Volume 6 Number 1 2001

AUSTROBAILEYA

A Journal of Plant Systematics

Queensland Herbarium

Queensland Government
Environmental Protection Agency

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Austrobaileya

Vol. 1, No. 1 was published on 1 December 1977

Vol. 5, No. 4 was published on 15 December 2000

Vol. 6, No. 1 was published on 12 December 2001

Austrobaileya is published once per year.

Exchange: This Journal will be distributed on the basis of exchange.

Australian subscribers: Orders for single issues and subscriptions may be placed. The price is (2001 GST included): A$31.62 per issue for individuals, A$50.60 for institutions, including postage.

Overseas subscribers: Order for single issues and subscriptions may be placed. The price is (2001): A$28.75 per issue for individuals, A$46.00 for institutions, including postage.

All correspondence relating to exchange, subscriptions or contributions to this journal should be addressed to: The Editor, Austrobaileya, Queensland Herbarium, Environmental Protection Agency (EPA), Brisbane Botanic Gardens, Mt Coot-tha, Mt. Coot-tha Road, Toowong Qld 4066, Australia.

ISSN 0155-4131

Austrobaileya is the journal of the Queensland Herbarium and is devoted to publication of results of sound research and of informed discussion on plant systematics, with special emphasis on Queensland plants.

Opinions expressed by authors are their own and do not necessarily represent the policies or views of the Queensland Herbarium.

Contents

(*continued*)

Note

A taxonomic revision of *Convolvulus* L. (Convolvulaceae) in Australia

R.W. Johnson

Summary

Johnson, R.W. A taxonomic revision of *Convolvulus* L. (Convolvulaceae) in Australia. *Austrobaileya* 6 (1): 1–39. A revision of the genus *Convolvulus* L. in Australia is presented. Twelve species are recognised and described, including four that are new. They are *C. graminetinus, C. recurvatus, C. tedmoorei* and *C. wimmerensis*. In two species, C. *angustissimus* and C. *recurvatus*, subspecies have been recognised and described. *C. angustissimus* subsp. *omnigracilis* and *C. angustissimus* subsp. *peninsularum,* and *C. recurvatus* subsp. *nullarborensis* are described as new while C. *angustissimus* subsp. *fililobus* is a new combination based on *C. erubescens* var. *fililobus* Wawra. A key to identify all species and subspecies is provided together with distribution maps and illustrations of certain diagnostic characters.

Keywords: Convolvulaceae, *Convolvulus,* Australia

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Introduction

The genus *Convolvulus* was formally established by Linnaeus (1753) and he recognised 31 species. From these species, the name *Convolvulus arvensis* was selected as the type of the genus by Hitchcock (1929). In Genera Plantarum, Linnaeus (1754) attributed the name to Tourneforte. Linnaeus adopted a broad concept of the genus including in it species which are now segregated into other genera including *Calystegia* R. Br. (*Convolvulus sepium*), *Ipomoea* L. (*C. batatas*), *Operculina* Silva Manso (*C. turpethum*), *Merremia* Dennst ex Endl. (*C. umbellatus*), *Evolvulus* L. (*C. alsinoides*) and *Xenostegia* D. F. Austin & Staples (*C. tridentatus*).

The first published record of *Convolvulus* from Australia was by Sims (1808) when he described *Convolvulus erubescens* from a specimen collected by Mr Loddiges from New South Wales. Brown (1810) described three new species from Australia, namely *C. angustissimus, C. remotus* and *C. multicaulis*. The latter species is now placed in the genus *Jacquemontia* Chois. Later Choisy (1824) described *C. acaulis* from Kangaroo Island while still later Lehmann (1826) described *C. geniculatus* though no type was designated. Subsequently this species was listed as occurring in Australia. Vriese (1845) described four new species from Western Australia, namely *C. adscendens, C. huegelii, C. preissii* and *C. subpinnatifidus*. Mueller (1853) recognised *C. crispifolius,* based on a specimen he collected from Cudnaka in South Australia. However, in 1864, he concluded that the extreme variation exhibited by *C. erubescens* embraced all previously described species from Australia including *C. crispifolius* (Mueller 1864). Bentham (1869) agreed with this taxomony and decided in his Flora treatment to recognise only one species, *C. erubescens,* to include the segregate species that had already been described. He also included in *Convolvulus* the genera *Jacquemontia* and *Calystegia*. Yet soon after, Bentham & Hooker (1873) recognised these three genera as being distinct. Domin (1928) described *C. clementii* from northern Western Australia as a new species occurring across tropical Australia.

Until the late 1980's, only two species of *Convolvulus* were recognised in local and

Accepted for publication 16 May 2001

regional floras, *C. arvensis*, an early introduction from Europe, and the highly variable *C. erubescens* embracing all previously described native species. Since then I have described two species, *C. eyreanus* and *C. microsepalus* from South Australia as new (Johnson 1987).

According to Mabberley (1997) and Austin (1998), *Convolvulus* is a genus of about 100 species mainly of temperate origin, though Sa'ad (1967) recognised 118 species from the Mediterranean and Middle East alone while Austin (1982a), Ooststroom (1953) and Mabberley (1989) indicated there may be about 250 species in the genus. It is more likely it comprises about 150 species. *Convolvulus* is included in tribe Convolvuleae which also includes *Jacquemontia* and *Calystegia.*

Classification

Ooststroom (1953) recognised three tribes within the Convolvulaceae. One of these tribes, Cuscuteae, represented by the genus *Cuscuta* L. is regarded as a separate family, Cuscutaceae, by some authors. The separation of the other tribes, the Convolvuleae and the Ipomoeeae, is based on whether their pollen is spinulose (Ipomoeeae) or smooth (Convolvuleae). Ooststroom (l.c.) placed *Convolvulus* in subtribe Convolvulinae with *Calystegia*, *Jacquemontia, Merremia*, *Operculina* and *Aniseia* Chois. Austin (1973, 1975) recognised 9 tribes within Convolvulaceae, two of which were equivalent to subtribe Convolvulinae of Ooststroom. His Convolvuleae included *Convolvulus, Calystegia, Polymeria, Jacquemontia* as well as *Evolvulus* (Dicranostylinae) while his Merremieae (Austin 1982) included *Aniseia, Operculina* and *Merremia*. This division was based on cytological data, corolla shape and stylar characters. However, more recent studies (Austin 1998) using cladistic analyses suggest the Merremieae may not form a clade distinct from the Convolvuleae.

Three sections are recognised within *Convolvulus* (Sa'ad 1967), separated on the presence or absence of spines and whether or not the stems are twining. All of the Australian species belong to *C.* sect. *Convolvulus*, being espinose and twining.

Relationships

According to Austin (1973), *Convolvulus* is most closely related to *Calystegia*, *Evolvulus*, *Polymeria* and *Jacquemontia*. In Australia, *Jacquemontia* is clearly distinguished in possessing triramous hairs while *Evolvulus* has biramous hairs. The remaining genera have simple hairs. The style in *Polymeria* bears a much divided stigma with usually 4–8 lobes unlike that in *Convolvulus* which has two lobes. *P. distigma,* however, has a 2-lobed stigma though the branches are similar in structure to the other species of *Polymeria* and usually have short lobes at the base. *Calystegia* is distinguished by its large bracts which enclose or closely subtend the calyx. *Convolvulus* and *Polymeria* can also be distinguished from the other genera in possessing tri-colpate rather than either pantoporate or pantocolpate pollen grains.

Materials and Methods

This revision is based principally on herbarium specimens held at AD, BRI, CANB, HO, MEL, NE, NSW and PERTH. Only limited field work in Queensland and the Northern Territory was possible. In addition, plants were grown from seed in a glasshouse at BRI. Specimens were sorted into nominal taxa and, from each, specimens with flowers and fruit were selected for comprehensive dissections. Those specimens which could not be placed within nominal taxa were also dissected. Attributes from dissected specimens were then classified using a variety of numerical taxonomic programs. While the classifications produced as a result were not completely satisfactory, groupings that were produced formed part of the input into the taxonomic treatment presented below.

Attributes

Attributes of Australian species of *Convolvulus* which are significant diagnostically are discussed below.

***Cotyledons*:** The cotyledons fall into one of two morphological groups i.e. those that are:

- bilobed, with the lobes, linear, diverging and greatly exceeding the base e.g. *C. clementii* (Fig. 1A), or

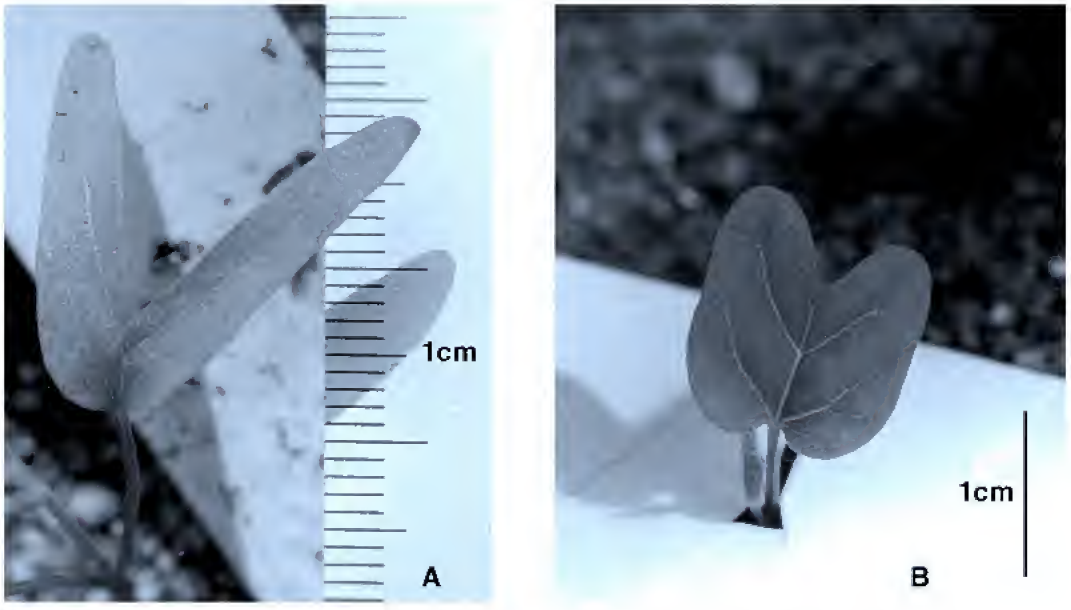


Fig. 1. Cotyledons of *Convolvulus* species. A. *C. clementii* from *S.A. Pastoral Board* s.n. (AD98010365); B. *C. remotus* from *Kenneally* 4643 (PERTH).

- oblong to rounded oblong, with two short rounded apical lobes, always shorter than the base e.g. *C. angustissimus, C. arvensis, C. crispifolius, C. eyreanus, C. graminetinus, C. microsepalus, C. recurvatus* and *C. remotus* (Fig. 1B).

***Habit*:** Most species have long trailing and twining stems. The initial leaves are somewhat similar in shape in all the Australian species, being oblong to linear, often hastate, and with entire to undulate margins. However, the cauline leaves can vary greatly both between and within species. In some species such as *C. remotus*, *C. microsepalus* and *C. arvensis,* leaf shape is similar from base to the tips of the stems. In other species such as *C. angustissimus* and *C. clementii,* considerable variation occurs within a single plant. Lower cauline leaves are often greatly different in both shape and size from leaves found on fertile branches. In some taxa this difference may have taxonomic significance. This is particularly so within *C. angustissimus*. Because of considerable variation within individuals and within populations, identification can be difficult from single specimens taken from one part of a plant. This problem is compounded by seasonal conditions. Specimens taken from the same population can vary greatly when collected in the spring and late summer, while plants which are rapidly forced into early flowering and fruiting can produce inflorescences from the axils of basal and lower cauline leaves.

***Vestiture*:** Hairs are simple and tubercle-based. They vary considerably in length and orientation but there is some consistency in the vestiture in individual species. Both *C. remotus* and *C. microsepalus* have characteristically short (< 0.4 mm long), appressed hairs. By contrast the hairs on *C. clementii* and *C. angustissimus* subsp. *angustissimus* when present are commonly irregularly spreading and often exceed 0.5 mm, and may even approach 1 mm in length. Both *C. eyreanus* and *C. crispifolius* have dense silky semi-appressed hairs. In many species, the vestiture changes from that on basal leaves to that on fertile stems with hairs more likely to be spreading in basal parts and tightly appressed on terminal shoots. Terms such as sparsely hairy, moderately hairy and densely hairy are used in the text. Moderately hairy is used when the length of the hairs begins to exceed their distance apart while densely hairy is used where the density is such that the vestiture obscures the leaf surface.

***Inflorescence*:** All species have a simple or compound dichasial inflorescence which is axillary. Normally only one inflorescence is found in a leaf axil but in many species such as

C. clementii, C. graminetinus, C. remotus, C. arvensis, C. tedmoorei, *C. recurvatus* and *C. erubescens*, occasionally two occur. Some species, such as *C. angustissimus* and *C. microsepalus*, almost always have a simple inflorescence. In other species, such as *C. clementii*, *C. erubescens* and *C. arvensis*, it is common to find compound inflorescences on most specimens. While bracteoles are paired on all branches, it is only the outer one that subtends a bud or flower. In the text, such inflorescences are referred to as one-sided dichasia. The bracteoles are usually opposite in species with solitary flowers but in those with one-sided dichasia they are often sub-opposite to alternate, even when a single flower is present.

Another distinguishing character is the shape of the pedicel at fruiting. In some species, such as *C. angustissimus, C. wimmerensis* and *C. recurvatus*, the pedicel becomes strongly recurved at fruiting while in other species, such as *C. erubescens* and *C. clementii*, the fruiting pedicel is straight or occasionally is sinuate or rarely slightly curved. Aside from *C. graminetinus*, a straight pedicel at fruiting appears to be characteristic of northern species with species restricted to southern areas all possessing strongly recurved pedicels.

***Calyx*:** The calyx consists of 5 free sepals, quincuncially arranged. The outer two sepals are similar or slightly unequal in size but they are usually somewhat different in shape and / or size from the inner pair. The intermediate sepal is a hybrid in shape, the exposed half resembling that of the outer sepals, the enclosed half resembling the inner. The shape of the outer sepals, in particular the apex, is diagnostic. Both *C. arvensis* and *C. microsepalus* have small outer sepals with a rounded, emarginate apex. By contrast all other species have an acute to rounded apex with a ± prominent recurved apiculum.

***Corolla*:** The corolla is typically funnel-shaped with a narrow tube which flares distally into a broad limb. The point at which it flares is marked by five V-shaped structures where the midpetaline bands diverge. The length of the tube to the point where the corolla flares has use as a possible discriminating attribute. The length of the corolla and the diameter of the limb are difficult to ascertain on herbarium specimens because the corolla is funnel-shaped and is flattened during pressing. The length of the flattened and dried corolla approaches the petal length and it is for this reason, petal length has been used in the key to species and in species descriptions.

Each petal has a distinct mid-petaline band, hairy on the outside in the upper part and which tapers towards the apex. The tube is always glabrous on the outside. The colour of the corolla varies from white to pale pink, or occasionally purplish. As in other species of Convolvulaceae, white-flowered forms have been recognised e.g. *Convolvulus erubescens* var. *albus,* but such formal recognition appears trivial.

***Stamens*:** The five stamens are affixed to the corolla tube at the base and alternate with the lobes. The lower part of the filament, attached to the corolla tube, is flared downwards and usually bears low tubercles on the margin. The tubercles extend beyond the point of attachment onto the inner face of the free upper part of the filaments. The filaments are usually unequal in length. The pollen grains are spheroidal or ellipsoidal and 3-colpate. The colpi are linear in shape and the surface of the pollen grains is smooth (Fig. 2).

***Ovary*:** In all species the ovary is borne on a cup-shaped disk. The ovary is 2-celled with 2 basal ovules in each cell and is tipped by a style with two ± cylindrical stigmas. The nature of the stigmas is a generic character.

***Capsule*:** All species have globular to globular-ovoid capsules with a distinct beak resulting from the persistent style base. The capsules dehisce loculicidally into 2 valves with each valve often splitting further into 2 parts. The capsule also dehisces at the base leaving a persistent dissepiment. The size of the capsule varies depending on maturity and seasonal conditions but can be used to discriminate among species.

***Seeds*:** Under normal circumstances four seeds are produced in each capsule, two in each cell. The seeds are therefore ¼-globular or globular-

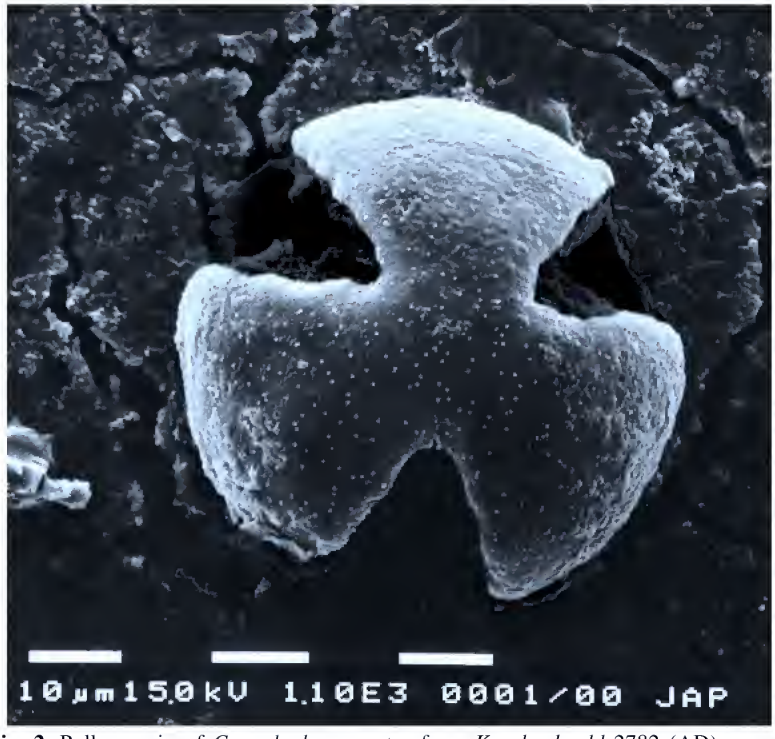


Fig. 2. Pollen grain of *Convolvulus remotus* from *Kraehenbuehl* 2782 (AD).

ovoid in shape, with two flat faces and the abaxial face concave. On occasions, fewer seeds are produced and in these circumstances the seed shape diverges from the usual pattern. The size and surface sculpture are diagnostic. Seeds of all species are illustrated in the text. The underlying surface is finely and regularly punctate but is usually covered with low tubercles or ridges of irregular shape. A wing, continuous or discontinuous, may or may not occur. The characteristic patterning on the seed surface appears to be produced towards maturity and immature seed may lack any raised surface structures. However, mature seed of *C. angustissimus* subsp. *filiobus* appears to have a smooth finely punctate surface without surface structures. Though no species has hairy seeds, the tubercles on the surface and wings on the outer margins in some species, in particular in *C. clementii*, appear to be formed by the fusion of hair-like structures.

***Hybridisation*:** While no study was made of gene interchange among species, genetic traits such as recurved pedicels and the one-sided dichasial inflorescence do appear to flow into populations of species which normally lack them. In areas of geographical overlap where both *C. angustissimus* subsp. *angustissimus* and *C. erubescens* are found, strongly recurved pedicels are occasionally found in populations of *C. erubescens*.

***Biogeography*:** The genus is primarily temperate in distribution. The greatest diversity of species in Australia is found in the south-east with 8 species being recorded in Victoria, 8 in South Australia and 10 in New South Wales. By contrast only 2 species are known from the Northern Territory, 5 from Western Australia and 7 from Queensland. *Convolvulus* is one of a few genera, including *Calystegia* and *Wilsonia* R.Br., in Convolvulaceae which are concentrated in temperate regions of Australia. Most genera and species of this family occurring in Australia are tropical and sub-tropical in distribution.

Within *Convolvulus*, three species are common and widespread with *C. angustissimus* occupying moister mainly southern areas of Australia, *C. clementii* occupying arid and semi-arid regions of all mainland states and *C. remotus* more common in southern wetter areas but extending into more arid areas, often

on moister sites. The remaining species, aside from *C. graminetinus* which is found in grasslands and grassy forests and woodlands on mainly clay soils in semi-arid and sub-humid Queensland and New South Wales, have relatively restricted distributions.

Taxonomy

Convolvulus L., Sp.Pl. 1:153 (1753). **Type**: *Convolvulus arvensis* L. (lecto: *fide* Hitchcock 1929).

Annual or perennial herbs with erect, trailing or twining stems, or in some extra-Australian species shrubs or sub-shrubs, sometimes spiny; stems hairy, more rarely ± glabrous; hairs simple. Leaves simple, alternate, petiolate or sub-sessile; blade very variable in shape, entire to deeply divided, often hastate or sagittate, with base usually cordate. Flowers axillary in 1- to few-flowered dichasia or in sub-umbellate heads in some extra-Australian species. Sepals 5, free, with inner and outer pairs subequal and the intermediate one asymmetric. Corolla funnel-shaped or more rarely campanulate, white, pink or mauve with 5 midpetaline bands usually hairy outside towards the apex, otherwise glabrous; limb sub-entire to shallowly 5-lobed. Stamens 5, included; filaments epipetalous, alternating with the petals, terete above, flattened and dilated downwards, often with low tubercles towards the base; anthers bilocular, dehiscing longitudinally; pollen spheroid or ellipsoid, smooth. Ovary on a cup-shaped disk, bilocular, each locule with 2 ovules; style simple, filiform; stigmas 2, cylindrical, obtuse. Capsule globular or globular-ovoid, with a persistent style base, 2–4-valved, irregularly circumscissile at the base but with a persistent dissepiment. Seeds 4 or less by abortion, ¼-globular or ¼-globular-ovoid, with a finely punctate surface usually bearing irregular tubercles or ridges.

Distribution: A genus of c. 150 species found throughout the temperate and subtropical regions of both hemispheres, rarely extending into the tropics.

Etymology: The generic name refers to the twining habit of most species being based on the latin *convolvere*, to roll together or entwine.

Key to native and naturalised (*) species of *Convolvulus* in Australia

Because of the extreme variability in leaf shape from base to tip of the stem in some species, the leaf shape used in the key refers to mid-cauline leaves, particularly those subtending inflorescences.

1. Leaves hastate or sagittate, with an entire, oblong or triangular-oblong, occasionally linear, terminal lobe usually > 2 mm wide, and a pair of entire or occasionally 2-toothed or 2-lobed basal lobes, ascending lobes absent, rarely a tooth or a short lobe present on a few leaves at the junction of the terminal and basal lobes 2
   Leaves crenate, serrate to shallowly lobed or if a distinct terminal lobe is present then basal lobes auriculate and toothed or much divided with ascending lobes prominent 6

2. Sepals 4 mm or less in length, with a rounded to truncate, emarginate apex, glabrous to sparsely hairy 3
   Sepals 4–7 mm long, rarely shorter, with apex acute to rounded, apiculate 4

3. Petals 15–30 mm long; sepals 3–4 mm long; leaves glabrous or with a few weakly erect hairs ..... **1. *C. arvensis**
   Petals 5–10 mm long; sepals usually < 3 mm long; leaves moderately to sparsely hairy with appressed hairs ..... **2. C. microsepalus**

4. Sepals and leaves with short appressed or crisped-appressed hairs, or if hairs spreading then seeds with a fine pattern of low irregular tubercles; inflorescence a 1-sided dichasium with 1–3 flowers; pedicels at fruiting straight or sinuate, or if recurved, then petals 7–10 mm long 5
Sepals and leaves with spreading hairs and seeds with sparse low reticulate ridges; inflorescence of solitary flowers; pedicel at fruiting recurved; petals 8–25 mm long ..... **9. C. angustissimus**

5. Pedicels at fruiting recurved; capsule globular to 5.5 mm long; seeds ¼-globular in shape, to 3.5 mm in length, faces with a fine pattern of low irregular tubercles; petals to 10 mm long; sepals usually ± glabrous to sparsely hairy ..... **3. C. graminetinus**
Pedicels at fruiting straight or sinuate; capsule globular to globular-ovoid, 5.5–8.5 mm long; seeds ¼-ellipsoid in shape, 3–4.8 mm long, faces with irregular ridges; petals exceeding 10mm in length; sepals moderately to densely hairy ..... **4. C. remotus**

6. Leaves crenate or serrate with basal lobes usually not prominent, sericeous; hairs ± appressed, commonly > 0.5 mm long 7
Leaves with distinct terminal lobe and much divided basal lobes or basal lobes auriculate and toothed, not sericeous; hairs usually < 0.5 mm long 8

7. Peduncle at flowering < 12 mm long; seeds < 3 mm long; capsule < 4.5 mm in diameter ..... **5. C. crispifolius**
Peduncle at flowering usually > 12 mm long; seeds > 3 mm long; capsule 5–6 mm in diameter ..... **6. C. eyreanus**

8. Corolla with petals > 9 mm long; seeds reticulate, tuberculate or smooth 9
Corolla with petals < 9 mm long; seeds tuberculate 12

9. Pedicel at fruiting straight or sinuate; inflorescence a 1-sided dichasium with 1–3 flowers; peduncle slightly ribbed; margin of terminal lobe usually undulate to lobed; basal lobes auriculate, dentate; seeds with many laterally compressed sinuate tubercles ..... **7. C. erubescens**
Pedicel at fruiting strongly recurved 10

10. Faces of seeds with a fine pattern of low irregular tubercles; inflorescence a 1-sided dichasium with 1 or 2 flowers; peduncle and stems often slightly ribbed; petals to 10 mm long ..... **3. C. graminetinus**
Faces of seeds with sparse, low, reticulate ridges; flowers solitary; peduncle and stems terete; petals 9–25 mm long 11

11. Leaves densely hairy, silvery coloured, with mainly appressed hairs, with ascending lobes often at least half the length of the terminal lobe ..... **8. C. wimmerensis**
Leaves moderately to sparsely hairy, or if densely hairy, then hairs ascending or spreading, with ascending lobes rarely half the length of the terminal lobe ..... **9. C. angustissimus**

12. Pedicel at fruiting recurved 13
Pedicel at fruiting ± straight to sinuate 14

13. Sepals ± glabrous to sparsely hairy; pedicel at fruiting 3–12 mm long; seeds densely tuberculate, wingless ..... **3. C. graminetinus**
Sepals moderately to densely hairy, pedicels at fruiting 3–6 mm long; seeds sparsely tuberculate, with a discontinuous wing of fused hair-like structures ..... **10. C. recurvatus**

14. Stems slender; seeds 2.5–3.2 mm long, with wing present, often discontinuous ..... **11. C. clementii**
Stems coarse; seeds 3.5–4 mm long with no obvious wing ..... **12. C. tedmoorei**

1. Convolvulus arvensis L., Sp. Pl. 1: 153 (1753). **Type:** Sweden, herb. Linn. 218.1 (lecto: LINN), *fide* Meeuse (1957), p. 695.

Perennial with trailing and twining stems arising from a well developed underground root system; stems terete, narrowly winged, glabrous or sparsely to very rarely moderately hairy, glabrescent, hairs crisped to sinuate and semi-erect, 0.2–0.5 mm long. Leaves petiolate, of similar shape from base to tip of the stem (Fig. 3A) though petiole becoming shorter and blade smaller towards the tip; petiole 5–25 mm long; blade ovate to oblong, often triangular-oblong, hastate or sagittate, 15–60 mm long, 5–40 mm wide, apex acute to rounded, sometimes emarginate, mucronulate, base truncate to cordate, basal lobes triangular, to 10 mm long, acute to rounded, entire or very rarely with a tooth on the lower margin, ascending lobes absent, terminal lobe oblong, 12–55 mm long, glabrous or with scattered hairs, hairs crisped and spreading to weakly erect, 0.2–0.5 mm long. Inflorescence solitary, axillary, bracteolate, a one-sided dichasium, with 1–4 flowers or rarely with 2 inflorescences per axil; peduncle terete, with low ribs, 4–65 mm long, glabrous to sparsely hairy, rarely moderately hairy, hairs loosely crisped-appressed to weakly erect, 0.1–0.5 mm long; bracteoles opposite to subopposite, linear to narrowly obovate, 1.5–7 mm long, up to 2 mm wide, apex acute to obtuse, mucronulate, eciliate or with well developed cilia, sparsely hairy on the back with hairs mainly on the midrib; pedicel 6–22 mm long, recurved at fruiting, hairs as for peduncle. Outer sepals oblong, elliptic-oblong to obovate-oblong, 3–4.2 mm long, rarely shorter, 1.75–2.8 mm wide, apex rounded or retuse, glabrous or moderately ciliate and ± glabrous or sparsely hairy outside, with occasional hairs along the midrib and near the tip; inner sepals orbicular to obovate-orbicular, 3–4.5 mm long, 3–4.5 mm wide, apex retuse, mucronulate, base rounded, ± glabrous. Corolla funnel-shaped, white to pink, 15–25 mm long, 20–30 mm diameter, flared 4–7 mm above the base of the tube; petals 17–30 mm long, 13–18 mm wide, with rounded, emarginate to shortly bilobed lobes, glabrous except for scattered hairs on the outside of the midpetaline band for 4–8 mm, occasionally up to 15 mm, from the apex. Stamens 5, unequal; filaments affixed to the corolla tube for 2.5–3.5 mm from the base, free for 4.5–10 mm, with short cylindrical tubercles to 0.2 mm long, mainly on the margins, from 0.75–1.25 mm above the base of the corolla and extending for 4–7 mm; anthers oblong to oblong-elliptic, 2.5–3.2 mm long, 1–1.5 mm wide, apex truncate, emarginate, base sagittate, basal lobes 0.7–0.9 mm long. Ovary ovoid, 1.5–2.5 mm long, on a lobed disk 0.5–0.8 mm high, glabrous or hairy; style 8–9 mm long; stigmas cylindrical to narrowly obovate, occasionally falcate, obtuse, 2.5–4 mm long. Capsule globular to globular-ovoid, 4–7 mm long, 4–6 mm diameter, glabrous. Seeds 4, ¼-globular-obovoid, 3–4 mm long, c. 3 mm wide, dark-brown to black, surface finely punctate bearing a fine and ± regular pattern of small, often laterally compressed, tubercles, wingless (Fig. 4A).

Selected specimens (113 specimens examined): **Western Australia**. Dwarda, Feb 1941, *O'Connell* s.n. (PERTH); Boyup Brook, Jan 1949, *O'Sullivan* s.n. (PERTH); South Coogee, Feb 1951, *Quinlivan* s.n. (PERTH); Fremantle, Mar 1946, *Royce* s.n. (PERTH); Bunbury, Dec 1952, *Simpson* s.n. (PERTH). **South Australia**. Yallanda Flat, Feb 1964, *Alcock* 654A (AD); Railway Terrace, Edwardstown, Nov 1987, *Dashorst* s.n. (BRI); Fulham, c. 8 km W of Adelaide, Nov 1967, *Smith* 984 (AD); Adelaide, Jan 1960, *Symon* 332 (NE). **Queensland.** Leichhardt District: Trelinga, 2 miles W of Wandoan, Mar 1972, *Elphinstone* s.n. (BRI). Port Curtis District: Marlborough, Property of G.J.A.Hack, Jun 1966, *Kelly* s.n. (BRI). Burnett District: Monto, Oct 1951, *Stubbs* s.n. (BRI). Wide Bay District: 2 miles SW of Kilkivan, Feb 1970, *Ditchmen* s.n. (BRI). Maranoa District: St George Irrigation, Jan 1969, *Hazard* s.n. (BRI). Darling Downs District: Cooper Gully road, NE of Yangan, Oct 1997, *Bean* 12426 (BRI). Moreton District: 6 miles ESE of Gatton, Aug 1968, *Hazard* s.n. (BRI). **New South Wales.** Carrol near Gunnedah, Jan 1971, *Dale* s.n. (NSW); Henty, Feb 1949, *McBarron* 3078 (NSW); Campbelltown, Feb 1962, *McBarron* s.n. (NSW); Parkes, Mar 1925, *Swann* s.n. (NSW); Armidale, Nov 1982, *Wilson & Lapinpuro* LL11 (NSW). **Victoria.** Midlands: Avoca, 1894, *Martin* s.n. (MEL). **Tasmania.** Sandy Bay, Hobart, Nov 1941, *Curtis* s.n. (HO); New Town Research Laboratories,

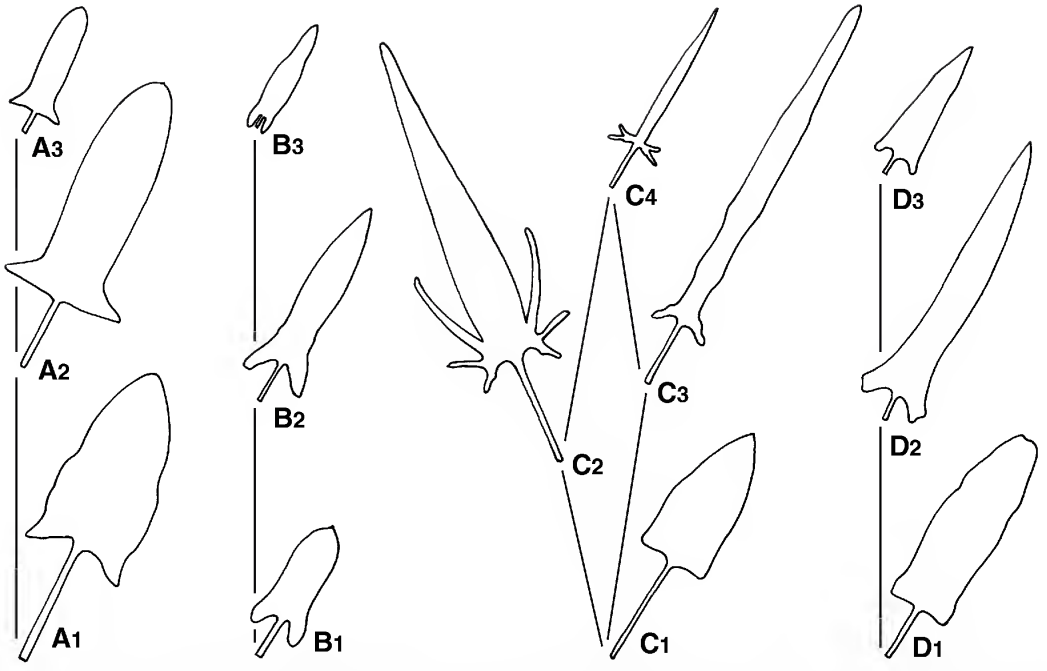


Fig. 3. Variation in leaf shape of *Convolvulus* species from base to tip of stems. A. *C. arvensis* × 1. (1) *Failes* s.n. (NE25445a), (2,3) *Rodway* s.n. (HO 15261); B. *C. microsepalus.* (1) *Pfeiffer & Pfeiffer* s.n. (AD96919556) × 2, (2,3) *Orchard* 211 (AD) × 1; C. *C. graminetinus.* (1) *McDonald* 46 (BRI) × 0.5, (2) *McDonald* 46 (BRI) × 1, (3) *Fensham* 2803 (BRI) × 1, (4) *Fensham* 1736 (BRI) × 1; D. *C. remotus* (1-3) *Alcock* 653G (AD) × 1. Del. W. Smith

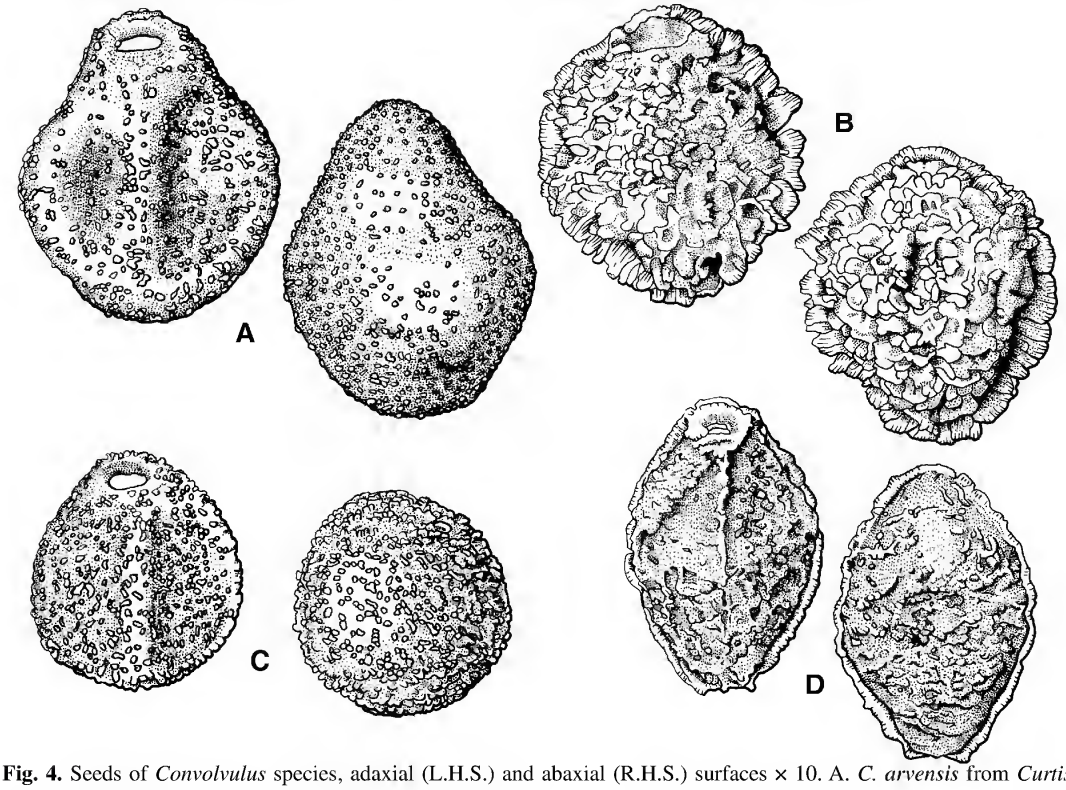
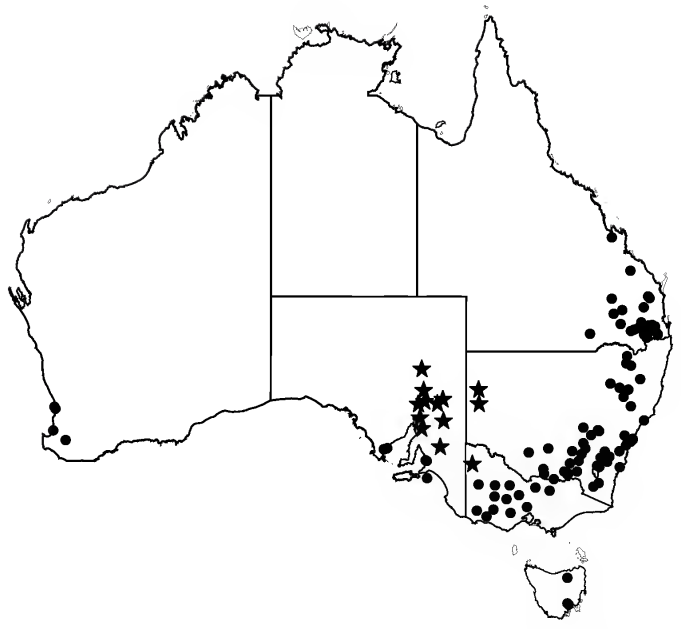


Fig. 4. Seeds of *Convolvulus* species, adaxial (L.H.S.) and abaxial (R.H.S.) surfaces × 10. A. *C. arvensis* from *Curtis* s.n. (HO36313); B. *C. microsepalus* from *Copley* 192 (AD); C. *C. graminetinus* from *Fensham* 3332 (BRI); D. *C. remotus* from *Lothian* 1214 (AD). Del. W. Smith.



Map 1. Distribution of ●. *Convolvulus arvensis.* ★. *C. microsepalus.* Del. W. Smith.

Feb 1983, *Morris* 8338 (HO); Granton, Jan 1981, *Orchard* 5278 (HO); Royal Park, Hobart, Mar 1961, *Somerville* s.n. (HO); Hobart, Jan 1877, *Spicer* 118 (HO).

***Distribution and habitat*:** *C. arvensis* is a native of Eurasia but is now widespread throughout the temperate regions of the world. In Australia, it is a weed of cultivation and roadsides, often on deep fertile clay soils. It has been recorded from most of the major cultivation regions of temperate Australia and northwards to the Darling Downs and central Queensland (Map 1).

***Affinities*:** Though it is not a native of Australia, *C. arvensis* most closely resembles *C. microsepalus*. Both species have sepals which are small and similar in shape with a blunt, somewhat emarginate apex, very different from those in other Australian species and both have hastate leaves with entire margins. However, the latter has much smaller flowers.

***Phenology*:** Flowering occurs mainly from mid spring to early autumn (October–March) with fruiting mainly in early to mid autumn (March-April).

***Notes*:** The date of introduction of this species into Australia is unknown. Bentham (1869) makes no reference to *C. arvensis* in Australia. Earliest herbarium records include *Woolls* s.n. (MEL) collected in 1869 in New South Wales, *Wilson* 12 (MEL) in 1883 in Victoria and *Spicer* 118 (HO) in 1877 in Tasmania. Woolls (1867) in his paper on accidental plant introductions does not mention *C. arvensis*.

***Etymology*:** The specific epithet is from the Latin *arvensis* meaning ' pertaining to fields or cultivated lands' which refers to the habitat where the species is commonly found.

2. Convolvulus microsepalus R.W. Johnson, Austrobaileya 2:410 (1987). **Type**: South Australia, Flinders Ranges: c. 51 km N of Quorn on the Quorn to Hawker road, 8 November 1970, *A.E. Orchard* 2626 (holo: AD; iso NCU, COLO, n.v.).

Perennial with trailing and twining stems; stems slender, terete, moderately densely to sparsely hairy, glabrescent, hairs appressed, 0.15–0.4 mm long. Leaves similar in shape from base to tip of the stem (Fig. 3B). Basal leaves petiolate; petiole short, 2–7 mm long; blade oblong, slightly hastate, 10–20 mm long, 4–5 mm wide, apex obtuse to bluntly acute, mucronulate, base truncate to shallowly cordate. Leaves on fertile stems petiolate; petiole 3–8 mm long; blade linear to oblong, sometimes triangular, hastate

or sagittate, 10–45 mm long, 3–20 mm wide, apex acute to rounded-truncate with a short recurved mucro, base truncate to cordate, basal lobes 1–10 mm long, acute to obtuse, entire, 2-toothed or lobed, ascending lobes absent, terminal lobe oblong, linear to linear-triangular, 10–40 mm long, 3–8 mm wide, entire to slightly undulate, moderately dense to sparsely hairy, hairs silvery, appressed 0.2–0.4 mm long. In upper parts, leaves similar but smaller. Inflorescence solitary, axillary, bracteolate, with solitary flowers; peduncle slender, terete, 8–30 mm long, densely hairy, hairs appressed, 0.3–0.4 mm long; bracteoles opposite, subulate to linear, 0.7–1.8 mm long, 0.4–0.5 mm wide, apex acute, ciliate, moderately to densely hairy on the back; pedicel 3–12 mm long, recurved at fruiting, moderately to densely hairy, hairs appressed 0.2–0.4 mm long. Outer sepals obovate-elliptic to obovate, 2–3 mm long, rarely to 4 mm, 2–3 mm wide, apex rounded to truncate, ± emarginate, glabrous or with some appressed hairs outside at the base and on the basal margin; inner sepals orbicular to obovate, 2.5–3.5 mm long, 3–3.5 mm wide, apex rounded to truncate, emarginate, mucronulate, base rounded, glabrous. Corolla funnel-shaped, white or pink, with a creamish-green throat, 5–8 mm long, 5–13 mm diameter, flared 2–3 mm above base of the tube; petals 6–9 mm long, 3–6 mm wide, with rounded apiculate lobes, glabrous except for a few hairs around the apex. Stamens 5, slightly unequal; filaments affixed to the corolla tube for 1–1.5 mm from the base, free for 1.8–3 mm with low tubercles, mainly along the margins, from almost the base of the corolla and extending for up to 3 mm; anthers oblong to triangular-oblong, 1–1.3 mm long, 0.5–0.75 mm wide, apex rounded, base sagittate, basal lobes 0.2–0.25 mm long. Ovary ovoid, 1.5–2 mm long, on a well developed disk, 0.2–0.4 mm high, glabrous; style 1.5–2.5 mm long, with cylindrical, falcate, obtuse stigmas, 1.2–2.3 mm long. Capsule globular to globular-ovoid, 5–7 mm long, 5–7 mm diameter, glabrous. Seeds ¼-globular, 3.5–4 mm long, 3–3.5 mm wide, dark brown to honey-coloured, surface finely punctate bearing prominent raised tubercles of fused hairs, usually laterally flattened and of irregular shape, to 0.25 mm high, with interrupted wing comprising fused hair-like structures (Fig. 4B).

***Specimens examined*: South Australia.** LAKE EYRE: 1 km S of Paradise Creek, c. 40 km S of Marree, Jun 1978, *Badman* 32 (AD). FLINDERS RANGES: Parachilna Gorge nr Mt Mary, c. 60 km N of Wilpena Pound, Oct 1987, *Browne* 463 (BRI); c. 16 km N of Hawker, Apr 1966, *Copley* 192 (AD); 8 miles E of Wilmington, Mar 1959, *Filson* 809 (MEL, AD); 5.1 km N of Fred Hughes (Eukaby) Gold Mine, Parachilna, Sep 1987, *Vonow* 584 (BRI). EASTERN: c. 6 km NE of Curnamona (Arkipena Springs road), Apr 1968, *Barker* 454 (AD); c. 3 km N of Curnamona Homestead, Apr 1968, *Orchard* 211 (AD); Oak Park Homestead, c. 50 km S of Yunta, Mar 1969, *Pfeiffer & Pfeiffer* s.n. (AD). NORTHERN LOFTY: reserve between Gladstone and Laura, Nov 1920, *J.M.Black Herb.* s.n. (AD). MURRAY: Upper Murray Mallee, E of Sutherlands, c. 105 km NE of Adelaide, Oct 1962, *Boehm* 376 (AD). **New South Wales.** 0.5 miles W of Fowlers Gap Research Station, May 1954, *Briggs* s.n. (NE); 42 km E of Broken Hill on Barrier Highway to Wilcannia, Nov 1989, *Palmer* 282 (CANB). **Victoria.** WIMMERA: Wimmera, *F. Mueller* Herb. [*Dallachy*?] (MEL 689646, 689644).

***Distribution and habitat*:** *C. microsepalus* is known mainly from eastern South Australia, where it occurs in the Flinders Ranges and surrounding areas. Two specimens of it on sheets bearing F. Mueller labels were collected from the Wimmera area. It has also been recorded from south-western NSW (Map 1). It grows in gravelly clay loam or loamy soils on open plains carrying chenopod shrublands.

***Affinities*:** *C. microsepalus* most closely resembles *C. remotus* in leaf shape and indumentum. However the sepals of *C. remotus* are about twice as long, are apiculate, not ± emarginate, and are hairy. The corolla of *C. remotus* is also much larger. The sepals of *C. microsepalus* most closely resemble those of *C. arvensis* but the latter has a corolla at least twice as large.

***Phenology*:** The main flowering period is from late winter to early autumn but flowers have occasionally been recorded at other times. Capsules are produced from spring onwards.

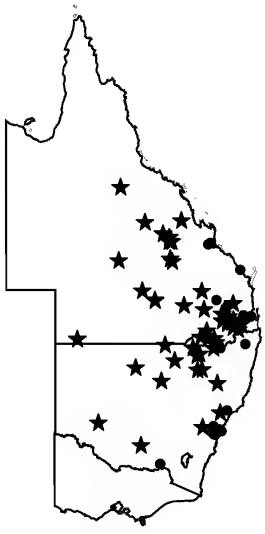
***Notes*:** *C. microsepalus* was first described as *Convolvulus* sp. A in the Flora of South Australia (Johnson 1986).

***Etymology*:** The specific epithet refers to the size of the sepals in this species which are by far the smallest of any species of *Convolvulus* recorded from Australia.

3. Convolvulus graminetinus R.W. Johnson, **sp. nov**. affinis *C. remoto* R.Br. sed corollis et sepalis minor, pedicellis ad fructificantem recurvis et paginis seminum differt. **Typus:** Queensland. LEICHHARDT DISTRICT: Gregory Mine Site (23°10'S 148°22'E), 50 km NE of Emerald, 25 November 1998, *R.W. Johnson* 5300 (holo: BRI; iso: BRI, CANB, NE, NSW).

Perennial with trailing and mainly twining stems; stems terete often ribbed, moderately to sparsely hairy, glabrescent, hairs crisped-appressed, mainly 0.2–0.35 mm long, rarely longer to 0.7 mm and more loosely appressed to ascending. Leaves may or may not vary in shape from base to tip of the stem (Fig. 3C). Basal leaves petiolate; petiole long, often equal to or longer than the blade; blade oblong-triangular to linear-triangular, commonly hastate, 24–40 mm long, 6–16 mm wide, apex acute to rounded, mucronulate, base cordate, basal lobes entire or 2-toothed, margin ± entire occasionally undulate, ± glabrous to very sparsely hairy, hairs crisped, appressed to ascending, 0.25–0.5 mm long. Leaves on fertile stems petiolate; petiole short, 2–10(–20) mm long; blade linear, triangular-ovate to narrow elliptic, hastate or sagittate, 15–60 mm long, 2–15 mm wide, apex acute, mucronulate, base cordate to truncate, slightly decurrent, basal lobes linear, 1–10(–15) mm long, entire, two-toothed or lobed, or with a short recurved tooth or lobe on the lower margin, ascending lobes absent or occasionally becoming prominent in terminal parts, linear, to 25 mm long and 1–3 mm wide, margin ± entire, terminal lobe narrow-linear or narrow-elliptic to narrow-oblong, oblong-elliptic or narrow-ovate, 20–55 mm long, 2–8 mm wide, margin ± entire to undulate, occasionally with a few lobes on more basal leaves, ± glabrous to very sparsely hairy above, rarely denser, sparse below, hairs crisped-appressed to ascending, 0.1–0.5 mm long. In upper parts, petiole and blade shorter and lobes narrower. Inflorescence solitary, axillary, bracteolate, a one-sided dichasium with 1–2 flowers, or occasionally with 2 inflorescences per axil; peduncle terete, wiry, 7–55 mm long, moderately to sparsely hairy, hairs crisped-appressed, 0.15–0.3 mm long; bracteoles opposite to subopposite, occasionally alternate, linear to subulate, 1–2 mm long, 0.35–0.5 mm wide, apex acute, with or without cilia, ± glabrous or very sparsely hairy on the back; pedicel 3–12 mm long, recurved at fruiting, hairs as for peduncle, sometimes denser. Outer sepals obovate to elliptic or oblong, 3–5(–5.5) mm long, 2.2–3.8 mm wide, apex acute to obtuse-rounded with a short recurved apiculum, ± ciliate, ± glabrous to sparsely hairy, rarely denser, outside, hairs crisped, ± appressed to ascending, 0.1–0.4 mm long; inner sepals obovate, obovate-orbicular to broadly elliptic, 3.5–5 mm long, 2.5–4 mm wide, apex rounded, occasionally acuminate, with a short recurved apiculum, base rounded to truncate, glabrous or with a few hairs at the tip. Corolla funnel shaped, pink, occasionally white, with a greenish-cream throat, 6–10 mm long, 7.5–15 mm diameter, flared 3–3.8 mm above the base of the tube; petals 7–11 mm long, 4–7 mm wide, with rounded-triangular, apiculate lobes, glabrous except for hairs on the outside of the midpetaline band for 2–3 mm from the apex. Stamens 5, unequal; filaments affixed to the corolla tube for 1.5–2.5 mm from the base, free for 1.6–3.5 mm, with low tubercles from 0.5 mm above the base of the corolla and extending for 2–3.5 mm; anthers oblong to ovate-oblong, 0.8–1.5 mm long, 0.55–0.85 mm wide, apex obtuse, base sagittate, basal lobes 0.15–0.4 mm long. Ovary ovoid, 1-1.3 mm long, on an undulate disk 0.25–0.4 mm high, glabrous; style 2.5–4 mm long, with cylindrical, slightly flattened, obtuse stigmas, 1.4–2.2 mm long. Capsule globular, 4–5.5 mm long and diameter, glabrous. Seeds 4, ¼-globular to ¼-obovoid-globular, 2.5–3(–3.5) mm long, 2–3 mm wide, dark brown to black, surface finely punctate bearing low, laterally flattened, wavy tubercles forming a close regular pattern, wingless (Fig. 4C).

***Selected specimens (64 specimens examined)*: Queensland.** NORTH KENNEDY DISTRICT: 72 km NW of Pentland, Jun 1993, *Thompson & Figg* HUG443 (BRI). MITCHELL DISTRICT: Thornleigh Ck, stockroute Malverton to Gowan Hills, 70 km W of Blackall, Nov 1975, *Johnson* 3017 (BRI). SOUTH KENNEDY DISTRICT: 150 km NW of Clermont, Aug 1977, *Dale* 169 (BRI). LEICHHARDT DISTRICT: Peak Downs, Jun 1951, *Everist* 4378 (BRI); 13 km SE of Capella, Mar 1995, *Fensham* 2803 (BRI). BURNETT DISTRICT: Kingaroy, Oct 1949, *Benham* s.n. (BRI). WARREGO DISTRICT: Morven, Apr 1936, *Blake* 10996 (BRI); Pinnacle Station, W of Augathella, Mar 1982, *Greenfield* JT1090 (BRI). MARANOA DISTRICT: 10 miles SE of Roma, Apr 1961, *Johnson* 2075 (BRI). DARLING DOWNS DISTRICT: between



Map 2. Distribution of ★. *Convolvulus graminetinus.* ●. *C. erubescens.*

Clifton and Allora, Nov 1946, *Everist & Webb* 1251 (BRI); 7 km SW of Toowoomba, Apr 1994, *Fensham* 1736 (BRI). Moreton District: Cowley Vale, 16 miles E of Helidon, Aug 1969, *Schroder* s.n. (BRI). **New South Wales.** c. 13 km WSW of Moree on road to Collarenebri, Sep 1975, *Henderson* H2352 (BRI); Tamworth District, Feb 1967, *Loveridge* s.n. (NSW); Twenty-one Mile Warrambool between Walgett and Collarenebri, Nov 1967, *McGillivray* 2785 (NSW); 5.5 km W of North Star, near entrance to "Mungle", Sep 1988, *Moore* 8792 (CANB); 4 km S of Melton Grove on Darnick road, just N of Willandra, May 1994, *Porteners & Benson* 9405019 (NSW); 10 miles NE of Yetman, Nov 1952, *SWQS* 1317 (BRI); Iolanthe, c. 25 km SW of Garah, Apr 1976, *Wilson* 1470 (NSW).

***Distribution and habitat*:** *C. graminetinus* is widespread throughout the semi-arid and subhumid regions of Queensland and New South Wales though it extends into coastal areas in south-east Queensland (Map 2). It occurs mainly on clay soils on alluvial plains with *Eucalyptus coolabah* and *E. tereticornis* and on rolling downs, often derived from basalt, dominated by *Dichanthium sericeum.* In north-eastern NSW it is found in *Eucalyptus albens* woodlands on clay to clay loam soils and in *Acacia harpophylla - Casuarina cristata* woodlands. In drier areas it occurs on clay soil downs with chenopods.

***Affinities*:** *C. graminetinus* appears most closely related to *C. erubescens* with its similar crisped appressed hairs, and its tendency for the stems and peduncles to be slightly ribbed. Its seeds have a similar surface pattern and the inflorescence tends to be a one-sided dichasium with 1 or 2 flowers. *C. erubescens* grows in moister *Eucalyptus* forests and on the edges of rainforest whereas *C. graminetinus* is found in grasslands and marginal brigalow woodlands on heavy clay soils in sub-humid to arid areas. Plants with hastate-sagittate leaves resemble those of *C. remotus.* However, *C. graminetinus* has smaller and less hairy sepals, smaller flowers and the seeds are quite different in size, shape and surface pattern.

***Phenology*:** Flowering and fruiting occurs throughout the summer to early winter (November-June).

***Notes*:** Throughout central Queensland, populations of *C. graminetinus* tend to have hastate leaves, ± glabrous sepals and crisped appressed hairs though plants with leaves bearing prominent ascending lobes are found. Similar populations are found through the north western plains of New South Wales with the presence of ascending lobes on leaves becoming more common. However, in the north western slopes region of that state, some populations, such as *Moore* 9108 (CANB) have many spreading hairs on leaves, stems and sepals. Aside from this character, the leaves are often deeply divided with well developed ascending lobes. Two specimens *Hoskings* 1608 and 1681 (NSW) from the same population in Oxley Park, Tamworth are revealing. *Hoskings* 1608 collected in October 1998 features typical short crisped appressed hairs and ± glabrous sepals in contrast to the specimen collected in February 1999 which bears moderately dense spreading hairs on leaves and sepals similar to those in *Moore* 9108. A specimen collected by J. Crawford from near Bingera (CBG12272) contains two separate branches, each branch representing the two different forms described above. The specimen, *Portenters & Benson* 9405019 , was collected at a distance from the main area of distribution of this species. It has longer hairs, longer bracteoles, much hairier sepals, commonly 2 inflorescences per axil and larger seeds than do the other specimens. *Wilson* 1470 also has large seeds but it otherwise agrees morphologically with specimens of *C. graminetinus* from Queensland.

This species has been recorded as a weed of cultivation on clay soils on the Darling Downs and Central Highlands of Queensland.

***Etymology*:** The specific epithet is derived from the latin *graminetum*, meaning grassland, and *-inum,* belonging to. This refers to the most common habitat where this species occurs.

***Conservation Status*:** This species is widespread and not endangered at present.

4. Convolvulus remotus R.Br., Prod.: 483 (1810). **Type:** Australia: South Coast [Port Lincoln, 4 March 1802], *R. Brown* (holo: BM; iso: MEL[MEL689915]).

Convolvulus preissii de Vriese in Lehmann, Plantae Preissianae 1: 346 (1845). **Type:** Ad promontorium Cape Riche, 21 Nov 1840, *Herb. Preiss* no. 1927 (holo: LD).

Convolvulus huegelii de Vriese in Lehmann, Plantae Preissianae 1: 346 (1845). **Type**: In solo limoso haud longe a praedio rustico Maddington, ad flumiun Canning River, 2 Nov 1839, *Herb. Preiss* no. 1928 (holo: LD).

Perennial with twining, sometimes trailing, stems; stems terete, sparsely to densely hairy, hairs short, appressed 0.2–0.4(–0.6) mm long. Leaves somewhat variable in shape and size from base to tip of the stem (Fig. 3D). Basal leaves petiolate; petiole often longer than the blade, 12–20 mm long; blade triangular, triangular-oblong to triangular-ovate, bluntly hastate to sagittate, 10–30 mm long, 3–12 mm wide, apex acute to rounded, sometimes emarginate, mucronate, base truncate, decurrent, terminal lobe entire to slightly undulate, sparsely hairy above, slightly denser below, hairs appressed, rarely spreading, 0.1–0.4(–0.5) mm long. Leaves on fertile stems petiolate; petiole 2–20 mm long; blade ovate to triangular or triangular-oblong, bluntly hastate to auriculate-sagittate, 10–80 mm long, 5–40 mm wide, apex acute to rounded, sometimes emarginate, mucronate, base cordate, rarely truncate, basal lobes spreading or recurved, to 10 mm long, obtuse, entire, sometimes 2-toothed, occasionally with a distinct recurved lobe from the lower margin, very rarely with a short ascending lobe, terminal lobe linear or oblong, often triangular, occasionally narrow elliptic, to 67 mm long, 2–17 mm wide, entire or rarely slightly undulate, moderately to densely hairy above, more rarely sparsely hairy, similar to slightly denser below, hairs appressed, 0.1–0.4(–0.5) mm long, silvery. In upper parts, petiole shorter and blades smaller with narrower lobes. Inflorescence solitary, axillary, bracteolate, a one-sided dichasium, with 1–2, rarely 3, flowers, or rarely with 2 inflorescences per axil; peduncle filiform, 5–42 mm long, moderately to densely hairy, hairs appressed, 0.2–0.4 mm long; bracteoles opposite to sub-opposite, subulate to linear, 1.3–3 mm long, 0.25–0.5 mm wide, apex acute, ciliate, moderately to sparsely hairy on the back; pedicel 3–16 mm long, hairs as for peduncle. Outer sepals broadly elliptic to almost orbicular, occasionally slightly obovate, 5–6.5(–7) mm long, 3.5–4.5(–5.5) mm wide, apex obtuse to rounded, often shortly apiculate, mucronate, usually ciliate, moderately to densely, rarely sparsely, hairy outside, hairs mainly appressed, 0.2–0.4(–0.6) mm long; inner sepals broadly elliptic to almost orbicular, often obovate-elliptic, rarely ovate-elliptic, 4.2–6 mm long, 3–4.5 mm wide, apex rounded, shortly apiculate, mucronate, base truncate, face glabrous to sparsely hairy. Corolla funnel-shaped, pink to pale pink, occasionally white, mauve or reddish-purple, midpetaline band brownish-yellow on the outside, throat creamish-green, 8–12 mm long, 8–20 mm diameter, flared 3.5–5 mm above the base of the tube; petals 9–18 mm long, 4–11 mm wide, with rounded-triangular, emarginate lobes, often with a short apiculum, glabrous except for hairs on the outside of the midpetaline band for up to 5 mm from the apex. Stamens 5, slightly unequal in length; filaments affixed to the corolla tube for 1.5–3.5 mm from the base, free for 2–5 mm, with low tubercles from just above the base of the corolla and extending for 2.5–5 mm; anthers oblong to triangular-oblong, 1–2 mm long, 0.6–1 mm wide, apex rounded to emarginate, base sagittate, basal lobes 0.2–0.5 mm long. Ovary ovoid, 1–2.5 mm long, on a prominent disk, 0.3–0.5 mm high, glabrous; style 3.5–6 mm long, with cylindrical to slightly obovate, obtuse stigmas, 1.3–2.5 mm long. Capsule globular to globular-ovoid, 5.5–8.5 mm long, 5–7 mm diameter, glabrous. Seeds 4, ¼-ellipsoid or ¼-globular-ellipsoid, 3–4.8 mm long, 2–3 mm wide, brown to dark brown

often with irregular darker patches and stripes, surface finely punctate bearing low irregular ± anastomosing ridges and tubercles and a narrow ± continuous to broken wing on the outer margins (Fig. 4D).

Selected specimens (309 specimens examined): **Western Australia.** 201 miles E of Kalgoorlie on Trans-Australian Railway, Jun 1964, *Aplin & Trudgen* 5762 (PERTH); 1.3 km S on Keating road, Chittering, Dec 1981, *Cranfield* 1980 (PERTH); 97 km NW of Forrest, Apr 1984, *Downing* 919 (PERTH); Rocky Pool, Gascoyne River, c. 850 km N of Perth, Oct 1975, *Kenneally* 4643 (PERTH). **Northern Territory.** Palm Valley, Jul 1965, *Beauglehole* 10409 (BRI); Bond Gap, Simpsons Gap National Park, Nov 1980, *Latz* 8530 (DNA, BRI); Mt Benstead Creek, c. 50 km ENE of Alice Springs, Jun 1984, *Latz* 9928 (DNA, BRI). **South Australia.** 12 miles N of Bordertown, Nov 1964, *Beauglehole* 19821 (AD); c. 5 km NE of McLaren Flat, c. 30 km S of Adelaide, Dec 1976, *Bell* 75 (AD); Beresford Hill, Oct 1978, *Chorney* 991 (AD); 25 km E of Watson, Aug 1980, *Weber* 6588 (AD); c. 1 km N of Nudlamutana Well, c. 20 km N of Balcanoona, Oct 1967, *Whibley* 2180 (AD). **Queensland.** "Budgerygar", 64 km SW of Yaraka, Nov 1975, *Johnson* 3045, 3111 (BRI). **New South Wales.** Delta road junction, Sturt Highway, E of Wentworth, May 1979, *Fox* 7905071 (NSW); NE edge of Narran Lake, Brewarrina, Nov 1967, *McGillivray* 2856 (NSW); 26 miles N of Wentworth on road to Broken Hill, Aug 1969, *Rodd* s.n. (NSW); Depot Glen, 12 km N of Milparinka, Sep 1990, *Wilson* 1646 (NSW). **Victoria.** GRAMPIANS: Mt Arapiles, S side, upper reaches of N arm of golf course gorge, Nov 1968, *Beauglehole* 29687 (MEL). MURRAY MALLEE: Lake Hindmarsh Reserve, Dec 1986, *Beauglehole* 87629 & *Huebner* (MEL); Lake Wallawalla area, c. 4 km NW of causeway on Lake Wallawalla, Dec 1988, *Browne* 566 (LTB, BRI); Thurla, South Cardross Lakes, Dec 1964, *Chandler* ACB19687 (MEL).

***Distribution and habitat*:** *C. remotus* occurs mainly south of the Tropic of Capricorn in all mainland states. It is also absent from eastern coastal areas (Map 3). It occurs on a wide variety of soil types from clays through loams to sands. In more arid areas, it occurs on sandhills in *Zygochloa* grasslands as well as on alluvial soils along drainage lines. It is commonly found in chenopod shrublands with bluebush and saltbush. In semi-arid areas, it has been recorded from *Acacia* shrublands, including mulga, and from open mallee woodlands and heaths.

***Affinities*:** *C. remotus* does not appear to be closely related to the other Australian species. As noted under *C. graminetinus*, sterile specimens can resemble those of that species.

***Phenology*:** Flowering occurs throughout the year but mainly in spring and early summer (August-December); fruit are found mainly in spring to early autumn.

***Etymology*:** Unknown

***Conservation Status*:** This species is widespread and not endangered at present.

5. Convolvulus crispifolius F. Muell., Linnaea 25:423 (1853), (as "crispifolias"). **Type**: South Australia. In montibus nudis petraeis aliquot milliaria Anglica directione boreali-orientali a Cudnaka, October 1851, *F. Mueller* s.n. (holo: MEL[MEL1544962]; iso: MEL[MEL689518]).

