A taxonomic revision of the White Mahoganies, *Eucalyptus* series *Acmenoideae* (Myrtaceae)

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Abstract

Hill, K.D. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1999. A taxonomic revision of the White Mahoganies, Eucalyptus *series* Acmenoideae *(Myrtaceae).* Telopea *8(2): 219–247*. A taxonomic revision of the White Mahogany group is presented. Twelve species are treated, seven of them described here as new (**E. contracta** L.A.S. Johnson & K.D. Hill, **E. helidonica** K.D. Hill, **E. irritans** L.A.S. Johnson & K.D. Hill, **E. latisinensis** K.D. Hill, **E. mediocris** L.A.S. Johnson & K.D. Hill, **E. portuensis** K.D. Hill, **E. uvida** K.D. Hill). Relationships are discussed, and a classification is presented, with keys to subgroups and species, illustrations of the new species and distribution maps of all species.

Introduction

The white mahoganies are a distinct and readily recognised group of 12 species, with seven described here as new. The group is eastern in distribution, ranging from the Cooktown district of Queensland south to around Sydney in New South Wales. Habitat is mainly coastal, extending to the western slopes of the Great Divide in some parts, but not onto the colder tablelands regions.

This account presents the results of studies over 10 years, including extensive field study. All taxa have been studied in the field, and the collections held by BRI, CANB and QRS have also been examined. Selected specimens cited are listed in geographical regions, within which they are listed in alphabetic order of collector. Terminology and nomenclature follows previous papers in this series (see Hill & Johnson 1995). Seedlings of all species have been grown at the Royal Botanic Gardens Sydney.

Taxonomic history

The first white mahogany species recognised was *E. acmenoides* Schau. (Schauer 1843), followed by *E. umbra* R. Baker (1901) and *E. carnea* R. Baker (1906). Bentham (1867) reduced *E. acmenoides* to a variety of *E. pilularis*, although this status was shortly after reversed by Mueller (1884). Bentham included *E. pilularis* var. *acmenoides* in the large Section *Renantherae,* with no further subdivision. The white mahoganies were first formally recognised as a distinct taxonomic entity by Blakely (1934), although Maiden had earlier informally segregated the White Mahogany species group (below).

Maiden recognised only two species in the White Mahoganies, *E. umbra* and *E. acmenoides*, reducing *E. carnea* to a variety of the latter (Crit. Revis. *Eucalyptus* [abbreviated to 'CR' hereafter] 1: 264). These two species he placed in anther section *Renantherae* (CR 6: 526). Maiden later (CR 7: 121) placed these species in seed series '*Pyramidales–D-shaped*', with the White Mahoganies in a separate subgroup denoted only as '*f* '. He had earlier (CR 6: 141) separated the White Mahoganies informally on the basis of timber (timber group 1, Pale Hardwoods, subgroup C, White Mahoganies), and had also placed them in a bark group '*Pachyphloiae*', the stringybarks (CR 6: 49), following Mueller (1859).

Blakely (1934) recognised four species in this group, reverting to specific rank for *E. carnea* and including his newly described species *E. anomala* (now regarded as a hybrid, see below). In addition, he erected a new series, series 'White Mahoganies' in section *Renantherae* to accommodate the group.

Johnson (1962) again reduced *E. carnea* in rank, this time to a subspecies of *E. umbra*. Pryor and Johnson (1971) recognised a series *Acmenoideae* with two species, *E. acmenoides* and *E. umbra*, the latter including *E. carnea* as a subspecies. This series was included in their subgenus *Monocalyptus,* section *Renantheria*.

Chippendale (1988) adopted and formalised the series name '*White-mahoganies*' from Blakely, with the same species treatment as that of Pryor and Johnson but lacking any of their hierarchical arrangement of related groups. The nomenclatural acceptability of such a series name is questionable under article 21 of the International Code of Botanical Nomenclature (Greuter 1994).

This series is included in subgenus *Monocalyptus,* section *Renantheria*, following the extracodical system of classification developed by Pryor and Johnson (discussed below). Twelve species can now be recognised in the series, falling into three subgroups, treated below as subseries.

Morphology

Habit varies from medium to tall forest trees with a long bole (*E. acmenoides*) to small open woodland trees with short trunks and spreading crowns (*E. umbra*). Few develop large subterranean lignotubers, although *E. umbra* may be few-stemmed with some lignotuber development in shrub-heath developed on deeper sandy soils.

Bark is mostly persistent, consistently medium- to long-fibrous, although fibres are not strong and flexible as seen in the true stringy barks (series *Capitellatae* of the extra-codical Pryor & Johnson system; series *Pachyphloiae* Blakely). Colour of the unexposed persistent bark is pale red- or orange-brown to rich red-brown, weathering to grey on the exterior. Subseries *Acmenoidosae* and *Helidonicosae* tend to smooth outer branches (less than about 3 cm diam.), whereas Subseries *Umbrosae* is consistently wholly rough barked. Subseries *Acmenoidosae* in particular possesses stiff and brittle bark fibres, giving the bark a distinctively 'prickly' feel when touched.

Cotyledons are relatively large (in comparison to those of other species groups in section *Renantheria*), shallowly obreniform, and red-pigmented beneath. *Seedling leaves* are uniformly opposite, sessile and elliptical to narrowly elliptical. *Juvenile leaves* vary from lanceolate to ovate or sub-orbicular in different taxa in early stages (until after node 10–15). *Intermediate leaves* then become petiolate, disjunct and falcate somewhere between nodes 10 and about 25 in all taxa except *E. helidonica*, in which opposite leaves persist for much longer, and shape becomes more uniform after the disjunct stage. Intermediate leaves are characteristically larger and proportionately broader than adult leaves, but otherwise similar. *Adult leaves* vary in shape, size, surface gloss and stomatal distribution (stomata are readily visible in fresh leaves with a ×10 hand lens). These adult leaf characters are usually consistent within taxa, and are described individually below under each taxon. Leaves are glabrous at all stages.

Leaf venation is unspecialised, all species showing regularly pinnate venation at an intermediate angle to the midrib (40–60°), and a distinct intramarginal vein clearly separate from the leaf margin. Higher orders of venation are complete and finely reticulate.

Oil glands are small, spherical and numerous, situated in both intersectional and island positions (see Brooker & Kleinig 1994 for descriptions of oil gland types).

Inflorescences comprise solitary, usually 7–11-flowered axillary umbellasters, sometimes aggregated on more or less leafless lateral or terminal shoots which may then grow out vegetatively. Flower number is greater that 11 in some species. It is difficult to give precise numbers in these cases because crowding of primordia causes abortion of many buds, and bud numbers recorded in descriptions below as 'more than 11'.

Buds are fairly uniform in shape: ovoid to fusiform with a single persistent calyptra that is broadly conical to hemispherical and usually apiculate or rostrate. Buds are pedicellate in all taxa, and pedicel length remains the same in flowers and fruits. *Filaments* are irregularly flexed and all fertile, and anthers are reniform and dehiscent through confluent slits. The *style base* is not sunken into the top of the ovary, and the stigma and style tip is clearly engaged in a pit in the calyptra in some taxa, but not in others. The *stigma* is tapered and shortly papillate.

Seeds are pyramidal or cuboid, angular, lightly sculptured and red-brown to grey-brown, with a terminal hilum on the smaller ventral face. *Chaff* is similar in colour and texture to fertile seeds.

Phylogeny

A series of papers by Ladiges and collaborators has addressed aspects of the phylogeny of subgenus *Monocalyptus* (Ladiges, Humphries & Brooker 1983, 1987; Ladiges & Humphries 1986; Ladiges, Newnham & Humphries 1989). Ladiges et al. (1983) provided a cladistic analysis of the eastern Australian groups of the subgenus and thus aimed to identify sister groups for use as outgroups in more detailed analyses. Ladiges et al. (1987) attempted the same for Western Australian taxa. However, the two treatments are not consistent with each other, and several important characters have been either misinterpreted or incorrectly scored.

The 1983 analysis of eight composite taxa used 16 characters, three of which are synapomorphies for the subgenus and another six of which are autapomorphies. A further three are polymorphic in some taxa, leaving four informative characters on which to base the analysis. This analysis omitted all Western Australian taxa, and the results suggested that the White Mahogany group may be paraphyletic.

The 1987 analysis took a very different approach, using 51 characters across 29 species as terminal taxa. Characters were often detailed morphological measurements, and a number of individual species were chosen as terminal taxa to represent much larger groups, particularly for the eastern taxa. This introduced inconsistencies since some of the taxa chosen to represent eastern groups are highly apomorphic within groups of otherwise quite morphologically different species (e.g. *E. planchoniana* ostensibly representing the blue-leaved ash group). The choices of *E. acmenoides* to represent the mahoganies and the lineage leading to the stringybarks, and *E. pilularis* to represent the 'peppermints' was also not supported by the 1983 analysis; this had indicated that *E. acmenoides* was a sister to all other eastern species, that the mahoganies were paraphyletic, and that *E. pilularis* was unresolved with respect to a group comprising the peppermints, the stringybarks and the ashes. The 1987 analysis suggested that section *Renantheria* sensu Johnson (1976) may be paraphyletic.

Detailed analysis of relationships within subgenus *Monocalyptus* is beyond the scope of this paper, albeit highly desirable in the light of the above. Examination of characters defining the White Mahoganies reveals that many may be shared plesiomorphic states (Table 1). The opposite, sessile and stem-clasping juvenile leaves are clearly apomorphic within *Monocalyptus*, but similar characteristics are also seen in peppermints, blackbutts and black sallees.

Table 1. Distinguishing features of the White Mahoganies.

Characters marked * are plesiomorphic or general within Monocalyptus.

Habit: woodland or forest trees*.

Lignotubers: present, not developed into mallee form*.

Bark: persistent, long-fibrous, fibres brittle rather than flexible*.

Cotyledons: large, red-pigmented beneath.

Seedling leaves: opposite, sessile, stem-clasping.

Leaf venation: regularly pinnate, at an intermediate angle to the midrib (40–60°)*.

Higher orders of venation: complete, finely reticulate*.

Oil glands: small, spherical, numerous, situated on and between fine reticulate veins.

Inflorescences: solitary, axillary, 7–11-more than 11-flowered, sometimes aggregated*.

Buds: ovoid to fusiform*.

Calyptra: single, persistent, broadly conical to hemispherical, apiculate or rostrate*.

Filaments: irregularly flexed, all fertile*.

Anthers: reniform, dehiscent through confluent slits*.

Style base: not sunken*.

Style tip: variable, engaged in a pit in the calyptra in some taxa, but not in others.

Stigma: tapered, shortly papillate*.

Seeds: pyramidal or cuboid, red-brown to grey-brown*.

Hilum: terminal*.

Chaff: similar in colour and texture to fertile seeds*.

These groups are not placed with the White Mahoganies by any other characters, suggesting that this leaf morphology has arisen more than once. If this is so, it may be regarded as a synapomorphy uniting the White Mahoganies. The large cotyledons are also not shared within Eastern Australian *Renantheria*, but are held in common with many Western Australian monocalypt taxa, suggesting that this condition is plesiomorphic, and has been lost in many eastern taxa. However, the extremely close overall morphological similarity within the group suggests that the White Mahoganies are a close natural group. High levels of homoplasy in characters at this level make morphological data inadequate in resolving certain relationships, and the white mahoganies are here treated as a group although this is not unequivocally demonstrated. The subseries below are defined on combinations of character states that that are in themselves not clearly apomorphic, but in combination form congruent sets that allow a practical subdivision.

Taxonomic treatment

The White Mahoganies are here placed as a series (series *Acmenoideae*) in section *Renantheria* of subgenus *Monocalyptus*, in the extracodical system of Pryor and Johnson (1971). This section was treated as Series *Renantherae* by Bentham (see above) and Section *Renantherae* by Maiden (see above). *Renantheria* is a large and widespread group, occurring predominantly in wetter parts of eastern Australia (Fig. 1). Although Pryor and Johnson (1971) included Western Australian taxa in *Renantheria*, we would now exclude these and restrict the section to eastern Australian taxa only.

Fig. 1. Distribution of section *Renantheria* (Qld, NSW, Vic, SA and Tas — solid line), and the White Mahoganies (shaded).

About 120 species make up the section as now defined. Taxonomy below this level is far from clearly resolved, Pryor and Johnson (op cit.) placing the 61 species then recognised in 4 series. Chippendale (1988) recorded 75 species in 13 series, these corresponding to Pryor & Johnson groups at various ranks but with no indication of hierarchical relationships among the somewhat heterogeneous 'series'.

Section *Renantheria* is unambiguously defined as a natural group by the reniform anthers dehiscing through confluent slits. The combination of characters listed in the diagnosis below define the White Mahogany group (series *Acmenoideae*) within the section and within the genus.

Series **Acmenoideae**

Juvenile leaves glabrous, glossy, green, opposite for several to many pairs. Adult leaves hypostomatic or amphistomatic, concolorous or discolorous. Bark long-fibrous, fibres brittle. Filaments irregularly flexed. All stamens fertile. Seeds red-brown to grey-brown.

