notes. E. captiosa is the westernmost taxon of the series and is readily seen on roadsides in sandy country north-east and north of the Stirling Range.

27. Eucalyptus dolichorhyncha (Brooker) Brooker & Hopper, stat. nov.

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 359 (1990).

Basionym: E. forrestiana Diels subsp. *dolichorhyncha* Brooker, J. Roy. Soc. W. Austral. 56: 74 (1973). *Type:* Grasspatch, 16 March 1957, *J.W. Green* 1252 (PERTH).

Notes. This taxon was distinguished by the beaked operculum, shorter pedicels, and smaller buds and fruit compared with the typical subspecies. Robinson (1984) demonstrated that *E. forrestiana* subsp. *dolichorhyncha* has narrower adult leaves (1.7-2 cm), wider wings to the bud (0.4-0.5 cm) and lacked ribs between the four wings compared with the typical subspecies (leaves 2-2.5 cm wide, wings 0.3-0.4 cm deep). From recent field examinations of the two subspecies, we agree with Robinson's findings on morphology but consider that *dolichorhyncha* is specifically distinct. *E. forrestiana sens. strict.* has a wide east-west distribution from the Cascades area east to the vicinity of Mt Ney. *E. dolichorhyncha* has a more restricted distribution to the north from Truslove to Salmon Gums.

We do not agree with Robinson (1984) and Green (1985) in their treatment of *E. stoatei* as a subspecies of *E. forrestiana.* The phenogram in Robinson (1984) shows that populations of *E. stoatei* are relatively uniform and distinct from those of *E. forrestiana.* Specific rank rather than subspecific is favoured here.

Eucalyptus ser. **Ovulares** Brooker, Brunonia 4:1 (1981).

Type: E. ovularis Maiden & Blakely

The *E.* ser. *Ovulares* belong in the informal *E.* subgenus *Symphyomyrtus* and is diagnosed as follows: tree or mallee, bark rough rarely smooth, pith of branchlets glandular although glands often obscure, cotyledons reniform, juvenile leaves petiolate, adult leaves glossy green rarely bluish, in most species densely glandular, stamens inflexed, ovules in 4 vertical rows, fruit often with prominent thin rim, seeds brown, shallowly reticulate.

Key to taxa of *E.* ser. *Ovulares*

1. Bark smooth or rough at butt only
 2. Adult leaves dull to slightly glossy, light green to blue-green; fruit to 1 x 1 cm ..... *E. cyclostoma*
 2. Adult leaves glossy green
  3. Bud constricted at join of operculum ..... 29. *E. exigua*
  3. Bud not constricted at join
   4. Adult leaves densely reticulate, oil glands obscure ..... *E. oraria*
   4. Adult leaves with obscure reticulation, oil glands distinct, very numerous ..... *E. cylindrocarpa*
1. Bark rough over part or whole of stems or trunk
 5. Bud hypanthium widest towards base ..... *E. ovularis*
 5. Bud hypanthium not widest towards base
  6. Bud constricted at join of operculum ..... *E. brachycorys*
  6. Bud not constricted
   7. Adult leaves with prominent secondary venation ..... *E. baudiniana*
   7. Adult leaves with obscure secondary venation and very numerous oil glands
    8. Buds pyriform
     9. Buds to 0.5 x 0.3 cm; fruits to 0.5 x 0.3 cm ..... *E. myriadena* subsp. *myriadena*
     9. Buds to 0.3 x 0.15 cm; fruits to 0.2 x 0.2 cm ..... 30. *E. myriadena* subsp. *parviflora*
    8. Buds double-conic, rarely ovoid ..... 28. *E. aequioperta*

28. Eucalyptus aequioperta Brooker & Hopper, sp. nov. (Figure 26)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 369 (1990).

Frutex "mallee" affinis *Eucalypto ovulari* Maiden & Blakely a qua foliis juvenilibus adultisque majoribus, hypanthio alabastri fructusque obconico vel hemisphaerico differt.

Typus: 3.5 km E of Mt Walker, 20 March 1985, 32°04'S, 118°47'E, *M.I.H. Brooker* 8891 (holo: PERTH; iso: CANB, MEL, NSW).

Mallee or rarely *tree* to 8 m tall with rough bark on lower half of stems. Forming *lignotubers. Seedling leaves* petiolate, remaining decussate for about 3 pairs, elliptical to ovate, to 4.5 x 2 cm, blue-green, dull. *Adult leaves* alternating, petiolate, lanceolate, to 11 x 1 cm, concolorous, glossy, green; reticulation moderate to dense, more or less obscured by numerous large oil glands. *Inflorescences* axillary, unbranched, 7- to 11-flowered; peduncles slender, to 1.6 cm long. *Buds* pedicellate, "egg-in-egg cup shaped" or broadly fusiform, to 0.6 x 0.7 cm, bi-operculate; inner operculum slightly beaked. *Stamens* inflexed in bud, all fertile; anthers versatile, dorsifixed, oblong, opening by longitudinal slits. *Flowers* not seen. *Ovules* in 4 vertical rows. *Fruits* shortly pedicellate, cupular to slightly obconical, to 0.5 x 0.4 cm; rim thin; disc descending; valves 3(4), to rim level or slightly exserted. *Seed* compressed-ovoid, brown, with shallow distinct reticulum.

Other specimens examined. WESTERN AUSTRALIA: 49 km NW of Hyden towards Narambeen, 37°08'S, 118°35'E, 4 Oct. 1975, *M.I.H. Brooker* 4999 and *D. Blaxell* (CANB, NSW, PERTH); 34 km from Narambeen on Hyden road, 12 Aug. 1979, *M.I.H. Brooker* 6326 (CANB, PERTH); 13.3 km W of Bullabulling, 20 Aug. 1979, *M.I.H. Brooker* 6397 (CANB, PERTH); 56 km S of Widgiemooltha, 21 Aug. 1979, *M.I.H. Brooker* 6412 (CANB, PERTH); Sandmine NW of Gnarlbine Rock, c. 32 km SW of Coolgardie, 23 Aug. 1979, *M.I.H. Brooker* 6467 (CANB, PERTH); 128 km W of Kalgoorlie, 14 Mar. 1984, *M.I.H. Brooker* 8490 (CANB, NSW, PERTH); 4.6 and 3.5 km E of Mt Walker, 32°04'S, 118°47'E, 19 Dec. 1984, *M.I.H. Brooker* 8769, 8770 (CANB, NSW, PERTH); 12.2 km SW of Bullabulling, 31°05'S, 120°48'E, 27 June 1987, *M.I.H. Brooker* 9699 & *S.D. Hopper* (CANB, NSW, PERTH); 4 km E of Corrigin-Bruce Rock road on Yelberrin road, 23 Aug. 1988, *M.I.H. Brooker* 10044 (CANB, PERTH); c. 3 km E of Mt Walker, 23 Aug. 1988, *M.I.H. Brooker* 10048 (CANB, PERTH); Church Road, E of Narambeen, 14 Sep. 1990, *M.I.H. Brooker* 10542 (CANB, MEL, NSW, PERTH); c. 30 km SSW of Coolgardie, 3 km NW of Gnarlbine, 31 Jan. 1979, *M.D. Crisp* 5610 (CBG, PERTH).

Distribution. From north-east of Corrigin towards Coolgardie, Western Australia (Figure 21).

Conservation status. Poorly known and in need of further survey.

Flowering period. Not known.

Etymology. From the Latin *aequi* - equal and *opertus* - cover, referring to the operculum shape, in relation to the hypanthium.

Notes. A little-known taxon readily seen at the type locality and probably occurring widely scattered to the north-east towards Coolgardie.

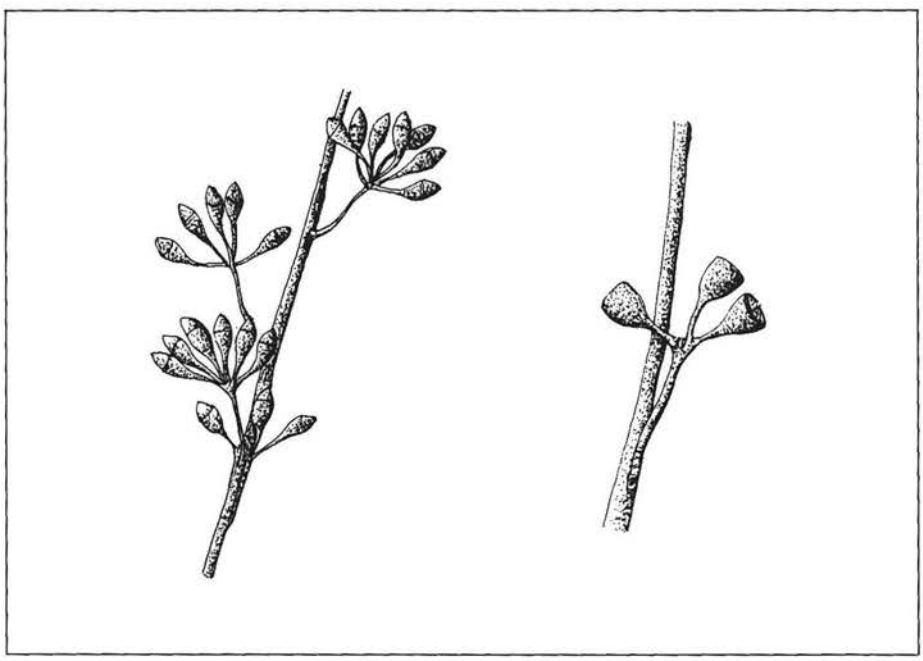

Figure 26. *E. aequioperta* - buds and fruit (*MIHB* 8891) (x1.25)

29. Eucalyptus exigua Brooker & Hopper, sp. nov. (Figure 27)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 373 (1990).

Frutex "mallee" *Eucalypto brachycorytho* Blakely affinis sed statura inferiore, cortice laevi, et foliis plantularum alabastris fructibusque parvioribus differt.

Typus: 22 km W of Mt Day Road on Hyden-Norseman track, 32°15'S, 120°19'E, 7 Nov. 1983, *M.I.H. Brooker* 8359 (holo: PERTH; iso: CANB, NSW).

Mallee with affinity to *Eucalyptus brachycorys* Blakely but differing in the lower stature, smooth bark and smaller seedling leaves, buds and fruit.

Mallee to 3 m tall with grey or whitish grey smooth bark. *Seedling leaves* petiolate, decussate, remaining opposite for 3-4 pairs, ovate, to 4 x 1.5 cm, light green. *Juvenile leaves* petiolate, alternating, narrowly lanceolate, to 6 x 0.8 cm, light green. *Adult leaves* petiolate, alternating, narrowly lanceolate, to 9 x 1 cm, concolorous, glossy, green; side veins thin, obscure; reticulation absent and with very numerous island oil glands. *Inflorescences* axillary, unbranched, 7-flowered; peduncles more or less terete, to 1.8 cm long. *Buds* on distinct pedicels, more or less cylindrical, to 0.5 x 0.4 cm; operculum flattened - hemispherical or pileate, with the bud markedly constricted at the join of hypanthium and operculum. *Stamens* inflexed, all fertile; anthers versatile, sub-basifixed, oblong, opening by longitudinal slits. *Flowers* not seen. *Ovules* in 4 vertical rows. *Fruits* pedicellate, cupular and slightly constricted at the rim, to 0.6 x 0.6 cm; rim thin; disc obliquely on vertically sloping downwards; valves 4, to rim level. *Seed* brown, flattened-ovoid, with a distinct shallow reticulum, hilum ventral.

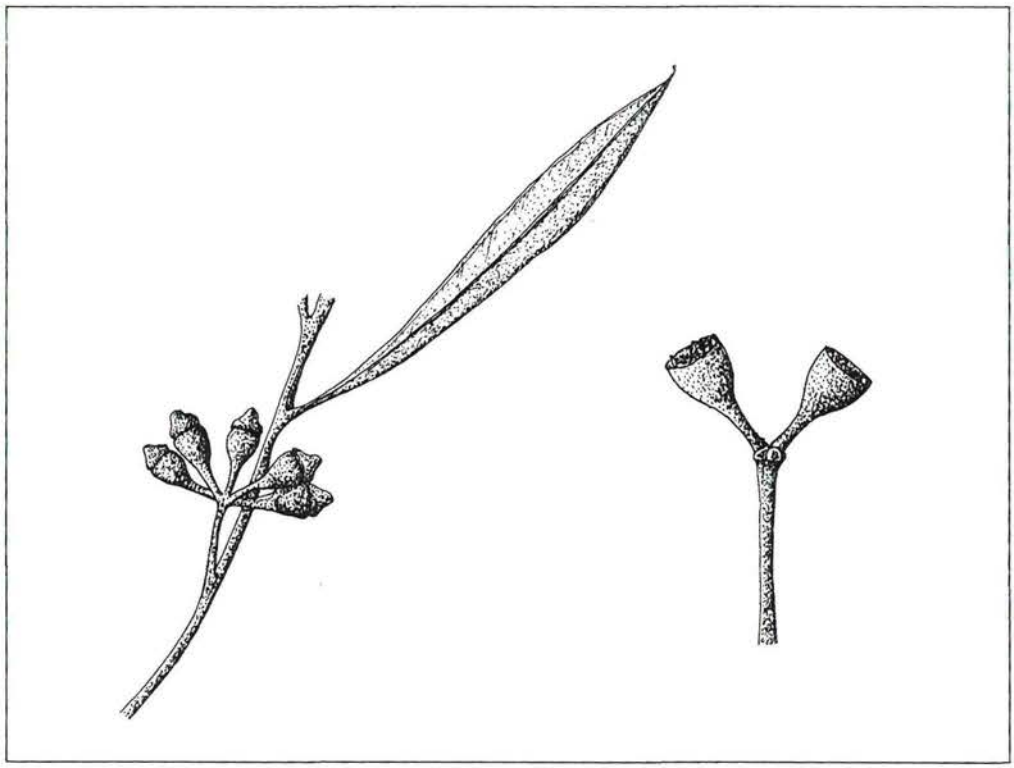

Figure 27. *E. exigua* - buds (actual size) (*MIHB* 10013) and fruit (x1.5) (*MIHB* 8900)

Other specimens examined. WESTERN AUSTRALIA: 93 km E of Hyden on Norseman track, 3 Oct. 1975, *M.I.H. Brooker* 4984 (CANB, PERTH); 52 km E of cross-roads on Hyden-Norseman track, 6 April 1985, *M.I.H. Brooker* 8900 (CANB, NSW, PERTH); NE of Lake Cronin, 100 m E of Caravan, 21 October 1986, *M.I.H. Brooker* 9483 (AD, CANB, MEL, NSW, PERTH); 11.8 km S of Cross Roads, 22 July 1988, *M.I.H. Brooker* 10013 (AD, CANB, MEL, NSW, PERTH); 142.7 km W of Coolgardie-Norseman Road on track to Hyden, 7 Nov. 1983, *K. Hill* 630 (CANB, NSW, PERTH); 1.8 km N of main road on old track, 8.8 km E of Lake Cronin, *S.D. Hopper* 5426 (PERTH); near Lake Cronin, 6 Feb. 1981, *G.J. Keighery* 3772 (PERTH); Lake Cronin area, 16 Feb. 1967, *A. Kessell* 567 (PERTH); 35 km SW of McDermid Rock, c. 117 km W of Norseman, 15 July 1979, *K.R. Newbey* 5299 (PERTH); 1 km NE of Lake Cronin, c. 86 km E of Hyden, 19 July 1981, *K.R. Newbey* 8324 (PERTH).

Distribution. From the Cross Roads area east of Hyden eastwards towards Mt Day, Western Australia (Figure 21).

Conservation status. Poorly known and in need of further survey.

Flowering period. Not known.

Etymology. The name alludes to the distinction from the nearest allied species, *E. brachycorys*, Latin - *exiguus* small, feeble.

Notes. Known from three localities only, in an area not well surveyed botanically. It occurs in a small pure stand at the Lake Cronin site.

30. Eucalyptus myriadena Brooker subsp. **parviflora** Brooker & Hopper, subsp. nov. (Figure 28)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 419 (1990).

A subspecie typica alabastris (ad 0.3 x 0.15 cm) fructibusque (ad 0.2 x 0.2 cm) minimis differt.

Typus: 9.5 km S of Cross Roads, E of Hyden, on Varley Road, 32°29'S, 119°45'E, 22 July 1988, *M.I.H. Brooker* 10012 & *C.J. Ranford* (holo: PERTH; iso: AD, CANB, MEL, NSW).

It differs from the typical subspecies by the smaller buds (to 0.3 x 0.15 cm) and fruit (to 0.2 x 0.2 cm).

Other specimens examined. WESTERN AUSTRALIA: 4.6 km N of Cross Roads, E of Hyden (32°22'S, 119°44'E), 28 Jan. 1987, *M.I.H. Brooker* 9571 (AD, CANB, MEL, NSW, PERTH); 5.2 km N of Cross Roads, 24 Aug. 1988, *M.I.H. Brooker* 10066 (CANB, PERTH, NSW, MEL, AD); 542 m.p. near Cross Roads to Marvel Loch, 8 Dec. 1968, *S. Chambers* 179 (PERTH).

Distribution. Restricted to a small area north and south of the Cross Roads east of Hyden, Western Australia (Figure 21).

Conservation status. Poorly known and in need of further survey.

Flowering period. Not known.

Etymology. From the Latin - *parviflorus,* small-flowered. This subspecies has the smallest buds and fruits of all eucalypts in the southern half of Western Australia.

Notes. The new subspecies occurs within the distribution of but not sympatrically with the typical form. Little exploration for *Eucalyptus* has been made away from the principal roads in its vicinity.

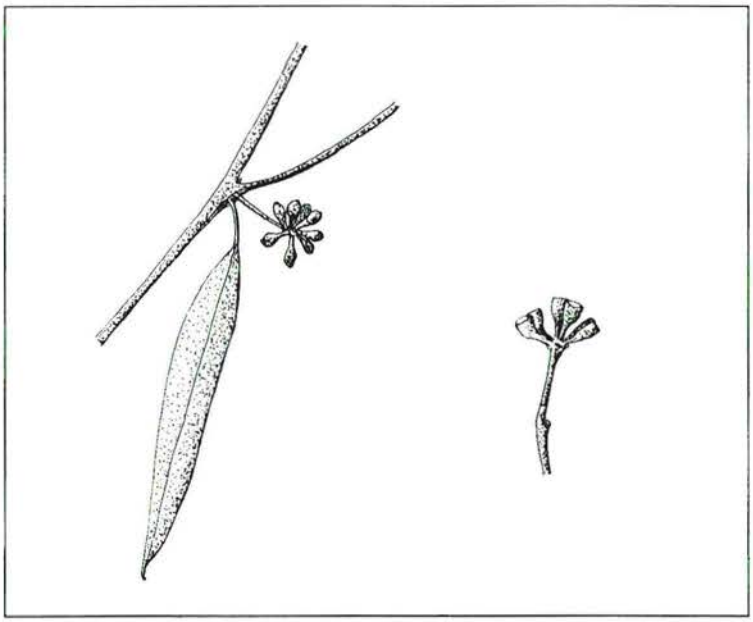

Figure 28. *E. myriadena* subsp. *parviflora* - buds (*MIHB* 10066) and fruit (*MIHB* 10012)

Eucalyptus ser. **Exsertae** Blakely, "A Key to the Eucalypts" 29: 128 (1934).

Type: E. exserta F. Muell.

The series *Exsertae* belongs in the informal *E.* subgen. *Symphyomyrtus* and is diagnosed by: tree or mallee, cotyledons reniform, pith of branchlets not glandular, juvenile leaves petiolate, inflorescences axillary, outer stamens erect in all but one species, ovules in 6 vertical rows, disc of fruit prominent, level or ascending, seed elongately cuboid with hilum on small face (from apparently anatropous ovules).

The *E.* ser. *Exsertae* (the eastern red gums (Boland *et al.* 1984)) has only two species in Western Australia and it is sufficient in this paper to contrast only these taxa. *E. camaldulensis* is predominantly smooth-barked and has seed with a smooth yellow seedcoat while *E. rudis* is predominantly rough-barked and has dark brown to black seed with a finely pitted seedcoat.

Key to the subspecies of *E. rudis*

1. Buds to 1.2 cm long, fruits to 0.9 cm wide ..... *E. rudis* subsp. *rudis*
1. Buds to 1.5 cm long, fruits to 1.4 cm wide ..... 31. *E. rudis* subsp. *cratyantha*

31. Eucalyptus rudis Endl. subsp. **cratyantha** Brooker & Hopper, subsp. nov. (Figure 29)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 419 (1990).

A subspecie typica alabastris (ad 1.5 cm longis), fructibusque (ad 1.4 cm latis) majoribus, valvis fructum numerosioribus, et plerumque pedicellis longioribus (ad 0.7 cm longis) differt.

Typus: On Moses Rock Road, 33°44'S, 114°59'E, 10 May 1986, *S.D. Hopper* 4825 (holo: PERTH).

It differs from the typical subspecies in the larger buds (to 1.5 cm long) and fruits (to 1.4 cm wide), the greater number of valves to the fruit (5 or 6) and the usually longer pedicels (to 0.7 cm long).

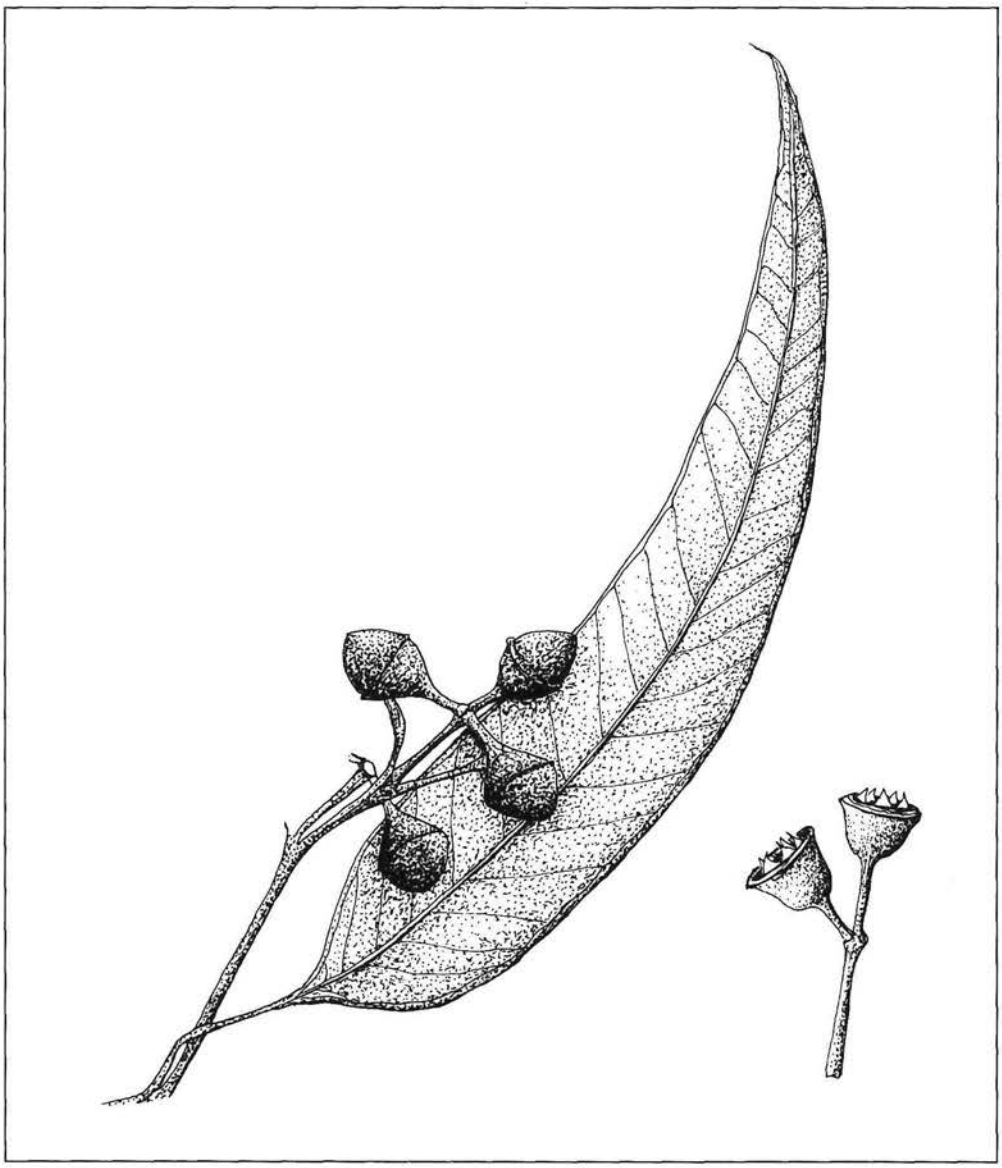

Figure 29. *E. rudis* subsp. *cratyantha* - buds (*SDH* 4820) and fruit (*MIHB* 9801)

Other specimens examined. WESTERN AUSTRALIA: Murray River flats between Pinjarra and Mandurah, 32°35'S, 115°50'E, 13 August 1979, *M.I.H. Brooker* 6333 (CANB, NSW, PERTH); 6.4 km along Wonnerup Road from Wonnerup South Road, E of Busselton, 33°39'S, 115°27'E, 6 November 1987, *M.I.H. Brooker* 9801 & *S.D. Hopper* (AD, CANB, MEL, NSW, PERTH); Meelup Beach, c. 500 m from sea at foot of coastal slopes, 33°52'S, 114°59'E, 8 May 1986, *S.D. Hopper* 4820, 4821 (PERTH); Eagle Bay (Fern Road, 3 km N of Meelup Road, 26 Oct. 1988, *L.A.S. Johnson* 9134 & *B. Briggs* (NSW, PERTH); Fern Road, Eagle Bay, Cape Naturaliste, 12 August 1986, *G.J. Keighery* 8290 (PERTH); bank of Collie River, 7 August 1980, *J. Koch* 442 (PERTH).

Distribution. Coastal and subcoastal from Mandurah and Pinjarra south and south-west towards Cape Naturaliste, Western Australia (Figure 21).

Conservation status. Poorly known and in need of further survey. Priority 3 in Hopper *et al.* (1990) - reserve flora list.

Flowering period. Not known.

Etymology. From the Greek *craty* - strong and *anthos* - flower in reference to the flower buds being larger than those of the typical subspecies.

Notes. This subspecies is the south-western form of *E. rudis*. It may be reduced to a mallee or small tree on stony sites.

Eucalyptus ser. **Lucasianae** Chippendale, Fl. Australia 19:500 (1988).

Type: E. lucasii Blakely

The *E.* series *Lucasianae* belongs in the informal *E.* subgenus *Symphyomyrtus* and is diagnosed as follows: mallee, cotyledons reniform, pith of branchlets not glandular, juvenile leaves petiolate, inflorescences arranged on leafless ends of branchlets with a terminal usually aborting vegetative bud, few axillary inflorescences, outer stamens without anthers.

Key to the subseries of *E.* ser. *Lucasianae*

1. Bark smooth; adult leaves dull ..... *E.* subser. *Lucasianae*
1. Bark rough; adult leaves glossy ..... *E.* subser. *Cupreanae*

Eucalyptus subser. **Cupreanae** Brooker & Hopper, subser. nov.

A subserie typica cortice fibroso et foliis adultis nitentibus differt.

Typus: E. cuprea Brooker & Hopper

32. Eucalyptus cuprea Brooker & Hopper, sp. nov. (Figure 30)

Brooker & Kleinig, "Field Guide to Eucalypts" 2: 400 (1990).

Frutex "mallee" ad 4 m altus cortice aspero cinereo in dimidio inferiore caulium, caulibus superis laevibus cupreis. Lignotuberum formans. Cotyledones reniformes vel bilobae. Folia plantularum, decussata, petiolata, ovata, ad 6 x 3 cm, hebetia, thalassica. Folia adulta alternantia, petiolata, lanceolata, ad 14 x 2 cm, concoloria, nitentia, viridia. Inflorescentiae apparenter terminales. Pedunculi ad 1 cm longi. Alabastra immatura cylindrica, apparenter sessilia, matura pedicellata, clavata, ad 0.6 x 0.4 cm; operculum exterius exutum in alabastro praecoci, interius conicum vel hemisphaericum. Stamina valde inflexa, exteriora sine antheris. Antherae vel versatiles vel adnatae. Ovarium (4)5-loculare; ovula verticaliter 4-seriata. Fructus pedicellati, cupulares, ad 0.5 x 0.4 cm.

Typus: 9.6 km N of Murchison River of NW coastal highway, 27°45'S, 114°40'E, 28 Aug. 1984, *M.I.H. Brooker* 8635 (holo: PERTH; iso: CANB, NSW).