Perennial with short trailing stems, rarely to 1 m long; stems wiry, terete, moderately to densely hairy, becoming less densely hairy with age, hairs appressed to loosely ascending, 0.2–1 mm long. Leaves somewhat variable in shape and size from base to tip of the stem (Fig. 5A). Basal leaves petiolate; petiole long, often longer than the blade; blade ovate, oblong-ovate to triangular-ovate, lacking distinct basal lobes, 10–20 mm long, 4–18 mm wide, apex obtuse to rounded, base truncate to shallowly cordate, margin crenate, moderately to densely hairy, hairs appressed, 0.15–0.6 mm long. Leaves on fertile stems petiolate; petiole short, 2–15 mm long; blade ovate, oblong-ovate to triangular-ovate, sometimes slightly hastate, 5–25 mm long, 4–15 mm wide, apex acute to truncate, base cordate, ± decurrent, margin unevenly crenate to bluntly serrate, with 7–10 teeth per side, more deeply indented towards the base or with short basal lobes, moderately to densely hairy, hairs appressed, 0.3–0.8 mm long. In upper parts, basal and ascending lobes becoming more prominent but rarely exceeding 3 mm in length. Inflorescence solitary, axillary, bracteolate, a one-sided dichasium with 1–2 flowers; peduncle terete, 2–12 mm long, rarely extending to 20 mm at fruiting, moderately to densely sericeous, hairs appressed to loosely ascending, 0.2–0.5 mm long; bracteoles opposite, linear-subulate to narrowly ovate, 1.2–2.2 mm long, 0.25–0.3 mm wide, apex acute, ciliate, densely hairy on the back; pedicel 1.5–4 mm long, recurved at fruiting, hairs as

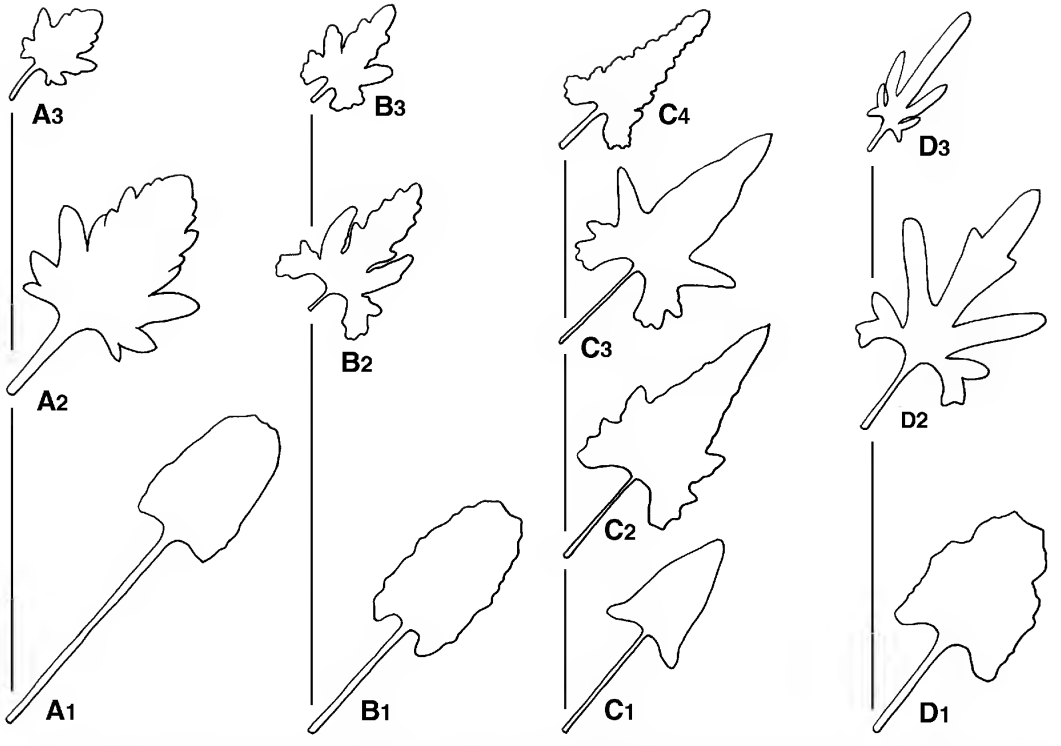
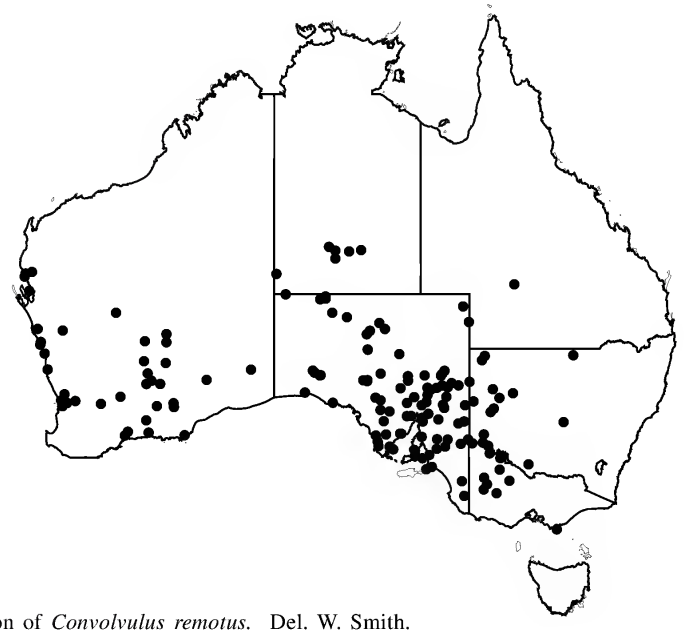


Fig. 5. Variation in leaf shape of *Convolvulus* species from base to tip of stems A. *C. crispifolius*. (1) *Copley* 571 (AD) × 1, (2,3) *Chinnock* 2915 (AD) × 2; B. *C. eyreanus*. (1) *Kuchel* 884 (AD) × 1, (2) *Hill* 163 (AD) × 0.5; (3) *Hill* 163 (AD) × 1; C. *C. erubescens*. (1) *Johnson & Pedley* 453 (BRI) × 0.5, (2) *Simmonds* s.n. (BRI-AQ275832) × 0.5, (3) *Hind* s.n. (NSW198642) × 0.5, (4) *McBarron* 12570 (NSW) × 2; D. *C. wimmerensis* × 1. (1) *Beauglehole* ACB83982 (MEL) (2,3) *Beauglehole* ACB86599 (MEL). Del. W. Smith.



Map 3. Distribution of *Convolvulus remotus*. Del. W. Smith.

for peduncle. Outer sepals obovate to obovate-elliptic, 4-–4.5 mm long, 3–3.7 mm wide, apex rounded-obtuse with a distinct recurved apiculum, moderately to densely ciliate, sericeous outside, hairs appressed to loosely ascending, 0.25–0.7 mm long; inner sepals obovate to obovate-elliptic or obovate-orbicular, 3.6–4.3 mm long, 3–4 mm wide, apex rounded or truncate, shortly apiculate, base obtuse to truncate, glabrous or with hairs on the midrib. Corolla funnel-shaped, white to pink, with a whitish-green throat, 5–6 mm long, 6–8 mm diameter, flared 3–4 mm above the base of the tube; petals 6–8 mm long, 2.5–3.5 mm wide, with irregularly rounded, bluntly apiculate lobes, glabrous except for sericeous hairs on the outside of the midpetaline band for 2–2.5 mm from the apex. Stamens 5, unequal; filaments affixed to the corolla tube for 1.5–2 mm from the base, free for 1.5–2.8 mm, with low tubercles, mainly along the margins, from almost the base of the corolla and extending for 2–3 mm; anthers oblong to ovate, 0.65–0.75 mm long, 0.5–0.7 mm wide, apex truncate or rounded, sometimes emarginate or apiculate, base sagittate, basal lobes 0.1–0.15 mm long. Ovary ovoid to ovoid-elliptic, 1–1.25 mm long, on a distinct disk 0.25–0.3 mm high, glabrous; style furrowed, 2–2.5 mm long, with cylindrical to narrowly ellipsoid, obtuse stigmas, 1.2–1.5 mm long. Capsule globular to globular-ovoid, 4–4.5 mm long, 4–4.5 mm diameter, glabrous. Seeds 4, ¼ globular, 2.4–3 mm long, 1.75–2 mm wide, dark brown to black, surface finely punctate bearing low, short irregular sinuate ridges and a narrow, ± continuous wing of fused hair follicles, 0.1–0.15 mm wide (Fig. 6A).

***Specimens examined*: South Australia.** FLINDERS RANGES: Wilpena Pound, Sep 1989, *Bates* 20915 (BRI). EYRE PENINSULA: Hundred of Hawker, Lincoln Highway, c. 16 km S of Elbow Hill, Jul 1965, *Alcock* 652 (AD); Hundred of Hambidge, Flora & Fauna Reserve, Prominent Hill, NE of Loch, Sep 1965, *Alcock* 1063 (AD); Lincoln Highway, N of Elbow Hill, Nov 1965, *Alcock,* s.n. (AD); Hambidge Flora & Fauna Reserve, W of Prominent Hill, NE of Lock, Oct 1966, *Alcock* 1151 (AD); Crown lands, WNW of Kimba, Oct 1981, *Alcock* 9001 (AD); 23 km NE of Poochera, N of Karoultaby, Oct 1975, *Chinnock* 2915 (AD); Mount Ive, Gawler Ranges, c. 160 km W of Port Augusta, Sep 1969, *Donner* 3242 (AD); between Cowell and Arno Bay, Nov 1961, *Kraehenbuehl* 526 (AD); junction of Sections 24 & 14, Hundred of Verran, c. 95 km NNE of Port Lincoln, Oct 1963, *Kuchel* 1470 (AD); County Buxton, Pinkawillinie, c. 36 km WNW of Kimba, Feb 1959, *Rohrlach* 166 (AD); Price Beach, Oct 1983 *Toelken* 7741 (BRI); c. 5 km NE of Corrobinnie Hill, Oct 1981, *Weber* 6932 (AD). YORKE PENINSULA: Hundred of Wiltunga, NW corner of Sect 168, c. 140 km NNW of Adelaide, Aug 1966, *Copley* 571 (AD); Sect 200, Hundred of Wiltunga, c. 140 km NNW of Adelaide, Nov 1966, *Copley* 876 (AD); Ardrossan, c. 80 km NW of Adelaide, *Tate* s.n. (AD). MURRAY: Berri, Jun 1921 *J.M.Black Herb* s.n.(AD); Berri, Jan 1921, *Cleland* s.n.(AD); Mantung District, c. 140 km ENE of Adelaide, Aug 1924, *Cleland* s.n. (AD); between Overland corner and Barmera, Sep 1965, *Eichler* s.n. (AD). **Victoria.** MURRAY MALLEE: Sunset Country, Pheeny's Track, c.10 km W of S. Bambill Track, Oct 1981, *Browne* 536 (BRI).

***Distribution and habitat*:** *C. crispifolius* is found south of 32°S in the southern part of the Flinders Ranges and in both the Eyre and Yorke Peninsulas of South Australia. Its distribution extends eastward into the Murray-Mallee area and into far western Victoria (Map 4). It occurs on sandy and sandy-loam, sometimes rocky, soils, commonly in mallee scrubs, and on sandhills.

***Affinities*:** *C. crispifolius* appears most closely related to *C. eyreanus*. Johnson (1987), in describing *C. eyreanus*, referred to a form of that species with small serrate, silvery coloured leaves which he considered may prove taxonomically distinct. This form is now considered referable to *C. crispifolius*. The latter species can be distinguished from *C. eyreanus* by its small crenate, silvery coloured leaves, its shorter pedicels and its smaller seeds and capsules. *C. eyreanus* has a more vigorous twining habit; branches from the crown in *C. crispifolius* are mainly prostrate and non-twining.

Phenology: Flowering has been recorded mainly from spring to early summer with fruiting extending into the late summer.

***Notes*:** Though this species was described in 1853, the name has rarely appeared in print. Strangely, Bentham (1869) did not take account of the name and appeared unaware of its publication. Under *C. erubescens* Sims he remarked on a remarkable form or variety ".. with the leaves very densely tomentose and much-cut and crisped and the peduncles very short from Cudnaka" which had been collected by Mueller. This specimen had been selected by Mueller as the type for the name of his species,

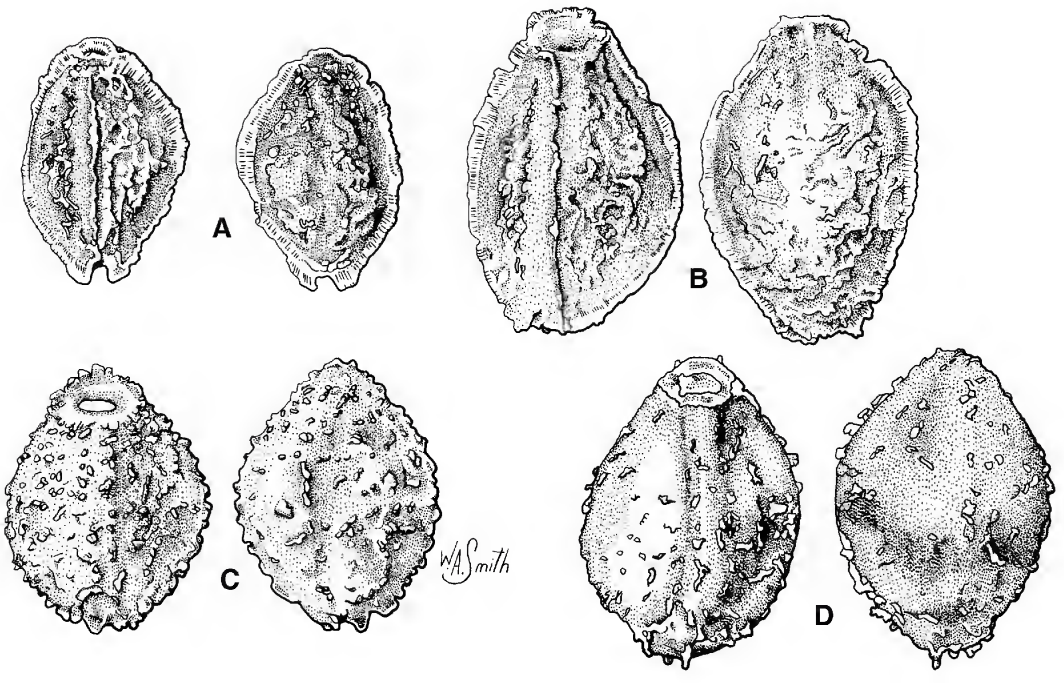
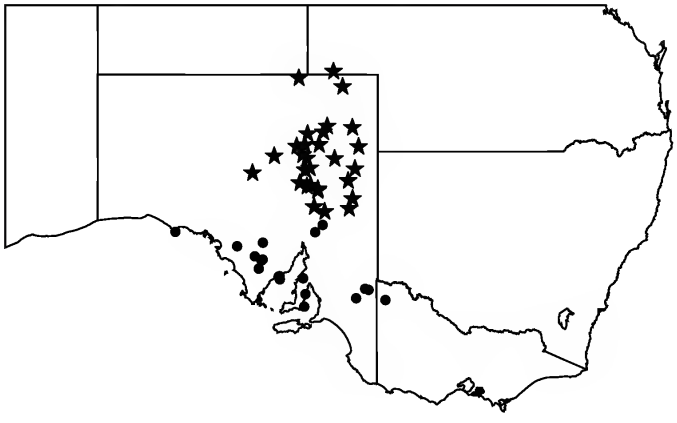


Fig. 6. Seeds of *Convolvulus* species, adaxial (L.H.S.) and abaxial (R.H.S.) surfaces × 10. A. *C. crispifolius* from *Chinnock* 2915 (AD); B. *C. eyreanus* from *Donner* 3531 (AD); C. *C. erubescens* from *Johnson* 1801 (BRI); D. *C. wimmerensis* from *Beauglehole* ACB82670 (MEL). Del. W. Smith.



Map 4. Distribution of ●. *Convolvulus crispifolius.* ★. *C. eyreanus.* Del. W. Smith.

C. crispifolius. Mueller (1864) wrote of the extreme variation existing within *C. erubescens* and reduced *C. crispifolias* (now spelt as *C. crispifolius*) to synonomy under *C. erubescens*. I was not aware of its existence until after *C. eyreanus* was described.

***Etymology*:** The specific epithet refers to the characteristically unevenly crenate to bluntly serrate margins of the leaves.

6. Convolvulus eyreanus R.W. Johnson, Austrobaileya 2:408 (1987). **Type**: South Australia: Frome East, c. 40 km ENE of Frome Downs Homestead, 23 July 1971, *N.N. Donner* 3531 (holo: AD; iso: Altona Springs, Oshkosh, n.v.).

Perennial with trailing and twining stems; stems terete, sericeous, moderate to densely hairy on younger parts becoming less dense with age, hairs appressed to ascending, 0.2–0.7 mm long. Leaves variable in shape and size from base to tip of the stem (Fig. 5B). Basal leaves petiolate; petiole 3–25 mm long; blade oblong to oblong-triangular, barely hastate, 8–20 mm long, 3–18 mm wide, apex truncate, mucronulate, base truncate to barely cordate, margin undulate, toothed or lobed, with 6–7 lobes/side, moderately to densely hairy, hairs ± appressed, 0.2–0.7 mm long. Leaves on fertile stems petiolate; petiole 1–10(–12) mm long; blade ovate to oblong, hastate or sagittate, 7–35 mm long, 3–20 mm wide, apex acute to rounded, mucronulate, base cordate, margin serrate to shallowly lobed, basal lobes often more prominent, 2–10(–20) mm long, entire to 2 or 3-lobed, ascending lobes linear, 3–16(–22) mm long, entire to shallowly lobed, terminal lobe linear to oblong, crenate to shallowly lobed with 5–8 lobes or rounded teeth, densely sericeous and silvery on both sides, hairs 0.2–0.6 mm long, ± appressed. On terminal branches, basal lobes becoming more prominent with ascending lobes to 7–8 mm and basal 2–3 mm long, often with a secondary recurved 3-toothed lobe. Inflorescence solitary, axillary, bracteolate, a one-sided dichasium with 1 or 2, rarely 3 flowers; peduncle slender, terete, 10–30(–60) mm long, moderately to densely hairy, hairs appressed to ascending, occasionally erect, 0.2–0.5 mm long; bracteoles opposite to subopposite, linear to subulate, 1–3 mm long, 0.3–0.5 mm wide, apex acute, moderately to densely ciliate, cilia 0.25–0.5 mm long, moderately to densely hairy on the back, hairs ± appressed to ascending, 0.2–0.5 mm long; pedicels terete, 1–10 mm long, hairs as for peduncle. Outer sepals obovate, obovate-elliptic to obovate-oblong, 4.2–5.5 mm long, 3–4 mm wide, apex bluntly acute to rounded with a short recurved apiculum, moderately ciliate, cilia 0.3–0.7 mm long, sparsest at the tip, moderately to densely hairy outside, hairs ± appressed to ascending, 0.2–0.6 mm long; inner sepals obovate, 3.2–4. 5 mm long, 3–3.7 mm wide, apex rounded, abruptly acuminate, with a short recurved apiculum, base rounded to obtuse, glabrous or with occasional hairs mainly on midrib and at base. Corolla funnel-shaped, off-white to pink, 6–8 mm long, 6–10 mm diameter, flared 3.5–4 mm above the base of the tube; petals 8–9 mm long, 3.7–4.5 mm wide, with well developed rounded-triangular and obtuse lobes, glabrous except for some appressed hairs on the outside of the midpetaline band for 2.5–3 mm from apex. Stamens 5, unequal; filaments affixed to the corolla tube for 1.8–2 mm from the base, free for 2–4.3 mm, with low tubercles to 0.1 mm long, mainly along the margins, from almost the base of corolla and extending for 2–3 mm; anthers oblong to triangular-ovate, 0.75–0.95 mm long, 0.55–0.7 mm wide, apex obtuse to rounded, apiculate, base sagittate, basal lobes 0.1–0.2 mm long. Ovary ovoid, c. 1 mm long, on a disk 0.2–0.3 mm high, glabrous or with an occasional hair in the upper part; style 2.7–3 mm long, glabrous or hairy, with cylindrical to very narrowly ellipsoid, occasionally falcate, stigmas, 1–1.4 mm long. Capsule globular to globular-ovoid, 6–7 mm long, 5–5.5 mm diameter, glabrous or with a few hairs at the apex. Seeds 4, ¼-globular, 3.2–4.4 mm long, 2.3–3 mm wide, dark brown, surface finely punctate bearing irregular shaped tubercles or short wavy ridges, with a narrow discontinuous to ± continuous wing, 0.1–0.2 mm wide (Fig. 6B).

Selected specimens (43 specimens examined): **South Australia.** Lake Eyre Region: Far N Lake Eyre, Central Hunt Peninsula, just N of Muloorina H/S, Sep 1968, *Cornwall* 109 (AD); Mt Gason Bore, Birdsville Track, c. 250 km NE of Marree, Sep 1960, *Filson* 3330 (AD, MEL); Wirragalpina Swamp, c. 46 km WSW of new Stuart H/S, Mar 1984, *Haegi* 3353 (BRI); Muloorina Station between Station and Lake Eyre, Jul 1955, *Hill*

163 (AD); Birdsville Track nr camp at Lake Palankarinna, c. 30 km N of Dulkaninna H/S, Mar 1972, *Jackson* 1901 (AD); Mulka Bore Ruins, 3 miles S of new H/S, c.155 km NNE of Marree, Aug 1960, *Lothian & Francis* 280 (AD); Ooroowilanie, c.165 km NNE of Marree, Jul 1960, *SA Pastoral Board* s.n. (AD); just S of Strangways Railway Siding, 53 km E of William Creek, Mar 1983, *Weber* 8851 (BRI). FLINDERS RANGES REGION: Oraparinna National Park, central portion, c. 6 km SSW of headquarters, *Jackson* 1767 (AD); c. 25 km S of Moolawatana Station, c. 140 km ENE of Leigh Creek, Aug 1963, *Kuchel* 884 (AD); c. 8 km W of Yadlakenna Dam, between Myrtle Springs and Termination Hill, Nov 1964, *Lothian* 3385 (AD); Lake Torrens East, Motpena, c. 24 km WSW of Parachilna, Aug 1955, *SA Pastoral Board* s.n. (AD); Ideyaka, Sep 1883, *Tate* s.n. (AD). GAIRDNER-TORRENS REGION: Mulgaria, Aug 1955, *SA Pastoral Board* s.n. (AD); Lake Torrens Basin, c. 15 km W of Yadlakenna Well, c. 30 km NW of Leigh Creek, Nov 1964, *Lothian* 3428 (AD). EASTERN REGION: Frome Downs Station, Oct 1971, *Trezise* 348 (AD); 5 km N of North Mulga Outstation on pipeline, Sep 1987, *Vonow* 702 (BRI); Lake Frome East, Billeroo Creek Area, c. 45 km ENE of Frome Downs Homestead, Jul 1971, *Whibley* 3455 (AD). **Queensland.** GREGORY SOUTH DISTRICT: 3 km S of Birdsville via old cement crossing road heading S, Sep 1995, *Edmunds* AD149 (BRI).

***Distribution and habitat*:** *C. eyreanus* occurs throughout the north-eastern parts of South Australia in the basins of Lake Eyre, Lake Torrens and Lake Frome. It also grows in the Simpson Desert extending into Queensland, south of Birdsville (Map 4). It is found mainly on sand dunes and associated habitats, often growing in *Acacia* shrublands.

***Affinities*:** *C. eyreanus* is most closely related to *C. crispifolius*. It also resembles *C. clementii* but can be distinguished from that species by its more sericeous vestiture, more shallowly lobed leaves and its seed size and surface architecture.

***Phenology*:** Flowering and fruiting occurs mainly from the late winter to early summer.

***Etymology*:** The specific epithet refers to the name Eyre in Lake Eyre and the Eyre Region of South Australia, both named in honour of the Australian explorer, Edwin John Eyre (1815-1901).

***Conservation Status*:** This species appears to be widespread in South Australia but is known from only one collection in Queensland.

7. Convolvulus erubescens Sims, Curtis's Botanical Magazine 27: t. 1067 (1807) **Type:** NSW, *Loddiges* s.n. (holo: not found).

Convolvulus erubescens var. *dilatatus* Choisy in A.DC., Prodr. 9:412 (1845). **Type**: "Varietas e cultura nota (described from living plants in the wild - no type) (v.v.)".

Perennial with trailing and twining stems; stems terete, ribbed to narrowly winged, moderately to sparsely hairy, becoming sparser with age, hairs mainly crisped-appressed, 0.2–0.35(–0.5) mm long. Leaves variable in shape and size from base to tip of the stem (Fig. 5C). Basal leaves petiolate; petiole long, often equal to or longer than the blade, 25–35 mm long; blade triangular-ovate, sagittate, 20–45 mm long, 15–27 mm wide, apex obtuse, mucronulate, base cordate, margin undulate to shallowly lobed, basal lobes not prominent, ± glabrous above, moderately hairy below, hairs crisped, 0.15–0.4 mm long. Leaves on fertile stems petiolate; petiole 2–25 mm long; blade triangular to oblong-triangular, occasionally linear, auriculate to sagittate, 15–60 mm long, 2–40 mm wide, apex acute to obtuse or rounded, occasionally emarginate, apiculate, base cordate, margin lobed, basal lobes auriculate, rounded, slightly prominent with 2–6 teeth or lobes per side, including an ascending lobe becoming more prominent in upper parts, to 20 mm long and 6 mm wide, terminal lobe triangular to oblong triangular, even linear, to 40 mm long and 15 mm wide, margin undulate to shallowly lobed, ± glabrous to moderately hairy above, moderate to sparse below, hairs crisped-appressed to loosely ascending, occasionally semi-erect, 0.2–0.4(–0.5) mm long. In upper parts, leaves with shorter petioles, blades narrower triangular-ovate, sagittate and basal lobe barely 2-toothed with 4 or 5 undulations per side. Inflorescence solitary, axillary, bracteolate, a one-sided dichasium, with 1–3(–4) flowers, or occasionally with 2 inflorescences per axil; peduncle terete to slightly flattened, ribbed, 10–60 mm long, moderately to sparsely hairy, hairs crisped appressed 0.15–0.4 mm long; bracteoles opposite to distinctly alternate, linear to

subulate, 1–3 mm long, 0.4–0.7 mm wide, apex acute, ± ciliate, ± glabrous to sparsely hairy on the back; pedicel ± ribbed, 5–20 mm long, not or only very slightly recurved at fruiting, hairs similar to and often denser than on the peduncle. Outer sepals obovate to oblong or elliptic, 5–7 mm long, 2.5–5 mm wide, apex acute with a recurved apiculum, ± ciliate, moderately to sparsely hairy to ± glabrous outside, hairs crisped, loosely appressed to ascending, 0.15–0.3(–0.5) mm long; inner sepals obovate to elliptic, acuminate, 4.6–6.5 mm long, 3.5–5.5 mm wide, apex acute to obtuse with a distinct curved apiculum, base truncate, ± glabrous, sometimes sparsely hairy and ciliate. Corolla funnel-shaped, pink or mauve with a pale greenish throat, 7–15 mm long, 8–20 mm diameter, flared 3.5–5 mm above the base of the tube; petals 10–16 mm long, 7–12 mm wide, with rounded-triangular, emarginate to apiculate lobes, glabrous except for hairs on the outside of the midpetaline band for 4–8 mm from the apex. Stamens 5; filaments affixed to the corolla tube for 1.5–3 mm from the base, free for 3–5.2 mm, with low tubercles from 1 mm above the base of the corolla and extending for 1.75–4 mm; anthers broadly oblong to triangular-oblong, 1.4–2.2 mm long, 0.6–0.9 mm wide, apex rounded, emarginate, base sagittate, basal lobes 0.25–0.45 mm long. Ovary globular-ovoid, 1–1.5 mm long, on a distinct disk 0.25–0.5 mm high, glabrous; style 3–7 mm long, with cylindrical, obtuse, stigmas, 1.8–2.35 mm long, suffused with pink. Capsule ±globular to globular-ovoid, 4.5–6 mm long, 5.5–6.5 mm diameter, glabrous. Seeds 4, ¼-globular, 2.8–3.7 mm long, 2.3–2.5 mm wide, black to dark brown, surface finely punctate bearing numerous small irregular tubercles and no distinct wing (Fig. 6C).

***Specimens examined*: Queensland.** Port Curtis District: Rockhampton, Apr 1867, *O'Shanesy* 55 (MEL); Neeko[o]l Creek, s.d., [*Bowman*] s.n. (MEL). Burnett District: Bundaberg, Mar 1980, *Stanley* 919 (BRI). Darling Downs District: c. 3 miles S of Mt Mowbullan Guest House on Bunya Mts - Bell road, May 1958, *Johnson & Pedley* 453 (BRI); Atkins Lagoon, Pelican, Jan 1980, *Lithgow* 702 (BRI). Moreton District: Tarampa Creek, s.d., *Bailey* s.n. (BRI); Mt Mistake, s.d., *Simmonds* s.n. (BRI). **New South Wales**. Clarence River, s.d., *Beckler* s.n. (MEL); Mt Annan Botanic Garden, Mt Annan Ridge, 4 km W of Campbelltown, Dec 1985, *Hind* s.n. (NSW); St Johns RC Cemerery, Campbelltown, May 1966, *McBarron* 12570 (NSW); Darvall Park, Dennistone, Dec 1978, *Coveny* 10408 (NSW); RC Cemetery, Camden, Oct 1965, *McBarron* 11396 (NSW); 1 mile S of Cambelltown on Appin Road, Jan 1969, *Coveny* 779 (NSW); South Creek, Rossmore, 10 miles W by S of Liverpool, Apr 1968, *Johnson* 1801 (NSW); Doonside, Feb 1984, *Coveny* 11781 (NSW); Maitland Longbridge on New England Highway, Jan 1981, *Medd* 160021 (NSW); Singleton, Jun 1912, *Breakwell* s.n. (NSW).

***Distribution and habitat*:** *C. erubescens* is found in coastal and sub-coastal areas from the Sydney area in New South Wales to Rockhampton in Queensland (Map 2). It is found mainly in wetter eucalypt forests and in rainforest margins.

***Affinities*:** *C. erubescens* appears most closely related to *C. graminetinus*. However, *C. erubescens* has a larger corolla and longer, straight to sinuate, pedicels at fruiting while in *C. graminetinus* the pedicels are shorter and strongly recurved at fruiting. For more than a century, *C. angustissimus* was regarded as conspecific with *C. erubescens* but the latter has a compound dichasial inflorescence and a distinctly different seed surface pattern which distinguishes it from that species.

***Phenology*:** Flowering occurs throughout the late spring to early autumn with fruits recorded mainly in summer and autumn.

***Notes*:** Though the type specimen was not located, the illustration, given in Curtis's Botanical Magazine and the associated protologue, relate extremely well to the taxon described above. Though no type specimen or description of *C. erubescens* var. *dilatatus* Choisy has been found, based on the specific and subspecific epithets, I have concluded it probably falls within my concept of *C. erubescens*.

Specimens collected in the Sydney area indicate there may have been some gene flow between populations of *C. angustissimus* and *C. erubescens*. Specimens which appear to be of *C. erubescens* occasionally have recurved pedicels but agree with *C. erubescens* in having compound inflorescences, hastate leaves with dentate basal lobes, ribbed peduncles and seeds with closely patterned tubercles, e.g. Perthville, *Schiff* (NSW455842). A specimen labelled as from Yarra Yarra (MEL 689505) appears to belong to this species. However the collecting locality given for it is well outside the normal range of *C. erubescens* and the label information

is queried.

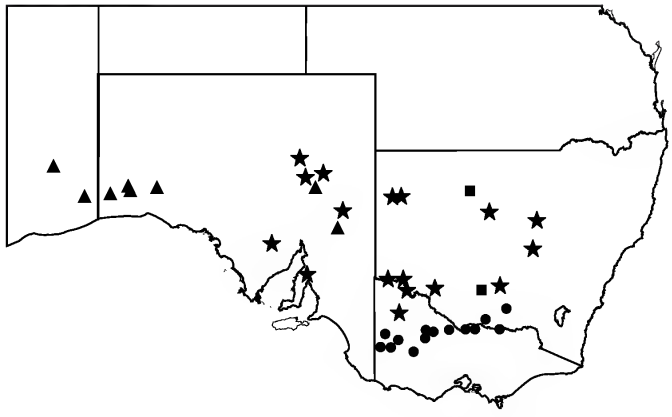
***Etymology*:** The specific epithet refers to the flower colour in this species.

***Conservation Status*:** In Queensland, populations of this species have been considerably reduced since European settlement and no collections have been recorded in the past 20 years. In view of the uncertainty of the current population it is probably best to regard it as rare.

8. Convolvulus wimmerensis R.W. Johnson, **sp. nov.** affinis *C. angustissimo* R. Br. sed pilis densis, appressis et argenteis, et inflorescentia dichasiali unilaterali differt. **Typus:** Victoria. Terrick Terrick State Park M2, 24 November 1985, *A.C. Beauglehole* 82670 (holo: MEL [MEL689790]).

Perennial with trailing and twining stems; stems terete, moderately to densely hairy, becoming sparser with age, hairs crisped-appressed, silvery, 0.15–0.5 mm long, sometimes with some ascending and occasionally spreading hairs to 0.9 mm. Leaves variable in shape and size from base to tip of the stem (Fig. 5D). Basal leaves petiolate; petiole long, occasionally equalling the blade, 12–20 mm long; blade ovate to oblong, occasionally triangular-oblong, 8–25 mm long, 5–15 mm wide, apex rounded to truncate, sometimes slightly emarginate, base cordate to truncate, decurrent, margin crenate to shallowly lobed, basal lobes soon becoming more prominent, moderately densely hairy to ± glabrous, hairs ascending to erect, 0.2–0.7 mm long. Leaves on fertile stems petiolate; petiole short 2–10 mm long; blade ovate in outline, 13–30 mm long, 8–20 mm wide, apex obtuse to rounded, rarely acute, base cordate, decurrent, deeply divided almost to the base into 5 lobes, basal pair of lobes linear, 2–12 mm long, toothed or bifid, with a secondary recurved lobe from the lower margin, ascending lobes linear, prominent, often more than half the length of the terminal lobe, up to 20 mm long, terminal lobe linear to narrowly oblong or narrowly obovate 10–25 mm long, 1–5 mm wide, irregularly toothed or lobed particularly on more basal leaves, undulate to entire above, moderately to densely hairy, hairs appressed 0.2–0.5 mm long, silvery. In upper parts, lobes narrower and entire. Inflorescence solitary, axillary, bracteolate, a one-sided dichasium with 1–2 flowers; peduncle terete, 10–35 mm long, moderately to somewhat densely hairy, hairs short, appressed to slightly ascending 0.15–0.5 mm long; bracteoles opposite to alternate, linear to subulate, 1–2.5 mm long, 0.4–0.75 mm wide, apex acute, ciliate, moderately densely hairy on the back; pedicel 3–6 mm long, up to 10 mm at fruiting, recurved at fruiting, hairs as for peduncle. Outer sepals elliptic to obovate, 5–6.5 mm long, 3–4.5 mm wide, apex barely acute to rounded with a short recurved apiculum, ciliate, moderately to densely hairy outside, hairs appressed to slightly ascending, 0.2–0.5 mm long; inner sepals orbicular-oblong, 5–6 mm long, 4–4.5 mm wide, apex rounded, with a short recurved apiculum, base slightly cordate, rare ciliate hair at the apex, ± glabrous. Corolla funnel-shaped, pink, c. 10 mm long, 10–12 mm diameter, flared c. 4–4.5 mm above the base of the tube; petals 9–12 mm long, 7–8 mm wide, with rounded apiculate lobes, glabrous except for appressed hairs on the outside of the midpetaline band for 3–6 mm from the apex. Stamens 5, unequal; filaments affixed to the corolla tube for 2–2.5 mm from the base, free for 3–4 mm, with low scattered tubercles from 1 mm above the base of the corolla and extending for 2.5–3 mm; anthers ovate to oblong, 1.25–1.5 mm long, 0.75–0.8 mm wide, apex obtuse, emarginate, base sagittate, basal lobes to 0.3–0.35 mm long. Ovary ovoid, 1.25 mm long, on a disk 0.3 mm high, glabrous; style c. 4 mm long, with cylindrical, obtuse stigmas, 1.2–1.25 mm long. Capsule globular, 5.5–6 mm long, c. 5.5 mm diameter, glabrous. Seeds 4, ¼-globular to ¼-globular-obovoid, 3.2–3.8 mm long, 2.5–3 mm wide, dark brown, surface finely punctate bearing scattered low, laterally compressed tubercles, wingless (Fig. 6D).

***Specimens examined*: New South Wales.** Brooking near Urana, *Crouch* s.n. (MEL); Berrigan, Apr 1950, *Godden* s.n. (NSW). **Victoria.** Lowan Mallee: Lowan, Oct 1896, *Reader* s.n. (MEL). Midlands: Terrick Terrick State Park M2, Nov 1985, *Beauglehole* ACB82670 (MEL). Riverina: Barmah Regional Park L52, Jan 1986, *Beauglehole* ACB83555 (MEL); Waaia via Numurkah, Mar 1959, *Cleaves* s.n. (MEL). Wannon: Yarrackigarra Swamp Wildlife Reserve C38, Nov 1986, *Beauglehole* ACB86983 (MEL); Nurcoung Lakes Reserve C41, Nov 1986, *Beauglehole* ACB86599 (MEL). Wimmera: West Yanac Wildlife Reserve C3, Sep 1986, *Beauglehole* ACB83982 (MEL); Lake Marmal Reserve H7, Dec 1985,



Map 5. Distribution of ●. *Convolvulus wimmerensis*. ★. *C. recurvatus* subsp. *recurvatus*. ▲. *C. recurvatus* subsp. *nullarborensis*. ■. *C. tedmoorei*. Del. W. Smith.

Beauglehole ACB82942 (MEL); Mt Jeffcott Flora Reserve, 17 km ENE of Donald PO, Oct 1979, *Beauglehole & Donald History Group* ACB65283 (MEL); Wimmera, *Dallachy* 101 (MEL); Wimmera, in 1892, *Eckert* s.n. (MEL); near Wycheproof, Oct 1917, *Watts* 778, 785, 786 (MEL); near Dimboola, s.d., *coll. ign.* 23 (MEL).

***Distribution and habitat*:** *C. wimmerensis* has been most commonly recorded from the Wimmera region of Victoria, but its distribution extends along the northern part of the Riverina District and into New South Wales (Map 5). It grows on flat to undulating plains in open *Eucalyptus* woodlands.

***Affinities*:** *C. wimmerensis* resembles *C. angustissimus* in having strongly recurved fruiting pedicels and much divided leaves. It differs in the shape of the lower cauline leaves, in having dense appressed hairs on cauline leaves and stems, and in having a one-sided dichasial inflorescence with commonly 2 flowers. It has a small corolla at the lower end of the size range for *C. angustissimus*. It also resembles *C. eyreanus*, *C. recurvatus*, *C. crispifolius* and *C. clementii* but differs from them in having flowers with longer petals.

***Phenology*:** Flowering and fruiting have been recorded from November to March.

***Etymology*:** The specific epithet refers to the Wimmera District of Victoria where the species occurs.

9. Convolvulus angustissimus R.Br., Prod. 482 (1810); *Convolvulus erubescens* var. *angustissimus* (R.Br.) Choisy in A.DC., Prod. 9:412 (1845). **Type**: Tasmania, Van Diemens Land near Risdon Cove, in 1804, *R. Brown* (holo: BM[Bennett 2765];iso:MEL[MEL689920], MEL[MEL689582]) (see under Notes).

Convolvulus erubescens var. *albus* Guilfoyle, Australian Plants: 117 (1911). **Type**: "Vic." (holo: n.v.).

Convolvulus geniculatus Lehm., Semina in horto botanico Hamburgense 1826 collecta quae pro mutua commutatione offeruntur (1826). **Type**: not cited.

Perennial with trailing and twining stems; stems terete, densely hairy to ± glabrous in younger parts, becoming sparser with age; hairs short, ± appressed, 0.2–0.5 mm long, in older parts becoming erect and spreading and up to 0.8 mm long, the relative abundance of erect and appressed hairs varying among subspecies. Leaves variable in shape and size from base to tip of the stem. Basal leaves petiolate; petiole long, often longer than the blade; blade ovate to oblong, sometimes triangular, or linear, occasionally slightly hastate, 5–35 mm long, 2–15(–20) mm wide, apex acute to rounded-truncate, occasionally emarginate, base tapering to cordate, decurrent, margin entire, undulate, irregularly crenate to shallowly lobed, basal and ascending lobes barely more prominent, moderately hairy to ± glabrous, hairs short, appressed to longer, erect, depending on subspecies. Leaf size and shape of lower cauline leaves very variable depending on subspecies.

Leaves on fertile stems petiolate; petiole 2–20 mm long; blade narrowly ovate to ovate in outline, 10–65 mm long, apex acute to obtuse, mucronulate, occasionally rounded-emarginate, more acute in upper parts, base tapering to cordate, decurrent, hastate to deeply 3–5-lobed from the base, basal lobes linear to obovate, spreading to recurved, to 17 mm long, apex obtuse or 2-toothed, often with a 2-toothed, recurved secondary lobe on the lower margin, ascending lobes linear, up to 30 mm long, 1–8 mm wide, terminal lobe narrow-linear to narrow-oblong, occasionally triangular, 10–60 mm long, 1–8 mm wide, margin entire, rarely undulate to slightly lobed, moderately hairy to ± glabrous above, sometimes slightly denser below, hairs appressed to crisped-appressed, 0.15–0.35 mm long on some subspecies, mainly ascending to semi-erect, 0.25–0.6 mm long on others. In upper parts, petiole shorter, blade shorter and with narrow acute lobes, often with short, sometimes bifid, basal lobes and a very narrow ascending lobe. Inflorescence solitary, axillary, bracteolate with solitary flowers, very rarely a one-sided dichasium with 2 flowers or with 2 inflorescences per axil; peduncle terete, 4–50 mm long, moderately to sparsely hairy, hairs mainly appressed, occasionally spreading; bracteoles opposite, rarely sub-opposite, linear, subulate to narrowly ovate, 1–4 mm long, 0.2–0.5 mm wide, apex acute, ciliate, moderately hairy to glabrous on the back; pedicel often darker than the peduncle 3–23 mm long, recurved at fruiting, hairs similar to and often denser than on the peduncle. Outer sepals obovate, obovate-oblong, to elliptic, (3.5–)4–6.5 mm long, 2–5 mm wide, apex acute to rounded with a short recurved apiculum, ciliate, more rarely ± eciliate (in subsp. *fililobus*), moderately hairy to glabrous outside, hairs appressed to spreading, depending on subspecies; inner sepals obovate to obovate-orbicular, more rarely elliptic or oblong, 3.5–6 mm long, 2.5–4.5 mm wide, apex rounded, with a short recurved apiculum, base rounded to truncate, ± glabrous or with some hairs around the apex and upper spine. Corolla funnel-shaped, pink, with a paler throat, rarely white, 7–20 mm long, 7–20 mm diameter, flared 2.5–6 mm above base of the tube; petals 8–25 mm long, 3–12 mm wide, with rounded to rounded-triangular, erose, often emarginate, barely apiculate lobes, glabrous except for hairs on the outside of the midpetaline band for 1–9 mm from the apex. Stamens 5, slightly unequal; filaments affixed to the corolla tube for 1.5–3 mm from the base, free for 1.75–5 mm, with low tubercles from 0.75 mm above the base of the corolla and extending for 1–4 mm; anthers oblong to ovate, 0.8–2.75 mm long, 0.5–1 mm wide, apex rounded, emarginate, base sagittate, basal lobes 0.2–0.7 mm long. Ovary ovoid 1–1.8 mm long, on a well developed disk, 0.25–0.6 mm high, glabrous; style 3–10 mm long, with cylindrical to narrowly ovoid, obtuse stigmas, 1–2.5 mm long. Capsule globular to globular-ovoid, 4–8 mm long, 4–7.5 mm diameter, glabrous. Seeds 4, ¼-globular to slightly ¼-globular-obovoid, 2.9–4 mm long, 2.2–3.5 mm wide, dark brown to black, surface finely punctate usually bearing low reticulate ± continuous ridges, smooth in subsp. *fililobus,* wing not prominent, discontinuous to absent.

***Affinities*:** *C. angustissimus* most closely resembles *C. wimmerensis. C. recurvatus* has similar recurved pedicels subtending mature capsules but its pedicels are much shorter than those in *C. angustissimus*, its flowers smaller and its inflorescences often compound.

***Notes*:** Brown (1810) gave no indication of the type locality in Tasmania. He collected specimens of *C. angustissimus* in Tasmania in 1804 and these collections are now represented in the Natural History Museum, London on two herbarium sheets (David Moore, BM, *pers. com.*)

1. Bennett 2767 – One of three labels lists a collecting locality as "Port Dalrymple prope littora Jan: 1804".

2. Bennett 2765 - Two labels are present on the sheet, one states "In campis prope Baie du Nord quandum Frederick Harvey (Henry) Bay dict Feb: 1804", the other "Van Diemens Land near Risdon Cove" [Type of *Convolvulus angustissimus* R.Br. according to the sheet].

Based on this I have accepted the designation of the latter collection as the holotype. A further two specimens of this taxon collected by Brown and held at MEL list only "Van Diemens Land" as the collecting locality and I have assumed these are isotypes.

Although the description of *C. geniculatus* Lehm. is a very general one, and no type specimen has been cited, on the basis of its solitary flowers and geniculate pedicels at fruiting, it is highly likely it is conspecific with *C. angustissimus*.

This species shows considerable variation. While the simple inflorescence, relatively large flowers and recurved fruiting pedicels characterize this taxon, other attributes are very variable, particularly its leaf shape and vestiture. Further field work is probably needed for a better understanding of the complex. The specimen collected by Brown from Risdon Cove consists of the plant crown and upper leaves which have much divided narrow basal lobes, narrow ascending lobes and a narrow-linear entire terminal lobe. Leaves in the lower part of the plant are absent. A good match for the type specimen is one collected at Ross (*Burns* 7). All other specimens borrowed from HO have ovate, oblong or triangular, hastate, lower cauline leaves, becoming much divided up the stem with leaves on terminal branches of older plants with very narrow lobes resembling those on the holotype. Parham (*pers. comm.*) did not find any specimens in HO with narrowly lobed, much divided leaves to the base of the stem. In addition, in visits to both Risdon Cove and Ross, Parham did not find any plants with narrow, deeply divided, lower cauline leaves.

However in Victorian specimens seen, many have a few linear hastate basal leaves which are abruptly replaced distally by lobed leaves with very narrow linear lobes up to 2 mm in width. These leaves resemble those on the type specimen. The basal leaves absent from the type specimen may have been similar to the broad divided leaves found on other Tasmanian specimens or the very narrow leaves found on the type may have occurred along the stem to the base as occurs in many Victorian specimens. For this revision I have accepted the former possibility. On this basis, all Tasmanian material is of *C. angustissimus* subsp. *angustissimus*.

Both *C. angustissimus* subsp. *omnigracilis* and *C. angustissimus* subsp. *fililobus* are reasonably distinctive but much variation is present within *C. angustissimus* subsp. *angustissimus* and *C. angustissimus* subsp. *peninsularum*. Because of the great variation, resulting from ontogenetic development and geographic distribution, and the influence of time of germination and length of the growing season on morphology, it is difficult to classify the existing variation on the basis of herbarium specimens. In addition, hybridisation further confounds attempts at classification. More field work will be necessary to clarify the variation which exists within these taxa.

Four subspecies are recognised and can be distinguished as follows.

1. Lower cauline leaves broad and much divided with the terminal lobe more than 1.5 mm wide; lobes gradually becoming narrower towards the tip ..... **9a. C. angustissimus** subsp**. angustissimus**
   Cauline leaves with narrow lobes almost from the base of the plant; lobes < 1.5 mm wide, or if wider then basal lobes spreading and clavate and terminal lobe distinctly obovate-clavate. 2

2. Flowers 14–25 mm long; flowering pedicels 8–18 mm long; outer sepals moderately to sparsely hairy, usually ciliate at the tip; seeds with sparse low reticulate ridges. ..... **9b. C. angustissimus** subsp. **omnigracilis**
   Flowers 9–14 mm long; flowering pedicels 4–8 mm long 3

3. Seeds smooth; sepals ± glabrous to sparsely hairy, with hairs mainly appressed, leaves with ascending lobes often > 1/3 the length of the terminal lobe and lacking distinctive basal lobes ..... **9c. C. angustissimus** subsp. **fililobus**
   Seeds with sparse low reticulate ridges; sepals moderately to sparsely hairy with ascending and spreading hairs common**;** leaves with ascending lobes mostly < 1/3 the length of the terminal lobe; lower cauline leaves with distinct, spreading, clavate basal lobes. ..... **9d. C. angustissimus** subsp.**peninsularum**

9a. Convolvulus angustissimus R. Br. subsp. **angustissimus**

Convolvulus adscendens de Vriese in Lehmann, Plantae Preissianae 1: 346 (1845). **Type**: In arenosis apertis distr. York, 16 March 1839, *Herb. Preiss* No. 1924 (holo: LD; iso: MEL[MEL689918, MEL689919]).

Convolvulus subpinnatifidus de Vreise in Lehmann, Plantae Preissianae 1: 347 (1845). **Type**: In solo sublimoso fertili prope Beljarup, Hay, 4 November 1840, *Herb. Preiss* No. 1925 (holo: LD; iso: MEL[MEL689916, MEL689917]).

Convolvulus acaulis Choisy in A.DC. Prodr. 9:406 (1 Jan 1845). **Type**: Nova Hollandia (ins. Kanguroos) (PARIS). (holo: P).

Stems densely to moderately hairy in younger parts, becoming sparser with age, hairs ± appressed, 0.2–0.4 mm long, on older parts becoming erect and spreading and up to 0.8 mm long. Leaves variable in shape and size from base to tip of the stem (Fig. 7A). Blade of basal leaves ovate to oblong, sometimes triangular or linear, occasionally slightly hastate, 5–25 mm long, 4–15 mm wide, apex acute to rounded-truncate, occasionally emarginate, base truncate to cordate, decurrent, margin irregularly crenate to serrate to shallowly lobed, basal and ascending lobes barely more prominent, moderately hairy to ± glabrous, hairs semi-erect, 0.25–0.8 mm long. Leaves on fertile stems petiolate; petiole 2–20 mm long; blade ovate to triangular-ovate in outline, 10–65 mm long, 2–40 mm wide, apex acute, rarely obtuse to rounded-emarginate, more acute in upper parts, base cordate, decurrent, often 3–5 lobed from the base, basal lobes linear to narrowly oblong to 17 mm long, entire or 2-toothed, often with a 2-toothed recurved secondary lobe on the lower margin, ascending lobes linear, up to 30 mm long, 1–8 mm wide, terminal lobe linear to narrow-oblong, often triangular, 10–60 mm long, 1–8 mm wide, entire, rarely undulate to slightly lobed, moderately hairy to ± glabrous above, slightly denser below, hairs mainly ascending to semi-erect, 0.25–0.6 mm long. In upper parts, petiole shorter, lobes becoming narrower, more acute, sometimes with very short basal and ascending lobes and a long narrow-linear terminal lobe. Peduncle 5–50 mm long; pedicel 3–23 mm long. Outer sepals obovate to obovate-oblong, more rarely elliptic, 4–6 mm long, 2.5–5 mm wide, ciliate, moderately to sparsely hairy outside, hairs loosely ascending to spreading, some appressed, or more rarely almost all appressed, 0.15–0.5 mm long; inner sepals obovate to obovate-orbicular, rarely elliptic, 4.5–5.7 mm long, 3–4.5 mm wide, ± glabrous to sparsely hairy outside. Petals 9–21 mm long, 5–12 mm wide. Capsule globular to globular-ovoid, 4–8 mm long, 4–7 mm diameter. Seeds 2.9–4 mm long, 2.2–3.5 mm wide bearing low reticulate ± continuous ridges (Fig. 8A).

***Selected specimens (230 specimens examined)*: Western Australia.** King Georges Sound, s.d., *Muir* s.n. (MEL689547); Harvey, Nov 1916, *Stoward* s.n. (PERTH). **South Australia.** Big Heath NP, S portion, c. 7 km SE of Nine Mile Well, Nov 1969, *Jackson* 1605 (AD); Mt Lofty Ridge Wildlife Reserve, Feb 1969, *Sexton* s.n. (AD); Lenswood Agricultural Research Centre, north east, Nov 1978, *Spooner* 6205 (AD); near summit of Mt Barker, c. 30 km SE of Adelaide, Dec 1964, *Whibley* 1526 (AD); c. 20 km SE of Mt Gambier, *Wilson* 799 (AD). **Queensland.** Burnett District: Narayen, Mar 1973, *coll. ign.* N1334 (BRI). Maranoa District: Stanhope Downs, 44 km by road NW of Roma, Nov 1996, *Thomas* s.n. (BRI). Darling Downs District: Kildonan, Feb 1936, *Blake* 10528 (BRI). **New South Wales.** Molong, Nov 1906, *Boorman* s.n. (NSW); NSW-ACT border adjoining Queanbeyan rubbish tip, Jan 1983, *Coveny & Hind* 11502 (BRI, NSW); 12 miles NE of Albury on Hume Highway, Oct 1967, *Muir* 4605 (MEL); Sinclair Lookout, 14.4 km W of Glen Innis, Mar 1987, *Plat, Coveny & Dunn* 7 (BRI); SE of Nimmitabel, Nov 1960, *Salasoo* 1980 (NSW); Armidale, UNE hill, Nov 1959, *Winterhalder* s.n. (NE). **Victoria.** Midlands: 7 miles SW of Thoona, Nov 1960, *Muir* 1756 (MEL). Riverina: Farran's Lookout on Murray Valley Highway, 3 miles N of Towong, Oct 1961, *Muir* 2395 (MEL). Victorian Volcanic Plain: Warrnock road, c. 14 km SSW of Chetwynd, Nov 1982, *Corrick* 8472 (BRI, MEL). Wannon: Portland, Gorae West, 1946, *Beauglehole* 38437 (MEL). **Tasmania.** Poatina, Nov 1986, *Buchanan* 8854 (HO); Domain, Hobart, Oct 1942, *Curtis* s.n. (HO); Cape Portland, Oct 1983, *Moscal* s.n. (HO); Township Lagoon, Nov 1983, *Moscal* 3894 (HO, MEL).

***Distribution and habitat*:** *C. angustissimus* subsp. *angustissimus* has been recorded from all States but not from the Northern Territory (Map 6). It occurs in Tasmania mainly in the Hobart–Launceston area with no records from the western part of the State. It is widespread in Victoria but is absent from the north-west and east coast. It extends into the south-east of South Australia with other populations in the

Adelaide area and on the Yorke and Eyre Peninsulas. In Western Australia, it is restricted to the south-western corner. In eastern Australia, it extends northwards through the tableland areas of New South Wales into southern Queensland, where it is found mainly west of the Great Dividing Range as far north as Springsure. It is found on level to hilly terrain in mainly loamy and clay soils, less commonly in sandy and rocky soils. It grows in grassy eucalypt woodlands and forests and in grasslands which develop following the clearing of the woodlands.

***Phenology*:** Flowering occurs mainly in early spring to mid autumn (September-April) while fruiting occurs from late spring to late autumn (November-May).

***Notes*:** As circumscribed here, considerable variation exists within this subspecies. The typical form with large flowers and long pedicels is found in Tasmania and southern Victoria and extends into south-eastern South Australia and north into New South Wales. Similar forms are found at Narayen, Queensland (AQ 637866), at Armidale in northern New South Wales and at the Wombeyan Cave (*Constable* NSW56058). In the Kosciusko region of New South Wales and nearby areas of Victoria, specimens (e.g. *Muir* 2395, *Makinson* 975, *Walsh* 279, *Forbes* 576) have denser erect hairs. However similar vestiture is also found on occasional specimens throughout the range of this subspecies. In drier parts of Victoria on through South Australia to Western Australia there is a gradual reduction in the size of the corolla with petals on most specimens rarely exceeding 14 mm in length.

In Queensland, a variant with moderately dense ascending to erect hairs up to 0.75 mm long is found in the Charleville district (*Clements* AQ275818, *Bailey* AQ275821). This variant has black seeds, 4.5–5 mm long, which are larger than those from other populations. In addition the surface ridges on the seeds are more distinctly raised and the discontinuous wing more prominent. Both are formed by fused hair-like structures. No collections have been made of this population since 1945 and the study of further material may warrant its recognition as a distinct taxon.

9b. Convolvulus angustissimus subsp. **omnigracilis** R.W. Johnson, **subsp. nov.** affinis *C. angustissimo* R. Br. subsp. *angustissimo* sed foliis valde anguste lobatis fere basi differt. **Typus:** Victoria. Victorian Volcanic Plain: Nerrin-Nerrin - Woorndoo road, 4 km WSW of Mt Hamilton, near Pagel's Lane (37°48'S 142°56'30"E), 27 November 1983, *S.J. Forbes & N. Scarlett* 1867 (holo:MEL [MEL67409]; iso: BRI [AQ420954]).

Stems moderately densely to sparsely hairy, becoming sparser with age, hairs ± appressed, occasionally spreading, 0.15–0.4 mm long. Leaves are somewhat variable in shape and size from base to tip of the stem though lobes are narrowly linear throughout (Fig. 7B). Blade of basal leaves linear, linear-elliptic to narrow oblong, hastate, 5–35 mm long, 2–10 mm wide, apex obtuse to rounded, rarely emarginate, base tapering to truncate, margin entire to slightly undulate but soon with narrow bifid basal lobes, well developed ascending and terminal lobes, sparsely hairy to ± glabrous, rarely moderately hairy, hairs ± appressed, 0.15–0.4 mm long. Leaves on fertile stems petiolate; petiole short, 3.5–15 mm long; blade linear to ovate in outline, 12–60 mm long, apex acute to almost obtuse, base tapering to cordate, hastate to deeply lobed, basal lobes linear, often short, 0.5–5 mm long, occasionally to 12 mm long, sometimes with a recurved secondary lobe from the lower margin, ascending lobes linear to 25 mm long, < 1 mm wide, terminal lobe linear or obovate-linear 12–60 mm long, < 2 mm wide, ± glabrous to sparsely hairy, hairs appressed, 0.15–0.35 mm long, margin entire. In upper parts, leaves smaller but of similar shape. Peduncle 5–35 mm long; pedicel 5–18 mm long. Outer sepals obovate to elliptic, 4.5–6 mm long, 2.8–3.7 mm wide, apex acute to rounded with a shortly recurved apiculum, ciliate, moderately to sparsely hairy outside, hairs appressed, 0.1–0.3 mm long; inner sepals obovate, 4.8–6 mm long, 3–4 mm wide, ± glabrous to sparsely hairy outside. Petals 14–25 mm long, 8–12 mm wide. Capsule globular, 5–8 mm long, 4.5–7 mm diameter. Seeds 3.5–4 mm long, 2.7–3.3 mm wide bearing low reticulate ± continuous ridges (Fig. 8B).

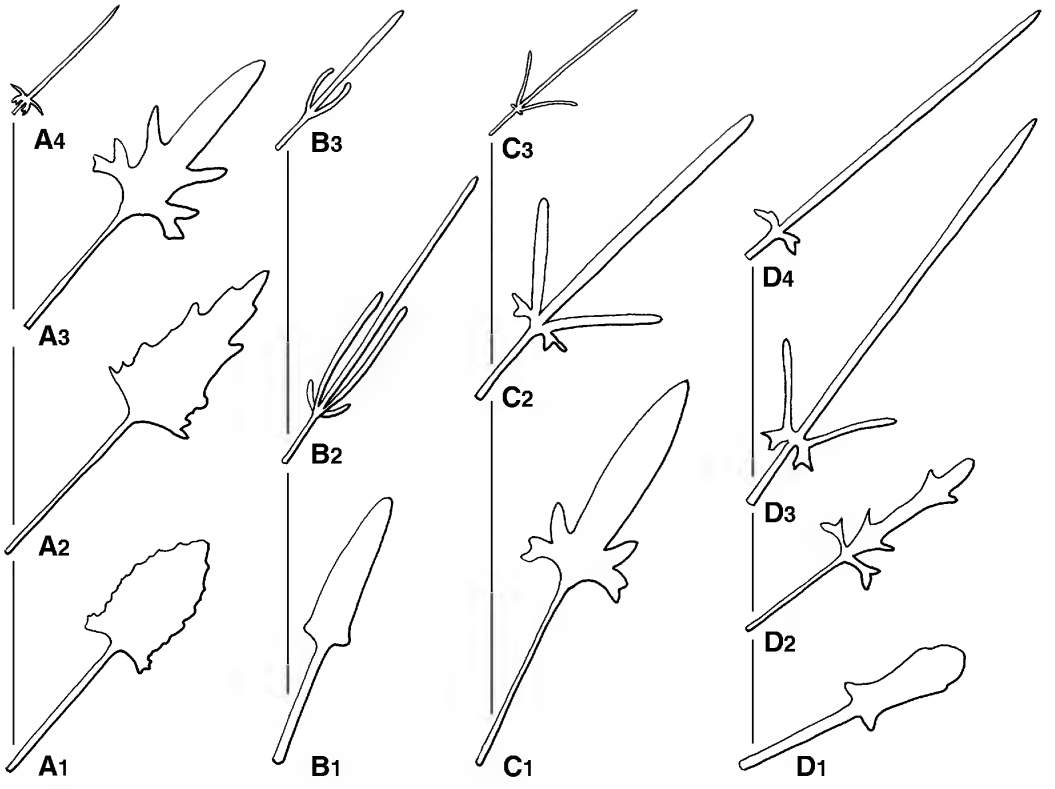


Fig. 7. Variation in leaf shape of *Convolvulus* species from base to tip of stems. A. *C. angustissimus* subsp. *angustissimus*. (1) *Moscal* 3894 (HO) × 1, (2) *coll. ign.* s.n. (HO36311) × 1, (3) *Rodway* s.n. (HO15256) × 1, (4) *Tate* s.n. (AD97605515) × 2; B. *C. angustissimus* subsp. *omnigracilis*. (1) *Stones* s.n. (MEL503463) × 2, (2) *Baker* s.n. (MEL536246) × 1, (3) *Forbes* 1867 *& Scarlett* (MEL) × 2; C. *C. angustissimus* subsp. *fililobus* × 2. (1) *Beauglehole* ACB87768 (MEL), (2) *Aston* 2367 (MEL), (3) *Beauglehole* ACB66176 (MEL); D. *C. angustissimus* subsp. *peninsularum*. (1) Eichler 14063 (AD) × 2, (2) Eichler 14063 (AD) × 1, (3) *Alcock* 654E (AD) × 2, (4) *Alcock* 654B (AD) × 1. Del. W. Smith.

Selected specimens (36 specimens examined): **Victoria.** East Gippsland: Amboyne Creek Area, 11 km NW of Tubbut PO, Jan 1980, *Beauglehole* ACB67710 (MEL). Eastern Highlands: Whittlesea, Mar 1904, *Baker* s.n. (MEL 536248). Midlands: 15 km W of Maryborough PO, N of abandoned goldmine J7, Nov 1979, *Beauglehole & Maryborough FNC* ACB66592 (MEL); 8.2 km SE of Ararat, Jan 1995, *Zich & Young* 258 (CANB). Otway Plains: Limeburners Lagoon Flora & Fauna Reserve P3, Mar 1982, *Beauglehole & Errey* ACB70341 (MEL). Victorian Volcanic Plain: Corio, Geelong Area, Feb 1964, *Anderson* s.n. (MEL 503341); Laverton, 13 miles WSW of Melbourne, 0.5 miles NE of Laverton, Nov 1962, *Aston* 847 (MEL); Broadmeadows & Glenroy, Oct 1903, *Baker* s.n. (MEL 536247); Campbellfield, Broadmeadows, Nov 1900, *Baker* s.n. (MEL 536250); Preston, Nov 1899, *Baker* s.n. (MEL 536249); Deer Park, Sep 1900, *Baker* s.n. (MEL 536246); Werribee, Dec 1899, *Baker* s.n. (MEL 536255); Keilor, n.d., *Cowle* s.n. (MEL 579995; MEL 689658); Nerrin-Nerrin Woorndoo road, 4 km WSW of Mt Hamilton, Nov 1983, *Forbes & Scarlett* 1867 (MEL); Williamstown Butts, Dec 1953, *Hansen* s.n. (MEL 689793); Camperdown-Foxhow road, 25 km WSW of Cressy PO, Oct 1977, *Hirth* s.n. (MEL 1513254); Campbellfield, Melbourne, Oct 1978, *Muir* 6277 (MEL); Lake Corangamite, SW of Cundare, Oct 1982, *Scarlett* s.n. (BRI [AQ377773]); Rifle Range, Williamstown, Dec 1943, *Smith* 43/104 (MEL); Altona, Oct 1975, *Stones* s.n. (MEL 503463); St Albans Railway, Oct 1975, *Stones* s.n.(MEL 503472).

***Distribution and habitat*:** *C. angustissimus* subsp. *omnigracilis* is restricted to Victoria being found around Melbourne and extending to the west and north-west to near Ararat and St Arnaud (Map 7). It grows mainly in grassy communities on plains on grey to yellow clay loam or clay soils. These soils are commonly derived from basalt or Ordovician shales. Populations also occur around Lake Corangamite, sometimes on *Coxiella* shell deposits.

***Phenology*:** Flowering occurs mainly in mid

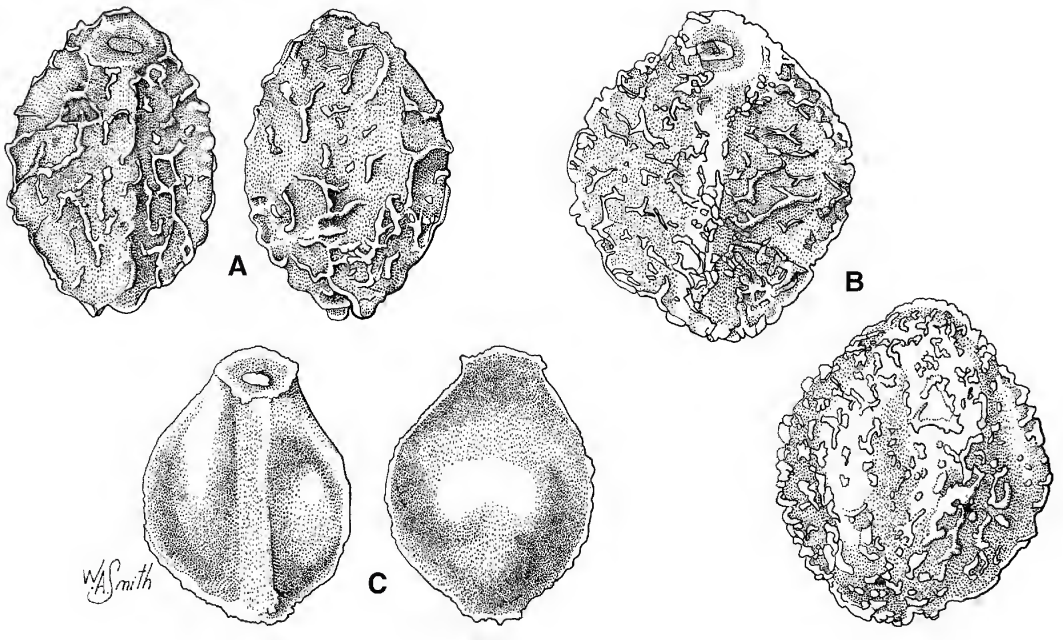
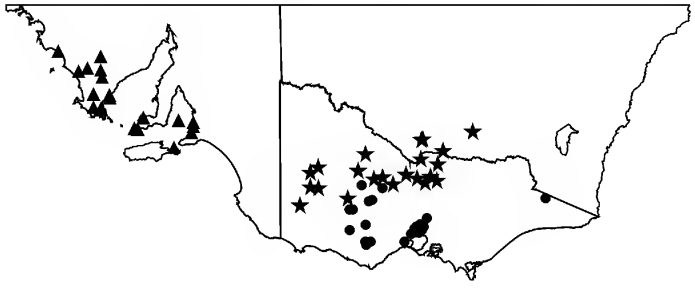


Fig. 8. Seeds of *Convolvulus augustissimus*, adaxial (L.H.S.) and abaxial (R.H.S.) surfaces × 10. A. *C. angustissimus* subsp. *angustissimus* from *Hosking* 661 (NSW); B. *C. angustissimus* subsp. *omnigracilis* from *Smith* 43/104 (MEL); C. *C. angustissimus* subsp. *fililobus* from *Aston* 2367 (MEL); NB. Seeds of *C. angustissimus* subsp. *peninsularum* not available. Del. W. Smith.



Map 7. Distribution of ●. *Convolvulus angustissimus* subsp. *omnigracilis.* ★. *C. angustissimus* subsp. *fililobus.* ▲. *C. angustissimus* subsp. *peninsularum.* Del. W. Smith.

spring to early summer (October-December) with some flowering throughout late summer and autumn. Fruits are produced throughout the spring to autumn period.

***Etymology*:** The subspecific epithet refers to the lobes of the much divided leaves of this subspecies which are slender in all leaves on the plant.

9c. Convolvulus angustissimus subsp. **fililobus** (Wawra) R.W. Johnson, **comb. nov.** *Convolvulus erubescens* var. *fililobus* Wawra, Itinera Principum S. Coburgi 1: 102 (1883). **Type**: Victoria. Prarien des Murraygebietes (holo: W).

Stems mainly trailing, moderately to sparsely hairy, becoming sparser with age, hairs short appressed, 0.15–0.3(–0.5) mm long. Blade of basal leaves linear, linear-elliptic to narrowly oblong, hastate, 5–20 mm long, 5–8 mm wide, apex obtuse to rounded, mucronulate, base tapering to truncate, margin undulate, often toothed or lobed towards the base, sparsely hairy to ± glabrous, hairs appressed, 0.1–0.4 mm long, but soon becoming deeply and narrowly 5-lobed. Leaves on fertile stems petiolate; petiole short 2.5–8 mm long; blade ovate in outline, 15–40 mm long, apex acute to almost obtuse, base tapering to shallowly cordate, deeply 5-lobed, basal lobes linear, 1–7(–10) mm long, sometimes with a recurved secondary lobe from the basal margin, ascending lobes narrowly linear to 20 mm long, < 1 mm wide, terminal lobe narrowly linear, 15–40 mm long, < 1.5 mm, entire, moderately to very sparsely hairy, hairs appressed, 0.1–0.3 mm long. In upper parts, leaves smaller, often with prominent terminal lobe and short but distinct narrowly linear basal and ascending lobes (Fig. 7C). Peduncle 4–13(–20) mm long; pedicel 4–8 mm long, occasionally extending to 12 mm at fruiting. Outer sepals obovate to elliptic, 3.5–5(–5.5) mm long, 2.4–3.5 mm wide, eciliate or with a few scattered cilia, sparsely hairy to ± glabrous, very rarely moderately hairy outside, hairs mainly appressed, 0.15–0.25 mm long. Inner sepals obovate to oblong, 3.5–5(–5.5) mm long, 2.7–3.8 mm wide, glabrous. Petals 9–14 mm long, 5–9 mm wide. Capsule globular, 6–6.5 mm long, c. 5.5 mm diameter. Seeds 3–4 mm long, 2.2–2.6 mm wide, golden brown with darker mottling, surface finely punctate without any protuberances, scurfy with a distinct ridge on the outer margins, occasionally with a very narrow discontinuous wing of fused hair-like structures (Fig. 8C).