Formally treated as series *White-mahoganies* Blakely by Chippendale (1988). Chippendale's name is not part of the extra-codical system of classification used here and derived from Pryor and Johnson (1971), and is not used for reasons previously stated (Hill & Johnson 1995).

The white mahoganies are a group of 12 species, ranging in distribution from the Cooktown district of Queensland south to around Sydney in New South Wales. Habitat is mainly coastal, extending to the western slopes of the Great Dividing Range in some parts, but not onto the colder tablelands regions or into drier regions (Fig. 1).

Three subseries are recognised.

Key to the subseries

1 Juvenile leaves remaining opposite for more than 8 internodes beyond the cotyledons; intermediate leaves not falcate, not twisted; bark shedding on smallest branches

2 Juvenile leaves amplexicaul, persistent into plants 2–3 m tall (more than 20 nodes) ..... Subseries **Helidonicosae (sp. 1)**

2* Juvenile leaves obtuse or cuneate, not amplexicaul, persistent for less than 1 m (8–15 nodes) ..... Subseries **Acmenoidosae (spp. 2–9)**

1 Juvenile leaves remaining opposite for 8 or fewer internodes beyond the cotyledons; intermediate leaves falcate, twisted; bark fully persistent ..... Subseries **Umbrosae (spp. 10–12)**

Key to the species

1 Adult leaves strongly discolorous, hypostomatic, thinly chartaceous

2 Juvenile leaves persistent for many nodes (more than 20) ..... **1. E. helidonica**

2* Juvenile leaves persistent for few nodes (up to 15)

3 Fruits globular to hemispherical; juvenile leaves lanceolate to broad-lanceolate (to 30 mm wide) ..... **2. E. acmenoides**

3* Fruits ovoid to urceolate; juvenile leaves linear to narrow-lanceolate ..... **3. E. contracta**

1* Adult leaves concolorous or discolorous, amphistomatic, more or less coriaceous

4 Adult leaves distinctly bluish ..... **10. E. carnea**

4* Adult leaves green

5* Juvenile leaves ovate to orbicular (up to 60 mm wide)

6 Juvenile leaves persisting beyond node 20 ..... **7. E. portuensis**

6 Juvenile leaves becoming disjunct early (before node 15)

7 Intermediate leaves subsessile, petioles 0–5 mm long ..... **11. E. umbra**

7* Intermediate leaves petiolate; petioles 4–10 mm long ..... **12. E. latisinensis**

5 Juvenile leaves lanceolate (less than 25 mm wide)

8* Adult leaves distinctly discolorous, broad-lanceolate to ovate (up to 50 mm wide) ..... **5. E. uvida**

8 Adult leaves concolorous or weakly discolorous, narrow-lanceolate to lanceolate (up to 26 mm wide)

9 Disc narrow (up to 1 mm wide), steeply depressed (not readily visible)

10 Fruits small (4–6 mm × 4–6 mm), pedicels slender ..... **4. E. apothalassica**

10* Fruits large (6–7 mm × 6–7 mm), pedicels thick ..... **6. E. irritans**

9* Disc broad (1 mm or more wide), level to moderately depressed (usually visible)

11 Intermediate leaves subsessile; petioles 0–1 mm long .... **9. E. psammitica**

11* Intermediate leaves petiolate; petioles 4–9 mm long .... **8. E. mediocris**

Subseries **Helidonicosae**

Juvenile leaves remaining opposite for many internodes, sessile, amplexicaul, intermediate leaves not falcate or twisted, bark shedding on smallest branches.

A series of a single species.

1. Eucalyptus helidonica *K.D. Hill*, **sp. nov.**

Inter seriem *Acmenoideae* distinguitur foliis juvenilibus persistentibus oppositis sessilibus amplexicaulibus, foliis adultis hypostomaticis.

Type: Queensland: 3.8 km NE of Helidon, *K.D. Hill 4883*, 26 Oct 1996 (holo NSW; iso BRI, CANB).

Tree to 25 m tall. Bark persistent to smaller branches, stringy, grey. Cotyledons obreniform, 5–6 mm wide. Juvenile leaves opposite, linear, sessile and amplexicaul, c. 11 cm long, c. 17 mm wide. Intermediate leaves opposite, narrow lanceolate, falcate to straight, entire, dull green, sessile, 7–15 cm long, 10–23 mm wide. Adult leaves disjunct, narrow-lanceolate to lanceolate, falcate or straight, acuminate, basally tapered, entire, dull, green to grey-green, thin, hypostomatic, strongly discolorous, 6–14 cm long, 9–22 mm wide; petioles narrowly flattened or channelled, 9–20 mm long. Intramarginal vein distinct, continuous, 0.5–1 mm from margin. Conflorescence simple, axillary; umbellasters 11- or more flowered. Peduncles terete or angular, 10–25 mm long. Pedicels terete or angular, 3–5 mm long. Buds ovoid, 4–5 mm long, 1.5–2 mm diam. Calyptra conical or rostrate, about as long as hypanthium, as wide as hypanthium. Fruits globular, pedicellate, 4–6-locular, 3.5–6 mm long, 3.5–6 mm diam. Calyptra scar flat, c. 0.2 mm wide. Stemonophore flat, c. 0.2 mm wide. Disc depressed, c. 0.5 mm wide. Valves enclosed, flat to raised at up to 30°, apices rim-level. Seeds 1–1.5 mm long. (Fig. 2).

E. helidonica is distinguished by the narrow juvenile leaves which remain opposite, sessile and stem-clasping until the plant reaches several (2–3) metres in height, which is considerably longer than in any other species of White Mahogany. Adult leaves differ from those of the other White Mahoganies in being dull and strongly discolorous.

The epithet is from the occurrence centred on the settlement of Helidon, west of Brisbane.

Distribution: restricted to the Helidon district and nearby ranges in southern Queensland (Fig. 3).

Ecology: locally frequent in dry sclerophyll woodland on sandstone.

Selected specimens (from 12 examined): Queensland: On track to Valley of Diamonds, c. 600 m from car park, *Blaxell 89/286*, 15 Aug 1989 (NSW); 1 km ESE of Mt Berryman, 10 km SSW of Laidley, property of Markwell, *Forster 2092 & Bird*, 11 Aug 1985 (BRI, CANB, NSW); 3.5 km NE of Helidon on '17 mile road', *Hill 803 & Johnson*, 8 May 1984 (NSW, BRI, CANB, K, MEL); NE of Helidon on back road to Crows Nest, *Johnson 7076 & Briggs*, 21 May 1971 (NSW, BRI, CANB, MEL, NE).

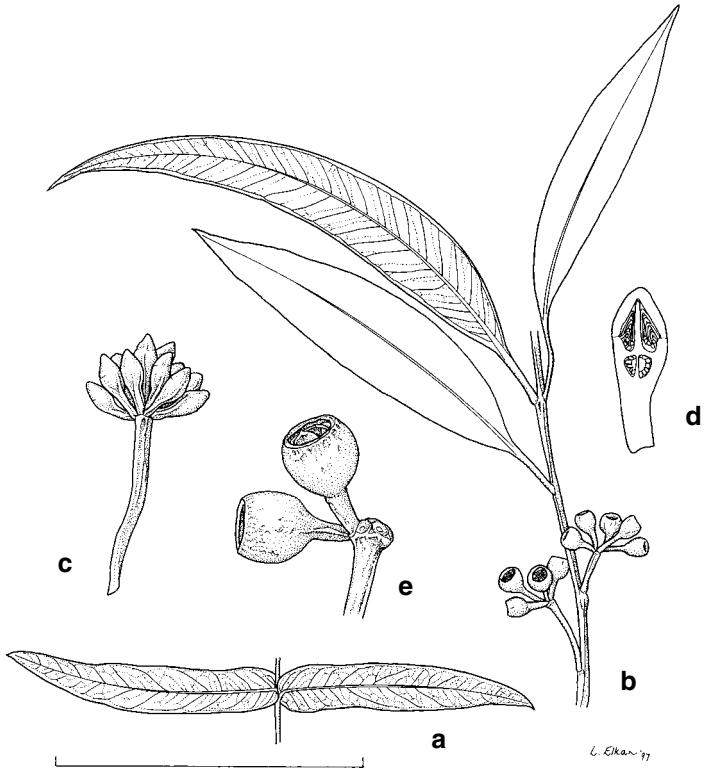

Fig. 2. *E. helidonica.* **a**, juvenile leaves. **b**, adult leaves, fruits and inflorescences. **c**, inflorescence and buds. **d**, transverse section of bud. **e**, fruit. (a from *Hill 803 & Johnson*, b from *Johnson 7076 & Briggs*, c–e from *Hill 4883*). Scale bar: a, b = 7.5 cm, c, e = 2.5 cm, d = 1 cm.

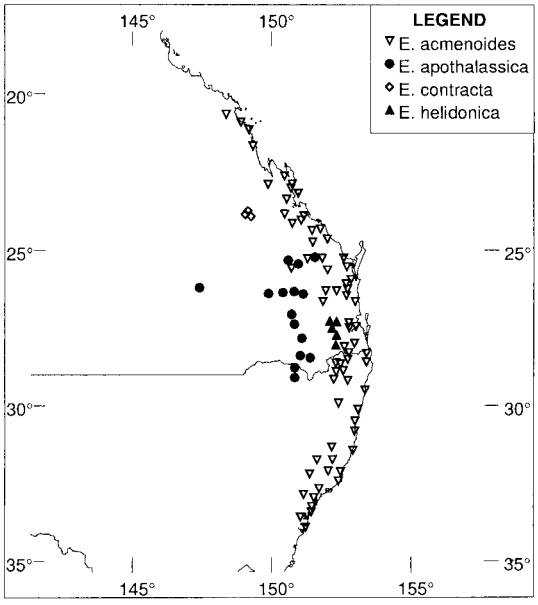

Fig. 3. Distribution of *E. helidonica, E. contracta, E. acmenoides* and *E. apothalassica.*

Subseries **Acmenoidosae**

Juvenile leaves remaining opposite for several internodes, sessile to shortly petiolate, not amplexicaul, intermediate leaves not falcate or twisted, bark shedding on smallest branches.

2. Eucalyptus acmenoides Schauer in Walp., *Rep. Bot. Syst. 2, Suppl.* 1: 924 (1843).

Type: New South Wales: Beyond Castle Hill, *A. Cunningham 20*, 14 Jan 1817 (holo BM; iso K). Cited as 'In sylvis Novae Cambriae australia. — A. Cunn.'

≡ *E. pilularis* Sm. var. *acmenoides* (Schauer) Benth., *Fl. Austral.* 3: 208 (1867).

E. triantha auctt. non Link (1822): Domin (1928), Blakely (1934); fide Blake (1958). Blake (op. cit.) discussed the confusion surrounding this name. The description does not fit *E. acmenoides*, and the type is at present unknown (possibly held in B, or destroyed).

Tree to 30 m tall (sometimes 50 m). Bark persistent to smaller branches, stringy, grey to red-brown. Cotyledons obreniform. Juvenile leaves opposite, lanceolate to broad-lanceolate, sessile, to c. 12 cm long, to c. 30 mm wide. Intermediate leaves becoming disjunct early, lanceolate to broad lanceolate, straight, entire, glossy green, sessile, becoming petiolate later, 7–13 cm long, 20–50 mm wide; petioles 0–4 mm long. Adult leaves disjunct, lanceolate or broad lanceolate, falcate, acuminate, oblique or basally tapered, entire, glossy, green, thin, hypostomatic, strongly discolorous, 8–12 cm long, 15–25 mm wide; petioles narrowly flattened or channelled, 8–15 mm long. Intramarginal vein distinct, continuous, 1–2 mm from margin. Conflorescence simple, axillary; umbellasters 7–11- or more flowered. Peduncles narrowly flattened or angular, 6–15 mm long. Pedicels terete, 2–6 mm long. Buds ovoid to fusiform, 5–7 mm long, 3–4 mm diam. Calyptra conical or rostrate, about as long as hypanthium, as wide as hypanthium. Fruits globular to hemispherical, thin-walled, pedicellate, 4-locular, 4–8 mm long, 4–7 mm diam. Calyptra scar flat, c. 0.2 mm wide. Stemonophore depressed, c. 0.2 mm wide. Disc narrow, steeply depressed, 0.5–1 mm wide. Valves enclosed, raised at 30–60°, apices rim-level. Seeds 1–2 mm long.

Distinguished by the following combination of characters: juvenile leaves narrow; adult leaves thin, lanceolate to broad-lanceolate, hypostomatic, strongly discolorous; fruit globular to hemispherical, thin-walled; disc steeply depressed; valves enclosed with apices at rim-level.

Hybrids are recorded with *E. cloeziana, E. pilularis* and *E. eugenioides*. The first is of particular note in that it crosses the subgeneric boundaries of Pryor & Johnson (1971).

Distribution: Proserpine to Sydney, somewhat sporadic in the north of the range (Fig. 3).

Ecology: usually a component of wet sclerophyll forests, often on sloping sites on reasonably fertile loamy or clayey soils.