Mallee to 4 m tall with rough flaky or fibrous grey bark on lower half of stems, smooth coppery or grey above. Forming *lignotubers. Seeding leaves* decussate, remaining opposite for 3-4 pairs, petiolate, ovate, to 6 x 3 cm, blue-green, dull. *Juvenile leaves* alternating, petiolate, ovate, to 10 x 6 cm. *Adult leaves* alternating, petiolate, lanceolate, to 14 x 2 cm, concolorous, glossy, green; reticulation dense, incomplete, with scattered to very sparse intersectional or island oil glands. *Inflorescences* apparently terminal. *Peduncles* slender, to 1 cm long. *Immature buds* apparently sessile, cylindrical, with prominent scar caused by very early loss of outer operculum; mature buds distinctly pedicellate, clavate, to 0.6 x 0.4 cm; inner operculum conical to hemispherical. *Stamens* strongly inflexed, outer ones without anthers. Fertile *anthers* sub-versatile to adnate, cuboid to irregular in shape, opening by lateral pores; *flowers* white. *Ovary* (4) 5-locular; ovules in 4 vertical rows. *Fruits* distinctly pedicellate, cupular, to 0.5 x 0.4 cm; valves below rim level. *Seed* compressed-ovoid, grey-brown, with distinct shallow reticulum.

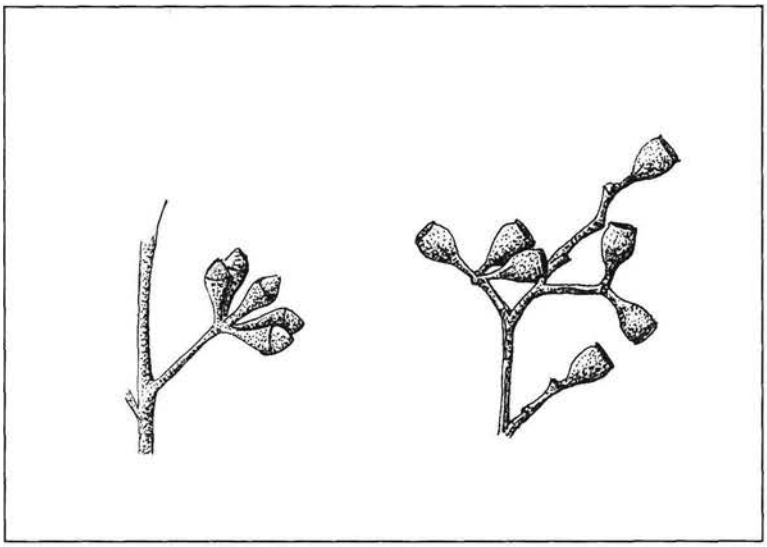

Figure 30. *E. cuprea* - buds (*MIHB* 8635) and fruit (*MIHB* 9406)

Other specimens examined. WESTERN AUSTRALIA: 15 km along the Northampton and Lyndon Road, 1952, *G. Brockway s.n.* (PERTH); 14 miles N of T.O. to Kalbarri on northern highway, 9 January 1970, *M.I.H. Brooker* 2392 (CANB, PERTH); 29.8 km N of Northampton, 25 May 1983, *M.I.H. Brooker* 8121 (CANB, NSW, PERTH) and 27 October 1983 (CANB, NSW, PERTH); 9.6 km N of Murchison

River crossing on highway, 25 May 1983, *M.I.H. Brooker* 8124 (CANB, NSW, PERTH) and 27 October 1983, *M.I.H. Brooker* 8305 (CANB, NSW, PERTH); 29.6 N of Northampton, 27 Oct. 1983, *M.I.H. Brooker* 8304 (CANB, PERTH); Nanson Road, E side of hill, 11 June 1985, *M.I.H. Brooker* 9037 (CANB, NSW, PERTH); Morseby Range, 4 November 1985, *M.I.H. Brooker* 9062 (CANB, NSW, PERTH); Nanson Road, 12 March 1986, *M.I.H. Brooker* 9198 (CANB, NSW, PERTH); 2 km on Ogilvy West Road, E of Chillinup Road, 8 May 1986, *M.I.H. Brooker* 9275 (CANB, PERTH); 3.8 km W of Highway 1 on Ogilvie West Road, 22 July 1986, *M.I.H. Brooker* 9406 (CANB, NSW, PERTH); Hutt River between Northampton and Lyndon, September 1959, *C.A. Gardner s.n.* (PERTH); 9.6 km N of Murchison River bridge, 27°45'S, 114°40'E, 25 May 1983, *S.D. Hopper* 2750 (PERTH).

Distribution. From the Moresby Range to north of the Murchison River, Western Australia (Figure 21).

Conservation status. Vulnerable, and declared as Rare Flora (species no. 157 in Hopper *et al.* (1990)).

Flowering period. October.

Etymology. The name refers to the seasonal colour of the smooth bark, Latin *cupreus* - coppery.

Notes. *E. cuprea* belongs in the informal section *Adnataria* Pryor & Johnson. This section is overwhelmingly eastern in distribution and therefore probably in origin. Few species in the group penetrate into the southern half of Western Australia. These are *E. coolabah* Blakely & Jacobs var. *rhodoclada* Blakely along the Murchison River, *E. intertexta* R.T. Baker to south and south-west of Warburton and four endemics, *viz. E. petraea* Carr & Carr which is widespread in the wheatbelt and goldfields near granite rocks, *E. lucasii* Blakely in the northern goldfields, *E. absita* Grayling & Brooker, a rare species in the Badgingarra area and *E. cuprea.*

Acknowledgements

We are grateful to the directors of various herbaria for allowing access to specimens, to Dean Nicolle for drawing our attention to *E. kingsmillii* subsp. *alatissima*, to Elaine Cooper for the illustrations of the buds and fruits, to Garry Brown for the maps, and to many colleagues for assistance with field studies.

References

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

Boland, D.J., Brooker, M.I.H., Chippendale, G.M., Hall, N., Hyland, B.P.M., Johnston, R.D., Kleinig, D.A. & Turner, J.D. (1984). "Forest Trees of Australia". (Thomas Nelson and CSIRO: Melbourne.)

Boomsma, C.D. (1981). " Native Trees of South Australia". (Woods and Forests Department: Adelaide.)

Brooker, M.I.H. (1988). *Eucalyptus foecunda* revisited and six related new species. Nuytsia 6: 325-334.

Brooker, M.I.H. & Hopper, S.D. (1982). New subspecies in *Eucalyptus caesia* and in *E. crucis* (Myrtaceae) of Western Australia. Nuytsia 4: 113-128.

Brooker, M.I.H. & Hopper, S.D. (1991). A taxonomic revision of *Eucalyptus wandoo* Blakely, *E. redunca* Schauer, and allied species (*E.* ser. *Levispermae* Maiden - Myrtaceae) in Western Australia. Nuytsia 8: 1-189.

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

Carr, D.J. & Carr, S.G.M. (1985). "Eucalyptus I". New or little-known species of the *Corymbosae* (Phytoglyph Press: Canberra.)

Chippendale, G.M. (1973). "Eucalypts of the Western Australian Goldfields and the adjacent Wheatbelt". (AGPS: Canberra.)

Chippendale, G.M. (1988). "Flora of Australia" Vol.19. (AGPS: Canberra.)

Drinnan, A.N. & Ladiges, P.Y. (1989). Operculum development in the *Eudesmieae* B eucalypts and *Eucalyptus caesia* (Myrtaceae). Pl. Syst. & Evol. 165: 227-237.

Gardner, C.A. (1952-1966). "Eucalypts of Western Australia". (Western Australian Herbarium: Perth.)

Green, J.W. (1985). "Census of Vascular Plants of Western Australia". (Department of Agriculture: Perth.)

Hill, K.D. & Johnson, L.A.S. (1992). Systematic studies in the eucalypts. 5. New taxa and combinations in *Eucalyptus* (Myrtaceae) in Western Australia. Telopea 4: 561-634.

Hopper, S.D., van Leeuwen, S., Brown, A.P. & Patrick, S.J. (1990). "Western Australia's Endangered Flora". (Dept of Conservation & Land Management: Perth.)

Ladiges, P.Y., Humphries, C.J. & Brooker, M.I.H. (1987). Cladistic and biogeographic analysis of Western Australian species of *Eucalyptus* L'Hérit., informal subgenus *Monocalyptus* Pryor & Johnson. Austral. J. Bot. 35: 251-281.

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

Robinson, C.J. (1984). *Eucalyptus stoatei* as a subspecies of *Eucalyptus forrestiana*. Nuytsia 5: 195-200.

Sampson, J.F., Hopper, S.D. & James, S.H. (1988). Genetic diversity and the conservation of *Eucalyptus crucis* Maiden. Austral. J. Bot. 36: 447-460.

INDEX

Acacia Miscellany 7. *Acacia sulcata* and related taxa (Leguminosae: Mimosoideae) in Western Australia

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Abstract

Cowan, R.S. and B.R. Maslin. *Acacia* Miscellany 7. *Acacia sulcata* and related taxa (Leguminosae: Mimosoideae) in Western Australia. Nuytsia 9(1): 69-78 (1993). A key is presented to the nine taxa of the informal "*A. sulcata* group", followed by a review of *A. sulcata* R. Br., including the description of a new variety *A. sulcata* var. *planoconvexa* Cowan & Maslin; in addition, a new variety of *A. brachyphylla* Benth. is described (var. *recurvata* Cowan & Maslin) and a new species, *A. octonervia* Cowan & Maslin. In addition, *A. nitidula* Benth. and *A. sulcata* var. *platyphylla* Maiden & Blakely have been lectotypified.

Introduction

Acacia sulcata R. Br. is a highly variable species comprising three varieties separated largely by details of phyllode dimensions, shape and nervature. The related taxa are less well-known but appear to be more constant morphologically: *A. brachyphylla* Benth. var. *brachyphylla, A. brachyphylla* Benth. var. *recurvata* Cowan & Maslin var. nov., *A. dura* Benth., *A. nitidula* Benth., *A. octonervia* Cowan & Maslin sp. nov. and *A. tetanophylla* Maslin. These taxa comprise the informal "*A. sulcata* group" which is characterised by small, narrow, flat to terete, linear to oblanceolate, mucronate to pungent, 6-8-nerved phyllodes, small globular heads of flowers on mostly binate peduncles subtended by cucullate basal peduncular bracts, pentamerous flowers with the sepals free or partially united and small undulate pods enclosing seeds that are mottled in most of the taxa. *Acacia prismifolia* E. Pritzel is not included in the "group", largely because it has 4-nerved phyllodes that are more or less triangular in section but it is probably related.

All measurements in the following account are from dried material unless specifically stated otherwise. Only the taxa that are numbered in the key are discussed or described.

Key to the taxa of the "*A. sulcata* group"

1. Phyllodes sharply pungent with needle-like points that readily pierce the skin ..... *A. tetanophylla*

1. Phyllodes innocuous or with a hard mucro; seeds commonly mottled browns or greys

2. Phyllodes hairy on nerves, rarely only papillose; branchlets villose-tomentose or pilose

3. Phyllodes commonly 5-7 mm long, mucronulate, 6-8-nerved; gland in basal half of phyllode on midrib; pods hairy ..... 1a. *A. brachyphylla* var. *brachyphylla*

3. Phyllodes 8-10 mm long, recurved-mucronulate, 6-nerved; gland basal or absent; pods glabrous or subglabrous and glabrescent ..... 1b. *A. brachyphylla* var. *recurvata*

2. Phyllodes glabrous; branchlets glabrous, sparingly appressed-puberulous or infrequently pilose

4. Phyllodes narrowly oblanceolate, compressed to flat

5. Phyllodes flat with 1 or 2 nerves per face, adaxial margin with two nerves coalescing above gland near middle of phyllode; peduncles 7-11 mm long; heads 20-flowered; pods undulate, 4-4.5 mm wide; seeds dull, obscurely mottled, the aril subterminal ..... 2. *A. nitidula*

5. Phyllodes compressed to flat with 2 nerves per face, the gland borne on adaxial nerve; peduncles 3-8 mm long; heads 6-16-flowered; pods ± constricted between seeds, scarcely undulate, 3 mm wide; seeds shiny, tan, the aril extending along one side ..... *A. dura*

4. Phyllodes ± terete to compressed

6. Phyllodes 8-nerved; stipules persistent, narrowly triangular; seeds not mottled ..... 3. *A. octonervia*

6. Phyllodes 6- or 7-nerved; stipules deciduous to persistent, triangular to setaceous; seeds mottled

7. Phyllodes commonly 18-25 mm long; peduncles 8-15 mm long ..... 4a. *A. sulcata* var. *sulcata*

7. Phyllodes 5-16 mm long; peduncles 4-10 mm long

8. Nerves strongly raised, phyllode apex recurved-mucronate ..... 1b. *A. brachyphylla* var. *recurvata*

8. Nerves not strongly raised, often obscured in drying, or not evident on adaxial surface

9. Phyllodes green, not glaucous, terete or compressed; gland near junction of 2 adaxial nerves; pods not pruinose ..... 4b. *A. sulcata* var. *platyphylla*

9. Phyllodes commonly glaucous, plano-convex, upper surface nearly flat and without obvious nerves, lower with 3 prominent nerves; gland near middle of phyllode or absent; pods pruinose ..... 4c. *A. sulcata* var. *planoconvexa*

1. A. brachyphylla Benth., Linnaea 26: 615 (1855)

Type: South-western Australia, *J. Drummond* 37 (holo: K; iso: NSW, PERTH-fragments ex K and NSW).

Subshrubs 0.2-0.3 m tall. *Branchlets* terete, pilose to villose-tomentose, old ones roughened by persistent, raised phyllode-scars. *Stipules* persistent, narrowly triangular to subulate, to 1.5 mm long, glabrous. *Phyllodes* terete to compressed with a straight or recurved apex, 3-12 mm long, ± 1 mm wide, ascending to erect, villose on 6-8 strongly raised nerves, sometimes hairs reduced to papillae, rarely glabrous; apex obtuse and apiculate to mucronate; pulvinus 0.25-0.5 mm long; gland located from near apex of pulvinus to near phyllode-apex. *Peduncles* 1 or 2 per axil, 4-10 mm long, villosulose or glabrous; basal peduncular bract caducous, cucullate, rostrate, glabrous or glabrescent, 2-3 mm long. *Flower-heads* globular, golden, 3-4 mm diam., 8-12-flowered; bracteoles spathulate, acuminate, puberulous and ciliolate. *Flowers* 5-merous. *Sepals* 1/3 length of petals, irregularly 1/4-1/2-united, oblanceolate, ciliate. *Petals* free, glabrous, acute. *Ovary* glabrous. *Pods* linear, raised over but not constricted between seeds, 10-50 mm long, 1.5-4.5 mm wide, thin-coriaceous to firm-chartaceous, undulate, smooth, pilose, but sometimes glabrescent or glabrous. *Seeds* longitudinal, broadly ovate, tapered toward apex, 2-2.5 mm long, 1.5-2 mm wide, 1.3 mm thick, strongly umbonate, subnitid, mottled dark-brown on paler grey-brown, the pleurogram minute, U-shaped, the aril subterminal.

Distribution. Occurs in south-western Western Australia from near Tammin south-east to near Jerramungup. It is related to *A. sulcata* which has more or less free sepals and glabrous phyllodes; it is also similar to *A. prismifolia* which has 4-nerved phyllodes that are about triangular in section and its calyx is united almost to the apex.

Typification. Bentham cited only *Drummond* 37 in the protologue but the Kew specimen has only old peduncles without flowers; the pod fragment and immature seed in the packet cannot be this taxon. A second Drummond collection at K without number but with the author's annotation bears young fruits and old flowers from among the phyllodes; it may have been the source of data for the parts of the description concerned with the fruits; it is, however, referrable to *A. sulcata* var. *platyphylla*. Even though two different collections were probably involved in the protologue, only one was cited and it is viewed as the holotype.

1a. A. brachyphylla var. **brachyphylla**

Phyllodes 3-12 mm long but most commonly 5-7 mm, 6-8-nerved; apex not recurved, apiculate to mucronulate; gland in basal half of phyllode on mid-nerve. *Pods* 20-50 mm long, 3-4.5 mm wide, pilose, but sometimes partly glabrescent.

Other specimens examined. WESTERN AUSTRALIA: Kulin, *A.M. Ashby* 148 (PERTH); Brookton-Corrigin, Oct. 1965, *A. Beck s.n.* (PERTH); 4 mi. [6.4 km] W of Lake King, *K. Newbey* 2635 (PERTH); 29 mi. [46.7 km] E of Billericay, *K. Newbey* 3231 (PERTH); 10.5 km N of Bungalla turn-off [near Tammin] from Great Northern Highway, *M.D. Tindale* 3715 (AD, BRI, CANB, CBG, K, MEL, NSW, PERTH, US).

Distribution. South-west Western Australia from near Tammin south-east to near Lake King.

Habitat. Grows in sandy loam and gravel, commonly in mallee.

Flowering and fruiting periods. Flowering specimens have been collected from August to October. No information is available on fruiting period.

1b. A. brachyphylla var. **recurvata** Cowan & Maslin, var. nov.

A var. *brachyphylla* phyllodiis ad apicem recurvo-mucronatis, 8-10 mm longis, 6-nervatis, glandi basali vel nulla differt.

Typus: 10 mi. [16 km] E. of Jerramungup, Western Australia, 28 July 1963, *K. Newbey* 785 (holo: PERTH; iso: PERTH).

Branchlets pilose to villose. *Phyllodes* linear, 8-10 mm long, ascending, villosulose or only papillose on 6 distant, raised nerves; tip recurved to sub-uncinate and strongly mucronate; gland near-basal or not evident. *Peduncles* 6-8 mm long, glabrous. *Sepals* basally united. *Pods* 10-20 mm long, 1.5-3 mm wide, glabrous or subglabrous and glabrescent, pruinose.

Other specimens examined. WESTERN AUSTRALIA: Highbury State Forest, Newman Block (Veg. Site 17), *K.J. Atkins* 89008 (PERTH); 11 miles [17.6 km] N of Pingrup, *K. Newbey* 1014 (PERTH); 6 miles [9.6 km] SE of Kukerin, *K. Newbey* 1362 (PERTH); 4 km N of Calyerup Rock, *K. Newbey* 4231 (PERTH); 1 mile [1.6 km] E of Nyabing, *K. Newbey s.n.* (PERTH 00898333 and 00690864); c. 20 km E of Jerramungup near road to Ravensthorpe, *M.H. Simmons* 653 (PERTH).

Distribution. South-western Western Australia from near Kukerin south-east to near Jerramungup. This variety is more southerly in its distribution than the typical variety.

Habitat. Grows on often gravelly loam and sand in scrub.

Flowering and fruiting periods. Flowering specimens have been collected in June, July, September and October. No information is available on fruiting period.

Affinity. Variety *recurvata* is quite similar to var. *brachyphylla* by virtue of its pubescent phyllodes and basally united calyx, but var. *recurvata* is easily separable by the somewhat longer phyllodes with recurved tip and glabrous pods.

Conservation status. Poorly known, CALM Priority 3.

Etymology. The varietal epithet is from *recurvatus*, Latin for recurved, in reference to the apex of the phyllodes.

2. Acacia nitidula Benth., Fl. Austral. 2: 381 (1864)

Lectotype (here selected): Cape Arid, Western Australia, *G. Maxwell s.n.* (K; iso: NSW, PERTH-fragment ex K). *Paralectotypes:* (1) Swan River, Western Australia, *J. Drummond* 128 (K, PERTH-fragment ex K: not *A. nitidula*, see discussion below); (2): Goose Island Bay, Western Australia, *R. Brown s.n.* (not seen).

Bentham (1864) included three collections in his protologue, the Maxwell one, Drummond 3: 128, and a R. Brown collection from Goose Island Bay. The first of these most faithfully represents Bentham's concept, as well as preserving current usage, and we have chosen it as lectotype; the second represents an unrecognised taxon related to *A. sclerophylla*; we have not seen the R. Brown collection but it is from very near the type locality and probably represents *A. nitidula, sensu lectotypico.* An unnumbered Drummond collection at K on which Bentham had written "A. nitidula var.", but later erased the varietal designation, represents another species altogether, *A. trinalis* Cowan & Maslin; it is of no type significance.

Acacia nitidula is nearest *A. dura* which has longer phyllodes in relation to their width and different pods and seeds. Of the varieties of *A. sulcata, A. nitidula* is perhaps nearest the compressed-phyllode element of *A. sulcata* var. *platyphylla*. The two taxa differ in phyllode width and shape: those of *A. nitidula* are flat, oblanceolate to narrowly oblanceolate and usually 3-5 mm wide; those of var. *platyphylla* are terete to somewhat compressed and much narrower. The terete, strongly sulcate phyllodes of *A. sulcata* var. *sulcata* readily separate it from *A. nitidula.*

3. Acacia octonervia Cowan & Maslin, sp. nov.

Ab *A. sulcata* phyllodiis 8-nervatis, teretibus, micro-papillosis, stipulis anguste triangularibus persistentibus, capitulis globularibus diluto-luteis, 20-floribus, perianthio glabro, gynoecio glabro differt.

Typus: Fitzgerald River National Park, Whoogarup Range, Western Australia, 7 Oct 1975, *B.R. Maslin* 3878 (holo: PERTH; iso: BRI, CANB, K, MEL, NSW, NY).

Spreading *shrubs* 0.1-0.5 m, rarely to 1 m, tall. *Bark* light grey on stem-bases. *Branchlets* brownish-red, glabrous, sometimes nitid. *Stipules* persistent, narrowly triangular, 1.5-2 mm long, 0.5 mm wide at base, acute, glabrous. *Phyllodes* terete, (10-12)15-20(50) mm long, 1-1.5 mm wide, rigid, erect, straight or only slightly arcuate, dark green; apex obtuse and mucronulate; nerves 8, conspicuous; stomata raised as micro-papillae; gland inconspicuous, 1/4-1/2 length of phyllode from base at junction of two adaxial nerves. *Peduncles* solitary or more often binate in axils, 7-12 mm long, glabrous; basal peduncular bracts cucullate, deciduous to persistent. *Flower-heads* globular, pale yellow, 3-4 mm diam., 20-flowered. *Flowers* 5-merous, glabrous. *Sepals* free, spathulate-oblanceolate, half the length of the corolla. *Petals* free, elliptic, acute. Gynoecium glabrous. *Pods* narrowly oblong, undulate, 20-25 mm long, 3 mm wide, somewhat nitid, glabrous. *Seeds* longitudinal, ovate, somewhat compressed, 2-2.5 mm long, 1.5 mm wide, subnitid, brown, the aril subterminal and white.

Other specimens examined. WESTERN AUSTRALIA: SE of Ravensthorpe, *K.L. Bradby* 81 (PERTH); 29.75 km E of Muckinwobert Rock, *M.A. Burgman & S. McNee* 2110(PERTH); 28.5 km E of Muckinwobert Rock, *M.A. Burgman* 4008 (PERTH); approx. 47 km N of mouth of Oldfield River, *Hj. Eichler* 20404 (PERTH); Thumb Peak Range, *A.S. George* 7163 (PERTH); junction of Melaleuca and Rawlinson Rds,33° 30'S, 120° 43'E, *G.J. Keighery* 3700 (PERTH); Bandelup Creek, *F. Lullfitz* 5492 (PERTH); base of Thumb Peak, Fitzgerald River National Park, *B.R. Maslin* 5552 (BM, PERTH), *K. Newbey* 2730 (PERTH) and *R.D. Royce* 9251 (PERTH); 36 km SSE of Ongerup, *K. Newbey* 9518 (MELU, PERTH); Monjilup Rd, 3.2 km N of Toompup South Road [c. 13 km W of Boxwood Hill], *M. Simmons* 602 (PERTH); E of Middamidjup Road at intersection 51 km from Newdegate and 51 km from Ravensthorpe, *J. & M. Simmons* 1353 (PERTH); 36 km SSE of Ongerup, *N. Stevens* KRN9518-1 (MELU, PERTH).

Distribution. Known from only a few scattered localities between the Fitzgerald and Young Rivers in the Ravensthorpe region of Western Australia. Two collections occur outside this area, near Boxwood Hill, c. 100 km west-south-west of the Fitzgerald River.

Habitat. Grows in rocky sand or loam and sandy clay in open mallee shrubland, dense low heath and dwarf scrub.

Flowering and fruiting periods. Main flush of flowering occurs from August to October; single flowering collections have been recorded in December and January. Pods with mature seeds collected in December.

Affinities. While clearly related to the *A. sulcata* complex, the new species differs in having 8-nerved phyllodes, persistent narrow-triangular stipules, and pale yellow, 20-flowered heads and non-mottled seeds. In common with *A. sulcata* it has cucullate peduncle bracts, and 5-merous flowers with free perianth parts. Of the varieties of *A. sulcata*, the new species is most similar, at least superficially, to var. *sulcata*.

Conservation status. Poorly known, CALM Priority 3.

Etymology. The specific epithet is derived from two Latin words, *octo* for eight, and *nervius* for nerved, an allusion to the number of nerves evident in the phyllodes.

4. Acacia sulcata R. Br. in W.T. Aiton, Hort. Kew. ed. 2, 5: 460 (1813)

Lectotype (flowering specimen): Princess Royal Harbour, King George Sound, Western Australia, Dec. 1801, *R. Brown,* Iter Austral. [Britten no.] 4302 (BM), *fide* Maslin & Cowan (in press). *Paralectotypes* (fruiting specimens): BM; ? *paralectotypes:* E, K.

Spreading, often prostrate *shrubs* 0.2-2 m tall, rarely 3 m. *Branchlets* glabrous, appressed puberulous, tomentulose or pilosulose, sometimes pruinose apically. *Stipules* deciduous to persistent, setacous. *Phyllodes* linear to narrowly oblanceolate, 5-25 mm long, 1-2 mm wide, terete to depressed or compressed, usually strongly angled in drying, rigid, patent to erect, straight to shallowly arcuate, glabrous or pubescent on nerves; apex obtuse to acute, mostly mucronulate or uncinate-mucronulate; 6- or 7-nerved; gland inconspicuous, at junction of adaxial nerves or on undivided midnerve, sometimes not evident. *Peduncles* 1 or 2 per axil, 4-15 mm long, glabrous, appressed puberulous or puberulous; basal peduncular bract cucullate, caducous to deciduous. *Flower-heads* globular, bright golden, 10-15-flowered. *Flowers* 5-merous; sepals free or irregularly united basally. *Pods* linear, undulate, to 3.5 cm long, 2-4 mm wide, thin-coriaceous to chartaceous, glabrous, sometimes pruinose. *Seeds* longitudinal, widely elliptic to ovate, 1.5-3 mm long, 0.8-2 mm wide, subnitid, commonly mottled with shades of grey and black or brown, the aril minute, subterminal and white.

Variation. This is a highly variable species which is broadly circumscribed here with three varieties being recognised; future studies may demonstrate the need for further revision. Ovary pubescence and gland position in relation to phyllode-nervature and the depression/compression of the phyllodes are some of the characteristics that deserve further attention; field observations of phyllode form are especially needed, for drying often obscures the true form. The typical variety has more or less terete phyllodes; var. *platyphylla* has two phyllode forms, compressed and terete, although the distinctions between these cannot be precisely demarked in some collections; and var. *planoconvexa* has phyllodes

essentially flat on the adaxial surface but rounded on the abaxial one. The adaxial nervature of the phyllodes varies widely with respect to the point at which the two nerves coalesce and in vars. *sulcata* and *planoconvexa* they are more or less submerged and obscure.

Separation of *A. sulcata* from *A. nitidula* is arbitrary and is based on the longer, much wider, flat phyllodes of the latter.

4a. A. sulcata R. Br. var. **sulcata**

Branchlets mostly glabrous, rarely appressed puberulous and glabrescent. *Stipules* persistent. *Phyllodes* more or less terete, linear, acute, mucronulate, mostly (15)18-25 mm long, somewhat incurved, glabrous, 6-nerved; gland about 1/3 from phyllode-base on adaxial midnerve. *Peduncles* commonly 8-15 mm long, glabrous. *Sepals* free. *Pods* 20-35 mm long, 2-4 mm wide, thinly coriaceous. *Seeds* 1.5-2 mm long, 0.8-1 mm wide.

Other specimens examined. WESTERN AUSTRALIA: Mount Adelaide, Albany, *A.M. Ashby* 4600 (DNA, E, NY, PERTH), 4602 (CANB, PERTH) and *H. Sanderson s.n.* (PERTH 00661546); Mount Clarence, *R. J. Cumming* 926 (PERTH); Cape Riche, *R. J. Cumming* 1025 (PERTH) and *C. A. Gardner s.n.* (PERTH 00660507); Mount Melville, *L. Diels* 3490 (PERTH) and *B.R. Maslin* 1070 (PERTH); S end of Two Peoples Bay on road to Little Beach, *D.J. Edinger* 228 (PERTH); Pallinup River near Albany-Jerramungup road, *A.R. Fairall* 2265 (PERTH); Warriup Hills, *C.A. Gardner s.n.* (PERTH 00693979); Willyung Hill, *A.S. George* 9488 (PERTH, TLF) and *G.J. Keighery* 5721 (PERTH); King George's Sound, *B.T. Goadby* B.2525 (PERTH) and *W.H. Harvey s.n.* (PERTH 00661996); South Sister, 3 km N of Manypeaks town, G. J. Keighery 8130 (PERTH); Mount Barker, *A. Lea s.n.* (PERTH 00661570); Boat Harbour, *K. Newbey* 817 (PERTH); 9 mi. [14.5 km] SE of Jerramungup, K. Newbey 1297 (PERTH); Mount Manypeaks area, *S.P. Pfeiffer* 24 (PERTH); Two People's Bay, *W. Rogerson* 264 (PERTH).