***Specimens examined*: New South Wales.** 13 km E of Urana, on Urana to Lockhart road, Nov 1982, *Aston* 2367 (MEL,BRI); Falkiner Memorial Field Station, Deniliquin, Nov 1975, *Crisp* 1813 (CBG); Falkiner Memorial Field Station, Deniliquin, Dec 1945, *Willoughby* 77 (CANB). **Victoria.** Grampians: Mt Arapiles SW side, c. 0.75 miles W of Natimuk Golf Course, Nov 1968, *Beauglehole* ACB29738 (MEL); Mitre Rock, 10 km W of Natimuk PO, Nov 1979, *Beauglehole* ACB66176 (MEL); Grampians, 6.4 km from Stawell on road to Halls Gap, Nov 1959, *Symon* 86 (NE). Riverina: Gaynor Swamp Wildlife Reserve, Apr 1981, *Beauglehole* ACB68838 (MEL); Spence Bridge Education Area L38, Sep 1985, *Beauglehole* ACB80211 (MEL); Tocumwal Regional Park, Sep 1985, *Beauglehole* ACB81273 (MEL); Barmah State Park L53, Nov 1985, *Beauglehole* ACB82215 (MEL); Barmah State Forest L52, Nov 1985, *Beauglehole* ACB82460 (MEL); Murray River Reserve G36, Dec 1985, *Beauglehole* ACB83322 (MEL); Hunter, 11 km NW of Elmore, Nov 1989, *Davies & Hadlow* 1334 (CBG); Tatura, Nov 1945, *Gauba* s.n.(CBG 12623);13 miles S Shepparton on Goulburn Valley Highway, Oct 1967, *Muir* 4632 (MEL); Rushworth-Murchison Road, 6 km ESE of Rushworth M34, Dec 1981, *Muir* 7000 (MEL); c. 1 km S of Wunghnu between Goulburn Valley Highway and railway line, Nov 1981, *Stebbing* s.n. (MEL 642833). Wannon: Mooree Historic Reserve C19, Nov 1986, *Beauglehole* ACB87426 (MEL); Kialla Roadside Reserve, Dec 1986, *Beauglehole* ACB87649 (MEL); Tarranjurk Roadside Reserve C17, Dec 1986, *Beauglehole* ACB87768 (MEL). Wimmera: Jeffcott Roadside Reserve, Dec 1986, *Beauglehole* ACB87967 (MEL); 9 miles from Quambatook towards Dumosa, Oct 1963, *Phillips* 17 (CBG).

***Distribution and habitat*:** *C. angustissimus* subsp. *fililobus* is found in an arc from central western Victoria, west of Horsham, through the Riverina District of Victoria and extending into New South Wales in the southern part of the south western plains in the Urana–Deniliquin area (Map 7). It grows on clay and clay loam soils on plains.

***Phenology*:** Flowering occurs mainly in early spring to early summer (September – December) while fruit are produced throughout spring to early autumn.

***Etymology*:** The subspecific epithet refers to the finely divided leaves characteristic of plants of this subspecies.

9d. Convolvulus angustissimus subsp. **peninsularum** R.W. Johnson, **subsp. nov.** affinis *C. angustissimo* R. Br. subsp. *angustissimo* sed foliis anguste lobatis e basi et foliis humilibus lobis basalibus distincte effusis obovatis differt. **Typus:** South Australia. YORKE PENNINSULA REGION: Innis National Park, 3 km S of northern boundary (35°15'S 136°55'E), 9 October 1974, *C.R. Alcock* 4733 (holo: AD[AD97523049]; iso: SYD, n.v.).

Stems moderately hairy to ± glabrous, glabrescent, hairs appressed to crisped-appressed, 0.2–0.4 mm long though towards the base, hairs more spreading and longer. Leaves variable in shape and size from base to tip of the stem (Fig. 7D). Blade of basal leaves oblong hastate, 5–10 mm long, 3–8 mm wide, apex obtuse to rounded, base cordate, margin undulate, sparsely to moderately hairy, hairs spreading, 0.25–0.5 mm long, blades soon becoming longer and narrower with distinct, spreading, entire, 2-toothed or bi-lobed basal lobes and a narrow-linear to linear obovate terminal lobe up to 25 mm long, rarely more than 4 mm wide with an undulate to distinctly lobed margin, hairs becoming more appressed. Leaves on fertile stems petiolate; petiole 3–12 mm long; blade narrow-linear or narrowly ovate in outline, 15–35 mm long, apex obtuse, mucronulate, base cordate, sometimes truncate, basal pair of lobes linear to obovate, lateral to recurved, up to 7 mm long, apex obtuse, toothed, often with a recurved secondary lobe from the lower margin, ascending lobes linear, up to 10 mm long, terminal lobe linear to linear-obovate, 15–35 mm long, up to 5 mm wide, margin entire or slightly undulate, moderately hairy to ± glabrous, hairs spreading to appressed, 0.2–0.5 mm long. In upper parts, leaves linear, hastate, often with short basal lobes, sometimes bifid, sometimes with ascending lobes, and a very narrow terminal lobe. Peduncle 4–20(–35) mm long; pedicel 3–8 mm long. Outer sepals oblong, obovate-oblong, rarely elliptic, 4–5.5 mm long, 2–4 mm wide, apex rounded apiculate, ciliate, moderately dense to sparsely hairy outside, hairs appressed, ascending to spreading, 0.2–0.5 mm long; inner sepals obovate-oblong to elliptic, 4–5.5 mm long, 2.5–3.5 mm wide, moderately hairy to glabrous. Petals 8–13 mm long, 3–10 mm wide. Capsule globular 5–6 mm long, c. 5 mm diameter. Seeds 3.2–3.3 mm long, c. 2.5 mm wide, surface finely punctate bearing low reticulate ridges.

***Selected specimens (28 specimens examined)*: South Australia**. nr Yallunda Flat, midway between Tumby Bay and Cummins, Oct 1964, *Alcock* 654A (AD); [Port] Lincoln, Northshore, Nov 1964, *Alcock* 654B (AD); Coontra Creek, Lincoln Highway, Nov 1964, *Alcock* 654C (AD); near Lipson, Lincoln Highway, 10 km N of Tumby Bay, Dec 1964, *Alcock* 654E (AD); near Boston House, 3 km N of Port Lincoln, Jan 1965, *Alcock* 654L (AD); Lincoln Highway, 3 km N of Port Lincoln, Oct 1964, *Alcock* s.n. (AD); Hundred of Blessing, E End Camp, S of Bascombe Well, Oct 1967, *Alcock* 1481(AD); Hincks NP, N-S track, Hundred of Nicholls, Oct 1968, *Alcock* 2365 (AD); Innis NP, 3 km S of N boundary, Oct 1974, *Alcock* 4733 (AD); Coontra Creek, near Tumby Bay, Jan 1965, *Alcock* 654 (AD); Pondalowie Bay, c. 10 km NW of Stenhouse Bay, Oct 1965, *Blaylock* 43 (AD); Port Lincoln, in 1875, *Browne* s.n. (MEL); sea coast, c. 4 km S of Corny Point, Sep 1957, *Eichler* 14063 (AD); Hallett Cove, c. 20 km SSW of Adelaide, Mar 1937, *Ising* s.n. (AD); Sellicks Beach scrub, Nov 1968, *Kraehenbuehl* 2657, 2670 (AD); Hallett Cove Conservation Park, Dec 1978, [*Launer*] 9 (AD); Hundred of Noarlunga Sec. 190, Nov 1966, *Parsons* 200 (AD); Hog Bay E end, Kangaroo Island, Nov 1883, *Tate* s.n. (AD); Venus Bay, s.d., *Warburton*. s.n. (MEL); Hundred of Blessing, c. 10 km SW of Bascombes Well, Oct 1967, *Wheeler* 662 (AD).

***Distribution and habitat*:** *C. angustissimus* subsp. *peninsularum* is found on the Eyre and Yorke peninsulas in South Australia and on Kangaroo Island (Map 7). It is found on seashores and coastal cliffs but also extends inland, occuring mainly in heathlands and grasslands.

***Phenology*:** Flowers are found in late spring and throughout summer with fruits being produced soon after flowering.

***Notes*:** This subspecies includes very distinctive variants which occur in coastal areas mainly in the southern parts of the Yorke and Eyre Peninsulas. It is characterised by spreading basal lobes on the lower leaves. It becomes difficult from incomplete herbarium specimens to distinguish this subspecies from smaller flowered forms of *C. angustissimus* subsp. *angustissimus* which occur to the north of it. Further field work will be needed to understand better the relative distributions of these subspecies. Few seeds of *C. angustissimus* subsp. *peninsularum* were available for study and further information on seed size and sculpture is needed to assess their relevance.

***Etymology*:** The specific epithet refers to the known distribution of this subspecies which is found mainly on the Yorke and Eyre peninsulas in South Australia.

10. Convolvulus recurvatus R.W. Johnson, **sp. nov.** affinis *C. clementio* Domin sed pedicellis ad fructificans brevioribus et recurvis differt. **Typus:** South Australia. Bute District, c. 140 km NNW of Adelaide, 28 October 1966, *B. Copley* 827 (holo: AD; iso: K, n.v.).

Perennial with trailing and twining stems; stems terete, moderately hairy, becoming sparser with age, hairs appressed to ascending and spreading, 0.2–0.8 mm long. Leaves variable in shape and size from base to tip of the stem. Basal leaves petiolate; petiole long, often longer than the blade, 5–20 mm long; blade linear to oblong, sometimes triangular, 6–20 mm long, 4–15 mm wide, apex obtuse to rounded, mucronulate, sometimes emarginate, base truncate to cordate, sometimes hastate, margin ± entire, undulate to irregularly crenate or lobed, soon becoming 3–5-lobed with lobes having lobed to entire margins, ± glabrous, soon becoming moderately hairy, hairs loosely appressed to spreading 0.15–0.6 mm long. Leaves subtending inflorescences petiolate; petiole 2–20 mm long; blade ovate in outline, usually divided almost to the base into 3–5 lobes, 7–35 mm long, 5–20 mm wide, apex bluntly obtuse to truncate, mucronulate, sometimes emarginate, base cordate, decurrent, basal pair of lobes linear to narrowly oblong, 1–12 mm long, often 2–3-toothed with a secondary recurved lobe from the lower margin, ascending lobes linear to narrowly obovate contracted towards the base up to 20 mm long, 1–4 mm wide, often more than half the length of the terminal lobe, terminal lobe linear to narrowly obovate or oblong, contracted towards the base, 5–25 mm long,1.5–6(–10) mm wide, margin undulate to irregularly crenate, more rarely entire, sometimes shallowly lobed, sparsely to moderately hairy, hairs appressed, crisped-appressed to spreading, 0.1–0.5 mm long. In upper parts, leaves with shorter petioles, lobes becoming narrower and, except for the basal lobes, always entire. Inflorescence, solitary, axillary, bracteolate, a one-sided dichasium with 1or 2 flowers, or occasionally with 2 inflorescences per axil; peduncle terete, 5–25 mm long, moderately to sparsely hairy, hairs appressed to spreading, 0.1–0.6 mm long; bracteoles opposite, occasionally alternate, linear, 0.8–2.5 mm long, 0.25–0.6 mm wide, apex acute, ciliate, sparsely to moderately hairy on the back; pedicel 2–6(–8) mm long, recurved at fruiting, hairs denser and more appressed than on the peduncle. Outer sepals obovate, obovate-oblong to broadly elliptic, 3–5 mm long, 2.5–3.5 mm wide, apex acute to rounded with a short recurved apiculum, ciliate, moderately to densely hairy outside, hairs short appressed, ascending or erect, 0.1–0.6 mm long; inner sepals orbicular to obovate-orbicular or obovate-elliptic, 3–6 mm long, 2–4.5 mm wide, apex obtuse to rounded or slightly emarginate, with a short recurved apiculum, face glabrous or with a few hairs around the apex and down the spine. Corolla funnel-shaped, white or pink, 5–8 mm long, 6–8 mm diameter, flared 2–4 mm above the base of the tube, petals 5–9 mm long, 2.5–6 mm wide, with rounded-triangular to rounded-oblong, emarginate to apiculate lobes, glabrous except for hairs on the midpetaline band for 1.5–3.5 mm from the apex. Stamens 5, unequal, filaments affixed to the corolla tube for 1–2.3 mm from the base, free for 1.2–3 mm, with low scattered tubercles from 0.5 mm above the base of the corolla and extending for 1–1.5 mm; anthers ovate-oblong to oblong-elliptic, 0.5–1 mm long, 0.35–0.7 mm wide, apex rounded, emarginate, often apiculate, base sagittate, basal lobes 0.15–0.25 mm long. Ovary ovoid, 1–1.5 mm long, on a disk 0.25 mm high, glabrous; style 1.5–2.0 mm long, with cylindrical to narrowly ovoid, obtuse stigmas, 0.6–2 mm long. Capsule globular, 4–5 mm long, 4–5.5 mm diameter, glabrous. Seeds 4, ¼-globular, 2.5–3.5 mm long, 2–2.5 mm wide, dark brown, surface finely punctate bearing numerous laterally compressed, wavy tubercles and an irregular, narrow discontinuous wing of fused hair-like structures (Fig. 10A&B).

***Affinities*:** *C. recurvatus* most closely resembles *C. clementii* in the small size of its corolla, its much divided leaves and compound inflorescence. However, it is readily distinguished from that species by its short and strongly recurved pedicels subtending the mature capsules. The cauline leaves of

C. recurvatus also tend to be smaller and more finely divided.

***Etymology*:** The specific epithet was chosen to highlight the characteristic recurved pedicels which support mature capsules.

Two subspecies are recognised and can be distinguished as follows

Hairs on stems and leaves mainly ascending or spreading; petals 7–9 mm long; outer sepals 4–5 mm long ..... **10a. C. recurvatus** subsp. **recurvatus**

Hairs on stems and leaves mainly appressed; petals 5–7 mm long; outer to 4 mm long ..... **10b. C. recurvatus** subsp. **nullarborensis**

10a. Convolvulus recurvatus R.W. Johnson subsp. **recurvatus**

Perennial with trailing and twining stems, with ± appressed hairs especially towards the tip, but also with many spreading, 0.2–0.8 mm long. Leaves subtending inflorescences petiolate; petiole 2–20 mm long; blade 10–35 mm long, 5–20 mm wide (Fig. 9A). Inflorescence with 1–2 flowers. Pedicel 2–6 (–8) mm long. Outer sepals obovate, 4–5 mm long, 2.5–3.5 mm wide, moderately to densely hairy outside, hairs mainly erect or ascending, 0.25–0.6 mm long; inner sepals 3.5–5 mm long, 3.0–4.5 mm wide. Corolla 6–8 mm long; petals 7–9 mm long, 3–4 mm wide. Stamens affixed to the corolla tube for 1.5–2.3 mm from the base, free for 2–3 mm; anthers 0.8–1.0 mm long, 0.65–0.7 mm wide, basal lobes 0.2–0.25 mm long. Style 2.5–3.0 mm long; stigmatic lobes 1.0–2.0 mm long.

***Specimens examined*: South Australia.** Siam Station, c. 100 km W of Pt Augusta, Apr 1921, *Black* s.n. (AD 97524062); between Pt Wakefield & Kilpara, c. 12 km NW of Port Wakefield, Sep 1967, *Blaycock* 606 (AD); Wangianna, 40 km W Marree on railway, Apr 1941, *Cleland* s.n. (AD 97218292); Mt Lyndhurst Station, c. 45 km N of Leigh Creek, May 1924, *Cleland* s.n. (AD 97217274); Curnamona, c. 110 km N of Yunta, Dec 1930, *Cleland* s.n. (AD 97218289); Bute District, c. 140 km NNW of Adelaide, Oct 1966, *Copley* 827 (AD); gate, 3 km E of Ediacara, c. 50 km W of Leigh Creek, Sep 1963, *Lothian* 2422 (AD). **New South Wales.** Near Fowlers Gap, Sep 1952, *Anon* (NE 21249); Fowlers Gap Station, 110 km N from Broken Hill, Dec 1988, *Browne* 557 (LTB); Bogan Gate, Apr 1924, *Ising* 2156 (NSW); 16 miles S of Cobar on Nymagee road, Sep 1966, *Moore* 4488 (CANB); Nucha Lake, 30 km E of Fowlers Gap, Jun 1979, *Paijmans* 3331 (CANB); Trangie, May 1965, *Robards* TR2 (NSW). **Victoria.** MURRAY MALLEE: Red Cliffs, S of Mildura, Sep 1964, *Beauglehole* ACB38486 (MEL); Wyperfeld NP, c. 0.5 miles SW of Wonga Hut, Sep 1968, *Beauglehole* ACB28484 (MEL); between Lakes Mournpoull and Kondarin, 9.7 km NE of Hattah, Aug 1977, *Cameron* 8683 (MEL). LOWAN MALLEE: Wyperfeld NP, Callitris Plain N boundary, Oct 1968, *Beauglehole* & *Finck* ACB29216 (MEL).

***Distribution and habitat*:** *C. recurvatus* subsp. *recurvatus* is found south of about 30°S from north of Leigh Creek in South Australia in the west to Trangie in New South Wales in the east. It extends south into far north-western Victoria and southern South Australia to the west of Port Augusta (Map 5). Its distribution partly overlaps the south-eastern part of the range of *C. clementii*. It grows on red brown earths and sandy and loamy soils generally in low-lying areas such as flood plains and dry lake bottoms. It has been recorded from *Eucalyptus* woodlands and mallee communities.

***Phenology*:** Flowering occurs throughout the year but mainly in late winter to early spring (August–October); fruit have been recorded mainly from early autumn to late spring (March–November).

***Notes*:** The specimens collected in the Wyperfeld National Park area in Victoria cited above are immature and further collections from the area will be necessary to confirm their identity.

10b. Convolvulus recurvatus subsp. **nullarborensis** R.W. Johnson, **subsp. nov.** affinis *C. recurvato* R.W. Johnson subsp. *recurvato* sed corollis et sepalis parvioribus et pilis plerumque adpressis et brevioribus differt. **Typus:** South Australia. NULLABOR REGION: c. 1 km NW of Cook, 16 September 1960, *P. Wilson* 1692 (holo: AD, iso: BRI, MEL).

Perennial with mainly trailing, more rarely twining stems, with appressed hairs 0.2–0.4 mm long with an occasional longer spreading hair. Leaves subtending inflorescences petiolate; petiole 2–10 mm long; blade 7–25 mm long, 6–20 mm wide (Fig. 9B). Inflorescence commonly 1-flowered, more rarely with 2 flowers. Pedicel

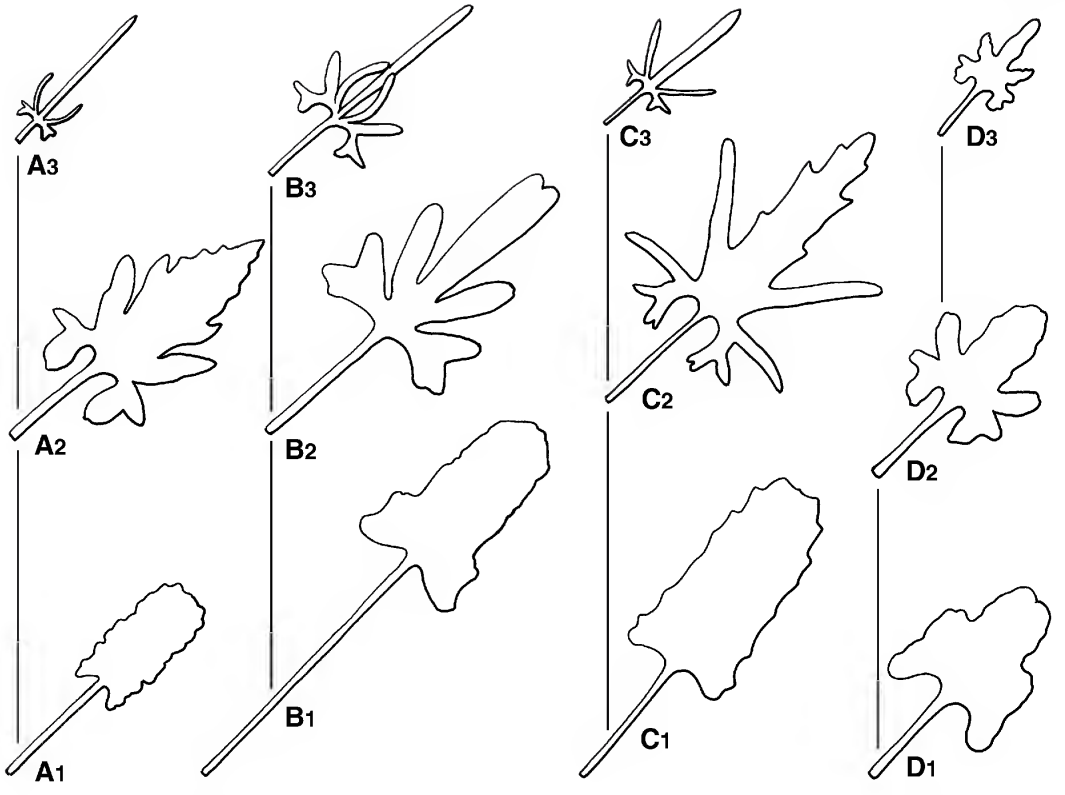


Fig. 9. Variation in leaf shape of *Convolvulus* species from base to tip of stems. A. *C. recurvatus* subsp. *recurvatus.* (1) *Copley* 823 (AD) × 1, (2) *Robards* TR2 (NSW) × 2, (3) *Copley* 823 (AD) × 2; B. C. *recurvatus* subsp. *nullarborensis* × 2. (1) *Ising* s.n. (AD966061026), (2,3) *Wilson* 1710 (AD); C. *C. clementii* × 1. (1) *Lay* 254 (AD), (2,3) *Law* 3 (BRI); D. *C. tedmoorei*. (1) *Moore* 5863 (CANB) × 1 (2) *Moore* 5863 (CANB) × 0.5, (3) *McKean* s.n. (CANB301718) x 1. Del. W. Smith.

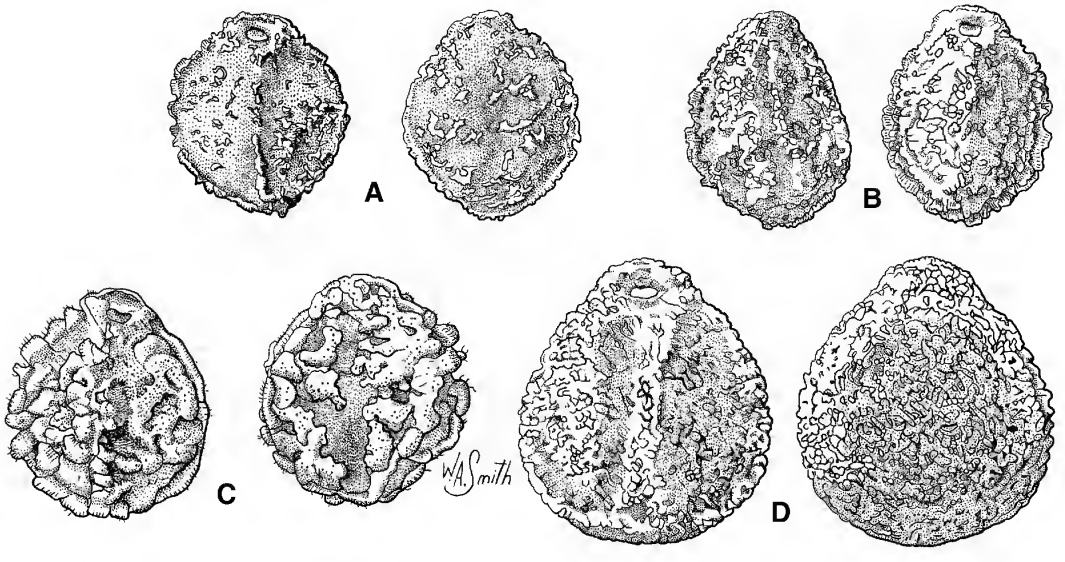


Fig. 10. Seeds of *Convolvulus* species, adaxial (L.H.S.) and abaxial (R.H.S.) surfaces × 10. A *C. recurvatus* subsp. *recurvatus* from *Ising* 2156 (NSW); B. C. *recurvatus* subsp. *nullarborensis* from *George* 8482 (PERTH); C. *C. clementii* from *George* 3938 (PERTH); D. *C. tedmoorei* from *McKean* 5169 (CANB). Del. W. Smith.

2–5 mm long. Outer sepals obovate, obovate-oblong to broadly elliptic, 3–4 mm long, 2.4–3 mm wide, moderately hairy outside, hairs short appressed to ascending, 0.1–0.4 mm long; inner sepals 3–4 mm long, 2–3 mm wide. Corolla 5–6 mm long, petals 5–7 mm long, 2.5–3 mm wide. Stamens affixed to the corolla tube for 1–1.4 mm from the base, free for 1.2–2.75 mm; anthers 0.5–0.7 mm long, 0.35–0.6 mm wide, basal lobes up to 0.15 mm long. Style 1.5–1.9 mm long; stigmatic lobes, 0.6–1.4 mm long.

***Specimens examined*: Western Australia**. 2 miles S of Reid, Nullarbor Plain, Sep 1962, *Aplin* 1671 (PERTH); Nullarbor Plain, c. 115 miles NW of Reid, Oct 1966, *George* 8482 (PERTH). **South Australia**. NULLARBOR REGION: Nullarbor Plain N part, c. 22 km N of Cook, Aug 1980, *Donner* 7216 (AD); Hughes, Sep 1920, *Ising* 1528 (AD, BRI, MEL); c. 1 km NW of Cook, Sep 1960, *Wilson* 1692 (AD, BRI, MEL); 6 km E of Watson, c. 240 km E of WA border on railway line, Sep 1960, *Wilson* 1710 (AD, BRI). FLINDERS RANGES REGION: Leigh Creek on railway to Alice Springs, Oct 1953, *Lothian* s.n.(AD); Leigh Creek, opp. Scout Hut, c. 230 km NNE of Port Augusta, Oct 1969, *Lothian* 5053 (AD). EASTERN REGION: Koonamore Station, c. 60 km N of Yunta, Dec 1926, *Black J.M.Herb* s.n. (AD); Koonamore Vegetation Reserve, c. 400 km NNE of Adelaide, May 1971, *Crisp* 181(AD); Koonamore Vegetation Reserve, 60 km N of Yunta, Mar 1962, *Lange* s.n. (AD); Koonamore, c. 60 km N of Yunta, Nov 1927, *Paltridge* s.n. (AD). EYRE PENNINSULA REGION: Gawler Range, 2 km W of Wartaka H/S, Oct 1983, *Weber* 7921(BRI).

***Distribution and habitat*:** *C. recurvatus* subsp. *nullarborensis* occurs in Western Australia and South Australia on the Nullarbor Plain (Map 5) where it grows in chenopod shrublands on clay loam soils derived from limestone. Other populations recorded from central South Australia have been assigned to this subspecies. Three specimens from the Koonamore area appear to belong to this taxon. In particular *Crisp* 181 clearly resembles *Ising* 1528 which was collected from Hughes on the Nullarbor Plain. Two specimens from Leigh Creek (*Lothian* s.n. (AD96212336) and *Lothian* 5053 possess the short recurved fruiting pedicels and short appressed hairs of *C. recurvatus* subsp. *nullarborensis* and though the leaves appear much less divided I have included them under this subspecies. The latter populations grow in arid shrub steppes.

***Phenology*:** Flowering and fruiting have been recorded from late winter to mid spring, from August to October.

***Etymology*:** The subspecific epithet refers to the Nullarbor Plain from which the most typical specimens of this subspecies have been collected.

11. Convolvulus clementii Domin, Biblioth. Bot. 89: 539 (1928) **Type:** Nordwest-Australien: zwischen Ashburton und De Grey River, *E. Clement* (holo: PR).

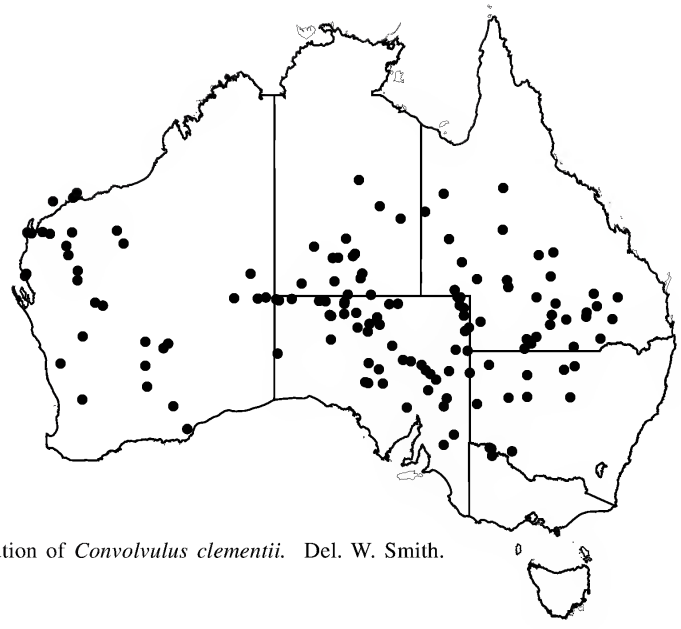
Convolvulus clementii var. *biflorus* Domin, Biblioth. Bot. 89: 539 (1928). **Type:** Queensland. Sandsteinhugel der Dividing Range bei Jericho, *Domin* III 1910 (holo: PR).

Perennial with trailing and twining stems; stems terete, occasionally with low ribs, moderately densely to sparsely hairy, becoming sparser with age, hairs ± appressed especially towards the tip of the stem but in lower parts ascending to spreading hairs are common, 0.2–0.8 mm long. Leaves variable in shape and size from base to tip of the stem (Fig. 9C). Basal leaves petiolate; petiole often equal to or longer than the blade, 6–30 mm long; blade oblong to ovate, sometimes triangular, sometimes hastate or auriculate, 7–30 mm long, 5–15 mm wide, apex obtuse to rounded, occasionally emarginate, mucronulate, base truncate to cordate, margins ± entire to undulate, soon becoming lobed with a prominent pair of basal lobes, a pair of ascending lobes and a terminal lobe, all undulate to irregularly lobed, ± glabrous but soon becoming moderately hairy, hairs mainly spreading, 0.3–0.5 mm long. Leaves subtending inflorescences petiolate; petiole 2–30 mm long; blade ovate in outline, 10–60 mm long, apex obtuse to rounded, emarginate, mucronulate, base cordate with a broad sinus, deeply lobed, basal pair of lobes linear or narrowly-oblong, 2–15 mm long, with a secondary recurved lobe from the lower margin, often 2–3 toothed, ascending lobes linear to narrowly oblong, occasionally slightly obovate, to 30 mm long, 1–3 mm wide, terminal lobe linear to linear-obovate, up to 55 mm long, 2–10 mm wide, occasionally triangular-oblong and up to 30 mm wide, margin entire, undulate, toothed to shallowly lobed, moderately to sparsely hairy becoming glabrous, usually slightly denser

below, hairs crisped-appressed to spreading, 0.2–0.6 mm long. In upper parts, leaves deeply lobed, lobes becoming narrower and aside from the basal lobes, with entire margins. Inflorescence solitary, axillary, bracteolate, a one-sided dichasium with 1or 2, rarely 3 flowers, or occasionally with 2 inflorescences per axil; peduncle terete, 5–50 mm long, moderately densely to sparsely hairy, hairs crisped appressed, ascending and spreading, 0.2–0.6 mm long; bracteoles opposite to alternate, linear to subulate or rarely narrowly elliptic, 1–4.5 mm long, 0.25–0.5 mm wide, apex acute, ciliate, moderately hairy to ± glabrous on the back; pedicel 3–15 mm long, rarely longer at fruiting, straight to sinuate or slightly curved at fruiting, hairs often denser and more appressed than for peduncle. Outer sepals obovate, orbicular to broadly elliptic, 4–5.5(–6) mm long, 2.5–4.5 mm wide, apex barely acute to rounded with a recurved apiculum, ciliate, moderately to sparsely, occasionally densely, hairy outside, hairs crisped-appressed, ascending and spreading, 0.2–0.7 mm long; inner sepals orbicular, obovate to obovate-elliptic, 3.5–5.5 mm long, 2.5–4 mm wide, apex obtuse to rounded-truncate with a recurved apiculum, base rounded to truncate, eciliate or with a few hairs on the upper margin, face ± glabrous with some hairs around the apiculum and midrib. Corolla funnel-shaped, white to pink, rarely purplish, 5–8 mm long, 4–10 mm diameter, flared 2.5–4 mm above the base of the tube; petals 6–9 mm long, 1.5–4 mm wide, with rounded-triangular, broadly emarginate lobes, with a short apiculum, glabrous except for hairs on the outside of the midpetaline band for 1–3 mm from the apex. Stamens 5, slightly unequal; filaments affixed to the corolla tube for 1.5–2.5 mm from the base, free for 1.5–3 mm, with scattered low tubercles, mainly along the margins, from 0.5 mm above the base of the corolla and extending for 1–3 mm; anthers oblong, oblong-elliptic to triangular-ovate, 0.5–0.9 mm long, 0.3–0.5 mm wide, apex obtuse to rounded emarginate, base sagittate, basal lobes 0.1–0.3 mm long. Ovary ovoid to globular ovoid, 1–1.5 mm long, on a disk 0.2–0.25 mm high, glabrous; style 2–3 mm long, with cylindrical to narrowly ovoid, sometimes falcate, obtuse stigmas, 1.3–1.9 mm long, often suffused with purple. Capsule globular to globular-ovoid, 4–7 mm long, 4–6 mm diameter, glabrous. Seeds 4, ¼-globular, 2.5–3.2 mm long, 2–2.7 mm wide, dark brown to black, surface finely punctate bearing irregular short raised ridges and tubercles, made of fused hairs and a serrated to ± continuous wing of fused hairs to 0.25 mm wide (Fig. 10C).

Selected specimens (170 specimens examined): **Western Australia**. Between Menzies and Comet Vale, Sep 1939, *Blackall* 4193 (PERTH); 4.4 miles N of Meekatharra, Oct 1973, *Demarz* 4701 (PERTH); 4 km S of Mt Magnet, Sep 1984, *Demerz* 10196 (PERTH); 1 mile E of Yanrey Homestead, Aug 1960, *George* 1154 (PERTH); Wingkilina, Hinckley Ranges, Jun 1981, *Kalotas* 868 (BRI). **Northern Territory**. Argadargada H/S Bore, Sep 1954, *Chippendale* 308 (DNA); 1 mile S of Elkedra H/S, Oct 1956, *Chippendale* 3097 (DNA); Mt Ebenezar H/S, 57 km W of Stuart Highway on road to Ayers Rock, Sep 1979, *Johnson* 3364 (BRI); 10 miles SSW of Alice Springs, Oct 1956, *Lazarides* 6101 (DNA); Uluru NP - Docker River road, 51 km WNW of Ranger Station, Aug 1988, *Lazarides & Palmer* 542 (BRI). **South Australia.** Far East N of Curnamona Gate & boundary fence, c. 130 km N of Yunta, Nov 1962, *Lothian* 1216 (AD); NW Region Mt Davies, Tomlinson Range, Sep 1955, *SA Pastoral Board* 107 (AD); Lake Eyre Basin NE, Cadelga Waterhole, 10 km S & 60 km E[W] of Queensland border, Aug 1973, *SA Pastoral Board* s.n. (AD); Everard Range at foot of Mt Areteinna, Sep 1968, *Spooner* 136 (AD); Lake Frome NE, c. 10 km W of Quinyambie H/S, Jul 1971, *Whibley* 3535 (AD). **Queensland.** Burke District: 15 km NW of Richmond, May 1974, *Byrnes* 3047 (BRI). Gregory North District: 13 km S of Boulia, Oct 1984, *Neldner* 1631 (BRI). Mitchell District: Winton, Jul 1934, *Blake* 6551 (BRI). Leichhardt District: Wandoan, Nov 1930, *Hubbard* 5021 (BRI). Gregory South District: 35 miles ENE of Nappamerry, May 1971, *Silcock* S363 (BRI). Warrego District: 6 km E of Charleville along Morven road, Mar 1976, *Purdie & Boyland* 200/23 (BRI). Maranoa District: 8 miles E of Weengallen, Nov 1961, *Pedley* 914 (BRI). Darling Downs District: c. 12 miles W of Meandarra, Mar 1959, *Johnson* 749 (BRI). **New South Wales.** Donalds Plain, 75 km W of Cobar, Oct 1963, *Constable* 4655 (NSW); Bulloo River, in 1887, *Lockhart Morton* s.n. (MEL); NE edge of Narran Lake, near Brewarrina, Nov 1967, *McGillivray* 2856A (NSW); Paika, Balranald, Mar 1910, *McPherson* s.n. (MEL); 11 km E of Warratta Bore, 32 km E of Milparinka, Oct 1976, *Wilson* 1643 (NSW). **Victoria.** Murray Mallee: Red Cliffs, Nov 1987, *Browne* 474 (LTB, BRI).

***Distribution and habitat*:** *C. clementii* is found south of about 20°S, from around Dampier in Western Australia across the Northern Territory to Richmond in Queensland. It extends southwards to the southern parts of Western Australia and across southern Australia to far north-western areas of Victoria. It is common throughout semi-arid New South Wales and Queensland and is absent within this region in



Map 8. Distribution of *Convolvulus clementii.* Del. W. Smith.

only the most arid areas of the continent (Map 8). It is found mainly on plains, often in flooded and swampy situations, but also on clay pans between sand dunes. It grows mainly in grassy woodlands, commonly with *Eucalyptus populnea*, *E. intertexta* and *Acacia aneura*, where it occurs in red-brown sandy and loamy duplex soils and in sands. It is also found in grassy woodlands with *E. coolabah* and *E. largiflorens* along floodplains where soils are usually brown to grey clays, sandy clays to clay loams. It is occasionally found in *Astrebla* grasslands.

***Affinities*:** It appears most closely related to *C. recurvatus* which can be distinguished from this species by its short pedicels which are strongly recurved at fruiting.

***Phenology*:** Flowering and fruiting have been recorded throughout the year though flowering may be more common in late winter to mid spring (August–October) and fruit are found mainly in the early autumn to late spring (March–November).

***Etymology*:** This species was named in honour of Dr E. Clement, a botanical collector who lived in Western Australia and who sent the type specimen to Dr K. Domin in Prague.

***Conservation Status*:** This species is widespread.

12. Convolvulus tedmoorei R.W. Johnson, **sp. nov.** affinis *C. clementio* Domin sed caulibus et foliis multis grossis et seminibus grandioribus et alis destitutis differt. **Typus:** New South Wales. 5 miles [8 km] NW of Louth, 7 September 1971, *C.W.E. Moore* 5863 (holo: CANB; iso: BRI, NSW).

Perennial with trailing stems; stems coarse, terete, moderately to sparsely hairy, hairs weakly ascending, 0.25–0.4 mm long. Leaves somewhat similar in shape from base to tip of the stem (Fig. 9D). Basal leaves petiolate; petiole long, often as long as the blade; blade ovate, apex rounded to emarginate, base cordate, shallowly lobed particularly at the base, sparsely hairy, hairs as for the stem. Leaves on fertile stems petiolate; petiole 10–40 mm long; blade broadly ovate, oblong or oblong-triangular, 20–50 mm long, 15–40 mm wide, apex rounded to emarginate, base cordate, decurrent, basal lobes broad, 5–10 mm long, with 2 or 3 rounded emarginate lobes, ascending lobes oblong, 5–12 mm long, 2–8 mm wide, terminal lobe oblong 10–25 mm long, 3–20 mm wide, margin undulate to shallowly lobed, moderately to sparsely hairy, hairs crisped and

loosely appressed to weakly ascending, 0.25–0.4 mm long. In upper parts, leaves similar in shape but shorter and with narrower lobes. Inflorescence solitary, axillary, bracteolate, a one-sided dichasium with 1 or 2 flowers, or commonly with 2 inflorescences in each axil; peduncle terete, 7–30 mm long, moderately hairy, hairs crisped-appressed to weakly ascending, 0.25–0.5 mm long; bracteoles opposite to sub-opposite, narrowly triangular, 1.5–2.5 mm long, acute, ciliate, moderately to sparsely hairy on the back; pedicel thicker than the peduncle, dilated upwards, 6–13 mm long, more densely hairy than the peduncle. Outer sepals elliptic to obovate, becoming orbicular, 5–6 mm long, 4.5–5.5 mm wide, obtuse to barely acute with a short recurved apiculum, becoming rounded acuminate, mucronate, ciliate particularly in the upper half, sparsely to moderately hairy outside, hairs ascending 0.15–0.3 mm long; inner sepals obovate, 5–6 mm long, 4.8–6 mm wide, apex rounded, shortly apiculate, base truncate, glabrous except for short cilia around the apex. Corolla funnel-shaped, 5-lobed, white to pink?, c. 7 mm long and c. 8 mm diameter, flared c. 4.5 mm above the base of the tube; petals 8–9 mm long, 2.5–3 mm wide, with well developed oblong, rounded, emarginate lobes, glabrous except for dense hairs on the outside of the midpetaline band for c. 1.5 mm from the tip. Stamens 5, unequal; filaments affixed to the corolla tube for c. 2 mm from the base, free for 2–3 mm with low tubercles, mainly along the margins, from almost the base of the corolla tube and extending for c. 2.5 mm; anthers ovate to triangular-ovate, 0.75–0.85 mm long, 0.6–0.65 mm wide, apex rounded-emarginate, base sagittate, basal lobes 0.1–0.2 mm long. Ovary ovoid, 1.25–1.3 mm long on a disk, 0.3 mm high, glabrous; style stout, c. 3.5 mm long, with stout cylindrical stigmas, 1–1.1 mm long. Capsule globular, 6–7 mm long and wide, glabrous, 2-valved. Seeds 4, ¼-globular to ¼-globular-obovoid, 3.5–3.8 mm long, 2.8–3.2 mm wide, very dark brown to black, surface finely punctate bearing numerous laterally compressed and wavy tubercles, with no obvious wing (Fig. 10D).

***Specimens examined*: New South Wales**. Toganmain Station, Darlington Point, Jun 1969, *McKean* 5169 (CANB); 5 miles NW of Louth, Sep 1971, *Moore* 5863 (CANB, BRI, NSW).

***Distribution and habitat*:** *C. tedmoorei* is known from only two areas on the flood plains of the Darling and Murrumbidgee Rivers in central western New South Wales (Map 5). It grows in self-mulching grey clay soils.

***Affinities*:** This species most closely resembles *C. clementii* but it can be distinguished by its more prostrate and fleshy habit, its coarse stems and its larger capsules and seeds. The seed surface structure is also a distinguishing character as can be seen in Fig. 10, as is the lack of a wing on the seed.

Notes: Only one flower of this species was available for dissection so information on its floral attributes is limited.

***Etymology*:** This species is named in honour of C.W.E.(Ted) Moore, a distinguished CSIRO plant ecologist, who brought this taxon to my notice and collected one of the two known collections of it.

***Conservation Status*:** This species is known from only two localities and both collections were made about thirty years ago. It is certainly a rare species and should possibly be accorded a higher conservation status than rare.

Acknowledgements

I am deeply grateful for the assistance provided by Jeny Calway and Hans Dillewaard in growing and collecting data from plants in the BRI glasshouse at Indooroopilly in Brisbane. In particular, I would like to thank Hans for his photographic assistance. The generous help given by John Parham in collecting material from key areas in Tasmania is also appreciated. Many thanks are also due to Will Smith for the illustrations. I would also like to thank the referees for their careful reading of the manuscript and helpful comments.

The curators of AD, HO, MEL, NE, NSW and PERTH are thanked for providing loans of specimens for this study. My special thanks are given to Dr G.P. Guymer, Director of the Queensland Herbarium, for allowing me to use the herbarium and providing space and facilities to enable me to continue my research.

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Vanguerieae A.Rich. ex Dum. (Rubiaceae) in Australia, 2. *Cyclophyllum* Hook.f.

S.T. Reynolds & R.J.F. Henderson

Summary

Reynolds, S.T. & Henderson, R.J.F. (2001). Vanguerieae A.Rich. ex Dum. in Australia, 2. *Cyclophyllum* Hook.f. *Austrobaileya* 6 (1): 41–66. As a result of critical studies of Australian species that have, in the past, been included in *Canthium* Lam., the genus *Cyclophyllum* Hook.f. (Rubiaceae, Vanguerieae) is now accepted as occurring in Australia. A revision of this genus in this continent is presented here. Nine of its species occur in Australia, five of which are described here as new, namely *C. longipetalum* S.T.Reynolds & R.J.F.Hend., *C. maritimum* S.T.Reynolds & R.J.F.Hend., *C. multiflorum* S.T.Reynolds & R.J.F.Hend., *C. protractum* S.T.Reynolds & R.J.F.Hend. and *C. rostellatum* S.T.Reynolds & R.J.F.Hend. The new combinations *C. brevipes* (Merr. & L.M.Perry) S.T.Reynolds & R.J.F.Hend., *C. coprosmoides* (F.Muell.) S.T.Reynolds & R.J.F.Hend., *C. costatum* (C.T.White) S.T.Reynolds & R.J.F.Hend. and *C. schultzii* (O.Schwarz) S.T.Reynolds & R.J.F.Hend. are provided for the remaining four. The new combination *C. coprosmoides* var. *spathulatum* (O.Schwarz) S.T.Reynolds & R.J.F.Hend. is provided for a distinctive variety of *C. coprosmoides*, and *C. schultzii* forma *angustifolium* S.T.Reynolds & R.J.F.Hend. for a distinctive form of *C. schultzii*. All recognised taxa are described, and keys to identify them as well as maps showing their known distribution are provided. Line drawings representing some of the recognised taxa are also provided.

Keywords: Rubiaceae, Vanguerieae, *Cyclophyllum*, Australia

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Introduction

Psydrax Gaertn. and *Cyclophyllum* Hook.f. have of recent times been combined under *Canthium* Lam., but based mainly on the work of Bridson (1985, 1987, 1992) and studies of much Australian material, these genera plus *Everistia*, the only other genus with taxa previously included in *Canthium* in Australia, are now considered worthy of recognition in Australia. As a result, the genus *Canthium* in the strict sense is found not to occur in this country. A key to distinguish *Cyclophyllum* from *Psydrax* and *Everistia* has been provided by Reynolds and Henderson (1999).

Bridson (1987) accepted that there existed a group of species allied to *Pyrostria* Commerson ex Juss. from Africa, and centred on the New Caledonian *Cyclophyllum deplanchei* Hook.f., which could be recognised as either a distinct genus with the name *Cyclophyllum* Hook.f., an infra-generic group within *Pyrostria* or even as an infra-generic group within *Canthium*. At that time, she left the question of what rank to recognise this group at as a matter still "to be settled". She diagnosed the group and listed *Canthium barbatum* (G.Forst.) Seem. and *C. sessilifolium* A.Gray, from Fiji, *C. brevipes* Merr. & L.M.Perry, *C. caudatum* (Valeton) S.Moore, *C. longiflorum* (Valeton) Merr. & L.M.Perry and *C. valetonianum* S.Moore from New Guinea, and *C. coprosmoides* F.Muell. and *C. costatum* C.T.White from Australia as species she believed "should be considered for transfer to *Cyclophyllum*".

Smith & Darwin (1988, p.232), in dealing with the group in Fiji, recognised *Cyclophyllum* as a distinct genus and included three species from that country in it. Guilluamin had earlier (Guilluamin, 1948) recognised 14 species from New Caledonia as belonging to this genus. As stated above, our studies have led us to accept that *Cyclophyllum* should be recognised as a distinct genus.

Although the species treated here as *Cyclophyllum costatum* (from north Queensland) and *C. schultzii* (from the Northern Territory) are very distinctive, herbarium material that was previously included under *Canthium*

Accepted for publication 16 March 2001

coprosmoides (from Queensland) was found to be very variable and, in fact, represented a number of undescribed taxa in addition to *Cyclophyllum coprosmoides* in the strict sense. These new taxa have been formally described in this account.

As stated previously (Reynolds & Henderson, l.c.), this study was based mostly on herbarium material, but measurements given for leaves, inflorescences, flowers and fruits are based on dried, fresh or spirit material. In the list of specimens cited, only the herbaria from which specimens have been seen are recorded. State subdivisions (pastoral districts) are provided for Queensland collections only. The taxonomic concepts accepted here are those of the first author and result from her many years of detailed herbarium studies.

Taxonomy

Cyclophyllum Hook.f. in Benth. & Hook. f., Gen. Pl. 2: 535 (April 1873). *Canthium* sect. *Cyclophyllum* (Hook.f.) Baillon, Adansonia 12: 184 (1879); from Greek *cyclo-* (circular) and *-phyllus* (-leaved), in reference to the leaf blades of the type. **Type:** *Cyclophyllum deplanchei* Hook.f.

Trees or shrubs, usually with horizontal branches; branchlets without spines. **Leaves** stipulate, petiolate, usually coriaceous; stipules interpetiolar, ovate to deltoid, acuminate or with a subulate tip. **Inflorescences** axillary, of 1 to few-flowered, umbelliform, sessile or shortly pedunculate cymes, or sometimes with flowers along rudimentary inflorescence branchlets. **Flowers** in bud obtuse or acuminate at apex, 5-merous (sometimes 4-merous in *C. costatum*), pedicellate, each subtended by a single bract; calyx tube cupuliform except in *C. costatum* where long attenuated into pedicel; corolla tube slender, longer than lobes, hypocrateriform, coriaceous, hairy adaxially with dense, white, moniliform hairs projecting from its mouth and obscuring anthers; stamens (4 or) 5, with filaments very short, and anthers ovoid, dorsifixed, introrse, the locules attached by their dorsal surface to a brown coloured connective with pallid margins; ovary 2-locular; ovules solitary in each locule, pendulous; style as long as the corolla tube; stigma attached to the style at its rounded base, fleshy, capitate, usually obscurely 2-lobed. **Fruit** transversely ellipsoid, broadly obovoid to obcordiform, smooth, entire (or ribbed in *C. costatum*); pyrenes exceedingly woody, usually broadly hemispherical and depressed distally, smooth or slightly granular or rugose when dry.

Distribution: About 30 species, occurring in New Caledonia, Fiji, the Moluccas, New Guinea and Australia; nine species in Australia.

Notes: The genus *Cyclophyllum* is characterised by its axillary, fasciculate inflorescences, and by its fleshy flowers with a long hypocrateriform corolla tube with moniliform hairs protruding from the throat, introrse shortly stalked anthers with a dorsal brown-coloured connective, style which shortly exceeds the corolla tube, and capitate stigma which is attached to the style at its convex base.

In the Australian species, the flowers are clustered on very reduced, thickened, broad, knob-like peduncles, each flower being subtended by a bract, or the flowers and bracts are clustered distally on a short, more or less slender peduncle.

Affinities: *Cyclophyllum* Hook.f. is closely related to *Pyrostria* Commerson ex Juss. from Africa, and Bridson (1987) included it as one of five informal groups she recognised within that genus. However, Guilluamin (1948) and Smith & Darwin (1988) recognised it as a distinct genus. *Cyclophyllum* is also related to *Everistia* and *Psydrax* and resembles those genera in the placement of its cotyledons, but differs from them by its long fleshy hypocrateriform corolla tube which is always longer than the corolla lobes, anthers with a distal appendage, and its capitate stigma. It resembles *Canthium*, with which it was previously combined, in its habit, inflorescence attributes, anthers with a dark dorsal membranous connective, and in style and stigma attributes, but the latter genus has cotyledons placed perpendicular to the ventral face of the seed and a consistently shorter corolla tube.

Key to species of *Cyclophyllum* in Australia

1. Calyx tube elongate, attenuate at base into a slightly winged pedicel, together with pedicel 11–19 mm long; fruits strongly ridged; leaves thin, slightly membranous when dry ..... **1. C. costatum**
   Calyx tube short, cupular, attached to a slender, rounded pedicel, together with pedicel less than 10 mm long; fruits evenly rounded or slightly ridged; leaf blades ± coriaceous when dry 2

2. Domatia present on leaf blades, usually conspicuous 3
   Domatia absent on leaf blades or if present, small and inconspicuous 5

3. Cymes (2–)5–12-flowered, sessile; branchlets densely covered with exceedingly conspicuous lenticels; leaf blades (6.7–)9–13 cm long ..... **7. C. multiflorum**
   Cymes (1or)2–5-flowered, shortly stalked or sessile; branchlets with few, usually inconspicuous lenticels or lenticels absent; leaf blades usually 5.5–9.5 cm long 4

4. Corolla 8.5–9 mm long; cymes 2–5-flowered, sessile; leaf blades 5.6–7.7 (–8.3) × 2.7–3.2(–4) cm, usually abruptly acuminate at apex; petioles 3–8 mm long ..... **5. C. protractum**
   Corolla 13–14 mm long; cymes (1 or)2–4-flowered, on short peduncles or sessile; leaf blades 5.5–7(–9.5) × (2.2–)3.3–5.2 cm, acuminate or subacute at apex; petioles 5–16 mm long ..... **4. C. longipetalum**

5. Inflorescences distinctly pedunculate; peduncles (1 or) 2–6 mm long 6
   Inflorescences sessile or with reduced peduncles; peduncles (where present) 0.5–1.5 mm long 7

6. Peduncle branched or simple; cymes (2–)7–11(–16)-flowered; leaf blades 8.5–16.2 × 1.8–7.2(–8.2) cm; fruits 8–12 × 16–23 mm, usually obcordiform, broadly 2-lobed distally; corolla 6–9 mm long ..... **8. C. schultzii**
   Peduncle simple; cymes 2–7-flowered; leaf blades 3.8–8.2 × 2.1–4.6(–5.2) cm; fruits 8.5–11.5 × c.8.5 mm, transversely ellipsoid, usually depressed distally; corolla 9–10 mm long ..... **6. C. maritimum**

7. Cymes (4–)7–10-flowered; bracts glabrous; leaf blades usually acuminate or subcaudate at apex, 6.2–14.7 × 2.5–5.5 cm, drying blackish coloured or dark brown on both surfaces ..... **9. C. brevipes**
   Cymes (1 or)2–4-flowered; bracts pubescent; leaf blades rounded, obtuse, retuse, subacute or subacuminate at apex, 3.6–11(–13.5) × 1.6–5.2(–6.7) cm, drying dark or greyish brown adaxially, pale grey or yellow green abaxially 8

8. Petioles 8–10 mm long; cymes (1–)3–6-flowered; corolla 10–12 mm long, cream to orange or brownish coloured; apex of flower buds and corolla lobes acuminate or rarely obtuse; bracts usually with rusty brown hairs ..... **3. C. rostellatum**
   Petioles 4–7 mm long; cymes (1 or)2–4-flowered; corolla 6.5–8(–11) mm long, cream or deep yellow coloured; apex of flower buds and corolla lobes obtuse; bracts with white or pale brown coloured hairs or glabrous ..... **2. C. coprosmoides**

Conspectus of some diagnostic attributes in *Cyclophyllum*

Leaf blades membranous when dry; fruits usually strongly ribbed	*C. costatum*
Leaf blades with prominent domatia	*C. longipetalum*, *C.multiflorum*, *C. protractum*
Leaf blades usually with small, obscure domatia	*C. brevipes*, *C. coprosmoides*, *C. maritimum*, *C. schultzii*
Inflorescences usually 5– or more-flowered	*C. maritimum*, *C. multiflorum*, *C. schultzii*, *C. brevipes*
Inflorescences usually 4– or less-flowered	*C. coprosmoides*, *C. costatum*, *C. longipetalum*, *C. protractum*

1. Cyclophyllum costatum (C.T.White) S.T.Reynolds & R.J.F.Hend., **comb. nov.**; *Canthium costatum* C.T.White, Contr. Arn. Arb. 4: 99 (1933). **Type:** Queensland. Cook District: Daintree River, 11 March 1932, *L.J. Brass* 2261 (holo: ?A n.v.; iso: BRI).

Trees 4–8 m high; bark brown or whitish coloured, slightly fissured; branchlets slightly angular distally, reddish brown coloured but usually with a white bloom, the older ones with small, whitish coloured lenticels. **Leaves** with stipules deltoid, keeled, attenuated into a narrow subulate apex 6–7 mm long; petioles (1–) 6–7 mm long; blades elliptic to ovate-elliptic, (4.2–)7–7.7 × (1.9–)3.3–4.2 cm, with apex acute or abruptly obtuse and subacuminate, and base abruptly obtuse or subacute and attenuate into petiole, glabrous, thick and fleshy but membranous when dry, pale green in colour, glossy adaxially and matt abaxially; midrib slender, slightly sunken adaxially but prominently raised abaxially; lateral nerves in 4–7 pairs, extremely slender, arcuate and looping at margins; reticulate venation obscure; domatia absent. **Cymes** 1–3-flowered, with flowers fasciculate on a short, thick, knob-like peduncle. **Flowers** in bud acute at apex, 4 or 5-merous, strongly perfumed; pedicels 10–17 mm long, slender; calyx elongate with a long, flattened, narrowly turbinate, longitudinally ribbed tube attenuating into the pedicel, together with pedicel 11–19 mm long, with a short, 4– or 5-denticulate limb; lobes subequal, narrowly ovate to ovate, 1–1.5 mm long, unicostate; corolla pale yellow, 13–15 mm long, with tube 10–11 mm long, sparsely hairy at mouth; lobes ovate, cuculate at apex, abruptly long-acuminate or cuspidate with a long acumen, tricostate, 3–3.5 × 1.5–1.75 mm, scurfy adaxially, densely papillose abaxially on and near margins with usually 2 rows of papillae; disc shorter than calyx limb, glabrous; stamens with anthers ellipsoid or ± oblongoid, apiculate, c.1mm long. **Fruits** on pendulous pedicels 6–11mm long, reddish coloured when ripe, laterally compressed and 2-lobed, broadly obovate to ± obcordate in broad side view, 1.3–1.4 × c.1.4 cm, strongly angled with 8 or 9 prominent longitudinal ridges, or fruits ellipsoidal and c.10 mm × 6 mm; pyrenes slightly rugose. (Fig. 1, F–I).

Other specimens examined: **Queensland.** Cook District: Daintree River, Dec 1929, *Kajewski* 1450 (BRI); ditto, Aug 1985, *Williams* 85120 (BRI); Mossman, Aug 1957, *Volck* 1388 (BRI); Little Falls Creek, Aug 1957, *Smith* 10050A (BRI); on road up to Mt Windsor Tableland, 16°17'S, 145°05'E, Jul 1978, *Webb & Tracey* 11409 (BRI); Chowchilla Logging Area, State Forest Reserve 144, Mt Windsor, 16°17'S, 145°05'E, Jul 1978, *Unwin* 608 (QRS); State Forest Reserve 144, Oct 1975, *Irvine* 1632 (BRI).

Distribution and habitat: North Queensland; in rainforest at altitudes of 960–1095 m (Map 1).

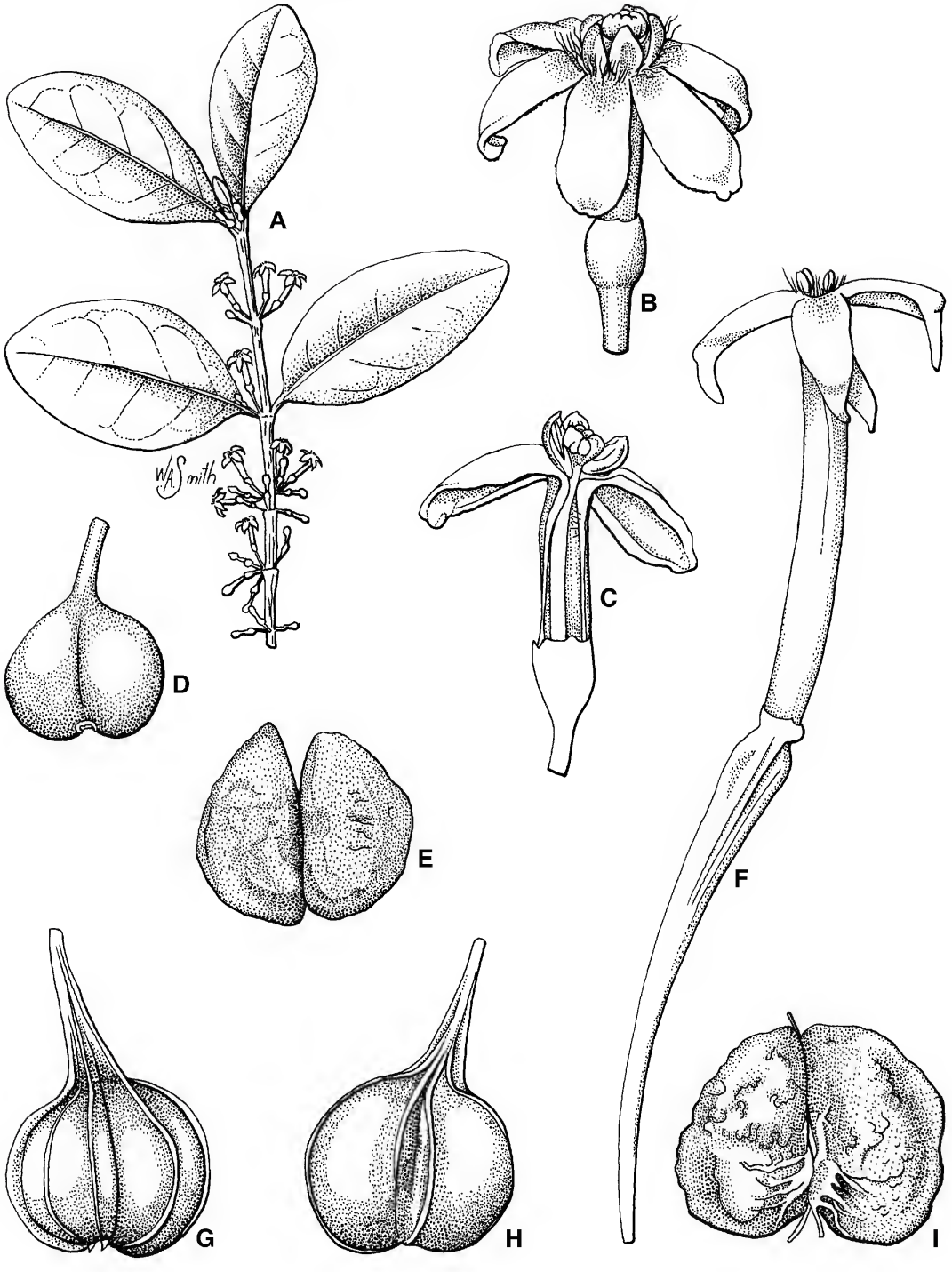
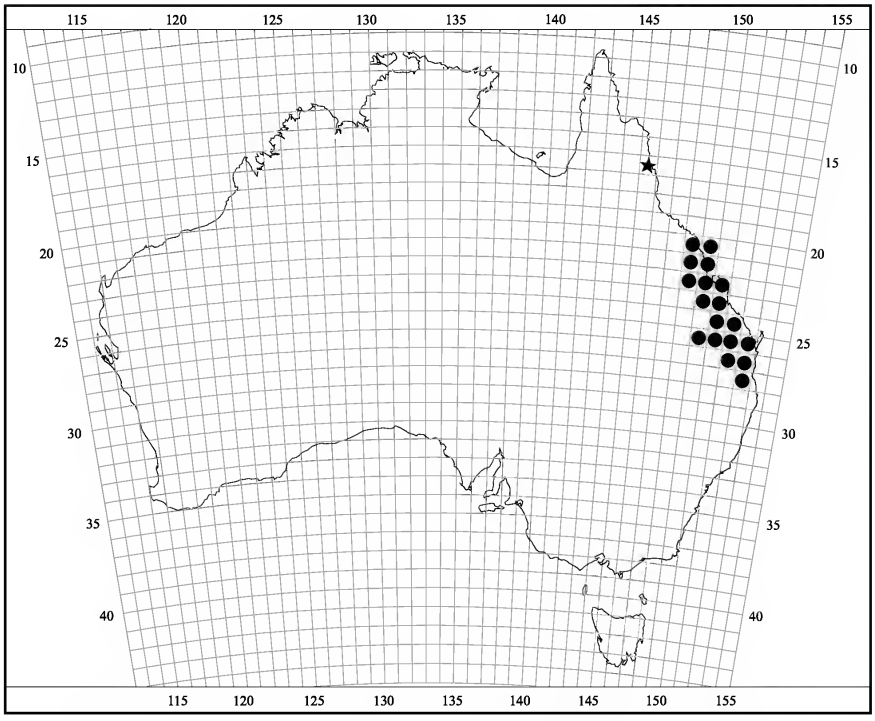


Fig. 1. ***Cyclophyllum coprosmoides*** var. ***coprosmoides***. A. flowering branch × 0.6. B. flower × 5. C. LS of flower × 5. D. fruit × 2. E. pyrenes × 3. A, *Jessup* s.n. (from Lebler 1978, p.529); B & C, *Anderson* 4100 (BRI); D & E, *White* 7287 (BRI). ***Cyclophyllum costatum***. F. flower × 5. G. & H. fruits × 2. I. pyrenes × 3. F, *Kajewski* 1450 (BRI); G–I, *Webb & Tracey* 11409 (BRI).



Map 1. Distribution of *Cyclophyllum costatum* ★ and *Cyclophyllum coprosmoides* var. *coprosmoides* ●.

Notes: *Cyclophyllum costatum* is readily distinguishable by its long-attenuate somewhat laterally compressed calyx tube, complanate winged pedicels, usually strongly ribbed fruits, and leaves ± membranous when dry.

Conservation status: This species, as *Canthium costatum*, is listed as vulnerable under the Regulations of Queensland Nature Conservation Act (as amended 2000) and the Environment Protection and Biodiversity Conservation Act 1999.

2. Cyclophyllum coprosmoides (F.Muell.) S.T.Reynolds & R.J.F.Hend., **comb. nov.**; *Canthium coprosmoides* F.Muell., Philos. Inst. Vic. Trans. 3: 47 (1858). **Type:** Dawson River, date unknown, *Mueller* s.n. (syn: MEL [MEL1538527]); ditto, December 1856, *Mueller* s.n. (syn: MEL [MEL1538570, p.p.]); Mackenzie River, date unknown, *Mueller* s.n. (syn: MEL [MEL1538570, p.p.]); Brisbane River, August 1855, *Mueller* s.n. (syn: MEL [MEL1538569]).

[*Plectronia barbata* sensu F.Muell., Fragm. 9: 186 (1875), non (G.Forst.) F.Muell.]