Selected specimens (from 196 examined): New South Wales: Central Coast: Parramatta River, Parramatta, *Blakely & Shiress*, 22 June 1919 (NSW21056); Myall Range, Hunter lookout, 15 km SSE of Cessnock, *Crisp 7404 & Telford*, 2 Oct 1984 (CANB, AD, NSW); Yarramalong, Forest Res. 38429, Parish of Wyong, *de Beauzeville 24*, June 1916 (NSW); West Pennant Hills, *Johnson*, 22 Oct 1974 (NSW321046); Arcadia Rd, close to Geelands Rd, Arcadia, *McDougall 95*, 27 Mar 1989 (NSW); between Avoca Beach and Copacabana, *McGillivray 1215*, 3 July 1965 (NSW). Northern Tablelands: 1 km S of Pine road on logging track opposite Little River road, Wild Cattle Creek State Forest, *Hill 2733, Johnson & Weston*, 18 Oct 1987 (NSW, CANB, MEL, PERTH). North Coast: 36 km NW of Bulahdelah on Gloucester Rd, *Bale 1286*, 3 Nov 1991 (NE); Mt Sugarloaf, 11 miles [18 km] SW of Wyan (29 miles [47km] SW of Casino), *Coveny 1834 Clark & Pickard*, 28 July 1969 (NSW); Rivertree area, c. 38 miles [c. 61 km] E of Liston c. 25 miles [40 km] NW of Tabulam, *Coveny 1793 Clark & Pickard*, 27 July 1969 (NSW); Horseshoe Rd, Chaelundi State Forest, about 50 km NW of Dorrigo, *Gilmour 6665*, 11 Mar 1988 (CANB, NSW); Richmond Range State Forest off Buckadon Road, 30 km

NW of Kyogle, *Jackson 42*, 18 Oct 1978 (CANB, NSW, N,A, BISH); 9.3 miles [15km] E of Buladelah, *Johnston 479 & Chippendale*, 30 May 1968 (CANB, NSW); The Bald Knob, Angourie, c. 4.5 miles [7.2 km] S of Yamba, *McGillivray 2179*, 1 July 1966 (NSW); 6 miles [9.6 km] NW of Raymond Terrace, *Story 7276*, 1 May 1960 (CANB, NSW); Cranky Corner, 13 miles [21km] E of Singleton, *Story 7388*, 10 May 1960 (CANB, NSW).

Queensland: North Keppel Island, Moke Point, *Batianoff 5206 & Dillewaard*, 10 Oct 1987 (BRI, NSW); Caloundra, *Blake 19216*, 20 Aug 1953 (BRI, NSW, CANB, MO, K, SP, NA, KW, BISH, PRE, B); between Mt Roberts and Shipstern Range, North spur of McPherson Range, *Blake 20163*, 19 Aug 1957 (BRI, NSW); 8 km E of Miriam Vale on Round Hill Head Road, *Boyland 1539*, 17 Apr 1970 (BRI, NSW); 24 km from Kalpowar toward Gin Gin, *Brooker 7398*, 11 Mar 1982 (CANB, NSW); Mt Walsh, 6 km S of Biggenden, *Crisp 2608*, 28 May 1977 (CANB, BRI, NSW); Mt Hector station, track over Normanby Range, near top of range, *Hill 3787 & Stanberg*, 6 Aug 1990 (NSW, BRI, CANB); 15 km north of Yeppoon on Byfield road, *Hill 4853*, 22 Oct 1996 (NSW, BRI CANB); 40.4 km from Eidsvold to Monto road on Mount Perry road, *Hill 4875*, 24 Oct 1996 (NSW, BRI, CANB); 9.4 km from Rosedale on Bundaberg road, *Hill 4877*, 25 Oct 1996 (NSW, BRI, CANB); at foot of Calliope Range, on road to "Tableland", *Johnson 7117 & Briggs*, 1 June 1971 (NSW); Arthur's Lookout near Round Hill Head, *Pedley 2874*, 30 Aug 1969 (BRI, NSW); Mt Glorious Road, 8.1 km NNW of Mt Nebo, 1.0 km S of Samford–Mt Glorious Road, *Weston 1461 & Richards*, 5 Jan 1990 (NSW).

3. Eucalyptus contracta *L.A.S. Johnson & K.D. Hill*, **sp. nov.**

Ab *E. acmenoide* distinguitur foliis juvenilibus adultisque tenuioribus, fructibus urceolatis et valvis profunde inclusis.

Type: Queensland: Mimosa Creek, Blackdown Tableland, *D.F. Blaxell 758 & L.A.S. Johnson*, 26 Nov 1972 (holo NSW; iso BRI, CANB, K, MEL, MO).

Tree to 40 m tall. Bark persistent to smaller branches, stringy, grey or grey-brown. Cotyledons obreniform, c. 11 mm wide. Juvenile leaves opposite, linear to narrow-lanceolate, sessile, to c. 10 cm long, to c. 12 mm wide. Intermediate leaves becoming disjunct late, lanceolate, straight, entire, glossy dark green, petiolate, 8–12 cm long, 20–35 mm wide; petioles 2–3 mm long. Adult leaves disjunct, lanceolate, falcate or straight, acuminate, oblique or basally tapered, entire or undulate, semi-glossy, dark green, thin, hypostomatic, strongly discolorous, 6–12 cm long, 10–23 mm wide; petioles narrowly flattened or channelled, 8–14 mm long. Intramarginal vein distinct, continuous, c. 0.5 mm from margin. Conflorescence simple, axillary; umbellasters 7–11- or more flowered. Peduncles terete or angular, 7–14 mm long. Pedicels terete or angular, 3–6 mm long. Buds ovoid, 6–7 mm long, 3–4 mm diam. Calyptra conical or rostrate, about as long as hypanthium, as wide as hypanthium. Fruits ovoid or urceolate, pedicellate, 3-locular, 5–7 mm long, 4–5 mm diam. Calyptra scar flat, c. 0.2 mm wide. Stemonophore depressed, c. 0.2 mm wide. Disc depressed, 0.5–1mm wide. Valves enclosed, flat or raised at up to 30°. Seeds 1–1.5 mm long. (Fig. 4).

E. contracta differs from *E. acmenoides* in the narrower juvenile and adult leaves, the urceolate fruit and the deeply enclosed valves.

The epithet is from the Latin, *contractus*, restricted, referring both to the restricted and isolated distribution of the subspecies, and to the restricted orifice of the fruit.

Distribution: endemic to Blackdown Tableland, west of Rockhampton, Queensland (Fig. 3).

Ecology: this species occurs on sandy soil over sandstone, often associated with *E. sphaerocarpa*, *E. longirostrata*, *E. baileyana* or *E. cloeziana*.

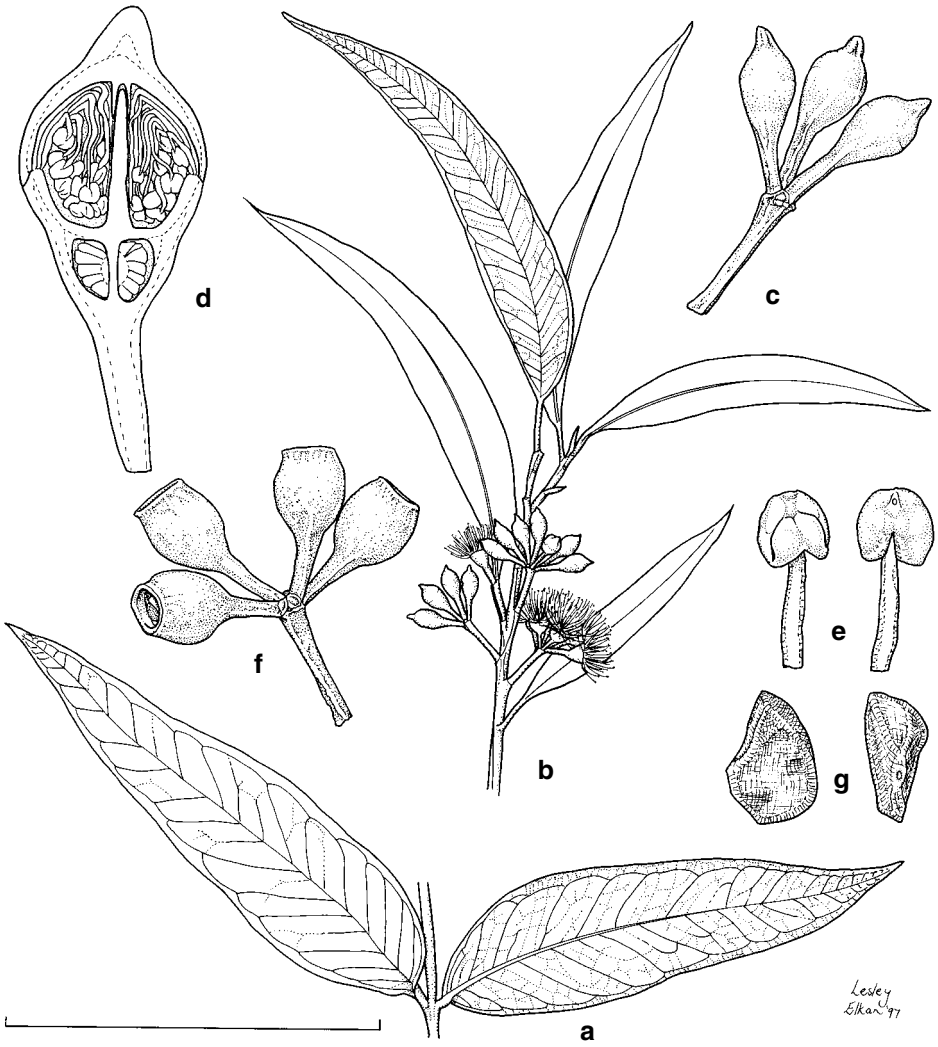

Fig. 4. *E. contracta*. **a**, juvenile leaves. **b**, adult leaves, inflorescences, buds and flowers. **c**, inflorescence and buds. **d**, transverse section of bud. **e**, anther. **f**, inflorescence and fruits. **g**, seed (a from *Hill 4856*, b–e from *Brooker 4822*, f–g from *Blaxell 758 & Johnson*). Scale bar: a, b = 7.5 cm, c, g = 2.5 cm, d = 1 cm, e, f = 3 mm, h, i = 5 mm.

Selected specimens (from 11 examined): Queensland: 12.2 miles [20 km] from Umolo towards Blackdown Tableland, *Brooker 4808*, 19 Apr 1975 (CANB, NSW); c. 4.5 miles on west leading track from end of main road, Blackdown Tableland, *Brooker 4822*, 21 Apr 1975 (CANB, BRI, NSW); Stony Creek Falls, Blackdown Tableland, *Brooker 7381*, 10 Mar 1982 (CANB, NSW); 27.8 km SW of Umolo R/S, Blackdown Tableland State Forest, *Chippendale 1118 & Brennan*, 17 Sep 1974 (CANB, NSW); Blackdown Tableland, c. 32 km SE of Blackwater (campsite on Mimosa Creek), c. 3.2 km NE of campsite, *Henderson 1052 Durrington & Sharpe*, 6 Sep 1971 (BRI, NSW); carpark at Rainbow Falls, Blackdown Tableland, *Hill 4856*, 23 Oct 1996 (NSW); Blackdown Tableland (c. 32 km SE of Blackwater) North branch of Mimosa Creek, *Watson 72/421*, 23 Feb 1973 (BRI, NSW).

4. Eucalyptus apothalassica L.A.S. Johnson & K.D. Hill, *Telopea* 4(1): 84 (1990).

Type: Queensland: on property 5 km S of Kogan on Tara road (27°04'S 150°03'E), *K.D. Hill 1245 & L.A.S. Johnson*, 25 Aug 1984 (holo NSW; iso BRI, CANB, PERTH).

Tree (sometimes multistemmed) to 15 m tall (often less). Bark persistent to smaller branches, stringy, grey to red-brown. Cotyledons obreniform, c. 8 mm wide. Juvenile leaves opposite, lanceolate, sessile, to c. 10 cm long, to c. 20 mm wide. Intermediate leaves becoming disjunct early, lanceolate to broad lanceolate, straight, entire to crenate, glossy green to dull green, petiolate, c. 12 cm long, c. 25 mm wide; petioles c. 4 mm long. Adult leaves disjunct, narrow lanceolate or lanceolate, falcate or straight, acuminate, oblique or basally tapered, entire to undulate, glossy, mid green, thick, unequally amphistomatic, weakly to moderately discolorous, 5–11 cm long, 8–18 mm wide; petioles narrowly flattened or channelled, 10–22 mm long. Intramarginal vein distinct, continuous, c. 0.5 mm from margin. Conflorescence simple, axillary; umbellasters 7–11-flowered. Peduncles terete or angular, 6–15 mm long. Pedicels terete or angular, 2–6 mm long. Buds ovoid, 5–7 mm long, 2–4 mm diam. Calyptra conical or

Fig. 5. *E. apothalassica*. **a**, adult leaves, buds and inflorescence. **b**, adult leaves, fruits and inflorescences. **c**, inflorescence and fruits. **d**, seed (a from *Lane 6*, b–d from *Bosman 6*). Scale bar: a, b = 1 cm, c = 5 mm, d = 1 mm.

rostrate, about as long as hypanthium, as wide as hypanthium. Fruits globular to hemispherical, pedicellate, 3- or 4-locular, 4–6 mm long, 4–6 mm diam. Calyptra scar flat, c. 0.2 mm wide. Stemonophore depressed, c. 0.2 mm wide. Disc depressed (concealed), 0.5–1 mm wide. Valves rim-level, raised at 30–80°. Seeds 1.5 mm long. (Fig. 5).