Distribution. Of the three varieties, the typical one is the most restricted; it is confined to coastal and near-coastal sites (inland as far as near Jerramungup) from Albany (Mounts Adelaide and Clarence) and Willyung Hill (10 km north of Albany) east to Pallinup River (c. 100 km east of Albany), south-west Western Australia.

Habitat. Grows mostly on hills and mountains in low to tall scrub on grey or white sand in association with granite, sometimes in peaty, sandy clay over granite.

Flowering and fruiting periods. Flowering June-November (one collection recorded January-February). Mature pods and seeds collected in January.

Affinities. Variety *sulcata* differs from the other varieties by its relatively long phyllodes and peduncles.

4b. A. sulcata var. **platyphylla** Maiden and Blakely, J. & Proc. Roy. Soc. Western Australia 13: 3 (1928)

Lectotype (here selected): Israelite Bay, Western Australia, 1893, *Miss [S.T.] Brooks* (NSW 216916, upper left-hand, flowering specimen; iso: M, PERTH-fragment ex NSW). *Paralectotypes:* Israelite Bay, *Miss [S.T.] Brooks*, remaining five branchlets on lectotype sheet (NSW).

? *A. sulcata* var. *hirsuta* Maiden & Blakely, J. & Proc. Roy. Soc. Western Australia 13: 3, pl. 1, figs. 8-12 (1928). *Type.* Israelite Bay, Western Australia, Sept. 1915, *J.P. Brooks* (holo: NSW 216926).

Branchlets glabrous, pilosulose or appressed puberulous. *Stipules* persistent. *Phyllodes* terete to compressed, narrowly oblanceolate, obtuse, sometimes mucronulate, commonly 8-16 mm long, ascending, glabrous, more or less shiny, dark green, 6- or 7-nerved; gland 1/3-2/3 distance from phyllode-base (when present) at junction of 2 adaxial nerves. *Peduncles* mostly 4-8 mm long, glabrous to appressed puberulous to rarely pilosulose; basal peduncular bract deciduous. *Legume* 22-30 mm long, 2.5-3.5 mm wide, chartaceous, not pruinose. *Seeds* 2.5-3 mm long, 1.5-2 mm wide, the aril subterminal.

Selected specimens examined. WESTERN AUSTRALIA: 9 mi. [14.4 km] SW of Mt Ragged, *T.E.H. Aplin* 4297(DNA, NT, PERTH, W); 2.6 mi. [4 km] from Bilbarin turn-off on Quairading-Corrigin road, *I.B. Armitage* 460 (PERTH); Borden, *A.M. Ashby* 4649 (CANB, PERTH); 10 mi. [16 km] E of Mount Walker, *J.S. Beard* 5917 (PERTH); Ravensthorpe Ranges, *E.M. Bennett* 2355 (MO, NY, PERTH); 5 mi. [8 km] NW of Point Culver, *M.G. Brooker* 3685 (PERTH); 22 km SW of Mt Beaumont, *M.A. Burgman* 1711 and *S. McNee* (PERTH); near Stirling Range Caravan Park, *R.J. Cumming* 793 (PERTH); 21 km S of Cocklebiddy, *A.S. George* 11858 (CANB, PERTH); 14 km N of Eyre, *S.D. Hopper* 3111 (PERTH); about 4 mi. [6.4 km] S of Kulin, *B.R. Maslin* 524 (PERTH); 1.2 mi. [1.9 km] W of Nyabing on road to Katanning, *B.R. Maslin* 795 (MEL, NSW, PERTH); between Hamersley River and East Mount Barren, *B.R. Maslin* 813 (MEL, PERTH); 2.5 km N of Salmon Gums towards Norseman, *B.R. Maslin* 2451 (PERTH); Cape Riche, *B.R. Maslin* 2627 (PERTH); 3 km S of Ravensthorpe towards Hopetoun, *B.R. Maslin* 2651 (CANB, K, MEL, PERTH); 4.5 km NW of Wongan Hills township on road to Piawaning, *B.R. Maslin* 5365 (PERTH); 7 mi. [11.2 km] N of Bendering, *K. Newbey* 3238 (MEL, NSW, PERTH); 20 km NE of Jerramungup, *K. Newbey* 4390 (CANB, K, MEL, MO, NSW, NY, PERTH); 5.5 km S of Peak Charles, *K. Newbey* 6427 (PERTH); 6.4 km S of Newdegate on Lake Magenta road, *M.H. Simmons* 1341 (PERTH); intersection of Kulin-Wickepin road, 48.3 km to Pinjaring and 48.3 km to Harrismith, *M.D. Tindale* 3747 (B, CANB, K, P, PERTH, RSA); 8 mi. [12.8 km] SW of Mt Ragged, *P.G. Wilson* 10069 (K, PERTH).

Distribution. Variety *platyphylla* is by far the most widespread of the three varieties; it occurs in scattered localities from near Corrigin and Mt Walker south to near Borden and east to Israelite Bay, south-west Western Australia. Two near-coastal outliers occur to the east of Israelite Bay, the first near Pt Culver (c. 150 km east) and the second between Eyre and Cocklebiddy (c. 300 km east). A third collection occurs north of the main distribution near the Wongan Hills, c. 175 km north-north-east of Corrigin; it is unusual, apart from its distribution, in having densely pilosulose branchlet tips, although plants with such pubescent branchlets also occur sporadically farther south. Variety *platyphylla* occurs sympatrically with var. *sulcata* at Cape Riche and with var. *planoconvexa* at Tutanning Reserve.

Habitat. Shrubland in association with *Eucalyptus redunca, E. platypus, E. occidentalis, Melaleuca uncinata, et al.,* frequently on rocky hills or granite outcrops in sand, often over or with varying clay fractions, or in sandy loam, sometimes with ironstone gravel.

Flowering and fruiting periods. Flowers have been collected in July-October (one collection in December), mature pods in December.

Typification. The type is from Israelite Bay, collected by Miss S. T. Brooks in 1893 and it represents the compressed-phyllode element of this variety. The NSW sheet bears six branchlets, only one of which is flowering; we have designated this specimen as lectotype, the others as paralectotypes. The fruiting specimens must have been collected at a different time and we conclude that at least two

separate collections are involved on the type sheet. At the same locality J. P. Brooks collected material on which Maiden and Blakely based var. *hirsuta*. This entity was described as differing from the typical variety "in its small phyllodes, long peduncles and in the vestiture". The holotype has a few attached, very young phyllodes, as well as some loose flower-heads in an envelope, but the branchlets are only sparingly appressed-puberulous, rather than hirsute. The authors of the variety may have mistaken some of the mould which is evident on parts of some branchlets for pubescence. The type collection of var. *hirsuta* is in very poor condition and appears only to represent one aspect of var. *platyphylla* with which we provisionally synonomise var. *hirsuta*.

4c. Acacia sulcata var. **planoconvexa** Cowan & Maslin, var. nov.

A var. *platyphylla* et *sulcata* phyllodiis 5-12 mm longis, vulgo glaucis et aliquando etiam pruinosis, plano-convexis, faciebus adaxialibus subplanis et enervatis, abaxialibus cum 3 nerviis elevatibus, legumine pruinoso differt.

Typus: 11 mi. [17.6 km] SE of Ongerup, Western Australia, 17 May 1964, *K. Newbey* 1268(holo: PERTH).

Branchlets glabrous or infrequently pilosulose, often pruinose apically. *Phyllodes* linear, plano-convex, adaxial surface nearly flat and nerveless, 5-12 mm long, commonly glaucous to subglaucous and sometimes also more or less pruinose, 6-nerved, adaxial nerve indistinct, 3 abaxial ones prominent; gland near middle of phyllode, often absent or obscure. *Peduncles* mostly 5-8 mm long, glabrous; heads in masses. *Pods* 25-30 mm long, 3-4 mm wide, pruinose. *Seeds* ovate, 2 mm long, 1.5 mm wide.

Selected specimens examined. WESTERN AUSTRALIA: Cape Riche, *R.J. Cumming* 1026A (PERTH); 19 mi. [30.5 km] E of Brookton towards Corrigin, *R. J. Cumming* 1037 (PERTH); 19 mi. [30.5 km] N of Esperance, *H. Demarz* 3635 (PERTH); Tuttaning Reserve, SE of Pingelly, *A.S. George* 9505 (PERTH); W of lower Fitzgerald River, Reserve 24048, *A.S. George* 9963 (PERTH); Pt Ann, *A.S. George* 10049 (PERTH); South Stirlings, *R. Glencross* 332/62 (PERTH); Salt River Road at turn-off of track to Camel Lake, c. 5 km N of The Abbey, *E.N.S. Jackson* 3347 (PERTH); 16 km S of Jerramungup towards Albany, *B.R. Maslin* 2590 (CANB, PERTH); Yornaning Reserve, c. 19 km due E of Yornaning Siding, *B.G. Muir* 484 (PERTH); 11 mi. [17.6 km] SE of Ongerup, *K. Newbey* 1268D (PERTH); 18 km SE of Jerramungup, *K. Newbey* 4301 (PERTH); c. 20 mi. [32 km] E of Albany toward Jerramungup, *S. Paust* 485 (PERTH); 20-25 mi. [32-40 km] W of Ravensthorpe, *S. Paust* 705 (PERTH); 4 mi. [6.4 km] W of Nyabing, *R.D. Royce* 6711 (PERTH); Kojonup, 15 Aug. 1969, *M. Wittwer s.n.* (PERTH 00690767).

Distribution. South-west Western Australia from near Brookton south through Kojonup and Nyabing to near Albany, then east to near Ravensthorpe. One collection from near Esperance (*H. Demarz* 3635) is c. 150 km east of Ravensthorpe.

Habitat. Found in low, dense scrub and open shrubland in sandy or stony loam, sandy gravel and white sand.

Flowering and fruiting periods. Flowers July to September. Pods with mature seeds have been collected in December and January.

Etymology. The name refers to the shape of the phyllodes in transverse section, from two Latin words in combination, *planus* for flat, and *convexus* for convex.

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References

Bentham, G. (1864). "Flora Australiensis" Vol. 2. (Reeve & Co.: London.)

Maslin, B.R. & Cowan, R.S. (in press). Robert Brown, the typification of his new *Acacia* names in edition 2 of Aiton's "Hortus Kewensis".

Acacia Miscellany 8. *Acacia masliniana* (Leguminosae: Mimosoideae: Section *Plurinerves*), a new species of Western Australia

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Abstract

Cowan, R.S. *Acacia* Miscellany 8. *Acacia masliniana* (Leguminosae: Mimosoideae: Section *Plurinerves*), a new species of Western Australia. Nuytsia 9 (1): 79-82 (1993). *Acacia masliniana* is described and compared with related taxa in the context of a discussion of their morphological character states.

Introduction

This new wattle may be valuable in connection with reclamation of farmland in semi-arid regions rendered sterile by the accumulation of salt in the soil, for it is very salt-tolerant. In the following, all measurements and observations have been made using dried herbarium material but includes the field observations of the specialist for whom the species is named.

Description

Acacia masliniana Cowan, sp. nov. (Figure 1)

Frutices vel arbores parva 1-3 m altae, cortice fibroso, griseo, ramulis teretibus, appresso-puberulis. Phyllodia teretia, acute elongato-pungentia, parce curvata, 50-95(135) mm longa, 1-1.5 mm diametro, glabra (inter nervos numerosos tenues elevatos sericea exceptis), plus minusve glauca; glandula plerumque 4-5 mm super pulvinum. Pedunculi binati, 0.5-2 mm longi; capitula globularia, 4-5 mm diametro, 30-45-floribus; bracteolae spathulatae, ciliolatae, plus minusve puberulae. Flores (4)5-meri, puberuli, sepalis plus minusve spathulatis, 1/4-2/3-connatis, petalis anguste ellipticis, discreta vel 1/2-cohaerentibus, puberulis. Legumina linearia, supra semina valde elevata, (30)70-100 mm longa, 3-4.5 mm lata, chartacea, recta, grosse reticulata, glabra. Semina longitudinalia, elliptico-oblonga, 4.5-5 mm longa, 2-2.5 mm lata, nitida, brunnea, arillo terminale.

Typus: between Ninghan Station and Fields Find, Western Australia, 30 August 1976, *B. R. Maslin* 4244 (holo: PERTH; iso: AD, BM, BRI, CANB, G, K, MEL, NSW, NY, W, Z).

Rounded *shrubs* or *bushy trees* 1-3 m tall. *Bark* grey, fibrous, exfoliating in narrow, thin, recurved sheets. *Branchlets* terete, sometimes ribbed, appressed-puberulous. *Phyllodes* terete, basally contracted into an indistinct pulvinus and with a long-tapered, sharply pungent apex, 50-95(135) mm long, 1-1.5 mm diameter, rigid, ascending, straight to slightly curved, light green and more or less glaucous, glabrous except commonly sericeous between the numerous, fine, parallel, raised nerves; gland 1.5-5(10) mm above the phyllode-base, small, slit-like and embedded in wider portion of phyllode. *Peduncles* 2 per axil, 0.5-2 mm long, appressed puberulous to glabrous; basal peduncular bracts cucullate, more or less semicircular, appressed-puberulous and ciliolate; *heads* globular, medium golden-yellow, 4-5 mm diameter, 30-45-flowered; bracteoles spathulate to oblong-spathulate, puberulous, ciliolate, longer than calyx. *Flowers* (4)5-merous. *Sepals* 1/2-3/4 as long as petals, 1/4-2/3-united, oblong-spathulate to spathulate, puberulous, ciliolate. *Petals* narrowly elliptic, free or 1/2-coherent and becoming free with age, puberulous and ciliolate. *Ovary* puberulous or appressed-puberulous. *Pods* linear, strongly raised over seeds, (30)70-100 mm long, 3-4.5 mm wide, chartaceous, straight, coarsely reticulate over seeds, glabrous. *Seeds* longitudinal, elliptic-oblong, 4.5-5 mm long, 2-2.5 mm wide, glossy, brown, the aril terminal.

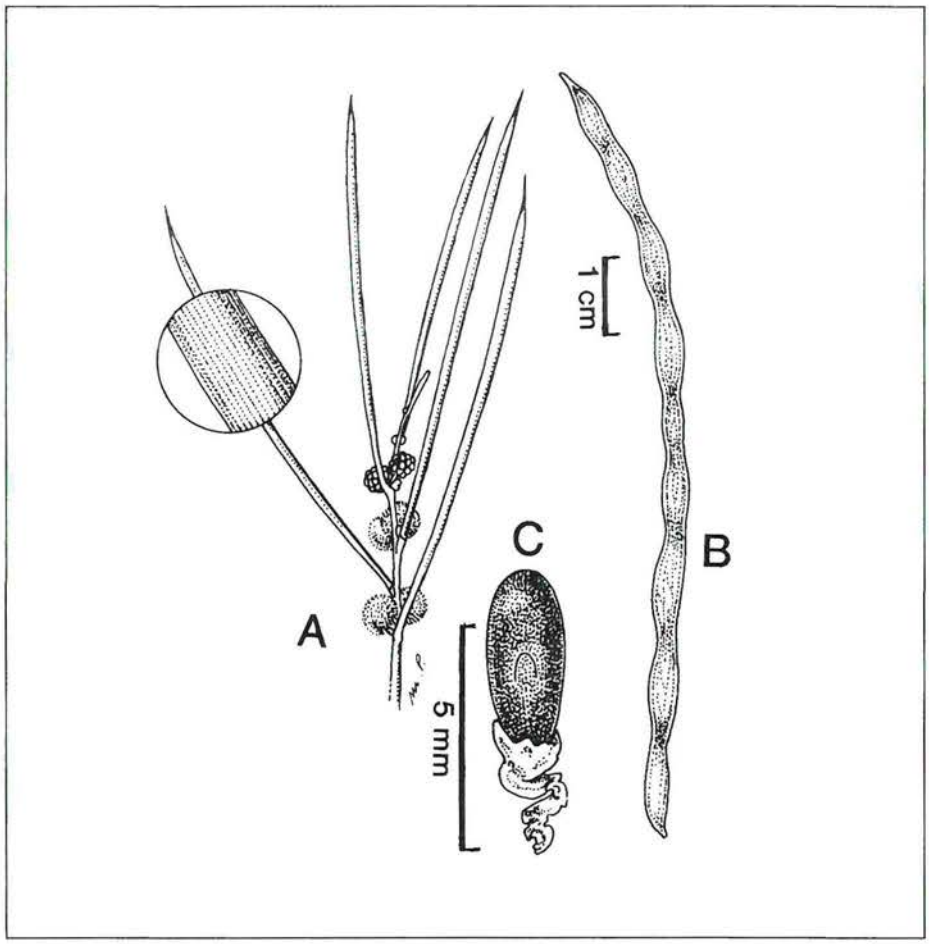

Figure 1. *Acacia masliniana* A - habit with enlargment of portion of phyllode to show form and nervature (x1) from *Maslin* 4248 (PERTH), B - pod (x1) from *Maslin* 4248 (PERTH) and C - seed from *Maslin* 4243 (PERTH). (Drawings by Margaret Pieroni).

Other specimens examined. WESTERN AUSTRALIA: c. 535 km from Perth on inland highway [c. 34 km S of Mt Magnet towards Paynes Find on Great Northern Highway], *A.M. Ashby* 4228 (BM, BRI, PERTH); between Yuinmery and Cashmere Downs, *J.S. Beard* 6487 (NSW, PERTH); 28 mi [45 km] E of Perenjori, *J.S. Beard* 7364 (PERTH); western shore of Lake Lefroy, Kambalda, *R. Coveny* 8431 and *B. Haberley* (PERTH); 2.7 mi [3 km] S of Yalgoo towards Paynes Find, *R.J. Cumming* 1985 (NSW, PERTH); 6.2 mi [10 km] S of Fields Find towards Paynes Find, *R.J. Cumming* 2026 (PERTH); about 3 km N of Mt Magnet towards Cue, *B.R. Maslin* 3579 (CANB, K, PERTH); 1.6 km N of Cue towards Meekatharra, *B.R. Maslin* 3593 (NY, PERTH); between Ninghan Station and Fields Find, c. 29° 13' S, 117° 15' E, *B.R. Maslin* 4243 (CANB, K, MEL, PERTH); Thundelarra Station, between Yalgoo and Paynes Find, *B.R. Maslin* 4248 (PERTH); 47 km S of Yalgoo on road to Paynes Find, *B.R. Maslin* 6328 and *V. Maslin* (PERTH); 22.5 km E of Koolanooka Hills (E of Morowa) on Mungala Road, *B.R. Maslin* 6608 (PERTH); 3 km by road SSE of Warriedar Homestead (c. 50 km WNW of Paynes Find), *B.R. Maslin* 6629 (PERTH); 12 km by road SSE of Paynes Find on Maranalgo Road, E side of Lake Moore, *B.R. Maslin* 6658 (PERTH); c. 6 km S of Bimbijy Homestead (SE of Paynes Find) on road to Beacon, *B.R. Maslin* 6674 (PERTH); 26-27 km N of Kalgoorlie on road to Menzies, *M.H. Simmons* 1174 (PERTH); 1.8 km E of turn-off from Wooleen Station Road, along road to Twin Peaks, *L. Thomson* JC2327 (PERTH).

Distribution. South-west Western Australia, mainly in the Austin Botanical District but extending also into the adjacent Coolgardie Botanical District (1:250,000 maps G50-14, 15; H50-2, 3, 4, 6, 7; H51-9, 14). Most collections occur in the western goldfields from near Cue south to near Perenjori and east to near Youanmi. Two collections, representing the Coolgardie Botanical District, occur in the Kalgoorlie-Kambalda area, c. 300 km south-east of Youanmi.

Habitat. Margins of saline lakes, marshes and flats on red clay and yellow-, orange-, or red-brown loam in open scrub.

Flowering and fruiting periods. Flowers July-September; pods with mature seeds August-October.

Affinities. There are many species of *Acacia* with these rigid, pungent, terete phyllodes but not all are closely related by any means. In general aspect the new species may remind one of the terete-phyllode phase of *A. rigens* Cunn. ex Don which also has the sericeous inter-nerve areas on the phyllodes. The attenuate, sharply pungent apex of the subglaucous to glaucous phyllodes of *A. masliniana* quite readily separate it from *A. rigens* which also has a basal gland, longer peduncles and larger heads of fewer flowers, but in both species the sepals are partly united. *Acacia kalgoorliensis* Cowan & Maslin has similar phyllodes but its branchlets are crispate-sericeous, its straight phyllodes have about 20 nerves, raised stomata, usually two glands and free perianth parts. Another similar-appearing species from the same general region, *A. donaldsonii* Cowan & Maslin, has much coarser phyllodes with 4-8 distant nerves and quite different pods.

Conservation status. Not considered rare or endangered.

Etymology. This interesting new species is named for Bruce R. Maslin, with whom I have worked for the past several years preparing the account of the genus *Acacia* for the Flora of Australia. It is entirely appropriate that an *Acacia* species should bear the name of one of the most active and authoritative specialists on the taxonomy of the genus. I am very pleased indeed to have this opportunity of thus commemorating him and his devotion to achieving an understanding of the genus.

Acknowledgements

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Acacia Miscellany 9. The taxonomic status of *Acacia coriacea* (Leguminosae: Mimosoideae: Section *Plurinerves*)

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Abstract

Cowan, R.S. & B.R. Maslin. *Acacia* Miscellany 9. The taxonomic status of *Acacia coriacea* (Leguminosae: Mimosoideae: Section *Plurinerves*). Nuytsia 9(1): 83-90 (1993). *Acacia coriacea* DC. is regarded as comprising three subspecies, subsp. *coriacea* (which is here lectotypified), subsp. *pendens* Cowan & Maslin, subsp. nov. and subsp. *sericophylla* (F. Muell.) Cowan & Maslin, comb. et stat. nov. These are described and compared with the similar appearing *A. stenophylla*; a key is provided to distinguish the four taxa.

Introduction

The name *Acacia coriacea* DC. has in the past been applied to plants occurring from the islands off the north-west coast of Western Australia and eastwards across Northern Territory to Queensland, New South Wales and South Australia. An extensive suite of collections from this geographic range has been examined in an attempt to understand the morphological heterogeneity observed both in the herbarium and in the field. Our studies have led us to recognise *A. coriacea* as an aggregate species comprised of three subspecies, two confined almost completely to the Pilbara region in north-western Western Australia (subsp. *coriacea* and subsp. *pendens* Cowan & Maslin, subsp. nov.) and the third, subsp. *sericophylla* (F. Muell.) Cowan & Maslin, comb. et stat. nov., occurring in all mainland states except Victoria. Although subsp. *sericophylla* has a distinctive facies in the field (see below), it cannot always be reliably distinguished from the other two on herbarium material. Future studies may show that it is preferable to re-instate subsp. *sericophylla* as a distinct species, but we believe that regarding it as a subspecies of *A. coriacea* better serves the practical needs of users who need to apply a name to new collections while at the same time recognising the incipient-species nature of the constituent elements. A key will serve to summarise the data on which our conclusions are based. *Acacia stenophylla* Cunn. ex Benth. is included here because it is frequently confused with *A. coriacea* and is superficially similar, but they are probably not very closely related.

All measurements are from dry material unless specifically noted otherwise.

Key to taxa

1. Pods longitudinally venose-striate, coriaceous, dehiscent in 2 complete valves; seeds with a conspicuous orange aril covering 1/3-1/2 of seed, pleurogram open; raceme axis absent or very short, one or two flower heads per node; phyllodes finely nerved, the spaces between them less than diameter of nerves (*A. coriacea*)
   2. Bark thin, fibrous and hard; flowering peduncles typically 5-10 mm long; pods ± twisted and coiled before dehiscence
      3. Phyllodes mostly more or less erect, almost straight to very shallowly incurved, ~~5-10~~ 1.5-10 mm wide ..... 1a. subsp. *coriacea*
      3. Phyllodes and branchlets pendulous, producing weeping habit; phyllodes shallowly to strongly recurved, 1.5-5 mm wide ..... 1b. subsp *pendens*
   2. Bark thick and spongy, yellow inside; flowering peduncles mostly more than 10 mm long; pods curved or straight, becoming twisted after dehiscence; phyllodes 1.5-12 mm wide ..... 1c. subsp. *sericophylla*
1. Pods not striate, woody, indehiscent but easily fragmenting transversely between the seeds; seeds exarillate, funicle white and slightly enlarged at hilum, pleurogram nearly closed at base; racemes normally with a well-developed axis and several flower-heads; phyllodes with many slightly raised nerves separated by spaces which are obviously wider than diameter of nerves ..... 2. *A. stenophylla*

1. Acacia coriacea DC., Prodr. 2: 451 (1825); Mem. Legum. pt. 8: 446 (1827)

Lectotype (here selected): Western Australia (sphalm. "Nouvelle-Holland. orient."), [June-July 1801, N. Baudin Expedition s.n.], unlabelled fruiting specimen on type sheet (G-DC); isolecto: K, P. *Paralectotype*: labelled flowering specimen on type sheet (G-DC, P).

Spreading *shrubs* or *trees* 1-10 m tall. Young new growth yellow-green sericeous. *Bark* thin, fibrous and hard or thick and spongy. *Branchlets* sometimes pendulous, glabrous to minutely sericeous. *Phyllodes* narrowly elliptic to ligulate, 10-33 cm long, 1.5-12 mm wide, coriaceous to rigid-coriaceous, almost straight to shallowly arcuate, occasionally very narrow ones semi-terete, green, silvery- or grey-green, silvery-grey or rarely ± glaucous, subglabrous to sericeous between the numerous, parallel, closely spaced, fine nerves; apex acute to acuminate. *Inflorescences* ~~sometimes~~ mostly racemose with a very short, 1-2-headed axis; peduncles 1 or 2 per axil, 5-32 mm long, subglabrous to sericeous. *Flower-heads* globular, pale golden or cream-coloured, 3-8 mm diam., 15-50-flowered. *Flowers* 5-merous. *Sepals* 1/2-3/4-united. *Pod* moniliform, 15-34 cm long, 7-12 mm wide, coriaceous, twisted and coiled or nearly straight before dehiscence, longitudinally nerved, often conspicuously so, minutely sericeous. *Seeds* longitudinal, widely elliptic, compressed, 4-8 mm long, 4-6 mm wide, shiny, black, the pleurogram narrowly to broadly oblong and open, the aril terminal, bright orange, covering at least 1/3 of seed. Wirewood, Desert Oak, Dogwood.

Distribution. All mainland states except Victoria.

Affinities. Superficially resembling *A. stenophylla* (see below).

1a. Acacia coriacea DC. subsp. **coriacea**

Illustrations. F. Mueller, Iconogr. Austral. Acacia, dec. 6, pl. [6] (1887); J. H. Maiden, Forest Fl. New South Wales 7(4): fig. 242L-T, (1920).

Bushy *shrubs* or *trees* 1-3 m tall, occasionally semi-prostrate and sometimes markedly wind-pruned (exposed coastal habitats). *Bark* thin, fibrous and hard. *Phyllodes* silvery- or grey-green, usually erect, 10-22 cm long, 1.5-10 mm wide, commonly 20-50 times longer than wide. *Flowering peduncles* 5-10 mm long. *Pods* ± twisted and coiled before dehiscence, usually curved.

Selected specimens examined. WESTERN AUSTRALIA: inland of Sandy Point, Dorre Island, *J.S. Beard* 7092 (PERTH); Hearson Cove near Dampier, 6 Feb. 1981, *G. Craig s.n.* (PERTH 00613185); Dirk Hartog Island near Cape Inscription, *B.R. Maslin* 4297 (PERTH); north-east end of Enderby Island, Dampier Archipelago, *B.R. Maslin* 4691 (BRI, PERTH); about 5 km N of Exmouth Gulf Homestead toward William Preston Point, *B.R. Maslin* 4757 (BRI, PERTH); Dolphin Island, Dampier Archipelago, *R.D. Royce* 7164 (PERTH).

Distribution. North-western Western Australia along the coast and offshore islands from Dirk Hartog (Shark Bay) and Dorre Islands north-east to Point Samson near Wickham. A few specimens from north of the Tanami Desert in Northern Territory are provisionally referred to this subspecies, although they are distributionally and ecologically very anomalous. Indeed, they occur within the geographic range of subsp. *sericophylla* but their bark is described by the collectors as "fibrous". Future collecting in this area should take special note of bark characteristics to test our identification. The specimens which we have seen from north of the Tanami Desert and which we have referred to this taxon are: 40 mi. [64 km] E of Limbunya Station, *R.A. Perry & M. Lazarides* 2293 (PERTH); 10 mi. [16 km] W of Birrindudu out-station, *R. Perry & M. Lazarides* 2370 (PERTH); 35 mi. [56 km] SSE of Nicholson Station, *R.A. Perry & M. Lazarides* 2434 (PERTH). These collections are identified as the typical subspecies rather than subsp. *pendens* because they all have the characteristic relatively broad phyllodes and short peduncles of this subspecies.