Shrubs or trees 0.9–10.5 m high, with usually opposite branching; bark grey mottled with pale grey or white; branchlets usually slightly 4-angular distally, pale greyish coloured or very pale brown or brownish-grey, usually slightly scurfy distally and with minute spreading white hairs, usually with conspicuous minute red resin granules and small, round, ± pustular whitish coloured lenticels. **Leaves** with stipules ovate or triangular, keeled and tapered into a short or long, folded apex, glabrous or sparsely white hairy towards base adaxially; petioles 3–7mm long, narrowly winged or ridged distally; blades elliptic, elliptic-oblong, obovate or spathulate, 2.5–8(–12.5) × 1.6–4.6(–6.7) cm, with apex obtuse, ± rounded, slightly retuse or truncate, subacute or rarely abruptly shortly acuminate with obtuse acumen, and base ± cuneate or narrowly cuneate and decurrent into the petiole, thin or thick coriaceous, with both upper and lower surfaces usually with a slight sheen, the upper one dark green or slightly yellowish-green but drying dark brown to blackish and usually dull above, and the lower one pale green

but drying greenish-yellow, grey or pale brown with darker brown or white nerves and occasionally blotched, concave along midrib on adaxial surface; lateral nerves in 3–6 pairs, slender, slightly oblique or arcuate, looping and anatomising near margins; margins flat or slightly recurved; domatia, if present, small. **Cymes** (1or)2–4-flowered, sessile; bracts or hairy or glabrous. **Flowers** in bud obtuse or subacute at apex; pedicels (1.5–)3–5 mm long, minute spreading hairy or glabrous; calyx 2–2.5 × 1.75–1.5 mm, sparsely hairy or glabrous except for ciliolate lobes; limb short, with lobes minute, ovate; corolla white or cream, becoming yellow with age, 6.5–8(–11) mm long, with tube greenish yellow, 3–8 mm long, c.2 mm wide at mouth, sparsely hairy adaxially but densely hairy at throat; lobes ovate-elliptic, ± patent or slightly recurved, abruptly acute and cucullate at apex, 3–5 × 1.5–2 mm, glabrous, usually very scurfy adaxially, streaked with whitish or reddish brown streaks, usually densely papillose towards the apex adaxially on the margins, sparsely papillose abaxially; disc fleshy, as long as or shorter than calyx limb; stamens with filaments c.0.5 mm long and anthers ellipsoid, apiculate at apex, tailed at base, 1.5–1.75 mm long; style with stigma 7–8 mm long; stigma c.1.5 mm × 1.75–2 mm long; ovary walls (especially of mature ovaries) usually covered with numerous reddish resinous cells. **Fruits** on spreading to pendulous pedicels 6–9 mm long, orange or orange-yellow when ripe, ellipsoid to obovoid, slightly obcordiform or transversely ellipsoid, slightly lobed at apex, when dry shallowly grooved between the lobes, 6–10 × 8–12 mm; pyrenes broadly hemispherical, smooth or slightly rugose.

Distribution and habitat: Eastern Queensland, from Fitzroy Island, east of Cairns, to Brisbane River; along creeks and river banks, on ridges along rivers and on rocky headlands.

Notes: *Cyclophyllum coprosmoides*, as based on specimens filed under the name *Canthium coprosmoides* in various herbaria, was found to be a very variable species within which seven distinct taxa were distinguishable. Why this very different material had been included in one taxon in the past was probably because, with the exception of the distinctive *Canthium costatum* (now *Cyclophyllum costatum*) from north Queensland and *C. schultzii* (now *Cyclophyllum schultzii*) from the Northern Territory, *Canthium coprosmoides* was the only name available for specimens of the *Canthium* alliance with clustered umbelliform inflorescences, and flowers with a corolla with a long hypocrateriform tube and short lobes. However, critical examination of the above specimens led to the recognition of five new species, namely *Cyclophyllum longipetalum, C. maritimum, C. multiflorum, C. protractum* and *C. rostellatum*, in addition to *C. coprosmoides* which is now considered to contain two varieties.

Some very early collections of this alliance from northern Queensland were previously identified as of *Canthium barbatum* (or *Plectronia barbata*), a Pacific species. That species, however, differs from the above Australian material by its very acuminate, usually membranous leaves. *Cyclophyllum coprosmoides* is distinguishable by its shortly stalked, elliptic, elliptic-oblong or obovate coriaceous leaf blades with obtuse, rounded or subacute apex, usually hairy young branchlets, sessile 1–3(or 4)-flowered cymes, obtuse or subacute flower buds, corollas 6.5–8(–11) mm long, and obtuse or abruptly subacute corolla lobes which are scurfy adaxially.

Affinities: *Cyclophyllum coprosmoides* is most closely related to *C. rostellatum* in its more or less similar leaves, sessile cymes and number of flowers in each cyme, but that species differs from it by its longer petioles (8.0–10 mm long), usually narrower leaf blades, rostrate flower buds and acuminate corolla lobes. However, specimens which appear to be intermediate between these species are occasionally found (see under *C. rostellatum*).

Variability: The leaves of this species are very variable but the material can be divided into two subordinate taxa which are accepted here as varieties following O. Schwarz (1927).

Key to varieties of *Cyclophyllum coprosmoides*

1. Leaf blades elliptic, elliptic-oblong or subobovate, 5–9.3 × 2.7–5.2 cm, rarely less, with apex obtuse, subacute or shortly obtusely acuminate, and base obtuse or subacute; lateral nerves in 3–6 pairs; petioles 4–7 mm long ..... **2a. *C. coprosmoides*** var. ***coprosmoides***
   Leaf blades obovate to spathulate, 2.5–4.8 × 1.6–2.3 cm, rarely more, with apex obtuse or rounded, and base cuneate and decurrent into petiole; lateral nerves in 3 or 4 pairs; petioles 3–4 mm long ..... **2b. *C. coprosmoides*** var. ***spathulatum***

2a. C. coprosmoides var. **coprosmoides** Leaf blades elliptic, elliptic-oblong or subobovate, dull green or slightly yellowish green, drying yellowish green to pale greyish coloured on the abaxial surface. (Fig. 1A).

Representative specimens: **Queensland.** North Kennedy District: Proserpine River, 7 km ESE of Proserpine, Nov 1985, *Sharpe* 4202 (BRI). South Kennedy District: Cape Hillsborough National Park, Hidden Valley road, 1.5 km S of picnic area, Jan 1990, *Thompson* 163 (BRI). Leichhardt District: Dawson Range, Blackdown Tableland, 23°44'S,149°07'E, Jun 1977, *Telford* 5778 (CANB); Isla Gorge, about 28 km SW of Theodore, Aug 1973, *Sharpe* 620 & *Hockings* (BRI). Port Curtis District: Deepwater National Park, 40 km E of Miriamvale, Jul 1989, *Gibson* 1609 (BRI); Raspberry Vale, Apr 1945, *Blake* 15547 & *Webb* (BRI); Callide, Oct 1947, *Smith* 3585 (BRI); Greenfields, about 14 km NE of Goovigen, Mar 1986, *Anderson* 4115 (BRI). Wide Bay District: Black Gin Creek, Timber Reserve 580, 25°29'S,151° 55'E, Apr 1990, *Forster* PIF6594 (BRI); Mt Walsh, 6.5 km S of Biggenden, 25°34'S,152°02'E, May 1977, *Telford* 5335 (CANB). Moreton District: Base of Mt Coolum, Apr 1945, *Clemens* s.n. (BRI); Brisbane, Gold Creek road, Brookfield, Jan 1984, *Williams* 84011 (BRI).

Distribution and habitat: Eastern Queensland, from near Proserpine to Brisbane; on sandstone ranges, ridges, stony hillsides and gullies; in remnant scrubs on sandy stony soil, at altitudes up to 450 m. (Map 1).

Variability: Leaf blades in this variety are very variable in shape; specimens from the vicinity of Brisbane usually have small, elliptic leaf blades which are obtuse, rounded or subacuminate at apex, and which dry olive-green on the abaxial surface, whereas specimens from ridges further north, near the Dawson and Mackenzie Rivers as well as from near Proserpine and Cape Hillsborough, usually have larger, broadly elliptic or elliptic-oblong to subobovate leaf blades which usually dry a very pale grey on the abaxial surface. These latter specimens also have flowers that are slightly larger than those on specimens from south-eastern Queensland.

Note: Specimens with more or less obovate leaf blades can be confused with those of *C. coprosmoides* var. *spathulatum*, but the latter variety differs from the former in its smaller leaf blades or by having a fewer number of nerves in those blades.

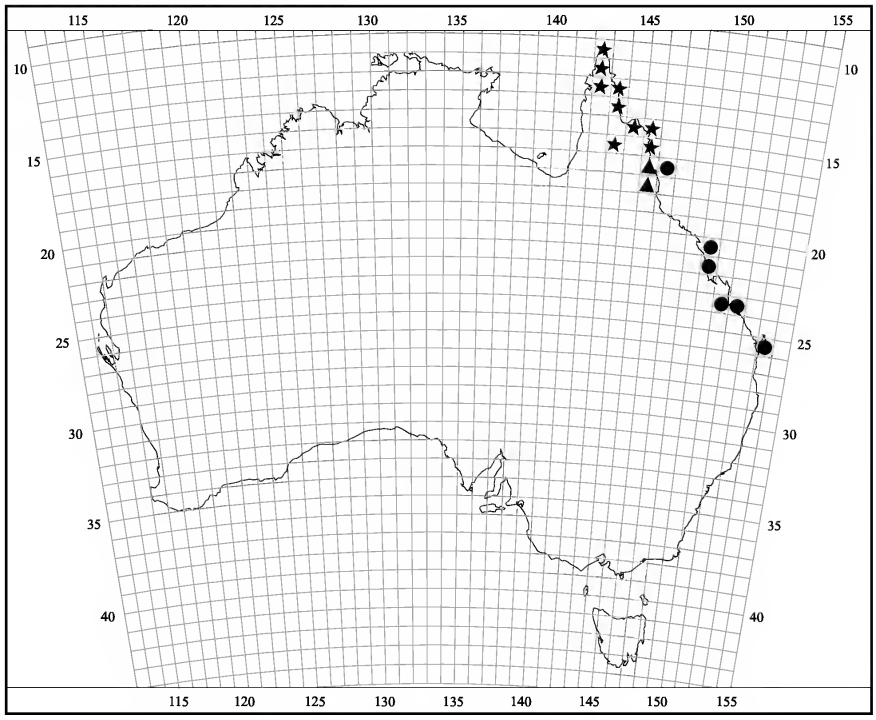
2b. C. coprosmoides var. **spathulatum** (O.Schwarz) S.T.Reynolds & R.J.F.Hend., **comb. nov.**; *Plectronia coprosmoides* var. *spathulata* O.Schwarz, Feddes Repert. 24: 102 (1927). **Type**: East Coast, *Brown* s.n. (lecto [here designated]: BRI; isolecto: CANB, MEL, NSW).

Leaf blades obovate or spathulate, rounded, obtuse or occasionally retuse at the apex and cuneate at the base, of varying shades of green to grey but paler on the abaxial surface than on the adaxial surface.

Specimens examined: **Queensland.** Cook District: Fitzroy Island, 16°55S, 146°03E, Jan 1997, *Jago* 4233 (BRI). North Kennedy District: Harold Island, 20°14'S,149°09'E, Nov 1983, *Batianoff* 3404 & *Dillewaard* (BRI). South Kennedy District: Port Mackay, date unknown, *Dietrich* 1042 (MEL); Bailey Islet, May 1969, *Firth* s.n. (BRI). Port Curtis District: Gladstone, Dec 1864, *Dietrich* 1229 (MEL); ditto, near Keppel Bay, Jan 1865, *Dietrich* 2388 (MEL); Sloping Island, S of N Keppel Island, Oct 1987, *Batianoff* 9197 & *Dillewaard* (BRI). Wide Bay District: Fraser Island, May 1967, *Baxter* 797 (BRI); ditto, Sep 1979, *Coutts* 3 (BRI).

Distribution and habitat: Eastern coastal Queensland, commonly on offshore islands; usually along beaches, on rocky headlands and on frontal dunes. (Map 2).

Notes: Leaf blades in specimens from offshore islands, especially in those collected from plants growing in deep sand on high dunes (e.g. *Batianoff* 9197 & *Dillewaard*) are comparatively very small, and are clustered on usually stunted branchlets with the nodes very close together. Leaf blades in those from plants



Map 2. Distribution of *Cyclophyllum rostellatum* ★, *Cyclophyllum protractum* ▲ and *Cyclophyllum coprosmoides* var. *spathulatum* ●.

growing on the mainland, e.g. from near Gladstone, are usually larger and resemble those in some specimens of the typical variety. However, that variety has leaf blades with a greater number of lateral nerves than are present in the leaf blades of this variety.

Typification: O. Schwarz (1927) cited six collections when describing *Plectronia coprosmoides* var. *spathulata*, namely [1] East Co[a]st, *R.Br[own]*, [2] Gladstone, *Dietrich* no.1229, [3] [locality unknown], *Banks et Solander* s.n., [4] Rockingham Bay, [collector unknown], [5] Queensland [without precise locality], *F. Mueller* [s.n.] and [6] Richmond River, [collector unknown]. These syntypes were all apparently housed in herbarium B in Berlin and are probably now no longer in existence. As to isosyntype material, only *Brown* s.n. (BRI, CANB, MEL, NSW) and *Dietrich* 1229 (MEL [MEL1538514]) has been available for study here. The former collection agrees with the protologue and matches specimens included in this variety here, whereas *Dietrich* 1229 has larger leaf blades which approach in size those on specimens included in *Cyclophyllum coprosmoides* var. *coprosmoides* here. Therefore, based on the material that was available for this study, Brown's duplicate specimen at BRI, stated only to have been collected on the "East Coast" of Australia, is chosen here as lectotype of Schwarz's varietal name. Brown's "East Coast" locality is almost certainly in coastal eastern Queensland.

The locality of collection of the Banks and Solander specimen cited by Schwarz was probably the Endeavour River in north Queensland. Banks and Solander specimens in BRI and CANB of the related *C. rostellatum* are definitely stated to have been collected from the Endeavour River and are possibly/probably conspecific with the specimen seen by Schwarz.

3. Cyclophyllum rostellatum S.T.Reynolds & R.J.F.Hend. **sp. nov.**; *C. coprosmoidi* (F.Muell.) S.T.Reynolds & R.J.F.Hend. similis sed foliis petiolis longioribus, floribus in statu alabastro subrostratis ad apicem, corollae lobis plerumque acuminatis vel caudatis et fructibus

obcordiformibus differt. **Typus**: Queensland. Cook District: 9 km N of Batavia Downs on the Peninsula Development Road, 12°35'S,142°10'E, altitude 100 m, 22 April 1990, *J.R. Clarkson* 8505 & *V.J. Neldner* (holo: BRI). *Canthium* sp. (Mt Rose A.R.Bean 1978), S.T. Reynolds (1997, p.180).

Small trees 2–6 m high; trunks 12–15 cm in diameter; bark grey mottled with white, tessellated; branchlets quadrangular distally, whitish or yellowish-white coloured, densely lenticellate, glabrous. **Leaves** with stipules triangular, keeled and attenuated into a long folded apex, thin and often paleaceous and ± fimbriate at margins, and with long rust-coloured hairs on the margins and at base adaxially; petioles 8–10 mm long; blades elliptic-oblong to subobovate, (3.7–)6.5–11(–13.5) × (1.6–)2.7–3.4(–5.5) cm, with apex obtuse or ± rounded, and base cuneate and attenuate into the petiole, glabrous, thick coriaceous, the adaxial surfaces drying brown, the abaxial ones drying olive green, greyish-brown, pale grey or whitish coloured (in young leaves) and often with whitish coloured flecks and blotches; midrib slightly channelled adaxially; lateral nerves in 4 or 5 pairs, slender, ± arcuate and looping near margins; reticulate venation obscure or absent; domatia very rarely present when inconspicuous. **Cymes** (1–)3–6-flowered, with flowers fasciculate on a short, thick, knob-like peduncle; bracts rust-coloured hairy. **Flowers** in bud acuminate and somewhat rostrate at apex, rarely obtuse or subacute, strongly perfumed; pedicels 2–3.5 mm long; calyx glabrous, c.2 × 1.5 mm, with short, denticulate limb with ciliolate lobes; corolla creamy yellow to orange or brown, 10–12 mm long (only 5 mm long in one specimen), with tube (2–) 4.5–7 mm long, 1–1.5 mm wide at mouth, sparsely hairy adaxially but densely hairy at mouth; lobes elliptic, abruptly long acuminate at apex with acumen usually about half the length of the lamina of corolla lobe, or subacute at apex, 2.5–4.5 × 1–2 mm, glabrous, scurfy adaxially, densely papillose along margins and at attenuated slightly folded apex; stamens with filaments c.0.5 mm long and anthers c.1.5 mm × 1 mm; style with stigma 7.5–8.5 mm long; stigma c.0.75 × 0.75 mm. **Fruits** on erect, spreading to pendulous pedicels (3–)6–8 mm long, orange-yellow, orange-brown or reddish coloured when ripe, obcordiform, slightly lobed at apex, prominently longitudinally 2-lobed, when dry with deep and narrow grooves between the lobes and with short ribs towards the base, 6–11 × 5–11 mm, or rarely 1-lobed; pyrenes depressed ovoid. (Fig. 2).

Selected specimens: **Queensland**. Cook District: Edith Falls, Jardine River, 11°09'S,142°30'E, Oct 1989, *O'Reilly* 541 (BRI); Brown's Creek, Pascoe River, Jul 1948, *Brass* 19583 (BRI); north bank of Pascoe River near Youngman's Crossing, 12°33'S,143°14'E, Nov 1977, *Tracey* 14597 (BRI); Mt Tozer, Iron Range, 12°45'S,143°13'E, Oct 1968, *Webb & Tracey* 8719 (BRI); Tozer [Iron] Range, 0.5 mile [0.8 km] E of Mt Tozer, Jul 1948, *Brass* 19401 (BRI, CANB); McIlwraith Range, Leo Creek Road, Timber Reserve 14, 13°43'S,143°20'E, Sep 1975, *Hyland* 3330 (BRI, CANB, NSW, QRS); ditto, Sep 1975, *Sanderson* 748 (QRS); McIlwraith Range, Lankelly Creek, Timber Reserve 9, Jun 1992, *Forster* PIF10382 & *Tucker* (BRI); Mt Rose area, NW of Cooktown, 15°20'S,145°02'E, Jul 1990, *Bean* 1978 (BRI); Ayton Road, Jun 1962, *Gittins* 566 (BRI, NSW).

Distribution and habitat: Far northern Queensland from Torres Strait islands to near Cooktown; on ranges, rocky slopes, gorges and gullies, usually near permanent streams; in rainforests, mostly on soils derived from granite at altitudes of 250-600 m (Map 2).

Notes: The inclusion of Torres Strait Islands in the distributional range of *C. rostellatum* is tentative because only scanty, sterile material presumably of this species from this locality has been seen.

The colour of its fresh leaves is recorded as bluish green by L.S. Smith (*Smith* 11834, BRI).

C. rostellatum is characterised by its subrostrate flower buds, acuminate or subacute corolla lobes, whitish coloured glabrous branchlets, usually narrow elliptic leaf blades on long petioles and its rusty hairy stipules and bracts. It is closely related to *C. coprosmoides* which it resembles at first sight in its leaves and few-flowered cymes but that species differs from *C. rostellatum* by its obtuse flower buds and corolla lobes, usually broader leaves, short petioles and hairy and scurfy young branchlets. These species, however, are connected by intergrades (see below) but the extremes are quite distinct.

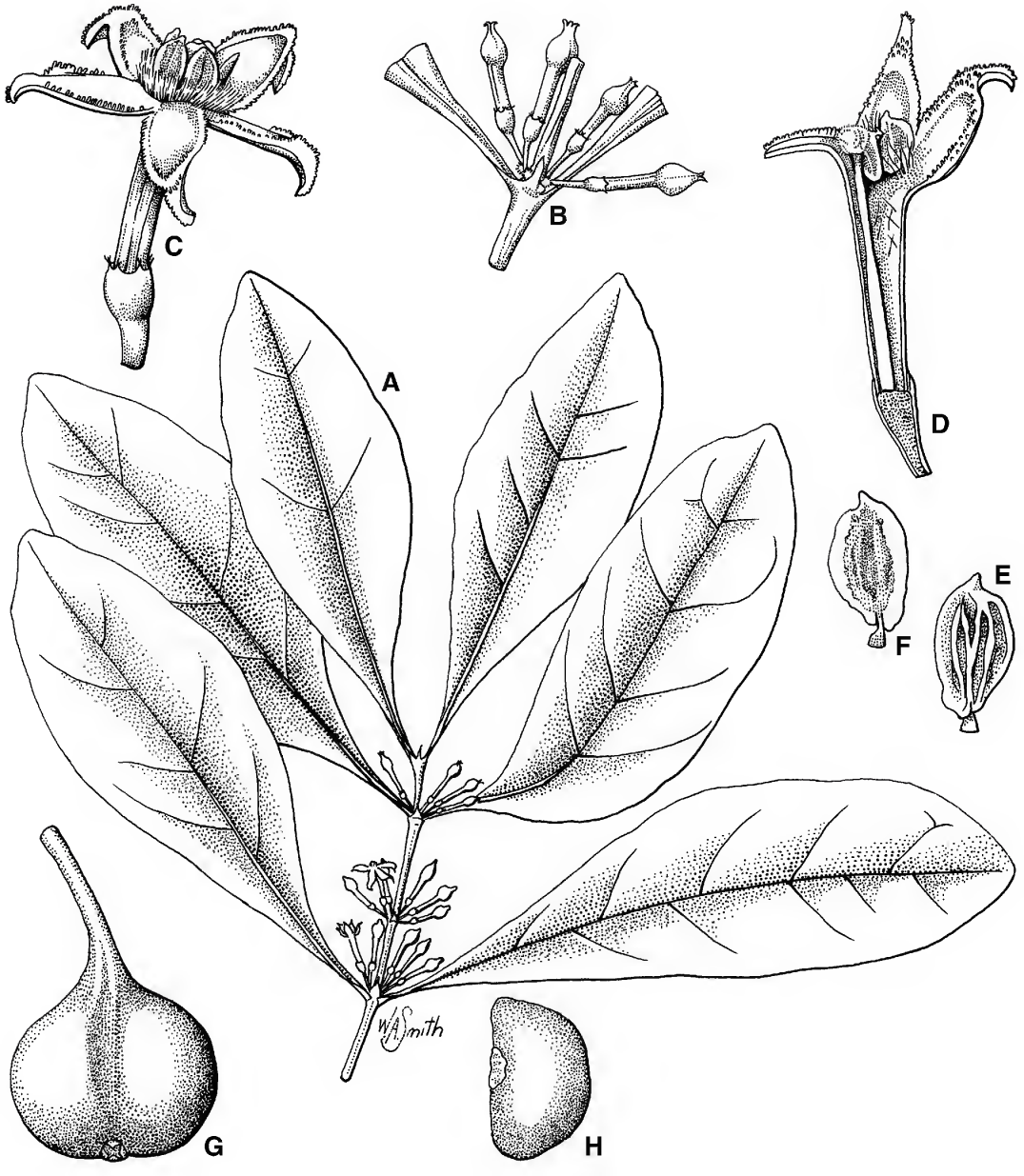


Fig. 2. ***Cyclophyllum rostellatum***. A. flowering branch × 0.8. B. detail of inflorescence × 2. C. flower × 5. D. LS of flower × 5. E. stamen (adaxial view) × 10. F. stamen (abaxial veiw) × 10. G. fruit × 3. H. pyrene × 3. A–H, *Clarkson* 8505 & *Neldner* (BRI). Del. W. Smith.

Variability: The shape and size of leaf blades and the shape of the flower buds in this species are quite variable. Specimens with narrowly elliptic or subobovate leaf blades which dry greyish or greyish-brown on the abaxial surface and have dark coloured nerves and paler coloured blotches, subrostrate flower buds and acuminate corolla lobes are typical of this species. Whereas specimens with very small thick leaves (e.g. *Hyland* 3330 and *Sanderson* 748 from McIlwraith Range, and *Brass* 19401A from Mt Tozer Range above) probably represent a distinct form or variant, they lack flowers. Examination of these, would be necessary to be certain of this. Moreover, specimens with broad leaves with acuminate flower buds (e.g. *Bean* 1978 and *Gittins* 566 above), and others with narrow leaves but with obtuse to subacute flower buds are also included here. These probably represent intergrades between this species and *C. coprosmoides*, but examination/study of more such specimens would be necessary to be certain of this. The broad-leaved form, as represented by *Bean* 1978 and *Gittins* 566 above, resembles the latter species but differs from that in the nature of its flower buds, overall aspect, longer petioles and glabrous branchlets.

Etymology: The specific epithet, from Latin *rostellatus*, beak-like, refers to the beak-like apex of the flower buds.

4. Cyclophyllum longipetalum S.T.Reynolds & R.J.F.Hend. **sp. nov.** differt a *C. coprosmoide* (F.Muell.) S.T.Reynolds & R.J.F.Hend. foliis conspicue foveolatis acuminatis subacutisve et petiolis corollisque longioribus. **Typus**: [New South Wales.] Port Jackson, February 1805, *R. Brown* s.n. (holo: MEL [MEL1538081]; iso: ?BM n.v., BRI [AQ123681]CANB,NSW [NSW193831]).

Canthium sp. (Cooroy S.T.Blake+ 15507), S.T. Reynolds (1997, p.180).

Trees 2.5–20 m high; trunks to 38 cm in diameter; branchlets glabrous, quadrangular distally, very pale brown often mottled with white, dotted with minute resin glands and small whitish coloured lenticels. **Leaves** with stipules triangular, keeled, attenuated into a long folded apex; petioles 5–16 mm long; blades elliptic, (5.5–)7–9.5(rarely –11.5) × (2.2–)3.3–4.3(–5.2, rarely –5.7) cm, usually abruptly narrowing and acuminate at both ends, or with apex abruptly acuminate or subacute, and base acute and decurrent into the petiole, glabrous, thin, coriaceous, with adaxial surface pale green and dull or slightly glossy but drying dull green, pale greenish-yellow or dark brown and usually blotched, and abaxial surface usually paler than adaxial one; lateral nerves in 4 or 5 pairs, slightly arcuate and looping near margins, obscure adaxially; domatia present, prominent, few, on each side of midrib. **Cymes** 1–4-flowered, sessile or subsessile with peduncles 1–2 mm long; bracts hairy. **Flowers** in bud obtuse at apex, strongly scented; pedicels 4–6 mm long, usually stout; calyx 2.5–3 mm long, with tube ± cupular but attenuate into the pedicel and with a short lobed limb; lobes minute, ovate, usually ciliolate; corolla 12–15 mm long, with tube white becoming brown with age, 8–12 mm long and c.2 mm wide, sparsely hairy adaxially and densely hairy at mouth; lobes white becoming greenish orange with age, ovate-elliptic, 3.5–5 × 1.5–2 mm, folded at apex where ± abruptly shortly acuminate or cuspidate, scurfy adaxially, glabrous abaxially and densely papillose on the margins; disc slightly shorter than the calyx limb, fleshy; anthers ovoid-ellipsoid, c.2 mm long, apiculate distally, tailed proximally, on filaments c.0.5 mm long; style with stigma 10–13 mm long; stigma 2–2.5 × 2–2.5 mm. **Fruits** on erect, spreading to pendulous pedicels 7.5–12 mm long, orange to red when ripe, obovoid, depressed or shallowly lobed at apex, deeply grooved between lobes when dry, 1–1.25 × 1.2–1.5 cm; pyrenes depressed ovoid. (Fig. 3).

Selected specimens: **Queensland.** Wide Bay District: Fraser Island, Nov 1915, collector unknown [? *Morrison* s.n.] (BRI); ditto, May 1967, *Baxter* 845 (BRI); Cooroy, Apr 1945, *Blake* 15507 & *Webb* (BRI). Moreton District: Rocky Creek, State Forest 249, SE of Yandina, 26°35'S,152°59'E, Apr 1990, *Bean* 1503 (BRI); Mt Glorious, Jan 1945, *Clemens* s.n. (BRI); ditto, Apr 1956, *Hoogland* 5237 (CANB); ditto, Apr 1999, *Phillips* 199 (BRI); Lyrebird Ridge road, northern end of Springbrook Plateau, 28°11'S,153°15'E, Dec 1993, *Grimshaw* 269 (BRI). **New South Wales.** Lennox Head, Ballina, Apr 1892, *Bauerlen* 799 (MEL, NSW); Lismore, Oct 1891, *Bauerlen* s.n. (MEL); Whian Whain State Forest, Gibberagunyah Mountain, 28°35'S,153°19'E, May 1968, *Jones* 3825 (CANB); Port Macquarie, Feb 1895, *Brown* s.n. (NSW [NSW193746]); Hastings River, date unknown, *Beckler* s.n.(MEL [MEL1538257]; NSW [NSW193747]);

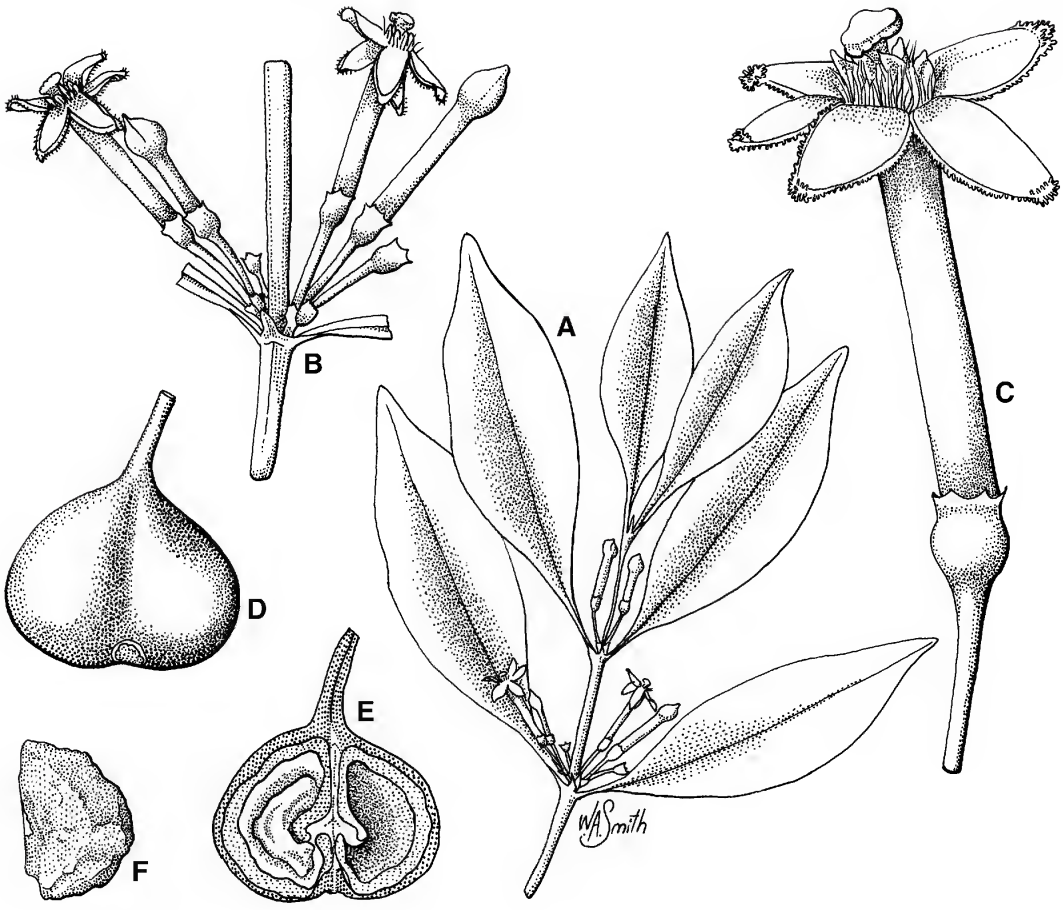


Fig. 3. ***Cyclophyllum longipetalum***. A. flowering branch × 0.6. B. detail of inflorescence × 2. C. flower × 5. D. fruit × 2. E. LS of fruit showing embryo × 2. F. pyrene × 2. A–C, *Brown* s.n. [MEL1538081] (MEL); D–F, *Peberdy* s.n. [AQ468261] (BRI). Del. W. Smith.

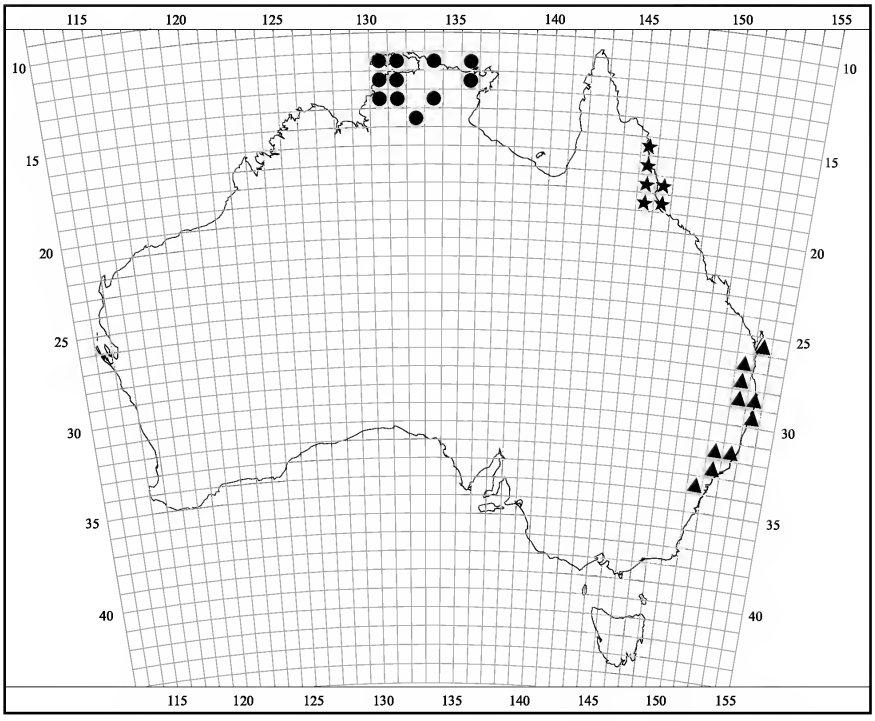
Kurrajong, Blue Mountains, date unknown, *Woolls* s.n. (MEL [MEL1538498]); Kalandra Sanctuary, Mona Vale, 33°44'S,151°17'E, Oct 1977, *Coveny* 9697 (NSW); Foley's Bush, Foxground, 34°43'S,150°46'E, Nov 1906, *Hay* s.n. (NSW).

Distribution and habitat: South-eastern Queensland to Illawarra District, New South Wales; usually on steep ranges, ridges and hillsides, in shallow stony soil; in rainforests at altitudes of 135–600 m (Map 3).

Notes: *C. longipetalum* is characterised by its few-flowered cymes, flowers with long corolla tubes and foveolate, usually subacuminate leaves with long petioles. It resembles *C. coprosmoides* at first sight in its leaves and inflorescences, but differs from that species as follows:-

C. longipetalum has glabrous branchlets, subacuminate or acute leaves with petioles 5–16 mm long and domatia present and prominent, sessile or subsessile cymes with peduncles 1–2 mm long, and flowers with a corolla 12–15 mm long. *C. coprosmoides* has branchlets usually scurfy and hairy distally, obtuse or slightly round-tipped leaves with petioles 3–7 mm long and domatia, if present, small, sessile cymes and flowers with a corolla 6.5–8(–11) mm long.

Etymology: The specific epithet, from Latin *longus*, long, and *petalum*, petal, refers to the comparatively long corollas in flowers of this species.



Map 3. Distribution of *Cyclophyllum longipetalum*▲,*Cyclophyllum multiflorum*★and *Cyclophyllum schultzii* forma *schultzii* ●.

5. Cyclophyllum protractum S.T.Reynolds & R.J.F.Hend. **sp. nov.**; *C. coprosmoidi* (F.Muell.)S.T.Reynolds & R.J.F.Hend. similis sed foliis foveolatis apice acuminato protractove et inflorescentiis 2-5-floribis differt. **Typus**: Queensland. Cook District: State Forest Reserve 144 Whypalla, Chowchilla Logging Area, 16°18'S,145°05'E, altitude 1000 m, 2 February 1988, *B.P.M. Hyland* 13500 (holo: BRI; iso: ?QRS n.v.).

Canthium sp. (Copper-Lode Falls C.H.Gittins 2211), S.T. Reynolds (1997, p.180).

Trees 8–15 m high; trunks 10–20 cm in diameter; branchlets glabrous, greyish coloured mottled with white and dotted with whitish or dark coloured, ± pustulate lenticels. **Leaves** with stipules broadly ovate, keeled, attenuated into a short lobe distally; petioles 3–8 mm long; blades elliptic-ovate, 5.6–7.7(–8.3) × 2.7–3.2(–4) cm, with apex usually abruptly long acuminate or ± caudate, and base subacute, glabrous, thin, coriaceous, drying dark brown adaxially, pale brown abaxially and sometimes irregularly blotched; lateral nerves in 3–5 pairs, ± arcuate and looping near margins; secondary veins loosely reticulate, usually obscure; domatia present, usually conspicuous. **Cymes** 2–5-flowered, on peduncles 0.5–1.5 mm long; bracts glabrous, smooth or ciliolate. **Flowers** in bud obtuse at apex, strongly perfumed; pedicels 2–3 mm long; calyx 1.5–2 × c.1.75 mm, cupular, glabrous, with a short, lobed limb; lobes minute, ovate, glabrous or rarely sparsely ciliolate; corolla 8.5–9 mm long, cream, yellow or orange with age, with tube 4.5–6 mm long and c.1.5 mm wide at mouth, sparsely hairy adaxially but densely hairy at mouth; lobes elliptic-ovate, 3.5–4.5 × c.1.5 mm, glabrous but densely papillose at the slightly cucullate apex; stamens with filaments c.0.5 mm long and anthers c. 1.5 mm long; style with stigma 6–7.5 mm long; stigma c.1.25 × 1.25 mm. **Fruits** on erect to spreading or decurving pedicels 8–10 mm long, red when ripe, transversely ellipsoid or ± obcordiform, slightly truncate to

lobed at apex, deeply grooved between lobes when dry, 7.5–9 × 9–11 mm; pyrenes smooth.

Selected specimens: **Queensland.** Cook District: State Forest Reserve 144, Agapetes Logging Area, 16°17'S,145°05'E, Dec 1979, *Hyland* 10178 (BRI, QRS); State Forest Reserve 143, Little Mossman Logging Area, 16°32'S,145°23'E, near Mossman, Oct 1978, *Moriaty* 2470 (QRS); State Forest Reserve 607, Shoteel Logging Area, Mickies Pocket, 16°55'S,145°36'E, [NE of Mareeba], Dec 1981, *Gray* 2318 (BRI, QRS); Copper-lode Falls Dam site, c.6 miles [c.9.5 km] S of Cairns, 16°56'S,145°46'E, Sep 1970, *Gittins* 2211 (BRI).

Distribution and habitat: North Queensland, from Daintree River to near Cairns and Mareeba; on ranges in rainforest at altitudes of 400-1000 m (Map 2).

Notes: *C. protractum* is characterised by its usually abruptly acuminate, prominently foveolate leaves, 2–5-flowered shortly pedunculate cymes and transversely ellipsoid or subobcordiform fruits. It resembles *C. maritimum* and *C. coprosmoides* in the shape and size of its leaves and few-flowered cymes, but the former species differs from *C. protractum* by its efoveolate leaves, peduncles (1–)2.5–6 mm long, (2–)4–7-flowered cymes, and transversely ellipsoid fruits which are slightly depressed at the apex and only shallowly lobed when dry. *C. coprosmoides* differs from *C. protractum* by having leaves with domatia, when present, comparatively small, and the abaxial surface of the blade is greenish yellow, greyish or pale brown coloured when dry, and its sessile, 1–4-flowered cymes.

Etymology: The specific epithet, from Latin *protractus*, drawn out, refers to the usually protracted apex of this species' leaf blades.

6. **Cyclophyllum maritimum** S.T.Reynolds & R.J.F.Hend. **sp. nov.** primo aspectu *C. protracto* S.T.Reynolds & R.J.F.Hend. persimilis, sed foliis efoveolatis apice obtuso et inflorescentiis distincte pedunculatis differt. **Typus**: Queensland. Cook District: Base of Mt Cook, near Cooktown, January 1982, *V.Scarth-Johnson* 1218A (holo: BRI).

Canthium sp. (Lizard Island R.L.Specht+ LI181), S.T. Reynolds (1997, p.180).

Shrubs or small trees 3–10 m high; bark mottled grey, slightly rough; branchlets glabrous, very pale brown or pale grey, with dense, whitish or dark coloured lenticels. **Leaves** with stipules triangular, keeled, attenuated into a short lobe distally; petioles 5–8 mm long, channelled adaxially; blades elliptic, broadly elliptic or elliptic-ovate, (3.8–) 5.5–8.2 × (2.1–)3–4.6(–5.2) cm, with apex obtuse or abruptly shortly acuminate, and base abruptly obtuse or subacute and decurrent into petiole, with margins slightly recurved, thin, coriaceous, the adaxial surface slightly glossy, drying brown, blackish or dark greyish-green and with midrib occasionally sunken proximally, the abaxial surface usually paler brown with nerves darker coloured; lateral nerves slender, in 4–6 pairs, suboblique or arcuate and looping near margins; secondary venation usually obscure; domatia absent or very rarely present but obscure. **Cymes** (2–)4–7-flowered, on peduncles (1–)2.5–6 mm long; bracts glabrous. **Flowers** in bud subacute or obtuse at apex, strongly perfumed; calyx c.2 × 1.5 mm, glabrous, with a short, denticulate limb; corolla 9–10 mm long, yellow, with tube 5–6 mm long and 1.5–2 mm wide at mouth, sparsely hairy adaxially but densely hairy at mouth; lobes sublanceolate, 3.5–5.5 × 1.5–1.75 mm, scurfy adaxially, glabrous abaxially, densely papillose distally on the acute and slightly reflexed apex; stamens with filaments c.0.5 mm long and anthers c.1.5 × 1 mm; style with stigma 7–8 mm long; stigma c.1.25 × 1.25 mm. **Fruits** on erect, spreading or decurving pedicels 6–10 mm long, greenish orange to red when ripe but drying black, transversely ellipsoid, obovoid or obliquely ellipsoid, slightly depressed at apex, with a broad shallow channel between the lobes when dry, 8.5–11.5 × 8.5–14 mm; pyrenes smooth. (Fig. 4).

Selected specimens: **Queensland.** Cook District: Torres Strait, Duan Island, Sep 1971, *Lawrie* s.n. (BRI); ditto, Yorke Island, 9°45'S,143°25'E, Jan 1971, Oct 1971, *Lawrie* s.n. (BRI); ditto, Jun 1995, *Waterhouse* BMW3640 (BRI); Bamaga District, Jacky Jacky Creek, May 1962, *Webb & Tracey* 5997 (BRI); 9.5 km S of Captain Billy Landing, 11°38'S,142°51'E, Mar 1992, *Clarkson* 9257 & *Neldner* (BRI); Shelburne Holdings, track between Round Point and Conical Hill, Nov 1985, *Gunness* AG1929 (BRI); Lizard Island, Jun 1973, *Specht* LI112 (BRI); Finch Bay near Cooktown, Mar 1966, *Smith* 13103 (BRI), ditto, Apr 1973, *Henderson* H1604 (BRI); Cooktown, Jul 1943, *Blake* 15066 (BRI); Endeavour River, in 1882, *Persieh* 761 (BRI,

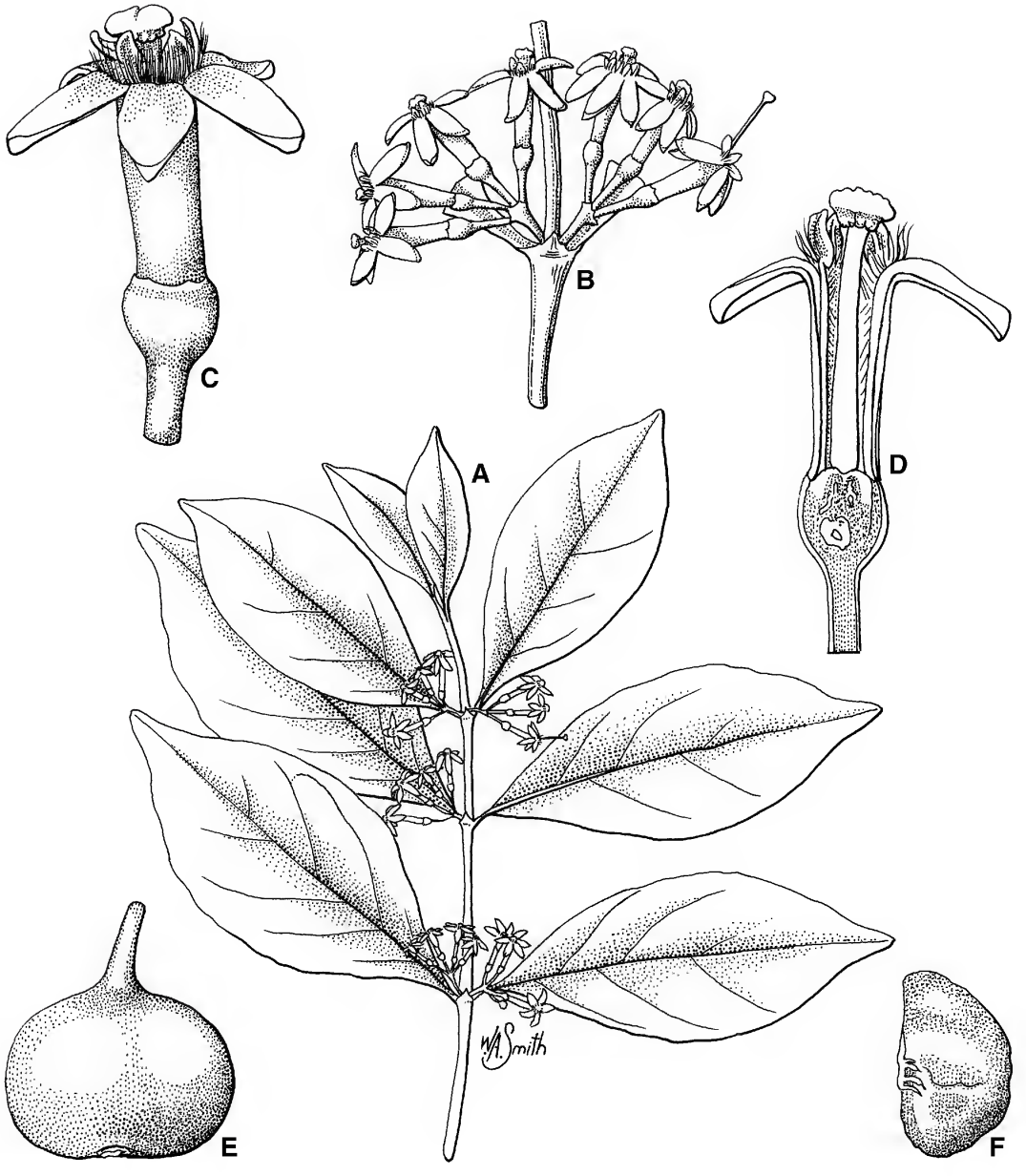
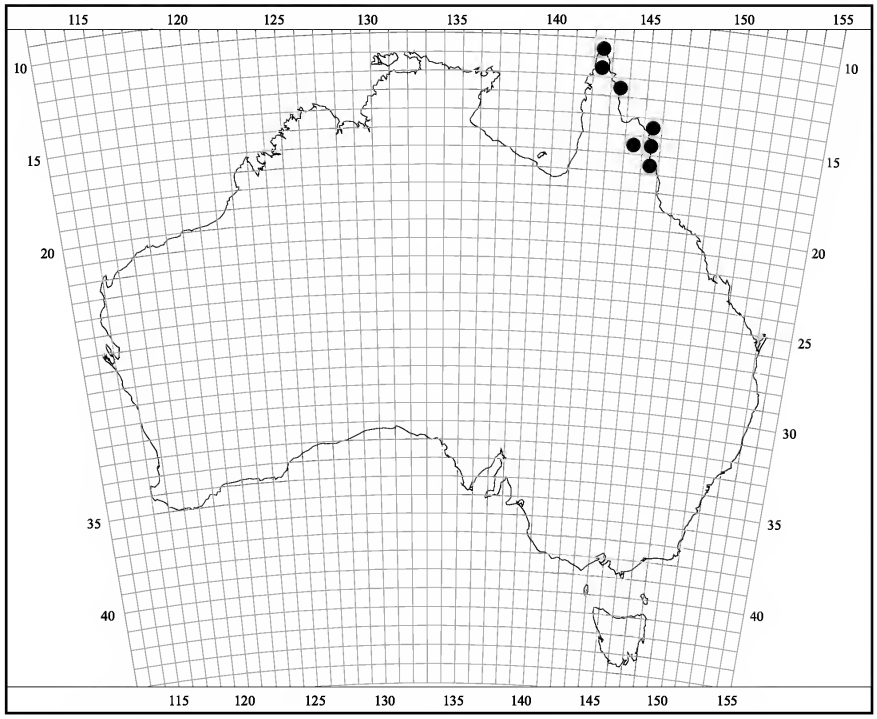


Fig. 4. ***Cyclophyllum maritimum***. A. flowering branch × 0.8. B. detail of inflorescence × 2. C. flowers × 5. D. LS of flower × 5. E. fruit × 2. F. pyrene × 3. A & B, *Gunness* AG1929 (BRI); C & D, *Clarkson* 8636 & *Neldner* (BRI); E & F, *Clarkson* 7699 & *Neldner* (BRI). Del. W. Smith.



Map 4. Distribution of *Cyclophyllum maritimum.*

MEL); Walker Bay, 15°31'S,144°16'E, Dec 1988, *Clarkson* 7699 & *Neldner* (BRI).

Distribution and habitat: North-eastern Queensland, from Torres Strait Islands to the Daintree River, common around Cooktown; in coastal scrubs on headlands, frontal sand dunes, in gullies, along tidal creeks and rivers; in sandy and sandy rocky soil (Map 4).

Affinities: *Cyclophyllum maritimum* is characterised by its thick, slightly glossy, efoveolate leaf blades, its pedunculate, (2–) 4–7-flowered, umbelliform cymes, and its large, broadly ellipsoid fruits which are shallowly channelled between the lobes and depressed at the apex. It resembles *C. protractum* at first sight in its leaves, but that species differs from *C. maritimum* in having leaf blades with prominent domatia and mostly abruptly long-acuminate at the apex, subsessile or sessile cymes, and fruits deeply grooved when dry.

Variability: The leaves of *C. maritimum* are variable. Specimens from around Cooktown which have elliptic leaf blades which are obtuse at both ends are typical of this species but specimens from Lizard Island usually have thicker, narrower, often comparatively smaller leaf blades which are much narrower at their base. These latter specimens possibly represent a distinct form or variant but the material presently available is insufficient to determine if this is correct.

Notes: Collections from near Captain Billy Landing in Cape York Peninsula which have comparatively larger and broader leaf blades are only tentatively included here. Their leaves approach some of those in specimens included under *C. coprosmoides* here but in most other characters they appear to be of this species. More material for examination is needed to be certain of their affinities.

Collector Margaret Lawrie recorded that on Yorke Island in the Torres Strait (*Lawrie* [AQ3960, AQ123642], BRI), this species is known by the native name "Uru", and that the fruits are inedible [for humans].

Etymology: The specific epithet, from Latin *maritimus*, growing by the sea, refers to the usual habitat of this species.

7. Cyclophyllum multiflorum S.T.Reynolds & R.J.F.Hend. **sp. nov.** quoad inflorescentiam *C. schultzii* (O.Schwarz) S.T.Reynolds & R.J.F.Hend. accedens sed inflorescentiis sessilibus, corollis longioribus fructibus obovoideis differt. **Typus**: Queensland. North Kennedy District: Edmund Kennedy National Park near Cardwell, 18°13'S, 146°00'E, 16 December 1991, *A.R. Bean* 3869 (holo: BRI).

Canthium sp. (Kuranda G.Sankowsky+ 680), S.T. Reynolds (1997, p.180).

Small trees 4–10 m high; bark light grey, smooth; branchlets whitish coloured or very pale brown, usually resin-gland dotted and very resinous distally, conspicuously densely lenticellate with usually small white lenticels, puberulous throughout or glabrous distally. **Leaves** with stipules triangular, keeled, cuspidate with a long folded apex (that on stipules distal on branchlets even longer), sparsely hairy adaxially at base; petioles (2.5–) 4–8 mm long, channelled adaxially; blades elliptic, elliptic-oblong or ± oblanceolate, (6.7) 9–12 (–13) × (2.9–)4.3–5.5(–6) cm, usually abruptly obtuse and attenuate at both ends, or with apex acuminate or obtuse and base acute or subacute and attenuate into the petiole, glabrous, thin or thick, coriaceous, drying dark or reddish brown adaxially, olive green, yellow-green or pale greyish coloured (especially in young leaves) and usually speckled and blotched with white abaxially; midrib slightly channelled towards the base adaxially; lateral nerves in 5 or 6 pairs, slightly arcuate or obliquely arched, looping near margins, drying reddish-brown in young leaves; secondary venation very openly reticulate; domatia present, few on each side of the midrib, conspicuous. **Cymes** (2–)6–9(–14)-flowered, sessile or subsessile; bracts hairy. **Flowers** in bud obtuse at apex; pedicels (1–)2.5–6 mm long, puberulous or glabrous; calyx c.2.5 × 2 mm, glabrous; limb short, denticulate; corolla cream coloured or pale yellow, orange or brown with age, (9–)11.5–13.5 mm long, with tube (7–)8–10 mm long, 1–1.5 mm wide at mouth, sparsely hairy adaxially but densely hairy at mouth; lobes ovate, abruptly acute and ± cucullate at apex, (2–) 3–4.5 × 1.5–2 mm, glabrous, scurfy adaxially, papillose on margins and more densely at apex; disc shorter than the calyx limb; stamens with filaments c.0.5 mm long and anthers c.1.5 mm long; style with stigma 10–11 mm long; stigma c.0.75 × 0.75 mm. **Fruits** on erect to spreading, slender pedicels (6–) 8–15 mm long, orange-red when ripe, obovoid or subellipsoid when slightly wider above the middle, laterally compressed, truncate at apex, when dried slightly rhomboidal and deeply grooved, or with shallow broad channels between the two lobes, 8–12 × 6–11 mm; pyrenes smooth or slightly rugose. (Fig. 5).

Representative specimens: **Queensland**. Cook District: Daintree River, Dec 1929, *Kajewski* 1465 (MEL); ditto, Oct 1968, *Webb & Tracey* 11371 (BRI); Mowbray River, Jan 1932, *Brass* 1955 (BRI); Noah Creek, 16°08'S,145°27'E, Dec 1986, *Sankowsky* 571 & *Sankowsky* (BRI); State Forest Reserve 1073, Buchan Logging Area near Kuranda, 16°46'S,145°37'E, Jan 1979, *Gray* 1256 (BRI); Bridle Creek about 12 miles [19.2 km] SE of Mareeba, Nov 1973, *Hartley* 14123 & *Hyland* (BRI, CANB); Russell River, in 1892, *Johnson* s.n. (MEL); Bellenden Ker Range, Oct 1977, *Jago* 19 (QRS); Mt Bartle Frere, in 1882, *Johnson* [MEL1538185] (MEL); ditto, Oct 1935, *Blake* 9803 (BRI); State Forest Reserve 194, East Barron, 17°21'S,143°27"E, Nov 1981, *Gray* 2241 (BRI); Fenby's Gap, 17°52'S,146°05'E, Oct 1951, *Smith* 4901 (BRI). North Kennedy District: Murray River, Oct 1867, *Dallachy* [MEL1538502] (MEL); Murray Upper, 18°05'S,145°42'E, Feb 1991, *Cooke* 464 (BRI); Wigham Creek Crossing, 37 km NW of Ingham on road to Broadwater Creek State Forest Park, 18°27'S,145°59'E, Nov 1992, *Halford* 689 (BRI); Family Islands, Sep 1864, *Dallachy* [MEL1538260] (MEL); Edmund Kennedy National Park near Cardwell, 18°13'S,146°06'E, Dec 1991, *Bean* 3869 (BRI); approx. 6.5 km NNW of Cardwell, Oct 1978, *Thorsborne & Thorsborne* 300 (BRI); Mt Fox, Apr 1949, *Clemens* s.n. (BRI); ditto, Dec 1949, *Clemens* s.n. (BRI).

Distribution and habitat: North-eastern Queensland, from the Daintree River to near Cardwell; usually along creeks, near swampy lowland forests, on banks of brackish lagoons, beach ridges and coastal sands; in vine thickets on sandy soil (Map 3).

Affinities: *Cyclophyllum multiflorum* is readily distinguishable by its 5–9-flowered, sessile cymes, usually hairy branchlets and pedicels, usually densely lenticellate branchlets, prominently foveolate leaf blades with arcuate lateral nerves and greenish-yellow or olive coloured discoloration of the abaxial surfaces of dried leaf blades. It resembles *C. schultzii* in

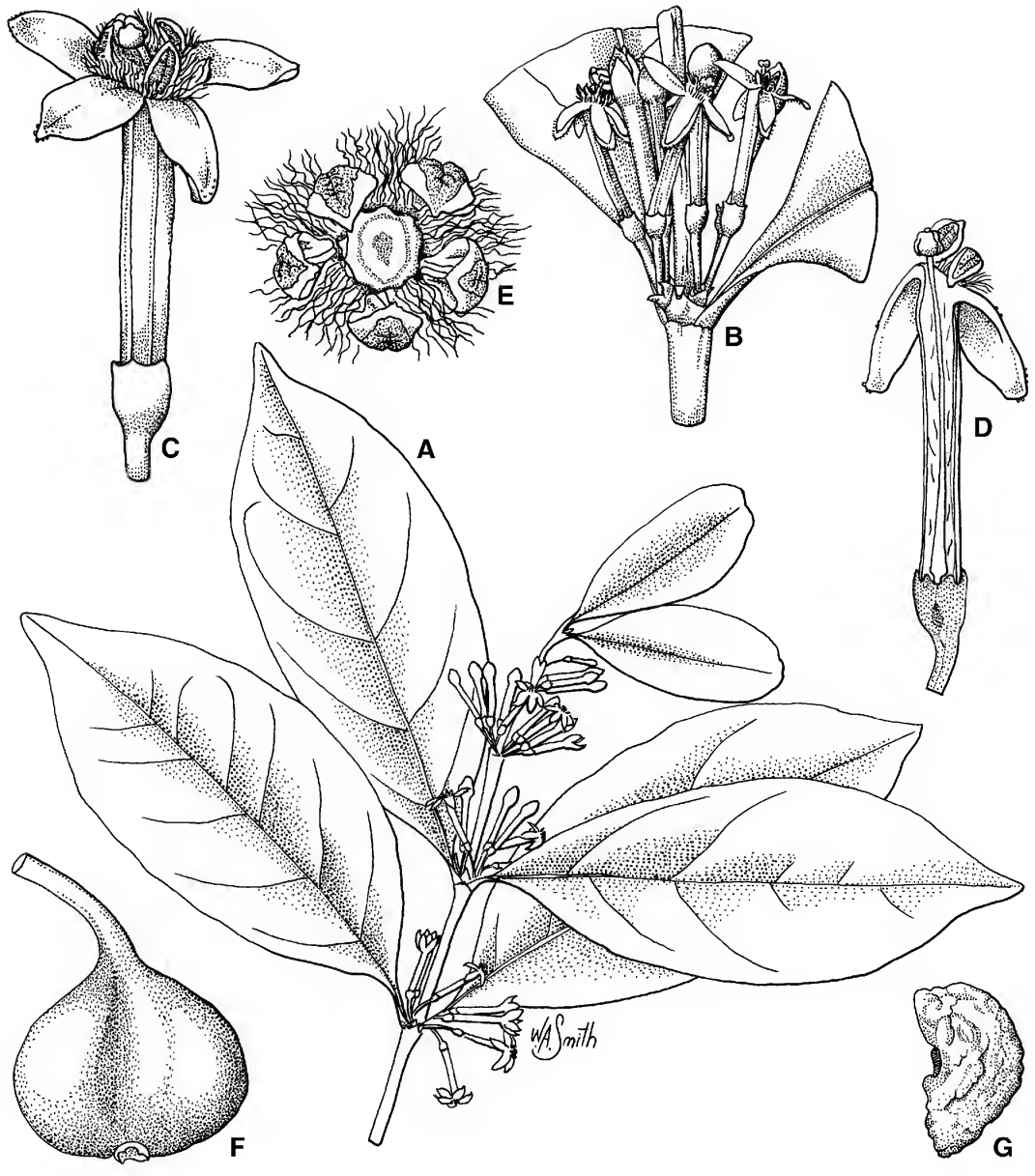


Fig. 5. ***Cyclophyllum multiflorum***. A. flowering branch × 0.8. B. detail of inflorescence × 0.8. C. flower × 5. D. LS. of flower × 5. E. detail of anthers and stigma (viewed from above) × 10. F. fruit × 3. G. pyrene × 3. A–E, *Bean* 3869 (BRI); F & G, *Sankowsky* 684 (BRI). Del. W. Smith.

its many-flowered inflorescences, but that differs from this species by its distinct, single or occasionally branched pedunculate inflorescences, its flowers with shorter corollas with tubes less than twice as long as the lobes, and its usually subcordiform fruits which are usually deeply and widely 2-lobed apically. In addition, *C. multiflorum* resembles *Canthium longiflorum* (Valeton) Merr. & L.M.Perry from New Guinea, a species also belonging in *Cyclophyllum*, in its sessile, many-flowered inflorescences, but that species differs from the former in its longer and larger leaf blades, and longer pedicels.

Variability: The shape, size and texture of leaf blades and the presence or absence of hairs on branchlets and inflorescence axes are very variable in this species. The majority of specimens examined have hairy branchlets and peduncles whereas two collections (*Jago* 19 and *Gray* 2241 above) differ in having these parts glabrous. Specimens from near Cardwell, the Atherton Tableland and the Daintree River, with elliptic, sublanceolate or elliptic-oblong, thick leaf blades with a subacute or acuminate apex are typical of this species. Collections from near the Russell River, Mt Bartle Frere and Mt Bellenden Ker usually have comparatively smaller, thinner leaf blades with subacute, ± obtuse or shortly acuminate apex. They probably represent a distinct form of this species, but more specimens especially ones in flower are necessary to be certain of this.

Etymology: The specific epithet, from Latin *multiflorus*, abounding in flowers, refers to the many-flowered inflorescences in this species.

8. Cyclophyllum schultzii

(O.Schwarz)S.T.Reynolds & R J.F.Hend. **comb. nov.**; *Plectronia schultzii* O.Schwarz, Feddes Repert. 24: 101 (1927); **Type**: [Northern Territory.] Port Darwin, 16 miles E [of], banks of Howard Creek, *Bleeser* 81 (?B†, n.v.). *Canthium schultzii* (O.Schwarz) Chippendale, Proc. Linn. Soc. NSW 96(4): 208 (1972).

Shrubs or trees 1.5–10 m high; bark mottled with grey or brownish-grey colouration, smooth or finely fissured; branchlets very pale to dark brown, glabrous, usually dotted with minute pale brown lenticels. **Leaves** with stipules triangular, keeled, attenuated into a long or short, narrow folded apex; petioles 5–15 mm long; blades broadly or narrowly elliptic, elliptic-ovate, elliptic-oblong to ± oblanceolate, 8.5–14(–16.2) × 1.8–7.2(–8.2) cm, with apex abruptly and shortly, bluntly acuminate, subacute or obtuse, and base abruptly obtuse or subacute, and usually attenuate into the petiole, thin or thick, coriaceous, glabrous, with adaxial surfaces glossy or dull green and drying brownish or blackish coloured and sometimes with white blotches, and abaxial surfaces pale green or slightly glaucous and drying pale brown to pale greyish brown, sometimes with midrib and nerves darker coloured; lateral nerves in (4–)6–11 pairs, obliquely arched or arcuate and looping near margins, prominent; secondary venation very openly reticulate; margins flat or sometimes slightly recurved; domatia usually present but usually inconspicuous. **Cymes** 2–11(–16) flowered, with a simple or once-branched glabrous peduncle 1–5 mm long; branches, where present, each terminated by a cymule of 4–8 flowers; bracts minute, glabrous. **Flowers** in bud obtuse at apex; pedicels (1.5–)3–5 mm long; calyx c.2 × 2 mm, cupuliform with a very short limb and minute ovate lobes, glabrous or with a few hairs on the lobes; corolla white, becoming yellowish with age, 6–9 mm long, with tube 3–5 mm long, 2–2.5 mm wide at mouth, densely hairy adaxially, the hairs at the mouth much denser and longer; lobes elliptic, 2.5–5.5 × 1.5–2 mm, obtuse, slightly recurved and cucullate at apex, glabrous or sparsely hairy towards the base adaxially, sparsely papillose abaxially; disc shorter than calyx limb, fleshy, glabrous; stamens erect, with filaments broad, c.0.5 mm long, and anthers ovoid, apiculate, 2–2.5 mm long; style with stigma 6–7 mm long, slightly protruding from mouth of corolla tube but shorter than anthers; stigma broad, ± orbicular but 2-lobed. **Fruits** on erect to ascending pedicels 5–7 mm long, pale reddish pink when ripe, fleshy, transversely ellipsoid or obcordate, depressed and lobed at apex, 8–12 × 16–23 mm, or fruits occasionally 1-lobed when slighty ellipsoid or obliquely obovoid, 8–10 × 5–8 mm; pyrenes rugose.

Affinities: *Cyclophyllum schultzii* is readily distinguishable by its usually 6–11-flowered, pedunculate inflorescences, short corollas with

dense hairs at the mouth of the corolla tube, and broadly obcordiform (sometimes ellipsoidal) fruits. This species is closely related to *C. brevipes* (Merr. & L.M.Perry) S.T.Reynolds & R.J.F.Hend. in its more or less similar leaves, flowers and fruits, but that species differs from *C. schultzii* in its sessile inflorescences with fewer flowers, and corollas which are glabrous at the mouth of the tube. (See under *C. brevipes* below.)

Variability: Attributes of the leaves of this species are very variable. Though two forms are recognised here based on these attributes, specimens are sometimes difficult to place in either taxon as they appear intermediate between these forms. Never-the-less, the extremes of these taxa are very distinctive.

Key to forms of *Cyclophyllum schultzii*

1. Leaf blades elliptic or elliptic-ovate, (4.2–)6–7.2(–8.2 cm) wide, less than twice as long as broad, usually obtuse at apex and base, thick, coriaceous, on petioles 7–15 mm long; lateral nerves in 6–11 pairs ..... **8a. *C. schultzii*** forma ***schultzii***

   Leaf blades narrowly elliptic or lanceolate, 1.8–3.3(–3.9) cm wide, 3 to 4 times as long as broad, usually subacute at both apex and base, thin, coriaceous, on petioles 5–6 mm long; lateral nerves in 4–7 pairs ..... **8b. *C. schultzii*** forma ***angustifolium***

8a. C. schultzii forma schultzii

Leaf blades broadly elliptic or elliptic-oblong, thick, coriaceous, green on adaxial surface, pale green abaxially, usually drying brownish coloured with nerves paler coloured.

Selected specimens: **Northern Territory**. Melville Island, Garden Point, 11°24'S,130°25'E, Nov 1986, *Dunlop* 6845 (DNA); ditto, Apr 1987, *Russell-Smith* 2134 & *Lucas* (DNA); Leader Creek, Gunn Point, 12°12'S,130°06'E, Mar 1983, *Wightman* 225 (DNA); Black Jungle, 12°32'S,131°13'E, Oct 1985, *Clark* 27 & *Wightman* (BRI, CANB, DNA); Darwin River Quarry area, 12°49'S,130°59'E, Nov 1978, *Rankin* 1602 (DNA); Channel Point, 13°08'S,130°15'E, Nov 1985, *Clark* 76 (BRI, CANB, DNA); ditto, Jan 1986, *Wightman* 2509 (DNA); Howard River headwaters, 12°32'S,131°07'E, Feb 1990, *Taylor* 10 (DNA); Howard Springs Creek, 12°27'S,131°04'E, Oct 1974, *Dunlop* 3686 (BRI); Adelaide River, 13°14'S,131°05'E, Dec 1971, *McKean* 178 (CANB, DNA); Catchment of Habgood River, Gapuwiyak, 12°39'S,135°52'E, Dec 1987, *Russell-Smith* 4362 & *Lucas* (BRI); Warangaya, Elcho Island, 11°56'S,135°42'E, Sep 1987, *Russell-Smith* 3299 & *Lucas* (BRI).

Distribution and habitat: Arnhem Land, Northern Territory, and offshore islands; chiefly in coastal areas, at the edge of wet monsoon forest. (Map 3).