E. apothalassica is is distinguished within the series by the lanceolate juvenile leaves, weakly to moderately discolorous adult leaves, and small fruits with slender pedicels.

Intergradation occurs with *E. acmenoides* in somewhat wetter sites in the north-east of the range of *E. apothalassica* where the ranges adjoin and *E. apothalassica* extends to the east of the Great Dividing Range.

Distribution: south-central Queensland, generally west of the Great Dividing Range, from around Eidsvold south to Inglewood, just extending into New South Wales near Yetman (Fig. 3).

Ecology: a component of dry sclerophyll forest or woodland on sandy soils, often over sandstone.

Selected specimens (from 27 examined): New South Wales: North-western Plains: Bebo State Forest 418, near Yetman, *Bosnan 4, 6*, Sep 1977 (NSW). North-western Slopes: Burral State Forest, *Lane 6*, 21 Oct 1971 (NSW).

Queensland: The Pinnacle wildflower area, Mount Mobil section (GPS 26°13'33" 147° 24'00"), *Grimshaw 2189 & Bean*, 22 Sep 1995 (BRI, NSW); 17.4 km ESE of Inglewood, Tobacco Road, *Halford Q1635A*, 18 Dec 1992 (BRI, NSW); Inglewood State Forest, c ½ km along track to N off Bybera rd just inside forest border, *Hill 808 & Johnson*, 9 May 1984 (NSW); 10.8 km along Stockyard Ck rd from Auburn rd, Barakula area, *Hill 1240 Johnson & Bean*, 25 Aug 1984 (NSW, BRI, CANB, PERTH); 40.8 km from Monto–Eidsvold road on Mt Perry road, *Hill 3802 & Stanberg*, 8 Aug 1990 (NSW, BRI, CANB); Little Morrow Creek, 1 km N of road, *Hill 4336 & Noble*, 7 Nov 1992 (NSW, BRI, CANB); 31.0 km S of Cadarga on Jandowae road, *Hill 4349 & Noble*, 7 Nov 1992 (NSW); 32.9 km from Cracow on Eidsvold road, *Hill 4868, 4869*, 24 Oct 1996 (NSW, BRI CANB).

5. Eucalyptus uvida *K.D. Hill*, **sp. nov.**

Ab *E. irritanti* distinguitur foliis adultis latioribus plus discoloribusque.

Type: Queensland: 15 km S of Port Douglas on highway, *K.D. Hill 4835*, 16 Oct 1996 (holo NSW; iso BRI, CANB, K, MEL).

Tree to 25 m tall. Bark persistent to smaller branches, stringy, grey. Cotyledons obreniform. Juvenile leaves sessile, broad-lanceolate, to c. 12 cm long, to c. 50 mm wide. Intermediate leaves becoming disjunct late, broad-lanceolate, straight, entire, glossy green, sessile, becoming petiolate later, 10–15 cm long, 45–60 mm wide; petioles 0–3 mm long. Adult leaves disjunct, broad lanceolate to ovate, falcate or straight, acute, oblique or basally rounded, entire, semi-glossy, mid green, thick, unequally amphistomatic, moderately discolorous, 6–12 cm long, 20–50 mm wide; petioles narrowly flattened or channelled, 8–16 mm long. Intramarginal vein distinct, continuous, 1–3 mm from margin. Conflorescence simple, axillary; umbellasters 7–11-flowered. Peduncles terete, 9–21 mm long. Pedicels terete or angular, 2–8 mm long. Buds ovoid, 7–8 mm long, 3.5–4 mm diam. Calyptra rostrate, about as long as hypanthium, as wide as hypanthium. Fruits hemispherical, pedicellate, 3- or 4-locular, 6–8 mm long, 7–8 mm diam. Calyptra scar flat, c. 0.2 mm wide. Stemonophore depressed to flat, c. 0.2 mm wide. Disc flat, 0.5–1.5 mm wide. Valves rim-level to exserted, raised at 30–60°. Seeds 1.5–2 mm long. (Fig. 6).

E. uvida is nearest to *E. irritans*, from which it is distinguished by the broader and more discolorous adult leaves

The epithet is from the Latin *uvidus*, moist or humid, referring to the occurrence of this species in wetter forests.

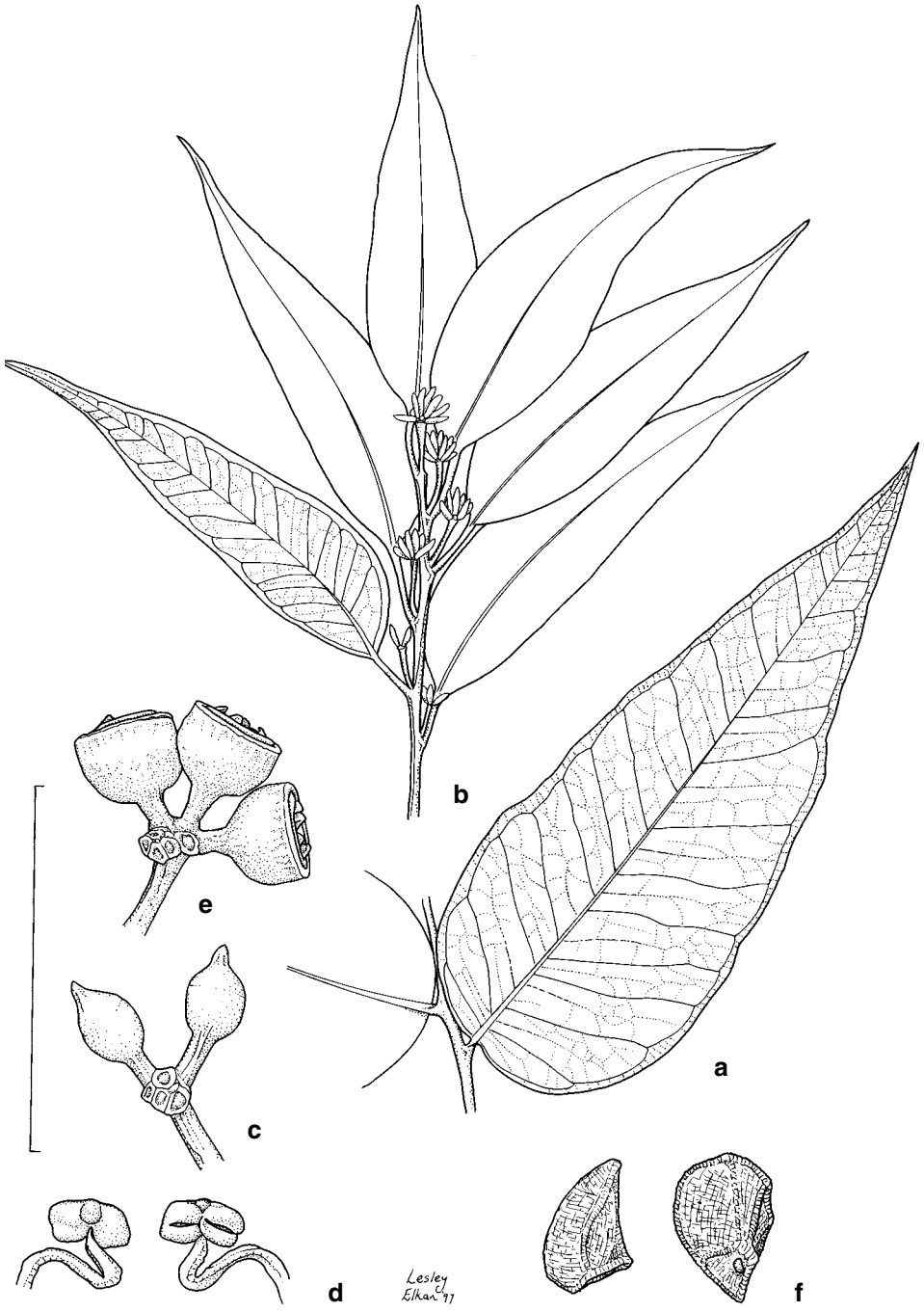

Fig. 6. *E. uvida*. **a**, juvenile leaves. **b**, adult leaves and inflorescences. **c**, inflorescence and buds. **d**, anther. **e**, fruit. **f**, seed (a, c–f from *Hill 1972* et al., b from *Blaxell 89/158* et al.). Scale bar: a, b = 7.5 cm, c = 2.5 cm, d = 3 mm, e = 2.5 cm, f = 5 mm.

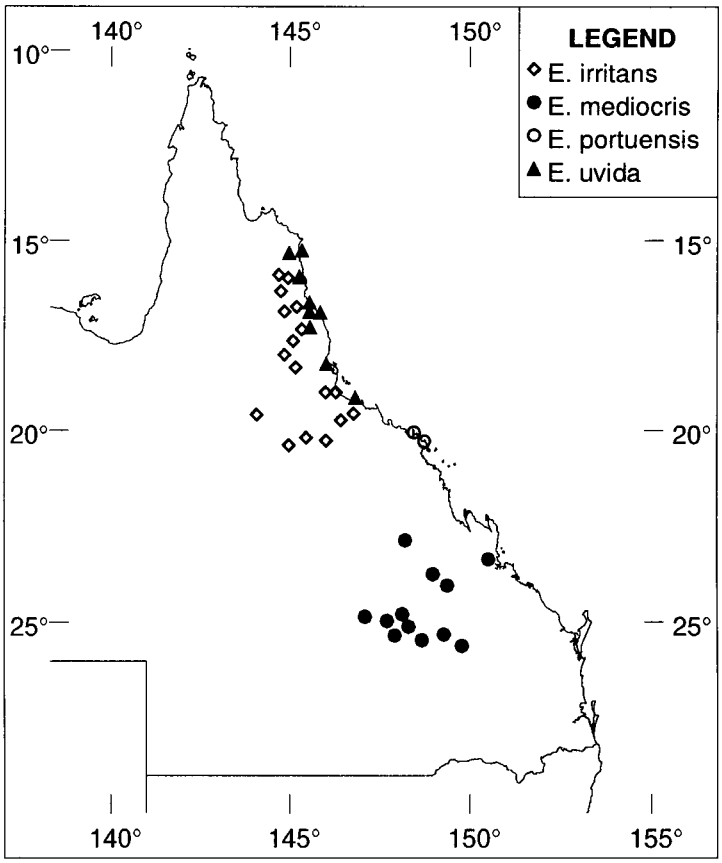

Fig. 7. Distribution of *E. uvida, E. irritans, E. portuensis* and *E. mediocris.*

Distribution: coastal ranges between Cooktown and Cardwell, particularly abundant on the steep slopes of the eastern fall of the Atherton Tablelands (Fig. 7).

Ecology: wet sclerophyll forest, often on more exposed ridges interspersed with closed forest in gullies and sheltered situations.

Selected specimens (from 17 examined): Queensland: 3 km W of Mount Rose, NW of Cooktown, *Bean 2001*, 19 July 1990 (BRI, NSW); 30 km along road to Yarrabah Aboriginal Reserve, south side of Trinity Bay, near Cairns, *Blaxell 89/158 Johnson & D'Aubert*, 3 Aug 1989 (NSW, BRI, CANB, DNA); at turn off to Koah, between Kuranda and Mareeba, *Brooker 3347*, 24 Jan 1972 (CANB, NSW); 7 miles from Atherton towards Herberton, *Brooker 3392*, 28 Jan 1972 (CANB, NSW); Forest Cardwell W of compartment 6, SF 461, *Brooker 10405*, 6 Mar 1990 (CANB, NSW); South Cape Bedford. Vegetation mapping site BED 3, *Clarkson 8678*, 22 May 1990 (BRI, K, MBA, MEL, NSW, QRS); 7.5 km from the Cooktown–Cape Tribulation road on the CREB track; Cape York mapping site 979 (WUJ 23), *Clarkson 10136 & Neldner*, 8 Sep 1993 (BRI, CANB, MBA, NSW); 3.4 km from Bloomfield road on China Camp road, *Hill 1972, Hind & Healey*, 5 Aug 1986 (NSW); 3 km N of Cardwell River on Highway 1, *Hill 3782 & Stanberg*, 5 Aug 1990 (NSW, BRI, CANB).

6. Eucalyptus irritans *L.A.S. Johnson & K.D. Hill*, **sp. nov.**

Inter seriem *Acmenoideae* distinguitur foliis juvenilibus lanceolatis, foliis adultis amphistomaticis leniter discoloribus, fructibus magnis pedicellis brevioribus crassioribusque.

Type: Queensland: 6.4 km from Mt Garnet on Nymbool road, *K.D. Hill 1135, L.A.S. Johnson & D.F. Blaxell*, 18 Aug 1984 (holo NSW; iso BRI, CANB, PERTH).