Habitat. Coastal dune or beach sands most commonly, infrequently in red sands or in lateritic and limestone soils.

Flowering and fruiting periods. Flowering June-July; mature pods with seeds in August to November.

Typification. De Candolle described *A. coriacea* first in his Prodromus (1825) and two years later in his Memoire on the Legumes (1827). The type sheet at herb. G-DC bears two branchlets, possibly representing different collections, one flowering and the other in very young fruit; we have assumed that the label on the flowering specimen applies equally to the fruiting branchlet. Because De Candolle described both flowers and young fruits in the protologue, either of the specimens on the type sheet could qualify as a lectotype. We have selected the left-hand specimen with young fruit as lectotype because it clearly represents the entity that most likely would have been encountered on the coastal islands by the Baudin Expedition and is consistent with the protologue. The identity of the right-hand (para-lectotype) specimen is equivocal, perhaps representing a narrow phyllode form of subsp. *coriacea (sensu lectotypico)* or even subsp. *pendens*.

The lectotype specimen is not labelled but data from the iso-lectotype collection at Paris establishes its provenance, namely, the west coast of Western Australia, collected by a member of the N. Baudin expedition of 1801. The G-DC paralectotype which is annotated "cote orient" is clearly an error.

The actual type locality cannot be determined with certainty but it is likely that the type collection came from either Bernier Island or one of the islands in the Dampier Archipelago. Certainly Bernier was visited extensively by the naturalists on the Baudin Expedition (Marchant 1982:154) and *A. coriacea* still occurs there. Although several times small boats were sent to search for a suitable place for landing on the coast of Shark Bay, and the "Geographe" itself made such a reconnaisance, Baudin left the area without the scientists ever having set foot on the mainland. After leaving Shark Bay on the way to Timor to restock supplies, near the end of July 1801, Baudin sailed north to the Dampier Archipelago where a detailed survey was made of some of the islands near Roebourne. Baudin did not permit the scientists to go ashore but some of the ship's company collected specimens for the naturalists (Marchant 1982:155), so it is not impossible that the type collection or part of it was made on one of these islands where the species can still be found.

Affinities. More closely related to subsp. *pendens* than to subsp. *sericophylla.*

Conservation status. Not rare or endangered.

1b. Acacia coriacea subsp. **pendens** Cowan & Maslin, subsp. nov.

A subsp. *coriacea* ramis plerumque pendulis phyllodiis flexuosis expansis usque ad pendulis, 55-110-plo longioribus quam latiores differt.

Typus: Hamersley Range National Park at Coppin Pool, 300 m. upstream from crossing, Western Australia, 12 May 1980, *M. Trudgen* 2518 (holo: PERTH; iso: CANB, G, K, NY).

Trees, rarely shrubs, (1)3-6(8) m tall with thin, hard and fibrous *bark* and gracefully pendulous branchlets and foliage. *Phyllodes* green, grey-green or silvery green, rarely subglaucous, 17-27 cm long, 1.5-5 mm wide, 55-110 times longer than wide. *Flowering peduncles* 5-10 mm long. *Pods* ± twisted and coiled before dehiscence.

Selected specimens examined. WESTERN AUSTRALIA: Paraburdoo, *K. Atkins* 1236 (BRI, PERTH); Barrow Island, *R. Buckley* 7246 (PERTH); 41.5 km W of Gascoyne Junction on the road to Carnarvon, *B.R. Maslin* 5002 (PERTH); 47.5 km SW of Marble Bar on the track to Spear Hill, *B.R. Maslin* 5265 (BRI, PERTH); Bulloo Downs Station, near E end of Lofty Range, *B.R. Maslin* 5285 (MO, PERTH); 8 km NE of Quarry Hill, *K. Newbey* 10623 (CANB, KARR); Depuch Island, *R.D. Royce* 7107 (PERTH); West Lewis Island, Dampier Archipelago, *R.D. Royce* 7422 (PERTH); Christies Crossing, Oakover River, *P.G. Wilson* 10378 (NT, PERTH).

Distribution. North-western Western Australia, predominantly inland from the coast in the Pilbara region. Extending from the Gascoyne River (Gascoyne Junction) north to the De Grey River (Yarrie Station) and as far inland as the Oakover River; infrequent along the coast and on offshore islands in the Dampier region.

Habitat. Mainly along rivers and creeks, on sandy soils and on stable sand dunes, less commonly on red sand and gravel in fringing woodland.

Flowering and fruiting periods. Flowering March to August; fruits with mature seeds collected July to December.

Affinities. Nearest the typical subspecies, especially with respect to bark characteristics. Both taxa are of some importance to horticulturists and are cultivated in native plant gardens in northwest Western Australia, for example at Karratha.

Conservation status. Not rare or endangered.

1c. Acacia coriacea subsp. **sericophylla** (F. Muell.) Cowan & Maslin, comb. et stat. nov.

Type: Based on the following.

A. sericophylla F. Muell., J. Proc. Linn. Soc., Bot. 3(11): 122 (1859). *Type:* desert along the Suttor R., Queensland, *F. Mueller s.n.* (holo: MEL (?), *n.v.*; iso: K).

A. coriacea DC. var. *angustior* Maiden, Forest Fl. New South Wales 7(4): 154 (1920). *Syntypes* (Queensland): Beta, *J.L. Boorman s.n.* (NSW 183183); Prairie, 30 mi. E of Hughenden, *R.H. Cambage* 3961(NSW); Prairie, *J.R. Chisholm s.n.* (NSW 183181); New Angledool, Feb.1900, *A. Paddison s.n.* (NSW 183180).

Illustrations: J.H.Maiden, Forest Fl. New South Wales 7(4): fig. 242U (1920); D.J.E.Whibley, Acac. S. Australia, 191 (1980); G.M.Cunningham *et al.*, Pl. W. New South Wales 358 (1981).

Shrubby, usually somewhat gnarled, *trees* 3-7 m tall, to 10 m in Queensland. *Bark* grey, thick and spongy, yellow inside. *Phyllodes* light green or grey-green, often pendent, 17-33 cm long, 1.5-12 mm wide, 60-100 times longer than wide. *Flowering peduncles* mostly 10-20 mm long, occasionally as short as 6 mm or as long as 32 mm. *Pods* straight or curved before dehiscence, not markedly twisted or coiled.

Selected specimens examined. WESTERN AUSTRALIA: Sturt Creek, 1.5 km E of Billiluna Station, *G.W. Carr* 3692 and *A.C. Beaglehole* 47470 (PERTH); 13 km SSE of E end of Clutterbuck Hills, Gibson Desert, *S.D. Hopper* 2883 (PERTH); 26.9 km from Ardjorie Homestead on road to Dampier Downs, *K.F. Kenneally* 9162 (MEL, NSW, PERTH); Cape Keraudren, *B.R. Maslin* 4864 (CANB, PERTH); 45 km NE of Whim Creek on North West Coastal Highway, *B.R. Maslin* 5255 (PERTH); 5 km NNW of Cooletha Hill, c. 65 km NE of Wittenoom, *K. Newbey* 10017 (KARR, PERTH); Bernier Island, Shark Bay, *R.D. Royce* 5979 (PERTH); Depuch Island, *R.D. Royce* 7092 (PERTH).
NORTHERN TERRITORY: Newland Creek, Elkedra, *G. Chippendale* 1184 (PERTH); Renner Springs, *N. Forde* 229 (PERTH); approx. 5 km W of Docker River Settlement, *A C. Kalotas* 1524 (PERTH); The Granites Tenements, Tanami Desert, *A.C. Kalotas* 1710 (PERTH); Bushy Park Station, *P.K. Latz* 9416 (DNA, PERTH); 29 km N of Tanami, *J.R. Maconochie* 1729 (DNA, PERTH).
SOUTH AUSTRALIA: N side of Mt Lindsay near base, *D.J.E. Whibley* 6629-A (AD); Lake Eyre region, Marquelpie Paddock, Innamincka Station, *J. Reid* 1635 (AD).
QUEENSLAND: Gilruth Plains, E of Cunnamulla, *S.T. Blake* 14049 (BRI); 31 km E of Urandangi, *V.J. Neldner* 2063 & *T.D. Stanley* (BRI); NE of Alpha, *J. & M. Simmons* 1097 (PERTH); 20 mi [32 km] E of Hughenden Township, *N.H. Speck* 4527 (PERTH); Barcaldine, Mitchell Distr., *C.T. White* 12348 (BRI).
NEW SOUTH WALES: SE of Narran Lake, Boorooma Sta., *C. Boyd* (NSW 216911); between Mc Phee Yards intersection and Remington, E of Narran Lake, *D.J. McGillivray* 2897 (NSW); E of Cumborah, *P.L. Milthorpe* 3827 & *G.M. Cunningham* (NSW).

Distribution. All mainland states (excluding Victoria). Rare on offshore islands in north-western Western Australia but common inland, extending through central Northern Territory and extreme north-western South Australia to central Queensland and north-central New South Wales.

Habitat. In near-coastal areas of red sands and in finely textured red, loamy alluvial soils on open plains, often in "spinifex" country, but absent from heavier textured soils of the Channel Country in northern Queensland. In some semi-arid areas it frequently forms pure stands along watercourses (Pedley 1978).

Flowering and fruiting periods. Flowering March to July; mature fruits with seed collected October to December.

Affinities. Until now this taxon has been considered simply as *A. coriacea*, e.g. Pedley (1978:191), Cunningham *et al.* (1981:358), Askew and Mitchell (1978:74), Everist (1969:15), Whibley (1980:190) and Turnbull (1986:124).

It is a well-defined taxon, particularly with respect to its habit and bark characteristics, which makes field identfication relatively easy. Unfortunately, bark characteristics are not generally given on herbarium specimens and it is often difficult to be certain of their identity. Future research may demonstrate the necessity of reinstating the taxon to specific rank.

Conservation status. Transcontinental; not rare or endangered

2. Acacia stenophylla Cunn. ex Benth., London J. Bot. 1: 366 (1842)

Type: New Holland [Lachlan River, New South Wales, June 1817], *A. Cunningham* (holo: K, right-hand specimen on sheet stamped Herb. Bentham 1854; iso: K).

A. longissima glauca pendula Rantonnet, Rev. Hort. 37: 138 (1866), an inoperative name.

A. stenophylla var. *linearis* Maiden, Forest Fl. New South Wales 7(4): 150 (1920). *Type:* not designated, *n.v.*

Illustrations: F.Mueller, Iconogr. Austral. Acacia dec. 6, pl. [5] (1887); J. H. Maiden, Forest Fl. New South Wales 7(4): fig. 242A-K (1920); D.J.E.Whibley, Acac. S. Australia 189 (1980); G.M.Cunningham *et al.*, Pl. W. New South Wales 373 (1981); B.R.Maslin in J.P.Jessop (ed.), Fl. Centr. Australia 123 (1981); L.Costermans, Native Trees Shrubs SE Australia 328 (1981); M.Simmons, Acac. Australia 2: 207 (1988).

Shrubs to straggly *trees* 2-20 m tall, the trunk to 60 cm diam., the crown sometimes rounded. *Bark* dark grey, fibrous. *Branches* normally pendulous, the branchlets glabrous to minutely sericeous, often pruinose, sometimes angular. *Phyllodes* ligulate, 20-40 cm long, 2-5 mm wide, thinly coriaceous, straight to weakly incurved, glabrous or appressed- puberulous, acute to acuminate, apex acute to acuminate, often strongly arcuate; nerves numerous, closely parallel but with diameters less than inter-nerve spaces. *Raceme-axis* 2-15 mm long, subglabrous to sericeous, rarely absent. *Peduncles* 6-13 mm long, glabrous to appressed puberulous. *Flower-heads* globular, pale yellow, 6-9 mm diameter (dry), 25-40-flowered. *Flowers* 5-merous; calyx half length of corolla, 3/4-united; petals not contiguous above calyx in mature bud, densely sericeous apically. *Pods* moniliform, 10-26 cm long, 8-12 mm

wide, woody, smooth, glabrous except micro-puberulous on the constrictions between seeds, indehiscent but easily fragmenting between seeds. *Seeds* longitudinal, widely elliptic to oblong-elliptic, 7-9 mm long, 5-6 mm wide, dark brown, the pleurogram closed or nearly so, the funicle white and slightly enlarged at hilum, exarillate.

Selected specimens examined: NORTHERN TERRITORY: Stuart Highway at Newcastle Creek, *T.S. Henshall* 2502 (BRI, NSW, NT, PERTH); 6 mi NE Austral Downs H.S., *G. Chippendale* 1478 (PERTH).
SOUTH AUSTRALIA: 170 km west of Maree on road to Oodnadatta, *J.Z. Weber* 790 (PERTH); Murray R., between Renmark and Chowilla Station, 2 Sept 1982, *B.R. Maslin s.n.* (PERTH 00673382).
QUEENSLAND: 0.5 mi. [0.8 km] N of Weemalah, *C. Slade* 3 (NSW, PERTH); 15 mi [25 km] NW of Headingly Stn, *R.A. Perry* 864 (CANB, PERTH).
NEW SOUTH WALES: E bank of Gol Gol Creek, 0.5 km E of Gol Gol, *L. Thomson* LXT 197 (PERTH).
VICTORIA: Wallpolla Id, 0.5 km W of Finnegan's Bridge, *G.R. Lucas* 367 (MEL).

Distribution. Inland areas of all mainland states; extending from north-eastern Western Australia east through Northern Territory to Queensland (west of the Great Divide) and south to the Murray-Lachlan-Darling system in South Australia, New South Wales and Victoria. Disjunct in South Australia between Lake Eyre and the Murray River.

Habitat. Usually on banks and in floodplains of creeks and rivers in clayey soils.

Flowering and fruiting periods. Flowering March to June; mature fruits with seeds collected October or later.

Typification. Acacia stenophylla was described by Bentham (1842) based on flowering material collected by Cunningham from the Lachlan River, N.S.W. As was Bentham's practice in this work, no collecting number was attributed to the Cunningham gathering.

There are two sheets at Herb. K with specimens which seem most likely to represent the original material (both in flower) upon which Bentham based this name: the right-hand specimen on the sheet stamped Herb. Bentham 1854, the left-hand one on the sheet stamped Herb. Hooker 1867. These specimens are both mounted with other gatherings and each is annotated "Acacia stenophylla" in what appears to be Bentham's handwriting. Unfortunately the label details on these specimens are very deficient and it is only by considering both together that one can derive the provenance details given in the protologue: the Herb. Bentham specimen shows Cunningham the collector and the Herb. Hooker specimen gives the collection locality as "L.R." (i.e. Lachlan River).

The Herb. Benth. sheet bears, to the right of a pencilled dividing line, a flowering specimen we consider as the holotype. To the left of the pencil line there are two specimens, a small packet with pod segments and a cluster of detached phyllodes. A large handwritten label, in neither Bentham's nor Cunningham's hand, also to the left of the pencil line, gives the information "Lachlan River June 432/ 1817" and "Hunter River May 113/1825". Cunningham recorded in his journal the presence of pods for his 432 and it seems likely that the pods in the packet and the two sterile branchlets just above the packet represent this gathering. The several detached phyllodes are bound together by a label, possibly in Cunningham's hand, reading: "stenophylla and pauciflora"; these have the same appearance as the holotype and may be from that collection. The identity of the other collection referred to on the label,

namely *Cunningham* 113, is uncertain, for the same number is given on the type sheet of *A. pendula* but with April 1825 as the date of collection.

The Herb. Hooker sheet at K also has multiple specimens of *A. stenophylla*: the one on the left of a dividing pencil line is regarded as an isotype; the other two, collected on the Darling Desert Victorian Expedition, are of no type value.

Pedley (1978) regarded the holotype of *A. stenophylla* to be *A. Cunningham* 432; however, if our interpretations in the preceding paragraphs are correct, it cannot be a type because it is a fruiting specimen. It and the flowering (holotype) specimen have dried with a rather different appearance and it seems unlikely that they represent the same collection. It is, consequently, difficult to be certain of a collection number for the type, if, indeed, it ever had one. We have concluded that it is better to cite the holotype unnumbered.

Affinities. Very similar in appearance to *A. coriacea* especially on account of its habit, very long phyllodes and globular heads, but the similarity is probably more superficial than real. The main characteristics separating the species are summarised in the key above.

Conservation status. Widespread and neither rare or endangered.

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References

Askew, K. and A.S. Mitchell (1978). The fodder trees and shrubs of the Northern Territory. Div. Primary Indus.Ext. Bull. 16.

Bentham, G. (1842). Notes on Mimoseae, with a Synopsis of Species. London J. Bot. 1: 318-528.

Candolle de, A.P. (1825). Prodromus systematis naturalis regni vegetabilis. Vol. 2.

Candolle de, A.P. (1827). Memoires sur la famille des Legumineuses. Pt 8 Paris.

Cunningham, G.H. *et al.* (1981). Plants of western New South Wales. (Government Printer: Sydney.)

Everist, S.L. (1969). Use of fodder trees and shrubs. Qld. Dept. Prim. Ind. Div. Plant Industry Advisory Leaflet 1024.

Marchant, L.R. (1982). France Australe. (Artlook Books: Perth.)

Pedley, L. (1978). A revision of *Acacia* Mill. in Queensland. Part 1. Austrobaileya 1(2).

Pedley, L. (1980). A revision of *Acacia* Mill. in Queensland (concluded). Austrobaileya 1(3).

Turnbull, J.W. (1986). Multipurpose Australian trees and shrubs: lesser known species for fuelwood and agroforestry. (Australian Centre for International Agricultural Research: Canberra.)

Whibley, D.J.E. (1980). Acacias of South Australia. (Government Printer: Adelaide.)

A new species of Restionaceae from south-western Western Australia

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Abstract

Dixon, K.W., Meney, K.A. and Pate, J.S. A new species of Restionaceae from south-western Western Australia. Nuytsia 9(1): 91-94 (1993). *Restio isomorphus* is a new species of Australian Restionaceae from a restricted area in the south-west of Western Australia. Rhizome morphology and ecological factors likely to influence the conservation status of this species are discussed.

Introduction

Western Australia contains approximately 110 species of Restionaceae representing over three-quarters of the known Australasian species. However, since the publication of Carlquist (1976) and more recently, Briggs *et al.* (1990), there has been no published description of new taxa in Western Australia pending resolution of the generic classification of the Australian Restionaceae by Dr B.G. Briggs and Dr L.A.S. Johnson.

This paper describes one of a suite of species collected as part of a broad-based botanical and ecological survey of the family in Western Australia (Meney & Dixon 1988, Meney, Pate & Dixon 1990a, Meney, Pate & Dixon 1990b, Pate, Meney & Dixon 1991). Most of the new taxa are geographically restricted, are limited to a few individuals in vulnerable habitats and/or are fire-sensitive. Thus special management considerations will be necessary to ensure the long-term survival of the species.

Restio isomorphus K.W. Dixon and K.A. Meney, sp. nov. (Figure 1)

Planta dioica spicis maribus femineisque similibus, rhizomate breviter repente, tomentoso, culmis erectis, viridibus, sparsim ramosis; culmorum vaginae ad basim purpurescentes, lateralibus marginibus expansis.

Typus: South-western Western Australia, South-west Botanical Province, Scott River along Governor Broome Road and Dennis Road (115° 17' E, 34° 15' S), December 1988, *Meney & Dixon* (KM 110, female plant) (holotype: PERTH; isotype: K, SYD). Growing in shallow sandy soils over lateritic ironstone often with a perched water-table during winter and spring.

Habit. Plants tufting to shortly creeping, 45 cm in diameter, roughly circular.

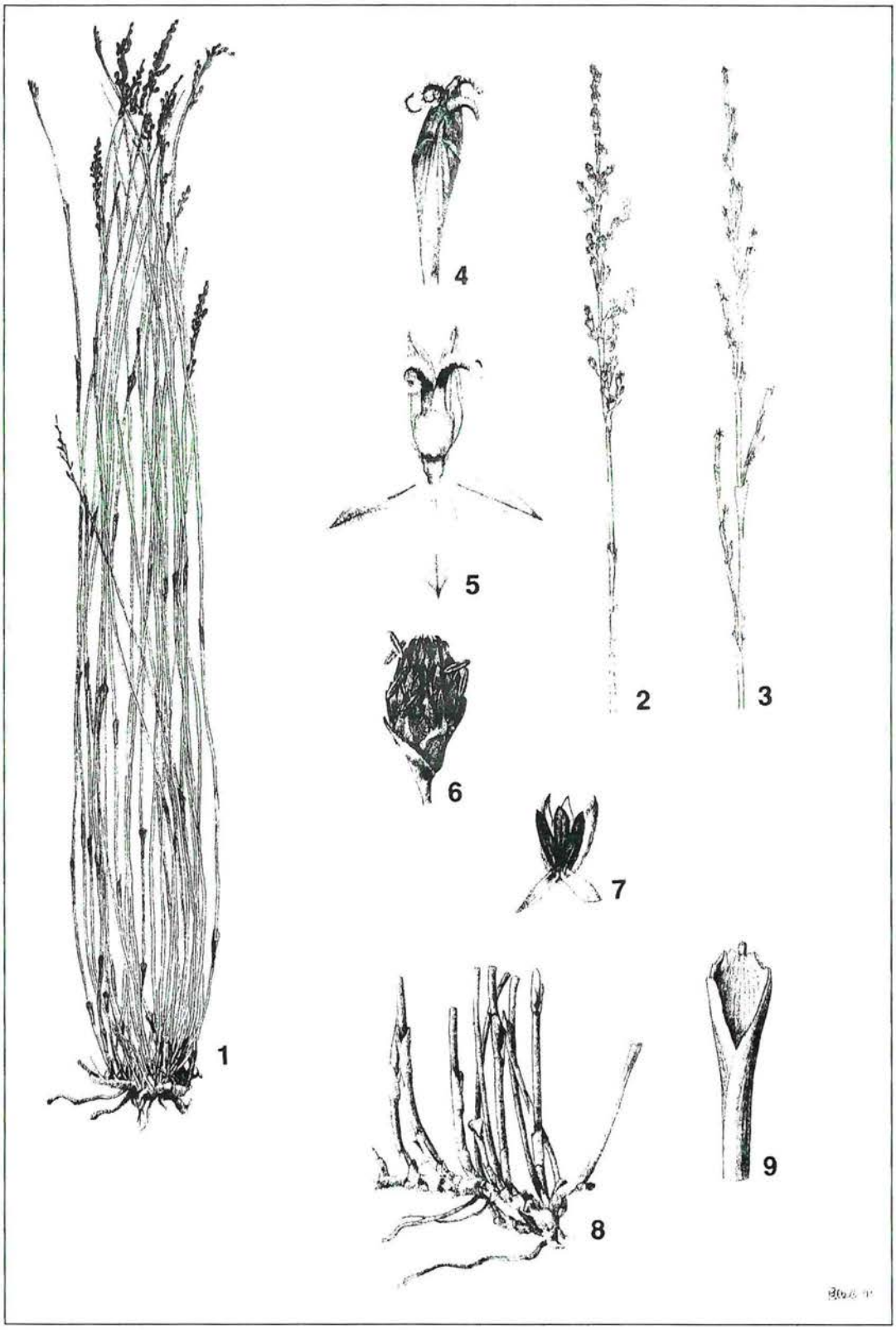

Figure 1. *Restio isomorphus*. 1 - sketch of plant (x0.25); 2 - single female culm (x0.5); 3 - single male culm (x0.5); 4 - female spikelet (x5); 5 - female flower opened out (x5); 6 - male spikelet (x5); 7 - male flower opened out (x5); 8 - rhizome and lower culm bases (x0.5); 9 - culm sheath (x2).

Rhizome elongated, variable in length, 2-3 mm in diameter, densely villous on young rhizomes but weathering with age, with broadly deltoid, closely appressed scale leaves, 0.3-0.4 mm long, glossy and deciduous. *Cataphylls* 2-4, 7-14 mm long, straw-coloured, closely appressed, chartaceous, acute to mucronate and persistent. *Culms* simple, glabrous, green flushed with purple at internodes, finely striate, 60-70 cm tall, 1-1.2 mm wide, erect and parallel, solid, chlorenchyma of two layers of palisade cells, stomata superficial. *Culm sheaths* 5-7, sterile and 9-14 fertile per culm, 1.5-2.1 cm long with a 1-2 mm long often deciduous mucro, appressed at base with flared lateral margins, striate, scarious, purple grading to fawn towards apex, persistent. *Male spikelets* erect, ovoid, 3-4 mm long, 2-3 mm wide, 2-3 per subtending inflorescence bract on short 1-2 mm long pedicels; subtending inflorescence bract broadly obovate, 2-3 mm long with a 1 mm long mucro; lower 1-2 glumes infertile, upper 10-25 glumes fertile, glossy, coppery-bronze aging grey, margins entire. *Male flowers* sub-sessile; tepals 5, 2 outer and 3 inner, 2.5 mm long, linear-lanceolate, flat; margins pale, membranous with rust-brown tips, lateral tepals keeled, glabrous, inner tepals slightly shorter and broader. *Stamens* 3, stout, exserted, pistallode absent. *Female spikelets* erect, narrow-ovoid to ovoid, 5-7 mm long, 1-1.8 mm wide, sessile; bracts 4, usually all fertile, sub-equal, keeled, red-brown, 3-5 mm long with a 1 mm long mucro and shortly fimbriate margins; spikelets solitary in upper 5-8 subtending inflorescence bracts, lower inflorescence bracts often subtending 1.5-7 cm long branches each terminating in 3-6(8) single spikelets; subtending inflorescence bracts similar to those on male plants. *Female flowers*: tepals 5(6), linear-lanceolate, acute, 3-3.5 mm long, pale to hyaline, outer tepals keeled with hairs, inner tepals only slightly keeled and glabrous; style red, divided to base with two style branches, stigma white, ovary bilocular, 1 mm wide, 1.2 mm long, compressed with two lateral raised sutures; staminodes absent. *Fruit* a capsule, glossy, chestnut brown to dark brown, 1.8-2.0 mm wide. *Seed* small, 1.5 x 1 mm, reniform, black, with white ridges.

Flowering period. Late February to April; *seed dehiscence:* November-December.

Affinities. Restio isomorphus shows affinity with *Restio stenandra* (Briggs and Johnson *ined.*) in plant habit and spikelet morphology but is distinct in possessing superficially similar male and female spikelets and in the flared purple and fawn culm sheaths. The species favours shallow white or red sandy soils over lateritic ironstone which is seasonally wet. The culms are erect and arise from a 1.5-2 cm deep subsurface more or less creeping rhizome. The rhizome morphology fits category type B_3 (Pate, Meney and Dixon 1991) and does not contain starch. The plants are killed by fire and regenerate from seed. The conservation status of the species warrants investigation as it is of limited local distribution; its known range is less than 5 km with the plants confined to ironstone soils which are poorly reserved (only one small area exists in Scott River National Park).

Etymology. The specific epithet is derived from the Greek *isos*, equal and *morphe,* form, referring to the similar male and female spikelets.

Acknowledgements

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References

Carlquist, S. (1976). *Alexgeorgea*, a bizarre new genus of Restionaceae from Western Australia. Austral. J. Bot. 24: 281-95.

Johnson, L.A.S. and Briggs, B.G. (1990). The species of *Alexgeorgea*, a Western Australian genus of the Restionaceae. Austral. Syst. Bot. 3: 751-8.

Meney K.A. and Dixon K.W. (1988). Phenology, reproductive biology and seed development in four rush and sedge species from Western Australia. Austral. J. Bot. 36: 711-26.

Meney K.A., Pate J.S.and Dixon K.W. (1990a). Phenology of growth and resource deployment in *Alexgeorgea nitens* (Nees) Johnson and Briggs (Restionaceae) - a clonal species from south-west Western Australia. Austral. J. Bot. 38: 543-57.

Meney K.A., Pate J.S. and Dixon K.W. (1990b). Comparative morphology, anatomy, phenology and reproductive biology of *Alexgeorgea* species (Restionaceae) from south-west Western Australia. Austral. J. Bot. 38: 523-41.

Pate J.S., Meney K.A. and Dixon K.W. (1991). Contrasting growth and morphological characteristics of fire-sensitive (obligate seeder) and fire-resistant (resprouter) species of Restionaceae (S. Hemisphere restiads) from South-Western Australia. Austral. J. Bot. 39: 505-25.

Drummondita wilsonii, *Philotheca langei* and *P. basistyla* (Rutaceae), new species from south-west Western Australia

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Abstract

Mollemans, F.H. *Drummondita wilsonii*, *Philotheca langei* and *P. basistyla* (Rutaceae), new species from south-west Western Australia. Nuytsia 9(1): 95-109 (1993). One new species of *Drummondita* and two new species of *Philotheca* are described. All three taxa are apparently rare, each restricted to limited geographic areas. *Drummondita wilsonii* is similar to *D. ericoides*, but has unequal calyx segments in common with *D. miniata*. *Philotheca langei* and *P. basistyla* both have affinities with *Eriostemon falcatus* which is currently presumed extinct. Similarities between *D. wilsonii*, *D. ericoides* and *D. miniata*, pollination mechanisms and flower colour variation in *Drummondita*, distribution and flowering time of the *D. ericoides* group (which includes *D. miniata* and *D. wilsonii*) and the evolutionary history of the *Drummondita ericoides* group, *D. hassellii* group and *D. calida* are discussed.