Variability: The leaf blades in this form are quite variable. Collections from near Howard River, Howard Springs Creek (type locality), Darwin River, Meckitt Creek, Black Jungle and Channel Point have comparatively large, broadly elliptic to elliptic-ovate leaf blades which are usually abruptly obtuse at apex and base, or are abruptly shortly and bluntly acuminate at the apex, whereas specimens from other areas usually have smaller or narrower leaves. Some of those from near Adelaide River have comparatively narrow leaves and are not too different in appearance from some of the specimens included under *C. schultzii* forma *angustifolium* here. However, the leaves in that form are usually much narrower and usually thinner in texture than those included here under *C. schultzii* forma *schultzii*. A few collections from north-eastern Arnhem Land resemble ones from far northern Queensland included under *C. brevipes* here in their thin, usually elliptic or elliptic-oblong leaf blades which possess prominent reddish coloured dots and flecks. However, in that species the inflorescences are sessile, have unbranched peduncles and fewer flowers, and the leaves are comparatively shortly petiolate (see also under *C. brevipes*).

These latter specimens of *C. schultzii* forma *schultzii* probably have only young leaves on them but study of more specimens would be necessary to establish if this is true.

8b. C. schultzii forma **angustifolium** S.T.Reynolds & R.J.F.Hend. **forma nova** a *C. schultzii* forma *schultzii* foliis lamina angustiora, textura plusminusve membranaceiore, nervis lateralibus paucioribus praeditis differt. **Typus**: Northern Territory. Deaf Adder Creek Gorge, 18 November 1972, *P. Martensz* AE324 (holo: BRI; iso: CANB, DNA).

Leaf blades narrowly elliptic, thin, coriaceous, reportedly discolorous and ± glaucous on their abaxial surface when fresh, usually drying blackish coloured or brown, with 4–7 pairs of slender and usually obliquely arched lateral nerves. (Fig. 6).

Selected specimens: **Northern Territory**. Finniss River, Jan 1973, *Byrnes* 2398 (BRI); approximately 19 miles [c.30.4 km] NNW of Oenpelli Mission, 12°04'S,133°—'E, Feb 1973, *Lazarides* 7708 (BRI, CANB, DNA); Cooper Creek, first billabong below Nabarlek Camp, 12°20'S,133°20'E, Sep 1978, *Rice* 2990 (CANB); Upper East Alligator River, 12°49'S,133°22'E, Oct 1987, *Russell-Smith* 3869 & *Lucas* (DNA); Waterfall Creek, UDP Falls area, 13° 26'S,132°25'E, Jul 1978, *Rankin* 1467 (DNA, PERTH); Edith Falls Reserve, 14°12'S,132°11'E, Oct 1977, *Must* 1658 (DNA); Katherine River, Katherine, Oct 1958, *Chippendale* 5042 (BRI, DNA, PERTH); ditto, Dec 1963, *Adams* 802 & 803 (BRI, CANB); Katherine Gorge National Park, Oct 1968, *Byrnes* 536 (BRI, DNA, PERTH).

Distribution and habitat: Arnhem Land, Northern Territory; usually along rivers, creeks and lagoons, or on sandstone slopes above river; in monsoon forests, usually on sandy soil (Map 5).

Notes: *Cyclophyllum schultzii* forma *angustifolium* is characterised by its comparatively thin, narrowly elliptic or lanceolate, thin leaf blades with 4–7 pairs of slender, suboblique looping lateral nerves.

Although O. Schwarz (1927, p.101), when describing *Cyclophyllum schultzii* (as *Plectronia schultzii*), made note of a narrow-leaved form of this species and cited collections as representing such, namely Adelaide River, *Schultz* 440, 447, 503, and Finniso River District, *Bleeser* A7, he did not formally name this form. Only duplicates of Schultz's collections from Adelaide River have been available for this study. They (*Schultz* 440 [MEL1538523], 447 [MEL1538524] and 503 [MEL1538493](all MEL)) all fall within the range of variability here accepted for *C. schultzii* forma *schultzii*. On the other hand, *Bleeser* A7 from the 'Finniso' [Finniss] River District is/was (?) probably the only part of Schwarz's material referrable to *C. schultzii* forma *angustifolium* for specimens of this form have since been collected (in 1973) in the Finniss River area by Norm Byrnes (see *Byrnes* 2398 in the list of specimens above).

Etymology: The epithet, from Latin *angustus*, narrow, and *folium*, leaf, refers to the narrow leaf blades in this taxon.

9. Cyclophyllum brevipes (Merr. & L.M.Perry) S.T.Reynolds & R.J.F.Hend. **comb. nov.**; *Canthium brevipes* Merr. & L.M.Perry, J. Arn. Arb. 26: 231-232 (1945). **Type:** Papua New Guinea. Western Division: Penzara, between Morehead and Wassi Kussa Rivers, December 1936, *L.J. Brass* 8443 (iso: BRI).

Shrubs or small trees 2–6 m high, usually with spreading branches; bark mottled grey; branchlets slightly quadrangular distally, grey or reddish brown, glabrous, usually dotted with white lenticels. **Leaves** with stipules ovate, keeled, attenuated into a usually short folded apex, glabrous; petioles 3–9 mm long; blades elliptic, (6.2–)10–13.5 (–14.7) × (2.5–)3.7–5(–5.5) cm, with apex shortly acuminate or subcaudate, and base subobtuse, abruptly obtuse or ± rounded, thin (more so when dry), coriaceous, glabrous, drying blackish coloured or brown, sometimes blotched and marked with reddish coloured resin dots, deeply channelled over midrib proximally on the adaxial surface; lateral nerves very slender, obliquely arched, ± obscure adaxially; secondary venation reticulate, obscure; domatia usually present, usually small and inconspicuous. **Cymes** (4–)6–8(–10)-flowered, sessile; bracts glabrous. **Flowers** in bud obtuse at apex, perfumed; pedicels 2–3 mm long; calyx c.2 ×.2.5 mm, glabrous; limb short, denticulate with lobes ovate, minute, glabrous or with scattered hairs distally; corolla white or yellow, 5.5–7.5 mm long,

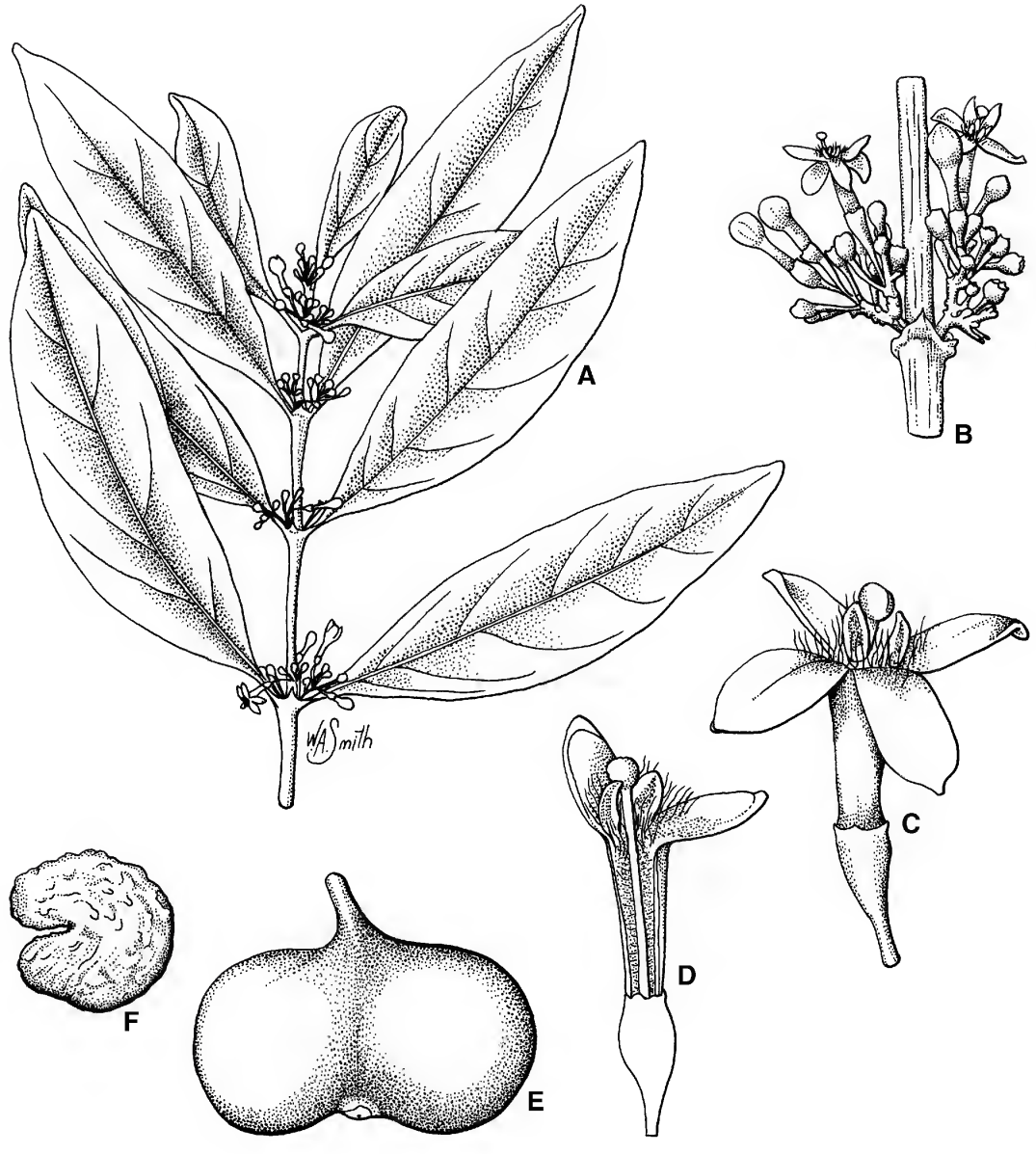
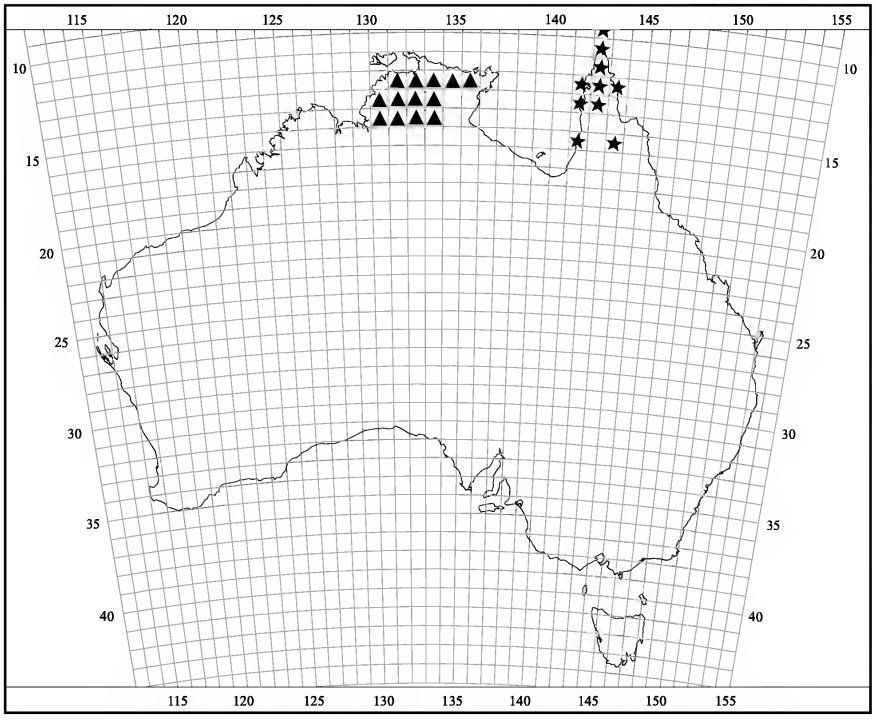


Fig. 6. ***Cyclophyllum schultzii*** forma ***angustifolium***. A. flowering branch × 0.8. B. pedunculate inflorescence with branches × 2. C. flower × 5. D. LS of flower × 5. E. fruit × 3. F. pyrene × 3. A–D, *Adams* 803 (BRI); E & F, *Byrnes* 1187 (DNA). Del. W. Smith.



Map 5. Distribution of *Cyclophyllum brevipes*★ and *Cyclophyllum schultzii* forma *angustifolium*▲.

with tube (2.5–)3.5–4.5 × c.1.5 mm, sparsely hairy adaxially but with hairs more dense at mouth; lobes subelliptic, 3–4 × 1–1.5 mm, obtuse or subacute and ± cucullate at apex, glabrous, densely papillate at apex and on margins; disc fleshy, as long as the calyx limb; stamens with filaments c.0.5 mm long and anthers 1.5–1.75 mm long; style with stigma 7–7.5 mm long; stigma c.1 mm long. **Fruits** on ascending to spreading pedicels 2.5–6.5 mm long, bright red when ripe, broadly ellipsoid to obcordate, slightly retuse or deeply and widely 2-lobed on top, 8–10 × 10–18 mm; pyrenes with slightly granular surface when dry.

Selected specimens: **Papua New Guinea**. Lake Daviumbu, Middle Fly River, Aug 1936, *Brass* 7470 (BRI); Western District, Weam, Bensbach subdistrict, 8°38'S,141°07'E, Jul 1967, *Ridsdale* [NGF33541] (BRI, NSW); Pangoa Airstrip, Lake Murray, Morehead subdistrict, 8°05'S,141°15'E, Mar 1968, *Millar* [NGF35421] (BRI). **Queensland.** Cook District: Cape York, 11°—'S,141°—'E, Nov 1955, *White* 1157 (BRI); Bamaga, 11°1-'S, 142°3-'E, Oct 1965, *Smith* 12381 (BRI); ditto, Oct 1965, *Jones* 3826 (CANB); Cockatoo Creek, at Telegraph Crossing Road, 11°39'S,142°27'E, Mar 1992, *Johnson* 5098 (BRI); Vyse Crossing, 19 km N of Lorim Point, Weipa, 12°30'S,141°53'E, Jan 1981, *Morton* AM1030 (BRI, MEL); Rocky Creek, 12°06'S,142°33'E, Jul 1984, *Puttock & King* [UNSW16940] (BRI, UNSW); Wenlock River, southern bank at Moreton Telegraph Station, 12°27'S,142°38'E, Oct 1989, *Neldner* 2804 & *Clarkson* (BRI); Wabum Creek, about 18 km from Aurukun on road to Merluna, 13°16'S,141°50'E, Dec 1981, *Clarkson* 4131A (BRI, QRS); Coconut Creek, downstream from Beagle North Camp, about 40 km SSW of Weipa, 13°01'S,141°47'E, Dec 1981, *Clarkson* 4163 (BRI); Lakefield National Park, Pocket Waterhole, "Bizant", 14°4-'S,144°0-'E, Oct 1985, *Williams* 85264 (BRI); Hann River, 15°12'S,143°52'E, Nov 1971, *Stocker* 842 (BRI); Magnificent Creek, Kowanyama, 15°2-'S,141°4-'E, Mar 1990, *Birchley* 4 (BRI).

Distribution and habitat: Southern Papua New Guinea to Cape York Peninsula, Australia; usually in riparian rainforests on sandy soil. (Map 5).

Affinities: *Cyclophyllum brevipes* is characterised by its shortly petiolate elliptic leaves which usually dry blackish coloured or dark brown, its 4–10-flowered sessile cymes, and its obcordate or ellipsoid fruits. It is closely related to *C. schultzii* with which it shares more or less similar leaves, inflorescences, flowers and fruits, but that species differs from *C. brevipes* mainly by its pedunculate inflorescences.

These two species may be distinguished using the following key.

1. Inflorescences pedunculate, with (2–)4–11(–16) flowers; peduncle sometimes branched; corolla tube 3–5 mm long, 2–2.5 mm wide at mouth where very densely hairy; fruit usually obcordiform, deeply 2-lobed at apex, 8–12 × 16–23 mm; petiole 5–15 mm long ..... **C. schultzii**
   Inflorescences sessile, (4–)7–10-flowered; corolla tube 2.5–4.5 mm long, to 1.5 mm wide at mouth where sparsely hairy; fruit ellipsoid or obcordiform, retuse or deeply 2-lobed at apex, 8–10 × 10–18mm; petiole 3–9 mm long ..... **C. brevipes**

Notes: The Queensland specimens match closely those from Papua New Guinea especially the isotype of *C. brevipes* at BRI, and the one collected by Len Brass from Lake Daviumbu on the Middle Fly River, also at BRI. Queensland plants are recorded as growing in habitats similar to those for plants in Papua New Guinea.

The fruits of this species are reported as edible [for humans].

Variability: This species varies greatly in the shape and size of its leaves and fruits, both in Australia and in Papua New Guinea. Specimens with shortly petiolate, blackish brown or brown, elliptic leaf blades, obcordiform fruits and glabrous flowers are typical of this species. However, specimens with narrowly elliptic leaf blades which dry pale brown and have typical obcordiform fruits, or ones with typical elliptic leaf blades but with small obovoid fruits, are also present. These probably represent distinct forms of the species, but more specimens for study would be necessary to be certain if this is correct. Moreover, a few specimens, e.g. *Jones* 3826 and *Johnson* 5098 cited above, resemble specimens from eastern Arnhem Land included here in *C. schultzii* in their thin, elliptic leaf blades which are prominently marked with numerous, small, reddish coloured dots or flecks but that species differs from *C. brevipes* by its pedunculate inflorescences which have a greater number of flowers in each.

Acknowledgements

We thank Les Pedley for help with the Latin diagnoses, colleagues at BRI for collecting many of the '*Canthium*' species and for their comments about the habitat of the species concerned, Clyde Dunlop for his comments on the manuscript, and Laurie Jessup, Gordon Guymer and Clyde Dunlop for their assistance in locating specimens and photographing types and literature during their term as Australian Botanical Liaison Officer at The Herbarium, Royal Botanic Gardens, Kew, England, Diane Bridson for her comments on *Psydrax* and *Canthium*, and assistance with specimens during visits to Kew (S.T.R. and, later, R.J.F.H), Will Smith for the illustrations and maps, David Halford and Kym Sparshott for assistance with measurements, maps and illustrations, the Directors/Keepers of the herbaria AD, BM, CANB, CGE, DNA, K, L, MEL, NSW, P, PERTH, PVNH, QRS and UNSW for allowing me (S.T.R.) full access to specimens in their institutions and for the loan of herbarium material, and the Australian Biological Resource Study, ABRS, Environment Australia f or a grant to (S.T.R.) to undertake research in the genus *Canthium* in Australia.

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Revision of the *Macrozamia miquelii* (F.Muell.) A.DC. (Zamiaceae section *Macrozamia*) group

David L. Jones*, Paul I. Forster and Ish K. Sharma***

Summary

Jones, David L., Forster, Paul I., Sharma Ish K. (2001). Revision of the *Macrozamia miquelii* (F. Muell) A.DC (*Zamiaceae* section *Macrozamia*) group. Austrobaileya 6 (1): 67–94. The *Macrozamia miquelii* group consists of seven species, *M. cardiacensis* P.I.Forst. & D.L.Jones, *M. douglasii* W.Hill ex F.M.Bailey, *M. longispina* P.I.Forst. & D.L.Jones, *M. macleayi* Miq., *M. miquelii* (F.Muell.) A.DC., *M. mountperriensis* F.M.Bailey and *M. serpentina* D.L.Jones & P.I.Forst. sp.nov., all occurring in eastern Queensland. The complicated typification of *Macrozamia douglasii* W.Hill ex F.M.Bailey and *Encephalartos douglasii* F.Muell. is resolved with lectotypes selected for both names. A key to the species in the group is provided and all species are illustrated. A partial electrophetic analysis of the complex is also presented.

Keywords: Zamiaceae, Key, taxonomy, electrophoresis, *Macrozamia miquelii, Macrozamia serpentina*

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Introduction

The genus *Macrozamia* Miq. consists of thirty-eight named species and a few others yet to be recognised formally. The genus is endemic to mainland Australia with the vast majority of species (c. 36) occurring in the eastern states of Queensland and New South Wales. Another six (including unnamed species) are known to occur in Western Australia and a single, isolated relict species is restricted to Central Australia. While some species of *Macrozamia*, such as *M. riedlei* (Fisch. ex Gaudich.) C.A.Gardner and *M. communis* L.A.S.Johnson, have a wide distribution, others, such as *M. cranei* D.L.Jones & P.I.Forst. and *M. viridis* D.L.Jones & P.I.Forst., are narrow endemics restricted to relatively small areas and specialised habitats.

This paper examines the systematics, morphology and relationships of the group of species centred around *Macrozamia miquelii* (F.Muell.) A.DC. in *Macrozamia* section *Macrozamia.* This group is defined by the intermediate size of the plants, untwisted or slightly twisted leaves that have spinescent petioles and hypostomatic leaflets with the lower leaflets grading into pinnacanths or the latter absent in some species. These features are shared by a group of three species allied to *M. communis* L.A.S.Johnson, but the *M. miquelii* group can be distinguished from these by narrow-based spines on the female sporophylls (c. 2-5 mm wide cf. 5–12 mm wide in the *M. communis* group). Species of the *M. miquelii* group form small to large cycads that are generally much larger than species in *Macrozamia* section *Parazamia* and smaller than the largest species of *M.* section *Macrozamia* such as *M. macdonnellii* (F.Muell. ex Miq.) A.DC., *M. moorei* F.Muell. and *M. johnsonii* D.L.Jones & K.D.Hill, all of which have amphistomatic leaflets. All of these species in *Macrozamia* section *Macrozamia* appear to be insect pollinated, either by thrips, beetles or a combination of the two (Forster *et al.* 1994; Forster, unpubl.; Mound & Terry 2000).

The earliest described species of the group, *Macrozamia miquelii,* was first named in *Encephalartos* by Mueller (1862), but was

Accepted for publication 30 March 2001

soon transferred to *Macrozamia* by De Candolle (1868). Additional species were added by Miquel (1868a,b) and Bailey (1883, 1886). Johnson (1959) took an extremely conservative view of the complex reducing all published names to synonymy of *M. miquelii* and also lectotypified this name using a type from Rockhampton (Forster 1999a). Further new species were recently added by Forster & Jones (1998) as part of the *Flora of Australia* account compiled by Hill (1998).

Although concise descriptions of five species from this group have been provided in the *Flora of Australia* by Hill (1998), there are numerous discrepancies in measurements between our observations and his accounts of *Macrozamia douglasii, miquelii* and *M. mountperriensis,* necessitating redescription of these species. Additionally the circumscription of *M. miquelii* is altered in the current paper with *M. macleayi* being resurrected from synonymy. Hence we provide detailed descriptions for all seven species in the group.

Materials and Methods

All species dealt with in this paper were examined in the field. Measurements cited here were made mainly from living material of adult plants, with some supplementation from herbarium collections, particularly those at BRI, CANB and MEL. Juvenile material of all species will generally have quite dissimilar leaves in terms of dimensions and component parts. The key is designed to be used with fertile material and adult leaves. When referring to "leaflets" in the descriptions, it indicates the total number of leaflets in the leaf. Leaflet dimensions are based on mature leaves and the leaflets from the central portion of the leaf. More accurate identifications will be arrived at if collectors either use the key on plants *in situ* or collect a range of leaves and cones, as there is often considerable variation even on a single individual. All types have been seen unless indicated n.v. Specimens of known sex are cited as A (female) or B (male), or C (seedling) following the collector's number. Some locality details in the citation of specimens are abbreviated or omitted for conservation purposes.

Limited allozyme analysis has been attempted for the complex but should not be regarded as all-encompassing. One species (*M. serpentina*) was not included in the analysis due to the loss of collected samples. The methodology used for the starch gel electrophoresis is the same as previously described (Sharma *et al.* 1999). Table 1 shows localities of species, vouchers and the number of samples used for analysis. Nei's genetic distance coefficient (Nei 1978) was used to measure the level of genetic differentiation among populations and species. Based on these values, a dendrogram (Fig. 1) was constructed (see Sharma *et al.* 1999 for details), which revealed that all the populations clustered into groups corresponding with the respective species.

Population codes, voucher numbers and sample size of the six species of *Macrozamia* examined in this study are listed below. Voucher details are given in the specimen citation for individual taxa (Table 1).

Table 1. Population codes, voucher details and sample size of collections used in isoenzyme analysis.

	M. mountperriensis	
BRO	Forster PIF9343 & Machin	26
SNY	Forster PIF13321 & Machin	26
GOO	Forster PIF2771	14
SEA	Forster PIF13372 & Machin	26
MON	Forster PIF13984 & Machin	14
SCH	Jones DLJ 6340 & Jones	26

	M. longispina	
WOO	Forster PIF13374 & Machin	26
WID	Forster PIF12137A-C & Machin	32
	M. miquelii	
BYE	Jones DLJ 9393	32
ARC	Forster PIF12253A-B & Machin	32
KPL	Forster PIF12268 & Machin	32
MOR	Forster PIF12251A-C & Machin	32
	M. macleayi	
BLK	Forster PIF12277A-B & Machin	32
BUL	Forster PIF12289A-B & Machin	28
BUR	Forster PIF12299A-B & Machin	28
BAN	Forster PIF13983 & Machin	28
KAL	Forster PIF13980A-B & Machin	28
KOO	Forster PIF12285A-B & Machin	28
IMB	Forster PIF13146 & Machin	28
	M. douglasii	
DOG	Forster PIF9346 & Machin	26
COO	Machin PM17	21
	M. cardiacensis	
CAR	Forster PIF13109A-C & Machin	32

Taxonomy

Key to species of the *Macrozamia miquelii* group

1. Lower 8 or more leaflets reduced to pinnacanths 2
   Lower 4 or less leaflets reduced to pinnacanths, or pinnacanths absent 5

2. Female cones narrowly ovoid; male cones 35–40 cm long ..... **1. M. cardiacensis**
   Female cones cylindrical to barrel-shaped; male cones 12–28 cm long 3

3. Male cones 2.5–3.5 cm diameter; microsporophylls 8–12 × 4–8 mm ..... **7. M. serpentina**
   Male cones 3.5–6.5 cm diameter; microsporophylls 12–25 × 8–15 mm 4

4. Leaves glossy above, thin-textured; female cones 7–10 cm diameter ..... **4. M. macleayi**
   Leaves dull to slightly glossy above, thick-textured; female cones 10–15 cm diameter ..... **5. M. miquelii**

5. Lower 1–4 leaflets reduced to pinnacanths ..... **2. M. douglasii**
   Pinnacanths absent 6

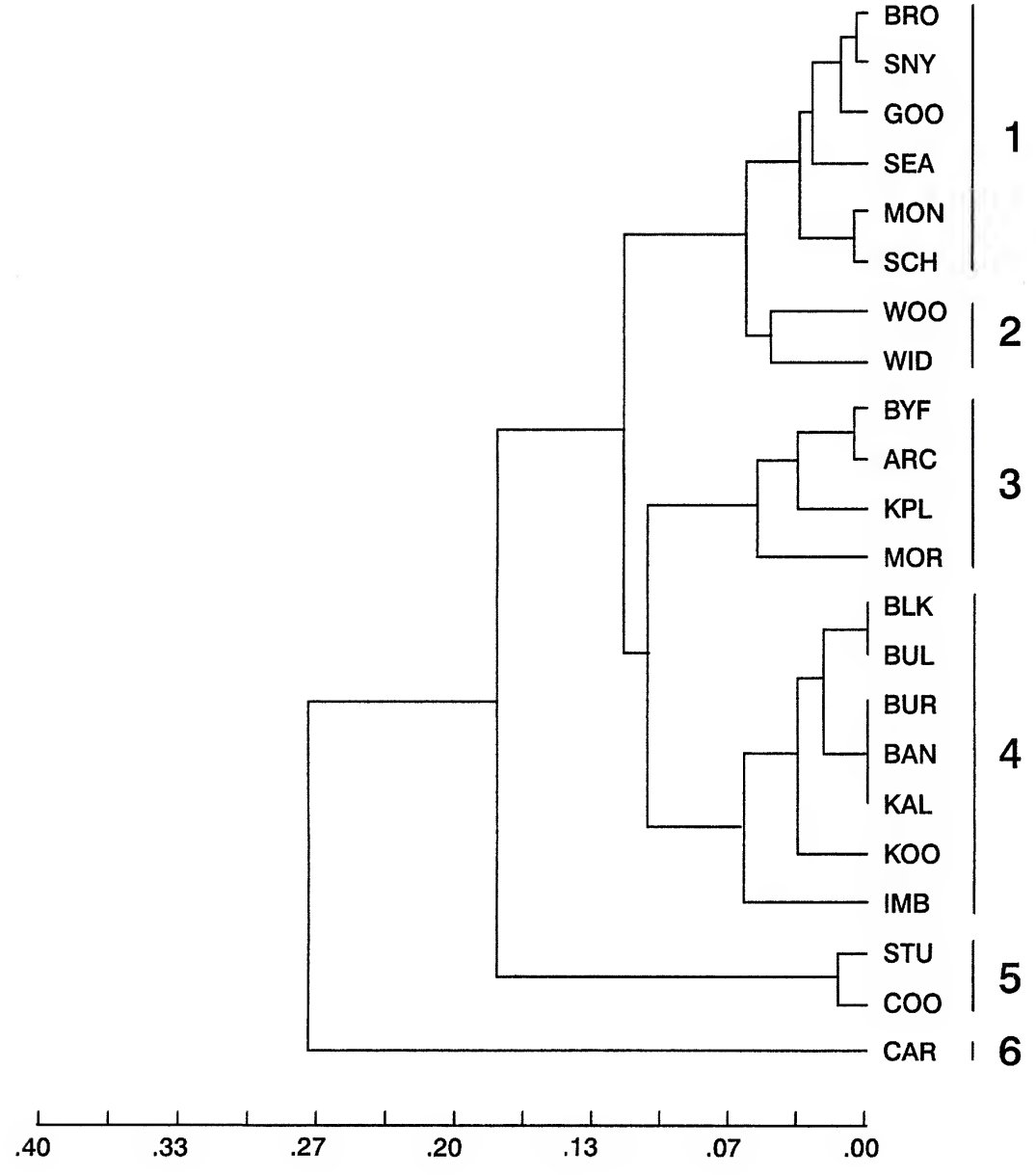

Fig. 1. Allozyme Based Dendrogram of *Macrozamia* species and populations based on Nei's unbiased Genetic Distance. 1=*M.mountperriensis*; 2=*M.longispina;* 3=*M.miquelii*; 4=*M.macleayi*; 5=*M.douglasii*; 6=*M.cardiacensis.*

Fig. 2. *Macrozamia cardiacensis*. Adult in habitat with P.Machin for scale. *Forster* PIF12151 & *Machin*. Photo: P.I.Forster.

6. Leaflets 50–110, 6–9 mm wide; male cones 12–25 × 3–4 cm; distal megasporophylls with spines 2.5–4 cm long ..... **6. M. mountperriensis**
   Leaflets 100–140, 3–6 mm wide; male cones 8–15 × 2.5–4 cm; distal megasporophylls with spines 4.5–7 cm long ..... **3. M. longispina**

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1. Macrozamia cardiacensis P.I.Forst. & D.L.Jones *in* P.McCarthy (ed.), *Fl. Australia* 48: 717 (1998). **Type:** Queensland. Wide Bay District: Cardiac Hill, Mt Walsh National Park, 26 February 1993, *P.I.Forster 13109A & P.Machin* (holo: BRI).

Caudex usually subterranean, occasionally emergent, erect, columnar or barrel-shaped, to 40 cm long, 20–40 cm diam., unbranched. Young leaves light green. Mature leaves elliptic-lanceolate in outline, 1–2 m long, obliquely erect to spreading, dark green, glossy, flat in cross-section, arching in profile, 10–20 in a moderately dense crown; expanded leaf base 9–12 cm × 3–4 cm, covered with grey-brown, soft woolly hairs; petiole (including the expanded base) 30–40 cm long, 1.5–2 cm wide at the first leaflet, flat adaxially, convex and angular abaxially; rhachis straight, not twisted, flat adaxially, the cross-section similar to that of the petiole; leaflets 100–140 per leaf, inserted at about 40° to the rhachis, crowded, distal leaflets densely packed, proximal leaflets progressively more widely spaced, linear, 20–31 cm × 0.8–1.2 cm, flat, moderately thin-textured, hypostomatic, dark green & glossy adaxially, paler beneath, contracted proximally to a pale yellow callous base, margins flat, entire, tapered to a pungent apex; lower 4–7 pairs of leaflets gradually reduced to rigid pinnacanths. Male cones 1–5, cylindrical, 35–40 cm × 6.5–8 cm, straight or curved with age, green; peduncle 15–30 cm × 1.5–2.5 cm, elliptical to round in cross-section; microsporophylls cuneate, 2.2–3.2 cm × 1–1.5 cm, with an erect, apical spine 0.2–2.5 cm long. Female cones 1 or 2, narrowly ovoid, 32–36 cm × 11–14 cm, green; peduncle 20–25 × 1.6–2.5 cm, elliptical to rounded in cross-section; megasporophylls 4–4.5 cm × 3.5–4.7 cm, broadly cuneate, with an erect apical spine 1–5 cm long, the distal sporophylls with spines 4.5–

Fig. 3. *Macrozamia cardiacensis*. Female plant with cones. *Forster* PIF13109A & *Machin* (type). Photo: P.I.Forster.

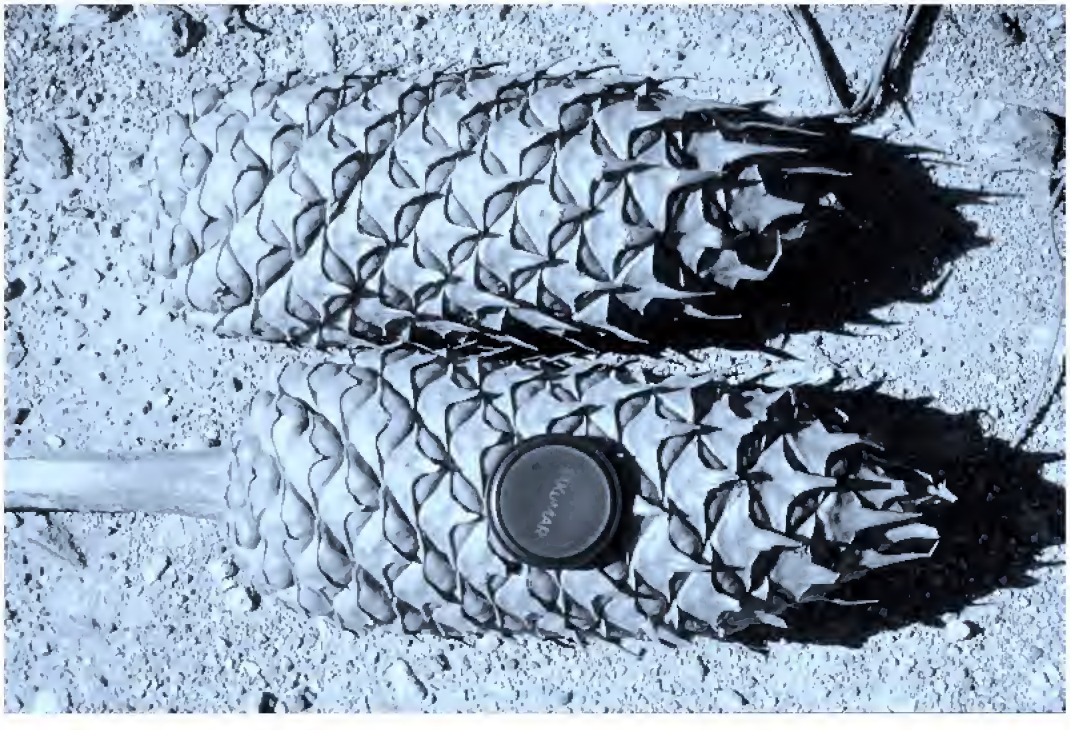
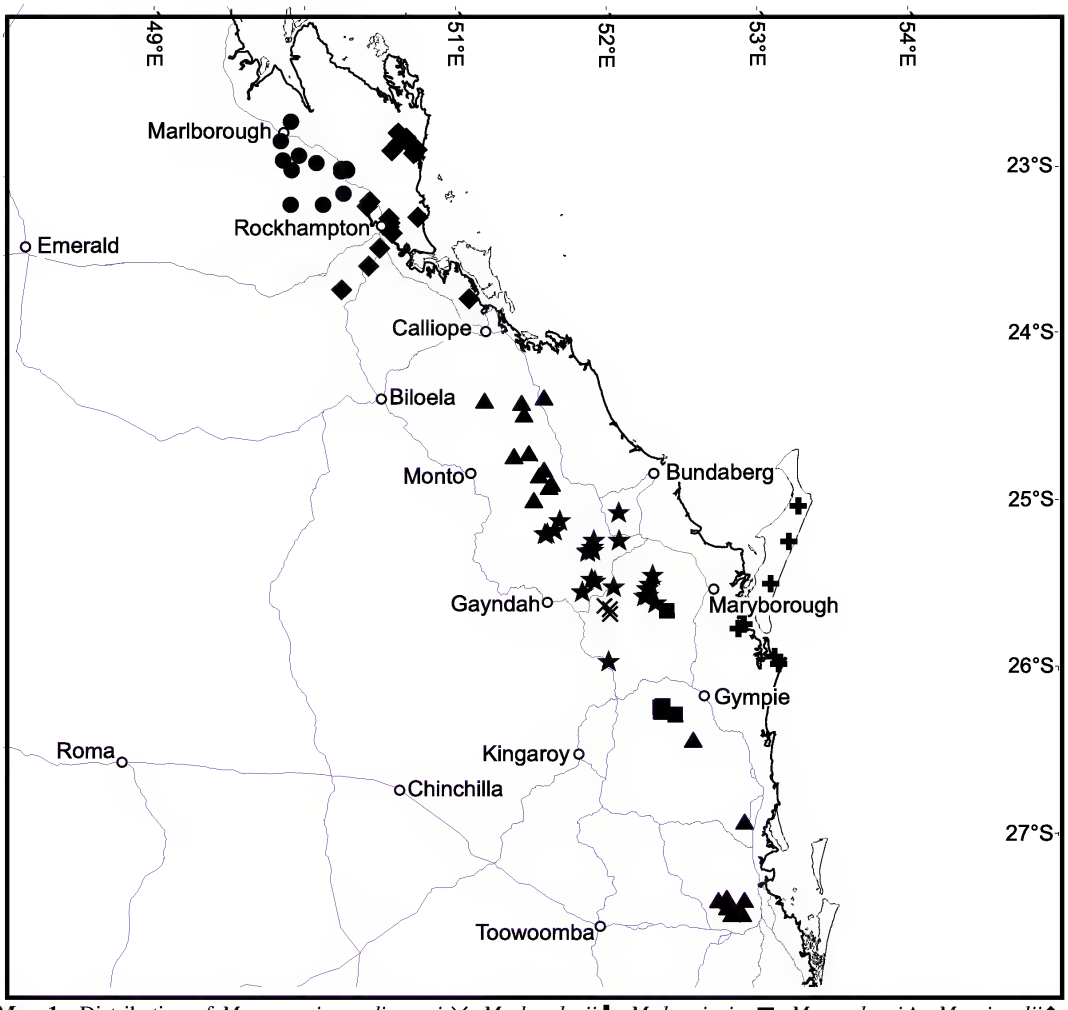


Fig. 4. *Macrozamia cardiacensis*. Detail of female cones. *Forster* PIF13109A & *Machin* (type). Photo: P.I.Forster.



Map 1. Distribution of *Macrozamia cardiacensis*×, *M. douglasii*✚, *M. longispina*■, *M. macleayi*▲, *M. miquelii*◆, *M. mountperriensis*★, *M. serpentina*● based on herbarium records in BRI, CANB and MEL.

5 cm long. Seeds oblong to ovoid, 2.2–3.5 cm × 1.2–2 cm, sarcotesta orange to dark red. (Fig. 2–4).

***Selected specimens*: Queensland**. WIDE BAY DISTRICT: Mt Walsh N.P., Coast Range, Oct 1992, *Forster* PIF12151 & *Machin* (BRI); ditto, Feb 1993, *Forster* PIF13109B & *Machin* (BRI); ditto, May 1994, *Forster* PIF15232 & *Bean* (BRI); ditto, Mar 1995, *Forster* PIF16367 (BRI); Coast Range, Oct 1995, *Grimshaw* PG2212 (BRI); ditto, *Grimshaw* PG2401 (BRI); Mt Walsh N.P., Coast Range, Aug 1992, *Machin* PM16-19 (BRI); Mt Walsh, 6.5 km S of Biggenden, May 1977, *Telford 5322* (CANB).

Distribution and habitat: *M. cardiacensis* (Map 1) is restricted to the Mount Walsh National Park near Biggenden in the Wide Bay District of Queensland. It grows in skeletal soils on steep to precipitous slopes on substrates derived from rhyolites or andesites at altitudes between 500 and 640 m in open eucalypt forest. Associated canopy species are *Eucalyptus andrewsii*, *E. decolor*, *E. acmenoides* and *Corymbia citriodora*.

Phenology: Cones shed pollen in November and December. Both male and female cones are attended by the thrips *Cycadothrips chadwickii* and a species of *Tranes* (P.I.Forster, pers. obs. Dec. 2000). *Macrozamia cardiacensis* is the only species in the *M. miquelii* group that has been observed to have both of these insects present. Ripe seeds are dispersed from March to May.

Notes: Plants usually have a subterranean trunk but on rocky sites or in shallow soils an emergent trunk is often formed.

Macrozamia cardiacensis is similar to both *M. miquelii* and *M. douglasii*. It differs from *M. miquelii* by its larger cones with longer apical spines on the distal megasporophylls and from *M. douglasii* by its more numerous pinnacanths, less prominent callous base and longer apical spines on the distal megasporophylls. It is perhaps most closely allied to *M. douglasii* on morphological characters, and the limited allozyme analysis based on few populations of the two species tends to support this (Fig. 1).

Conservation status: Although of restricted distribution *M. cardiacensis* is locally abundant in two localities, growing in dense colonies with strong seedling recruitment. This species is listed as Rare on the schedules of the Queensland Nature Conservation Act 1992 although it is conserved in Mt Walsh National Park.

Etymology: Named for the type locality of "Cardiac Hill" and also alluding to the difficulty experienced by the co-collectors of the type in transporting the heavy female cones.

2. Macrozamia douglasii W.Hill ex F.M.Bailey, *Syn. Queensland Fl.* 500 (1883).**Type:** Queensland. Wide Bay District: [comprises a pressed leaf] Fraser Island, [forwarded 24 April 1882 to K by J.Pink], *Sheridan* s.n. (lecto (here designated): K, photo!).

Encephalartos douglasii F.Muell., *Chem. Drugg. Australas.* 5: 80-81 (14 February 1883); *Macrozamia tridentata* var. *douglasii* (F.Muell.) J.Schust. in A.Engler, *Pflanzenr.* 99 (IV, I): 90 (1932). **Type:** Queensland. Wide Bay District: [comprises 5 bags of fruit & a photograph of an intact cone] Fraser Island, [collected prior to 17 Jan 1883 when forwarded to Mueller], *A.McDowall* s.n. (lecto [here designated]: MEL269564; isolecto: K [2 sheets of three portions of the one pressed frond, plus a copy of the photo of the intact cone] photo!).

***Illustrations*:** Ballard (1936: t. 3310, 3311); Jones (1993: 237).

Caudex subterranean or emergent, to 1 m tall and 70 cm diam., unbranched. Young leaves light green. Mature leaves elliptic-lanceolate in outline, 2–3.5 m long, erect to obliquely erect or widely spreading, bright green to dark green, flat in cross-section, arching in profile, 30–90 in a dense crown; expanded leaf base 10–15 cm × 3–4 cm, covered with greyish-white, soft woolly hairs; petiole (including the expanded base) 40–60 cm long, 12–20 mm wide at the first leaflet, green, flat or grooved adaxially, convex and angular abaxially; rhachis straight, not twisted or slightly twisted, pale green, the cross-section similar to that of the petiole; leaflets 120–200, inserted at about 40° to the rhachis, widely spreading, moderately crowded, distal leaflets densely packed, proximal leaflets becoming more widely spaced, linear,flat, moderately thin-textured, hypostomatic, 25–35 cm × 8–12 mm, dark green and glossy adaxially, paler beneath, contracted proximally to a prominent white callous base, margins entire, tapered to a sharply pointed apex; lower leaflets gradually reduced to 1–4 pairs of rigid, moderately long, yellowish pinnacanths. Male cones 1–3, cylindrical, 20–35 cm × 5–7 cm, straight or curved with age, green; peduncle 20–35 cm × 2–3 cm, elliptical in cross-section; microsporophylls cuneate, 2–3.5 cm × 1.5–2.5 cm, with an erect, apical spine 0.5–4 cm long. Female cones 1–3, cylindrical to barrel-shaped, 35–45 cm × 10–18 cm, green; peduncle 25–45 cm× 2–3 cm; megasporophylls broadly cuneate, 2.5–3.5 cm × 4–6 cm, with an erect, apical spine 1–4 cm long, the distal sporophylls with spines 3–4 cm long. Seeds oblong, 2.8–4 cm x 1.8–2.5 cm, sarcotesta orange to red. (Figs. 5–8).

***Selected specimens*: Queensland.** Wide Bay District: Cowra Logging Area, Tuan State Forest, Jan 1992, *Forster* PIF9346 A & B *& Machin* (BRI, CANB); ditto, Nov 1992, *Forster* PIF12330 *& Machin* (BRI); Great Sandy National Park – Cooloola section, Aug 2000, *Forster* PIF25968 *& Kokubugata* (BRI); Fraser Island, Nov 1930, *Hubbard* 4552 (BRI; K n.v.); Fraser Island, c. 0.1 km from Dilli towards Ungowa, Apr 1992, *Jones* 9414 *& Jones* (CANB); Fraser Island, c. 2 km W of Eumong, May 1992, *Jones* 9429 & *Jones* (BRI, CANB); Shark Creek, opposite southern end of Fraser Island, Jan 1928, *Kajewski* 1 (BRI); Fraser Island, May 1992, *Machin* (CANB); Tuan Ck, near Tin Can Bay, May 1992, *Machin* (CANB); Cooloola area, S.F. 451 Womalah, Jun 1993, *Machin* PM7 (BRI); Cooloola, Stutz Hut road, S.F. 915, Jul 1992, *Machin* PM21-22 (BRI); Cooloola, off Tinnanbar road, S.F. 451 Womalah, Jul 1992, *Machin* PM23-25 (BRI); Cooloola State Forest, Sep 1970, *Moriarty 434* (CANB); Fraser Island, Mar 1951,

Fig. 5. *Macrozamia douglasii*. Habit. Fraser Island. Photo: D.L.Jones.

Webb SW4761 (CANB); Fraser Island, Oct 1921, *White* AQ142034 (BRI).

Distribution and habitat: *Macrozamia douglasii* (Map 1) occurs on Fraser Island, where it is extremely abundant, and on adjacent coastal districts near Cooloola north of Noosa, both regions in the Wide Bay District. It grows at altitudes between 10-80 m in tall open forests developed on old coastal dunes, along streams and on the fringes of rainforest, with some specimens occurring within the rainforest canopy. The soils are deep grey to white sands with a permanent water table.

Phenology: Pollen shedding occurs in November with the cones attended by hordes of *Tranes* weevils (Forster *et al.* 1994). Ripe seeds are dispersed from March to April.

Typification: The typification of this twice published species is very complex. The species was first named *Encephalartos douglasii* by Mueller (1883) and soon after, and apparently independently, as *Macrozamia douglasii* by Bailey (1883). Both names were validations of the nomen nudum *Macrozamia douglasii* W.Hill (1879), but when used in *Macrozamia*, Bailey's name takes precedence. Bailey did not explicitly cite a type specimen (which was not unusual at the time) and it appears that a progression of material was sent to various herbaria and botanic gardens by a range of collectors around this time with the resultant

Fig. 6. *Macrozamia douglasii.* Female cone. Fraser Island. Photo: D.L.Jones.

descriptions being compiled from all (or at least most) of them. Bailey named this species "After the Hon. John Douglas" thus validating the unpublished name of Walter Hill's. Further on he states "(*Fraser's Island.*)". This has been incorrectly interpreted as "Fraser Island, Qld, *Douglas*; holo: BRI" by Hill (1998); however, no such specimen exists at BRI. In the *Synopsis* Bailey did not explicitly cite who the collectors of any new taxa were. Hence it does not necessarily follow that Douglas collected material of this species at all, and it is probable that the material used by Bailey in his description was collected by W. Hill or one of his contacts. W. Hill first coined the specific epithet and stated "Frazer's Island. During my visit to the above island, in April last, I took the opportunity of making a collection of the various seeds and plants flourishing there, and I am glad to say that I was enabled to secure a number of very interesting specimens, including Macrozamia douglasii , W. H. (*Goulbine*) (the nuts of this tree are largely used as an article of food by the aborigines)"(Hill 1879). Ballard (1936) cites collections by W. Hill in 1881, J. Pink in 1882 and A. McDowall in 1883, but does not state where these collections are deposited.

We have been able to locate four separate collections of this species from the early 1880's deposited in K and MEL, all of which must be critically examined for the typification of these

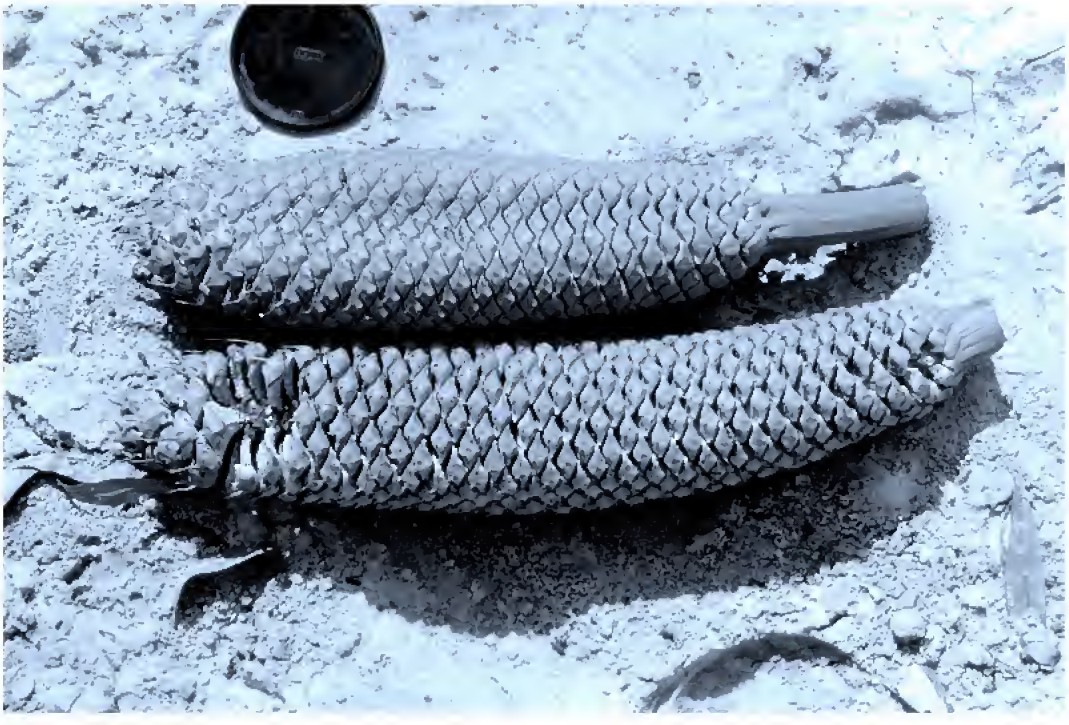


Fig. 7. *Macrozamia douglasii*. Male cones. *Forster* PIF12330 & *Machin*. Photo: P.I.Forster.

Fig. 8. *Macrozamia douglasii*. Detail of apical portions of male cones. *Forster* PIF12330 & *Machin*. Photo: P.I.Forster.

two names. No potential type material was located at BRI, despite extensive searching. None of these collections are by John Douglas. There are only seven collections by Douglas at BRI, all of which are ferns collected in June 1893 from Thursday Island where he was Government Resident and Police Magistrate (Joyce 1972).

Collections in question are: Specimen #1: MEL237356 (labelled as syntype). This comprises a pressed, partial and somewhat immature leaf and is labelled as "*Encephalartos Douglasii* F.vM. *Macroz. Douglasii* Ex horto. bot. Brisbane 1881".

Specimen #2: MEL269564 (labelled as syntype). This comprises four bags of seed and cone remnants and is accompanied by a photographic print of an intact cone in a wired (or perhaps string) cage and a long letter to Mueller from A.McDowall of Maryborough dated 17 January 1883. According to the letter four ripe cones were originally sent from Fraser Island. It is reasonable to assume that the collector of this material was A.McDowall. A copy of this photographic print is also at K.

Specimen #3: K. This comprises a pressed partial leaf and is accompanied by a letter by James Pink of the Brisbane Botanic Gardens to Thiselton-Dyer at K that is dated 24 April 1882. In the letter Pink quite clearly states that the material of *Macrozamia* was collected by "Mr Sheridan Collector of Customs & Police Magistrate Maryborough".

Specimen #4: K. This comprises a whole pressed leaf that is divided into three pieces and mounted on two sheets. The material is accompanied by a letter from Mueller to Thiselton-Dyer dated 17 February 1883 where it is stated that the collection is by A.McDowall. This material appears to be the leaf material that originally accompanied the four bags of seed in MEL (see specimen #2). Mueller states in the letter "It was my intention, dear Mr Dyer, to have sent you a female amentum of *Encephalartos Douglasii* by this mail, but it is not yet dry, nor is the photograph likely to get ready in time. So I shall keep back also leaves and male cone til next post".

Mueller (1883) in the description of *E. douglasii* quite clearly states that "through the kindness of Mr. A.McDowall, the districts' lands office and surveyor of Maryborough, Wide Bay, to place this cycadeous plant on diagnostic record". The name *Encephalartos douglasii* F.Muell. is adequately typified by the A.McDowall collection (specimen # 2), as this material is annotated by Mueller, collected prior to the publication of the name and referred to in the protologue. The collection has been split between MEL and K, with the former designated as lectotype and the latter isolectotype for this name.

This then leaves the problem of typification for *Macrozamia douglasii* W.Hill ex Bailey. As no type was explicitly cited, we are left with a number of options, either selection of a lectotype from the available collections or selection of a neotype. We cannot prove that the McDowall collection was seen by Bailey and it would appear that McDowall sent the material directly to Mueller, hence it is not appropriate to consider the type of both names to be the same.

Bailey would undoubtedly have seen the live material acquired by Hill or Sheridan. It is quite possible that Mueller sent a copy of his description of *Encephalartos douglasii* to Bailey and so the name *Macrozamia douglasii* is merely a new name in a different genus for the entity based on the McDowall specimen. The collection by Sheridan at K (specimen # 3), although only of a pressed leaf, is here designated as the lectotype for the name *Macrozamia douglasii* as it comprises a mature leaf undoubtedly prepared from a live plant in the Brisbane Botanic Gardens, and is likely to have been seen by Bailey.

Notes: *Macrozamia douglasii* is similar to *M. miquelii* but can be distinguished by the lustrous dark green leaves, extremely conspicuous, intensely white callous bases and only the lowest 1–4 pairs of leaflets reduced to spine-like pinnacanths. In comparison to *M. douglasii, M. cardiacensis* has fewer leaves in the crown, pale yellow callous bases and smaller cones with longer spine-like appendages on the distal megasporophylls. The allozyme analysis indicates a closer relationship between *M. douglasii* and *M. cardiacensis* than

between *M. douglasii* and the other species (Fig. 1).

The male cones of *M. douglasii* are destroyed rapidly by the larvae of a host-specific Curculionid weevil (*Tranes* sp.) after shedding pollen (Forster et al. 1994). This activity results in a complete lack of male cones on plants once pollen shedding has ceased and is one reason for a paucity of preserved material in herbaria. Hill (1998) states that "pollen cones not seen", yet these are described by both Mueller (1883), Bailey (1883) and Ballard (1936) and well illustrated in the latter.

Conservation status: This species is locally abundant and grows in scattered, sometimes dense colonies with strong seedling recruitment. It is not rare or threatened and is very well conserved in Cooloola and Fraser Island National Parks.

Etymology: Named for John Douglas (1828-1904), a politician and administrator in Queensland and British New Guinea (Joyce 1972). Douglas, a short-term Premier of Queensland, was considered a "leader in Brisbane's intellectual, literary and religious circles" and became involved in a number of societies (e.g. Royal Society of Queensland, Acclimatization Society of Queensland) along with Hill and Bailey. The naming can be interpreted as being one of political patronage. Port Douglas in north Queensland is also named after him.

3. Macrozamia longispina P.I.Forst. & D.L.Jones *in* P.McCarthy (ed), *Flora of Australia* 48: 717 (1998). **Type:** Queensland. Wide Bay District: State Forest 639, Wrattens, 25 October 1992, *P.I.Forster PIF12137B & P.Machin* (holo: BRI).

***Illustrations*:** Forster & Osborne (2001).

Caudex subterranean or less commonly an erect emergent trunk to 30 cm long and 30 cm diam., unbranched. Young leaves light green. Mature leaves elliptic-lanceolate in outline, 1–1.5 m long, obliquely erect to spreading, dark green, glossy, flat in cross-section, arching in profile, 6–20 in a moderately dense crown; expanded leaf base 25–35 × 1.2–1.5 cm, covered with grey-brown, soft woolly hairs; petiole (including the expanded base) 40–50 cm long, 0.4–0.5 cm wide at lowest pair of leaflets, flat adaxially, convex and angular abaxially; rhachis straight, not twisted, green, the cross-section similar to that of the petiole; leaflets 100–140, inserted at about 40° to the rhachis, widely spreading, crowded, distal leaflets densely packed, proximal leaflets more widely spaced, narrowly linear-lanceolate, 25–32 cm × 3–6 mm, flat, thin-textured, hypostomatic, dark green and glossy adaxially, paler beneath, contracted proximally to a white callous base, margins entire, tapered to a pungent apex; lower leaflets reduced in size but not spine-like. Male cones 1–5, cylindrical to fusiform, 8–15 cm × 2.5–4 cm, straight or curved with age, green; peduncle 15–28 cm × 0.5–1.5 cm; microsporophylls cuneate, 1.2–1.6 cm x 0.8–1.3 cm, with an erect, apical spine 0.5–2 cm long. Female cones 1–3, narrowly ovoid, 13–19 cm × 6–8 cm, green; peduncle 20–26 × 1–1.5 cm; megasporophylls broadly cuneate, 2.8–3.5 × 3.0–3.7 cm, with an erect, apical spine 2.5–7 cm long, the distal sporophylls with spines 4.5–7 cm long. Seeds oblong to obovoid, 2–2.5 cm × 1.5–2 cm, sarcotesta orange to red. (Figs. 9-10).

***Selected specimens*: Queensland**. Wide Bay District: Myravale, Dec 1964, *Clifford* (AQ142047 & AQ321067) (BRI); *ibid*, Apr 1965, *Clifford* (AQ142047) (BRI); S.F.639 Wrattens, Oct 1992, *Forster* PIF12137A-C (BRI); ditto, Feb 1993, *Forster* PIF13140 (BRI); Widgee Mt, Oct 1992, *Forster* PIF12120A & B (BRI); ditto, Feb 1993, *Forster* PIF13143 & *Machin* (BRI); ditto, Apr 1996, *Forster* PIF19138 & *Leiper* (BRI); S.F. 57 St Mary, Jun 1993, *Forster* PIF13374 & *Machin* (BRI).

Distribution and habitat: *Macrozamia longispina* (Map 1) occurs in south-eastern Queensland where it is mainly restricted to the vicinity of Glastonbury and Widgee west of Gympie, with an outlying population to the north at State Forest 57. It grows at altitudes between 420 and 680 m on slopes and ridges in tall moist eucalypt forest in shallow skeletal soils derived from serpentinite, or more rarely on deep sand. Common canopy species include *Eucalyptus biturbinata*, *E. acmenoides*, *E. tereticornis* and *Corymbia intermedia.*

Phenology: Cones shed pollen in October and November and are attended by the thrips

Fig. 9. *Macrozamia longispina*. Adult male plant in habitat. *Forster* PIF12137B & *Machin*. Photo: P.I.Forster.

Cycadothrips chadwickii (Forster et al. 1994). Ripe seed are dispersed in March and April.

Notes: *Macrozamia longispina* is similar to *M. macleayi, M. miquelii* and *M. mountperriensis* but differs from all these species by possessing leaves with fewer, narrower leaflets and markedly longer spines on the distal sporophylls of both the male and female cones. *Macrozamia longispina* is undoubtedly most closely allied to *M. mountperriensis* and differs in the leaves with fewer leaflets (usually 52–58 versus 70–86), narrower median leaflets (4.5–6 mm versus 6.5–9 mm) and in the apical sporophylls of the male cones having much longer spines (15–20 mm versus 3–13 mm). The allozyme analysis also supports the close relationship of these two species with the outlying and sand-dwelling population of *M. longispina* at State Forest 57 clustering more closely with the serpentine populations of that species, rather than the geographically nearby populations of *M. mountperriensis* (Fig. 1).

Conservation status: Although of restricted distribution the species is extremely abundant where it occurs with large numbers present in Wrattens State Forest and at one restricted locality in St Mary State Forest. Populations near Glastonbury appear to have been largely eradicated by local landowners because of their toxicity to domestic stock. The species is listed as Rare on the schedules of the Queenslnad Nature Conservation Act 1992.

Etymology: The specific epithet is derived from the Latin words *longi* (longer) and *spina* (a spine), alluding to the long apical spines on the distal microsporophylls.

4. Macrozamia macleayi Miq., *Arch. Néerl. Sci. Exact. Nat.* 3(5): 250 (post June 1868). **Type:** Queensland. MORETON DISTRICT: Moreton Bay, s.coll., s.dat. (holo U028258), *fide* Forster (1999b).

Macrozamia cylindrica C.Moore, *J. & Proc. Roy. Soc. New South Wales* 17: 119 (1884); *M. spiralis* var. *cylindrica* (C.Moore) Maiden & Betche, *Census New South Wales Pl.* 9 (1916), *nom. illeg. non* Regel (1876); *M. tridentata* subsp.

Fig. 10. *Macrozamia longispina.* Fruiting cone. *Forster* PIF19138 & *Leiper*. Photo: P.I.Forster.

cylindrica (C.Moore) J.Schust. in A.Engler, *Pflanzenr.* 99(IV, I): 91 (1932). **Type:** New South Wales. between the Upper Richmond and Clarence River, 1861, *C.Moore* (holo: NSW).

***Illustrations*:** Williams (1984: 187); Stanley & Ross (1989: 451)[all as *M. miquelii*].

Caudex usually subterranean, occasionally emergent, erect, columnar or barrel-shaped, to 35 cm tall and 30 cm diam., unbranched. Young leaves light green. Mature leaves elliptic-lanceolate in outline, 0.5–2 m long, obliquely erect to spreading, dark green, glossy, flat in cross-section, arching in profile, 6–50 in a moderately dense crown; expanded leaf base 8–12 cm × 2.5–3.5 cm, covered with grey-brown, soft woolly hairs; petiole (including the expanded base) 10–30 cm long, 0.8–1.2 cm wide at the first leaflet, greenish, flat adaxially, convex and angular abaxially; rhachis straight, not twisted or slightly twisted, pale green, the cross-section similar to that of the petiole; leaflets 80–160, inserted at about 40° to the rhachis, widely spreading, moderately crowded, distal leaflets densely packed, proximal leaflets becoming more widely spaced, narrowly linear-lanceolate, 15–50 cm × 6–9 mm, flat, thin-textured, hypostomatic, dark green and glossy

Fig. 11. *Macrozamia macleayi.* Adult male plant in habitat. *Forster* PIF12277B & *Machin*. Photo: P.I.Forster.

adaxially, slightly paler beneath, contracted proximally to a whitish callous base, margins entire, tapered to a pungent apex; lower leaflets gradually reduced to 8–28 pairs of rigid pinnacanths. Male cones 1–5, cylindrical, 15–20 cm × 3.8–6.5 cm, straight or curved with age, green; peduncle 15–29 cm × 1.5–2 cm, elliptical to round in cross-section; microsporophylls broadly cuneate, 1.5–2.5 cm × 1–1.5 cm, with an erect, apical spine 0.5–1.5 cm long. Female cones 1 or 2, cylindrical to barrel-shaped, 19–30 cm × 7–10 cm, green; peduncle 15–41 cm × 2–3 cm, elliptical in cross-section, furrowed; megasporophylls broadly wedge-shaped, 1.5–2.5 cm × 3–3.5 cm, with an erect apical spine 0.5–4.5 cm long, the distal sporophylls with spines 2.5–4.5 cm long. Seeds oblong to obovoid, 2.5–3.5 cm × 1.5–2.5 cm, sarcotesta orange to red. Figs. 11–13.

***Selected specimens examined*: Queensland.** Port Curtis District: Mt Colosseum, Nov 1992, *Forster* PIF12248 & *Machin* (BRI); Blackmans Gap, Nov 1992, *Forster* PIF12277A & B & *Machin* (BRI); Koolkoorum Creek Scientific Area 54, S.F. 121, Nov 1992, *Forster* PIF12285A & B & *Machin* (BRI); 8.5 km along road to Bulburin forestry camp site, Nov 1992, *Forster* PIF12289A & B & *Machin* (BRI); hill c. 2 km S of Mt Colosseum, S of Miriam Vale, May 1992, *Jones* 9394, *Jones & Forster* (BRI, CANB). Burnett District: Mt Takilberan, Wanbar S.F., Aug 1995, *Crane* 1268 (BRI); Burnett Range, S.F.54, Nov 1992, *Forster* PIF12299A & B & *Machin* (BRI); Kalpowar to Gin Gin road, Sep 1993, *Forster* PIF13980A & B & *Machin* (BRI). Wide Bay District: Burnett Range, 1.5 km NW of Mt Bania, Sep 1993, *Forster* PIF13983 & *Machin* (BRI); Mt Gaeta, c. 36 km N of Mt Perry township, Oct 1993, *Forster* PIF14174 (BRI); S.F.256 Imbil, Mitchell L.A., Feb 1993, *Forster* PIF13146A & B & *Machin* (BRI). Moreton District: Flaggy Creek tributary, 6 km E of Lake Manchester, May 1992, *Bostock* 1348 (BRI); Scientific Area 2, S.F. 309, May 1992, *Forster* PIF9885B & *Machin* (BRI); Brisbane Forest Park, Jan 1992, *Forster* PIF9355 & *Machin* (BRI); ditto, May 1992, *Forster* PIF9886A & *Machin* (BRI); 2 km NW of Mt Beerburrum, Jun 1994, *Forster* PIF15239 & *Machin* (BRI); Jolly's Lookout track to South Boundary road, Brisbane Forest Park, Nov 1991, *Machin* AQ517082 (BRI); Brisbane Forest Park, May 1993, *Machin (Jones* 11536*)* (CANB); S.F. 309, Enoggera, Apr 1970, *Moriarty* 120 (BRI, CANB); Brookfield, Dec 1888, *Simmonds* AQ142052 (BRI); Mt Nebo, Dec 1960, *Trapnell* AQ142053 (BRI).

***Distribution and habitat*:** *Macrozamia macleayi* (Map 1) is disjunctly distributed from Mt Colosseum near Miriam Vale in the Port Curtis District, south to the Brisbane region in the Moreton District, with a reported disjunct occurrence in northeastern New South Wales based on the 1861 type collection of *M. cylindrica* "between the Upper Richmond

Fig. 12. *Macrozamia macleayi.* Female cone. Imbil. Photo: D.L.Jones.

River and Clarence River"(Harden 1990; Hill 1998). There are no recent collections from New South Wales and this record should be regarded as extremely dubious. Plants grow at altitudes from 100 to 500 m in the understorey of araucarian microphyll vineforest or in open forest that is often dominated by *Eucalyptus acmenoides, E. crebra, E. major, E. microcorys* and *Lophostemon confertus*.

Phenology: Cones shed pollen October and November and are attended by the thrips *Cycadothrips chadwickii* (Forster et al. 1994). Ripe seeds are dispersed March and April.

Typification: See discussion in Forster (1999b).

Notes: This species is most closely related to, and has previously been included under, *M. miquelii* (cf. Johnson 1959; Hill 1998), but it has a more southerly distribution, and can be distinguished by its glossier, thinner-textured leaflets and smaller female cones. The allozyme analysis indicates that the northern populations near Miriam Vale are more closely related to one another than the disjunct population at Imbil (Fig. 1). Isozyme analysis incorporating the populations near Brisbane would be useful in further elucidation of these relationships.