Tree to 20 m tall. Bark persistent to smaller branches, stringy, grey. Cotyledons obreniform, 7–9 mm wide. Juvenile leaves opposite, lanceolate, sessile, 7–10 cm long, 14–23 mm wide. Intermediate leaves becoming disjunct early, lanceolate to broad lanceolate, straight, crenate, glossy green, petiolate, 6–11 cm long, 15–30 mm wide; petioles 3–5 mm long. Adult leaves disjunct, narrow lanceolate to lanceolate, falcate or straight, acuminate, oblique or basally tapered, entire to undulate, glossy to semi-glossy, mid green, thick, unequally amphistomatic, weakly discolorous, 6–12 cm long, 9–26 mm wide; petioles narrowly flattened or channelled, 8–18 mm long. Intramarginal vein distinct, continuous, 1–2 mm from margin. Conflorescence simple, axillary; umbellasters 7–11- or more flowered. Peduncles terete or slightly angular, 7–18 mm long. Pedicels terete to angular, robust, 3–6 mm long. Buds ovoid, 7–8 mm long, 3–4 mm diam. Calyptra rostrate, 1–1.5 times as long as hypanthium, as wide as hypanthium. Fruits globular to hemispherical, pedicellate, 3- or 4-locular, 6–7 mm long, 6–7 mm diam. Calyptra scar flat, c. 0.2 mm wide. Stemonophore depressed, c. 0.2 mm wide. Disc depressed (concealed), 0.5–1 mm wide. Valves rim-level to exserted, raised at 30–80°. Seeds 1.5–2 mm long. (Fig. 8).

E. irritans is distinguished by the combination of amphistomatic, weakly discolorous adult leaves, lanceolate juvenile leaves and large fruits with short, thick pedicels.

The epithet is from the Latin *irritans*, irritant, in reference to the finely prickly bark.

Distribution: northern Queensland, between Lakeland Downs and Charters Towers (Fig. 7).

Ecology: dry sclerophyll woodland on poor sandy soils.

Selected specimens (from 56 examined): Queensland: c. 58 miles [92.8 km] by road from Mt Garnet township towards Wairuna, *Brooker 4129*, 26 Aug 1973 (CANB, NSW); White Mountains, Torrens Creek catchment, *Brooker 8975*, 2 May 1985 (CANB, NSW); 1 km south east of Mt Janet on the survey road along the Dividing Range, c. 15 km WSW of Lakeland Downs township, *Clarkson 5515*, 5 Sep 1984 (BRI, CANB, K, NSW, QRS); Mount Mulligan, mountain c. 40 km north west of Dimbulah, 0.5km south west of the dam on top of the mountain, *Clarkson 5889*, 17 Apr 1985 (BRI, CANB, MEL, NSW, QRS); Mt Stewart, W of Charters Towers, *Cumming 13323*, 9 Sep 1994 (BRI, NSW); Herberton Road, on Atherton–Herberton road, *Hill 1109 Johnson & Blaxell*, 15 Aug 1984 (NSW, BRI, CANB, PERTH); 8 km east of Hidden Valley on Paluma road, *Hill 1155 Johnson & Blaxell*, 18 Aug 1984 (NSW, BRI, CANB, PERTH); Summit of Mount Stuart, near Townsville, *Hill 4824*, 14 Oct 1996 (NSW, BRI, CANB); c. 2.5 km E of road at first crossing of Reedy St George Creek, 50km WNW of Mt Carbine towards Palmer River, *Kleinig 306*, 11 Oct 1976 (CANB, NSW); NW of Homestead on Allandale Stn, on Charters Towers to Pentland road, *Martensz 1242*, 8 Oct 1978 (CANB, AD, BRI, MEL, NSW); 19.3 km E of Kennedy Highway along Tinaroo Creek road, 0.6 km W of road junction, *Neldner 4158 & Milne*, 9 Aug 1994 (BRI, NSW); Mount Bohle, 37 km SW of Charters Towers, *Thompson 237 & Dillewaard*, 24 Sep 1991 (BRI, NSW).

7. Eucalyptus portuensis *K.D. Hill*, **sp. nov.**

Inter seriem *Acmenoideae* distinguitur foliis juvenilibus latis persistentibus, fructibus plusminusve globosis disco angusto descendenti.

Type: Queensland: 2 km W of Shute Harbour on Shute Harbour road, *K.D. Hill 4837*, 18 Oct 1996 (holo NSW; iso BRI, CANB).

Tree to 10 m tall. Bark persistent to smaller branches, stringy, grey. Cotyledons obreniform. Juvenile leaves opposite, sessile, ovate, to 8 cm long, to 50 mm wide. Intermediate leaves becoming disjunct late, ovate, straight, entire, glossy green, petiolate, 9–14 cm long, 35–65 mm wide; petioles 2–5 mm long. Adult leaves disjunct,

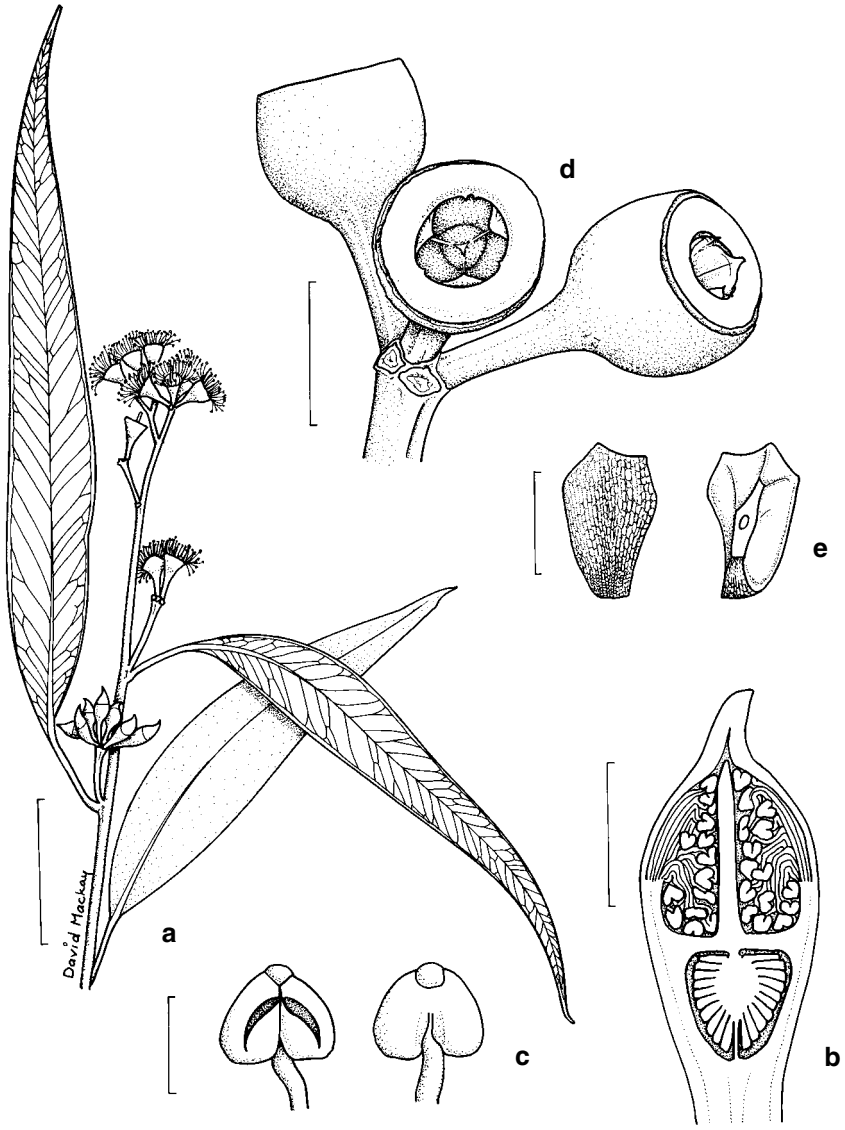

Fig. 8. *E. irritans*. **a**, adult leaves. inflorescences, buds and flowers. **b**, transverse section of bud. **c**, anther. **d**, inflorescences and fruits. **e**, seed (a–c from *Hyland 5585*, d–e from *Irvine 1257*). Scale bar: a = 1 cm, b, d = 5 mm, c, e = 1 mm.

lanceolate, falcate or straight, acuminate, basally tapered, entire to undulate, glossy, mid green, thin, unequally amphistomatic, discolorous, 6–12 cm long, 10–25 mm wide; petioles narrowly flattened or channelled, 8–14 mm long. Intramarginal vein distinct, continuous, 1.5–2 mm from margin. Conflorescence simple, axillary; umbellasters 11- or more flowered. Peduncles terete to quadrangular, 8–17 mm long. Pedicels angular, 3–6 mm long. Buds ovoid to rostrate, 6–8 mm long, 3–4 mm diam. Calyptra conical to rostrate, about as long as hypanthium, as wide as hypanthium. Fruits globular to hemispherical, pedicellate, 4-locular, 5–7 mm long, 5–7 mm diam. Calyptra

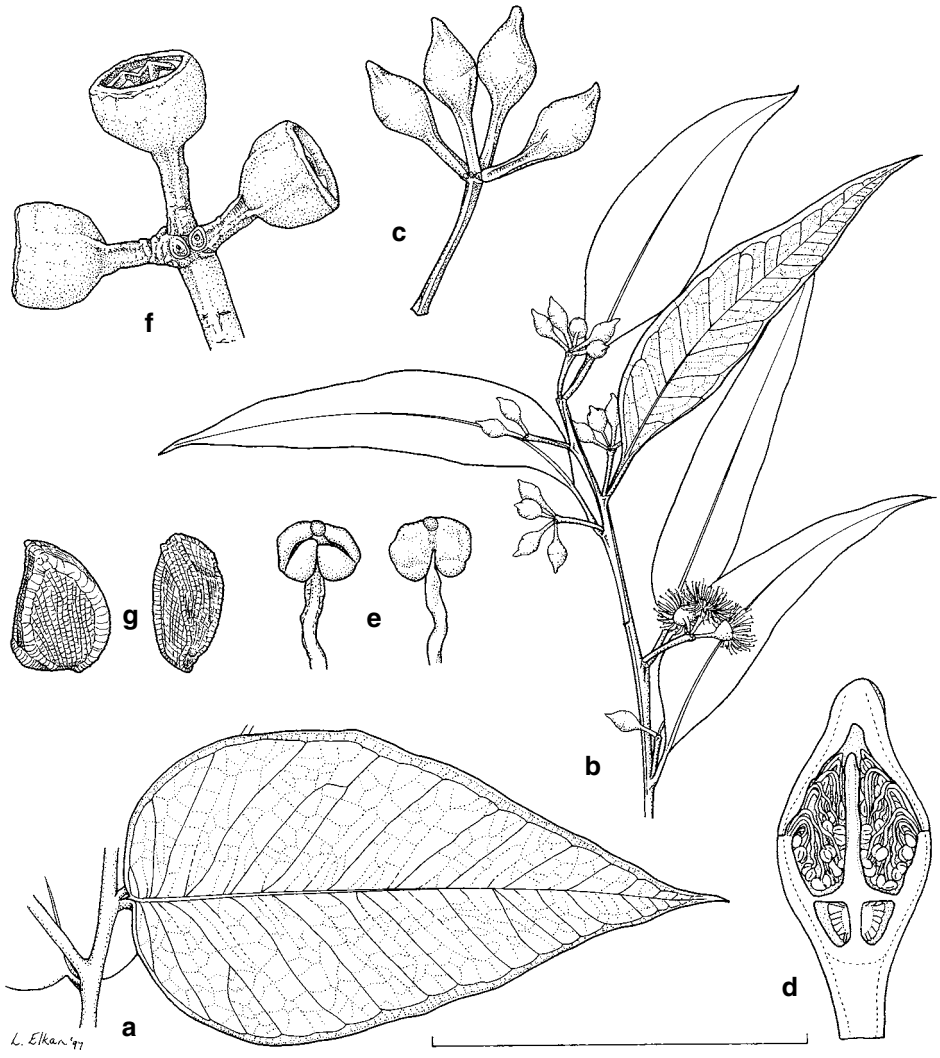

Fig. 9. *E. portuensis*. **a**, juvenile leaves. **b**, adult leaves, inflorescences, buds and flowers. **c**, inflorescence and buds. **d**, transverse section of bud. **e**, anther. **f**, inflorescence and fruits. **g**, seed (a from *Hill 4839*, b–g from *K.D. Hill 4837*). Scale bar: a, b = 7.5 cm, c, f = 2.5 cm, d = 1 cm, e = 3 mm, g = 5 mm.

scar flat, c. 0.2 mm wide. Stemonophore flat, c. 0.2 mm wide. Disc depressed, 0.5–1 mm wide. Valves rim-level, raised at up to 30°. Seeds 1–1.5 mm long. (Fig. 9).

E. portuensis is distinguished by the broad (ovate to orbicular) juvenile leaves that persist on young plants and coppice shoots, and the globular to hemispherical fruits with a narrow, depressed disc.

The epithet is from the Latin *portuus*, port or harbour, with the termination *-ensis*, an inhabitant of, from the occurrence and initial discovery of this species around Shute Harbour.

Distribution: known only from the vicinity of the Whitsunday Passage, on the mainland around Shute Harbour and on several of the offshore continental islands (Fig. 7).

Ecology: dry sclerophyll forest or woodland on slopes, near the sea.