Introduction

During 1990, three new species were collected, two of which were initially considered to be ecotypic variants of *Eriostemon falcatus* P.G. Wilson, a taxon which is currently presumed extinct. The third, an opportunistic collection of a "pink" flowered *Drummondita 'hassellii'* pointed out by my wife Nellie as being unusual, was made, while searching for a rare *Banksia* in an area north of known occurrences.

Detailed examination of all three taxa found that one of the species of *Eriostemon* was monadelphous, making it referable to *Philotheca*. The other *Eriostemon*, belonging to sect. *Nigrostipulae* (P.G. Wilson 1970), is also referred here to *Philotheca* in keeping with the intention of Armstrong in Wilson (1992) to transfer all species of *Eriostemon* sect. *Nigrostipulae* to that genus. The *Drummondita* was found to be morphologically similar to *D. ericoides* and *D. miniata*.

Additional collections were subsequently made by the author and the following descriptions are based on this material.

Taxonomy

Drummondita Harvey

Drummondita wilsonii F.H. Mollemans, sp. nov. (Figures 1 & 4)

Distinguitur folia aggregatus secus ramulo et flores color; calycis segmenta inaequalia et glaber; statura non robustus. Morphologia similitudo *Drummondita ericoides* et *D. miniata.*

Typus: W.A. Wheatbelt (eastern), Parker Range South, East of Skeleton Rocks (precise locality withheld), alt. 450 m., 15th June 1990, *F.H. Mollemans* 2761 (holo: PERTH; iso: BISH). (Figure 1)

Shrubs 40 cm to 1 m tall, erect, branching, ericoid. *Leaves* green, crowded, linear-clavate, semi-terete, channelled above, 2-6 mm long and 0.6-1 mm wide, with scattered glands, a large, black apical gland, and a petiole to 0.5 mm. *Flowers* 1-3, tubular to 1.5 cm long, terminal. *Calyx segments* unequal, oblong, 4-5 mm long, 2-2.5 mm wide, with scattered glands; green with reddish margins, glabrous outside, minute marginal hairs, inside glabrous. *Petals* oblong-ovate, 12 mm long, 3 mm wide, with scattered glands; reddish fading to green at base, glabrous inside and outside. *Stamens* pink, densely hairy in upper one-third. *Ovary* obtuse. *Seed* 3.5 mm long, dark brown-black.

Other specimens examined. WESTERN AUSTRALIA: W.A. Wheatbelt (eastern), Parker Range South, East of Skeleton Rocks, alt. 450 m., frequency fairly common, 14th July 1990, *F.H. & M.P. Mollemans* 3143, 3144, 3155, 3157, 3158, 3159 (PERTH); W.A. Wheatbelt, Parker Range South, alt. 450 m., frequency (locally) fairly common - 5 seen, 18th October 1990, *F.H. & M.P. Mollemans* 3717 (PERTH).

Distribution. Endemic to the boundary zone of the Avon and Coolgardie Botanical Districts of Western Australia, with one known area of occurrence on a low range located 75 km south-south-east of Southern Cross, Yilgarn Shire, on vacant crown land.

Habitat. Found in (*Eucalyptus* spp.) mallee to 4 m over *Hakea -Melaleuca -Grevillea* scrub to 1.5-3 m and heath to 1.2-1.5 m on part of the east-north-east facing slope of Parker Range South. Geology is quartzitic (silicified sandstone) as boulder, cobble, pebble and gravel outcrop, bordered up-slope (to west) by outcropping volcanics and down-slope (to east) by aeolian sands, with erosional gullies to the north and south. Soils are pale yellow to yellow olive-brown sands of a skeletal nature with gravel, pebbles and ± cobbles of quartzose and ferruginous rock fragments and minimal organic matter. *D. wilsonii* does not occur on the volcanics and is replaced down-slope by *Drummondita hassellii* on the aeolian sands.

Flowering period. Observed for June to July, but probably commenced May as flowering well underway in mid-June, and extends to at least August as the species was fruiting in October.

Affinities. Drummondita wilsonii is morphologically similar to both *D. ericoides* and *D. miniata.* Each has similar flowers and leaves with a large terminal gland. *D. wilsonii* differs from *D. ericoides* in the 1-3 terminal flowers and unequal calyx segments, characters which it shares with *Drummondita miniata. D. ericoides* differs from both species in possessing leaves with apical glands which are sometimes pointed. *D. miniata* has the largest flowers with woolly tomentose calyces and the largest leaves, which are more openly arranged and crowded towards branch apices. *D. ericoides* has a similar

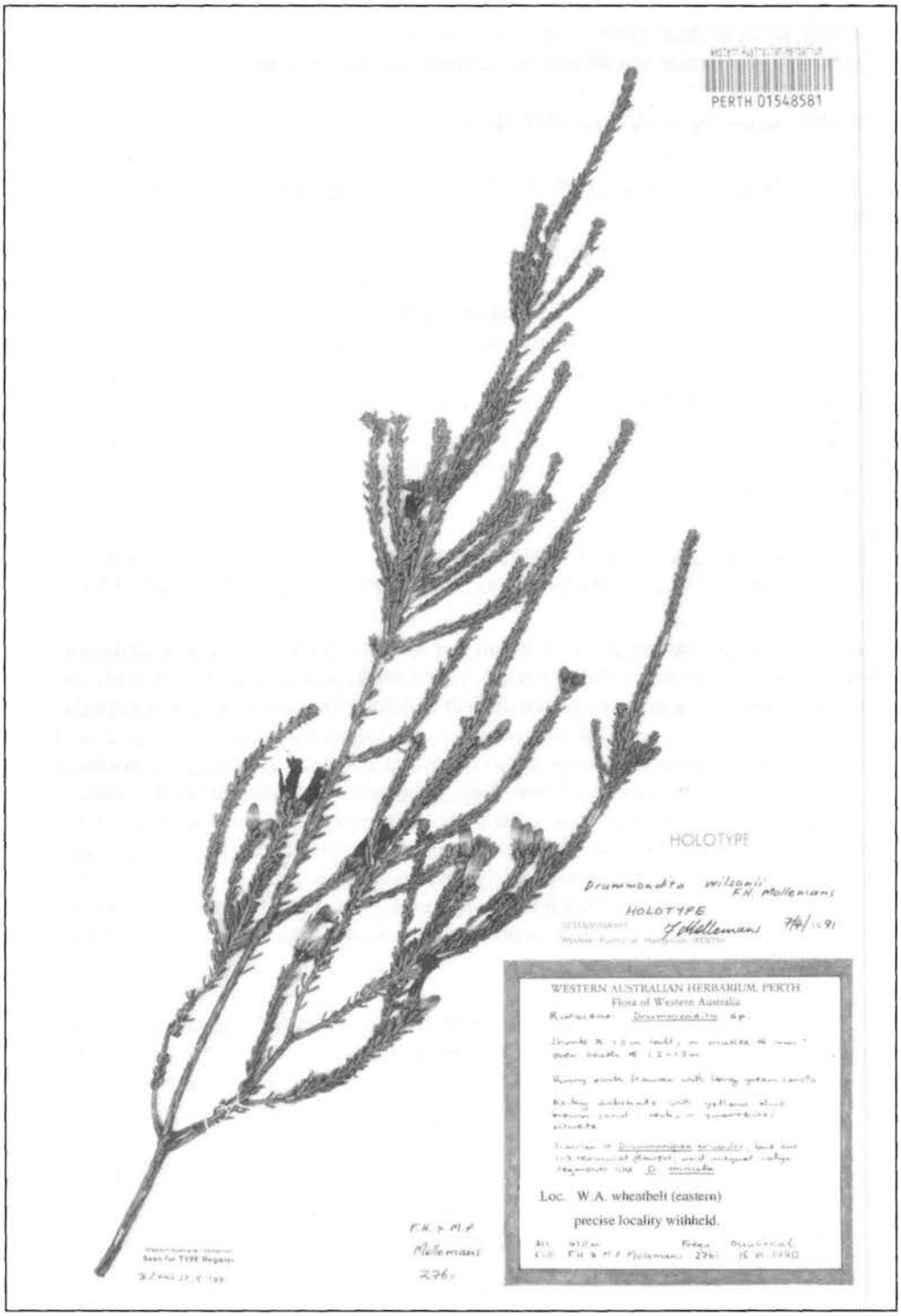

Figure 1. *Drummondita wilsonii* F.H. Mollemans - Holotype (*F.H. & M.P. Mollemans* 2761)

leaf arrangement to that of *D. miniata*, while *D. wilsonii* has leaves which are densely crowded along entire branchlets. *D. miniata*, at least from the type locality, is a more robust shrub than *D. ericoides*, and *D. wilsonii* is the least robust of the three. Flower colour differs in all three species. Table 1 summarises the similarities and differences between the three species.

Conservation status. Poorly known, CALM Priority 1.

Etymology. The species is named after Paul Wilson in recognition of his taxonomic studies of the Rutaceae.

Philotheca Rudge
(includes *Eriostemon* sect. *Nigrostipulae* - Wilson 1970)

1. Philotheca langei F.H. Mollemans, sp. nov. (Figures 2 & 4)

Distinguitur *Eriostemon falcatus* per parvus, ovatus sepala; parvus petalis; stamina filamenta paene glabra; folia glandis valde exsertis.

Typus: Northern Wheatbelt, NW of Chiddarcooping Hill (precise locality withheld), alt. c. 465 m., 25th August 1991, *F.H. & M.P. Mollemans* 4127 (holo: PERTH; iso: AD, BISH, CANB, K).

Shrubs or *undershrubs*, erect, to 1.2 m tall and up to 60 cm across. *Leaves* exstipulate, shortly petiolate, ascending, clavate, 4-6 mm long, c. 1 mm thick; adaxial surface flattened, canaliculate; margins and rounded abaxial surface with distinct glandular verrucosities, glands strongly exserted; apex pointed. *Flowers* 1-3, terminal, on a pedicel c. 2.5-3 mm long. *Sepals* obovate, c. 0.5 mm long; minutely pubescent, otherwise glabrous; centre thickened, glandular verrucose; margin flaccid. *Petals* white, elliptic, c. 3-4 mm long, 2-2.2 mm wide, pubescent inside, margin pilose, mostly glabrous outside, with a narrow, c. 0.5 mm wide, central glandular-verrucose band externally which is pink at the apex and fades to white at base. *Staminal filaments* 10, free, alternately 5 short c. 3 mm long and 5 longer c. 3.5 mm, terete at apex to marginally flattened at base, glabrous apart from a few scattered apical hairs; *anthers* oblong, c. 1.0 mm long, orange-pink, white-apiculate, pollen orange-pink. *Ovary* glabrous, of acute, narrowly pyramidal carpels. *Style* glabrous. *Seed* reniform, c. 1.8 mm long, black, minutely reticulate-foveate.

Other specimens examined. WESTERN AUSTRALIA: NNE of Chiddarcooping Hill, alt. c. 427 m., frequency (locally) fairly common - 12 seen, 7th November 1990, *F.H. & M.P. Mollemans* 3776 (PERTH); NW of Chiddarcooping Hill, alt. 465 m., frequency (locally) fairly common - 6 seen, 8th November 1990, *F.H. & M.P. Mollemans* 3796 (PERTH).

Distribution. Endemic to the boundary zone of the Avon and Coolgardie Botanical Districts of Western Australia, occurring north of Chiddarcooping Hill, which is located about 45 km north-west of Southern Cross, Westonia Shire.

Habitat. Found in *Allocasuarina campestris* ± *Acacia* ± *Thryptomene* scrub and open to dense shrubland vegetation to c. 1.8 - 2.8 m tall on pale orange sand over a similar coloured clay crust, near flat granite or amongst granite boulders.

Table 1. Comparison of some important taxonomic and ecological features of *Drummondita ericoides* Harvey, *D. miniata* (C.A. Gardner) P.G. Wilson and *D. wilsonii* F.H. Mollemans.

Character	*D. ericoides*	*D. miniata*	*D. wilsonii*
Leaf length (mm)	4.5-8.5	8.5-16	2-6
Leaf width max (mm)	0.9	1-1.5	1
Leaf shape	± falcate slender	± falcate slender	clavate thickened
Leaf arrangement	Crowded towards apices	Crowded at branch apices	Crowded along entire stem
Terminal leaf gland	Black, ± pointed	Red, round	Black, round
Leaf glands	Scattered	Scattered	Abundant
Leaf colour	Green	Grey	Green
Terminal flower number	1	1-3	1-3
Petal length (cm)	1.35	1.85-2	1.2
Petal width max (mm)	6	5.5	3
Branching	Erect	Divaricate	Very rigid erect
Flower colour	Yellow	Orange-cinnibar	Red
Flower length (ex style)	1.6	2.5-3.1	1.5
Plant stature	Semi-robust	Robust	Slender
Calyx shape	Obovate	Obovate	Oblong
Calyx length (mm)	3	5-6	4-5
Calyx width (mm)	3	3.5	2-2.5
Calyx pubescence	Glabrous	Woolly tomentose outside	Glabrous
Calyx segments	Equal	Unequal	Unequal
Habitat	Rocky peak	Granite	Sandstone

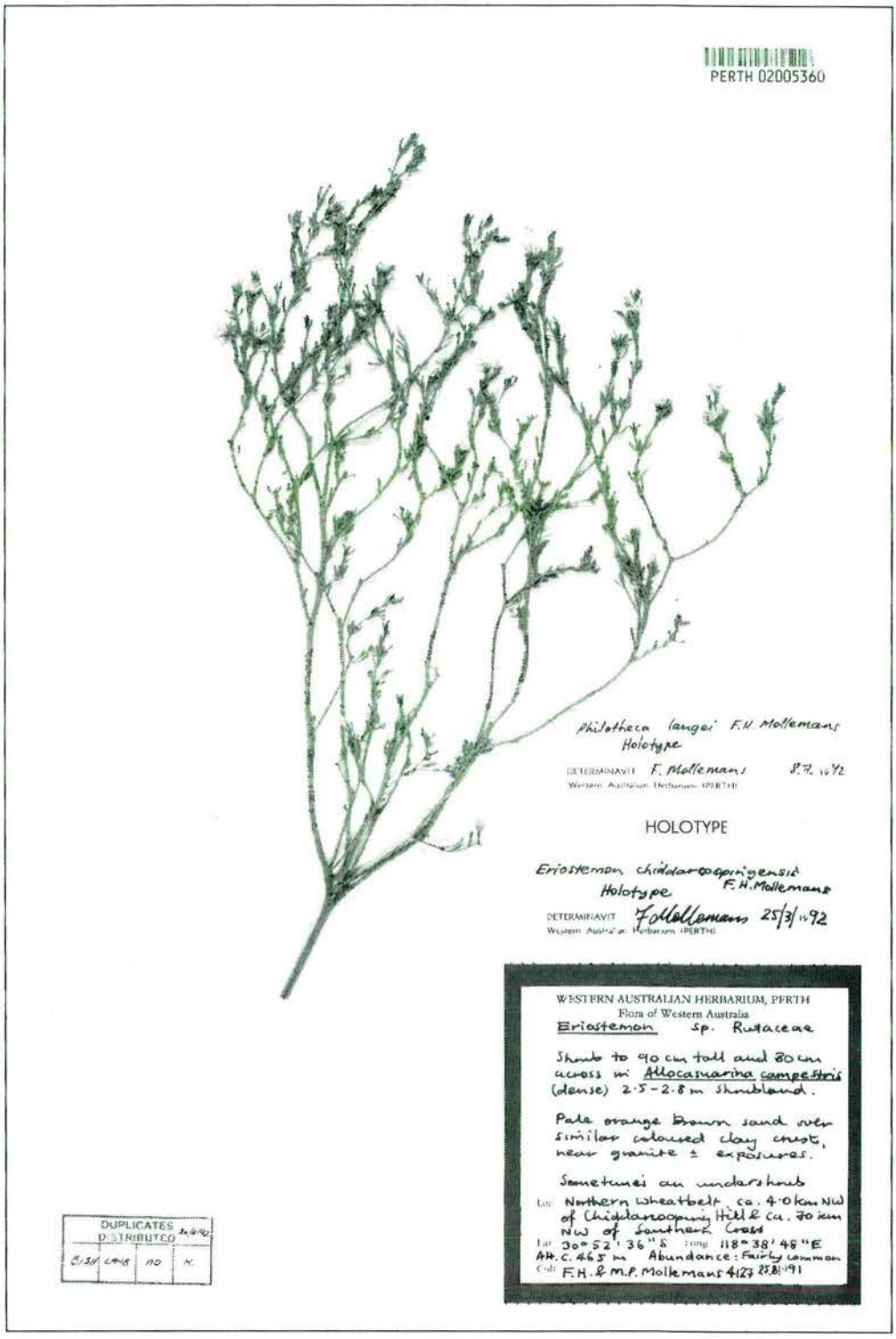

Figure 2. *Philotheca langei* F.H. Mollemans - Holotype (*F.H. & M.P. Mollemans* 4127)

Flowering period. August-October.

Fruiting period. November.

Affinities. Philotheca langei is morphologically similar to *E. falcatus,* each possessing abundant glands on branchlets, similarly shaped leaves and white-apiculate anthers, in common. *Philotheca langei* differs from *E. falcatus* in the smaller, ovate sepals, the smaller petals, the nearly glabrous staminal filaments and the strongly exserted leaf glands. The virtual absence (apart from the few at the apex) of hairs on the staminal filaments of *Philotheca langei* are an important distinguishing character. The petals of *Philotheca langei* are unusual in lacking a stalk (out-growth at the base of the petal) by which it is attached; *P. basistyla*, for example, possesses such a stalk. Table 2 summarises the important taxonomic and ecological features of *Philotheca langei* F.H. Mollemans, *E. falcatus* P. G. Wilson and *Philotheca basistyla* F.H. Mollemans.

The present taxon is referable to *Eriostemon* sect. *Nigrostipulae* (Wilson 1970), but all species in that section are being transferred to *Philotheca* (e.g. Wilson 1992). The species described here is therefore being placed in *Philotheca* in anticipation of the general transfer of other species in sect. *Nigrostipulae* to that genus.

Conservation status. Poorly known, CALM Priority 1.

Etymology. The species is named in honour of Dr Robert T. (Bob) Lange for his untiring efforts in rangelands ecology and palaeobotany in Australia, a mentor of some of Australia's leading botanists and my Honours supervisor at the University of Adelaide in 1981.

2. Philotheca basistyla F.H. Mollemans, sp. nov. (Figures 3 & 4)

Distinguitur *Eriostemon falcatus* per glandulosa-verrucosa absens ramulis; stamina filamenta connatus ille basalis dimidium ad formatus tubus, superus liber filum teretia, dense pilosus; folia longa; multo parvus sepala; parvus petalis; stylus (ubi immaturus) basalis expansus (pyriformis) supra punctum exaffixus cum ovarium et contractus versus ad angustus supra stylus, decrescens ut stylus maturus.

Typus: Trayning District, SSE of Trayning, 180 km east of Perth, (precise locality withheld), alt. 290 m., 25th August 1991, *F.H. & M.P. Mollemans* 4126 (holo: PERTH; iso: BISH).

Much-branched, spreading *shrubs* or *undershrubs*, to 1 m tall and up to 80 cm across. *Leaves* exstipulate, shortly petiolate; lamina slender-clavate, ascending, c. 7-14 mm long, up to c. 1-1.5 mm thick (when fresh), adaxial surface grooved in the lower half, abaxial surface with distinct glandular verrucosities but glands not strongly exserted, apex rounded. *Flowers* solitary, terminal, on a peduncle c. 0.5-1.5 mm long. *Sepals* triangular, c. 0.5-1 mm long; margin flaccid, minutely pubescent otherwise glabrous; centre thickened, glandular-verrucose. *Petals* white, elliptic c. 6(6.5) mm long, petiolate, glabrous outside, pubescent within, hairs longer centrally, an outer c. 1 mm broad thickened midrib, glandular-verrucose, pink at the apex fading to white at the base. *Staminal filaments* 10, alternately 5 c. 3 mm long and 5 c. 3.5 mm, fused in the basal half to form a tube, upper free filaments terete, densely pilose; *anthers* peltate, oblong, c. 0.5 mm long, pollen white. *Ovary* glabrous, obtuse carpels form a depressed cavity which contains the expanded style base. *Style* (when immature) basally expanded

Table 2. Comparison of some important taxonomic and ecological features of *Philotheca langei* F.H. Mollemans, *E. falcatus* P.G. Wilson and *Philotheca basistyla* F.H. Mollemans.

Character	*P. langei*	*E. falcatus*	*P. basistyla*
Plant stature/branching	Erect	Short, much-branched	Spreading, much-branched
Leaf length (mm)	4-6	6	7-14
Leaf width (mm)	1	1	1-1.5
Leaf shape	Clavate	Falcate	Slender-clavate
Leaf apex	Pointed	Rounded	Rounded
Stem glands	Abundant	Abundant	Few
Gland exertion	Strongly exserted	Exserted	Exserted
Petal length (mm)	3-4	7	6(6.5)
Petal width (mm)	2-2.2	3	2.5-3
Petal petiole	Absent	(?)	Present
Calyx length	0.5	3	1
Calyx shape	Obovate	Narrowly triangular	Triangular
Calyx apex	Obtuse	Acute	Obtuse
Staminal filament pubescence	A few apical hairs	Scattered hairs	Densely pilose in upper half
Staminal filaments	Free	Free	Fused in lower half as a tube
Anthers	White-apiculate	White-apiculate	Non-apiculate
Habitat	Sand loam, granite *Allocasuarina*	(?) sandplain	Deep sand yellow *Eucalyptus*, mixed heath

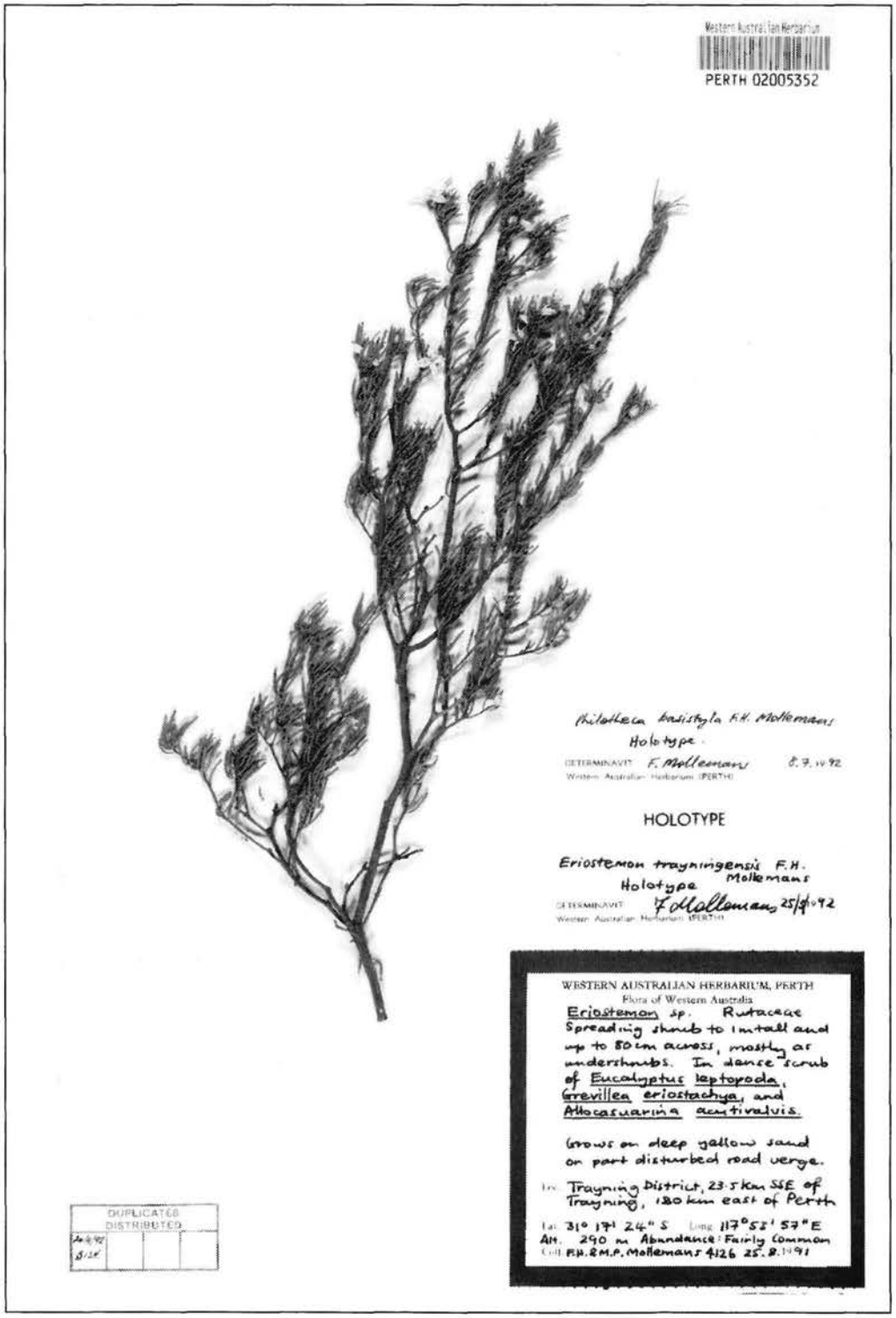

Figure 3. *Philotheca basistyla* F.H. Mollemans - Holotype (*F.H. & M.P. Mollemans* 4126)

(pear-shaped) above point of attachment with ovary and tapering upwards, narrowing as style matures, densely pilose. *Fruit* not seen.

Other specimens examined. WESTERN AUSTRALIA: Trayning District, 180 km east of Perth, alt. 290 m., frequency (locally) fairly common - c. 4 seen, 20th August 1990, *F.H. & M. P. Mollemans* 3213 (PERTH); Trayning District, 180 km east of Perth, alt. 290 m., abundance (locally) fairly common, 25th August 1991, *F.H. & M.P. Mollemans* 4124, 4125 (PERTH).

Distribution. Endemic to the boundary region of the Avon and Coolgardie Botanical Districts of Western Australia, occurring south-south-east of Trayning, which is located c. 180 km east of Perth, Trayning Shire.

Habitat. Found in dense scrub of *Eucalyptus leptopoda, Grevillea eriostachya, Allocasuarina acutivalvis, Baeckea muricata, Baeckea floribunda, Hakea coriacea, Melaleuca conothamnoides, Melaleuca* sp., *Daviesia* sp., *Choretrum pritzellii, Phebalium tuberculosum, Pimelea* sp. and *Hibbertia* sp. growing on deep yellow sand.

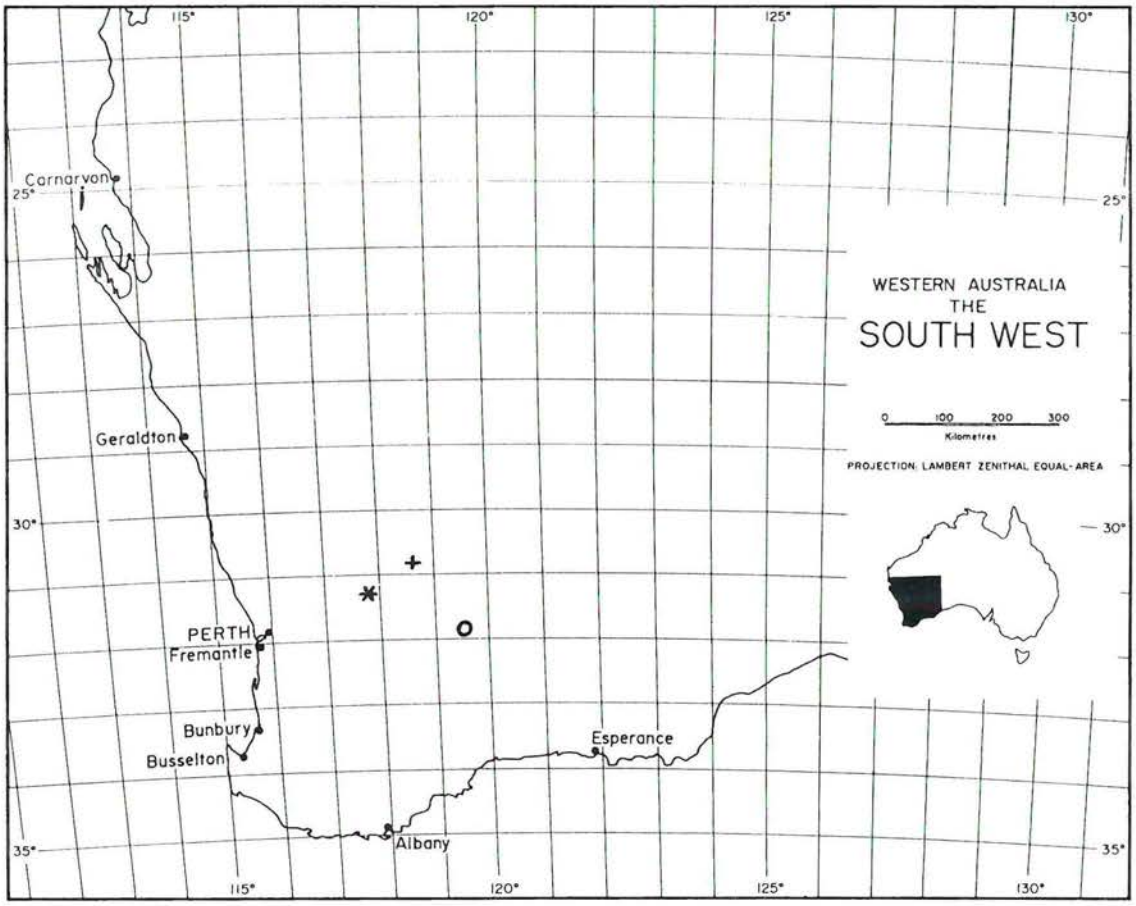

Figure 4. Distribution of *Drummondita wilsonii* F.H. Mollemans (o), *Philotheca langei* F.H. Mollemans (+) and *Philotheca basistyla* F.H. Mollemans (*)

Flowering period. August-October.