Conservation status: This species is abundant and well conserved in Brisbane Forest Park

Fig. 13. *Macrozamia macleayi*. Male and female cones. *Forster* PIF12277A & B & *Machin*. Photo: P.I.Forster.

where it is present in both National Parks and State Forests. The northern populations are well represented in State Forests.

Etymology: Probably named for William John Macleay (1820-1891), scientist and pastoralist and a stalwart of the Linnean Society of New South Wales (Australian Encylopaedia 1996). Miquel (1868a,b) states "Nascur in Novâ Hollandiâ orientali, in regione fl. Moreton, ubi probabititer detexit MacLeay".

5. Macrozamia miquelii (F.Muell.) A.DC., *Prodr.* 16(2): 535 (1868).

Encephalartos miquelii F.Muell., *Fragm.* 3: 38 (1862); *M. tridentata* var. *miquelii* (F.Muell.) J.Schust., in A.Engler, *Pflanzenr.* 99(IV, I): 90 (1932); *M. tridentata* var. *oblongifolia* Regel, *Trudy Imp. S.-Peterburgsk. Bot. Sada* 4: 320 (1876), *M. miquelii* cited as basionym; *M. tridentata* f. *oblongifolia* (Regel) J.Schust., in A.Engler, *Pflanzenr.* 99(IV, I): 93 (1932). **Type:** Queensland. Rockhampton, *A.Thozet* (lecto MEL; isolecto: K, n.v.) designated by Johnson (1959).

Macrozamia tridentata f. *milkaui* J.Schust., in A.Engler, *Pflanzenr.* 99(IV, I): 90 (1932). **Type:** Queensland. around Rockhampton, 11 May 1902, *L.Diels* 8249 (holo: B, destroyed).

***Illustrations*:** Jones (1993: 248, upper plate).

Caudex usually subterranean, occasionally emergent, erect, columnar or barrel-shaped, to 50 cm long and 45 cm diam., unbranched. Young leaves light green. Mature leaves elliptic-lanceolate in outline, 0.5–2.3 m long, obliquely erect to spreading, dark green, dull to slightly glossy, flat in cross-section, arching in profile, 20–80 in a dense crown; expanded leaf base 8–15 cm × 3–4 cm, covered with grey-brown, soft woolly hairs; petiole (including the expanded base) 20–40 cm long, 8–20 mm wide at the first leaflet, greenish, flat adaxially, convex and angular abaxially; rhachis straight, not twisted or slightly twisted, pale green, the cross-section similar to that of the petiole; leaflets 80–180, inserted at about 40° to the rhachis, widely spreading, moderately crowded,

Fig. 14. *Macrozamia miquelii.* Adult male plant in habitat. *Forster* PIF12262B & *Machin.* Photo: P.I.Forster.

distal leaflets densely packed, proximal leaflets becoming more widely spaced, linear, 15–50 cm × 6–12 mm, flat, thick-textured, hypostomatic, dark green and dull to slightly glossy adaxially, slightly paler beneath, contracted proximally to a whitish or rarely reddish callous base, margins entire, tapered to a pungent apex; lower leaflets gradually reduced to 6–16 pairs of rigid pinnacanths. Male cones 1–5, cylindrical to fusiform, 12–28 cm × 3.8–6.5 cm, straight or curved with age, green; peduncle 11–30 cm × 1.5–2.5 cm, elliptical to round in cross-section; microsporophylls broadly cuneate, 1.2–2.5 cm × 0.8–1.5 cm, with an erect, apical spine 0.2–2 cm long. Female cones 1–3, cylindrical to barrel-shaped, 25–40 cm × 10-15 cm, green; peduncle 10–30 cm × 2–3 cm, elliptical in cross-section, furrowed; megasporophylls broadly wedge-shaped, 1.5–3 cm × 2.5–4 cm, with an erect, apical spine 0–4.5 cm long, the distal sporophylls with spines 2–4.5 cm long. Seeds oblong to ovoid, 2–3 cm × 1.5–2 cm, sarcotesta yellowish, light orange or red. (Figs. 14–16).

***Selected specimens*: Queensland.** Port Curtis District: Western slopes of Mt Beserker, Beserker Range, Apr 1985, *Forster* PIF1991 (BRI); Mt Morgan, top of Razorback, Nov 1992, *Forster* PIF12251A-C (BRI); Mt Archer summit, Nov 1992, *Forster* PIF12252A & B & *Machin* (BRI); Mt Archer, 2 km from summit, Nov 1992, *Forster* PIF12253A & B & *Machin* (BRI); Waterpark Creek,

Fig. 15. *Macrozamia miquelii*. Female cone. Byfield. Photo: D.L.Jones.

SE of Byfield township, Nov 1992, *Forster* PIF12259A-C & *Machin* (BRI); 4 km NW of Byfield township, Nov 1992, *Forster* PIF12262A & B & *Machin* (BRI); northern end of Windmill Plains, Nov 1992, *Forster* PIF12263A & B & *Machin* (BRI); Ross Range, 6.5 km along Keppel Sands road off Emu Park road, Nov 1992, *Forster* PIF12268 & *Machin* (BRI); Byfield N.P., The Peaks area, 8 km NE of Byfield, Sep 2000, *Forster* PIF26232 & *Booth* (BRI); c.7.4 km N of Farnborough State School, beside road to Byfield, May 1992, *Jones* 9393 & *Jones* (CANB).

Distribution and habitat: *Macrozamia miquelii* (Map 1) is distributed in the Port Curtis District from near Mt Larcom to north of Byfield. Plants grow at altitudes between 10 and 540 m in open forest or woodland dominated by eucalypts, often on stony soil (e.g. trachyte at The Peaks), but at Byfield they grow on deep sand. At some localities the dominant canopy species is *Corymbia citriodora* and *Eucalyptus crebra*, whereas at others it is *Corymbia intermedia* and *Eucalyptus umbra.*

Phenology: Cones shed pollen from October to November and are attended by the thrips *Cycadothrips chadwickii* (Forster et al. 1994). Ripe seeds are dispersed in March and April.

Typification: When originally named, this species had three collections from different localities cited. Johnson (1959) lectotypified the name using the *Thozet* collection from Rockhampton, although Mueller had himself

Fig. 16. *Macrozamia miquelii*. Male and female cones. *Forster* PIF12263A & B & *Machin*. Photo: P.I.Forster.

already indicated a preferred application (Forster 1999a). A proposal to conserve the name with Johnson's lectotype (Forster 1999a) has been rejected by the IAPT committee for nomenclature (Brummitt 2001) as it was considered that Mueller's later attempt at restricting application of the name did not equate to lectotypification.

Notes: *Macrozamia miquelii* is very closely allied to *M. macleayi* (which has a more southerly distribution), but can be distinguished from that species by its duller, thicker-textured leaflets and larger female cones. The close relationship of these two species is reinforced by the allozyme analysis (Fig. 1). The female cones of *M. miquelii* are also very similar to those of *M. douglasii,* but *M. miquelii* has 6–16 pairs of prominent pinnacanths towards the base of the leaf as opposed to 1–4 pairs in *M. douglasii*. *M. serpentina* is also allied to *M. miquelii* but is smaller growing with fewer, shorter leaves, smaller leaflets, smaller male and female cones and smaller seeds. *Macrozamia cardiacensis, M. longispina* and *M. mountperriensis* are all superficially similar to *M. miquelii*. See under those species for differences.

Conservation status: Widespread and abundant with a number of populations in conservation reserves (e.g. Byfield National Park, Mt Archer National Park).

Etymology: Named for F.A.W.Miquel (1811-1871), Dutch botanist and early pioneer of cycad systematics.

6. Macrozamia mountperriensis F.M.Bailey, *Syn. Queensland Fl.*, Suppl. 1: 50 (1886). *Macrozamia tridentata* subsp. *mountperriensis* (F.M.Bailey) J.Schust., in A.Engler, *Pflanzenr.* 99(IV,I): 89 (1932).**Type:** Queensland. Adjacent to Schuh Lookout, W of Mt Perry, 29 Aug. 1990, *D.L.Jones 6340 & B.E.Jones* (neo: CANB; isoneo: BRI, NSW), *fide* Forster & Jones (1992).

***Illustrations*:** Bailey (1913: 516, 517); Jones (1993: 250).

Caudex usually subterranean, occasionally emergent, cylindrical to columnar, to 30 cm long and 40 cm diam. unbranched. Young leaves light green to yellowish green. Mature leaves elliptic-lanceolate in outline, 0.6–1.5 m long, obliquely

Fig. 17. *Macrozamia mountperriensis*. Adult female plant in habitat. *Forster* PIF9343. Photo: P.I.Forster.

erect to spreading, light green to yellowish green, flat in cross-section, arching in profile, 10–80 in a dense crown; expanded leaf base 6–12 cm × 2–3.5 cm, covered with light grey, soft woolly hairs; petiole (including the expanded base) 30–65 cm long, 7–10 mm wide at the first leaflet, pale green, ridged above, convex and angular beneath; rhachis straight, not twisted or with a slight twist, greenish white, the cross-section similar to that of the petiole; leaflets 50–110, inserted at about 40° to the rhachis, moderately crowded, evenly spaced throughout except those towards the base which are more widely spaced, linear, 20–35 cm × 6–9 mm, flat, hypostomatic, thin-textured, light green to yellowish, contracted proximally to a whitish callous base, margins entire, tapered to a sharp apex; lower leaflets slightly smaller but not spine-like. Male cones 1–4, cylindrical, 12–25 cm × 2.5–4 cm, usually curved, green; peduncle 12–22 cm × 1–1.5 cm, elliptical in cross-section; microsporophylls cuneate, 1–1.5 cm × 0.6–1.4 cm, with an erect, apical spine 0.2–1.2 cm long. Female cones 1 or 2, cylindrical to barrel-shaped, 17–30 cm × 6–10 cm, green; peduncle 23–40 cm × 1.5–2.5 cm; megasporophylls broadly cuneate, 1.5–3 cm × 2.5–3.5 cm, with an erect, apical, spine 0.5–4 cm long, the distal sporophylls with spines 2.5–4 cm long. Seeds ovoid to oblong, 2–2.5 cm x 1.5–2 cm, sarcotesta orange to red or yellow. (Figs. 17–18).

***Selected specimens*: Queensland.** Wide Bay District: Stony Creek, 4 km E of Didcot, Dec 1984, *Forster* PIF1966 (BRI); Farrels Scrub, Deep Creek road, Oct 1991, *Forster* PIF9128 (BRI, CANB, MEL); S.F.1294 Brooweena, Jan 1992, *Forster* PIF9343 & *Machin* (BRI, MEL); Fairlies Knob N.P., Seaview Range, Dec 1992, *Forster* PIF12571 (BRI); Stoney Range, S.F.38, Jun 1993, *Forster* PIF13321 (BRI); Seaview Range, Doongul L.A., S.F. 1294, Jun 1993, *Forster* PIF13372 (BRI); S.F. 57 St Mary, Jun 1993, *Forster* PIF13374 & *Machin* (BRI); 7 km from Mt Perry on Monto road, Sep 1993, *Forster* PIF13984 (BRI). Burnett District: 2 km SW of Boolbunda Rock, May 1986, *Forster* PIF2423 (BRI); Goodnight Scrub, Kalliwa Creek area, Dec 1986, *Forster* PIF2771 (BRI); Goodnight Scrub, May 1991, *Jones* 9388, *Jones & Forster* (CANB).

***Distribution and habitat*:** *Macrozamia mountperriensis* (Map 1) is distributed from the Mount Perry region to the west of Bundaberg, south to Brooweena and east to Aramara. This species grows at altitudes between 200 and 450m on sheltered slopes, ridges and gullies under sparse tall dry sclerophyll open forest or woodland in gravelly loams derived from granite

Fig. 18. *Macrozamia mountperriensis.* Female cone. Mt Perry neotype locality. Photo: D.L.Jones.

or granodiorite (rarely sandstone), and also in Araucarian microphyll vine forests on red-brown volcanic loams. Associated canopy species in open forest and woodland include *Angophora leiocarpa, Corymbia citriodora, C. trachyphloia, Eucalyptus acmenoides, E. crebra* and *E. siderophloia.*

Phenology: Pollen shedding occurs in October and November. The cones are attended by the thrips *Cycadothrips chadwickii* (Forster et al. 1994). Ripe seed is shed in March and April.

***Notes*:** *Macrozamia mountperriensis* can be distinguished from *M. miquelii* by its shorter paler green leaves with proportionately longer petioles, the absence of pinnacanths, much smaller cones and smaller seeds. *M. longispina* has more, narrower leaflets, smaller male cones and the distal megasporophylls have longer spines (see discussion under that species).

Conservation status: *M. mountperriensis* is locally abundant in extensive colonies with strong seedling recruitment. The species is widespread and well represented in a number of National Parks and several State Forests. It is not rare or threatened at present.

Etymology: Named for the township of Mount Perry where the species was first discovered.

Fig. 19. *Macrozamia serpentina*. Adult female plant in habitat. *Forster* PIF9408A & *Machin*. Photo: P.I.Forster.

7. Macrozamia serpentina D.L.Jones and P.I.Forst. **sp. nov.** affinis *M. miquelii* (F.Muell.) A.DC. sed statura minor foliis paucioribus (5–12 adversum 20–80), foliolis paucioribus (70–100 adversum 80–180), strobilis masculinis parvioribus tenuioribus (2.5–3.5 cm diam. adversum 3.8–6.5 cm) et strobilis femineis parvioribus tenuioribus (14–22 x 6.5–8 cm adversum 25–40 x 10–15 cm) spinis distalibus brevioribus (1.5–2 cm adversum 2–4.5 cm) differens. **Typus:** Queensland. Port Curtis District: 1 km W of Glen Geddes, 4 November 1992, *P.I.Forster* PIF12266 & *P.Machin* (holo: BRI; iso: CANB).

Macrozamia sp. (Marlborough P.I.Forster +PIF12269A) (Forster 1997).

Caudex subterranean, ovoid, to 30 cm long, 15–25 cm diam., unbranched. Young leaves light green. Mature leaves broadly elliptic in outline, 0.2–1 m long, obliquely erect to spreading, dark green, semi-glossy, flat in cross-section, arching in profile, 5–12 in a sparse crown; expanded leaf base 6–10 cm x 2–3 cm, covered with grey, soft woolly hairs; petiole (including the expanded base) 2–15 cm long, 6–12 mm wide at the first leaflet, pale green, flat to shallowly convex adaxially, angular abaxially; rhachis

Fig. 20. *Macrozamia serpentina*. Female cone. Glen Geddes. Photo: D.L.Jones.

straight, not twisted or slightly twisted, pale green, the cross-section similar to that of the petiole; leaflets 70–100, inserted at 40–60° to the rhachis, widely spreading, uncrowded, distal leaflets densely packed, proximal leaflets becoming more widely spaced, linear, 15–45 cm x 4–8 mm, flat, thick-textured, hypostomatic, dark green and glossy adaxially, slightly paler beneath, contracted proximally to a white callous base, margins entire, tapered to a sharp apex; lower leaflets gradually reduced to 5–8 pairs of rigid pinnacanths. Male cones 1–3, cylindrical, 12–20 cm x 2.5–3.5 cm, straight, curved or slightly twisted with age, green; peduncle 10–18 cm x 7–9 mm, round in cross-section, furrowed; microsporophylls cuneate, 8–12 mm x 4–8 mm, with an erect, apical spine 0–7 mm long, the distal sporophylls with the longest spines. Female cones 1 or 2, cylindrical to barrel-shaped, 14–22 cm x 6.5– 8 cm, green; peduncle 14–20 cm x 12–14 mm, round in cross-section, furrowed; megasporophylls broadly wedge-shaped, 1.5–2.5 cm x 3–3.5 cm, with an erect, apical, spine 0.5–2 cm long, the distal sporophylls with spines 1–2 cm long. Seeds oblong to ovoid, 1.8–2.5 cm x 1.5–2 cm, sarcotesta light orange to red. (Figs. 19–21).

Selected specimens examined: **Queensland**. Leichhardt District: Marlborough - Glenprairie road, Jul 1998, *Thompson* 1267 & *Fox* (BRI). Port Curtis District: Coorumburra Station, SSW of Marlborough, May 1998, *Batianoff* 980533W (BRI); Mt Fairview, W of

Fig. 21. *Macrozamia serpentina*. Male cones. *Forster* PIF12266 & *Machin*. Photo: P.I.Forster.

Ridgelands, S.F.114, May 1998, *Batianoff* 980534W (BRI); Glen Geddes, Jul 1987, *Champion* 295 (BRI); Between Canoona and Glen Geddes, Dec 1966, *Everist* 7945 (BRI); Glen Geddes, Jan 1992, *Forster* PIF9408 (BRI, CANB); NNE of Marlborough, Nov 1992, *Forster* PIF12269A & B & *Machin* (BRI); southern slopes of Mt Slopeaway, Nov 1992, *Forster* PIF12273A & B & *Machin* (BRI); E of Glenavon Homestead, Five Mile Creek Headwaters, Mar 1994, *Forster* PIF15041 & *Bean* (BRI); Glen Geddes, 6 May 1992, *Jones* 9389 B & *Jones* (CANB); Glen Geddes, Oct 1991, *Machin* AQ517058 (BRI); Ramilles Block, Jan 1989, *Specht* 146 & *Reeves* (BRI); Glen Geddes, Jan 1989, *Specht* 314 & *Reeves* (BRI).

Distribution and habitat: *Macrozamia serpentina* (Map 1) occurs in the Leichhardt and Port Curtis Districts between Marlborough and Yaamba, north of Rockhampton. It grows at altitudes between 80 and 160 m in low woodland with a mixed grassy and shrubby understorey in red clay loams over serpentinites. Associated canopy species include *Corymbia xanthope* and *Eucalyptus fibrosa*.

Phenology: Cones shed pollen from October to November and are attended by the thrips *Cycadothrips chadwickii* (Forster et al. 1994). Ripe seed are shed from March to May.

Notes: *Macrozamia serpentina* was not mentioned in the account of Hill (1998), although it had been listed as an undescribed species by Forster (1994 & 1997). *Macrozamia serpentina* is closely allied to *M. miquelii* but smaller growing with fewer (5–12 versus 20–80), shorter leaves, smaller and fewer (70–100 versus 80–180), more widely spaced leaflets, smaller and thinner (2.5–3.5 cm diameter versus 3.8–6.5 cm) male cones, and smaller and thinner (14–22 × 6.5–8 cm versus 25–40 × 10–15 cm) female cones that have shorter apical spines on the megasporophylls (1.5–2 cm versus 2–4.5 cm). Incomplete (not included in Fig. 1) allozyme analysis of this species indicates that it is most closely related to *M. miquelii*.

Conservation status: This species is listed as Endangered on the schedules of the Queensland Nature Conservation Act 1992. It is poorly conserved with no populations in conservation reserves. This species co-exists with a range of restricted endemics on serpentinite (Batianoff *et al.* 1991, 2000), in communities which are themselves threatened by clearing, mining and agriculture.

Etymology: The epithet is derived from the Latin *serpentinus*, growing on serpentine rock.

Names of Uncertain Application

Macrozamia mackenzii Hort. Ex Mast., *Gard. Chron.*, n.s. 7: 665 (1877); *M. tridentata* var. *mackenzii* (Hort. ex Mast.) J.Schust., in A.Engler, *Pflanzenr.* 99(IV,I): 90 (1932). **Type**: 'growing in the botanic garden at Brisbane, under the charge of Mr W. Hill'. No specimen is known to exist but an illustration in the Gardeners Chronicle of a cultivated plant places the species as a member of the *M. miquelii* group. This illustration is not diagnostic and is inadequate for identification of the taxon concerned.

Encephalartos spiralis var. *major* Miq., *Verslagen Meded. Afd. Natuurk. Kon. Akad. Wetensch.* 15: 368 (1863). **Type**: "Broad-Sound & Moreton Bays, *F.Mueller;* Jervis Bay, N.S.W., *F.Mueller*; Moreton Bay, *C. Stuart.*

We have not seen any of these syntypes. Given the broad geographic origin of the different collections it is certain that more than one species is involved.

Acknowledgements

Thanks to Peter Machin for his enthusiastic and prolonged interest and field assistance with this project; Peter Bostock (BRI) for the map and translation of the diagnosis into Latin; Corinna Broers, Marion Garratt, Karina FitzGerald and Barbara Jones for technical assistance at CANB; Bob Chinnock (AD) and Laurie Jessup (BRI) in their capacity as Australian Botanical Liaison Officers for examining material at Royal Botanic Gardens, Kew; Marco Duretto (MEL) for rechecking specimens in MEL; Greg Smyrell for determination of the northern limit of *M. miquelii*; Halina Winters (BRI) for library research on John Douglas and Will Smith (BRI) for scanning the illustrations.

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Oreodendron C. T. White reduced to *Phaleria* Jack (Thymelaeaceae, Thymelaeoideae)

B.E. Herber

Summary

Herber, B.E. (2001). *Oreodendron* C.T. White reduced to *Phaleria* Jack (Thymelaeaceae, Thymelaeoideae). *Austrobaileya* 6 (1): 95–97. The monospecific genus *Oreodendron*, endemic in Queensland, has been distinguished from the related genus *Phaleria* by the absence of involucral bracts, the presence of a short pedicel and the arrangement and exposition of stamens. A study of these characters in *Oreodendron* shows that involucral bracts are present before anthesis. Furthermore, the presence of a short pedicel as well as the arrangement and exposition of stamens, said to be characteristic of *Oreodendron*, also occur in *Phaleria*. Therefore, *Oreodendron* is reduced here to synonymy of *Phaleria* and the new combination *Phaleria biflora* (C. T. White) Herber is made for White's species. A key to identify the four Australian species of *Phaleria* is provided.

Key words: Thymelaeaceae, *Oreodendron*, *Phaleria*

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Introduction

The genus *Oreodendron* C. T. White with one species, *O. biflorum* C. T. White was established in 1933 based on a collection of S. F. Kajewski from Thornton Peak ("Mount Alexander"), Queensland, Australia. White (1933) stated that his new genus is "closely allied" to *Phaleria* Jack, a genus of about 30 species distributed from Malesia to Sri Lanka, Micronesia, the Samoan Islands, Tonga and Australia. Till now the Australian species recognised are *P. clerodendron* (F. Muell.) Benth., *P. octandra* (L.) Baill. and *P. chermsideana* (Bailey) C. T. White. *Phaleria* is mainly characterized by its bilocular ovary. In subfamily Thymelaeoideae, the gynoecium is typically unilocular, only in tribe Phalerieae, comprising *Oreodendron*, *Phaleria* and the African genus *Peddiea* Harv., are there bilocular ovaries. In addition to *Oreodendron* and *Phaleria* sharing this character, they also share a non-articulated floral tube, a diplostemonous androecium, terminal insertion of the style and the presence of a floral disk. White (1933: 74-75) claimed that *Oreodendron* differs from *Phaleria* in "...the absence of involucral bracts at the top of the peduncle, in the flowers being pedicellate not sessile and in the anthers being arranged in two very distinct series, the lower series being included". The genus *Oreodendron* is widely recognized (e.g. Hutchinson 1967, Takhtajan 1997). On the other hand, Domke (1934), who was not able to examine any material of *Oreodendron*, accepted the genus only with reservation. In her contribution for the Flora of Australia, Rye & Heads (1990: 130) remarked "[t]his genus is very closely related to *Phaleria* and needs further study to determine whether or not it should be retained as a separate genus" and of *O. biflorum* that it "[s]omewhat resembles *Phaleria chermsideana*".

Accepted for publication 2 March 2001

Results and Discussion

Absence of involucral bracts.- The capitate inflorescences of *Phaleria* are provided with two to more bracts in the distal part of the peduncle, which are often deciduous before or at anthesis. In *Oreodendron biflorum*, two involucral bracts are developed (Fig.1A,B). These two bracts are minute and deciduous before anthesis. On peduncles of open flowers, it is almost impossible to detect their scars and they are easily overlooked.

Presence of a pedicel.- The pedicel of *Oreodendron biflorum* is about 0.6 mm in length (Fig. 1A,B). Short pedicels are common in *Phaleria* too. In all Australian species pedicels up to 0.3 mm length sometimes occur (see Rye & Heads 1990). Neither Ding Hou (1960) nor Smith (1981) mentioned the presence of a pedicel in *Phaleria*, which may be due to its length of less than 1 mm. In such cases a distinction between sessile, sub-sessile or pedicellate flowers is questionable.

Arrangement of stamens.- The stamens in *Oreodendron* are arranged in two clearly separate series as described by White (1933). The same basic arrangement is found in *Phaleria*, where the stamens are usually inserted in two distinct series on the upper half of the floral tube as well.

Exposition of stamens.- In *Oreodendron* the anthers of the upper whorl are slightly exserted, whereas those of the lower whorl are included in the floral tube (Fig. 1C,D). The position of anthers in *Phaleria* is sometimes as in *Oreodendron* (e. g. as in *Phaleria disperma* (Forst. f.) Baill.), or all anthers are either exserted or rarely included. Heterostyly is common in *Phaleria* and occurs in two of the Australian species, *P. clerodendron* and *P. chermsideana*. It is unlikely but cannot be excluded that *Oreodendron* is heterostylic too. Nevertheless, neither the occurrence of heterostyly nor the arrangement or exposition of stamens provides characters to discriminate between *Oreodendron* and *Phaleria*.

Not a single character that would justify the generic distinction of *Oreodendron* has been confirmed. The arguments used by White (1933) for treating *Oreodendron* as a genus distinct from *Phaleria* Jack have proved to be based on incomplete observations or are irrelevant for the generic delimitation in question. Therefore, *Oreodendron* is reduced to a synonym under *Phaleria* and the following combination is made:

Phaleria Jack, Malayan Misc. 2: 59 (1822). **Type**: *P. capitata* Jack

Oreodendron C. T. White, Contrib. Arnold Arbor. 4: 74 (1933), **synon. nov. Type**: *O.biflorum* C. T White

Phaleria biflora (C. T. White) Herber, **comb. nov.**

Oreodendron biflorum C. T. White, Contrib. Arnold Arbor. 4: 74–75 (1933). **Type**: Queensland. Cook District: Thornton Peak, 18 Dec 1929, S. F. Kajewski 1499 (iso: BRI, B) Queensland

***Selected specimens*: Queensland**. Cook District: Daintree NP, Black Mtn area, Daintree River headwaters, May 1998, *Forster* et al. PIF22957 (BRI); Thornton Peak, Dec 1946, *Flecker* 7093 (BRI); North Mary L.A., SF 143, Jul 1994, *Forster* et al. PIF 15627 (BRI).

Phaleria now includes four species in Australia: *P. clerodendron* (F. Muell.) Benth., *P. octandra* (L.) Baill., *P. chermsideana* (Bailey) C. T. White and *P. biflora* (C. T. White) Herber. Most similar to *P. biflora* is *P. chermsideana*, which can be distinguished as outlined in the key below.

Key to Australian species of *Phaleria*

1. Leaf blade (1–)4–7(–9) cm long; involucral bracts 2 2
   Leaf blade (8–)13–17(–24) cm long; involucral bracts 4 3

2. Leaf blade ovate; inflorescence 2 (rarely 3)-flowered; septum of fruit thinner than seed-coat ..... **P. biflora**
   Leaf blade elliptic. Inflorescence 4–10-flowered. Septum of fruit thicker than seed-coat ..... **P. chermsideana**

3. Inflorescence 5–7-flowered; floral tube at anthesis 25 mm long or more; fruit when mature > 23 mm long ..... **P. clerodendron**
   Inflorescence 8–25-flowered; floral tube at anthesis up to 17 mm long; fruit when mature < 20 mm long ..... **P. octandra**

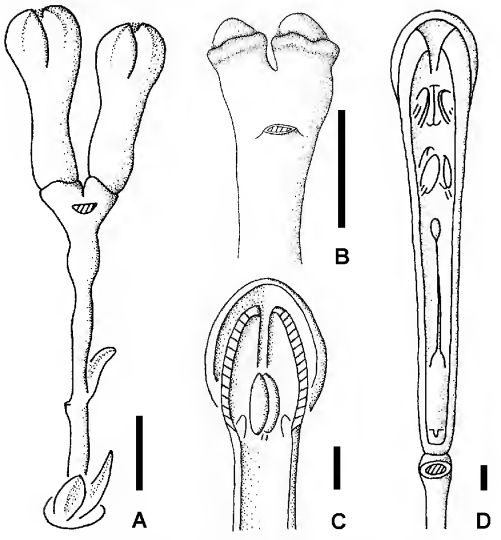

Fig. 1. ***Phaleria biflora***. A, inflorescence at early stage of anthesis; B, inflorescence before anthesis; C, D longitudinal sections of a young flower. A–D, *Kajewski* 1499 (B). Scale bar: A–D = 1 mm.

Specimens of other species examined:
***Phaleria chermsideana*: Queensland.** Wide Bay District: Norval Park c. 13km N of Yandaran, NW of Bundaberg, Oct 1996, *Bean* 11149 (BRI); Norville Park, N of Bundaberg, [no date], *Randall* 629 (BRI); 20 miles (32km) NW of Bundaberg, Dec 1982, *Sarnadsky* s.n. [AQ348777] (BRI). Darling Downs District: Moss Gardens, border fence, Jan 1990, *Forster* et al. PIF6217 (BRI); The Head near Killarney, Feb 1968, *Jones* 3659 (BRI); Norville Park, 32km NW of Bundaberg, Jul 1983, *Sarnadsky* s.n. [AQ339630](BRI). Moreton District: O'Reilly's Guest House, Nov 1969, *Hockings* 2 [AQ363220] (BRI); Mt Mistake, Oct 1969, *Smith* s.n. [AQ410839] (BRI); Mt Mistake, May 1948, *Smith* & *Webb* 3692 (BRI). **New South Wales**: Near Kyogle, Oct 1943, *Jones* s.n. [AQ 85756](BRI).

***Phaleria clerodendron*: Queensland** Cook District: Henrietta Creek on Palmerston Highway, Nov, 1979, *Clarkson* 2737 (BRI); Cedar Creek between Bingil Bay and ElArish, Dec 1984, *Jessup* 740 (BRI); Russell River near bridge on Bruce highway, Jul 1963, *Jones* s.n. [AQ85766] (BRI).

***Phaleria disperma*:** *A. Whistler* 6600 (HBG), 4453 (B).

***Phaleria octandra*: Northern Territory:** Darwin and Gulf District: Water Quarry rainforest, Melville Island, Dec 1984, *Jones* 1701 (BRI); 2km NW of Yirrkala, Feb 1988, *Russell-Smith* 4707 (BRI), North central Arnhem land 19km N of Mirrngatja, Nov 1987, *Russell-Smith* 3980 (BRI); Yirrkala, Aug 1948, *Specht* 806 (BRI); Banjo jungle, Snake Bay, Melville Island, near airstrip, May 1978, *Webb* & *Tracey* 12486 (BRI). **Queensland:** Cook District: Yam Is, forest adjacent to airfield, Oct 1981, *Clarkson* 4025 (BRI); Shiptons Flat, Nov 1989, *Jessup* et al. GJD2830 (BRI); Cape York, Bamaga, Sep 1963, *Jones* 2554 (BRI); SFR 191 Wongabel, near Atherton, Jan 1963, *Rudder* AFO2569 (BRI). South Kennedy District: Netherdale, Mirani Shire, Apr 1980, *McConnell* 2013 (BRI); Mt Mandurana NP 602, c 20km WNW of Mackay, May 1990, *McDonald* 4581(BRI); *Mueller* s.n. (P).

Acknowledgements

I extend my thanks to K. Kubitzki for helpful comments and to C. Bayer for the instructive discussion and for reviewing the manuscript. Furthermore, I wish to thank the curators of BRI, B and P for the loan of material in their care, and acknowledge the support of Deutsche Forschungsgemeinschaft (Ku 174/15-1).

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A new species of *Lissanthe* R.Br. (Epacridaceae) from Queensland

A.R. Bean

Summary

Bean, A.R. (2001). A new species of *Lissanthe* R.Br. (Epacridaceae) from Queensland. *Austrobaileya* 6 (1): 99-102. *Lissanthe brevistyla*, a new species from the serpentinite deposits near Rockhampton, is described and illustrated. It is compared to related taxa, and notes on the conservation status are provided.

Key words: *Lissanthe brevistyla, Lissanthe*, Epacridaceae, sepentinite, Queensland flora, taxonomy.

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Introduction

The serpentinite geological deposits near Marlborough, north of Rockhampton contain a high proportion of rare or endemic plant species, some of which are very restricted in distribution (Batianoff *et al.* 2000). The species under consideration here came to notice only recently, and only after a mining lease had been established over the area of its occurrence.

A revision of the whole of Epacridaceae is being undertaken at the National Herbarium of New South Wales by Elizabeth Brown and colleagues. Since the results of this revision are some years away, the opportunity is taken here to describe this rare Queensland epacrid.

The new species shares with *Lissanthe* R.Br. the following features: spicate inflorescence on terminal growth (not on old wood), with flowers subtended by a solitary persistent bract and two bracteoles; the bracteoles somewhat removed from the sepals; the inner surface of the corolla tube glabrous in the lower half, but hairy towards the throat; the corolla lobes valvate in bud; and the 5–7-locular drupaceous fruits.

The generic placement is not certain, as this taxon belongs to a group of closely related genera that include *Lissanthe, Cyathodes s. lat., Acrotriche* and some *Leucopogon* spp. (Brown and Crayn, pers. comm.). The pedicel lacks the degree of elongation usually associated with species of the genus *Lissanthe*, and the filaments are unusually wide and thick (Fig. 1c, 1d).

Accepted for publication 20 April 2001

The only other Queensland taxon currently ascribed to *Lissanthe* is *L. strigosa* subsp. *subulata* (R.Br.) J.M.Powell (Powell & Wiecek 1994). However, Powell (1992) foreshadowed the transfer of some species of *Leucopogon* R.Br. to *Lissanthe*, namely *Leucopogon pedicellatus* and *L. pleiospermus*. Determinavit slips at BRI annotated by Powell indicate a similar position for *Leucopogon pluriloculatus*. While these species have the densely hairy corolla lobes, traditionally indicative of *Leucopogon*, they otherwise conform to the characteristics of *Lissanthe*.

Taxonomy

Lissanthe brevistyla A.R.Bean **sp. nov.** affinis *L. strigosae* autem inflorescentia terminali spicata, pedicellis brevioribus, stylo ovarioque glabro, fructibus grandioribus purpureocyaneis differt. **Typus:** Queensland. Port Curtis District: Gumigil Mining Lease, 16.5 km and 189° from Marlborough Motel on Bruce Highway, 17 November 1999, *I.G. Champion* 1569 & *B. Tangey* (holo: BRI; iso: NSW).

Spreading shrub to 1.5 m high and 2.5 m across. Branchlets puberulous. Leaves lanceolate to narrowly lanceolate, 10–25 × 1.8–3 mm, glabrous, dark green and flat to convex above, whitish below, usually 7-veined, tapering into a pungent point 0.8–1.3 mm long, margins

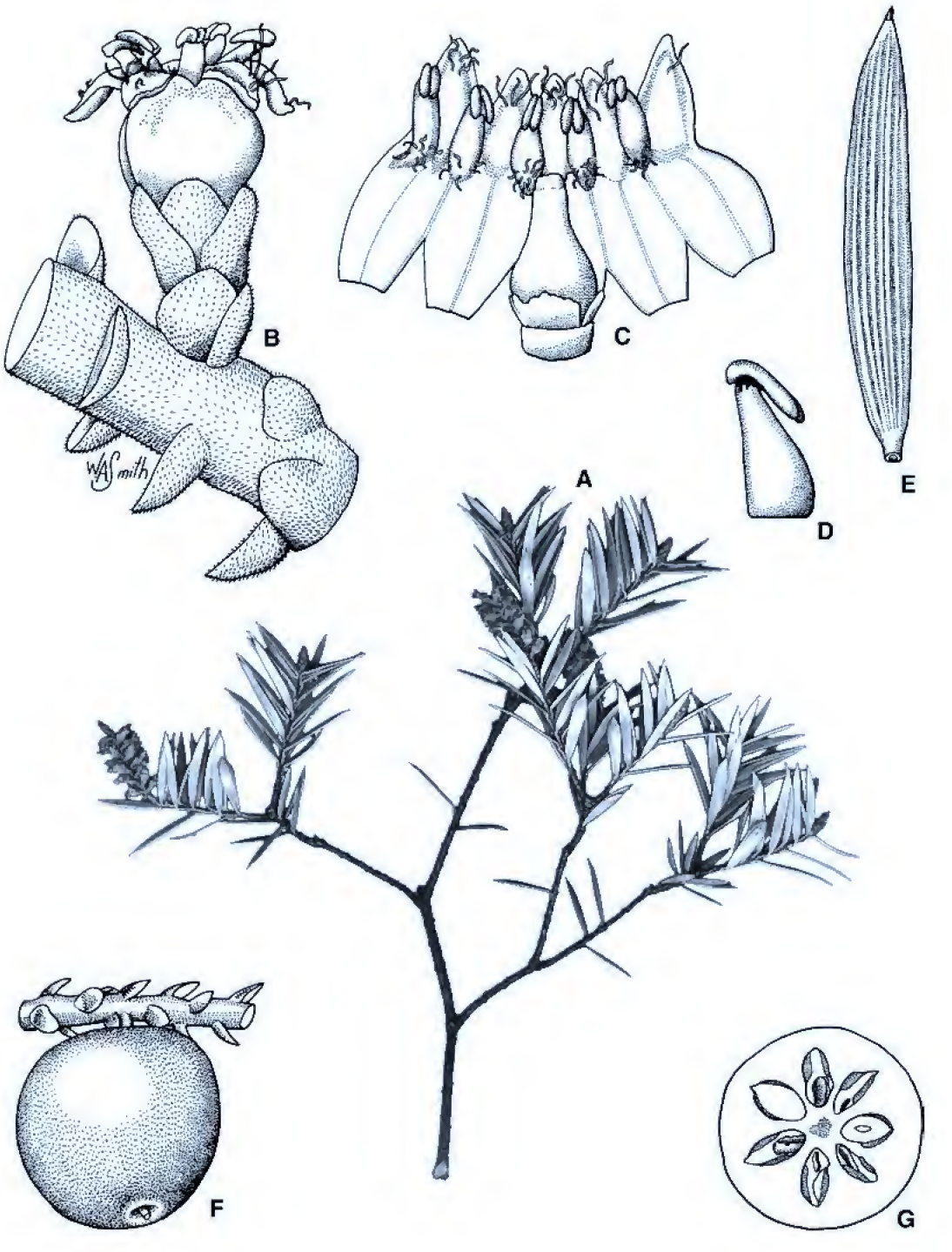

Fig.1. ***Lissanthe brevistyla***. A. flowering branchlet × 0.8. B. side view of flower showing the persistent bract (each subtending a flower), one (of two) bracteoles, sepals and corolla tube × 16. C. internal view of flower × 16. D. lateral view of stamen × 32. E. leaf, abaxial surface × 4. F. mature fruit × 4. G. transverse section of endocarp of fruit × 8. A, *Champion* 1570 & *Tangey*; B–E, *Champion* 1554 & *Tangey*; F, G, *Champion* 1565 & *Tangey* (all BRI). Del. W. Smith.

entire, 7–9 vascular bundles per leaf; petiole 0.8–1.5 mm long. Inflorescence a dense auxotelic spike, up to 25 mm long, comprising 18–26 bisexual flowers, in the axils of the uppermost leaves or apparently terminal. Rachis puberulous. Pedicels obscure. Subtending bract orbicular, c. 1 × 1 mm, sparsely puberulous to glabrous, persistent. Bracteoles 2, persistent, 0.7–1.1 mm long, keeled, obtuse, ciliolate, placed just below but not or scarcely overlapping the sepals. Sepals 5, imbricate, broadly ovate, 0.5–1 mm long, 0.5–0.8 mm wide, apex obtuse, margins ciliolate. Corolla white or pink; tube urceolate, 1.8–2.6 mm long, far exceeding sepals, glabrous externally, with long, flexuose, very sparse to moderately dense hairs internally towards distal end; lobes 5, valvate in bud, triangular, 0.7–0.9 mm long, acute, spreading or recurved, glabrous externally, with long, flexuose, sparse hairs on inner surface. Stamens 5, alternating with corolla lobes. Filaments 0.4–0.5 mm long, 0.25–0.3 mm wide and thick, hairy at base. Anthers free, brown, 0.4–0.6 mm long, slightly exserted from corolla tube, dorsifixed, attached above their middle onto the filaments. Ovary glabrous, 6 or 7-locular, each locule containing 1 ovule. Style terminal on the ovary summit, terete, 0.5–0.7 mm long, much shorter than corolla tube; stigma small. Mature fruits globose to depressed-globose, 4–6 mm long, 4–6.5 mm diameter, smooth (when fresh), style persistent, pedicel 1–1.5 mm long; pericarp glabrous, purple-blue in colour; mesocarp fleshy; endocarp woody, ribbed, not separating into pyrenes. Fig. 1.

Specimens examined: **Queensland.** Port Curtis District: SF 114, site 4, Mt Fairview, 65 km NW of Rockhampton, Dec 1998, *Batianoff* 981222 *et al.* (BRI); Poachers Gully, Gumigil Mining Lease, 16.2 km and 185° from Marlborough Motel on Bruce Highway, Nov 1999, *Champion* 1544 & *Tangey* (BRI); 'Magpie', 17.6 km and 171° from Marlborough Motel on Bruce Highway, Nov 1999, *Champion* 1554 & *Tangey* (BRI, MEL); 'Currawong' on Gumigil's Ramilies Lease, 19.4 km and 167° from Marlborough Motel on Bruce Highway, Nov 1999, *Champion* 1557 & *Tangey* (BRI, CANB); Gumigil Mining Lease, 16.5 km and 189° from Marlborough Motel on Bruce Highway, Nov 1999, *Champion* 1570 & *Tangey* (BRI); Marlborough Ck, 25 km SW of Marlborough, Nov 1997, *McCabe s.n.* (BRI).

Distribution and habitat: Endemic to the Marlborough area of central coastal Queensland. It is confined to steep hillsides in woodland dominated by *Eucalyptus fibrosa* F.Muell. and *E. xanthope* Brooker & A.R.Bean, and may be associated with other shrub species such as *Hakea trineura* F.Muell., *Pimelea leptospermoides* F.Muell. and *Leucopogon cuspidatus* R.Br. It grows in red gravelly soil or on stony scree, derived from ultramafic rocks.

Phenology: Flowers and fruits are recorded for November.

Affinities: *L. brevistyla* differs from *L. strigosa* ssp. *subulata* by its almost sessile flowers, shorter style (relative to corolla tube length), the larger purple-blue fruits (small and white for *subulata*), and glabrous style and ovary (densely hairy for *subulata*).

Of the species currently under *Leucopogon, L. brevistyla* most resembles *Leucopogon pedicellatus*, as they both have a glabrous style and ovary, and a style shorter than the corolla tube. However, *L. pedicellatus* has longer pedicels, and much longer and more pilose corolla lobes.

Conservation status: Applying the criteria of the IUCN (Anon. 1994), a category of 'vulnerable' is proposed (Criteria B1, B2 (b, c)).

Notes: This species is undoubtedly lignotuberous, as it grows in a very fire-prone area. It may spread vegetatively (by rhizomes), as dense clumps covering more than 10 m² have been observed (I. Champion pers. comm.).

Etymology: From the Latin *brevi-* short and *stylus-* style, referring to the style which is shorter than in related species.

Acknowledgements

Thanks are due to Irene Champion for making special collections of this species, to Will Smith for the illustrations, and Les Pedley for the Latin diagnosis.

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Hydnophytum ferrugineum (Rubiaceae: Hydnophytinae), a new species of ant-plant from Cape York Peninsula, Queensland

Paul I. Forster

Summary

Forster, P.I. (2001). *Hydnophytum ferrugineum* (Rubiaceae: Hydnophytinae), a new species of ant-plant from Cape York Peninsula, Queensland. *Austrobaileya* 6 (1): 103–106. A new species of ant-plant *Hydnophytum ferrugineum* P.I.Forst. is described and illustrated. Notes on the distribution, habitat and conservation status are provided for the new species which is restricted to upland rainforests on granite in the McIlwraith Range, Cape York Peninsula where it is known from a small area. A conservation status of Vulnerable is recommended. A key to the Australian species of Hydnophytinae is provided.

Keywords: *Hydnophytum* - Australia; *Hydnophytum ferrugineum*; *Hydnophytum moseleyanum*; *Myrmecodia*; ant-plants.

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Introduction

The tribe Hydnophytinae Huxley & Jebb of the Rubiaceae comprises the genera *Anthorrhiza* Huxley & Jebb, *Hydnophytum* Jack, *Myrmecodia* Jack, *Myrmephytum* Becc. and *Squamellaria* Becc. Apart from *Hydnophytum*, the other genera have been revised in a series of papers by C.R.Huxley and M.H.P.Jebb (Huxley & Jebb 1991, 1993; Jebb 1991). The genus *Hydnophytum* Jack comprises c. 50 species and although a monograph has been promised (e.g. Huxley 1993) it has yet to materialise. A single species of *Hydnophytum* has been long recognised to occur in Australia and was initially identified as *H. formicarium* Becc. by Bailey (1900). Huxley (1982) referred this species to *H. papuanum* Becc., but later annotated herbarium material as *H. moseleyanum* Becc. the name by which it is now known in Queensland (Reynolds & Halford 1997).

The presence of a second species of *Hydnophytum* in Australia was alluded to firstly by Huxley (1982) as "*Hydnophytum* sp. 1" based on a collection by the redoubtable L.J.Brass (#19885, but incorrectly as 1885) at Leo Creek in the McIlwraith Range on Cape York Peninsula and secondly by D.L.Jones in Elliot & Jones (1990) as "*Hydnophytum* species. An apparently undescribed species which occurs in the higher ranges of Cape York Peninsula". The Brass collection as held at BRI is sterile and this may have precluded Huxley from describing it. It has now been possible to collect fertile material of this entity enabling a description to be made and a name formally published.

Accepted for publication 27 June 2001

Taxonomy

Hydnophytum ferrugineum P.I.Forst., **sp. nov.** Ab *Hydnophyto moseleyano* bracteis inflorescentiae trichomatibus ferrugineis densis usque ad 2 mm longis obsitis, foliis valde discoloribus superne atroviridibus nitidis (adversum folia plus minus concoloria superne pallide viridia impolita), venis lateralibus 5 vel 6 in costae latere utroque (adversum venas laterales 3–4 in costae latere utroque) differt. **Typus:** Queensland. Cook District: Timber Reserve 14, Leo Creek, 9 July 1997, *P.I.Forster* PIF21406 *et al.* (holo: BRI [3 sheets + spirit]; iso: K, MEL).

Epiphytic subshrub with succulent tuber and stems. Tuber horizontal to pendent, globose-spherical to variously misshapen, somewhat mounded, unridged, up to 30 cm diameter,

spineless, glabrous, surface often with entrance holes for ants over the entire surface, cream-silver; chambers complex and forming a honeycomb of chambers. Stems solitary, rarely 2 or 3, up to 60 cm long, much branched, up to 10 mm diameter, spineless, glabrous, clypeoli absent. Interpetiolar stipules triangular-lanceolate, 3–3.5 mm long, 2–3.5 mm wide, caducous, glabrous. Leaves mesomorphic; petiole 2–6 mm long, 1.5–2 mm wide, generally as broad as long, channelled above, glabrous; lamina elliptic to elliptic-ovate, 10–60 mm long, 7–35 mm wide, strongly discolorous, upper surface dark glossy green and venation obscure, lower surface pale matt-green and with 5 or 6 indistinct lateral veins; tip obtuse to rounded; base cuneate. Inflorescence sessile, laterally displaced to the leaf axil, surrounded by dense bracts, each bract with dense ferruginous trichomes to 2 mm long. Flowers 4-merous. Corolla 4–5 mm long, c. 4 mm diameter, white; tube 2–3.5 mm long, 1.8–2 mm diameter, externally glabrous, internally with dense trichomes in top of throat forming a connivent mass around anthers; lobes lanceolate-ovate, fleshy and cucullate, upwardly apiculate, c. 2 mm long, 1.2–1.5 mm wide; anthers inserted, 1–1.1 mm long and c. 0.5 mm wide; stigma 2-lobed, c. 2.5 mm long. Fruit a fleshy oblong drupe, c. 6 mm long, white. Fig. 1.

Additional specimen examined: Queensland. Cook District: Leo Creek, Upper Nesbit River, Aug 1948, *Brass* 19885 (BRI).

Distribution & habitat: *Hydnophytum ferrugineum* is thus far known only from the headwaters of Leo Creek in the McIlwraith Range on Cape York Peninsula. Plants grow as epiphytes in the canopy of complex notophyll vineforest on granite substrates at altitudes above 500 m.

Notes: This species is clearly distinct because of the strongly discolorous, glossy foliage and the ferruginous trichomes that are copiously distributed in the inflorescences. When compared to *H. moseleyanum* it differs in the inflorescence bracts beset with dense ferruginous trichomes up to 2 mm long (versus sparse uncoloured trichomes less than 0.5 mm long) and the leaves being strongly discolorous and dark glossy-green above and with 5 or 6 lateral veins per side of midrib (versus more or less concolorous and pale matt-green above and with 3 or 4 lateral veins per side of midrib). None of the other New Guinea species represented in the BRI collections appears closely similar.

Although the genera *Hydnophytum* and *Myrmecodia* are readily distinguishable, it is felt opportune to provide a key to all of the Australian species of Hydnophytinae. There is now increased horticultural interest in these plants worldwide (e.g. Plummer 2000) and aids to their accurate identification are required.

Key to the Australian species of Hydnophytinae

1. Tuber and stem with spines, especially around ant exit-holes and inflorescences; stems thick, branching sparse or absent; inflorescences sunken 2
   Tuber and stems spineless; stems slender and freely branching; inflorescences pedunculate to sessile 4

2. Stems several from tuber; leaf lamina fleshy-succulent; fruit white ..... **Myrmecodia beccarii** Hook.f.
   Stems generally single from tuber, rarely with side branches; leaf lamina coriaceous to leathery; fruit orange-red to pink 3

3. Stems with spiny, shield-like outgrowths (clypeoli) at the base of each leaf ..... **Myrmecodia platytyrea** Becc.
   Stems without clypeoli, but with elongated depressions filled with bracts and hairs at the base of each leaf ..... **Myrmecodia tuberosa** Jack

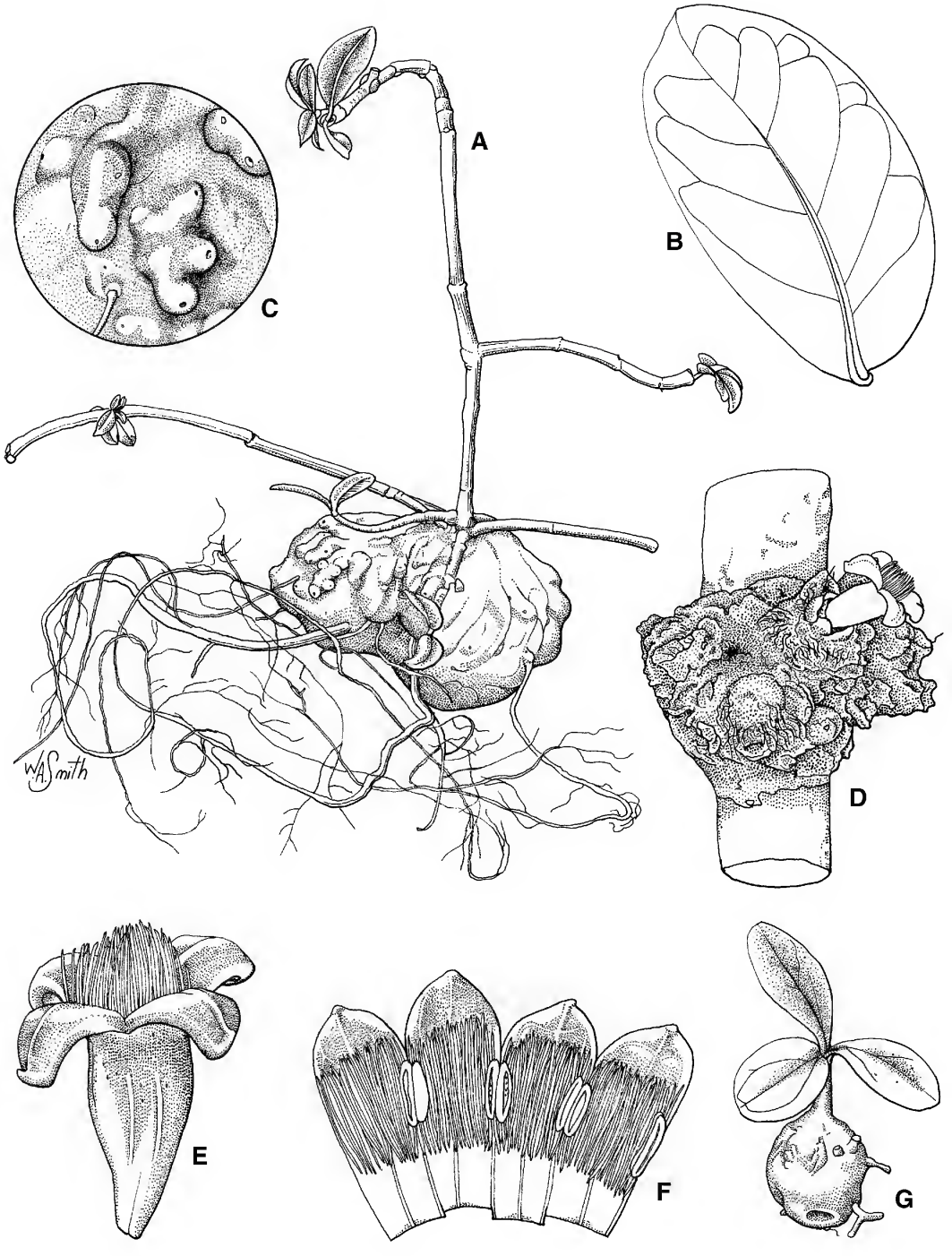

Fig. 1. ***Hydnophytum ferrugineum.*** A. whole plant. × 0.3. B. undersurface of leaf showing venation pattern. × 2. C. close-up of tuber surface showing ant exit-holes. × 1. D. node with axillary inflorescence and emerging flower. × 3. E. side view of flower. × 8. F. dissection of corolla showing anthers and hairs in throat. × 8. G. seedling. × 2. All from *Forster* 21406 (BRI). Del. W. Smith.

4. Leaf lamina with 5 or 6 lateral nerves per side of midrib, strongly discolorous, dark green and glossy above; inflorescence with copious ferruginous indumentum ..... **Hydnophytum ferrugineum** P.I.Forst.
Leaf lamina with 3 or 4 lateral nerves per side of midrib, more or less concolorous, pale green and matt above; inflorescences with scattered uncoloured indumentum ..... **Hydnophytum moseleyanum** Becc.

Conservation status: *H. ferrugineum* is locally common but appears to be very restricted in its distribution. Apart from damage by occasional cyclones there are no apparent natural threats. This species is however potentially under threat by hobbyist collectors of ant-plants. The Leo Creek locality is well-known for a number of endemic or rarely encountered Orchidaceae taxa and has been exploited by collectors over the last 30 years. Orchid collectors often also collect ant-plants and so the formal description of this species will undoubtedly arouse further interest in the locality. Large, mature ant-plants are very susceptible to damage and their removal is rarely followed by successful re-establishment. It is possible to grow ant-plants from seed and this is the best way to establish an ex-situ population of this species. Suggestions for the culture and propagation of *H. ferrugineum* may be found in D.L.Jones in Elliot & Jones (1990) or adapted from Forster (2000).

Applying IUCN guidelines (Anon. 1994), a category of 'vulnerable' is proposed (Criteria C2, D1, D2).

Etymology: The specific epithet is based on the Latin *ferrugineus* and alludes to the colour of the dense hairs present on the inflorescences of this species.

Acknowledgements

W.Smith (BRI) provided the figure. P.D.Bostock (BRI) translated the diagnosis into Latin and commented on the manuscript. Assistance with the difficult fieldwork undertaken to collect this plant was provided by R.Jensen, G.Kenning and M.C.Tucker.

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Alysicarpus (Leguminosae: Desmodieae) in Australia: a taxonomic revision

Les Pedley

Summary

Pedley, Les (2001). *Alysicarpus* (Leguminosae: Desmodieae) in Australia. *Austrobaileya* 6 (1): 107–116. Nine species of *Alysicarpus* occur in northern Australia, three of them naturalised. All species are described and a key to their identification and notes on their geographical ranges and habitats are provided. *Alysicarpus aurantiacus, A. major* and *A. suffruticosus* are described as new.

Key words: Australia: *Alysicarpus; Alysicarpus aurantiacus; Alysicarpus major; Alysicarpus suffruticosus.*

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Introduction

Alysicarpus is a genus of some 30 species restricted to the tropics and subtropics of the Old World. It is characterised by its scarious calyx with rather complex venation (Fig. 1) and the turgid articles of its pod, indehiscent, and round or oval in cross-section. Species of the genus are usually described as having leaves unifoliolate or 'very rarely' (Hutchinson 1964, Verdcourt 1971) or 'less often' (Ali 1977) trifoliolate. The leaves of all specimens from Australia examined are unifoliolate It seems that species with predominantly trifoliolate leaves should be referred to *Desmodiastrum* Prain (Pramanik & Thothathri 1986).

No critical review of the Australia species has been published. Bentham (1864) recognised three species: *A. vaginalis* (L.) DC., *A. longifolius* Wight & Arn. and *A. rugosus* (Willd.) DC., all of them occurring also in India. From his notes to *A. rugosus* it is evident that he took a wide view of species. Schindler recognised that some specimens seen by Bentham represented species different from the Indian ones and described *A. brownii*, *A. muelleri* and *A. schomburgkii*. Probably because of its inflated pod he also transferred *Desmodium campylocaulon* F. Muell. ex Benth. to *Alysicarpus*, describing *Alysicarpus* sect. *Desmodiopsis* to accommodate it. The transfer did nothing to sharpen the circumscription of *Desmodium* but a lot to obscure the limits of *Alysicarpus*. *Desmodium campylocaulon* is currently referred to *Desmodium*, albeit in a distinct section (Pedley 1999). Backer (1911) raised *A. rugosus* var. *ludens* Baker to specific rank and referred to it plants grown in Java from material received from Thursday Is., Queensland. Domin (1926) followed Bentham but described *A. rugosus* var. *longe-exsertus* and identified two specimens as *A. rugosus* var. *ludens* Baker. Presumably he was unaware of Backer's treatment of the latter as he remarked that he had the impression that the taxon would make a good species. White & Francis (1920) recorded *A. bupleurifolius* as naturalised in Queensland.

Both *A. vaginalis* and *A. rugosus* occur in Africa, and critical work associated with the Flora Congo-Belge, Ruanda-Urundi and the Flora of Tropical East Africa has influenced the perception of species in Australia. Léonard (1954) distinguished *A. ovalifolius* from *A. vaginalis*; both appear to be recent introductions into Australia. The occurrence of the last has obscured the presence of two endemic species: *A. major*, a poorly collected species from the Kimberley region of Western Australia and *A. aurantiacus*, an eastern Australian species that extends to New Guinea.

Accepted for publication 29 June 2001

Key to native and naturalised (*) species of Alysicarpus

1. Compact shrub to 1 m tall; stems and both surfaces of leaflets villose with dense spreading hairs 0.8–1mm long; petioles 2–3 mm long; pod unknown ..... **8. A. suffruticosus**
   Annuals or perennials, prostrate or erect, usually sparingly branched; stems and leaflets only sparsely hairy, not villose 2

2. Pod not, or only slightly, constricted between the articles; articles smooth or obscurely reticulately veined when dry; annual or perennial plants 3
   Pod markedly constricted between the articles; articles predominantly reticulately veined; plants annual 8

3. Articles of pod glabrous, not at all rugose or reticulately veined; pod slightly constricted between the articles; calyx lobes overlapping at base of fruit ..... **3. *A. bupleurifolius**
   Articles of pod glabrous or pubescent, pod not constricted between them; calyx lobes not overlapping at base of fruit 4

4. Leaflet lanceolate, 7–9 cm long, prominently reticulately veined on both surfaces; pod flattened ..... **2. A. brownii**
   Leaflet orbicular, broadly oblong, ovate or obovate, or lanceolate (sometimes all on a single plant), rarely more than 7cm long (only in *A. schomburgkii*) obscurely reticulately veined when dry; articles scarcely flattened 5

5. Flowers in short, rather open, racemes, terminal and in upper axils forming an open leafy panicle; leaflet 10–20(–24) mm wide; articles 2–3 mm long; plants annual ..... **6. *A. ovalifolius**
   Flowers in rather dense terminal racemes, seldom in upper axils; leaflets 3–12 mm wide; articles to 4mm long; plants perennial 6

6. Racemes dense, flowers overlapping at anthesis; pod articles somewhat flattened, pubescent, 3.5–4 mm long; seeds not seen, probably smaller than those of *A. aurantiaceus* and *A. vaginalis* ..... **4. A. major**
   Racemes open or dense; pod articles scarcely flattened, glabrous, to 3.5 mm long; seeds c. 2 × 1.5 mm. 7

7. Leaflets (2–) 3–15 times longer than wide, widest below the middle when elongate, acute, subacute, or rarely, in the lower part of the plant, rounded at the apex, drying greyish; inflorescence rather open at anthesis; calyx 5.5–7.7mm long; standard 6.5–8 × 4–7 mm; petals orange or yellow ..... **1. A. aurantiacus**
   Leaflets 1.3–2.5 (–4) times longer than wide, widest at or above the middle, rounded at the apex, drying brown or greenish; inflorescences dense at anthesis; calyx 4.5–5 mm long; standard c. 6 × 3.4mm; petals at least tinged pink, violet or purple ..... **9. *A. vaginalis**

8. Calyx 7–9 mm long; pod articles 2.5–4 mm long, 3–3.3 (–4) mm wide, coarsely reticulate, pale straw-coloured when mature ..... **5. A. muelleri**
   Calyx 4–6 mm long; pod articles 1.5–2.5 mm long, 1.5–2 mm wide, finely transversely reticulate, black when mature ..... **7. A. schomburgkii**

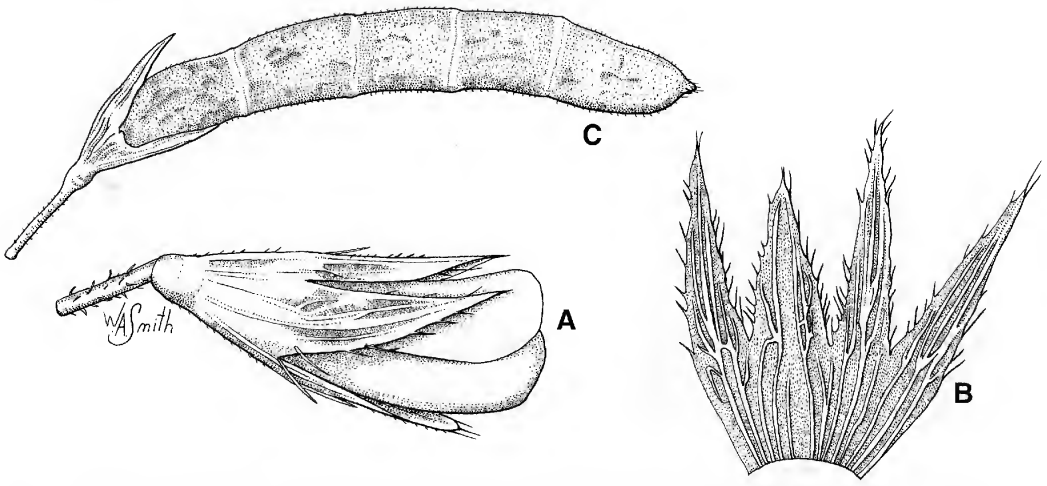

Fig. 1. *Alysicarpus aurantiacus*. A. Flower (×8), just before opening. B. Calyx (×8), flattened out, lower lobe at right. C. Pod (×4), slightly immature. A, B, *L.A. Craven* 324; C, *A.R. Bean* 2901.

1. Alysicarpus aurantiacus Pedley, **sp. nov.** affinis et saepe confusus *A. vaginali* (L.) DC. a quo foliolis elongatioribus, 3–15plo, rarius 2plo, (non 1.3–2.5 plo) longioribus quam latis, infra medium latissimis ubi elongatis, cinereis in sicco, inflorescentia floribus sub anthesi non confertis, calycibus longioribus, 5.5–7.7 mm non 4.5–5 mm, petalis aurantiacis flavisve non roseis purpureis violaceisve tinctis differt. **Typus:** Queenland. North Kennedy District: 45 km S of Townsville, 19°32'S, 146°45'E, 13 May 1979, *L. Pedley* 4588 (holo: BRI; iso: MEL).

Alysicarpus vaginalis auct. non (L.) DC: Bentham, Fl. Austral. 2: 239 (1864); Verdcourt, Man. New Guinea Leg.: 420 t. 98 (1979).

Prostrate or ascending perennial herb. Stem glabrous or with scattered appressed or ascending hairs and/or sparse weak uncinate hairs; stipules 6–15 (–18) mm long. Leaflet (10–) 15–45 (–50) mm long, 3–11 mm wide, (2–) 3–11 (–15) times longer than wide, narrowly lanceolate to narrowly ovate or oblong, subcordate to rounded at the base, subacute or rarely, on lower part or plant, obtuse at tip, mucronulate, glabrous or with scattered long hairs above, sparse or moderately dense appressed hairs beneath or hairs only on veins; petiolules 0.5–1 mm long; stipels somewhat longer than petiolules; petioles (3–) 5–8 (–10) mm long. Inflorescences rather open, terminal, to c. 50 mm long; rachis with uncinate hairs; bracts ovate c. 4 mm long; pedicels paired, 1–2 mm long. Flowers orange or yellowish: calyx 5.5–7.7 mm long, the tube 1.7–2.2 mm, the lobes narrowly acute, not overlapping at base, the upper to 3.5 mm long, slightly shorter than the others, bifid at apex; corolla: standard obovate, 6.5–8 mm long, 4–7 mm wide; wings 5.5–6.5 mm long, clawed, lamina oblong; keel petals about as long as wings; ovary uncinately pubescent. Pods with up to 8 articles, straight, not constricted between seeds, to c. 20 mm long; articles obscurely reticulate, uncinately pubescent, (2–) 2.5–3.5 mm long, 2–2.5mm wide; seeds 1.4–2 mm long, 1.2–1.5 mm wide. Fig. 1.

***Selected specimens*: Papua New Guinea.** Central District: Moitaka, 9°30'S 147°10'E, Dec 1964, *Gillison* NGF 22038 (BRI); Milne Bay District: near Modino, north east of Cape Vogel Pen., Sep 1954, *Hoogland* 4676 (BRI). **Queensland.** Cook District: Lockerbie, 10 miles [16 km] WSW of Somerset, Apr 1948, *Brass* 18463 (BRI); Endeavour River, in 1882, *Persietz* 261 (MEL). North Kennedy District: Saltwater Creek [Rockingham Bay], Nov 1865, *Dallachy* (MEL); Townsville, Feb 1918, *White* s.n. (BRI). South Kennedy District: Kelsey Creek, *Michael* 814 (BRI); 24.3 km from Proserpine towards Mackay, 20°35'S 148°37'E, Apr 1991, *Bean* 2901 (BRI). Port Curtis District: Rockhampton, Feb 1868, *O'Shanesy* No.15 ser. 9 (MEL); Bororen, Oct 1935, *Kahler* (BRI).

***Distribution and habitat*:** *Alysicarpus aurantiacus* extends from southern New Guinea through coastal districts of Queensland from Cape York to about Maryborough. It grows among grasses (often *Heteropogon*

contortus or *Themeda triandra*) usually in eucalypt communities.

***Affinities*:** The species is closely related to, and often confused with, *A. vaginalis*. It differs in its more open inflorescences, its more elongate, usually subacute leaflets and orange or yellowish flowers. Its leaflets dry greyish whereas those of *A. vaginalis* are brown or retain a greenish tinge.

***Etymology*:** The specific epithet is Latin meaning 'orange', a reference to the colour of the flowers of the species.

2. Alysicarpus brownii Schindler, *Trans. & Proc. Bot. Soc. Edinb.* 26:286 (1915). **Type:** Northern Australia, [Melville Bay (Arnhem Bay North), 16 February 1803, see below], *R. Brown,* 'Iter Australiense 4176' (holo: E; iso: BM, K).