Selected specimens (from 10 examined): Queensland: Shute Harbour, *Batianoff 9207186 & Dillewaard*, 18 June 1992 (BRI, CANB, DNA, MEL, NSW); Mount Bertha, upper W slope, Gloucester Island, *Batianoff 9403308 Dillewaard & Lind*, 21 Mar 1994 (BRI, NSW); Shute Harbour, *Batianoff 9403421 & Dillewaard*, 27 Mar 1994 (BRI, AD, CANB, MEL, NSW); 2 km W of Shute Harbour on Shute Harbour road, *Hill 4838, 4839*, 18 Oct 1996 (NSW, BRI, CANB).

8. Eucalyptus mediocris *L.A.S. Johnson & K.D. Hill*, **sp. nov.**

Inter seriem *Acmenoideae* distinguitur foliis adultis intermediisque crassis concoloribus, fructibus majusculis ovoideis margine hypanthii incrassato disco descendenti, pedicellis crassis.

Type: Queensland: 10 km north of Glenhaughton on Bauhinia Downs road, *K.D. Hill 4867*, 24 Oct 1996 (holo NSW; iso BRI, CANB).

Tree to 25 m tall. Bark persistent to smaller branches, stringy, grey. Cotyledons obreniform, c. 9 mm wide. Juvenile leaves opposite, lanceolate, sessile to petiolate, to 11 cm long, to 25 mm wide; petioles 0–2 mm long. Intermediate leaves opposite, becoming disjunct later, lanceolate to ovate, straight, entire, dull to semiglossy, mid-green, petiolate, 8–13 cm long, 20–55 mm wide; petioles 4–9 mm long. Adult leaves disjunct, lanceolate to broad lanceolate, falcate, acuminate, oblique, basally tapered or rounded, entire, semi-glossy, mid- to dark green, thick, amphistomatic, concolorous or weakly discolorous, 6–15 cm long, 12–33 mm wide; petioles narrowly flattened or channelled, 10–22 mm long. Intramarginal vein distinct, continuous, 1–3 mm from margin. Conflorescence simple, axillary; umbellasters 7–11-flowered. Peduncles terete or angular, 7–20 mm long. Pedicels angular, 3–7 mm long. Buds ovoid or fusiform, 7–11 mm long, 3.5–4.5 mm diam. Calyptra rostrate, 1–1.5 times as long as hypanthium, as wide as hypanthium. Fruits hemispherical to ovoid, pedicellate, 3- or 4-locular, 6–9 mm long, 6–10 mm diam. Calyptra scar flat, c. 0.2 mm wide. Stemonophore depressed to flat, c. 0.2 mm wide. Disc flat or moderately depressed (usually visible), 1–2 mm wide. Valves enclosed or rim-level, raised at 30–80°. Seeds 2 mm long. (Fig. 10).

E. mediocris is distinguished by the thick, concolorous adult and intermediate leaves and the relatively large, hemispherical to ovoid fruits with a thick hypanthium rim and thick pedicels.

The epithet is from the Latin *mediocris*, middling, referring to the medium-size tree habit of this species.

Distribution: widespread through central Queensland, from Blackdown Tableland to the Carnarvon Range (Fig. 7).

Ecology: dry sclerophyll forest or woodland on sandy soils, often over sandstone.

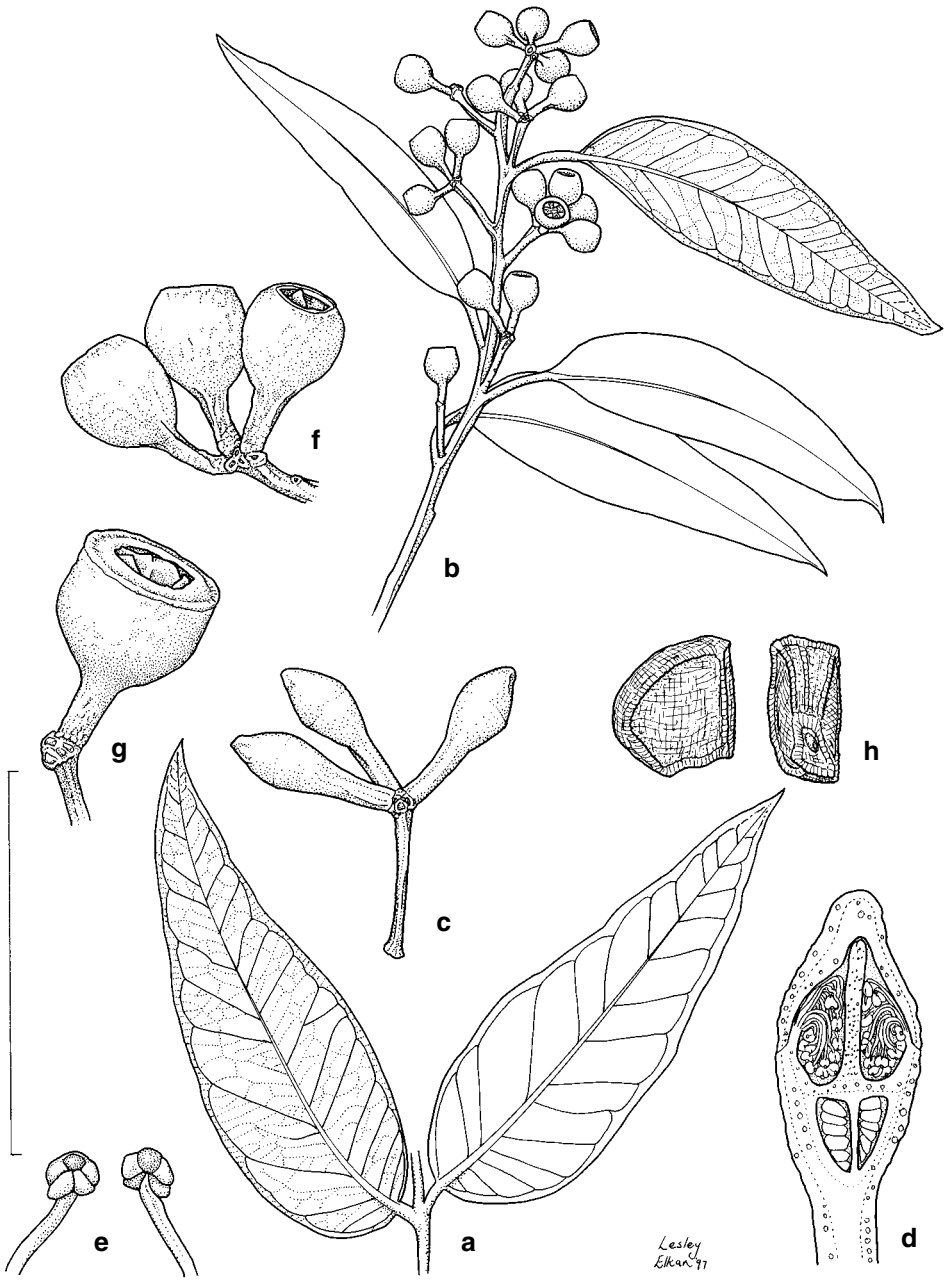

Fig. 10. *E. mediocris*. **a**, Juvenile leaves. **b**, adult leaves and inflorescences. **c**, inflorescence and buds. **d**, transverse section of bud. **e**, anther. **f**, **g**, fruit. **h**, seed (a, b, f, h from *Blaxell 835 & Johnson*, c, d, e, g from *Chippendale 1114 & Brennan*). Scale bar: a, b = 7.5 cm, c, f, g = 2.5 cm, d = 1 cm, e = 3 mm, h = 5 mm.

Selected specimens (from 40 examined): Queensland: Mt Playfair Station near Louisa Bore (S side of Salvator Rosa Nat. Park), *Blaxell 1445 & Armstrong*, 29 Aug 1977 (NSW, BRI, CANB); Mimosa Creek, near Forestry Camp, Blackdown Tableland, *Blaxell 835 & Johnson*, 27 Nov 1972 (NSW);

17 km N of Ogilvie Corner on road from Injune to Mt Moffatt, *Blaxell 1877 & Johnson*, 27 Apr 1981 (NSW); c. 5 miles [8.2 km] by W leading track from end of main road, Blackdown Tableland, *Brooker 4823*, 21 Apr 1975 (CANB, NSW); between Warrong and Ogilby, NW of Injune, *Brooker 4863*, 28 Apr 1975 (CANB, NSW); 60 km from Taroom–Theodore road, towards Glenhaughton, *Brooker 7339*, 7 Mar 1982 (CANB, NSW); Gt Dividing Range, c. 80 km SW of Rolleston, Kenniff Lookout, *Crisp 3081*, 15 June 1977 (CANB, BRI, NSW); Boolimba Bluff, above Carnarvon Gorge campground, *Hill 1330*, 1 Jan 1986 (NSW); 0.3 km north of third crossing of Dawson River, 60 km north of Injune, *Hill 4814*, 10 Oct 1996 (NSW, BRI, CANB); 4 miles [6.5 km] S of Wooroonah Homestead, Leichhardt District, *Speck 1821*, 12 Oct 1963 (CANB, NSW); SE slope of Ropers Peak, below basalt cliffs, *Weston 1550 & Richards*, 13 Jan 1990 (NSW).

9. Eucalyptus psammitica L.A.S. Johnson & K.D. Hill, *Telopea* 4(1): 85 (1990).

Type: New South Wales: Rocky Creek, c. 2 miles (3.2 km) N of Coaldale–Grafton Rd, 19 miles (30.6 km) NNW of Grafton, *R. Coveny 4985*, 23 Aug 1973 (holo NSW; iso AD, BRI, CANB, DNA, HO, K, LE, L, MEL, MO, NY, PERTH, UC).

Tree to 20 m tall. Bark persistent to smaller branches, stringy, grey to red-brown. Cotyledons obreniform, c. 10 mm wide. Juvenile leaves opposite, lanceolate to broad-lanceolate, sessile, to 11 cm long, to 35 mm wide. Intermediate leaves opposite, becoming disjunct later, lanceolate to broad lanceolate, straight, entire, glossy to dull dark green, sub-sessile, 6–16 cm long, 10–35 mm wide; petioles 0–1 mm long. Adult leaves disjunct, lanceolate, falcate or straight, acuminate, basally tapered, entire, glossy to semi-glossy, dark green, thick, amphistomatic, weakly discolorous, 7–17 cm long, 11–25 mm wide; petioles narrowly flattened or channelled, 10–20 mm long. Intramarginal vein distinct, continuous, 1–2 mm from margin. Conflorescence simple, axillary; umbellasters 7–11-flowered. Peduncles narrowly flattened or angular, 7–22 mm long. Pedicels angular, 2–7 mm long. Buds ovoid, 7–9 mm long, 3–4.5 mm diam. Calyptra conical or rostrate, about as long as hypanthium, as wide as hypanthium. Fruits globular or hemispherical, pedicellate, 4-locular (rarely 3), 6–9 mm long, 7–10 mm diam. Calyptra scar flat, c. 0.2 mm wide. Stemonophore flat, c. 0.5 mm wide. Disc flat or moderately depressed (usually clearly visible), 1–2 mm wide. Valves rim-level, flat to raised at up to 30°. Seeds 1.5–2 mm long. (Fig. 11).

E. psammitica is distinguished by the large fruits with a broad often level disc, in combination with the weakly discolorous adult leaves and the lanceolate to broad lanceolate juvenile leaves.

Distribution: Grafton district (Fig. 12).

Ecology: dry sclerophyll woodland on siliceous sandstone

Selected specimens (from 20 examined): New South Wales: North Coast: 0.8 km N of Chapmans Creek crossing on Coaldale road N of Grafton, *Brooker 10586*, 18 Nov 1990 (CANB, BRI, MEL, NSW); McCraes Knob via Tucabia, Clarence Valley, Portion 183, *Griffith PB8*, 20 Dec 1993 (NSW); 0.9 km from Grafton–Coaldale road on Stockyard Creek road, *Hill 2754, 2755 Johnson & Weston*, 19 Oct 1987 (NSW); 1.3 km N of Kremnos Creek, N of Glenreagh, *Hill 2741 Johnson & Weston*, 18 Oct 1987 (NSW); 9.0 km from Coaldale road on Fortis Creek road, *Hill 4894, 4895*, 29 Oct 1996 (NSW, BRI CANB); 0.6 km W of Orara River Bridge on old Grafton to Glen Innes road, *Hill 4885, 4886*, 27 Oct 1996 (NSW, BRI, CANB).

Subseries **Umbrosae**

Juvenile leaves remaining opposite for several internodes, intermediate leaves falcate, petioles twisted, bark fully persistent .

Fig. 11. *E. psammitica*. **a**, **b**, Juvenile leaves. **c**, adult leaves, inflorescences, buds and flowers. **d**, inflorescence and buds. **e**, transverse section of bud. **f**, anther. **g**, inflorescence and fruits. **h**, seed (a from *Hill 2755* et al., b from *Hill 4895*, c–h from *Hill 4894*). Scale bar: a–c = 7.5 cm, d, g = 2.5 cm, e = 1 cm, f = 3 mm, h = 5 mm.