Affinities. Philotheca basistyla is morphologically similar to *Eriostemon falcatus*. The complete absence of glandular verrucosities on branchlets and the terete staminal filaments which are fused in the lower half to form a tube makes it distinct. Additional differences are in the longer leaves, much smaller sepals and smaller petals. *Philotheca basistyla* also possesses a basally expanded style which grows in the depressed area between the carpels. Such a character is unusual in *Eriostemon*, but the character was present in different specimens (*Mollemans* 3213, 4126) collected in different years. Other important taxonomic and ecological features of *Philotheca basistyla* F.H. Mollemans are summarised in Table 2.

The presence of a distinct medial strip on the outside of petals is seen in *Philotheca basistyla, Philotheca langei*, and some other species (see Wilson 1970). Examination of the type of *Eriostemon falcatus* (*W.E. Blackall* B.917, October 1931: PERTH) indicates the presence of the same character, but due to the condition of the specimen it is quite obscure and difficult to see. In the smaller petals of *Philotheca langei* this petal medial strip is quite narrow and broadens with increasing petal size in the other species.

Monadelphous stamens are a character which places this taxon in *Philotheca*, a genus which is morphologically similar to *Eriostemon* sect. *Nigrostipulae* (Wilson 1970). The morphological similarity between *Philotheca basistyla* and *Eriostemon falcatus* suggests that they are related, and placing the present taxon in *Philotheca* tends to ignore this apparent relationship. However, it is recognised that all of *Eriostemon* sect. *Nigrostipulae* will eventually be transferred to *Philotheca* (Wilson 1992), and so the situation will be remedied once this has been accomplished.

Comments. Damage by locusts occurred during the 1990 locust plague (J. Armstrong pers. comm.), but plants were found flowering again without apparent ill effect in 1991.

Conservation status. Poorly known, CALM Priority 1.

Etymology. The specific epithet refers to the expanded style base of this taxon, and was suggested by P.G. Wilson.

Discussion

Similarities between D. wilsonii, D. ericoides and D. miniata. Gardner (1928) considered *Drummondita miniata* (C.A. Gardner) P.G. Wilson to be very closely related to *D. ericoides* Harvey, and pointed out the similarity in petal shape to support this suggestion. Shrub size and branching, leaf arrangement, size, shape, vestiture and colour of the apical gland, flower size, sepal size (unequal in *D. miniata*), shape and vestiture, petal vestiture and colour, were all cited by Gardner (1928) as differences. A comparison of *Drummondita wilsonii* with both *D. miniata* and *D. ericoides* (Table 1) also shows a comparable quantity of similarities and differences.

Gardner (1928) selected only one character in common amongst many differences to establish a relationship between *D. ericoides* and *D. miniata*. The three species *D. wilsonii, D. ericoides* and *D. miniata* have similarities in the leaves, petals, some calyx characters and in the preference for substrata which are always rocky in nature (Table 1), but there are clear size differences in particular

in habit, leaf and floral characters. Compared to the other *Drummondita* taxa (*D. hassellii*, *D. hassellii* var. *longifolia* and *D. calida*), all taxa have flowers which exhibit variations in colour and shape of floral parts, but there are significant differences between *D. hassellii*, *D. hassellii* var. *longifolia* and *D. calida* and what may be termed the *Drummondita ericoides* group (*D. ericoides, D. miniata* and *D. wilsonii*), in the possession by the latter group of leaves which are similarly shaped, channelled above and which possess the large terminal gland. None of the other taxa have large glands at leaf apices. Several leaf characters may therefore be added to petals (used by Gardner 1928) to further establish the relationship between *D. ericoides* and *D. miniata*, and to add *D. wilsonii*.

Pollination mechanisms and flower colour variation in Drummondita. One of the more striking characters of *D. ericoides*, *D. miniata* and *D. wilsonii* is that of flower colour. The petals of *D. miniata* are orange-cinnibar in colour, *D. ericoides* yellow-white (Gardner 1928) and *D. wilsonii* reddish fading to green at the base. From west to east the flower colour of these species, which are grouped here due to similarities in petals and several leaf characters, grades from yellow (*D. ericoides*) through orange-cinnibar (*D. miniata*) to red (*D. wilsonii*).

Gardner (1928) noted a similar pattern of petal colour variation in the flowers of *D. hassellii* again from yellow through to red, from west to east in its distributional range. This, he suggested limited the value of flower colour as a distinguishing character between *D. miniata* and *D. ericoides*. Colour variation in the flowers of *D. hassellii* is apparently clinal in nature, with populations varying more or less continuously over its range. But this species is quite variable taxonomically and may in time be subdivided into more than one taxon. Parallels are therefore apparent between what may be termed the *D. hassellii* group and the informal *D. ericoides* group (which includes both *D. miniata* and *D. wilsonii*) recognised here.

The species of the *Drummondita ericoides* group have a broader geographic range and more northerly distribution than that of the *D. hassellii* group, but are restricted by habitat requirements to certain geological features (Table 1), of apparently great age. Although exhibiting an identical pattern of flower colour to the *D. hassellii* group, the species of the *D. ericoides* group, rather than forming a cline, apparently occupy different locational foci within a hypothetical cline. What we see nowadays in these three species may be three divergent members of a formerly more widespread, common ancestor.

Flower colour has definite advantages for pollination, and in the *D. ericoides* group the flower colour of a common ancestor appears to have been retained by each species in the group. In the flora of south-west Western Australia the colours seen in this group are amongst the four most common and *Drummondita* is bird pollinated according to Keighery (1982).

Similar colour variation to that present in both the *D. ericoides* group and the *D. hassellii* group is also found in the flowers of *Diplolaena* (Rutaceae) with flowers again varying in colour from west to east from yellow through to red (G.J. Keighery pers. comm., P.G. Wilson pers. comm.). In this instance, however, the colour variation is in the stamens (P.G. Wilson *op. cit.*), which in *Diplolaena* are quite long and prominent. Armstrong (1979) lists birds as pollen vectors in *Diplolaena*.

Drummondita miniata is thought to be bird pollinated as Keighery (pers. comm.) has observed brown honeyeaters visiting the large flowers of this species at the Cue Rifle Range (Cue is the type locality of *D. miniata*). The relatively smaller flowers of *D. ericoides* and *D. wilsonii* (Table 1) would seem to be a factor preventing bird pollination. However, brown honeyeaters, for example, possess a

long slender tongue with a feather-like appendage at the apex (D. Graham pers. comm.), by which they could easily penetrate the narrow tubular flowers of these two species. According to Keighery (1982), such "narrow, tubular flowers are rarely visited by insects ... and can only be utilised by the smaller, slender-billed honeyeaters."

Insects are widespread, and likewise flower colour is an insect attractant, while moth and butterfly pollen vectors are also possible for the genus because some of these possess an extendible proboscis by which they could easily penetrate *Drummondita* flowers. So, although bird pollination is implicated in the reproductive strategy of *Drummondita*, it is still uncertain as to what if any other pollen vectors are involved. Field data on this aspect is required, particularly for *D. ericoides* and *D. wilsonii*, for which no information is available.

Distribution and flowering time of the D. ericoides group. The inland species, *D. miniata*, occupies an area subject to unreliable rainfall. Because of its eremaean (desert) distribution, *D. miniata* may flower opportunistically depending on rainfall, a characteristic of other eremaean species e.g. *Calothamnus* sp. (Hawkeswood and Mollemans *ined.*). *D. ericoides* and *D. wilsonii*, on the other hand, have a more temperate distribution and are unlikely to have developed such a survival mechanism, so are probably unlike *D. miniata* in having flowering times triggered by an environmental stimulus other than rainfall, such as day-length.

The evolutionary history of the Drummondita ericoides group (which includes D. miniata and *D. wilsonii), D. hassellii group and D. calida.* The distribution patterns of the *D. ericoides* group and the *D. hassellii* group, which occur in central and south-west Western Australia, overlap. But *D. calida* is distributed (in the north of the Northern Territory and Queensland) well away from other members of the genus. The presence of elements of the *D. ericoides* group and *D. calida* (which occurs in similar rocky habitats to those which carry the *D. ericoides* group) on geologically old stable features with very little soil development, and their exclusion from adjacent geologically recent aeolian deposits, suggests that they are amongst the oldest members of the genus. The *D. hassellii* group (apart from *D. hassellii* var. *longifolia*), on the other hand, seems to have developed later in association with the widespread development of aeolian deposits during the so-called period of developing aridity since the separation of Australia from Antarctica.

Drummondita hassellii (F. Muell.) Paul G. Wilson var. *longifolia* Paul G. Wilson, which occurs on Peak Charles has habitat preferences similar to those of the *Drummondita ericoides* group and *D. calida*. The presence of this taxon on the geologically stable substrate of Peak Charles, suggests that it is significantly older than the remainder of the *D. hassellii* group.

Drummondita calida (F. Muell.) Paul G. Wilson, occurs on mountainous habitats in the Gilbert's River area of North Queensland (see Wilson 1971) and its distribution also extends to rocky hillsides near Bloomfield Springs in Kakadu National Park, Northern Territory (*Menkhorst* KA 364: PERTH). The presence of *D. calida* on the other side of the continent, suggests that the past distribution of *Drummondita* encompassed a large part of Australia prior to the break-up of Gondwanaland, and the subsequent disintegration of the group resulting from associated climatic deterioration. The possibility may be considered that *D. calida* found its way to northern Australia through long distance dispersal mechanisms, from the apparent stronghold of the genus in southern Western Australia. But, *Drummondita* is ant dispersed according to J. Armstrong (pers. comm.).

On hills such as Parker Range south (habitat of *Drummondita wilsonii*) and White Peak near Geraldton (habitat of *Drummondita ericoides*), the substrate has remained essentially unaltered while

the climate has changed through time. However, on adjacent more recently developed aeolian sandplains and associated deposits both the substrate and the climate has changed.

D. hassellii has developed on the aeolian deposits, and in the Parker Range south area there is a clear segregation between *D. hassellii* and *D. wilsonii*. *D. wilsonii* occurs only on skeletal soils developed on the geologically old rocks, while down-slope it is replaced by *D. hassellii* on sandplains lapping onto and having extensive occurrence adjacent to the range. Even though both *D. wilsonii* and *D. hassellii* occur essentially side by side at the boundary between outcrop with skeletal soils and adjacent sandplains, no evident intermediate forms (hybrids) were observed. There is a clear substrate related line of demarcation between the two species, and this may also reflect a clear genetic segregation.

It is possible that if *D. ericoides*, *D. wilsonii* and *D. miniata* are brought together experimentally they could hybridise, as a relationship (albeit tenuous) has been established between them using several leaf characters coupled with the petal character used by Gardner (1928). But this would not occur in nature due to the vast distances separating the three species. *D. ericoides* occurs near Geraldton, *D. miniata* in the Cue district and *D. wilsonii* occurs south-south-east of Southern Cross; *D. ericoides* is separated from *D. miniata* by a distance of 360 km, while these two species are separated from *D. wilsonii* by distances of 600 and 550 km, respectively.

Heath vegetation is thought to have flourished in Australia for almost 50 million years (Specht *et al.* 1979), and had its beginnings in the pan-Australian rain forest which existed when Australia was part of Gondwanaland. The break-up of Gondwanaland allowed for altered climatic influences, particularly around southern Australia, which was associated with the gradual separation from west to east of Australia and Antarctica. As *Drummondita* exhibits evident divergence, associated with climatic and physiographic changes stemming from continental separation, there are clear indications that it is a genus of great antiquity.

Acknowledgements

I would like to thank Jim Armstrong, Paul Wilson and the staff of the Western Australian Herbarium (PERTH) for assistance in work associated with the preparation of this paper. The initial collection of the three species described here were made while I was employed on contract with the Department of Conservation and Land Management (CALM) on a survey of rare flora in CALM's Merredin District, a project funded jointly by the Australian National Parks and Wildlife Service and CALM. I wish to acknowledge the funding bodies. Thanks also to Mr P. Brown, District Manager, Department of Conservation and Land Management, Merredin, for permission to collect in Chiddarcooping Nature Reserve. Jim Armstrong and Paul Wilson pointed out aspects of this paper requiring improvement. Special thanks go to my wife Nellie for her untiring assistance and support, at home and in the field.

References

Armstrong, J.A. (1979). Biotic pollination mechanisms in the Australian flora; a review. New Zealand J. Bot. 17: 467-508.

Gardner, C.A. (1928). Contributiones florae Australiae occidentalis VII. J. Roy. Soc. West. Austral. 14: 79-80.

Hawkeswood, T.J. & Mollemans, F.H. *(ined.). Calothamnus superbus* T.J. Hawkeswood & F.H. Mollemans (Leptospermoideae: Myrtaceae), a new species from south-west Western Australia. Nuytsia 8: 311-318.

Specht, R.L., Rogers, R.W. & Hopkins, A.K.M. (1979). Seasonal growth and flowering rhythms: Australian heathlands. *In:* R.L. Specht (Ed.), Heathlands and Related Shrublands. B. Analytical Studies, pp. 5-13. (Elsevier Scientific Publishing Company: Amsterdam.)

Wilson, P.G. (1970). "A taxonomic revision of the genera *Crowea, Eriostemon* and *Phebalium*, Rutaceae". Nuytsia 1: 1-155.

Wilson, P.G. (1971). "Taxonomic notes on the family Rutaceae, principally of Western Australia". Nuytsia 1: 197-207.

Wilson, P.G. (1992). "*Philotheca citrina* (Rutaceae), a new species from Western Australia". Nuytsia 8: 245-248.

The status, ecology and relationships of *Meziella* (Haloragaceae)

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Abstract

Orchard, A.E. and Keighery, G.J. The status, ecology and relationships of *Meziella* (Haloragaceae). Nuytsia 9(1): 111-117 (1993). The monotypic genus *Meziella* has until now been known only from its very fragmentary and immature type. Because of this its status as a genus and relationships have been unclear, and its description has been incomplete. Recent rediscovery of the species has allowed a full description to be prepared for the first time. It is now confirmed that *Meziella* is a distinct genus, intermediate in many respects between *Haloragis* and *Myriophyllum*. Its somewhat bizarre features are described, its ecology discussed, and a revised key to the Australian genera of the family is provided.

Introduction

Nees (1844) described a new species, *Gonocarpus trifidus,* from a Preiss collection from the shores of a lake near Albany in Western Australia. The plant was a small creeping herb, rooting at the nodes, with trifid leaves and young flowers. The main collection was deposited in the Nees collection at LE, but a small fragment subsequently found its way to MEL.

Two years later, Walpers (1846) transferred the species to *Haloragis*, probably for no better reason than that it was considered that the two genera were synonymous. There is no indication that he re-examined the species, and even if he had, it is unlikely that he could have made much of it with only immature flowers to work with.

The only complete revision of the family Haloragaceae to species level since Walper's treatment is that of Schindler (1905). He recognised two subfamilies, Halorrhagoideae and Gunneroideae, the second of which is now generally considered to constitute a distinct family, Gunneraceae. Schindler divided subfamily Halorrhagoideae into two tribes, Halorrhageae and Myriophylleae, distinguished by the characters of the endocarp. In tribe Halorrhageae the 1-4-locular ovary develops into a fruit in which the woody or crustaceous endocarp constitutes a single structure, and the 1-4 seeds in each fruit are shed as a unit within the dry nut. In tribe Myriophylleae, containing only the genus *Myriophyllum*, the woody endocarp forms separately around each locule, and at maturity the fruit separates into two or four 1-seeded nutlets.

Schindler re-examined the single collection of "*Haloragis trifida*", and decided, despite its deficiencies, to segregate it as a distinct genus from *Haloragis* (which also included *Gonocarpus*).

a principal distinguishing character he used the fact that in *Meziella* (as he called it), the sepals were much longer than the ovary, whereas in *Haloragis sensu lato* they were much shorter. He also drew attention to the fact that *Meziella* had only a single whorl of 4 stamens, whereas most species of *Haloragis* had a double whorl totalling 6 or 8 (the only exception known to him being *Haloragis* (= *Gonocarpus*) *nodulosa*.

In a series of papers, Orchard (1975, 1976, 1977, 1979, 1980, 1981, 1986a, 1986b, 1990a, 1990b), revised the generic and specific taxonomy of the South American, Pacific and Australian members of the family. In general Orchard adopted the generic circumscription of Schindler, with two major differences. *Gonocarpus* was re-instated as a genus distinct from *Haloragis*, and a new genus *Haloragodendron* was created. In both cases the critical distinguishing characters were to be found in the development of the ovary into the fruit. The flowers of *Gonocarpus*, *Haloragis* and *Haloragodendron* all begin with four ovules in an ovary with essentially 4 locules (sometimes reduced to 2 or 3 ovules and locules). In *Gonocarpus* the septa are insubstantial and incomplete, and are crushed by the single ovule which develops into a seed. The ovary wall becomes crustaceous in fruit, but hardly woody. In *Haloragis* all 4 ovules can potentially develop into seeds, and the septa and endocarp become woody, forming a single, indehiscent, dry, 4-seeded nut which is shed as a single unit. *Haloragodendron* has a fruit development somewhat intermediate between *Gonocarpus* and *Haloragis*. In the flower the ovary has substantial and complete septa between the 4 locules (resembling *Haloragis*), but only a single seed is formed in each fruit, crushing the septa to one side (as in *Gonocarpus*). However, the endocarp becomes very woody, and the fruit increases in size considerably after anthesis (both characteristic of *Haloragis*, but not of *Gonocarpus*). Other characters support this generic disposition, but the developmental characters of the ovary/fruit were found to be the most diagnostic.

Orchard considered the status of *Meziella* in two papers (1975, 1990b), but because of the paucity and poor quality of the material available was unable to decide on the exact generic status of the species, and opted to maintain the *status quo* until more material became available. Attention was drawn to the superficial similarity of the habit and vegetative morphology of *Meziella* to some bog-dwelling small species of *Myriophyllum*. For example, *Myriophyllum limnophilum* has a very close resemblance to *Meziella* in habit and leaf shape, and is also found in boggy ground in the south-west of Western Australia. However, without fruits it was impossible to decide whether *Meziella* was in fact a distinct genus, or only a species of *Haloragis* or *Myriophyllum*. In the last 10 years several searches have been made in an attempt to re-discover *Meziella*, but in the absence of details of its original collection site, all failed, and it was feared that the species (and genus) had become extinct.

Recently one of us (G.J.K.) discovered a population of a strange bog-dwelling plant at Chester Forest Block (34° 11' S, 115° 19' E), approximately 30 km east of Augusta, and about 200 km west of Preiss' original collection from near Albany, but still in the Warren Botanical Subdistrict. Examination has confirmed it to be *Meziella*. The new discovery bore copious flowers and fruits, and these have finally allowed the question of the status of the genus to be resolved. In addition, the ecology of the species can now be described.

Chester Block occupies the only remnant of the Nillup Plain remaining uncleared. This area is a gently sloping pediment of the Blackwood Plateau, and is normally saturated or slightly submerged during winter and spring. *Meziella* occurs on slightly submerged flats, on grey sandy clays over clay. It is found in very shallow (c. 5 cm deep) pools or prostrate on saturated soils in slight depressions. Vegetation is a low heath of *Pericalymma crassipes* over mixed sedges (chiefly *Leptocarpus* and *Restio* species). Scattered through this community are emergent trees of *Melaleuca rhaphiophylla* and tall shrubs of *Adenanthos detmoldii*.

Meziella can over-summer in protected sites as a small rootstock with short dense leafy stems with linear leaves. However, many plants in drier more exposed sites die during the summer. Regrowth and germination occurs as the winter rains flood the small depressions and continues until the area begins to dry in October and November.

Flowering commences during November at Chester Block and continues until January. Mature fruits are present from January to February. Flowering ceases in January and the plants die or over-summer as vegetative shoots until the next winter. Dispersal of the fruit has not yet been observed.

The status of *Meziella*

Meziella is a fairly bizarre plant at first sight, but perhaps no more so than some of the more unusual species of *Myriophyllum,* such as *M. callitrichoides, M. decussatum* or *M. coronatum.* In habit it resembles several of the small bog-dwelling semi-aquatic species of *Myriophyllum.* The flowers are bisexual, with the 4-merous plan common in Haloragaceae, but have disproportionately long and narrow sepals almost equalling the petals, unlike any other species in the family. In fruit these sepals become stiffly erect or semi-spreading, forming a corona of soft spines at the summit of the fruit. At the same time further soft spine-like processes are developed in the lower half of the fruit, with groups of 6-7 "spines" below each sepal. These lower spines are present in the flower, but are very reduced, and expand rapidly once the petals and stamens are shed. They were not observed by any previous author.

The stamens of *Meziella* are also somewhat unusual. Only a single whorl of 4 is present, unlike the double whorl normal in the family. This reduction in number occurs occasionally in other genera, e.g. in *Gonocarpus nodulosus, Myriophyllum integrifolium, M. limnophilum, M. callitrichoides* subsp. *callitrichoides* and *M. mattogrossense,* but is not common. In addition, the anthers in *Meziella* are distinctly apiculate. This is an unusual feature in the family, found in most species of *Glischrocaryon,* all species of *Haloragodendron*, and rarely in *Myriophyllum* (e.g. *M. coronatum, M. muricatum, M. mattogrossense*).

As in many other Haloragaceae, while the flowers of *Meziella* are morphologically bisexual, they are often functionally unisexual. In the inflorescence there is a gradation from flowers at the top of the spike which are functionally male by virtue of their protandry, and which through truncation of the growing season will probably never develop their female parts, to those in the central region of the spike which, having shed their pollen develop their stigmas, become pollinated themselves and develop rapidly to fruit, and those towards the base of the spike in which the anthers, although present, do not split open to release pollen and are thus functionally female. A similar gradation is not unusual in many species of *Myriophyllum*, and in some species of *Haloragis* and *Gonocarpus.*

The ovary/fruit development provides the final evidence that *Meziella* deserves its separate generic status. The ovary is 4-locular with well-defined septa, and a single pendulous ovule in each locule (i.e. identical with *Haloragis* and *Haloragodendron*). Each of these ovules develops, potentially, to form a seed. In the process the endocarp around each locule becomes woody, but unlike *Haloragis,* where a single 4-locular woody mass is formed, in *Meziella* 4 separate woody 1-seeded pyrenes develop. This is similar to the situation in *Myriophyllum*, but there the exocarp splits to allow the mericarps to separate for dispersal. This does not happen in *Meziella.* Here the fruit remains indehiscent, and the four pyrenes or mericarps are shed as a unit, bound together by the spiny exocarp.

The above combination of characters is sufficient to confirm the status of *Meziella* as a distinct genus. Its relationships seem to be with *Myriophyllum*, with which it shares its sub-aquatic habit, dissected leaves, and fruits in which the endocarp becomes woody around each individual locule rather than around the fruit as a whole. However it differs from *Myriophyllum* in that the fruit does not separate into mericarps at maturity. The subulate sepals, equalling the petals in length, and persisting as spines on the fruit, serve to set the taxon apart from all others in the family.

Schindler's higher level classification needs modification with the discovery of the developmental structure of the fruit in *Meziella*. His tribe Myriophylleae was established on the basis that *Myriophyllum* differed from all other genera in having a fruit which split into mericarps at maturity, whereas the fruits of the genera comprising tribe Halorrhageae were completely indehiscent. *Meziella* straddles this divide. However it can be accommodated if tribe Myriophylleae is redefined as having a fruit made up of 1-seeded pyrenes, while tribe Halorrhageae has a fruit in which all carpels are fused into a single unit, which may contain as few as 1 seed, or as many as 4, but is never divided into pyrenes. This modified classification is reflected in the key to genera below.

Key to the genera of Haloragaceae

1. Fruit an indehiscent 1-4-seeded nut not subdivided into 1-seeded pyrenes ..... Tribe Halorrhageae
   2. All flowers with petals
      3. Petals hooded; anthers non-apiculate; inflorescence indeterminate
         4. Fruits (2-3)4-locular, pericarp woody with solid septa; flowers in (1)3-7-flowered dichasia in the axils of alternate bracts ..... *Haloragis*
         4. Fruits 1-locular, pericarp crustaceous with no septa (crushed by single seed); flowers solitary (very rarely 1-3) in the axils of opposite or alternate bracts ..... *Gonocarpus*
      3. Petals navicular; anthers usually apiculate; inflorescence determinate
         5. Leaves serrate; inflorescence narrow, spike-like; shrubs or small trees with 1-few woody stems/trunks ..... *Haloragodendron*
         5. Leaves entire; inflorescence broad, pseudo-umbelliform; subshrubs with numerous annual stems arising from a perennial rootstock ..... *Glischrocaryon*
   2. At least female flowers lacking petals (rudimentary petals in *Proserpinaca*)
      6. Fruit 1-locular; flowers predominantly unisexual, in dichasia of up to about 11 flowers per axil, the terminal one in each dichasium usually male, the others female or rarely bisexual; anthers linear-oblong ..... *Laurembergia*
      6. Fruit 3-locular; flowers bisexual, solitary or in dichasia of up to 3 flowers per axil; anthers ellipsoid ..... *Proserpinaca*
1. Fruit made up of 1-seeded pyrenes ..... Tribe Myriophylleae
   7. Fruit splitting at maturity into mericarps; sepals less than half length of petals (frequently absent), flat, lanceolate to ovate; flowers frequently unisexual ..... *Myriophyllum*
   7. Fruit not splitting at maturity into mericarps; sepals almost equalling petals in length, subulate, developing into soft spines; flowers bisexual ..... *Meziella*

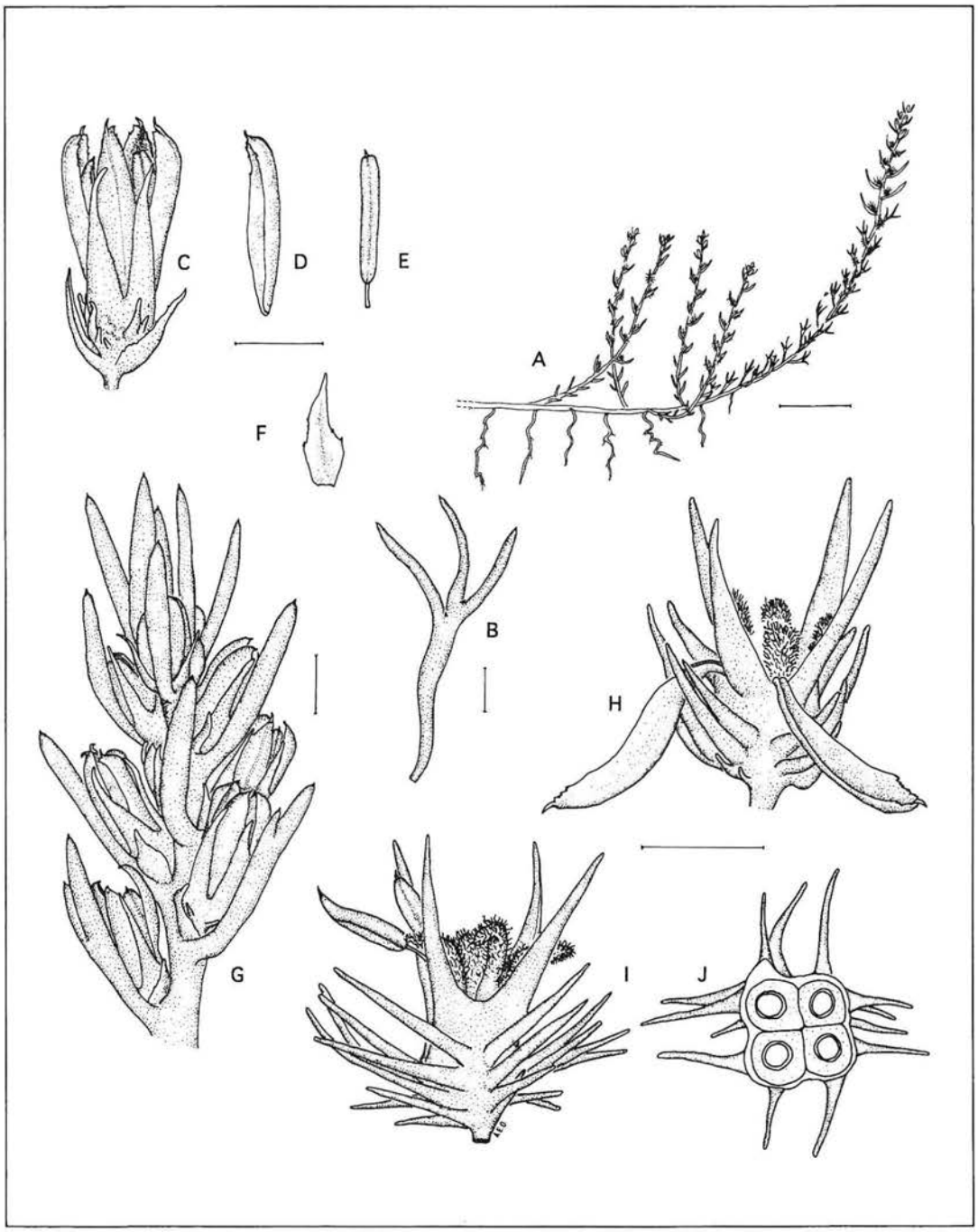

Figure 1. *Meziella trifida*. A - habit. B - trifid leaf from the mid-stem region. C - flower subtended by two bracteoles. D - petal. E - stamen. F - bracteole. G - tip of inflorescence showing buds, and flowers at anthesis. H - old flower/young fruit. I - mature fruit. J - transverse section of fruit showing the four pyrenes within a single pericarp. Scales represent 1 cm (A) or 1 mm (B-J). All illustrations are from *Keighery* 12789.