A. longifolius auct non (Spreng.) Wight & Arn.: Benth., Fl. Austral. 2:239 (1864).

Perennial with erect annual stems to 2.5 m tall (teste *Maconochie* 2000) from persistent rootstock. Stem terete, faintly longitudinally striate, uncinately pubescent, often with a few appressed hyaline hairs c. 0.5 mm long, glabrescent; stipules scarious, long pointed 15–25(–30) mm long. Leaflet narrowly lanceolate or linear lanceolate, sharply acute, slightly cordate or rounded at base, the margin slightly inrolled, (65–) 85–130 (–160) mm long, 3.5–10 (–15) mm wide, (10–) 12–22 (–27) times longer than wide, rather coriaceous, conspicuously reticulately veined on both surfaces, glabrous except for some uncinate hairs on veins and long appressed ones on margins and midribs beneath; petiolule 0.5–1.5 mm long; stipels cartilaginous, about as long as petiolules; petioles (3–)7–12 mm long. Inflorescence terminal, open in fruit, to c. 30 cm long; rachis densely uncinately pubescent; primary bracts ovate acuminate, 4–6 mm long, secondary bracts linear about half as long, all early deciduous; pedicels paired, densely pubescent, 0.5–3 mm long at anthesis, slightly longer in fruit. Flowers yellow or orange; calyx 4–5.5 mm long, densely uncinately pubescent, with stiff hyaline hairs on lobes, tube 1.6–2 mm long, lobes 2.2–3.5, the upper one slightly shorter than the others, bifid for c. 1 mm; corolla: standard broadly obovate, 6.5–8 m long, 5–6.5 mm wide; wings 6–7.3 mm long (including claw 1–2 mm long), 1.6–2 mm wide; keel petals about as long as keel, not clawed; ovary uncinately pubescent, occasionally with some hyaline hairs at apex extending to base of style. Pods with up to five somewhat flattened articles each 3.5–4 mm long, 2–2.5 mm wide (somewhat smaller than described by Schindler), obscurely reticulately veined, uncinately pubescent, slightly thickened at the septum when dry; seeds not seen.

***Selected specimens*: Northern Territory.** Berry Springs, 12°42'S 131°00E, Dec 1974, *Must* 1337 (DNA); Katherine Experimental Station, 14°27'S 132°15'E, Jan 1978, *Maconochie* 2310 (DNA, K); 9.5 km S. of Fish River homestead turn-off, Jun 1974, *Maconochie* 2000 (BRI, DNA, K); no definite locality (possibly Nabarlek, 12°22'S 133°22'E), Apr 1982, *Hinz* s.n. (DNA).

***Distribution and habitat*:** The species is confined to the north of the Northern Territory where it is reported to occur in eucalypt communities, probably in seasonally waterlogged sites. It is poorly collected and is evidently rare.

Affinities: In its protologue, Schindler noted *Alysicarpus brownii* to be nearly related to *A. vaginalis*. It differs in its erect habit, longer leaves, larger flattened pod-articles and colour of the flowers. It is probably closer to the yellow-flowered endemic *A. major* but differs in its habit and size and shape of leaflets.

***Notes*:** Type material at E and K has no details of a collecting locality, but the isotype at BM is well labelled. The article of the pods on the specimens examined are somewhat smaller than as described by Schindler.

3. Alysicarpus bupleurifolius (L.) DC., Prodr. 2: 352 (1825); White & Francis, *Bot. Bull. (Qld Depart. Ag. & Stock)* 22: 15 (1920); Meeuwen, *Reinwardtia* 6: 88 (1961); Verdcourt, Man New Guinea Leg. 420. t. 98G (fruit) (1979); Nguyên, Fl. Camb. Laos Vietnâm 23:130 t. 22, 1–5 (1987); Pedley, Rev. Handb. Fl. Ceylon 10: 153 (1996). *Hedysarum bupleurifolium* L., Sp. Pl. 745 (1753). **Type:** herb. Linnaeus 921.3 (LINN).

Erect or ascending annual herb. Branches with covering of appressed hairs, becoming glabrous; stipules acute, 3–10 mm long. Leaflet narrowly ovate on young plants, lanceolate to linear on older ones, rounded at the base acute at the apex, usually 30–70 mm long, 3–4.5 mm wide, 10–20 times longer than wide, occasionally down to 5 mm long, up to 9 mm wide and only twice as long as wide, glabrous on upper surface, sparse appressed hairs on lower; prominently reticulately veined on both surfaces; petiolules 0.5–1 mm long; stipels minute or absent; petioles 2–4 mm long. Inflorescences terminal, dense, to 20 mm long in flower, open, to 50 mm or more in fruit; rachis glabrous; pairs of flowers subtended by acute or acuminate bract, deciduous at anthesis; pedicels 0.8–1.5 mm long, with ascending brown hairs, becoming glabrous. Flowers: calyx rather stiff, angled towards the base, 6–7 mm long, the lobes equal in length, strongly overlapping at the base, 4–5 mm long, the upper entire or shortly bifid, glabrous; corolla orange and purple; standard oblong 4–5 mm long, 1.5–2.5 m wide, the wings and keel petals about equal in length, shorter, about 4 mm long; ovary glabrous. Pods to 15 mm long, slightly to markedly exserted from the calyx, not constricted between the articles; articles 3–8, cylindrical or slightly flattened, 1.6–2 mm long, 1.3–2 mm wide, smooth or very obscurely reticulately veined, glabrous; seeds almost cubic, about 1 mm long and 0.8 mm wide.

***Selected specimens (all BRI)*: Queensland.** Cook District: Mareeba, Apr 1962, *McKee* 9069. North Kennedy District: Cromarty, near Townsville, Mar 1933, *White* 8842. Leichhardt District: Camp Gully, 45 miles [72 km] SSW of St Lawrence, May 1962, *Johnson* 2293. Port Curtis District: Rodds Bay, near Gladstone, Mar 1955, *Shaw* s.n. Wide Bay District: Bundaberg, near city centre, Mar 1980, *Stanley* 962. Moreton District: The Gap, Brisbane, Feb 1963, *Blake* 22024 (CANB, K, MEXU).

***Distribution and habitat*:** The species ranges from India, Sri Lanka and south-east Asia through Malesia to Australia. In Australia it occurs in coastal and subcoastal districts between Mareeba and Brisbane, on roadsides and in eucalypt communities often on drainage lines. Some collectors have noted its being relished by cattle. It is probably a recent introduction to Australia first collected near Townsville in 1918.

***Affinities*:** *Alysicarpus bupleurifolius* is a well defined species showing little variation in Australia and is not often confused with any other species. In habit it resembles *A. schomburgkii* which, however, has pods strongly reticulately veined, constricted between the articles.

4. Alysicarpus major Pedley, **sp. nov.** similis *A. vaginali* (L.) DC. a quo floribus flavidis (non subroseis purpurascentibusve) vexillo majore c. 8 mm longo, leguminum articulis aliquantum complanatis pubescentibus longioribus 3.5–4 mm (non 2–3 mm) longis differt. **Typus**: Western Australia. Donkeys Creek, 29 km S of 'Drysdale River' Station, c. 15°27'S 126°20'E, 25 May 1975, *D.E. Symon* 10165 (holo: AD; iso: PERTH & (n.v.) NSW).

Prostrate or ascending perennial. Stems from stout tap-root with scattered short weak uncinate hairs, glabrescent; stipules (8–) 12–15 mm long. Leaflet somewhat dimorphic, short towards base of plant, 15–25 (–30) mm long, 7–14 (–16) mm wide, (1.4–) 1.8–2.4 (–3) times longer than wide, oblong (rarely ovate), obtuse mucronulate at the apex, cordate at the base, glabrous above with stiff appressed hairs beneath, strongly reticulately veined on both surfaces; petiolule c. 1 mm long; stipels about as long as the petiolules; petiole 4–7 mm long. Inflorescence terminal, rather dense at anthesis, pedicels paired, 1.5–2 mm long, bracts not seen. Flowers: calyx 5–5.5 mm long with minute uncinate hairs on tube and longer apressed hairs on lobes, tube 1.8–2 mm long, upper lobe 3–3.5 mm long, bifid for 1–1.5 mm, lateral lobes 3.2–3.5 mm long, lower lobe 3–3.2; corolla: standard (orange) c. 8 mm long, 3.5 mm wide, wings 5.3–5.6 mm long, the claw 1.2–1.3 m long, c. 1.6 mm wide, keel petals (reddish) c. 6 mm long, not clawed; ovary with a few long hairs at the apex. Pod to c. 20 mm long with up to 5 articles, not contracted, and sometimes with no perceptible junction, between them; articles slightly flattened, uncinately hairy, 3.5–4 mm long, c. 2.5 mm wide, the most proximal and distal larger than others; seeds not seen.

***Selected specimens*: Western Australia**. Sir Graham Moore Is., S side, 13°56'S 120°33'E, Jul 1973, *Paul G. Wilson* 11310 (PERTH); ... Secure Bay, 16°27'S 124°13'E, May 1993, *Mitchell* 3130 (K, PERTH);King Leopold Ranges, close to road crossing of Fern Creek,(17°09' S 125° 16'E) c. 310 m, Apr 1988, *Sands* 4211 (BRI, K, PERTH).

***Distribution and habitat*:** *Alysicarpus major* is known only from the Kimberley region of Western Australia where it is reported to grow on laterite.

***Affinities*:** The species is related to *A. vaginalis* from which it differs in having orange and rust-red petals and larger, somewhat flattened hairy pod-articles. It also has some affinity with the endemic *A. aurantiacus* from eastern Australia which also has yellow or orange petals and pubescent pods but the articles of *A. aurantiacus* are smaller and its leaflet narrower.

***Etymology*:** The epithet, Latin meaning 'larger' or 'greater', alludes to the plant's having somewhat larger flowers and fruits than its relative *A. vaginalis.*

5. Alysicarpus muelleri Schindler, *Rep. spec. nov. reg. veg.* 22: 269 (1926). **Type**: Victoria River and Depot Creek, *F. Mueller* (holo or iso: K; iso (?): MEL).

A. muelleri var. *clementii* Schindler, *op. cit.*: 270 (1926). **Syntypes**: Western Australia: between Ashburton and Yule Rivers, *Clement* s.n. (iso: K); between Ashburton and De Grey Rivers, *Clement* s.n. (iso: K).

A. rugosus var. *longe-exsertus* Domin, Biblioth. Bot. 89: 217 (1926). **Type**: in fl. Flinders River ad Hughenden, Feb 1910, *K. Domin* Iter australiense '4706' (lecto, chosen here: PR, herb. no 527404).

A. rugosus auct non (Willd.) DC.; Benth, Fl. Austral. 2: 239 (1864).

Erect annual to 1 m. tall. Stems with indumentum of short uncinate hairs and scattered long (0.5–1.5 mm) straight spreading or ascending hairs; stipules somewhat membranous, 3–10 (–20) mm long. Leaflet linear, oblong ovate-lanceolate or narrowly ovate, obtuse or subacute, mucronulate at the apex, rounded or truncate at base, 25–75 mm long, 5–22 mm wide, 2.3–5 (–7) times longer than wide, glabrous or with scattered long hairs above, scattered long hairs and usually moderately dense microscopic uncinate hairs beneath; petiolules 1–1.5 (–2) mm long, stipels shorter than petiolules 0.3–1 (–1.5) mm long; petioles 2.5–6 (–7.5) mm long. Inflorescence terminal, dense; rachis with indumentum similar to that of stems, though occasionally with multicellular glandular hairs towards the tip; bracts concave, ovate, acuminate 5–6 (–8) mm long, 2–2.5 mm wide, indumentum similar to that of calyx, subtending two flowers; pedicel 1.5–4 mm long. Flowers with yellow standard and orange or red wings; calyx 7–9 mm long, the tube c. 1 mm long, the lobes distinctly overlapping at the base at anthesis, the upper united almost to the tip, the lower slightly longer than the others; corolla: standard obovate, slightly retuse, 5–6.5 mm long, 3–4 mm wide; wing 4–4.5 mm long, including claw 0.8–1.5 mm; keel petals strongly tapered to base but not clawed, about as long as the wings, ovary densely puberulent. Pod of usually 4 articles (occasionally 3 or 5) exserted from calyx; articles 2.5–4 mm long, 3–3.3 (–4) mm wide, coarsely transversely reticulate with scattered minute uncinate hairs, pale straw coloured when mature; seeds subglobular 2–2.4 mm long slightly less than 2 mm wide.

***Selected specimens*: Western Australia.** Road Paddock c. 3 km S of Kalumburu Mission 14°18'05"S 126°39'08"E, Jun 1966, *Mitchell* 4437 (BRI, PERTH); Ord River, W of 'Ord River' Station 17°26'S 128°49'E, Apr 1977, *Pullen* 10754 (BRI, CANB). **Northern Territory**. Katherine Gorge Road, 5 miles [8 km] NE of Katherine, Mar 1964, *Adams* 903 (BRI, CANB, K); McArthur River, 16°46'S 135°45'E, May 1947, *Blake* 17812 (BRI, K); 25½ miles [41 km] W of `Rockhampton Downs', Jun 1960, *Chippendale* NT 7125 (BRI, CANB). **Queensland**. Burke District: Kilty Plain, 18 km NW of Mt Isa, 20°37'S 139°21'E, Mar 1987, *Harris* 152 (BRI); 'Lydia Downs' c. 45 miles [72 km] NW of Maxwellton, Jan 1966, *Pedley* 1960 (BRI). Leichhardt District: 'Lenton Downs' 65 miles [104 km] WNW of Nebo, May 1962, *Johnson* 2308 (BRI).

***Distribution and habitat*:** *Alysicarpus muelleri* occurs across tropical Australia. It is a summer-growing annual virtually restricted to dark grey and brown clay soil in grassland dominated by Mitchell grass (*Astrebla* spp.) and Flinders grasses (*Iseilema* spp.). In the eastern part of

its range, however, it has been collected from sandy soils that have been tilled.

***Affinities*:** The plant has been confused with *A. rugosus* sensu stricto, a plant not found in Australia, which has pod-articles finely transversely reticulate, black at maturity. It is certainly close to *A. rugosus* subsp. *reticulatus* Verdc. from Africa.

6. Alysicarpus ovalifolius (Shumach.) Léonard, *Bull. Jard. Bot. État. Brux.* 24: 88 t. 11(1954), Fl. Congo Belge Ruanda-Burundi 5: 226. t. 13B (fruit) & t. 18 (1954); Verdcourt, Fl. Trop. East Africa. Leguminosae: Papilion. 493 (1971). *Hedysarum ovalifolium* Schumach, Beskrwelse af Guineeske Planter 359 (1829). **Type**: Africa: 'Guinea' [Ghana: Ada, *fide* Verdcourt], *Thonning* (holo: C, n.v., photograph in Léonard, *loc. cit.*).

Annual with main stem erect, sometimes to 1 m tall, lower branches prostrate or often whole plant ± prostrate. Stems strigose with scattered yellowish ascending hairs, occasionally with minute weak uncinate hairs, rarely glabrous; stipules narrowly triangular, 5–12 mm long. Leaflet orbicular, broadly oblong or obovate to narrowly ovate, rounded, truncate or slightly retuse at apex, subcordate or cordate at base, (8–) 15–40 (–50) mm long, 10–20 (–25) mm, 1.2–2.5 times longer than wide, glabrous above, minutely uncinately pubescent with some appressed hairs on veins beneath; petiolules (0.5–) 1 (–1.5) mm long; stipels cartilaginous, obtuse about as long as petiolules; petioles 3–9 (–12) mm long. Inflorescence open to moderately dense racemes, terminal and in upper axils, forming an often leafy panicle; rachis glabrous in fruit, pedicels paired 0.5–2 mm long; bracts 2–4 mm long, concave, acuminate. Flowers orange to red; calyx c. 4.5 mm long the tube 2 mm long, upper lobe c. 2 mm long, shortly bifid, the rest c. 2.5 mm long; corolla: standard obovate, c. 6 mm long and 4 mm, wings clawed, c. 5 mm long, 1.2 mm wide; keel petals slightly longer than wings, not clawed, c. 5.5 mm long, 1 mm wide; ovary uncinately pubescent. Pods ± cylindrical, not constricted between articles, to 24 mm long, with up to 8 articles each 2–3.5 mm long, 1.5–2 mm wide, obscurely reticulately veined glabrous or minutely uncinately pubescent; seeds obloid, smooth, yellow or pale brown, variable in size, 1.7–3.2 mm long, 1–2.5 mm wide.

***Selected specimens*: Western Australia.** Mitchell Plateau, Old Mining Camp, 14°50'S 125°51'E, Apr 1988, *Dunlop* 7906 (BRI, DNA, MEL, NSW, PERTH). **Northern Territory.** Melville Is., Garden Point barge landing, 11°24'S 130°25'E, Mar 1994, *Cowie* 4713 (BRI, DNA); Fog Dam area, about 40 miles [64 km] SE of Darwin, May 1959, *Chippendale* NT 6189 (BRI, DNA); 'Malapunya' Station, 16°58'S 135°49'E, Mar 1981, *Maconochie* 2628 (BRI, CANB, NT). **Queensland.** Burke District: 'Myra Vale', Normanton, Mar 1944, *Bell* s.n. (BRI). Cook District: 'Heathlands', Mar 1992, *Johnson* 5200 & *Sharpe* (BRI); 4.8 km N of Little Laura River, Apr 1983, *Clarkson* 4782 (BRI). North Kennedy District: Townsville, Feb 1918, *White* s.n. (BRI); Sinclair Bay, 20°05'S 148°26'E, Mar 1994, *Batianoff* 9403263 (BRI). Port Curtis District: Cedarvale, 23°56'S 150°54'E, *Partridge* s.n. (BRI)

***Distribution and habitat*:** *Alysicarpus ovalifolius* is a native of Africa, naturalised in Australia. The earliest collection seen is from Townsville in 1918. At present it occurs sporadically in the Kimberley region of Western Australia, the north of the Northern Territory (common around Darwin) and sporadically along the Queensland coast from Thursday Is. to a little south Rockhampton where it was recorded in cultivated land. It is found usually in disturbed situations on soils of various types, probably most commonly on sand. It is reported to be eaten readily by cattle and to make excellent hay.

***Affinities*:** The species is closely related to *A. vaginalis* and the two are often confused. They are easily identified in the field but a small proportion of herbarium specimens is difficult to identify. Verdcourt (1971) mentioned intermediates between *A. ovalifolius* and *A. vaginalis* but none has been observed in Australia. Meeuwen (1961) and Dunlop *et al.* (1995) did not accept *A. ovalifolius* as distinct from *A. vaginalis*, though the latter, in a note, distinguished the two species quite well. In a well presented paper, Endo & Ohashi (1990) illustrated that attributes of the pod provided reliable distinctions between the two. As noted by them (*op. cit.*), *A. ovalifolius* occurs in the Philippines and the Lesser Sunda Is. and specimens from New Guinea (near Port Moresby, *Gillison* 22113, and near Lae, *Streimann* & *Kauro* NGF 27882 - both BRI) have also been seen. Leaflets of depauperate

plants of *A. ovalifolius* may be only 7 mm long and 6 mm wide, but the open inflorescences, attributes of the pod and the presence of long hyaline antrorsely curved hairs on the stems distinguish it from *A. vaginalis*.

7. Alysicarpus schomburgkii Schindler, *Repert. sp. nov. reg. veg.* 22: 269 (1926). **Syntypes**: Port Darwin, *Schomburgk* 84 (iso: K); Port Darwin, *Foelsche* 97 (iso: MEL); Palmer River, *Wycliffe* (iso: BM, MEL ?); Thursday Is., *Jaheri* s.n. (iso: K).

A. ludens auct. non. (Baker) Backer; Backer, Schoolflora voor Java: 349 (1911).

A. rugosus var. *ludens* auct. non Baker; Domin, Bibliotheca Bot. 89: 217 (1926).

Annual 60 cm, rarely to 1 m tall, main stem erect, basal branches ascending. Young stems angular throughout, glabrous or with appressed hairs on the angles or occasionally terete with hairs on ribs; stipules 2–12 (–14) mm long. Leaflet elliptic, narrowly ovate or narrowly obovate, obtuse at base of plant, becoming lanceolate, acute in upper part, rounded at base, 15–30 mm long, 3–7.5 mm wide, 2.5–7 times longer than wide becoming 30–145 mm long, 2.2–9 mm wide, 9–20 (–40) times longer than wide, glabrous on upper surface, stiff ± appressed hairs scattered on veins beneath and sometimes with sparse minute uncinate hairs; petiolules c. 0.5; stipels shorter than petiolules, sometimes absent; petioles 1.5–3 (–5.5) mm long. Inflorescence terminal, moderately dense; rachis with indumentum of minute uncinate hairs and usually longer stiff erect yellowish hairs; bracts ovate acute, 3–6 mm long, 1.5–3 mm wide, subtending 2 flowers; pedicels 1.5–3 (–5.5) mm long. Flowers yellow; calyx 4–6 (–8) mm long, the tube c. 1 mm long, lobes overlapping at base slightly at anthesis, upper lobe slightly bifid at tip; corolla: standard obovate, obtuse, 3.5–6 mm long, 2.5–4 mm wide; wings 4–5.5 mm long including claw c. 1 mm long; keel petals as long as or slightly shorter than wings, claw 1–1.5 mm long; ovary glabrous or minutely puberulent towards the tip. Pod to c. 8 mm long of 2–4 articles, deeply constricted between them, each 1.5–2.2 mm long, 1.5–2 mm wide, transversely reticulately veined (not as closely or deeply as in *A. rugosus*), glabrous or sparsely puberulent, blackish when mature; seeds smooth, brown subglobular 1.4–1.6 mm long, 1.3–1.4 mm wide.

***Selected specimens*: Western Australia**. near Manning gorge, 16°39'S 125°55'E, Jun 1978, *George* 15189 (PERTH). **Northern Territory**. Darwin, Oct 1946, *Blake* 17315 (BRI, CANB, MEXU, NT); Litchfield N.P., 13°03'S 130°50'E, Mar 1995, *Cowie* 5257 & *Taylor* (BRI, CANB, DNA, PERTH); Jabiru, 12°40'S 132°53'E, Feb 1973, *Dunlop* 3351 (BRI, CANB, DNA, MEL, MO). **Queensland**. Cook District: Milman Hill, Thursday Is., 10°35'S 142°13'E, Apr 1986, *Clarkson* 6421 (BRI, DNA, K, L, MBA, MO, NSW, PERTH, QRS); Mareeba Mining Lease, c. 15 km SE of Mareeba, 17°15'S 145°30'E, Apr 1972, *Staples* 030472/5 (BRI, CANB).

***Distribution and habitat*:** *Alysicarpus schomburgkii* is most common in the extreme north-west of the Northern Territory, with scattered occurrences in the Kimberley region of Western Australia and in the eastern tropical part of Queensland from Thursday Is. to about Proserpine on the central coast. It has been recorded from shallow skeletal soils, sands, red earths derived from laterite and rarely, heavy alluvial soil, occasionally near seasonally flooded depressions.

***Affinities*:** The affinities of the species are with *A. rugosus* and, less closely, *A. muelleri*, both of which have pods less constricted between the articles which are also larger. The articles of *A. rugosus* have a closer, more sharply defined reticulum, and become much darker than those of *A. schomburgkii* when mature. Specimens examined suggest that plants from Queensland have smaller flowers than those from the Northern Territory. Their standards are 3.5–4 mm long (N.T.: 4.5 mm or more) and have 2 or 3 ovules (N.T. usually 4, occasionally 3).

Backer and Domin independently identified specimens from Australian as the Indian taxon currently accepted as *A. heyneanus* var. *ludens* (Baker) A. Pramanik & Thoth. (Pramanik & Thothathri 1983).

8. Alysicarpus suffruticosus Pedley **sp. nov.** affinis *A. vaginali* (L.) DC. a quo planta suffruticosa, petiolis brevioribus, foliolis utrinque villosis, et fortasse coloribus florium differt. **Typus**: Western Australia.

4 km NNW of Milliwindi road turn-off, opposite Mt Hart outcamp, 17°06'S 124°12'E, 15 April 1988, *R.J. Cranfield* 6401 (PERTH); iso (n.v.): CANB).

Compact subshrub to 30 cm tall with stout taproot. Stem ± terete, with dense spreading hairs c. 0.8 mm long and scattered weak uncinate hairs; stipules 3–6 mm long, 1.5–2 mm wide, acute, closely longitudinally veined, spreading and lacinate when old. Leaflet oblong or ovate, rounded or slightly retuse at the apex, rounded or slightly cordate at the base, 15–30 mm long, 8–16 mm wide, 1.2–2.5 times longer than wide, villose with weak hairs on both surfaces (or hairs somewhat shorter beneath, or less dense above) strongly reticulately veined beneath; petiolules c. 0.6 mm long; stipels about half as long as petiolules, often obscure; petioles 2–3 (–5) mm long. Inflorescences terminal to c. 80 mm long; rachis with uncinate hairs; bracts ovate acuminate, c. 4 mm long; secondary bracts c. 2 mm long, oblong, both early decidous. Flowers 'pale pink' (*teste* Cranfield) or 'yellow and rust red' (*teste* Sands); calyx c. 5 mm long, the tube 1.5 mm, lobes narrow, acute, not overlapping at the base, the upper slightly shorter than the others, bifid at apex, indumentum of minute uncinate hairs with 0.8 mm long hyaline hairs on margin of lobes; corolla: standard obovate, obtuse, c. 8 mm long, 5 mm wide; wings 6.3 mm long (including claw 1 mm long), 1.3 mm wide; keel petals 5.7 mm long; ovary with indumentum of long appressed hairs, ovules 5, style truncate. Pods and seeds not seen.

***Selected specimen*: Western Australia**. Old Settlement, Sunday Is., 16°24'S 123°11'E, Apr 1992, *Mitchell* 2231 (PERTH).

***Distribution and habitat*:** *Alysicarpus suffruticosus* is known from the two localities cited, in the Kimberley region of Western Australia. It has been recorded from sandy soil in grassland and beneath *Livistona* sp.

***Affinities*:** The species is allied to *A. vaginalis* and *A. aurantiacus* but is easily distinguished from both by its growth form and the villosity of its leaflets.

Etymology: The epithet is Latin meaning somewhat woody, an allusion to perennial shrubby habit of the species best shown in the *Sands* specimen cited.

9. Alysicarpus vaginalis (L.) DC., Prodr. Syst. Veg. 2: 353 (1825); Meeuwen, *Reinwardtia* 6: 87 (1961) *pro parte* (incl. *A. ovalifolius*); Léonard, Fl. Congo Belge Ruanda-Urundi 5: 224 (1954); Verdcourt, Fl. Trop. East Africa. Leguminosae: Papilion. 493 (1971), Man. New Guinea Leg. (1979) *pro parte* (incl. *A. aurantiacus*); Nguyên, Fl. Camb. Laos Viétnam 23: 128 (1987); Pedley, Rev. Handb. Fl. Ceylon 10: 152 (1996). **Lectotype**: Sri Lanka (Ceylon), herb. Hermann 1:27, No. 287 (BM), *fide* Verdcourt in Turland & Jarvis, Taxon 46:473 (1997).

Prostrate perennial. Stems glabrous or sparsely minutely uncinate pubescent; stipules 4–12(–15) mm long, often longer than the petioles. Leaflet broadly ovate or oblong (orbicular when young), rarely ovate, rounded at apex, cordate at base, (5–) 8–35 mm long, 4–12 (–14) mm wide 1.3–2.5 (–4) times longer than wide, glabrous above, sparsely uncinately pubescent beneath with scattered appressed hairs, sometimes only on veins; petiolule c. 0.3 mm long, stipels about as long as petiolules; petiole 4–10 mm long. Inflorescence terminal, dense at anthesis; rachis uncinately pubescent; bracts narrowly ovate, 4–5 mm long; pedicels paired, c. 1.5 mm long. Flowers bluish, purplish or mauve to wine red, not yellow or orange; calyx 4.5–5.5 mm long, tube 1.7–2.5 mm long, lobes subequal 2.3–3 mm long, the upper shortly bifid at apex, somewhat shorter than the other; corolla: standard ovate c. 6 mm long, 3–4 mm wide, wings as long as or slightly shorter than keel clawed, 4.5–6 mm long, 1–1.5 mm wide; keel petals not clawed, 5–6 mm long, 1.2–1.5 mm wide; ovary sparsely uncinately puberulent. Pods to 18 mm long with up to 8 articles, not contracted between them; articles drying black, obscurely coarsely reticulately veined when mature, 2–3 mm long, 2–2.3 mm wide; seeds obloid, c. 2 mm long, 1.3 mm wide.

***Selected specimens*: Northern Territory**. c. 12°40'S 131°20'E, Sep 1946, *Blake* 17004 (BRI); Bamboo Point, Mary River, Apr 1972, *Barrett* 8 (DNA, K).

Queensland. Cook District: Thursday Is., 10°35'S 142°13'E, Apr 1986, *Clarkson* 6444 (BRI, DNA, K, L, MBA, MEL, MO, NSW, PERTH, QRS); Rutland Plains near mouth of Mitchell River, Jun 1943, *Whitehouse* s.n. (BRI). North Kennedy District: Nettle Creek, 10 km E. of Mt. Garnet, Jul 1990, *Silcock* S1050 (BRI). South Kennedy District: Slade Point, Mackay, 21°05'S 149°14'E, Apr 1975, *McDonald* 1304 & *Batianoff* (BRI). Leichhardt District: Boothill Creek, 10 miles [16 km] S of Nebo turnoff on [Old] Bruce Highway, c. 21°50'S 148°55'E, Jun 1958, *Pedley* 270 (BRI). Port Curtis District: North Rockhampton, Feb 1980, *Stanley* 557 (BRI).

Distribution and habitat: *Alysicarpus vaginalis* is widely spread in the tropics of the Old World but is probably a 20th century introduction to Australia. It is rare in the Kimberley region of Western Australia and the north of the Northern Territory but is more common in Queensland where it occurs in sandy soils in eucalypt communities. It is, however, essentially an urban weed, occurring in lawns and on road verges in Gladstone, Rockhampton, Mackay, Townsville and Cairns.

Affinities: The species is frequently confused with *A. ovalifolius*. The latter is a less conspicuously prostrate plant with much larger leaflets (when well grown) and always with a more open branched inflorescence. The differences between *A. vaginalis* and the indigenous *A. aurantiacus* are more subtle. *A. aurantiacus* has more elongate leaflets, a more open inflorescence, though not branched as in *A. ovalifolius*, and orange or yellow flowers. Herbarium specimens of the two are easily separated: *A. aurantiacus* dries greyish while *A. vaginalis* is either brown or retains a greenish tinge.

Acknowledgments

I am grateful to the officers in charge of the Australian herbaria, CANB, DNA, MEL, and PERTH for extended loans of specimens, and to the Director, Royal Botanic Gardens, Kew and to the Director of The Natural History Museum, South Kensington for allowing me access to the collections under their care. Members of the Legume Section at the Herbarium, Kew were particularly generous in their assistance.

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Eucalyptus broviniensis (Myrtaceae), a new critically endangered species from south-eastern Queensland

A.R. Bean

Summary

Bean, A.R. (2001). *Eucalyptus broviniensis* (Myrtaceae), a new critically endangered species from south-eastern Queensland. *Austrobaileya* 6 (1): 117–119. *E. broviniensis*, a new gum-barked species is described, illustrated and diagnosed against the closely related *E. hallii* Brooker. The new species is confined to a very small area near Mundubbera in south-east Queensland, and its conservation status is assessed as 'critically endangered'.

Keywords: *Eucalyptus*, Myrtaceae, taxonomy, *Eucalyptus broviniensis*, Queensland flora.

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Introduction

Brooker (1975) described *Eucalyptus hallii*, a restricted but common eucalypt of the sandy coastal lowlands between Maryborough and Bundaberg in southern Queensland. A recently discovered, very rare, gum-barked eucalypt is named here as *Eucalyptus broviniensis*. While it grows in a vastly different habitat and is geographically disjunct, it is clearly a very close relative of *E. hallii*.

Taxonomy

Eucalyptus broviniensis A.R.Bean **sp. nov.** affinis *E. hallii* autem fructibus grandioribus, foliis adultis 2.5–4.5 cm latis, glandulis oleosis paucioribus praeditis, et pedunculis longioribus differt. **Typus:** Queensland. Burnett District: 10 km ESE of Brovinia, S.F. 132, S of Mundubbera, 7 April 1997, *A.R. Bean* 11911 (holo: BRI; iso: CANB).

Small tree to 10 metres high, lignotuberous. Bark deciduous, dull, granular, mottled light and dark grey. Juvenile leaves alternate, ovate, c. 10 × 5 cm, petiolate. Intermediate leaves similar to adult leaves. Adult leaves lanceolate, 10–14.5 × 2.5–4.5 cm, alternate, leathery, concolorous, dull; penninerved, lateral veins at 40–60° to the midrib; reticulation dense, with sparse small island oil glands, one per areole or absent from some areoles; petioles 20–30 mm long. Inflorescences axillary, unbranched, 7-flowered; peduncles thick, more or less terete, 8–22 mm long. Mature buds ovoid, 6–9 mm long, 4.5–6.5 mm in diameter, sessile or with pedicels up to 2 mm long. Hypanthium with 1–3 prominent longitudinal ribs; operculum scar present; inner operculum hemispherical, smooth, thick; stamens c. 4.5 mm long, white, mostly inflexed but with a few erect, all fertile, in 3 or 4 whorls on narrow staminophore. Anthers oblong, versatile, dorsifixed, opening in longitudinal slits. Style terete, with broad conical base, stigma blunt. Ovary 3 or 4 locular, ovules in 6–8 indistinct vertical rows. Fruits obconical, 5.5–8.5 mm long, 7–11 mm in diameter, disc annular, valves 3 or 4, exserted. Seeds ellipsoidal to cuboid, 0.75–1 mm long, not toothed, surface faintly reticulate, hilum terminal. Chaff pale brown to yellow, mostly cuneate. Fig. 1.

Specimens examined: **Queensland**. Burnett District: Brovinia S.F., S of Mundubbera, Dec 1998, *Bean* 14439 (AD, BRI, NSW); S.F. 132, 10 km ESE of Brovinia, Nov 1997, *Bean* 12581 (BRI).

Distribution and habitat: *E. broviniensis* is confined to a small area within Brovinia State Forest south of Mundubbera. It grows on the edges of a lateritised plateau, in heathy eucalypt woodland with *Eucalyptus exserta* F.Muell., *E. cloeziana* F. Muell., *E. virens* Brooker & Bean and *Triodia scariosa* N.T.Burb.

Accepted for publication 25 May 2001

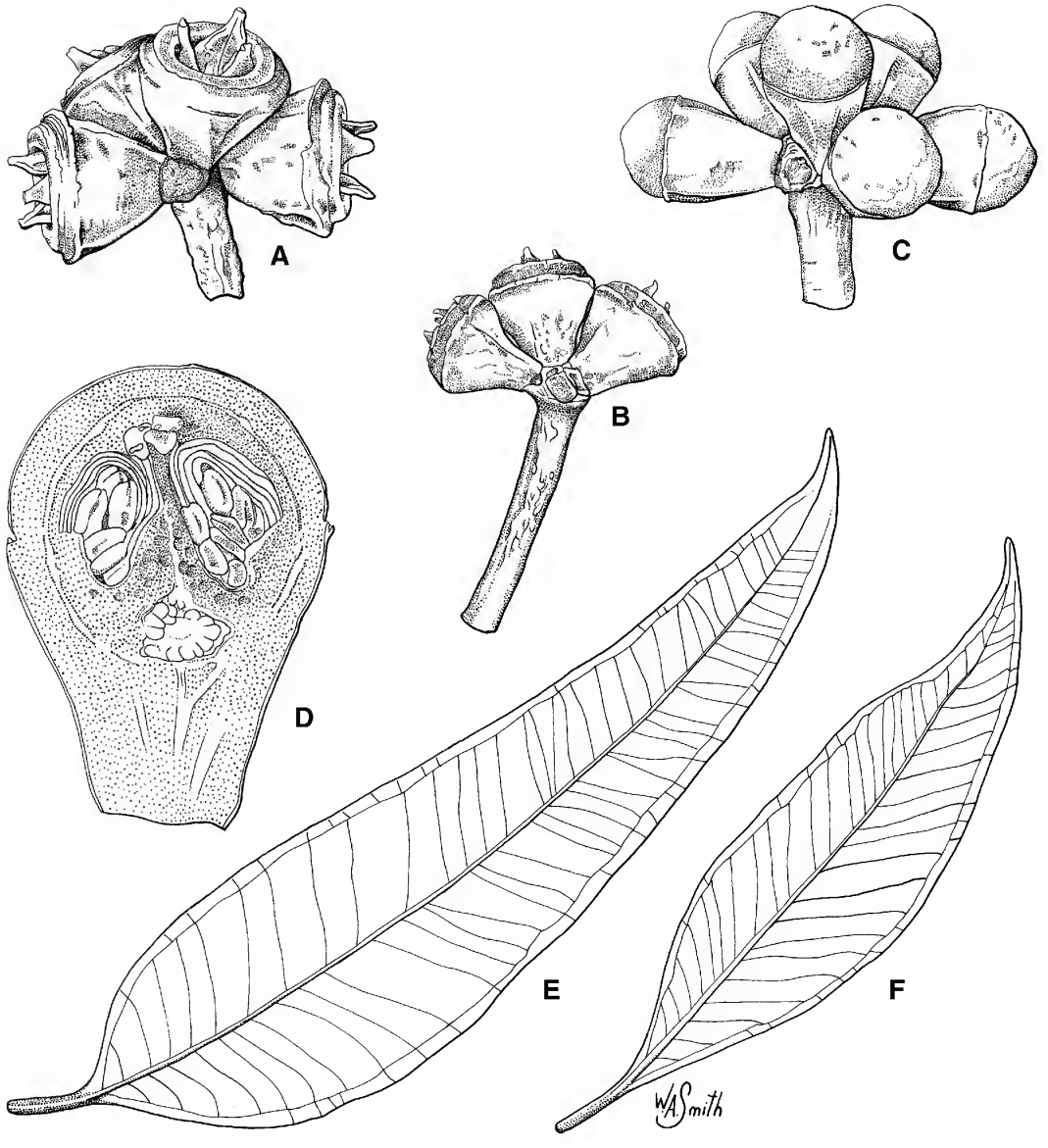

Fig. 1. ***Eucalyptus broviniensis***. A, fruits × 2. B, fruits × 2. C, buds × 2. D, longitudinal section of bud, showing ovules, style and stamens × 8. E, adult leaf × 1. F, intermediate leaf × 1. A–C, E, *Bean* 11911; B,F, *Bean* 12581; D, *Bean* 14439 (all BRI). Del. W. Smith.

Phenology: Flowers in summer.

Affinities: *E. broviniensis* is most closely related to *E. hallii*, and the main differences are detailed in the following table. Both species have dull deciduous bark which is off-white to grey for much of the year, shedding to bright orange in summer. This bark type is virtually identical in texture, colour and pattern to that of the related species *E. bancroftii* (Maiden) Maiden and the less closely related species *E. propinqua* H.Deane & Maiden and *E. major* (Maiden) Blakely.

	E. broviniensis	*E. hallii*
Adult leaf width	2.5–4.5 cm	1.5–3 cm
Oil gland density (adult lvs)	sparse	moderately dense
Peduncle length	8–22 mm	4–8mm
Fruit diameter	7–11 mm	5–7 mm

The classification of *E. hallii* within *Eucalyptus* has been somewhat difficult. It was placed in *E.* ser. *Subexsertae* Blakely (Chippendale 1988), and in informal *E.* ser. *Albae* of Brooker & Kleinig (1994). However it differs significantly from all other members of these series by its dull, thick, granular bark, which is bright orange when newly exposed following decortication. Brooker (2000) created a monotypic series (*E.* ser. *Connexentes*) for *E. hallii*, hence recognizing its distinctive suite of characters. The present author agrees with the removal of *E. hallii* (with *E. broviniensis*) to a separate series, but recommends their placement under *E.* sect. *Liberivalvae* (Blakely) Brooker. *E.* ser. *Connexentes* has many features in common with *E.* sect. *Liberivalvae* e.g. bark type, leaf venation, leaf oil glands, fruit morphology; but differs mainly in seed morphology and operculum shape.

Conservation status: *E. broviniensis* is known from only about 20 individuals at the type locality. It is under threat from increased fire frequency. In recent years, fires have destroyed a number of mature stems. Applying IUCN guidelines (Anon. 1994), a category of 'critically endangered' is proposed (Criteria B1, B2, C2, D).

Etymology: The specific epithet refers to the Brovinia State Forest where the species is endemic.

Acknowledgements

I am grateful to Martin Ambrose for assistance in the field, Les Pedley for the Latin diagnosis, and Will Smith for the illustration.

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Proiphys infundibularis (Amaryllidaceae), a new species from the Townsville region of Queensland

D.L. Jones & J.L. Dowe

Summary

Jones, D.L. & Dowe, J.L. (2001). *Proiphys infundibularis* (Amaryllidaceae), a new species from the Townsville region of Queensland. *Austrobaileya* 6 (1): 121–126. *Proiphys* in Australia comprises four species, *P. amboinensis* (L.) Herbert, *P. cunninghamii* (Aiton ex Lindl.) Mabb., *P. alba* (R.Br.) Mabb. and *P. infundibularis* D.L.Jones & Dowe sp. nov., all occurring in eastern Queensland with *P. alba* also found in northern Western Australia and *P. cunninghamii* in northern New South Wales. A key is provided for identification of the Australian species of the genus. Three of the four species (not including *P. alba*) are illustrated. Notes on the habitat and ecology of *P. infundibularis* are included.

Keywords: Amaryllidaceae, *Proiphys, Proiphys infundibularis,* new species, tunicate bulbs, Queensland flora.

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Introduction

Proiphys Herb. is a genus of bulbous, seasonally deciduous geophytes distributed in South-east Asia, Melanesia and Australia (Backer & Bakhuizen van den Brink 1968; Telford 1987). In Australia *Proiphys* is one of the few indigenous bulbous genera to have tunicate bulbs. Plants commonly grow in colonies and their growth and flowering is linked closely with the wet season, dying back to dormant tubers during the dry season. They are frequently cultivated as ornamentals, especially in tropical regions.

Three species of *Proiphys* were previously recorded for Australia (Telford 1987): *P. amboinensis* (L.) Herb. distributed from Cape York to near Cardwell, Queensland, *P. cunninghamii* (Aiton ex Lindl.) Mabb. occurring in south-eastern Queensland and north-eastern New South Wales and *P. alba* (R.Br.) Mabb., occurring on northern Cape York Peninsula, Queensland and the Kimberley region of Western Australia. A fourth Australian species, from the Townsville region in Queensland is described here.

Accepted for publication 6 July 2001

Materials and Methods

All species dealt with in this paper were examined in the field and as cultivated plants in the living collection of the Australian National Botanic Gardens in Canberra. Measurements cited here were made from both living material and herbarium collections.

Taxonomy

Proiphys infundibularis D.L.Jones & Dowe, **sp. nov.**, *P. amboinensi* (L.) Herb. affinis sed pedicellis ad 25 mm longis, floribus infundibuliformibus, lobis corollae anguste imbricatis, lobis coronae ad 16 mm longis, et filamenti staminum ad 30 mm longis, differt. **Typus:** Queensland. North Kennedy District: 22 km W of Townsville, lower slopes of Hervey Range, alt. c. 250 m, 2 Oct 1998, *J.L.Dowe* 521 (holo BRI; iso CANB, JCT, K, QRS).

Bulbous herb growing in loose colonies. Bulb ovoid, 3–6 cm long, 4–6.5 cm wide. Leaves 1–4 per bulb, erect; petiole 15–50 cm long, 4–9 mm wide, broadly channelled distally; lamina broadly ovate to oblong-ovate or ovate-elliptic, 10–30 cm long, 8–28 cm wide, bright green, shiny, with veins slightly lighter, the midvein prominent, slightly sunken; base shallowly

cordate; apex acute to shortly acuminate. Inflorescence an erect umbel; scape 35–90 cm long, 8–14 mm wide, fleshy, bright green; umbel 5–14-flowered; involucral bracts 2, 10–35 mm long, 4–7 mm wide, papyraceous, whitish coloured; pedicels 15–25 mm long, c. 1.5 mm diam., fleshy, pale green. Flowers infundibuliform, 4–5 cm long, 4–4.5 cm diam., white, fragrant, each lasting 2–4 days; perianth tube 20–25 mm long, nectariferous; lobes obovate to obovate-spathulate, 28–38 mm long, 11–16 mm wide, obtuse to apiculate, obliquely erect, with margins shortly imbricate. Corona 14–16 mm long, the expanded filaments fused for 8–11 mm with adjacent filaments; lobes linear, tapered upwards, 8–10 mm long, acuminate. Stamens 6, protruding from the perianth; filaments 18–30 mm long, white; anthers linear, 4.5–6.5 mm long, yellow. Style protruding from the perianth, 50–55 mm long, white; stigma c. 1.5 mm wide. Capsule oblong to subovoid, 20–35 mm long, 10–20 mm wide, greenish coloured to yellow. Fig. 1.

Additional specimens examined: **Queensland.** North Kennedy District: lower slopes of Hervey Range, alt. c. 250 m, Jan 1998, *Jones* 15703 *& Dowe* (BRI, CANB); Magnetic Island, Gustav Ck, among granite boulders, Oct 1998, *Corbett* (CANB).

Distribution and ecology: *P. infundibularis* is known only from near-coastal locations between Townsville and Home Hill in Queensland, with populations of it occurring on the eastern lower slopes of Hervey Range, southern and northern footslopes of Mt Stuart, eastern footslopes of Mt Elliot, Magnetic Island (Gustav Creek) and hills to the northwest of Ayr and Home Hill. It grows close to streams and in small sheltered gullies, in vine thickets, and among rocks and large granite boulders on open sites. Soils are mainly grey gravelly loams derived from granite. Altitude ranges from 100 to 300 m.

Phenology: Plants flower from October to January and fruit from October to February.

Recognition: Table 1 presents a comparison of some diagnostic morphological characters of the Australian species of *Proiphys*. *Proiphys infundibularis* is readily recognised by its erect funnel-shaped flowers with imbricate corolla lobes and long staminal filaments (Figs 1 & 2). The leaves of *P. infundibularis* and *P. amboinensis* are almost identical although those of the former species are often smaller than those of the latter. However, the flowers of *P. amboinensis* are readily distinguished from those of *P. infundibularis* by their spreading corolla lobes set widely apart and with short staminal filaments (Fig. 3). *Proiphys cunninghamii* can immediately be distinguished

Table 1. Comparison of morphological characters of *Proiphys alba*, *P. amboinensis*, *P. cunninghamii* and *P. infundibularis*.

Character	*P. alba*	*P. amboinensis*	*P. cunninghamii*	*P. infundibularis*
leaf shape	elliptic-oblong	ovate-cordate	ovate-cordate	ovate-cordate
leaf size	10–35 × 2–11 cm	18–35 × 15–35 cm	10–25 × 8–13 cm	10–30 × 8–28 cm
involucral bracts	20–30 mm long	30–100 mm long	15–50 mm long	10–35 mm long
umbels	10–30 flowered	5–25 flowered	5–12 flowered	5–14 flowered
pedicels	7–30 mm long	15–45 mm long	25–35 mm long	15–25 mm long
flowers	erect	erect	porrect to drooping	erect
flower size	6–24 mm long	25–40 mm long	15–18 mm long	40–50 mm long
corona lobes	5–12 mm long	7–10 mm long	15–20 mm long	14–16 mm long
filament length	3–12 mm	7–12 mm	12–16 mm long	18–30mm

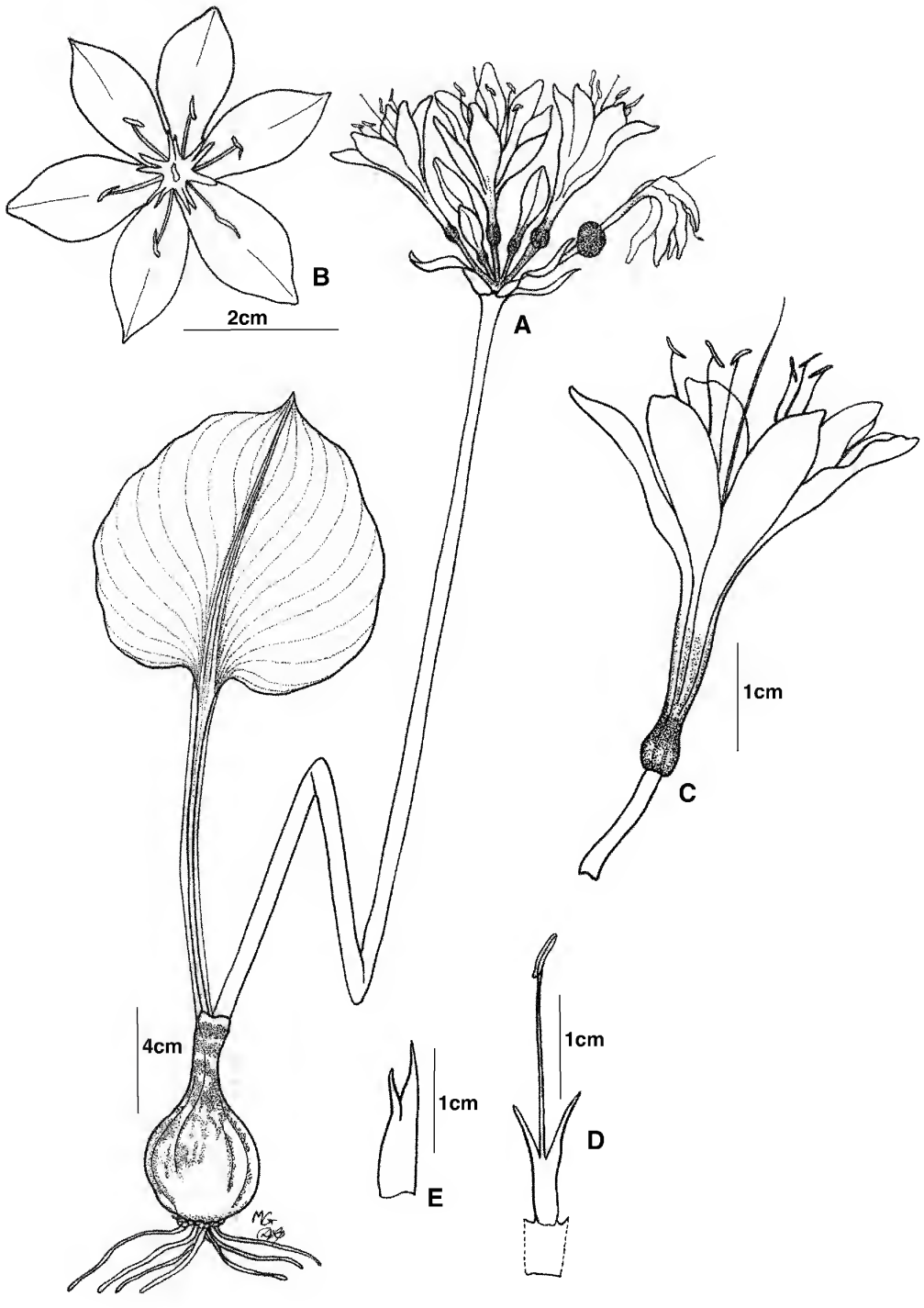

Fig. 1. *Proiphys infundibularis*, Hervey Range. A. flowering plant; B. flower, front view; C. flower, side view; D. stamen; E. corona segment. All from Jones DLJ 15703 & Dowe (CANB).

from *P. infundibularis* by its porrect to drooping flowers, broadly imbricate corolla lobes that are spreading at right angles to the perianth tube and short staminal filaments (Fig. 4). *Proiphys alba* is readily distinguished from all other Australian species of *Proiphys* by its greyish green elliptic-oblong leaves.

Notes: Initially there was speculation that this new species was a natural hybrid between *P. cunninghamii* and *P. amboinensis*. However neither species occurs in the Townsville region and the new species has unique characters and does not appear intermediate in any way.

Proiphys amboinensis appears to be most closely allied to the new species having leaves of similar shape but achieving larger dimensions and with morphologically different flowers.

Etymology: From *infundibularis*, Latin for funnel-shaped, in reference to the shape of the flowers which readily distinguishes this species from all other Australian species of *Proiphys*.

Conservation Status: Uncommon, but conserved in Magnetic Island National Park and Cape Bowling Green National Park.

Acknowledgements

We thank Alex George for the Latin diagnosis and Marion Garratt for technical assistance with the drawing. Larry Corbett is thanked for assistance with field collections, and Allen King for first bringing this species to our attention. Karina FitzGerald, Laurie Adams and Rogier de Kok commented on the manuscript.

Key to Australian Species of *Proiphys*

1. Leaves with a broadly ovate lamina to 35 cm wide; perianth tube more than 20 mm long 2
   Leaves with an ovate or elliptic lamina to 13 cm wide; perianth tube less than 15 mm long 3

2. Flowers porrect, campanulate; corolla lobes widely separated; filaments 7– 12 mm long ..... **P.amboinensis**
   Flowers erect, infundibuliform; corolla lobes narrowly imbricate; filaments 18–30 mm long ..... **P. infundibularis**

3. Leaf lamina ovate, bright green; corolla lobes recurved at right angles to the perianth tube; corona to 20 mm long ..... **P. cunninghamii**
   Leaf lamina elliptic, grey green; corolla lobes obliquely erect; corona to 12mm long ..... **P. alba**

Fig. 2. *Proiphys infundibularis,* cultivated ex Hervey Range, Queensland (DLJ 15703).

Fig. 3. *Proiphys amboinensis*, cultivated ex Cape York Peninsula, Queensland.

Fig. 4. *Proiphys cunninghamii*, cultivated ex Glenugie Peak, New South Wales.

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Drupe - a term in search of a definition

H. Trevor Clifford and Mary E. Dettmann

Summary

Clifford H. Trevor and Dettmann, Mary E. (2001). Drupe - a term in search of a definition, *Austrobaileya* 6 (1): 127–131. The term drupe as defined in modern Australian Floras has several meanings and is often employed inconsistently. Reasons for the various usages are offered and a new definition of the term proposed.

Key words: drupe, drupaceous, exocarp, epicarp, mesocarp, endocarp

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Introduction and discussion

The need for a precise definition of the term drupe arose during a study of fossils described as "endocarp species" and presumed to represent the inner woody layers of drupes. Reference to recent Australian Floras revealed that there is a diversity of opinion as to the definition of the term drupe. Some authors (Carolin & Tindale 1994; McCusker 1981; Harden 1990; Beadle 1971; Walsh & Entwistle 1994) restrict the term to the product of a monocarpellary ovary whereas others (Stanley & Ross 1983; Jessop & Toelken 1986; Curtis & Morris 1975) ignore carpel number. Furthermore, there is inconsistency in the use of the term drupe especially by those who claim it develops from a monocarpellary ovary.

Thus, Walsh & Entwistle (1994) qualify their definition of drupe as monocarpellary by citing three examples of which only the peach is appropriate. The other two examples are the bicarpellary olive, and *Nitraria billardieri DC.* which is tricarpellary. It is ironic that in this context the olive is an inappropriate example of a drupe because Linnaeus (1751), when he coined the term, presumably assumed his readers would know that dryppa [Greek] and drupa [Latin] were words that in classical times referred to 'an over-ripe wrinkled olive' and so did not refer to the plant by name in either his text (p.53) or accompanying figure (Tab. VIII, Fig. 157)

Accepted for publication 25 May 2001

It should be noted that Linnaeus (1753) regarded both the peach and olive as monogynous. He was not familiar with the term carpel for it was not coined until 1817 almost forty years after his death. Originally employed for divisions of a fruit the term now applies to a gynoecium in any stage of its development (Stearn 1992).

The adjectival term drupaceous is also widely used in Australian literature but usually without adequate definition. Exceptions are Beadle (1971) and Carolin & Tindale (1994) who having accepted the drupe as monocarpellary, defined drupaceous as applying to fruits 'with the structure of a drupe but derived from more than one carpel'. An alternative approach to the problem of incorporating carpel number into the definition of drupe is that of Takhtajan (1991) who proposed that such a fruit be described as apocarpous or syncarpous according to the ovary type from which it develops. Although the definitions of drupe may vary in their concept of the number of carpels involved, all acknowledge the fruit contains a stone or stones derived solely from the endocarp. Monocarpellary ovaries have a single stone enclosing one (peach) or more than one seed (some *Persoonia* species). In contrast those that are syncarpous have either several one-seeded stones (*Leucopogon* species) or a single stone with one (*Semecarpus australiensis* Engl.) or more loculi of which one or more usually contain seeds the remainder being empty and sometimes compressed (*Elaeocarpus* species).

Alternative names for stone are shell, pyrene, putamen and endocarp each of which has been more or less widely used interchangably in the literature. Likewise both epicarp and exocarp have been employed as alternative terms for the skin or outermost layer of the drupe. For example, Jessup (1985), who has written extensively on genera occurring in both Australia and south-east Asia has followed Dutch terminology in referring to the outermost layer of the drupe as the exocarp (Hou 1978). In contrast most Australian glossaries refer to the tissue as the epicarp. Exceptions are in the glossaries of Stanley & Ross (1983), Walsh & Entwistle (1994), Harden (1990) and Jessop & Toelken (1986) who define the exocarp as the epicarp plus mesocarp in which sense the term is also used by some palaeobotanists including (Reid and Chandler 1933: p.30).

Furthermore, terminological confusion may also arise when portions of drupes are defined in terms of other fruit types as when Curtis & Morris (1975) defined the pyrene as 'a nutlet of a several-seeded drupe'. The incorporation of nutlet in the definition could be regarded as compromising the integrity of both fruit types, notwithstanding that in their definition the authors made it clear that in popular usage the term nutlets is widely applied to fruit segments which technically are not small nuts.

The most recent classification of fruits (Spjut 1994) described the drupe as 'a fleshy pericarpium or fruit with one or more stones'. This definition lacks any reference to either carpel number or the origin of the woody or bony tissue but is misleading in that it could be taken to suggest the stone is not part of the pericarp. In what follows there is further confusion in that he also states 'Drupes may consist of one or more stones', although it is possible that 'contain' rather than 'consist of' was intended. Furthermore, by defining a drupe with reference to the pericarp, Spjut has restricted the term to fruits which develop from superior ovaries. The pericarp, as widely understood, refers to a fruit wall that has developed from that of an ovary rather than an ovary plus its associated receptacle.

By defining the term drupe solely on its mature anatomy, Spjut (1994) has adopted a descriptive definition of the term. In contrast, those who relate the tissues of the fruit wall to those of the ovary from which it developed have an interpretive definition which, in most instances, is unsupported by developmental anatomical studies. This situation is unfortunate for, as stressed by Roth (1977), the anatomical development of relatively few fruits has been documented.

Therefore, it is not surprising that definitions of the term drupe based on surmize as to the developmental pathways of their anatomy should lead to conflicting interpretations of their anatomy. By way of example, the drupe as defined by Jessop & Toelken (1986), has a pericarp which ' consists of three layers (1) the epicarp or skin, (2) the mesocarp or juicy layer and (3) the bony endocarp or stone'. Such a definition prescribes that the mesocarp be juicy and the endocarp bony or woody. However, as was long ago observed by Hill (1934) the mesocarp of the fruit of *Pleiogynium timorense* (DC.) Leenh. is differentiated into two layers, the inner of which is thick and woody and the outer thin and fleshy (Fig.1 A). With the fruit of the closely related *Rhodosphaera rhodanthema* (F.Muell.) Eng. the outer fleshy tissue is so thin that Jessup (1985) thought it appropriate to describe the entire mesocarp as woody.

Although such a fruit does not match any current definition of drupe it is only a somewhat more extreme example of the situation which obtains with *Pleiogynium timorense*. The inadequacy of comparative anatomy for determining fruit type is indicated by the diversity of terms currently applied to the fruit of *Hicksbeachia pinnatifolia* F.Muell. These include the following - typical drupe (Rao 1971), indehiscent drupe (Stanley & Ross 1983), hard drupe (Beadle 1971), drupaceous (Johnson & Briggs 1975), nut (Filla 1926) and fleshy indehiscent follicle (Floyd 1978).

Anatomical studies of the developing ovary wall of this species (Strohschen 1986) have revealed that the woody layer of the fruit derives from the inner mesocarp and not the endocarp and so the fruit is not a drupe. Nor is it a nut or follicle. Perhaps it was this uncertainty

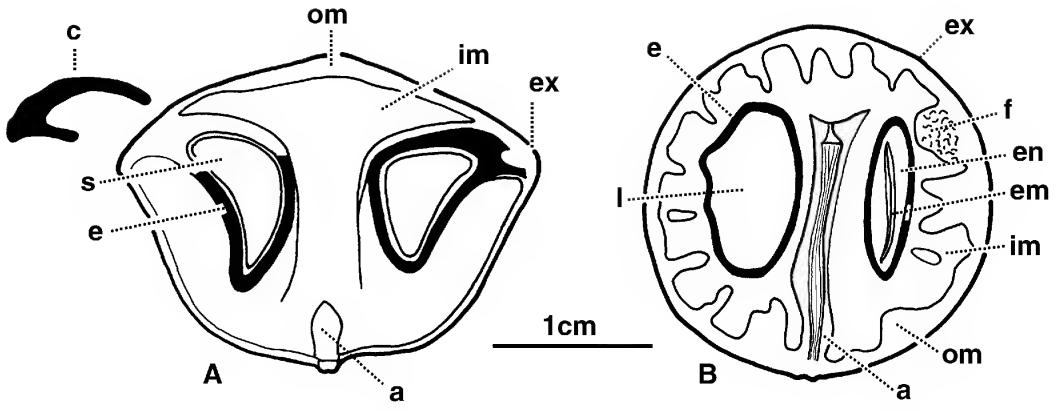

Fig. 1. Stones of *Pleiogynium timorense* (A) and *Elaeocarpus grandis* (B) in vertical section. a, axis; e, endocarp; en, endosperm; em, embryo; ex, exocarp; f, fibres; im, inner mesocarp; om, outer mesocarp; l, locule; s, seed. A, redrawn from Hill (1933).

as to the nature of the fruit that led Weston (1995) to describe but not name fruits of *Hicksbeachia*, *Athertonia* and *Catalepidia* in his Flora of Australia treatment of these genera.

A cursory survey of Australian species whose fruits are drupes derived from syncarpous ovaries has indicated that many have a woody inner mesocarp in which are encased the woody endocarps surrounding each seed as with *Pleiogynium timorense*. A notable example is *Elaeocarpus grandis* F. Muell. (Fig.1B) whose stones resemble permineralised fossils described from Oligocene sediments of central Queensland under the name *Elaeocarpus spackmaniorum* Rozefelds (Rozefelds 1990). A further complication in terminology arises when the term drupe is applied to the fruit of *Chrysanthemoides monilifera* (L). Norlindh which is derived from an inferior ovary and so derived in part from a receptacle, a situation not allowed for by any definition of drupe.

Accordingly, there is little agreement amongst taxonomists as to the fruit type of *C. monilifera* with some describing it as a drupe (Stanley & Ross 1986, Short 1999) others as drupe-like (Brown 1992) or a cypsela (Carolin & Tindale 1994). Obviously, the term drupe has been applied to a diversity of fruits without regard to adequate knowledge of their developmental anatomy. Nonetheless, inconsistency between the usage of a term and its application in the subsequent text should be avoided.

Conclusion

The term drupe because of its long and useful history in descriptive taxonomic botany deserves to be retained subject to agreement as to its definition. Until more information is available on the development of fleshy fruits with a stone or stones surrounding the seeds it would be helpful to have a definition of drupe based solely on anatomy.

The following definition of drupe is proposed:-

Drupe: A fruit whose wall has three distinct tissues - an outer membranous or chartaceous skin enclosing a zone of more or less fleshy tissue surrounding one or more woody, bony or parchment-like stones each of which if fertile contains one or more seeds. The term stone may be replaced by pyrene. Drupes may be either apo- or syncarpous, if the latter the stone may be unilocular or plurilocular and with respect to the receptacle the drupe may be superior or inferior. Plurilocular drupes may contain several pyrenes or these may be embedded in a woody tissue derived from the innner mesocarp to form a single stone.

With the passage of time the stones of plurilocular drupes may separate passively (*Elaeocarpus* species) or explosively into segments (*Petalostigma* species).

In combination these characters could be employed, to define a range of drupes, some examples of which from the Australian flora are

listed below.

1. *Persoonia* apocarpous
2. *Pleiogynium* syncarpous, superior, plurilocular
3. *Elaeocarpus* syncarpous, superior, 2-plurilocular
4. *Semecarpus* syncarpous , superior, unilocular
5. *Chrysanthemoides* syncarpous, inferior, unilocular
6. *Coelospermum* syncarpous, inferior, 4-locular

The drupes of these genera differ significantly in structure and so it could be argued merit different names. Nonetheless, until the developmental anatomy of fruits with flesh surrounding a stone or stones is better known it would be premature to replace the term drupe with a plethora of names. Instead it would appear preferable to retain the word drupe, defined soley on anatomical characters, and qualify its use with appropriate descriptive adjectives.

Acknowledgements

The authors are grateful to Laurie Jessup for his helpful comments on an early draft of this paper and to Jeremy Bruhl for assistance in supplying photocopies of the relevant pages of *Philosophia Botanica*.

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A new species of *Myriophyllum* L. (Haloragaceae) from artesian springs in Queensland

D. Halford & R.J. Fensham

Summary

Halford, D.& Fensham, R.J. (2001). A new species of *Myriophyllum* L. (Haloragaceae) from artesian springs in central Queensland. *Austrobaileya* 6 (1): 133–137. *M. artesium* Halford & Fensham is described, illustrated and diagnosed against related species. Notes on habitat and distribution are provided.

Key words: *Myriophyllum*, taxonomy, Australian flora, *Myriophyllum artesium*, Haloragaceae

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Introduction

Since 1997, the second author has been undertaking vegetation surveys of artesian mound springs in Queensland. In the course of this work a number of specimens of *Myriophyllum* were collected that did not match any species previously accounted for in Orchard's ('1985' 1986) revision of Australian *Myriophyllum*. Further research has since indicated that this *Myriophyllum* is a distinct, previously undescribed taxon. The new species is described here.

Taxonomy

Myriophyllum artesium Halford & Fensham, **sp. nov.,** quoad habitum et folia monomorpha et aliquantum sculpturam fructuum aspectu *M. implicati* Orchard, quoad folia opposita et caules comparate crassos *M. pedunculato* J. Hooker simile, autem ab illo foliis oppositis plerumque latioribus oblanceolatis vel anguste ellipticis in ambitu et caulibus florentibus crassioribus et mericarpiis pallido-brunneis et floribus masculis sub anthesi pedicellis longioribus differt, et ab hoc sepalis florum masculorum nullis et forma sculturaque mericarpiorum et forma foliorum facile distinguendum. **Typus:** Queensland. South Kennedy District: Doongmabulla, NW of Clermont, 3 Feb 1998, *R.J. Fensham* 3355 (holo: BRI).

Accepted for publication 9 March 2001

Myriophyllum sp. (Aramac B.A. Wilson 110) in Henderson (1997).

Creeping mat-forming herb 15 cm high, with erect flowering stems unbranched, arising from a tangled mat of prostrate rhizomatous stems. All stems slender, c. 0.8 mm in diameter; prostrate stems rooting freely at the nodes. Leaves monomorphic, all opposite (rarely, a few alternate on fast growing stems), oblanceolate to narrowly obovate or narrowly elliptic to elliptic, 3.3–5.5 mm long, 1.2–2.9 mm wide, obtuse or attenuate at base; margins entire; tip blunt with a small red terminal gland; midrib obscure. A very small (0.1 mm) hydathode present on each side of the base of the leaf. Plants dioecious (individual stems either male or female). Inflorescence a simple spike with the flowers borne singly in the axils of the leaves. Bracteoles sexually dimorphic. Bracteoles of male flowers ovate to broad ovate, 0.6–1 mm long, 0.4–0.6 mm long; ± margins entire; tip acute to obtuse. Bracteoles of female flowers ovate to lanceolate, 0.6–0.8 mm long, 0.2–0.3 mm wide; margins entire; tip acute. Male flowers 4-merous, on pedicels 2–3.5 mm long at anthesis. Sepals absent. Petals 4, maroon flush distally, 1.8–3 mm long, 0.9–1 mm wide, hooded, not keeled or unguiculate, tip rounded. Stamens 8; filaments 1–1.2 mm long; anthers linear-oblong, 1.4–1.7 mm long, c. 0.4 mm wide, non-apiculate. Styles and ovary absent. Female flowers 4-merous, sessile. Sepals, petals and stamens absent. Styles 4, sessile; stigmas white, fimbriate.