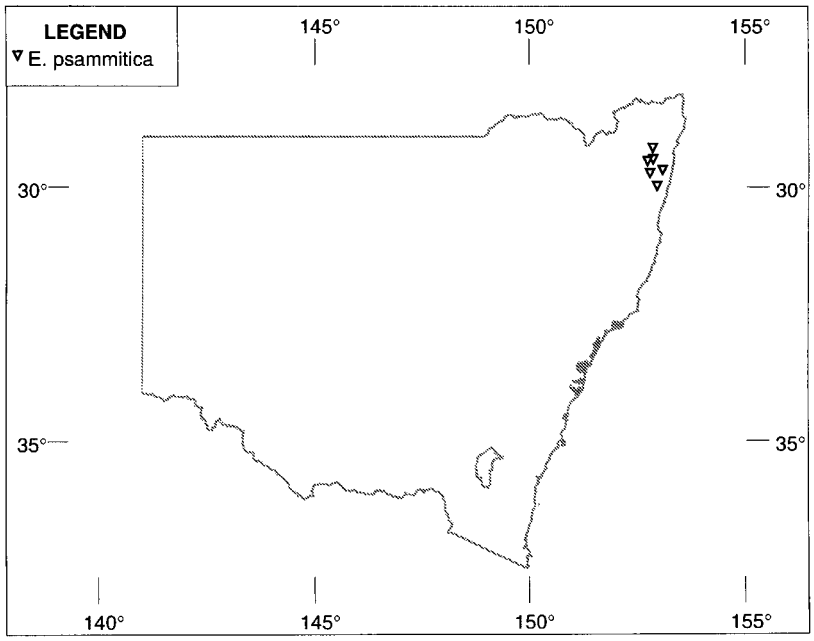

Fig. 12. Distribution of *E. psammitica.*

10. Eucalyptus carnea R. Baker, *Proc. Linn. Soc. New South Wales* 31: 303 (1906).

Type citation: 'Hab.–Wardell; Dunoon, Richmond River; Lismore (W. Baeuerlen).'

Type: Wardell, Lismore, N.S.W., *W. Baeuerlen* 14 Nov 1893 (lecto NSW, here designated). Blake (1958) designated a Baeuerlen collection from Woodburn, N.S.W., as the lectotype. This specimen was among those not cited by Baker, hence cannot be accepted as lectotype.

≡ *E. acmenoides* Schauer var. *carnea* (R. Baker) Maiden, *Crit. Revis. Eucalyptus* 1: 265 (1907).

≡ *E. triantha* Link var. *carnea* (R. Baker) Domin, *Bibl. Bot.* 89: 442 (1928).

≡ *E. umbra* R. Baker subsp. *carnea* (R. Baker) L.A.S. Johnson, *Contrib. New South Wales Nat. Herb.* 3(3): 123 (1962).

Tree to 30 m tall. Bark persistent throughout, stringy, grey to red-brown. Cotyledons obreniform. Juvenile leaves opposite, ovate, sessile, to 12 cm long, to 80 mm wide. Intermediate leaves becoming disjunct early, broad lanceolate to ovate or elliptic, falcate, entire, glossy green, petiolate, 8–15 cm long, 40–100 mm wide; petioles 2–6 mm long. Adult leaves disjunct, lanceolate or broad lanceolate, falcate, acuminate, oblique and basally tapered, entire, dull, bluish-green, thick, amphistomatic, concolorous or weakly discolorous, 6–18 cm long, 15–40 mm wide; petioles narrowly flattened or channelled, 10–22 mm long. Intramarginal vein distinct, continuous, 2–3 mm from margin. Conflorescence simple, axillary; umbellasters 7–11-flowered. Peduncles narrowly flattened or angular, 9–25 mm long. Pedicels angular, 3–7 mm long. Buds ovoid to fusiform, 6–9 mm long, 3–4 mm diam. Calyptra conical to rostrate, 1–2 times as long as hypanthium, as wide as hypanthium. Fruits hemispherical, pedicellate, 3–5-locular, 5–8 mm long, 5–9 mm diam. Calyptra scar flat, c. 0.2 mm wide. Stemonophore

flat, c. 0.2 mm wide. Disc depressed or flat, 0.5–1.5 mm wide. Valves enclosed with tips at rim-level, raised at 30–60°. Seeds 1–2 mm long.

E. carnea is distinguished within the series by the dull, bluish, amphistomatic, concolorous or weakly discolorous adult leaves and the thin-walled fruits with narrow rims.

Hybrids are recorded with *E. signata* as occasional individuals only.

Distribution: North Coast of New South Wales north from the Hunter River, and adjacent ranges on the eastern escarpment of the Northern Tablelands, extending to the Glasshouse Mountains and west to Toowoomba in south-eastern Queensland (Fig. 13).

Ecology: widespread and locally abundant in wet sclerophyll or wet grassy eucalypt forests, often on ridges and sloping sites, and on loamy to clayey soils, mostly over sedimentary or metasedimentary substrates.

Selected specimens (from 140 examined): North Coast: 2.3 km W Mummulgum [post office] on Casino–Tenterfield Road, *Brooker 4730*, 27 Feb 1975 (CANB, NSW); 13 km from Jackadgery towards Lilydale, *Brooker 12401 & Slee*, 15 Oct 1995 (CANB, MEL, NSW); 4.4 miles [7.1 km] SE of Eungai, *Chippendale 487 & Johnston*, 1 June 1968 (CANB, NSW); Acacia Creek, Macpherson [McPherson] Range, *Dunn 362*, Dec 1908 (NSW); Inlet Rd, Mt Boss State Forest, *Gilmour 5851*, 23 Aug 1986 (CANB, NSW); Horseshoe Road, Chaelundi State Forest, about 50 km north west of Dorrigo, *Gilmour 6664*, 11 Mar 1988 (CANB, NSW); c. 12 km from Pacific Highway at South Taree on road to Gloucester, *Hall 73/56*, 28 July 1973 (CANB, NSW); Peacock Creek logging area, off Cambridge Forest Drive, *Hill 4315 Johnson & Noble*, 4 Nov 1992 (NSW, BRI, PERTH); 7 miles [11.3 km] from Raymond Terrace towards Booral, *Rudder*, 19 Feb 1893 (NSW333866); Mill Hill c. 12 km Hillgrove on Long Point rd, *Williams s.n.*, May 1988 (NE, NSW337119). New South Wales: Northern Tablelands: Grasstree Ridge, New England National Park, *Williams s.n.*, 15 Feb 1974 (NE, NSW).

Queensland: Brisbane, Geebung–Aspley, *Blake 10420*, 1 Feb 1936 (BRI, CANB, NSW); near summit of Mt Brisbane, close to hut within Timber Reserve 209, W of 41.6 km west of Esk on road to Crows Nest via Eskvale, *Blaxell 89/276 Johnson & D'Aubert*, 15 Aug 1989 (NSW); 32.7 miles [52.6 km] NNW of Coolangatta, *Chippendale 515 & Johnston*, 3 June 1968 (CANB, NSW); Somerset Dam, *Grimshaw 710 & Halford*, 30 Mar 1994 (BRI, NSW); 3.8 km northeast of Helidon, *Hill 4881, 4882*, 26 Oct 1996 (NSW, CANB BRI); Ngungun, Glass House Mountains, *Johnson*, 13 June 1951 (NSW177729); Yarraman, *McGillivray 385*, 1 Sep 1957 (NSW); Mt Coolum, ½ way up and west of Telegraph Track, about 3 km S of Coolum Beach, *Sharpe 3014 & Batianoff*, 18 Sep 1981 (BRI, NSW); WNW ridge of Lost World, near Mt Razorback, *Weston 1369 & Richards*, 28 Jan 1989 (NSW).

11. Eucalyptus umbra R. Baker, *Proc. Linn. Soc. New South Wales* 25: 687 (1901).

Type: New South Wales: Central Coast: Gosford, *J. Martin*, 14 Nov 1893 (lecto NSW, 2 sheets; here designated). This specimen bears buds, flowers and fruits. Maiden (C.R. 1: 271 & 291) cited a Baker collection from Spit Road, Mosman (Sydney) as the type, and is followed by Blake (1958), who regarded this as the lectotype. The Baker collection was not cited by Baker, and hence cannot be accepted as lectotype (The type citation was: 'Hab.–Wardell, Dunoon, and Tumbulgum (W. Baeuerlen); Peat's Ferry, Military Road (R.T. Baker); Tinonee (J.H. Maiden); Gosford (J. Martin); Cowan Creek and Milton (R.H. Cambage); Eastwood (R.T. Baker).'). The 'Eastwood' and 'Milton' localities are not within the range of the species (specimens from these localities are *E. acmenoides*).

Tree to 25 m tall. Bark persistent throughout, stringy, grey to red-brown. Cotyledons obreniform. Juvenile leaves opposite, ovate, sessile Juvenile leaves opposite, ovate, sessile, to 10 cm long, to 60 mm wide. Intermediate leaves becoming disjunct early, elliptic or ovate, falcate, entire, glossy green, sessile or petiolate, to 20 cm long, to 100 mm wide; petioles 0–5 mm long. Adult leaves disjunct, lanceolate to broad lanceolate or ovate, falcate, acuminate or acute, oblique and basally tapered or rounded, entire, glossy to semi-glossy, green to yellow-green, coriaceous to thick, amphistomatic,

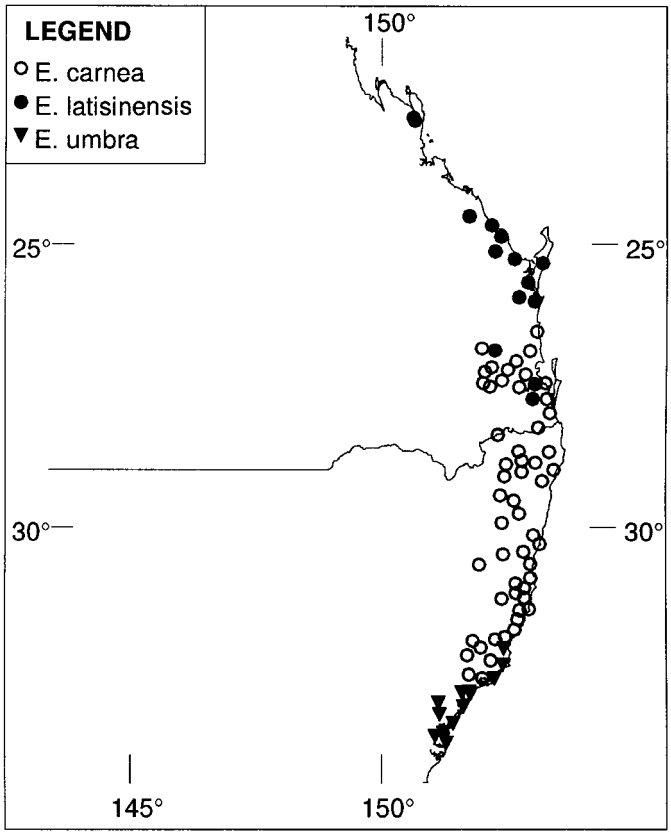

Fig. 13. Distribution of *E. latisinensis, E. carnea* and *E. umbra.*

concolorous or weakly discolorous, 10–14 cm long, 25–35 mm wide; petioles narrowly flattened or channelled, 13–20 mm long. Intramarginal vein distinct, continuous, 1–3 mm from margin. Conflorescence simple, axillary; umbellasters 7–11-flowered.

Peduncles narrowly flattened or angular, 12–22 mm long. Pedicels terete, 5–8 mm long. Buds ovoid to fusiform, 7–9 mm long, 3–4 mm diam. Calyptra conical or rostrate, about as long as hypanthium, as wide as hypanthium. Fruits hemispherical or conical, pedicellate, 3–5-locular, 6–8 mm long, 7–9 mm diam. Calyptra scar flat, c. 0.2 mm wide. Stemonophore depressed, c. 0.2 mm wide. Disc flat, 1–2 mm wide. Valves rim-level, flat or raised at up to 30°. Seeds 1.5–2 mm long.

Distinguished within the series by the semi-glossy, green adult leaves and the thick-walled, broad-rimmed fruits.

Occasional sporadic hybrids are recorded with *E. haemastoma* and *E. racemosa*.

Distribution: Taree to Port Jackson (Fig. 13).

Ecology: dry sclerophyll woodland on sand or sandstone, often on skeletal soils on outcropping sandstone ridges.

Selected specimens (from 95 examined): New South Wales: North Coast: 6.4 km (4 miles) SE of Nabiac at old landing site, *Coveny 6026 & Hind*, 16 Feb 1975 (NSW, CANB, K); Myall Lakes, *Baker*, Dec 1891 (NSW334276); c 3.4 km NE of Princes Highway bridge at Karuah, then

1 km W on dirt road, *Brooker 10567*, 16 Nov 1990 (CANB, BRI, MEL, NSW); Gan Gan Hill near Nelson Bay, *Coveny 16430 McCune & Tame*, 10 Mar 1993 (NSW, BRI, CANB); Waratah, near Newcastle, *Gregson*, 16 July 1900 (NSW334279); Merewether, Newcastle, *Cambage*, 22 June 1902 (NSW334282); Blue Gum Creek, near West Wallsend, *Earp*, 25 Mar 1954 (NSW334280).