Description of *Meziella trifida*

Meziella trifida (Nees) Schindler, Pflanzenr. 23: 61 (1905) (Figure 1)

Gonocarpus ['Goniocarpus'] *trifidus* Nees in Lehm., Pl. Preiss. 1: 159 (1844)

Typus: "In turfosis humidis ad lacum haud procul ab oppidulo Albany (Plantagenet) m. Octobri 1840. Herb. Preiss. No. 2401". Holo: LE; iso: MEL

Haloragis trifida (Nees) Walp., Rep. 5: 672 (1846)

Illustrations: Schindler, Pflanzenr. 23: 61, fig. 18 (1905); Blackall & Grieve, W. Austral. Wildfls 3: 463, 472 (1965); Orchard, Fl. Austral. 18: 86, fig. 29 A-F.

Decumbent, glabrous, annual or perennial *semi-aquatic herb*, reddish in most parts; main *stems* prostrate, rooting at the nodes, freely branched; lateral stems ascending, apparently all becoming fertile. *Leaves* alternate, subfleshy, the lowermost on each stem entire, linear, 3.5-5.0 mm long, 0.4 mm wide, sessile, tip acute; middle and upper leaves on each stem becoming trifid with 2 linear lobes at or above the middle and ± equalling central lobe in length; each lobe tipped with a hydathode, and tiny hydathodes sometimes also present in the axils of the lobes. *Inflorescence* an indeterminate spike of flowers borne singly in the axils of slightly reduced upper leaves (bracts) on each lateral stem. *Bracts* trifid in the lower part, becoming entire above, leaflike. Each flower subtended by a pair of lanceolate or narrowly deltoid bracteoles, which are red, acute, entire, 1.0 mm long, 0.3 mm wide. *Flowers* 4-merous, bisexual, sessile. *Sepals* 4, red, subulate, 1.7 mm long, 0.3-0.35 mm wide, entire, smooth, erect. *Petals* 4, red, narrowly hooded, 1.7-1.8 mm long, 0.2 mm wide (keel to margin), with a distinct apiculum; shed almost immediately after anthesis. *Stamens* 4, antisepalous; *filaments* deep red, lengthening to 0.4-0.5 mm; *anthers* yellow to reddish, narrowly oblong, 1.2 mm long, 0.25 mm wide, distinctly apiculate, sometimes indehiscent in lower flowers. *Styles* 4, reddish, clavate; *stigma* papillate. *Ovary* small, c. 0.5 mm diameter, ± globular, with clusters of short subulate processes below the sepals; 4-locular; expanding rapidly in fruit. *Fruit* red, indehiscent, of 4 woody 1-seeded pyrenes contained within a dry exocarp. Sepals persistent, increasing in size and thickness to form a terminal corona; clusters of 6-7 soft spreading spines to 1.3 mm long develop on the lower half of the torus beneath each sepal, upper half of torus smooth. Fruit (including spines) c. 2.7 mm long, 2.7 mm in diameter.

Specimens of the new collection (*G. Keighery* 12789) have been lodged at PERTH and HO.

References

Nees von Esenbeck, C.G.D. (1844). *In:* Lehmann, J.G.C., Plantae Preissianae 1: 159. (Hamburg.)

Orchard, A.E. (1975). Taxonomic revisions in the family Haloragaceae 1. The genera *Haloragis, Haloragodendron, Glischrocaryon, Meziella* and *Gonocarpus*. Bull. Auckland Inst. Mus. 10: 1-299.

Orchard, A.E. (1976). Rediscovery of *Gonocarpus trichostachyus* (Haloragaceae). Rec. Auckland Inst. Mus. 13: 109-110.

Orchard, A.E. (1977). Taxonomic revisions in the family Haloragaceae II. Further notes on *Haloragis, Haloragodendron* and *Gonocarpus*. Nuytsia 2: 126-144.

Orchard, A.E. (1979). *Myriophyllum* (Haloragaceae) in Australasia I. New Zealand: A revision of the genus and a synopsis of the family. Brunonia 2: 247-287.

Orchard, A.E. (1980). An anomalous South Australian *Haloragis* (Haloragaceae). J. Adelaide Bot. Gardens 2: 253-257.

Orchard, A.E. (1981). A revision of South American *Myriophyllum* (Haloragaceae), and its repercussions on some Australian and North American species. Brunonia 4: 27-65.

Orchard, A.E. (1986a). New taxa in *Gonocarpus* and *Haloragis* (Haloragaceae). Nuytsia 5: 327-339.

Orchard, A.E. (1986b). *Myriophyllum* (Haloragaceae) in Australasia II. The Australian species. Brunonia 8: 173-291.

Orchard, A.E. (1990a). Rediscovery of *Haloragodendron lucasii* (Haloragaceae). Telopea 3: 593-5.

Orchard, A.E. (1990b). Haloragaceae. *In:* George, A.S., Flora of Australia 18: 5-85

Schindler, A.K. (1905). Halorrhagaceae. *In:* Engler, H.G.A., Das Planzenreich 23: 1-133.

Walpers, W.G. (1846). Repertorium botanices systematicae 5: 672. (Leipzig.)

Thomasia glabripetala (Sterculiaceae), a new species from south-west Western Australia

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Abstract

Patrick, S.J. *Thomasia glabripetala* (Sterculiaceae), a new species from south-west Western Australia. Nuytsia 9(1): 119-122 (1993). A new species of *Thomasia* (Sterculiaceae) is described and illustrated, namely *Thomasia glabripetala* S.J. Patrick, endemic to the Avon Botanical District of the South-West Botanical Province of Western Australia. This is a declared rare species which, until recently, has been confused with *Thomasia montana* Steudel.

Introduction

This species was first collected in 1966 when it was identified as *Thomasia montana* Steudel. A survey for *Thomasia montana* in 1983 resulted in the discovery of more populations of the then undescribed *T. glabripetala,* but none of *T. montana* which had originally been collected in the York area (Patrick 1984). It was not until 1986, when a population of the latter was discovered, that comparison of fresh flowers of both species highlighted some of the differing characters that were not readily evident in herbarium specimens (Hopper *et al.* 1990)

Taxonomy

Thomasia glabripetala S.J. Patrick, sp. nov. (Figure 1)

T.montanae affinis sed differt floribus majoribus; calyce planiore, minus inciso; petalis longioribus, appressa ad calycem, margine glabro; staminodiis plerumque brevioribus, triangularibus; ovario 4- v.5-locularibus.

Typus: York area [precise locality withheld], Western Australia, 10 October 1991, *S.J. Patrick* 901 (holo: PERTH; iso: CANB, K).

Shrub to 120 cm high; young stems with dense, brown stellate hairs. *Stipules* paired, leaf-like, reniform or lobed, 6-16 mm long, stellate hairy on both surfaces. *Leaves* alternate; petiole 4-9 mm long; lamina elliptic or oblong, 15-35 x 7-18 mm, somewhat wrinkled, both surfaces green with scattered stiff

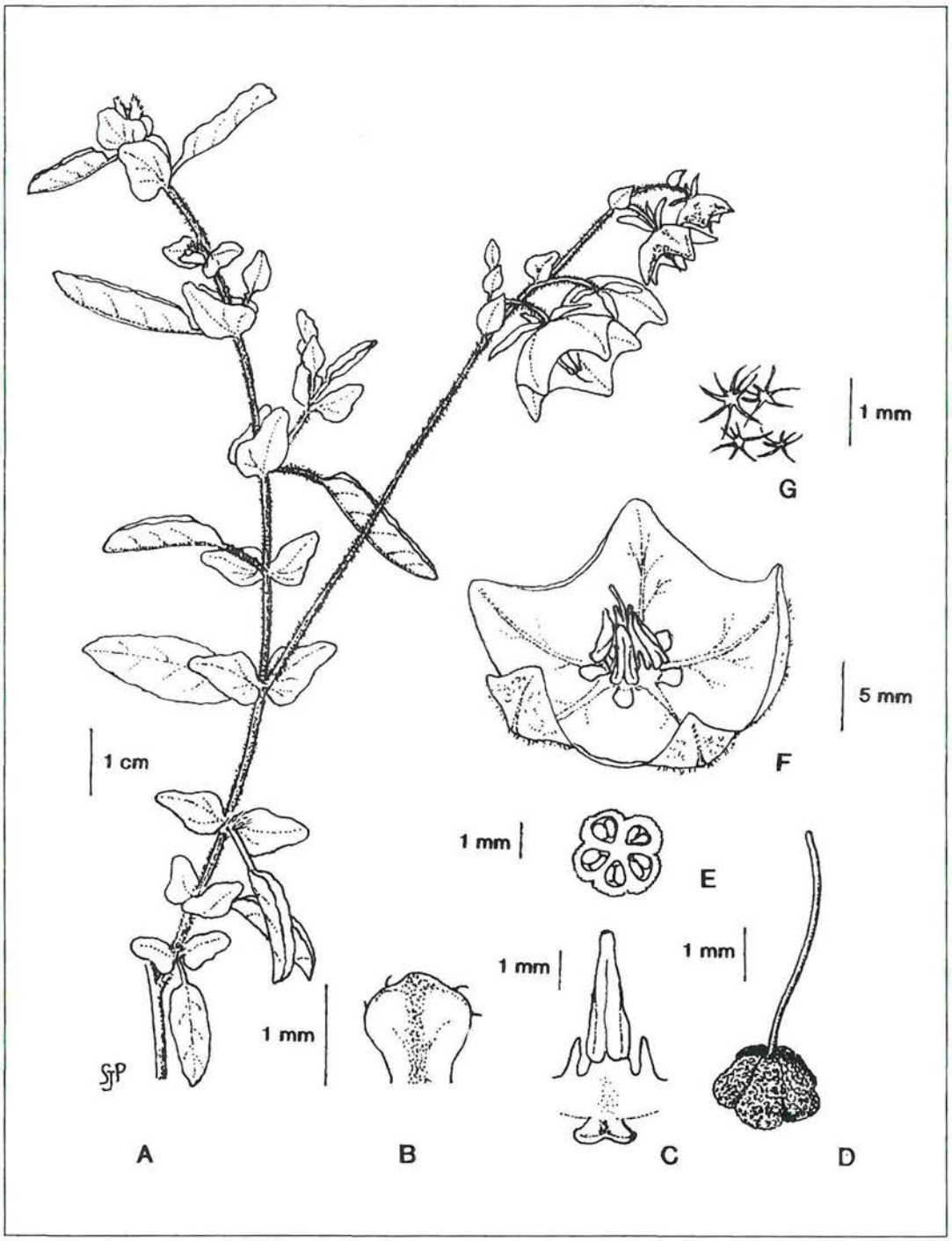

Figure 1. *Thomasia glabripetala*. A - habit. B - petal. C - stamen, with two staminodes on section of staminal cup, and petal at base. D - ovary and style. E - cross-section of ovary. F - flower. G - stellate hairs from leaf. Drawn from the holotype.

stellate hairs which are pale adaxially and rusty brown abaxially, particularly on young leaves. *Inflorescence* simple, axillary, racemose, 4-7-flowered, 4.5-9 mm long including the densely brown, stellate hairy peduncle. *Bracteoles* 3, subtending the calyx, elliptic, stellate hairy on both surfaces, 6-16 mm long. *Calyx* purplish-pink, shallowly cupular, 9-17 mm long, with conspicuous stellate hairs abaxially, and scattered, fine stellate hairs adaxially, divided for half or less than half its length, *lobes* 5, 4-8 mm long, obtuse. *Petals* 5, broadly spathulate, with rounded or rarely indented apex, dark purple with glabrous margins, or with a few white marginal hairs, 0.5-2.5 mm long, appressed against calyx. *Stamens* 5, dark purple, 4-5.5 mm long, filaments basally connate forming a cup half as long as or equal in length to the ovary; anthers 3-4.5 mm long. *Staminodes* 0.25-1.5 mm long, triangular, pale in colour, green when fresh. *Ovary* 4-5 celled, 1-1.5 mm long, papillose. *Ovules* 8-9 per locule. *Style* 3-6 mm long, glabrous, exserted beyond the stamens. *Fruit* a loculicidal capsule, crustaceous, 4-5-celled, c. 4 mm long. *Seed* not seen.

Flowering period. September to October.

Distribution. Endemic to the Avon Botanical District of the South-West Botanical Province of Western Australia, occurring over a restricted geographical range of 10 km, in remnants of natural vegetation to the east of York.

Habitat. The species occurs in the open scrub layer of *Eucalyptus wandoo* woodland on deep yellow sand over gravel.

Conservation status. A rare species known from five localities over a restricted range. The species was declared as Rare Flora under provisions of the Wildlife Conservation Act of Western Australia in 1987 (as *Thomasia* sp. (York) *A.S. George* 8075). It has the category 2VC of Briggs & Leigh (1988) where it is listed as *Thomasia* sp. 1 (York).

Other specimens examined. WESTERN AUSTRALIA: September 1966, *A.S. George* 8075 (PERTH); June 1984, *S.J. Patrick* 106 (BRI, PERTH); September 1985, *S.J. Patrick* 173, 174, 175 (PERTH); September 1985, *S.J. Patrick* 176 (PERTH); September 1985, *S.J. Patrick* 179, 180 (PERTH); September 1985, *S.J. Patrick* 181 (PERTH); September 1985, *S.J. Patrick* 183, 184 (PERTH); York, 18 December 1986, *T. Walley s.n.* (PERTH) [precise localities withheld].

Etymology. The specific epithet draws attention to the glabrous petals of this species which help to distinguish it from *Thomasia montana*.

Discussion. This species is apparently most closely related to *T. montana* Steudel. The latter can be distinguished by the calyx, which is shorter, 6-10 mm long, more deeply cupular and which is divided for never less than half its length into acute lobes. The petals are usually shorter, 1-1.5 mm long, reniform in shape and the margins are densely hairy with the hairs sometimes extending onto the adaxial petal surface. Further, in fresh material the petals are held in a semi-erect position. The staminodes are longer, 2-2.5 mm long, and the hypogynous staminal cup is as long as the ovary, which is 3- to 4-celled.

Acknowledgements

I am grateful to Diana Corbyn for writing the Latin diagnosis.

References

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

Hopper, S.D., van Leeuwen, S., Brown, A.P. & Patrick, S.J. (1990). "Western Australia's Endangered Flora." (Department of Conservation & Land Management: Perth.)

Patrick, S.J. (1984). "Rare and Geographically Restricted Plants of Western Australia No.26." Unpublished Report. (Department of Fisheries & Wildlife: Perth.)

Croninia kingiana (Epacridaceae), a change in status for *Leucopogon kingianus*

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Abstract

Powell, J.M. *Croninia kingiana* (Epacridaceae), a change in status for *Leucopogon kingianus*. Nuytsia 9 (1): 123-130 (1993). *Leucopogon kingianus*, an endemic Western Australian species exhibiting features atypical of *Leucopogon* is transferred to the new monotypic genus *Croninia* J. Powell as *C. kingiana* (F. Muell.) J. Powell.

Notes on its distribution and ecology are given and its relationships within the tribe Styphelieae discussed.

Introduction

Leucopogon kingianus, a species endemic in Western Australia, exhibits a number of features unusual in the genus: the paired keeled fleshy bracts at the base of the inflorescence, the conspicuous flowers with large pale-coloured bracteoles and sepals, the cylindrical corolla-tube with the lobes spreading horizontally immediately above the sepals, the linear bifurcate anthers, hirsute style and villous ovary (Figure 1).

Described initially by F. Mueller (1893) as *Styphelia kingiana* it was transferred to *Leucopogon* by C.A. Gardner in his census of Western Australian plants (Gardner 1931). Mueller (1893) stated that its relationships were 'near *S. rufa* [*Leucopogon rufus* Lindl.], which likewise is an inhabitant of desert-regions. It bears also some resemblance to *S. xerophylla* [*Astroloma xerophyllum* (DC.) Sond.].' The former relationship would place it within Section *Pleuranthus*, series *Concavae* of Bentham (1869), but Gardner (1931) placed it within series *Planifoliae* Benth. next to *Leucopogon strictus* Benth. His reason for doing so is unclear.

Willis annotated a specimen collected in 1949 by J.C. Kissane from Cannington with detailed drawings of the flower structure; he commented that the Western Australian Herbarium held the opinion that the taxon probably represented a new genus of Epacridaceae (Willis 1953, MEL 87664 specimen annotation). Franks & Watson (1963) described the pollen under the name *Styphelia kingiana* F. Muell. and commented that it was wrongly placed in that genus. They stated 'It does not resemble any other genus [of Epacridaceae] very closely, and its distinctness should be recognised taxonomically.'

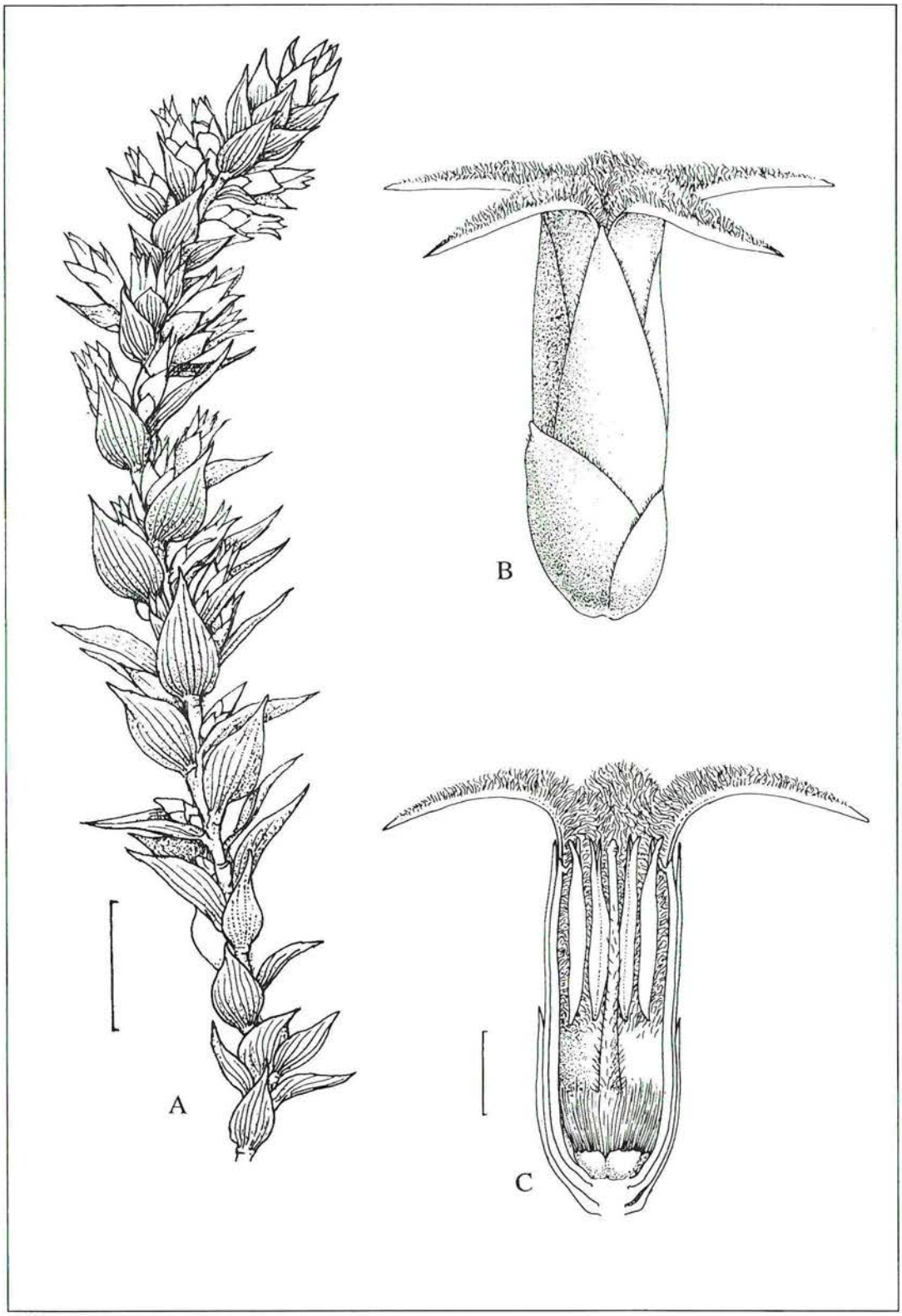

Figure 1. Flowering branch and flower structure of *Croninia kingiana*.. A: habit (scale bar = 10 mm) B, C: flower structure and section (scale bar = 2 mm).

Recent cladistic analyses (Powell *et al.* in press) also indicate that the taxon should be considered as a distinct genus. *Leucopogon kingianus* belongs to sub-tribe Styphelinae in the tribe Styphelieae (Powell unpublished data) together with the genera *Astroloma, Conostephium, Coleanthera, Styphelia, Melichrus* and *Leucopogon* section *Pleuranthus*. While the leaf fibre pattern (Figure 2E), distribution of the stomata on the abaxial surface only, and ornamentation of the corolla hairs (Figures 3A, B) are typical of members of the tribe Styphelieae, the pollen of this taxon appears unique in having an annulus surrounding the pores, and a verrucate surface pattern (Figure 3E). The suggested possible relationships with *Leucopogon rufus* or with *Astroloma xerophylla* (Mueller 1893) are not supported by the detailed morphological data.

Leucopogon kingianus is related to the genus *Conostephium* which also has linear bifurcate anthers and short terete filaments attached to the anther immediately below the bifurcation. *Conostephium* is unique however in having its corolla-lobes joined over most of their length to form a cone. The corolla hairs of *Conostephium* are smooth-surfaced rather than ornamented, as in *Leucopogon kingianus* (Figures 3A, B), and leaf venation is sub-parallel or actinodromous in most species of *Conostephium* while it is strictly parallel in *L. kingianus* (Figure 2B). The pollen of the two genera differ also.

Croninia J. Powell, gen. nov.

Frutex parvus. Folia simplicia, spiralia, parallelinervia. Inflorescentiae axillares; flores solitariae, bracteolis subtendis paucis et bracteis binatis, carinatis basi. Sepala quinque, scariosa. Corolla quinqueloba; tubus cylindricus, intus pubescens; lobi breviter barbati, aestivione valvata. Stamina quinque, tubo corollae proxime sub fauce inserta; filamenta brevia, teretia; anthera lineares, apice breviter bilobo, fissura singulari longitudinali dehiscentes. Ovarium quinqueloculare, ovulis in quoque loculo solitariis, placentatione apicali; stylus longus, in parva depressione ad apicem ovarii inserta; stigma truncata. Nectarium annulare, margine lobato. Drupa sicca.

Small *shrub*; *branchlets* pubescent with simple unicellular hairs. *Leaves* simple, spiral, shortly petiolate, strongly parallel-veined. *Flowering shoots* auxotelic; pherophylls persistent. *Flowers* solitary, axillary, subtended by a few bracteoles and with a pair of triangular keeled bracts at the base of the short peduncle. *Bracteoles* grading upwards in size to the sepals, scarious, unkeeled, ciliolate on the margins. *Sepals* 5, scarious, unkeeled, ciliolate on the margins. *Corolla* pentamerous; tube cylindrical, pubescent inside with ornamented hairs; lobes triangular, thick and fleshy, valvate in bud, shortly bearded on the upper surface. *Stamens* 5, inserted just below the throat of the corolla; filaments short, terete, attached to the anther dorsally immediately below the bifurcate apex; anthers linear, bifurcate at the apex, dehiscing by a single longitudinal slit. *Gynoecium*: style equal to or longer than the corolla tube, inserted in a small depression at the ovary apex; stigma truncate; ovary 5-locular with a single pendulous ovule per loculus; placentation apical. *Nectary* annular. *Fruit* a drupe, the mesocarp thin and dry, the endocarp hard and bony.

The genus is named in honour of Michael and Mary Cronin (father and daughter) who farmed near Dumbleyung from the early 1880's. They collected botanical specimens for Ferdinand Mueller from many different areas between Perth and Albany and eastwards to the goldfields (Diels in Carr 1981, Hamersley 1981).

Croninia kingiana (F. Muell.) J. Powell stat. et comb. nov. (Figure 1)

Basionym: Styphelia kingiana F. Muell. The Victorian Naturalist 10:78 (1893)

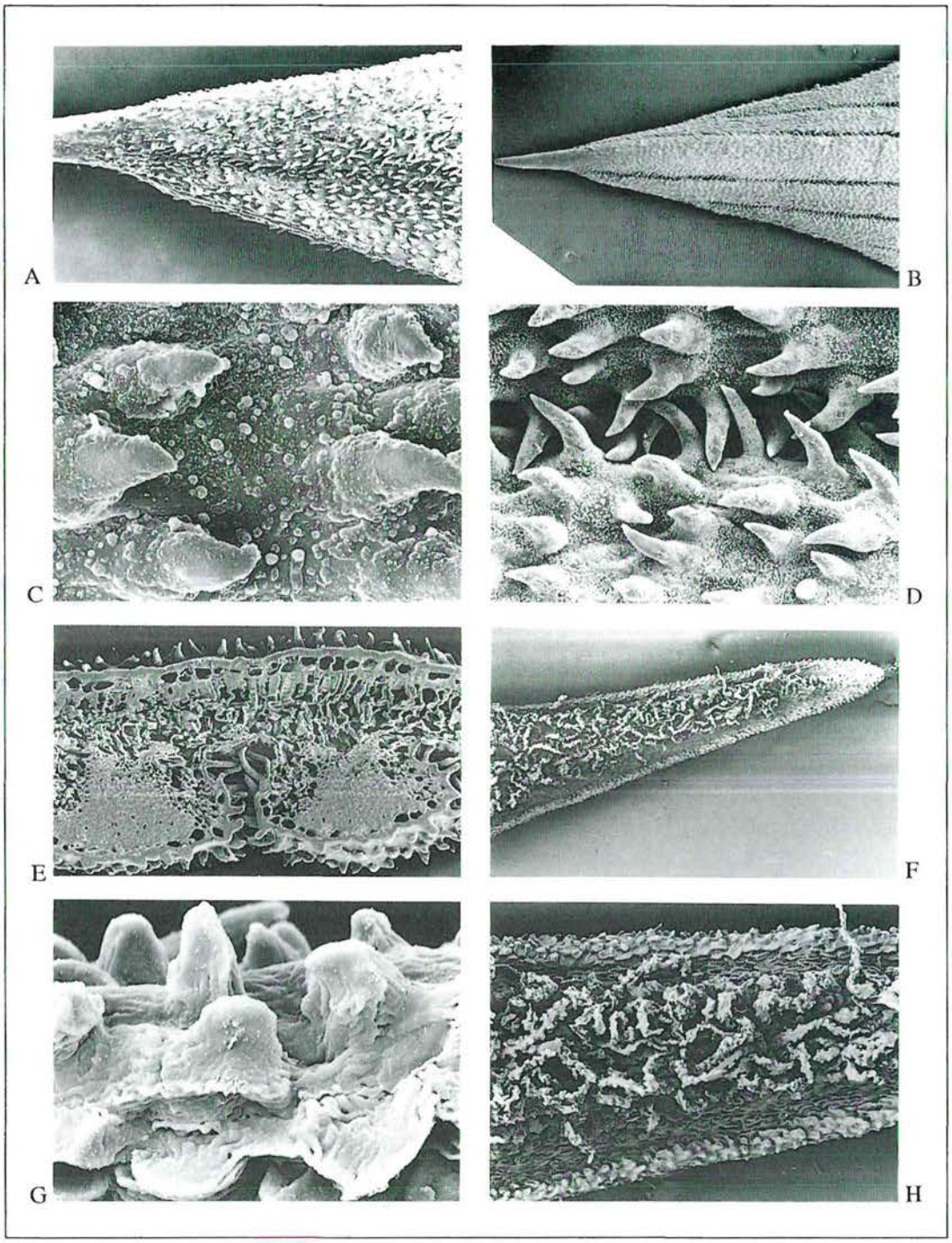

Figure 2. Scanning electron micrographs of leaves and corolla lobe. A: adaxial leaf tip (x80); B: abaxial leaf tip (x80); C: adaxial hairs and wax (x2550); D: abaxial surface near furrows (x1300); E: leaf transverse section (x500); F,H: corolla lobe and hairs (x130; x400); G: lobe margin (x3800).