Central Coast: between Wyong & Wattagan State Forest, *Brooker 4617*, 11 Nov 1974 (CANB, NSW); Bongon Head, Munmorah State Recreation Area, *Pettigrew 7*, 27 July 1977 (NSW); Terrigal, *de Beuzeville 2*, Apr 1918 (NSW); Staples Lookout, 7.6 km from Woy Woy on road to Kariong, *Chippendale 1019 & Godenzi*, 30 May 1974 (NSW); Elanora Heights, near the junction of Lumeah & Woorarra Avenues, *Coveny 4212 & Armstrong*, 3 July 1972 (NSW); Oxford Falls Road, Oxford Falls, *Coveny 14606 & Whalen*, 19 Feb 1993 (NSW, BRI, CANB, K, MEL); Dobroyd Point, Balgowlah, *Johnson*, 5 Aug 1951 (NSW334342); rear of fort, Middle Harbour, *Cameron*, Mar 1901 (NSW334339).

12. Eucalyptus latisinensis K.D. Hill, *sp. nov.*

Ab *E. umbra* distinguitur foliis juvenilibus mox disjunctis tortilibusque, foliis adultis majoribus, foliis in frondibus densioribus, valvis fructus plus expositis.

Type: Queensland: 4.9 km from Lowmead on Miriam Vale road, *K.D. Hill 4878,* 25 Oct 1996 (holo NSW; iso BRI, CANB).

Tree to 20 m tall. Bark persistent throughout, stringy, grey. Cotyledons obreniform. Juvenile leaves opposite, ovate, sessile, c. 5 cm long, c. 30 mm wide. Intermediate leaves becoming disjunct early, elliptic or ovate, falcate, entire, glossy green to dull green, sessile to petiolate, 7–14 cm long, 35–70 mm wide; petioles 4–10 mm long. Adult leaves disjunct, lanceolate to broad lanceolate or ovate, falcate, acuminate, oblique and basally tapered or rounded, entire, semi-glossy, dark blue-green to yellow-green, thick, amphistomatic, concolorous or weakly discolorous, 6–16 cm long, 12–40 mm wide; petioles narrowly flattened or channelled, 10–22 mm long. Intramarginal vein distinct, continuous, 1–4 mm from margin. Conflorescence simple, axillary; umbellasters 11- or more flowered. Peduncles terete or angular, 9–23 mm long. Pedicels terete or angular, 2–7 mm long. Buds ovoid, 7–9 mm long, 3.5–5 mm diam. Calyptra conical or rostrate, about as long as hypanthium, as wide as hypanthium. Fruits hemispherical to conical, pedicellate, 4- or 5-locular, 5–8 mm long, 5–9 mm diam. Calyptra scar flat, c. 0.2 mm wide. Stemonophore flat, c. 0.5 mm wide. Disc flat to raised, 1–2 mm wide. Valves rim-level to exserted, raised at 30–80°. Seeds 1.5–2.5 mm long (Fig. 14).

E. latisinensis is nearest to *E. umbra*, from which it is distinguished by the juvenile leaves becoming disjunct and twisted at an earlier stage, the denser crown with larger adult leaves, the more exposed valves in fruit. The habitat is also notably different, with *E. umbra* on skeletal soils in outcropping sandstone country, and *E. latisinensis* on deep sands on flat sites.

The epithet is from the Latin *latus*, wide, and *sinus*, bay, with the Latin termination -*ensis*, an inhabitant of; a reference to the occurrence of this species in the Wide Bay pastoral district of Queensland.

Distribution: Byfield to Brisbane, mostly near the coast (Fig. 13).

Ecology: locally frequent in dry sclerophyll woodland on deep sandy soils on flat, often low-lying sites.

Selected specimens (from 38 examined): Queensland: 3.5 km N of Byfield forestry camp, at Arnolds Road corner, *Hill 4855*, 22 Oct 1996 (NSW, BRI, CANB); 4.9 km from Lowmead on Miriam Vale road, *Hill 4879*, 25 Oct 1996 (NSW, BRI, CANB); Moorland, near Bundaberg, *Blake 11343*, 27 Apr 1936 (BRI, NSW); 6.5 km N of Woodgate turnoff on Childers – Bundaberg road, *Hill 4330 & Noble*, 6 Nov 1992 (NSW, BRI, CANB); 1.8 km from Bruce Highway on road to Isis Junction, *Hill 3809 & Stanberg*, 9 Aug 1990 (NSW, BRI, CANB); Tuan, S of Maryborough, *McGillivray 462*, 5 Sep 1957 (NSW); 17.9 miles [28.8 km] NE of Gympie, *Chippendale 536 & Johnston*, 6 June 1968 (CANB,

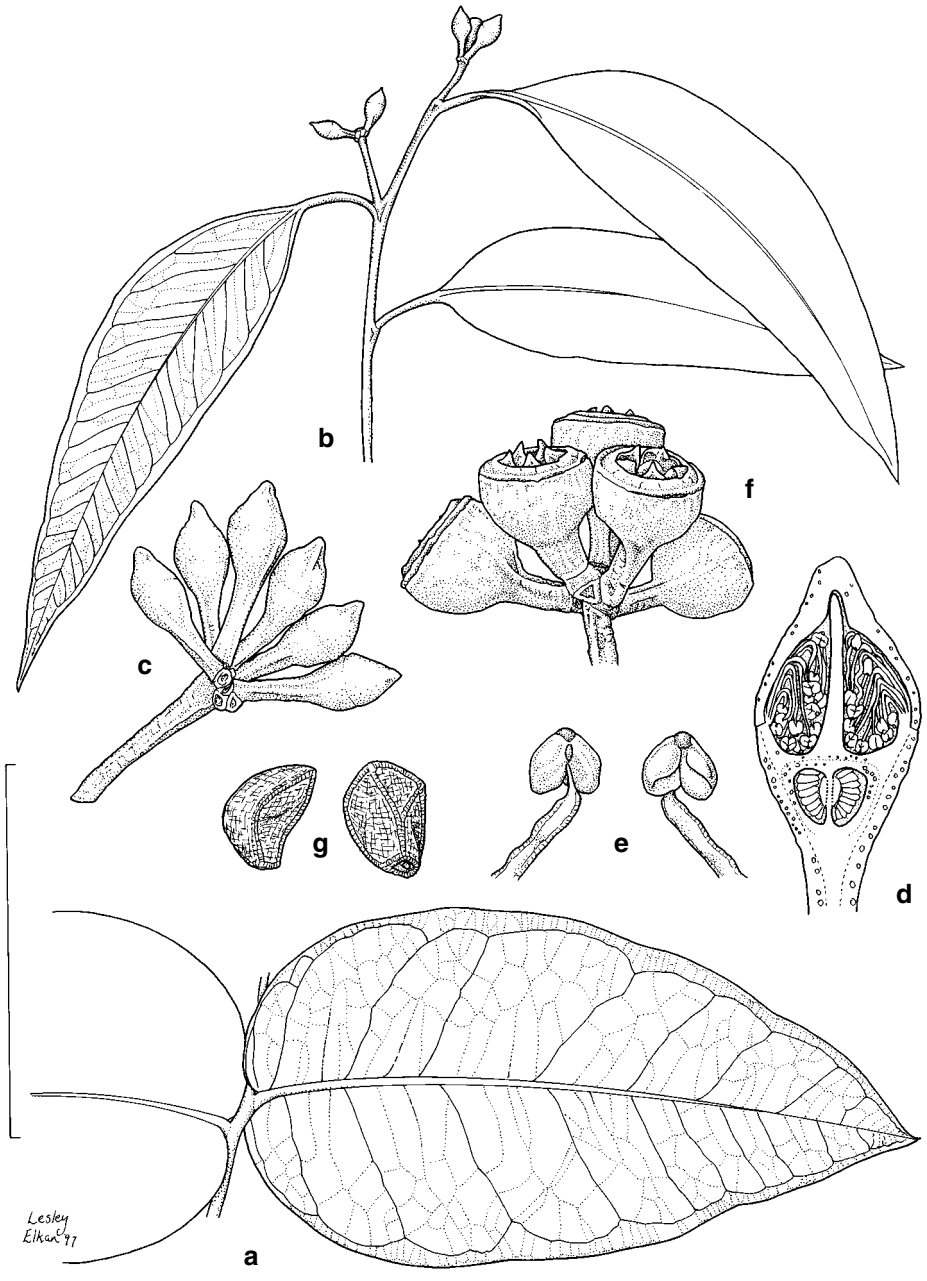

Fig. 14. *E. latisinensis*. **a**, juvenile leaves. **b**, adult leaves and inflorescences. **c**, inflorescence and buds. **d**, transverse section of bud. **e**, anther. **f**, fruit. **g**, seed (a, c, d, e from *Hill 3809 & Stanberg*, b, f, g from *K.D. Hill 4854*). Scale bar: a, b = 7.5 cm, c, f = 2.5 cm, d = 1 cm, e = 3 mm, g = 5 mm.

NSW); Powerline easement which crosses Gympie/Rainbow Beach road, *Grimshaw 929 & Turpin*, 6 Sep 1994 (BRI, NSW); 6.2 miles [10.0 km] S of Burrum Point, *Chippendale 544 & Johnston*, 7 June 1968 (CANB, NSW); Fraser Island, *Petrie*, July 1915 (NSW); near Mt Gravatt, *White 6*, 27 Oct 1918 (BRI, NSW); 2 miles [3.2 km] E of Goodwood Railway Station, *Chippendale 552 & Johnston*, 7 June 1968 (CANB, NSW).

Excluded name

E. anomala Blakely, *J. Proc. Roy. Soc. New South Wales* 62: 209 (1928).

Syntypes: New South Wales: Central Coast: Bywater, Hawkesbury River, *Shiress, Bott & Blakely s.n.*, 17 July 1927 (NSW 339882); Bywater, Hawkesbury River, *Blakely & Shiress s.n.*, (NSW 339884); S. side of Sugarloaf between Wondabyne and Woy Woy, *Blakely & Shiress s.n.*, Aug 1928 (NSW 339885); near 26.5 mile [42.4 km] post Cowan, *Blakely & Shiress s.n.*, 28 Apr 1929 (NSW 339886); 1 mile [1.6 km] E of Cowan, *Blakely & Shiress s.n.*, 9 Sep 1928 (NSW 339887).

All syntypes represent hybrids between *E. racemosa* and *E. umbra* (see below).

Hybrids

E. acmenoides × *E. cloeziana*

Selected specimens (from 4 examined): Queensland: Wide Bay: Toolara, near Gympie, *Pryor s.n.*, 7 Dec 1988 (NSW 213848, BRI CANB); State Forest 944 [near Neerdie], *Blaxell 89/271, Johnson & D'Aubert*, 14 Aug 1989 (NSW, BRI CANB DNA); Toolara State Forest, northeast of Gympie, *Podberscek s.n.*, — (NSW 207651).

E. acmenoides × *E. pilularis*

Selected specimens (from 7 examined): New South Wales: Central Coast: Gosford, *Murphy s.n.*, May 1904 (NSW 322931); Head of Canada Drop Down Creek, *Power s.n.*, July 1975 (NSW 322930).

North Coast: Bucca Creek near Coffs Hbr, *Boorman s.n.*, June 1911 (NSW 322928); Gundle Trail, Bellangry State Forest (NW of Wauchope), *White s.n.*, June 1959 (NSW 322929); Pacific H'way near Allworth, *McDonald s.n.*, 19 Nov 1954 (NSW 322932).

E. carnea × *E. signata*

Selected specimens (from 4 examined): Queensland: upper eastern slopes of Tunbubudla (western peak), Glasshouse Mountains, *Bean 785*, 24 Feb 1988 (NSW); Kedron Brook, *White s.n.*, 25 Aug 1917 (NSW).

E. contracta × *E. sphaerocarpa*

Specimens examined: Queensland: Stony Creek Falls, Blackdown Tablelands, *Brooker 7380*, 10 Mar 1982 (NSW).

E. haemastoma × *E. umbra*

Selected specimens (from 4 examined): New South Wales: Central Coast: Brooklyn, *Coveny 15417 & Plaza*, 1 Aug 1991 (NSW, CANB, CANB, BRI, MEL, K).

E. racemosa × *E. umbra* (*E. anomala* Blakely)

Selected specimens (from 11 examined), (see also syntypes of *E. anomala*, above): New South Wales: Central Coast: 4 miles [6.4 km] W of Narrabeen Lake, *Johnson 758,* 5 Oct 1946 (NSW).

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My colleagues in the study of the eucalypts at NSW have contributed greatly with helpful discussions, inspiration, and have been involved in the recognition of several of the new taxa. The late Lawrie Johnson in particular has made this work possible, and Don Blaxell has also assisted greatly. Barbara Briggs is gratefully acknowledged for valuable encouragement, support and assistance, and for critical reading of manuscripts. Peter Wilson has also helped with manuscripts and assisted with Latin diagnoses. Leonie Stanberg has provided extremely valuable technical and editorial assistance throughout the project, and prepared the maps. Lesley Elkan and David Mackay prepared the illustrations.

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