Type citation: 'Near Lake Deborah; Cronin.' *Holotype*: Western Australia: Coolgardie: Lake Deborah, *Cronin,* 1893 (MEL 1512224).

Synonym: Leucopogon kingianus (F. Muell.) C.A. Gardner, Enum. Pl. Austral. Occ. 105 (1931).

An erect, compact *shrub*, 40-100 cm high. *Stems* slender, erect, grey or dark grey-brown, glabrous, with thin tessellated to flakey bark, with prominent leaf-scars; *branchlets* yellow-brown or red-brown, usually densely hispidulous. *Leaves* bluish green, evenly spaced along the branches or sometimes more crowded towards the branch ends, erect to sub-erect or occasionally horizontally spreading, ovate, 3.3-11.6 mm long, 1.5-5.6 mm wide; apex acute with a 0.4-1 mm long aristate tip (Figure 2B); base cuneate or truncate; petiole poorly developed, 0.5-1 mm long, glabrous or scabrous; lamina thick, slightly concave adaxially, concolorous or slightly discolorous, scabrid to hispidulous (Figure 2A) and often hispid near base adaxially, scabrous to densely hispidulous abaxially (Figure 2B); venation inconspicuous adaxially, strongly parallel-ribbed and grooved abaxially with 5-9 veins (Figures 2B, D, E), not branching to the margins; margin minutely denticulate. Young seasonal growth leaves are smaller, almost orbicular and with a shorter tip. *Inflorescences* clustered near the branch tips, the flowers large, extending past the leaves, white, erect; *peduncles* very short; rudiment absent. *Basal bracts* ovate-triangular, keeled, fleshy, 1.6-2 mm long, 0.7-1.4 mm wide, acute, glabrous or scabrous and with ciliolate margins. *Bracteoles* 3 or 4, orbicular, 1.5-6 mm long, 2-6 mm wide, pale yellow-green, sub-obtuse to obtuse, apiculate, glabrous or scabrous outside, the margins ciliolate to ciliate near the apex. *Sepals* ovate, 9-10.3 mm long, 2.3-3.7 mm wide, pale yellow-green, acute, apiculate, glabrous or scabrous towards the apex outside, with ciliolate to ciliate margins. *Corolla-tube:* pale yellow-green, shorter than the sepals, 6.7-8.3 mm long, 1.9-4 mm wide, glabrous outside or scabrous over the upper 1-2 mm, pubescent inside to near base with ornamented hairs (Figure 3B); *lobes* always shorter than the corolla-tube, white, erect at the base, horizontally spreading above, 4.2-6 mm long, 1-1.8 mm wide, very acute (Figure 2F), the margin minutely serrate-papillose near the apex or overall (Figure 2G), externally glabrous or scabrous, internally tomentose near base, shortly bearded above, the hairs becoming shorter towards the apex and with the upper 0.5-1 mm glabrous (Figures 2F, H); lobe hairs long and twisted, with sparse to dense long-rectangular tubercules on the surface (Figure 3A). *Anthers* pink to brown, linear, 4.1-4.9 mm long, bifurcate (Figure 3C) and sterile over the upper 0.3-0.7 mm, acute at the base (Figure 3D); *filaments* 0.2-0.6 um long, fleshy, terete, attached below the bifurcate apex (Figure 3C); pollen monad, spherical, 36-42 µm diameter, 8- periporate, the pores with a thickened annulus, the surface fine-verrucate; no tetrad scar obvious (Figure 3E). *Ovary* dark green, ovoid or pyriform, 1.4-2 mm high, 0.7-1.3 mm wide, sub-angular over the lower half, bristly at the apex and clothed with longer hairs (up to 3 mm long) from near the base (Figure 3F), 5-locular; *style* woolly-white (Figures 3F-I), 7.5-10 mm long, usually longer than the tube but hidden in the erect corolla-lobe bases, hollow and 5-channelled in transverse section, slenderly obclavate but narrowing abruptly at the ovary and inserted in a shallow depression at the apex; *stigma* small, truncate or obscurely 5-lobed (Figure 3G), 0.1-0.2 mm high. *Nectary* annular but very deeply lobed (Figure 3F), 0.6-0.9 mm high, glabrous, with shallowly lobed upper margin. *Fruit* ovoid, dry, 4-5 mm high, c. 3 mm across, covered with long erect silky hairs; endocarp woody, ribbed; style base persistent.

Selected specimens examined. WESTERN AUSTRALIA: IRWIN: Badgingarra, *A.C. Burns* 107, 18 Sep. 1971 (PERTH); Brand Highway (153 m.p.) [41 km N of Badgingarra], *Demarz* 10321, 7 Oct. 1984 (PERTH); Cadda Road, Badgingarra area, *F.W. Humphreys* 5678/65, 14 Sep. 1965 (PERTH); 1.6 km S of Mullering Brook on Brand Hwy, S of Badgingarra, *R. Johnson* 3229, 25 Sep. 1976 (BRI, PERTH); 9 mls E of Mt Peron, *Newbey* 2300, 31 Aug. 1965 (PERTH). DARLING: Drummond: base of Darling Range, *R.J. Cranfield* 44, 12 Oct. 1977 (PERTH); Prinsep Road, Jandakot, *J. Dodd,* 9 May 1978 (PERTH 02429853); Gnangara, *C.A. Gardner* 13118, 13 July 1971 (PERTH);

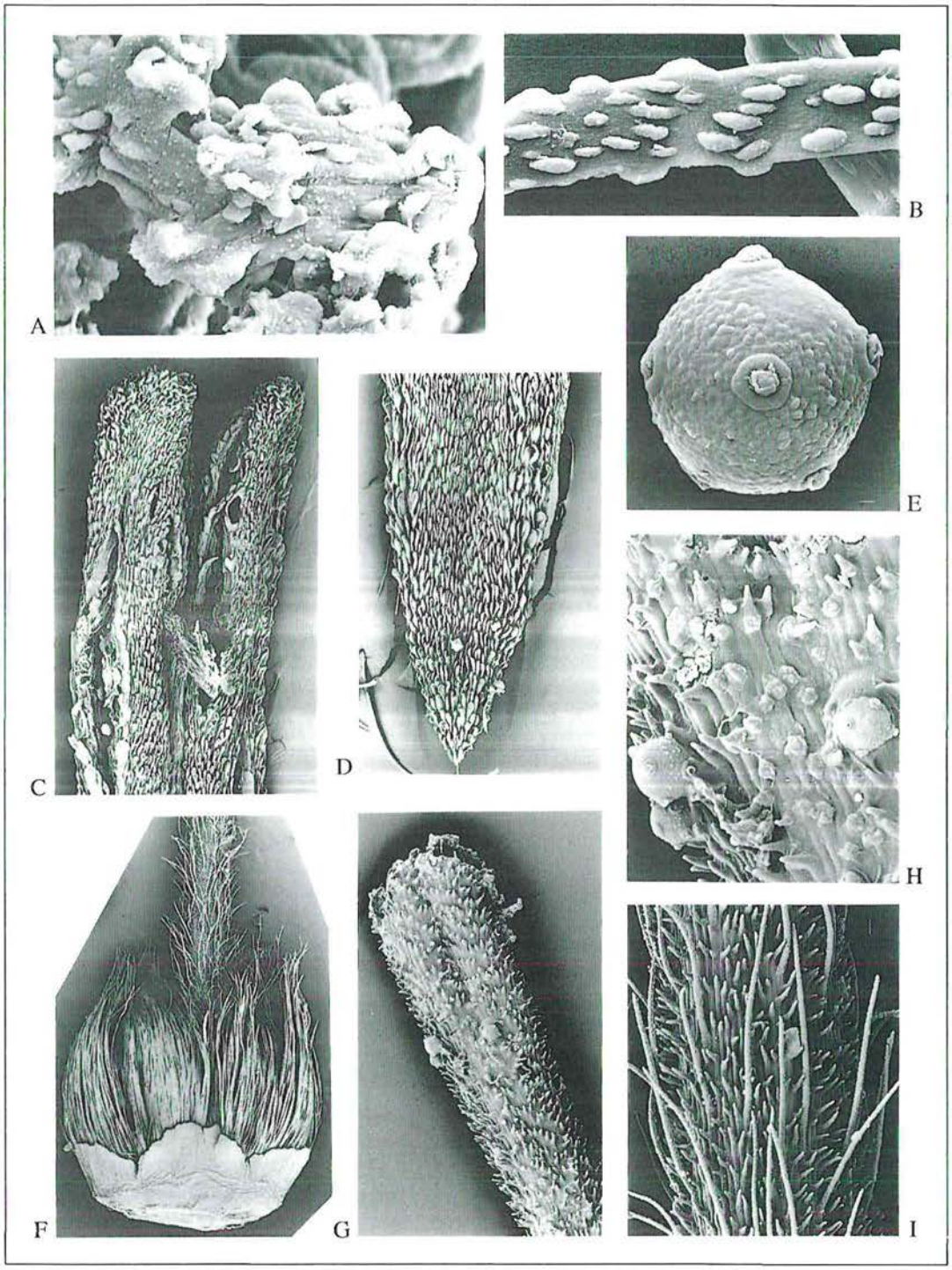

Figure 3. Scanning electron micrographs of corolla hairs, anthers, pollen and gynoecium. A: corolla-lobe hairs (x5000); B: corolla-tube hairs (x5000); C: anther apex and filament attachment (x260); D: base of anther (x260); E: pollen (x4000) F: ovary, style base and nectary (x80); G: upper style and stigma (x300); H: upper style surface (x1100); I: mid-style hairs (x500).

c. 2 miles [3 km] N of settlement, Gnangara Pine Plantation, *A.S. George* 889, 3 Aug. 1960 (MEL, NSW, PERTH); 20 miles [32 km] N of Gingin on Dandaragan road, *A.S. George* 1698, 14 Nov. 1960 (MEL, PERTH); off Brand Hwy, 13 km N of Jurien Road, *E.A. Griffin* 2232, 14 Sep. 1979 (CANB, PERTH); 0.7 km W of Brand Hwy, 25.3 km N of junction with Gingin Brook road, *R. Hnatiuk* 790039, 27 Sep. 1979 (PERTH); end of Glendale Crescent, Jandakot, *G.J. Keighery* 11780, 21 Nov. 1990 (PERTH); near Nicholson road swamp, Canning Vale, *Kissane*, 29 Aug. 1949 (MEL 87664); margin of Jandakot airport, Perth, *Powell* 1311, 25 Aug. 1979 (CANB, K, L, NSW, PERTH); Cannington, *Kissane*, Sep. 1948 (PERTH 02429845); Verna Street, Gosnells, *R.J. Cranfield* 534, 1 Aug. 1978 (PERTH). Dale: Yornaning Reserve, c. 26 km ESE of Popanyinning, *B.G. Muir* 415, 12 Sep. 1975 (PERTH). Warren: c. 20 ml from Walpole near Nornalup Hwy, Burnett area, *P. Gnuske* 22, Oct.1966 (PERTH). AVON: near Lake Wagin, *Cronin*, 1890 (MEL 87666, NSW); Kellerberrin, *MacNeil*, 26 Sep. 1972 (PERTH 02429616); Corrigin district, *s.coll.*, 20 Sep. 1961 (PERTH 02429632).

Distribution and habitat. Found in the Irwin, Avon and Darling Districts of the South-West Botanical Province eastwards to the Coolgardie District of the South-Western Interzone. Often recorded as locally common, growing in deep greyish white or yellow sand within open heath or low open woodlands. (Figure 4).

Flowering and fruiting period. Flowers in August and September with fruit in November.

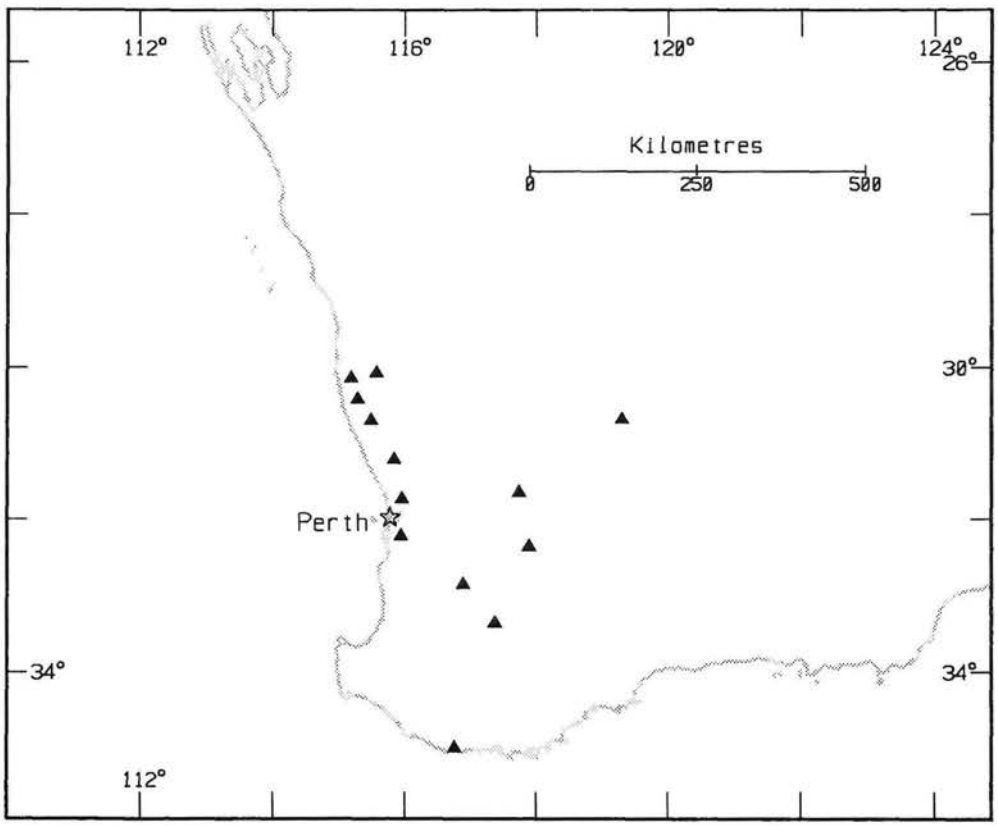

Figure 4. Distribution of *Croninia kingiana.*

Typification: C.A. Gardner annotated the label of a type fragment (designated syntype - PERTH 02429659) at PERTH ' This species is confined to the country between Gnangara and Cannington, so that a mistake has been made by Mueller in locality and collector.' More recent collections indicate a much wider distribution of this species (Figure 4) and hence the type location should not be dismissed before further collection in the area has been undertaken.

Conservation status. Herbarium records indicate the species is relatively widely distributed, but populations are small and some are threatened as they are near suburban developments. Known to be conserved in Badgingarra National Park and also possibly in Lesueur National Park.

Acknowledgements

I should like to thank Bob Roden for preparing the line drawing, Tony Martin for help with the scanning electron microscopy and Barbara Wiecek for preparing the photographs and map for publication. Thanks are due also to the Directors of PERTH and MEL herbaria for the loan of specimens. Australian Biological Resources Study grant funds assisted this project and are gratefully acknowledged.

References

Bentham, G. (1869). "Flora Australiensis" Vol. 4. (Reeve & Co.: London.)

Carr, D.J. (1981). Extratropical Western Australia - translation of first part (pp.41-72) of L. Diels Plant World of Western Australia, Leipzig, 1906; *In* D.J. & S.G.M. Carr (eds) "People and Plants in Australia." (Academic Press Australia: Sydney.)

Franks, J.W. & Watson, L. (1963). The pollen morphology of some critical Ericales. Pollen et Spores 5(1): 51-68.

Gardner, C.A. (1931). Enumeratio Plantarum Australiae Occidentalis Part 3.

Hamersley, M.J. (1981). Botany and Society in the Swan River Colony, pp. 259-279; *In* D.J. & S.G.M. Carr (eds) "People and Plants in Australia." (Academic Press Australia: Sydney.)

Mueller, F. (1893). Descriptions of new Australian plants, with occasional other annotations. [continued]. The Victorian Naturalist 10: 78-79. (An offprint of this paper was published in the 'Neue Litteratur' section of Botanishes Centralblatt (1893) 56: 124-125.)

Powell, J.M., Morrison, D. & Chapman, A.R., (in press). The Epacridaceae - a cladistic analysis.

Cytological notes in Rutaceae. 1: *Boronia tenuis*

Helen M. Stace[1] & S. J. Patrick[2]

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Abstract

Helen M. Stace & Patrick, S.J. Cytological notes in Rutaceae. 1: *Boronia tenuis*. Nuytsia 9(1): 131-133 (1993). A new chromosome number determination for *Boronia tenuis* (n=16) corrects a prior report and has implications for the cytotaxonomy of *Boronia* in Western Australia.

Introduction

Boronia Sm. (c. 100 spp.) is the largest genus of the Australasian tribe Boronieae (Rutaceae) and more than 45 species are Western Australian (Green 1985). The genus shows considerable cytoevolution through dysploidy from x=18 to n=7 (Smith-White 1954, Stace & Armstrong 1992). *Boronia* is of key interest in the cytotaxonomy of the Boronieae and family Rutaceae, as Smith-White (1954) utilised the available cytological data to argue that the genus, tribe and family had evolved from a base number of x=9 with most higher numbers having evolved from ancient polyploid ancestors (paleopolyploidy). This view was followed by Weston *et al.* (1984) in their cladistic analysis of *Boronia*, but their cladogram incorporating chromosome number information was reinterpreted by Stace *et al.* (1993) to show that *Boronia*, Boronieae and Rutaceae had evolved from a probable diploid base of x=18.

One of the key species supporting the possibility that *Boronia* had evolved on x=9 is *B. tenuis* Benth. This relatively rare species is known from several populations along the Darling Scarp, Western Australia (Patrick & Hopper 1981, Marchant *et al.* 1987) and at Cape Naturaliste some 150 km south-west of the Scarp populations. It was reported as n=9 by Smith-White (1954) although all cytologically known related species in section *Cyanothamnus* (Bentham 1863, Weston *et al.* 1984) are x=18 (n=18, 36). This note re-examines Smith-White's report in verified collections of *B. tenuis* from two localities east and south-east of Perth.

Methods

Young floral buds of *B. tenuis* plants from Bickley and North Dandalup were fixed in Bradley's fluid, and anther squashes stained in Snow's alcoholic carmine were examined for pollen mother cell (p.m.c.) meiosis. Vouchers (*S.J. Patrick* 1049, 1050) are housed at the Western Australian Herbarium (PERTH).

Results

Meiotic metaphase I and II cells clearly indicate that *B. tenuis* is n=16 from both populations (Figure 1). Meiosis is normal with no indications of multivalent formation. The two locations are about 60 km apart and sample much of the species' known distribution on the Darling Scarp.

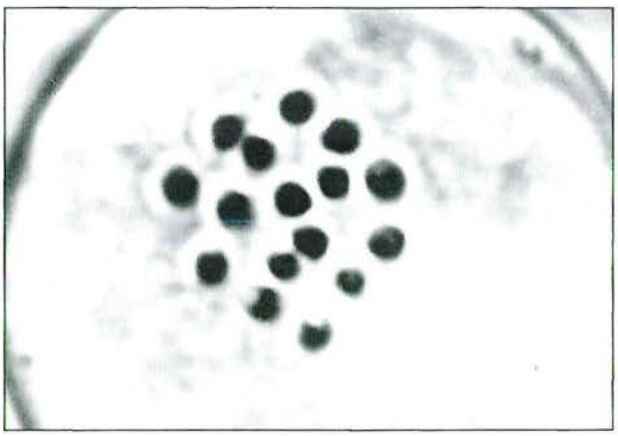

Figure 1. Meiosis in *B. tenuis*, n=16; metaphase I, polar view, showing sixteen bivalents. Bickley, Western Australia.

Discussion

B. tenuis is a small diffuse perennial plant and apparently rather advanced both morphologically and cytologically within section *Cyanothamnus* where six other species are presently reported as x=18. This is the first report of n=16 in a species of this section, but it is consistent with dysploid cytoevolution from x=18. In certain key characters *B. tenuis* groups with four other WA species *B. busselliana* F. Muell., *B. defoliata* F. Muell., *B. fabianoides* (Diels) P. G. Wilson and *B. subsessilis* Benth. (Weston *et al.* 1984) and it remains to be seen whether n=16 is typical of this and any other subgroupings of *Boronia-Cyanothamnus* species. Other reports of n=16 occur in eastern Australian species of section *Valvatae* (Smith-White 1954, Weston *et al.* 1984), where, presumably, it has evolved independently.

Smith-White's voucher of '*B. tenuis* ' from Albany has not been found, but probably the species determination was incorrect as *B. tenuis* Benth. is not known to occur in that district (P.G. Wilson, pers. comm.). It is clear that n=9 is neither definitive nor typical for *B. tenuis* Benth. Our new determination discounts the paleopolyploid model but further affirms the value of diploid chromosome number information in the taxonomy and evolution of *Boronia* (Smith-White 1954). Two-thirds of the genus are cytologically unknown but offer an intriguing area for future cytoevolutionary and ecological genetics research.

Acknowledgements

We thank Paul Wilson for herbarium determinations of *B. tenuis,* Jim Armstrong for discussions and the Western Australian Water Authority for funding field research along the Darling Scarp.

References

Bentham, G. (1863). "Flora Australiensis", vol. 1. (Lovell Reeve & Co.: London.)

Green, J.W. (1985). "Census of the vascular plants of Western Australia" edn. 2. (Western Australian Herbarium: Perth.)

Marchant, N.G., Wheeler, J.R., Rye, B.L., Bennett, E.M., Lander, N.S. and Macfarlane, T.D. (1987). "Flora of the Perth Region Part I". (Western Australian Herbarium: Perth.)

Patrick, S.J. and Hopper, S.D. (1982). "A guide to the gazetted rare flora of Western Australia: Supplement 1". (Western Australian Department of Fisheries and Wildlife: Perth.)

Smith-White, S. (1954). Chromosome numbers in the Boronieae (Rutaceae) and their bearing on the evolutionary development of the tribe in the Australian flora. Austral. J. Bot. 2: 287-303.

Stace, H.M. and Armstrong, J.A. (1992). New chromosome numbers for Rutaceae. Austral. Syst. Bot. 5: 501-5.

Stace, H.M., Armstrong, J.A. and James, S.H. (1993). Cytoevolutionary patterns in Rutaceae. Pl. Syst. Evol. (in press).

Weston, P.H., Carolin, R.C. and Armstrong, J.A. (1984). A cladistic analysis of *Boronia* Sm. and *Boronella* Baill. (Rutaceae). Austral. J. Bot. 32: 187-203.

Publication date of Nuytsia Volume 8 Number 3: 7 September 1992

CORRECTION

Correction to "New names and combinations for some *Melaleuca* (Myrtaceae) species and subspecies from the south-west of Western Australia considered rare or threatened " by F.C. Quinn, K.J. Cowley, B.A. Barlow and K.R. Thiele, Nuytsia 8(3): 333-350 (1992).

In the above paper, a new subspecies *Melaleuca huegelii* subsp. *pristicensis* Barlow, subsp. nov. was described. In the heading on page 338 the spelling '*pritsicensis*' was printed. This was a typographical error and the correct spelling is '*pristicensis*'. - **Editor.**

CONSERVATION CODES FOR WESTERN AUSTRALIAN FLORA

R: Declared Rare Flora - Extant Taxa (= Threatened Flora = Endangered + Vulnerable)

Taxa which have been adequately searched for, and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee.

X: Declared Rare Flora - Presumed Extinct Flora

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee.

1: Priority One - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2: Priority Two - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three - Poorly Known Taxa

Taxa which are known from several populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.

4: Priority Four - Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Notes for Authors

Nuytsia publishes papers relating to the flora of Western Australia. All papers are refereed and the Herbarium reserves the right to reject papers.

Manuscripts must be submitted in duplicate, typewritten and double spaced. Printing is now done using a desktop publishing system. After final acceptance of papers authors are requested to provide floppy discs readable directly by IBM computer. Wherever possible, the MS-WORD software should be used. Alternatives should be discussed with the editor before preparing manuscripts.

Great care with layout, spacing and typography must be exercised in the preparation of electronic manuscripts. In particular, note the following. Text is not to be right-justified. Where manuscripts are compiled with software other than MS-WORD all headings and paragraphs are to be left-justified. Within a paragraph two spaces are required between sentences; after colons, semicolons, commas and dashes a single space is required. Where MS-WORD is used, text should be italicised or emboldened where appropriate.

Original figures should not be lettered but instead accompanied by copies indicating lettering. Page proofs will be forwarded to authors for checking. Twenty reprints of each paper will be provided free of charge; no additional copies may be ordered. Style and layout should follow recent numbers of **Nuytsia**, noting particularly the following.

Title. Should include the family name of genera or species treated, but not authorities. New taxa should be named if not numerous. The geographic area of study should be given where appropriate.

Abstract. The paragraph (or paragraphs) should be indented and commence with bibliographic information. New taxa, combinations and names should be listed. The major contents of the paper should be summarised but no additional material given. Key words indicating all ideas and topics covered by the paper must be included to facilitate computerised abstract searching.

Headings. All headings should be in capitals and lower case, major headings being centred and minor ones left-justified.

Keys. May be either indented (e.g. Nuytsia 5: 277) or bracketed (e.g. Nuytsia 5: 84). Indented keys involving more than nine levels of indentation should be avoided.

Species treatments. Use of certain named paragraphs, or sets of paragraphs, for matter following the descriptions is encouraged. The desired sequence and examples of commonly used headings are shown below. Recommended headings which are italicised below, should be left-justified, followed by text on the same line.

(1) Taxon name, synonymy (if any) and type details (for previously published taxa).
(2) Latin (for new taxa - indented).
(3) *Typus:* (for new taxa - not indented).
(4) English description (indented).
(5) *Other specimens examined* or *Selected specimens examined* as appropriate.
(6) *Distribution.*
(7) *Habitat.*
(8) *Flowering period.*
(9) *Fruiting period.*
(10) *Typification* (discussion).
(11) *Affinities* or *Relationships.*
(12) *Discussion* or *Comments* or *Notes.*
(13) *Conservation status.* (Department of Conservation and Land Management conservation codes for rare and threatened (Declared Rare Flora) WA taxa are given in each issue).
(14) *Etymology.*

Threatened species. It is the policy of CALM not to publish precise locality data for threatened species. Authors are therefore requested not to cite precise locality data when describing threatened species. Generalised localities should be given accompanied by the statement "precise locality withheld".

Synonymy. The desired format is that used by P.G. Wilson, Nuytsia 4: 135-262.

Standard abbreviations. It is suggested that where possible the following standards be followed.

(1) Author abbreviations - Brummitt, R.K. & Powell, C.E. (1992). Authors of Plant Names. (Royal Botanic Gardens: Kew.)

(2) Book titles in literature citations - Stafleu, F.A. & Cowan, R.S. (1976-83). Taxonomic Literature. Edn 2. (I.A.P.T.: Utrecht) (but with capital initial letters.) - Green, J.W. (1985). Census of the Vascular Plants of Western Australia. Edn 2. Pp. 20-24. (Department of Agriculture: Perth.)

(3) Journal titles in literature citations and reference lists - Lawrence, G.H.M. *et al.* (1968). B-P-H (Botanico-Periodicum-Huntianum). - Green *loc. cit.*

Figures. Numbers should follow a single sequence including maps.

Structure of papers. Authors are encouraged to use the conventional structure of scientific papers when a complete study is being reported (e.g. a revision). A *Methods* section should include the method of drawing up the descriptions from specimens, extent of search for types, and discussion of concepts for choice of taxonomic categories. A *Discussion* section should be considered, which would include some or all of the following: a summary of the findings, emphasising the most significant; interpretation of the results in the light of other relevant work; statement of new problems which have arisen; advising of aspects which are to be followed up; suggestion of topics which others might usefully pursue; prediction and speculation.

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