Ovary ± cubic, 0.5–0.6 mm long, 0.4–0.5 mm wide, rounded on angles, weakly verrucose. Fruit sessile, pale brown, ± cubic (slightly longer than wide), 0.7–0.9 mm long, 0.7 mm diameter. Mericarps separating freely at maturity, ± cylindrical (slightly wider near the base). 0.6–0.8 mm long, 0.3–0.4 mm diameter, rounded at base, slightly obliquely truncate at apex, sparsely papillose on dorsal surface. Fig. 1.

***Additional specimens*: Queensland.** GREGORY SOUTH DISTRICT: Elizabeth Springs, ca 100 km SW of Boulia, Feb 1999, *Fensham* 3669 (BRI); MITCHELL DISTRICT: Edgbaston E of Aramac, Feb 1998, *Fensham* 3347 (BRI); Edgbaston Station, 40 km NE of Aramac, Nov 1994, *Wilson* 110 (BRI). LEICHHARDT DISTRICT: Karalee, Taroom district, Jul 1996, *Fensham* 2878 (BRI). GREGORY SOUTH DISTRICT: ca 35 km WSW of Quilpie, Mar 1997, *Connolly* [AQ522039] (BRI). WARREGO DISTRICT: Twomanee Plain, Granite Springs, ca 55 km SW of Eulo, Feb 1999, *Fensham* 3659 (BRI); Yowah Ck, Bundoona ca 40 km NW of Eulo, Feb 1999, *Fensham* 3681 (BRI); *loc. cit., Fensham* 3685 (BRI); Werewilka, ca 70 km SW of Eulo, Feb 1999, *Fensham* 3658 (BRI).

***Distribution and habitat*:** *Myriophyllum artesium* occurs in central and southern Queensland, where it has been collected from the Boulia, Clermont - Aramac, Taroom, Quilpie, and Eulo districts Map 1. It is generally restricted to the wetlands associated with springs emanating from the Great Artesian and associated basins. There are also two collections where the species was recorded having colonised a creek-line fed by permanent artesian water emanating from a running bore.

***Phenology*:** Flowers have been recorded in February and November; fruits have been recorded in February.

***Affinities*:** *M. artesium* resembles *M. implicatum* Orchard in its habit, monomorphic leaves and to some extent its fruit sculpturing. However, it differs in having opposite leaves which are oblanceolate to narrowly obovate or narrowly elliptic to elliptic in outline and generally broader, stouter flowering stems, light brown mericarps, and longer pedicels on male flowers at anthesis. *M. artesium* is similar to *M. pedunculatum* J. Hooker and *M. amphibium* Labill. in having

Table 1. Comparison of *Myriophyllum artesium* with similar species, *M. implicatum, M. pedunculatum* and *M. amphibium*.

Character	*M. artesium*	*M. amphibium*	*M. pedunculatum*	*M. implicatum*
sexuality	dioecious	monoecious	monoecious	monoecious
leaf arrangement	opposite	opposite	opposite	alternate
leaf shape	oblanceolate to narrowly obovate or narrowly elliptic to elliptic	oblanceolate to obovate	linear to terete	linear
leaf width (mm)	1.2–2.9	(1.5–)2–3(–5)	0.2–0.3(–0.4)	0.6–0.7
stem diameter (mm)	c. 0.8	c. 1	0.9–1.1	c. 0.4
pedicel length of male flowers at anthesis (mm)	2–3.5	< 0.5	1–4.5	0.6–0.7
sepals on male flowers	absent	present	present	absent
mericarp shape	± cylindrical	ovoid to lacrimiform	ovoid to obpyriform	cylindrical
mericarp sculpturing	papillate	verrucose-papillose	smooth or verrucose	papillate
mericarp colour	light brown	deep purplish black	reddish purple to black	purplish-red

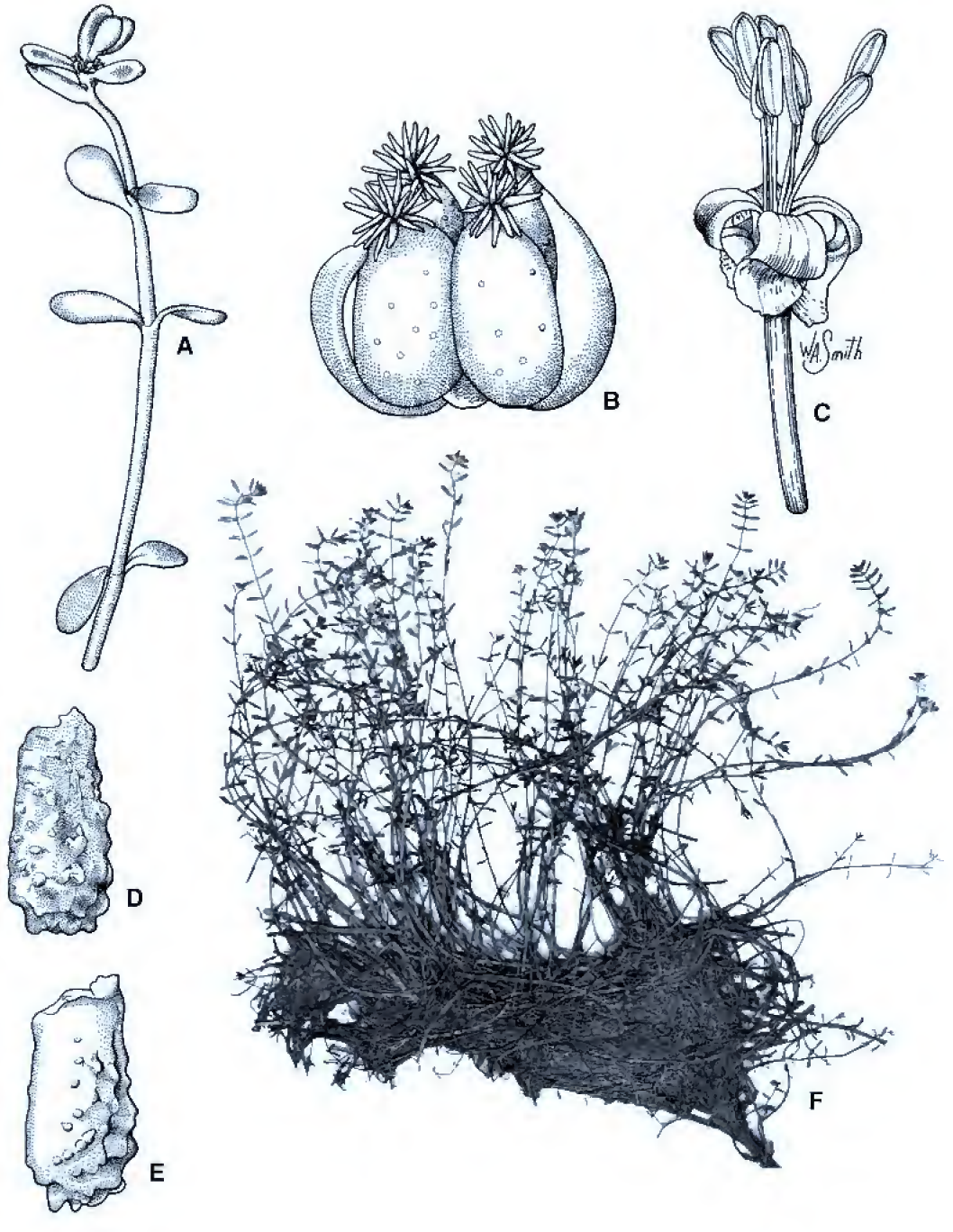
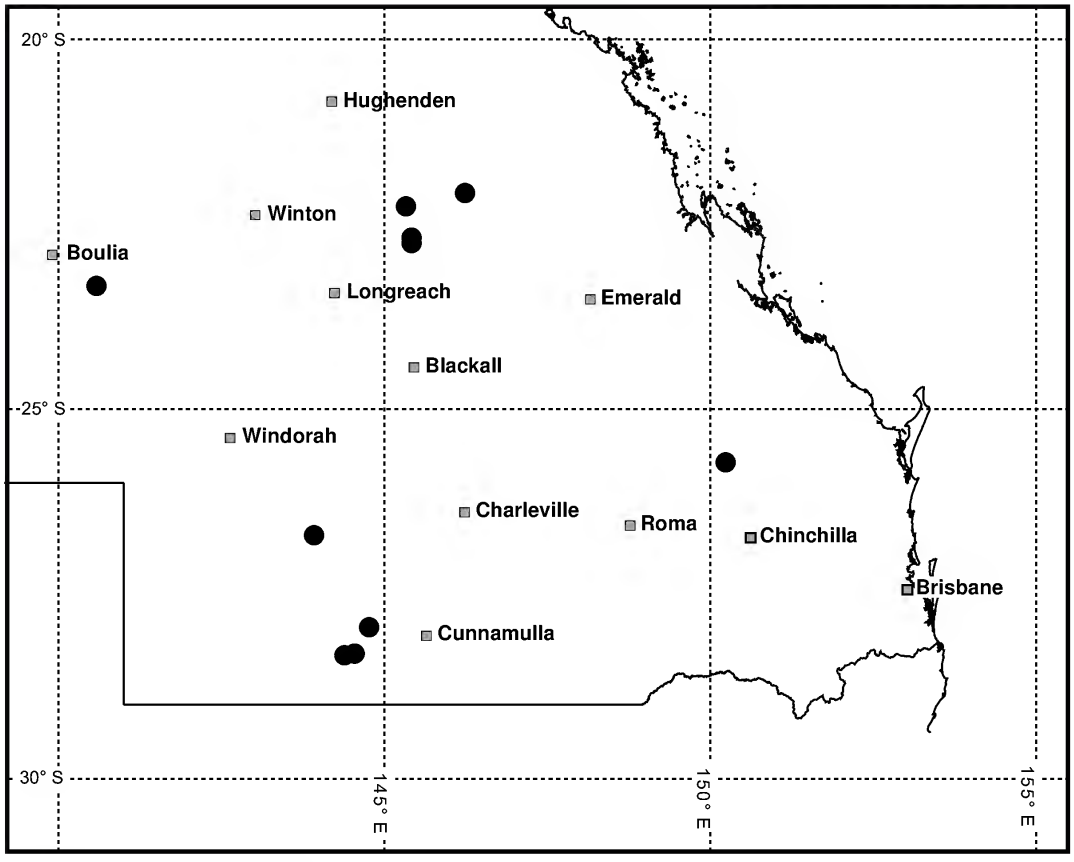


Fig. 1. *Myriophyllum artesium* Halford & Fensham. A. branchlet × 2. B. female flower × 40. C. male flower × 8. D. dorsal view of mericarp × 40. E. lateral view of mericarp × 40. F. whole plant × 0.5. A–C from Fensham 3685 (BRI); D–F from Fensham 3355 (BRI). Del. W. Smith.



Map 1. Distribution of *M. artesium.*

opposite leaves and relatively robust stems. However, *M. artesium* is easily distinguished from them by being dioecious; the absence of sepals in male flowers; the mericarp shape and the sculpturing on the dorsal surface. These and other differences are summarized in Table 1.

M. artesium will key to couplet 44 with *M. lophatum* and *M. austropygmaeum* in Orchard's (1990) key. It can be distinguished from both of these species by the papillate sculpturing on the mericarps and shorter pedicels on male flowers at anthesis (2.0–3.5 mm long for *M. artesium*; greater than 4.0 mm long for *M. lophatum* and *M. austropygmaeum*).

***Notes*:** There are a suite of taxa that are endemic to artesian springs in Queensland including *Eriocaulon carsoni, Eryngium fontanum, Sporobolus pamelae* and other undescribed taxa. *Myriophyllum artesium* is the most widespread of these species and the only one known to also occur outside the wetland habitat of natural springs.

Conservation status: *Myriophyllum artesium* is a Queensland endemic species known from 17 spring complexes and two artesian bore drains. There are a number of threatening processes that have had a dramatic impact on the natural springs of the Great Artesian Basin. These include drastically diminished flows as a result of pressure draw-down because of artesian bores, excavation, eradication of wetlands by pumping, introduction and spread of ponded pasture species such as *Brachiaria mutica,* trampling by domestic stock and rooting by pigs. Many of these threats are ongoing. The recommended conservation status for this species as defined under the Queensland *Nature Conservation Act 1992* is Vulnerable (V).

Etymology: The specific epithet *artesium* is derived from the latinization of the term artesian

and refers to the habitat in which this species grows.

Acknowledgements

The authors wish to thank Will Smith for the illustration, Peter Bostock for the map, Les Pedley for the Latin diagnosis and Tony Orchard for his constructive comments.

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Pappus morphology and terminology in Australian and New Zealand thistles (Asteraceae, tribe Cardueae)

A.R. Bean

Summary

Bean, A.R. (2001). Pappus morphology and terminology in Australian and New Zealand thistles (Asteraceae, tribe *Cardueae*). *Austrobaileya* 6 (1) 139–152. 23 pappus characters (including several newly recognised) and five achene characters have been used to compile comprehensive morphological descriptions for 30 species of mostly naturalised thistles occurring in Australia and New Zealand. This represents the first detailed English account of pappus morphology for tribe *Cardueae*. Some new pappus terminology for the tribe is introduced, and standardised definitions are suggested. A key to the described species is provided, based on pappus and achene morphology only.

Key words: Asteraceae, Compositae, pappus, morphology, terminology, thistles, Australia, New Zealand, tribe *Cardueae*.

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Introduction

The morphology of pappus in the Asteraceae is very useful taxonomically, as it offers a wealth of characters.

Dittrich presented a comprehensive account of fruiting morphology, covering numerous genera of the subtribes *Centaureinae* (Dittrich 1968) and *Carduinae* (Dittrich 1970). He also provided keys to genera based solely on achene and pappus characteristics. Petit (1997), in his cladistic analysis of the whole of the *Cardueae*, included further salient observations about pappus and achene morphology. Few other workers have paid much attention to the diversity of carduine pappus morphology.

Members of Asteraceae tribe *Cardueae* (*sensu* Bremer 1994), commonly known as the "thistles", are well represented in Australia (with c. 32 species in 15 genera) and New Zealand (with c. 21 species in 9 genera (Garnock-Jones 1988)). These all belong to either subtribe *Carduinae* or subtribe *Centaureinae*. Most are naturalised and originate from Europe. Australia has two indigenous species (*Hemisteptia lyrata* and *Stemmacantha australis*), while New Zealand is without indigenous species.

Accepted for publication 18 May 2001

This paper, the first of its kind in English, documents further details of pappus morphology not recorded by Dittrich (*loc. cit.*) or Petit (*loc. cit.*), and provides definitions for several terms (some new, some already established) as they apply to tribe *Cardueae*. It provides comprehensive, directly comparable measurements and observations of pappus characters for the great majority of Australian and New Zealand species, as well as a few obvious features of the achenes. A dichotomous key to these taxa is provided using only pappus and achene characters.

It is hoped that this paper will provide some impetus for a more wide-ranging study of pappus morphology, and that others will attempt to improve the standardisation of pappus terminology in this and other tribes of Asteraceae.

Materials and methods

30 taxa have been included in this study. Specimens from all major Australian herbaria and from Christchurch (CHR) in New Zealand have been examined (Appendix 1), using a light microscope (x 40) with graticule.

2–5 specimens per taxon were used, at least two pappi and two achenes were measured per specimen, and 23 pappus characters and 5 achene characters were recorded for each pappus and achene.

Proposed definitions for Tribe Cardueae

A plethora of terms have been used to describe Asteraceae pappus, viz. scale, seta, bristle, paleaceous, capillary, scabrid, plumose, barbellate, filamentous etc. Many of these terms are listed and loosely defined by Jackson (1928), but a lack of definition has resulted in a variety of terms being used for what amounts to the same structure, or conversely the one term has been applied to a wide range of structures. For this reason, appropriate pre-existing terms have been selected here, and more explicitly defined, to allow uniformity of interpretation, while reinforcing common usage. Also, a number of new terms have been introduced.

These definitions have been applied to members of tribe *Cardueae* only, and it should be realised that some of them may not be readily applicable to other tribes in Asteraceae.

a). The term "**monomorphic pappus**" is used for a pappus where all the elements are the same or similar, or they vary in length or width only (e.g. Fig. 1A). The term "**dimorphic pappus**" is used where there are two distinct types or groups of pappus elements forming an entire whorl or partial whorl (e.g. Fig. 1E). They must be discernible by position, orientation or major morphological trait. Discordant elements within a whorl e.g. the few long broad bristles in *Onopordum acanthium*, are not considered sufficient to constitute a distinct pappus type.

b). A "**pecten**" (plural "**pectines**") is the term used here for the regularly or irregularly spaced antrorse side-branches (or lateral projections) of a bristle. They are formed by an extension of the outer epidermal cells of the bristle (Fig. 1G, 1H).

c). A "**bristle**" is defined here as a pappus element which is more than 5 times longer than wide, is parallel-sided or slightly tapered apically or at both ends, and possesses pectines. A bristle with a length exceeding 100 times its width (excluding pectines) is called a "**capillary bristle**" e.g. Fig. 2A; a bristle with a length 5-50 times its width (excluding pectines) is called an "**ensiform bristle**" e.g. Fig. 2J; any rigid or non-parallel-sided pappus element with or without pectines is called an "**awn**" e.g. Fig. 2M.

d). A "**plumose**" bristle is one where the length of the average mid-bristle pecten is 10-30% of the (capillary) bristle length (e.g. Fig. 2F). In plumose bristles, the pectines are usually irregularly spaced. A "**subplumose**" bristle is one where the length of the average mid-bristle pecten is 2-10% of the bristle length. A "**barbellate**" bristle is one where the length of the average mid-bristle pecten is less than 2% of the bristle length (e.g. Fig. 2A). In barbellate bristles, the pectines are nearly always regularly spaced along the bristle.

e). The term "**fibrillas**", used by Petit (1997) is adopted here. Fibrillas are short, erect, uniseriate trichomes, often densely clustered, and borne on or near the top of the cylinder, forming the innermost pappus whorls in a few species (Fig. 1I).

f). The "**cylinder**" (equivalent to the pappus-cover of Dittrich (1970)), is a smooth ring-like structure composed of pericarpal tissue, and readily detaching from the achene (Fig. 1F, 1I). The cylinder forms the connate base of the pappus in many species, and is apparently associated only with capillary bristles. The bases of bristles are individually obliquely inserted onto the outer face of the cylinder, unifying the entire pappus. In a few species with connate pappus, the cylinder is absent, and the bristles are merely fused together at their bases.

List of characters used for descriptions of Australian and New Zealand taxa

1. pappus present or absent. A few species of *Centaurea* lack a pappus. In *Carthamus tinctorius*, the pappus is infrequently present.

2. pappus monomorphic or dimorphic. A term of convenience which does not indicate relationship. For example, the dimorphic pappus of *Silybum* is clearly not homologous with that of *Carthamus*.

3. number of whorls in pappus.

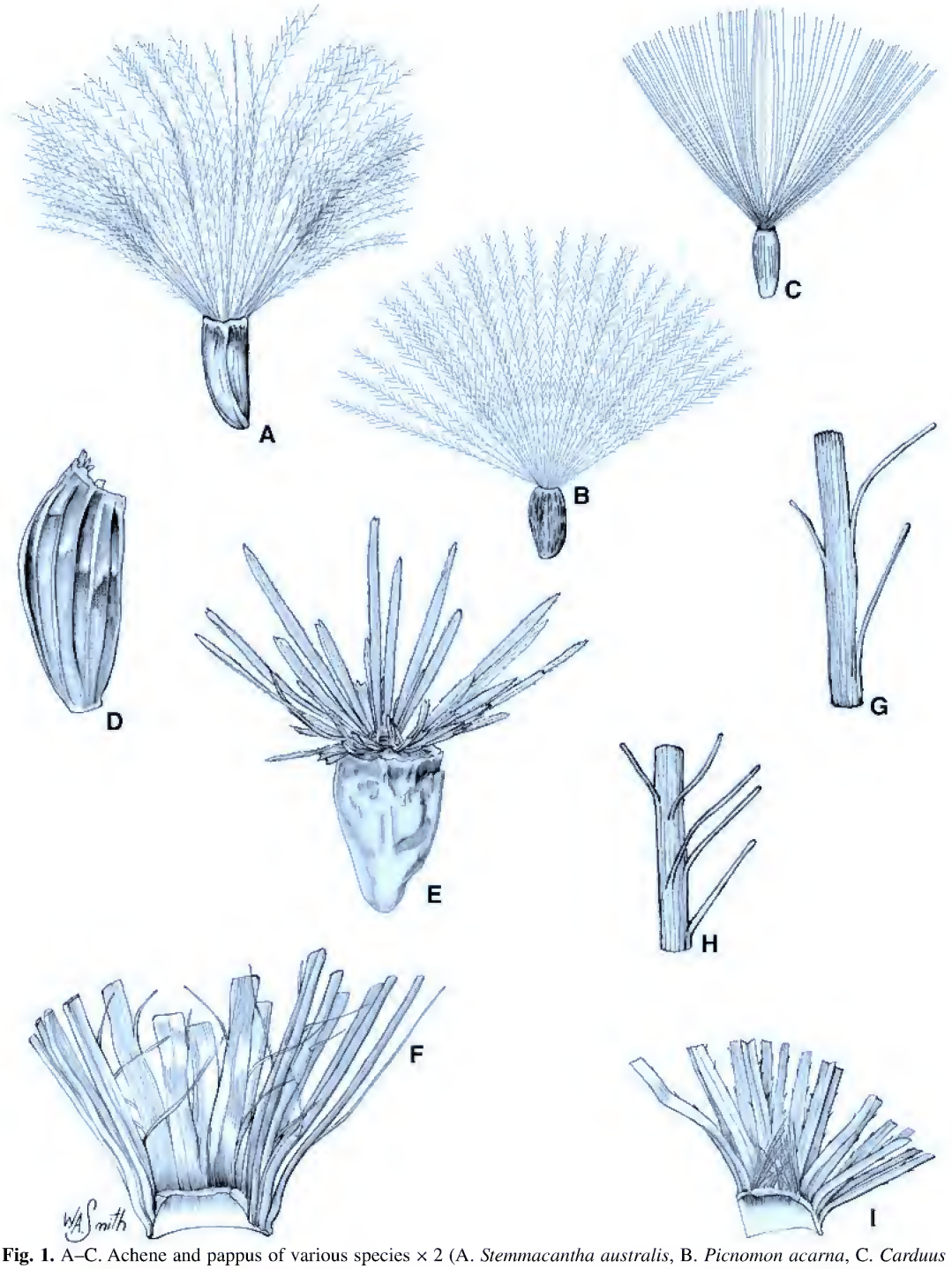

Fig. 1. A–C. Achene and pappus of various species × 2 (A. *Stemmacantha australis*, B. *Picnomon acarna*, C. *Carduus pycnocephalus*). D. achene of *Hemisteptia lyrata* showing persistent ensiform bristles on outer edge × 12. E. achene and pappus of *Carthamus lanatus*, some bristles removed to reveal inner whorl × 4. F. basal portion of pappus of *Cirsium vulgare*, showing cylinder, and bristles inserted at different points × 24. G–H. insertion of pectines. G. lateral only (*Cirsium vulgare*) × 48. H. lateral and dorsal (*Hemisteptia lyrata*) × 48. I. basal portion of pappus of *Silybum marianum*, showing cylinder and fibrillas × 12. A, *Bean* 11348 (BRI); B, *Tann* s.n. (MEL); C, *Bean* 15601 (BRI); D, *Bean* 14133 (BRI); E, *Blake* 5164A (BRI); F,G, *Dillewaard* 590 & *Stanley* (BRI); H, *K.McDonald* s.n. (BRI); I, *Bean* 15829 (BRI). Del. W. Smith.

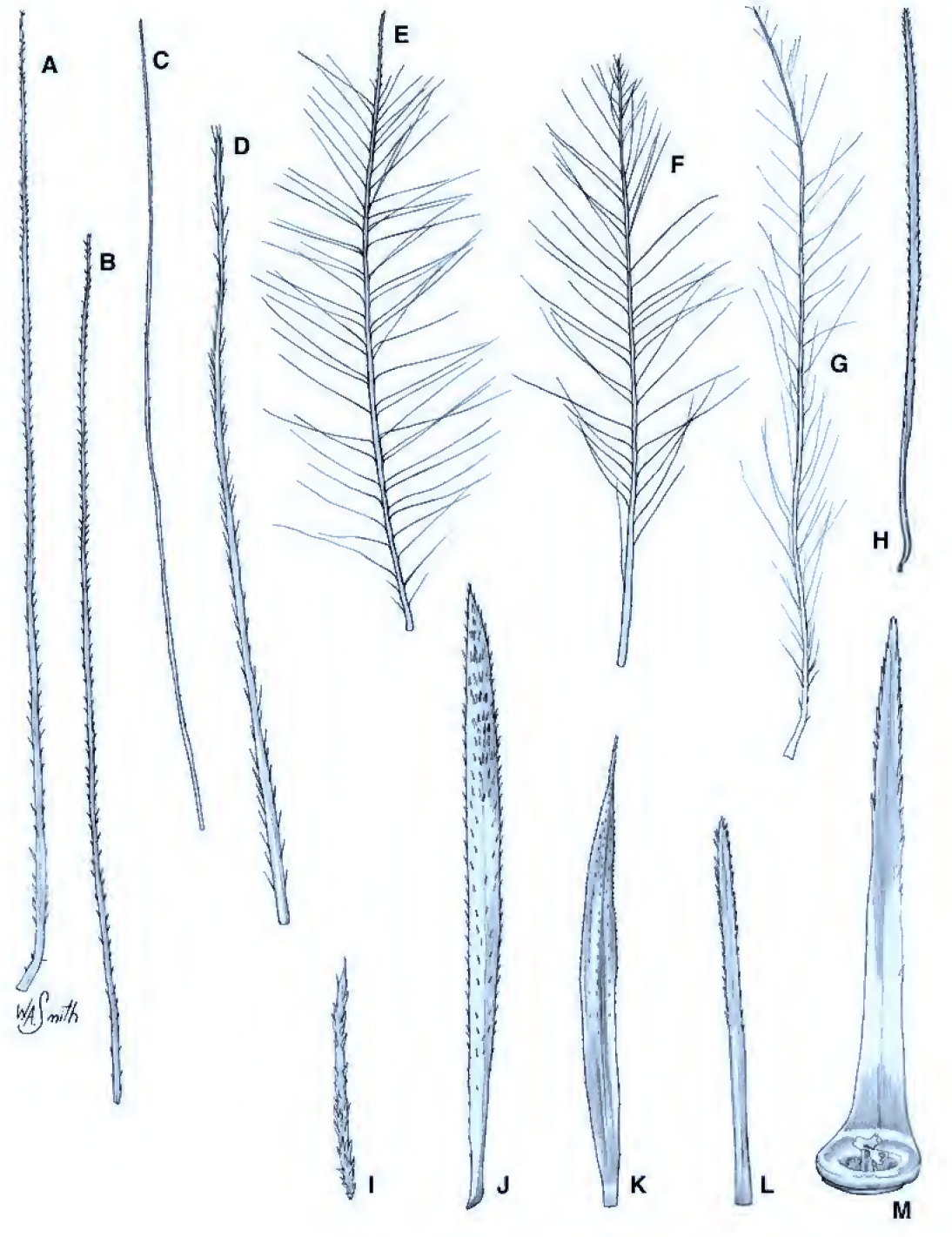

Fig. 2. Individual bristles of various species. A. *Carduus pycnocephalus* × 10. B. *Carduus tenuiflorus* × 12. C. *Carduus thoermeri* × 6. D. *Onopordum illyricum* × 12. E. *Picnomon acarna* (inner bristle) × 6. F. *Picnomon acarna* (outer bristle) × 6. G. *Hemisteptia lyrata* × 12. H. *Centaurea melitensis* × 24. I. *Arctium minus* × 24. J. *Carthamus lanatus* × 12. K. *Carthamus dentatus* × 6. L. *Mantisalca salmantica* (bristle from outer pappus) × 24. M. *Mantisalca salmantica* (inner pappus) × 24. A, *Bean* 15738 (BRI); B, *Whinray* 607 (AD); C, *Bean* 15914 (BRI); D, *Alcock* 4977 (AD); E,F, *Symon* 2095 (AD); G, *Jones* 2908 (CANB); H, *Bean* 15890 (BRI); I, *Grace* s.n. (HO); J, *Blake* 5164A (BRI); K, *Howlett* s.n. (MEL); L,M, *Bean* 15637 (BRI). Del. W. Smith.

4. pappus element type (bristles or awns).

5. bristle type (capillary or ensiform).

6. number of bristles/awns per pappus.

7. pappus deciduous from achene or persistent.

8. pappus connate (bristles fused at their bases into a ring) or free (bristles individually attached to achene).

9. cylinder present or absent.

10. length of cylinder.

11. bristle whorls uniform or varying in length. When bristle whorls vary in length, it is apparently always the inner whorls that are longer.

12. 1–3 bristles within a whorl longer and thicker than remainder. This character was noted for *Onopordum* by Tamamschyan (1998).

13. bristle length (if varying, longer or longest whorls have been measured).

14. bristle width (excluding pectines). This is the width measured about half way along the bristle.

15. bristles expanded at base or not. This character applies only to the innermost whorl where an expanded spathulate bristle base occurs in some species (Dittrich 1968). The bristles otherwise taper gradually from proximal to distal end.

16. bristles not fasciculate or some bristles fasciculate. In *Onopordum acaulon*, some bristle pairs (or triplets) are laterally fused for one-fifth to one-half of their length.

17. pecten type - plumose, sub-plumose or barbellate.

18. bristles plumose throughout on all whorls, or with barbellate apical section (Fig. 2E, 2F). The inner whorls of a pappus bearing plumose capillary bristles often have a barbellate apical section, where the pectines are abruptly reduced. This section is often twisted or bent relative to the rest of the bristle, and may be slightly thickened. This character has been noted for *Cirsium* by Davis and Parris (1975) and by Charadze (1998).

19. length of barbellate apical section.

20. bristle apex. Generally acute; some ensiform bristles may have a toothed or obtuse apices.

21. pecten insertion. In some species, pectines are inserted only laterally onto the bristles (Fig. 1G). Some species also have pectines inserted onto the dorsal surface of the bristle (Fig. 1H). Rarely, pectines are inserted onto the ventral surface. Ventral pectines were noted for *Cynara* by Dittrich (1970) and Wiklund (1992).

22. pecten length. This is often relatively uniform, but where there is variability, pectines occurring about midway along bristle have been measured.

23. fibrillas absent or present (Fig. 1I). Fibrillas occur in only a few species. They were noted for *Silybum* by Dittrich (1970).

24. achene length. Measured along medial axis.

25. achene maximum width.

26. achene ribbing (longitudinally ribbed or transversely rugose or smooth).

27. achene indumentum. Glabrous or with sparse ciliate hairs.

28. apical rim. Absent in some species; otherwise entire, dentate or sinuate.

Pappus and achene descriptions for Australian and New Zealand taxa

Taxa are arranged in systematic order, following Petit (1997). These descriptions are based entirely on measurements of the specimens cited in Appendix 1. None has been augmented by descriptions given in Flora treatments or revisionary works.

(i) Subtribe Carduinae

1. Hemisteptia lyrata (Bunge) Fisch. & C.A.Mey.
Pappus dimorphic. Inner pappus comprising one whorl of capillary bristles, 14–18 in number, deciduous, basally connate, cylinder absent; bristles ± uniform in length, 7–10 mm long, 0.05–0.1mm wide, not expanded at base, plumose throughout, barbellate apical section absent, apex acute; pectines borne laterally and dorsally, 1.3–2.2mm long at mid-bristle. Outer pappus comprising one part-whorl of 7–10 sub-plumose ensiform bristles, persistent, free, each 0.2–0.3 mm long and c. 0.05 mm wide, apex obtuse. Achenes 2.0–2.8mm long, 0.8–1.1mm wide, glabrous, conspicuously longitudinally ribbed, apical rim entire. (Fig. 1D, 1H, 2G).

2. Carduus nutans L.
Pappus monomorphic, comprising 5–7 whorls of capillary bristles, 130–169 in number, deciduous, connate to a cylinder 0.5–0.6 mm long; bristles ± uniform in length, 15–20mm long, 0.05–0.1 mm wide, not expanded at base, barbellate throughout, apex acute; pectines borne laterally only, 0.04–0.1 mm long; fibrillas absent or very few, not forming a whorl, each c. 0.6mm long. Achenes 3.3–3.8mm long, 1.3–1.7 mm wide, glabrous, smooth, apical rim entire.

3. Carduus pycnocephalus L.
Pappus monomorphic, comprising 6–8 whorls of capillary bristles, 167–190 in number, deciduous, connate to a cylinder 0.6–0.7 mm long; bristles ± uniform in length, 14–16mm long, 0.04–0.08 mm wide, not expanded at base, barbellate throughout, apex acute; pectines borne laterally only, 0.1–0.13 mm long; fibrillas absent. Achenes 4.8–5.3mm long, 1.8–2 mm wide, glabrous, smooth, apical rim entire. (Fig 1C, 2A).

4. Carduus tenuiflorus Curtis
Pappus monomorphic, comprising 6–8 whorls of capillary bristles, 147–195 in number, deciduous, connate to a cylinder c. 0.6 mm long; bristles ± uniform in length, 11–13mm long, 0.04–0.08 mm wide, not expanded at base, barbellate throughout, apex acute; pectines borne laterally only, 0.08–0.13 mm long; fibrillas absent. Achenes 4.0–4.3mm long, 1.7–2.0 mm wide, glabrous, smooth, apical rim entire. (Fig. 2B).

5. Carduus thoermeri Weinm.
Pappus monomorphic, comprising 5–7 whorls of capillary bristles, 125–170 in number, deciduous, connate to a cylinder 0.4–0.6 mm long; bristles ± uniform in length, 17–23mm long, 0.05–0.08 mm wide, not expanded at base, barbellate throughout, apex acute; pectines borne laterally only, 0.03–0.08 mm long; fibrillas absent. Achenes 3.5–4.1mm long, 1.4–1.7 mm wide, glabrous, smooth, apical rim entire. (Fig. 2C).

6. Silybum marianum (L.) Gaertn.
Pappus dimorphic. Inner pappus comprising many fibrillas, 0.6–1.2mm long. Outer pappus comprising 6–7 whorls of capillary bristles, 126–167 in number, deciduous, connate to a cylinder 0.4–0.8 mm long; bristles ± uniform in length, 15–20mm long, 0.06–0.18 mm wide, not expanded at base, barbellate throughout, apex acute; pectines borne laterally only, 0.08–0.13 mm long. Achenes 5.6–6.7mm long, 2.8–3.4 mm wide, glabrous, smooth, apical rim entire. (Fig. 1I).

7. Picnomon acarna (L.) Cass.
Pappus monomorphic, comprising 4–5 whorls of capillary bristles, 95–109 in number, deciduous, connate to a cylinder 0.4–0.6 mm long; bristles ± uniform in length, 13–17mm long, 0.07–0.1 mm wide, not expanded at base, plumose throughout on outer whorls, otherwise with barbellate apical section 0.8–2.2 mm long, apex acute; pectines borne laterally only, 3.0–5.2mm long at mid-bristle; fibrillas absent. Achenes 4.6–5.2 mm long, 2.4–2.6 mm wide, glabrous, smooth, apical rim entire. (Fig. 1B, 2E, 2F).

8. Cirsium arvense (L.) Scop. var. **arvense**
Pappus monomorphic, comprising 3–4

whorls of capillary bristles, 57–80 in number, deciduous, connate to a cylinder 0.2–0.3 mm long; bristles ± uniform in length, 15–22 mm long, 0.05–0.1 mm wide, not expanded at base, plumose throughout on outer whorls, otherwise with barbellate apical section 0.3–1.0 mm long, apex acute; pectines borne laterally only, 2.5–5.8 mm long at mid-bristle; fibrillas absent. Mature achenes not seen.

9. Cirsium brevistylum Cronquist

Pappus monomorphic, comprising 2–4 whorls of capillary bristles, 47–62 in number, deciduous, connate to a cylinder 0.25–0.3 mm long; bristles ± uniform in length, 20–25 mm long, 0.06–0.1 mm wide, not expanded at base, plumose throughout on outermost whorl, otherwise with barbellate apical section 0.8–2.0 mm long, apex acute; pectines borne laterally only, 3.0–5.1 mm long at mid-bristle; fibrillas absent. Achenes 3.7–4.0 mm long, 1.4–1.5 mm wide, smooth, glabrous, apical rim entire.

10. Cirsium palustre (L.) Scop.

Pappus monomorphic, comprising 2–3 whorls of capillary bristles, 35–44 in number, deciduous, connate to a cylinder 0.2–0.3 mm long; bristles varying in length with inner exceeding outer, longer ones 8–11 mm long, 0.05–0.09 mm wide, not expanded at base, plumose throughout on outermost whorl, otherwise with barbellate apical section 0.6–1.7 mm long, apex acute; pectines borne laterally only, 0.9–2.3 mm long at mid-bristle; fibrillas absent. Achenes 3.4–3.7 mm long, 1.1–1.2 mm wide, smooth, glabrous, apical rim entire.

11. Cirsium vulgare (Savi) Ten.

Pappus monomorphic, comprising 2–4 whorls of capillary bristles, 38–85 in number, deciduous, connate to a cylinder 0.3–0.4 mm long; bristles ± uniform in length, 19–28 mm long, 0.07–0.12mm wide, not expanded at base, plumose throughout on outer whorls, otherwise with barbellate apical section 0.5–1.8 mm long, apex acute; pectines borne laterally only, 3–6 mm long at mid-bristle; fibrillas absent. Achenes 3.5–4.0 mm long, 1.5–1.8 mm wide, smooth, glabrous, apical rim entire. (Fig. 1F, 1G)

12. Ptilostemon afer (Jacq.) Greuter

Pappus monomorphic, comprising 3–4 whorls of capillary bristles, 51–61 in number, deciduous, basally connate, cylinder absent; bristles ± uniform in length, 14–17 mm long, 0.1–0.17 mm wide, not expanded at base, plumose throughout, apex acute; pectines borne laterally only, 1.5–3 mm long at mid-bristle; fibrillas absent. Achenes 4.0–4.5 mm long, 2.7–2.9 mm wide, smooth, glabrous, apical rim absent.

13. Cynara cardunculus subsp. **flavescens** Wiklund

Pappus monomorphic, comprising 4–5 whorls of capillary bristles, 66–93 in number, deciduous, connate to a cylinder 0.3–0.4mm long; bristles varying in length with inner exceeding outer, longer ones 26–35mm long, 0.15–0.25mm wide, not expanded at base, plumose throughout on outermost whorl, otherwise with barbellate apical section 3–10 mm long, apex acute; pectines borne laterally only, or on inner whorl, pectines borne laterally and ventrally, 2.5–4.5 mm long at mid-bristle; fibrillas absent. Achenes 4.8–5.8 mm long, 3.1–3.8 mm wide, smooth, glabrous, apical rim absent.

14. Onopordum acanthium L.

Pappus monomorphic, comprising 2 whorls of capillary bristles, 73–119 in number, deciduous, basally connate, cylinder absent; bristles varying in length with inner exceeding outer, usually including 1–3 stout capillary bristles (9–11 mm long, 0.15–0.2mm wide) on inner whorl; of remainder, longer ones 6.0–8.0mm long, 0.05–0.08mm wide, not expanded at base, barbellate throughout, apex acute; pectines borne laterally and dorsally, 0.07–0.12 mm long. Achenes 4.1–5 mm long, 2.0–2.7 mm wide, strongly quadrangular, conspicuously transversely rugulose, glabrous, apical rim absent.

15. Onopordum acaulon L.

Pappus monomorphic, comprising 4–5 whorls of capillary bristles, 135–164 in number, deciduous, basally connate, cylinder absent; bristles ± uniform in length, 20–25mm long, 0.07–0.15mm wide, not expanded at base, a small proportion fasciculate, i.e. laterally fused for one-fifth to one-half of their length, barbellate throughout, apex acute; pectines borne laterally only, or in some bristles laterally, dorsally and ventrally, 0.15–0.3 mm long. Achenes 4.0–4.5 mm long, 2.1–2.5 mm wide, strongly quadrangular, transversely rugulose, glabrous, apical rim absent.

16. Onopordum illyricum L.

Pappus monomorphic, comprising 2 whorls of capillary bristles, 61–93 in number, deciduous, basally connate, cylinder absent; bristles varying in length with inner exceeding outer, occasionally including 1 stout capillary bristle (c. 13mm long, 0.18mm wide) on inner whorl; of remainder, longer ones 6–11 mm long, 0.05–0.12mm wide, not expanded at base, barbellate throughout, apex acute; pectines borne laterally and dorsally, 0.1–0.2 mm long. Achenes 4.1–6.5 mm long, 1.8–3.2 mm wide, strongly quadrangular, conspicuously transversely rugulose, glabrous, apical rim absent. (Fig. 2D).

17. Onopordum tauricum Willd.

Pappus monomorphic, comprising 2 whorls of capillary bristles, 55–84 in number, deciduous, basally connate, cylinder absent; bristles varying in length with inner exceeding outer, occasionally including 1 stout capillary bristle (9–11mm long, 0.1–0.13mm wide) on inner whorl; of remainder, longer ones 6–8.5 mm long, 0.04–0.08mm wide, barbellate throughout, apex acute; pectines borne laterally and dorsally, 0.1–0.15 mm long. Achenes 4.1–4.7 mm long, 1.6–2.4 mm wide, strongly quadrangular, conspicuously transversely rugulose, glabrous, apical rim absent.

18. Arctium lappa L.

Pappus monomorphic, comprising 2–3 whorls of ensiform bristles, 80–150 in number, deciduous, all free; bristles varying in length with inner exceeding outer, longer ones 2.5–3.5 mm long, 0.07–0.1 mm wide, sub-plumose throughout, apex acute; pectines borne laterally and dorsally, 0.05–0.1 mm long. Achenes 6.9–7.3 mm long, 2.5–3.0 mm wide, faintly longitudinally striate and rugulose, glabrous, apical rim obscure, or conspicuous and coarsely sinuate.

19. Arctium minus (Hill) Bernh.

Pappus monomorphic, comprising 2–3 whorls of ensiform bristles, 60–100 in number, deciduous, all free; bristles varying in length with inner exceeding outer, longer ones 2.0–3.3 mm long, 0.07–0.1mm wide, sub-plumose throughout, apex acute; pectines borne laterally and dorsally, 0.05–0.1mm long. Achenes 5.2–6 mm long, 2.2–2.7 mm wide, faintly longitudinally striate and rugulose, glabrous, apical rim obscure, or conspicuous and coarsely sinuate. (Fig. 2I).

(ii) Subtribe Centaureinae

20. Carthamus dentatus Vahl

Pappus dimorphic. Inner pappus comprising one whorl of connivent barbellate bristles, 12–13 in number, persistent, free, bristles 2.5–14mm long (usually with 2–6 much shorter than remainder). Outer pappus comprising 4–7 whorls of ensiform bristles, 115–155 in number, persistent, free; bristles varying in length with inner exceeding outer, longest ones 11–14mm long, all 0.5–0.9 mm wide, barbellate throughout, apex acute (inner) to serrate (outer); pectines borne laterally and dorsally, 0.06–0.12mm long. Achenes 4.5–5.8mm long, 4.4–5mm wide, angular, not ribbed, glabrous, apical rim entire. (Fig. 2K).

21. Carthamus lanatus L.

Pappus dimorphic. Inner pappus comprising one whorl of connivent barbellate bristles, 11–15 in number, persistent, free, bristles 0.2–1.5mm long or 4–11mm long. Outer pappus

comprising 4–7 whorls of ensiform bristles, 82–108 in number, persistent, free; bristles varying in length with inner exceeding outer, longest ones 6.5–11 mm long, all 0.4–0.6 mm wide, barbellate throughout, apex acute (inner) to serrate (outer); pectines borne laterally and dorsally, 0.08–0.12mm long. Achenes 4.5–5.7mm long, 3.5–4.2mm wide, angular, not ribbed, glabrous, apical rim entire to dentate. (Fig. 1E, 2J).

22. Carthamus leucocaulos Sm.
Pappus dimorphic. Inner pappus comprising one whorl of connivent sub-plumose bristles, 10–13 in number, persistent, free, bristles 1.0–4mm long (usually with one or more much longer than remainder). Outer pappus comprising 4–6 whorls of ensiform bristles, 77–95 in number, persistent, free; bristles varying in length with inner exceeding outer, longest ones 4.5–5.3 mm long, all 0.3–0.5 mm wide, barbellate throughout, apex acute (inner) to serrate (outer); pectines borne laterally and dorsally, 0.04–0.08mm long. Achenes 3–3.5mm long, 2.5–2.8mm wide, angular, not ribbed, glabrous, apical rim entire.

23. Carthamus tinctorius L.
Pappus absent from most achenes. When present, pappus dimorphic. Inner pappus of one partial-whorl of sub-plumose ensiform bristles, 7–10 in number, persistent, free, bristles 1.3–2.6mm long. Outer pappus comprising 4–6 partial-whorls of ensiform bristles, 13–50 in number, persistent, free; bristles varying in length with inner exceeding outer, longest ones 4.5–6 mm long, all 0.2–0.3 mm wide, barbellate throughout, apex acute (inner) to serrate (outer); pectines borne laterally and dorsally, 0.07–0.12mm long. Achenes 6.5–8mm long, 4.1–4.7mm wide, angular, not ribbed, glabrous, apical rim entire.

24. Stemmacantha australis (Gaudich.) Dittrich
Pappus monomorphic, comprising 4–5 whorls of capillary bristles, 89–112 in number, deciduous, connate to a cylinder 0.3–0.4 mm long; bristles varying in length with outer whorl somewhat shorter than remainder, longest ones 18–23 mm long, 0.07–0.15 mm wide (outer whorls), 0.35–0.4mm wide at base (inner whorl), sub-plumose throughout, apex acute; pectines borne laterally and dorsally, 0.8–1.6 mm long at mid-bristle; fibrillas absent. Achenes 6.5–8.4 mm long, 2.5–3.1 mm wide, longitudinally ribbed, glabrous, apical rim dentate. (Fig. 1A).

25. Mantisalca salmantica (L.) Briq. & Cavill.
Pappus dimorphic. Inner pappus comprising a single tapering awn, persistent, annular at base, 3–3.5mm long. Outer pappus comprising 4–6 whorls of ensiform bristles, 77–107 in number, persistent, free; bristles varying in length with inner exceeding outer, longest ones 2.5–3.3 mm long, all 0.07–0.1 mm wide, barbellate throughout, apex acute (inner) to obtuse (outer); pectines borne laterally and dorsally, 0.04–0.08mm long. Achenes 3.5–3.9mm long, 1.3–1.5 mm wide, lacunose, not ribbed, glabrous, apical rim shallowly dentate. (Fig 2L, 2M).

26. Centaurea calcitrapa L.
Pappus absent. Achenes 2.7–2.8 mm long, 1.7–1.8 mm wide, smooth, very sparsely hairy, apical rim absent.

27. Centaurea jacea L.
Pappus absent. Achenes 2.7–2.9 mm long, 1.2–1.3 mm wide, faintly longitudinally ribbed, very sparsely hairy, apical rim entire.

28. Centaurea melitensis L.
Pappus dimorphic. Inner pappus comprising one whorl of erect or connivent barbellate ensiform bristles, 16–17 in number, persistent, free, 0.5–0.7mm long. Outer pappus comprising 5–7 whorls of ensiform bristles, 100–150 in number, persistent, free; bristles varying in length with inner exceeding outer, longest ones 2.4–3.5 mm long, all 0.05–0.08 mm wide, barbellate throughout, apex acute (inner) to obtuse (outer); pectines borne laterally and dorsally, c. 0.03mm long. Achenes 2.6–

2.8 mm long, 1.2–1.3 mm wide, smooth, very sparsely hairy, apical rim minutely dentate. (Fig. 2H).

29. Centaurea solstitialis L.

Pappus dimorphic. Inner pappus comprising one whorl of erect or connivent barbellate ensiform bristles, 17–19 in number, persistent, free, 0.6–1.0mm-long. Outer pappus comprising 4–5 whorls of ensiform bristles, 70–100 in number, persistent, free; bristles varying in length with inner exceeding outer, longest ones 3.3–3.9 mm long, all 0.04–0.08 mm wide, barbellate throughout, apex acute; pectines borne laterally and dorsally, c. 0.04mm long. Achenes 2.3–2.6mm long, 1.2–1.3mm wide, smooth, very sparsely hairy, apical rim minutely dentate.

30. Cnicus benedictus L.

Pappus dimorphic. Inner whorl comprising one whorl of erect awns, 10 in number, persistent, free, annular at base, 2.3–3.0mm long, with coarse irregular trichomes along their length. Outer pappus comprising one whorl of erect or spreading awns, 10 in number, persistent, free, 10–11mm long, apex acute; pectines absent. Achenes 7.2–8.5mm long, 3.0–3.1 mm wide, prominently longitudinally ribbed, glabrous, apical rim conspicuously dentate.

Discussion

Bentham (1873) compared bristle *width* to pecten length to define the terms 'plumose' and 'barbellate', and this has been followed in recent times e.g. Dittrich (1968), Danin (1975), Anderberg (1991). In my opinion, these terms relate more to the bristle *length*, so that a bristle half as long as another, and with pectines half as long, is equally plumose, regardless of bristle width. The terms 'scabrid, scabrous, rough' and 'denticulate' are not here considered to be useful, as they are not significantly different from 'barbellate'.

While I have not attempted to define a scale, they are generally considered to have a small length-breadth ratio, are often scarious, and frequently broad-based, or with a subulate apex. Scales have not been observed in Australian or New Zealand thistles, but are reported for a few south-west Asian genera e.g. *Xeranthemum, Siebera, Chardinia* which were placed in subtribe *Carlininae* by Dittrich (1996), but transferred to subtribe *Carduinae* by Petit (1997).

Features of the pappus have been widely used by botanists to help distinguish or determine species or genera of Asteraceae, and the diversity of pappus morphology apparent in Australian and New Zealand species demonstrates their high value, but detailed studies of pappus morphology have been neglected. By contrast, there are many recent examples of studies dealing with other morphological aspects, such as pollen (Blackmore 1981, Feuer and Tomb 1977), corolla (Jeffrey 1977), ligules (Baagoe 1977), style (Jones 1976) and fruits (Källersjö 1985).

Within Australian and New Zealand *Cardueae* at least, there is a considerable morphological disjunction between capillary and ensiform bristles (as defined here), so that there is never any doubt about the application of these terms. Furthermore, most of those species with capillary bristles fall readily into either "plumose" or "barbellate" as defined here. In fact, only one species (*Stemmacantha australis*) classifies as "sub-plumose".For ensiform bristles, only the "barbellate" and "sub-plumose" categories apply, and there is apparently a continuum of forms. Plumose ensiform bristles are not known.

It is clear from this study that pappus morphology is more or less fixed at the species level. At the generic level, the situation is less clear. Dittrich (1968) suggested that pappus characteristics often vary between species of the same genus, and hence have limited value. There is certainly infrageneric variation in *Onopordum* pappus, where some species have barbellate bristles and some are reported to have plumose bristles (Feinbrun-Dothan 1978). Nevertheless, these infrageneric differences in pappus morphology may point to other correlated differences in other parts of the plant, and hence be of phylogenetic significance.

It would be foolish to make sweeping statements about generic relationships based on this study, because of the small proportion of taxa sampled. However, a few observations may be made:

Carduus, Silybum, Cirsium, Ptilostemon and *Picnomon* all have pectines that are borne laterally only; the last three genera have plumose bristles. *Cynara* also seems closely related, though it has pectines borne ventrally on the bristles of the inner whorl.

Ptilostemon afer has very closely spaced pectines compared to the other plumose species in this study. The number of pectines per bristle may prove to be another useful pappus character.

Hemisteptia stands apart from all other Australian and New Zealand *Cardueae*, though it is obviously close to the Asian genus *Saussurea* DC.

The Australian representative of *Stemmacantha*, with its monomorphic pappus, deciduous capillary bristles connate to a cylinder, and the basal detachment area of the achene, seems closer to subtribe *Carduinae* than to subtribe *Centaurinae*. Its broad-based inner bristles, while distinctive, do not constitute a separate pappus type.

Centaurea, Carthamus and *Mantisalca* have much in common (persistent barbellate ensiform bristles, varying in length), and both *Centaurea* and *Carthamus* have a connivent inner pappus whorl.

The pappus of *Onopordum acaulon* is strikingly different from the other three Australian *Onopordum* spp. Its bristles are about twice as long as the other species, and a small proportion of them are fasciculate, although this latter feature is not obvious to the casual observer.

Key to Australian and New Zealand thistle species, based on pappus and achenes

1. Pappus present 2
   Pappus absent 25

2. Pappus elements predominantly capillary bristles 3
   Pappus elements predominantly ensiform bristles or awns 16

3. Bristles plumose throughout or almost throughout 4
   Bristles barbellate or sub-plumose throughout 10

4. Bristles plumose throughout, cylinder absent 5
   Apical section of inner bristles barbellate 6

5. Capillary bristles 14–18 in a single whorl ..... **1. Hemisteptia lyrata**
   Capillary bristles 51–61, in 3–4 whorls ..... **12. Ptilostemon afer**

6. Barbellate apical section of inner bristles 3–10 mm long ..... **13. Cynara cardunculus** ssp. **flavescens**
   Barbellate apical section of inner bristles 0.3–2.2 mm long 7

7. Cylinder 0.4–0.6mm long; achenes 4.6–5.2 mm long ..... **7. Picnomon acarna**
   Cylinder 0.2–0.4mm long; achenes 3.4–4 mm long 8

8. Bristles 8–11 mm long; pectines 0.9–2.3 mm long ..... **10. Cirsium palustre**
   Bristles 15–28 mm long; pectines 2.5–6 mm long 9

9. Cylinder 0.2–0.3 mm long ..... **8. Cirsium arvense** var. **arvense, 9. C. brevistylum**
   Cylinder 0.3–0.4 mm long ..... **11. Cirsium vulgare**

10. Bristles sub-plumose ..... **24. Stemmacantha australis**
    Bristles barbellate 11

11. Pappus dimorphic, inner pappus fibrillate ..... **6. Silybum marianum**
Pappus monomorphic, fibrillas rare or absent 12

12. Bristles varying in length, in two whorls only
..... **14. Onopordum acanthium, 16. O. illyricum, 17 . O. tauricum**
Bristles ± uniform in length, in 4–7 whorls 13

13. Cylinder absent, some bristles fasciculate,
achenes quadrangular ..... **15. Onopordum acaulon**
Cylinder present, bristles not fasciculate,
achenes smooth and rounded 14

14. Bristles 15–23 mm long; pectines 0.04–0.1 mm long
..... **2. Carduus nutans, 5. C. thoermeri**
Bristles 11–16 mm long; pectines 0.08–0.13 mm long 15

15. Bristles 11–13 mm long; achenes 4–4.3 mm long ..... **4. Carduus tenuiflorus**
Bristles 14–16 mm long; achenes 4.8–5.3 mm long ..... **3. Carduus pycnocephalus**

16 Pappus comprising two whorls of awns, 10 awns per whorl ..... **30. Cnicus benedictus**
Pappus wholly or predominantly of ensiform bristles 17

17. Bristles deciduous 18
Bristles persistent 19

18. Achenes 6.9–7.3 mm long ..... **18. Arctium lappa**
Achenes 5.2–6 mm long ..... **19. Arctium minus**

19. Inner pappus comprising a single rigid awn ..... **25. Mantisalca salmantica**
Inner pappus comprising several connivent bristles 20

20. Pappus whorls partial only; achenes 6.5–8 mm long ..... **23. Carthamus tinctorius**
Pappus whorls complete; achenes 2.6–5.8 mm long 21

21. Inner pappus of 16–19 bristles; longest bristles of outer pappus
2.4–3.9 mm long 22
Inner pappus of 10–15 bristles; longest bristles of outer pappus
4.5–14 mm long 23

22. Longest bristles 2.4–3.5 mm long; achenes 2.6–2.8 mm long ..... **28. Centaurea melitensis**
Longest bristles 3.3–3.9 mm long; achenes 2.3–2.6 mm long ..... **29. Centaurea solstitialis**

23. Longest bristles 4.5–5.3 mm long; achenes 3–3.5 mm long ..... **22. Carthamus leucocaulos**
Longest bristles 6.5–14 mm long; achenes 4.5–5.8 mm long 24

24. Outer pappus of 115–155 bristles, longest ones 11–14 mm long .. **20. Carthamus dentatus**
Outer pappus of 82–108 bristles, longest ones 6.5–11 mm long 25

25. Achenes 6.5–8 mm long ..... **23. Carthamus tinctorius**
Achenes 2.3–2.8 mm long 26

26. Achenes 1.7–1.8 mm wide, smooth ..... **26. Centaurea calcitrapa**
Achenes 1.2–1.3 mm wide, faintly longitudinally ribbed ..... **27. Centaurea jacea**

Acknowledgements

I am grateful to Philip Sharpe for translating one of Dittrich's key to genera, to Ailsa Holland for providing comments on the manuscript, to the Directors of AD, CANB, CHR, DNA, HO, MEL, NSW and PERTH for the loan of thistle specimens, and to Will Smith for the illustrations. This work was completed with the assistance of a grant from the Australian Biological Resources Study.

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Appendix 1 - Voucher specimens used for measurements

Arctium

A. lappa: Welsh (HO), Drake (HO); *A. minus*: Anon. 10 (HO), Curtis (HO), Grace (HO), Lampinen 5449 (BRI).

Carduus

C. nutans: Bloomfield s.n. (MEL), Morris s.n. (HO), Doing s.n. 18/4/67 (CANB); *C. pycnocephalus*: Bean 15672 (BRI), Bean 15738 (BRI); *C. tenuiflorus*: Vonow 98 (AD), Whinray 607 (AD), Whibley 3723 (AD); *C. thoermeri*: Bean 15589 (BRI), Bean 15892 (BRI), Bean 15914 (BRI).

Carthamus

C. dentatus: Gray & Medway 7083 (BRI), Howlett s.n. (MEL); *C. lanatus*: Adams s.n. (BRI), Blake 5164A (BRI), Alcock 5556 (AD), Coveny 16368 & Whalen (BRI); *C. leucocaulos*: Hunt 1872 (AD), Overton 767 (AD); *C. tinctorius*: Moore s.n. (BRI), A.E.Smith s.n. (BRI).

Centaurea

C. calcitrapa: R.V.Smith 68/29 (BRI); *C. jacea*: Bird s.n. 29/4/89 (BRI); *C. melitensis*: Bean 15890 (BRI), L.S.Smith 3047 (BRI); *C. solstitialis*: Bean 14774 (BRI), Everist 4286 (BRI).

Cirsium

C. arvense var. *arvense*: Curtis s.n. (HO), Reid 2167 (MEL), Morrison s.n. (CANB), Scarlett 82-15 (CANB); *C. brevistylum*: Worsley s.n. 11/1/72 (CHR), Anon. [CHR 5714B] (CHR); *C. palustre*: Holm-Nielsen 330 et al. (BRI); McLaren s.n. (CHR). *C. vulgare*: Buchanan 750 (HO), Cummings 97 (CANB), Jobson 4575 et al. (BRI).

Cnicus

C. benedictus: Hoffman s.n. (CANB), Clydesdale s.n. (BRI).

Cynara

C. cardunculus ssp. *flavescens*: Ising s.n. (AD), Wilson 3600 (AD).

Hemisteptia

H. lyrata: K.McDonald s.n. (BRI), Jones 2908 (CANB).

Mantisalca

M. salmantica: Bean 15637 (BRI); Mansbridge s.n. (BRI).

Onopordum

O. acanthium: Cleland s.n. (AD), Ward s.n. (HO), Fitzpatrick ONO9 (CANB), Michael 29/12/69 (CANB); *O. acaulon*: H.W.Andrew (AD), Bartsch 5 (AD), Beauglehole 87638 & Huebner (MEL), Symon 1886 (AD); *O. illyricum*: Alcock 4977 (AD), Colwill ONO17 (CANB), Somneville ONO18 (CANB), Nelligan ONO19 (CANB); *O. tauricum*: Alcock 6151 (AD), Gebert s.n. (MEL).

Picnomon

P. acarna: Symon 2095 (AD), Amtsberg s.n. (AD), Copley 1106 (AD).

Ptilostemon

P. afer: E.G.Smith s.n. (CHR).

Silybum

S. marianum: Bean 15605 (BRI), Bean 15806 (BRI), Bean 15829 (BRI).

Stemmacantha

S. australis: Fensham 1396 (BRI), Bean 11348 (BRI), Bartlam s.n. (BRI).

Cycas cupida (Cycadaceae), a new species from central Queensland

Paul I. Forster

Summary

Forster, Paul I. *Cycas cupida* (Cycadaceae), a new species from central Queensland. Austrobaileya 6 (1): 153–160 (2001). The new species *Cycas cupida* P.I.Forst. from sandstone substrates in central Queensland is described (together with illustrations) and compared to *C. couttsiana* K.D.Hill and *C. desolata* P.I.Forst. A key to the species of *Cycas* series *Cairnsianosae* K.D.Hill is presented.

Key words: *Cycas, Cycas cupida, Cycas couttsiana, Cycas desolata, Cycas* series *Cairnsianosae*

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Introduction

In early November 2000, pressed material and photographs were sent to me by Tim Perry, then of the Environmental Protection Agency at Townsville, of a blue-leaved *Cycas* from sandstone substrates well to the south of Charters Towers in central Queensland. This population was highly disjunct from other populations of *Cycas* and of immediate interest given the patterns of speciation and taxon rarity in some of the Australian species. Taxonomic accounts of the Australian species of *Cycas* L. have been presented by Hill (1996, 1998) wherein some 27 species were enumerated together with identification keys. This pressed material differed in a number of ways from previously described species, although it was clearly placed in *Cycas* series *Cairnsianosae* K.D.Hill which includes the five species *C. cairnsiana* F.Muell., *C. couttsiana* K.D.Hill, *C. desolata* P.I.Forst., *C. ophiolitica* K.D.Hill and *C. platyphylla* K.D.Hill and is characterised by "Basal pinnae not gradually reducing to spines; pinnae slightly to strongly revolute, strongly glaucous; hypodermis fully continuous, often with more than 1 layer of cells. Cataphylls hard and pungent or soft. Pollen cones medium, ovoid, orange or brown" (Hill 1998).

Investigation of this population in December 2000 enabled collection of a range of fertile material and documentation of morphological variation from many individuals that is never possible only from herbarium collections. The new species is described in this paper as *Cycas cupida* and differentiated from other taxa in *Cycas* series *Cairnsianosae*.

Accepted for publication 16 July 2001

Taxonomy

Cycas cupida P.I.Forst., **species nova**, affinis speciebus ambabus *Cycadi desolatae* P.I.Forst. et *C. couttsianae* K.D.Hill sed ab illa numero majore foliolis in foliis maturis (174–240 non 90–136), foliolis e basi foliis non angustis et 90–100% latitudinis maximae (non 70–80%), cataphyllis multo longioribus (70–95 mm non 30–45 mm) dense tomentosis per longitudinem integram (adversum basin non nisi), strobilis microsporangiatis latioribus (10–16 cm diam. non 8–9 cm) microsporophyllo spina apicali longiore instructo (5–12 mm non 3–4 mm), et ab hac caulibus crassioribus (20–30 cm diam. non 14–20 cm), foliolis e basi foliis non angustis et 90–100% latitudinis maximae (non 70–80%), augmento novo indumento ferrugineo instructo (adversum canum), strobilis microsporangiatus magnioribus (25–33 × 10–16 cm non 15–20 × 7–9 cm) et megasporophyllis ferrugineis (adversum grisea) lamina late triangulari (adversum anguste triangularem) differens. **Typus:** Queensland. South Kennedy District: Terrace Range, 11 December 2000,

P.I.Forster PIF26540B (male plant) & *R.Booth* (holo: BRI [6 sheets and carpological]).

Stems to 6 m high (rarely multiheaded), 20–30 cm thick. Leaves 72–130 cm long, straight or sometimes somewhat wavy towards the apex, strongly keeled in cross-section, the opposing leaflets inserted at 30–50 degrees to the rhachis, the rhachis usually terminated by paired leaflets; petiole 12–26 cm long, 10–11 mm diameter, strongly blue-grey tomentose, otherwise green-grey beneath, with 12–26 short teeth c. 2 mm long and spaced 10–15 mm apart, rarely spineless. Leaflets 174–240 per leaf, evenly spaced in lower half of leaf, more interleaved and wavy in the upper half of leaf; median leaflets at 40–50 degrees to the rhachis, 150–240 mm long, 5–7 mm wide; glaucous blue-pruinose, green-grey when covering removed; more or less flat in cross-section, decurrent for 0–4 mm, not narrowed at base of frond (90–100 % of maximum width), midrib slightly raised above, prominent below. New growth densely tomentose with ferruginous-brown indumentum, glabrescent. Cataphylls pungent, linear, 70–95 mm long, 3–5 mm wide, densely tomentose for entire length with ferruginous-brown indumentum. Microsporangiate cones elongate-ovoid, 25–33 cm long, 10–16 mm diameter, with dense ferruginous-brown indumentum; microsporophyll fertile zone 14–48 mm long, 8–15 mm wide; sterile zone 8–19 mm long; apical spine antrorsely recurved, 5–12 mm long. Megasporophylls 22–30 cm long, when young densely ferruginous-brown tomentose, glabrescent and then glaucous blue-grey; ovules 4 to 6 (usually 4); lamina broadly triangular, 45–60 mm long, 25–35 mm wide, strongly dentate with well developed teeth to 3 mm long, apical spine 15–18 mm long. Seeds ovoid, 35–40 mm long, 32–35 mm diameter, strongly grey-blue pruinose, green beneath wax covering, becoming yellow-purple when ripe; sarcotesta 3–4 mm thick. Figs. 1–6.

Specimens examined: **Queensland.** South Kennedy District: Terrace Range, Dec 2000, *Forster* PIF26540A (BRI); ditto, PIF26540C (BRI); ditto, PIF26543 (BRI); ditto, PIF26544 (BRI); ditto, Nov 2000, *Perry* s.n. (BRI).

Notes: *Cycas cupida* clearly belongs in *Cycas* series *Cairnsianosae* as defined by Hill (1998). The new species appears to be closest morphologically to both *C. couttsiana* and *C. desolata*, both of which are also the closest geographically, albeit over 200 km to the north. *Cycas cupida* differs from *C. desolata* (Forster 1995) in the greater number of leaflets in mature leaves (174–240 versus 90–136), the leaflets at the base of the leaf not narrowed and 90–100% of maximum width (versus 70–80%), the much longer cataphylls 70–95 mm (versus 30–45 mm) that are densely tomentose for the entire length (versus base only), the thicker microsporangiate cones (10–16 cm diameter versus 8–9 cm) with a longer apical spine on the microsporophyll (5–12 mm long versus 3–4 mm). *Cycas cupida* differs from *C. couttsiana* (Hill 1998) in thicker stems (20–30 cm diameter versus 14–20 cm), the leaflets at the base of the leaf not narrowed and 90–100% of maximum width (versus 60–80%), the new growth with ferruginous-brown indumentum (versus grey-white), the longer and larger microsporangiate cones (25–33 x 10–16 cm versus 15–20 × 7–9 cm) and the ferruginous-brown megasporophylls (versus grey) with a broadly-triangular lamina (versus narrow-triangular).

All species in *Cycas* series *Cairnsianosae* have blue-coloured leaves to some extent. In some species such as *C. cairnsiana*, this colour is intense and held for the life of the leaf. Other species such as *C. platyphylla* and *C. ophiolitica* are blue-coloured when the leaves are young, however this colour is soon lost. Both *C. couttsiana* and *C. desolata* are somewhat intermediate in this feature. By comparison *C. cupida* appears to retain the blue coloration, but not to quite the intensity of *C. cairnsiana.*

The six species in *Cycas* series *Cairnsianosae* may be distinguished in the following key. This key is designed for leaves from mature plants and will not work on juvenile material. It is important to collect cataphylls and to note indumentum colour on young leaves and the cataphylls if possible.

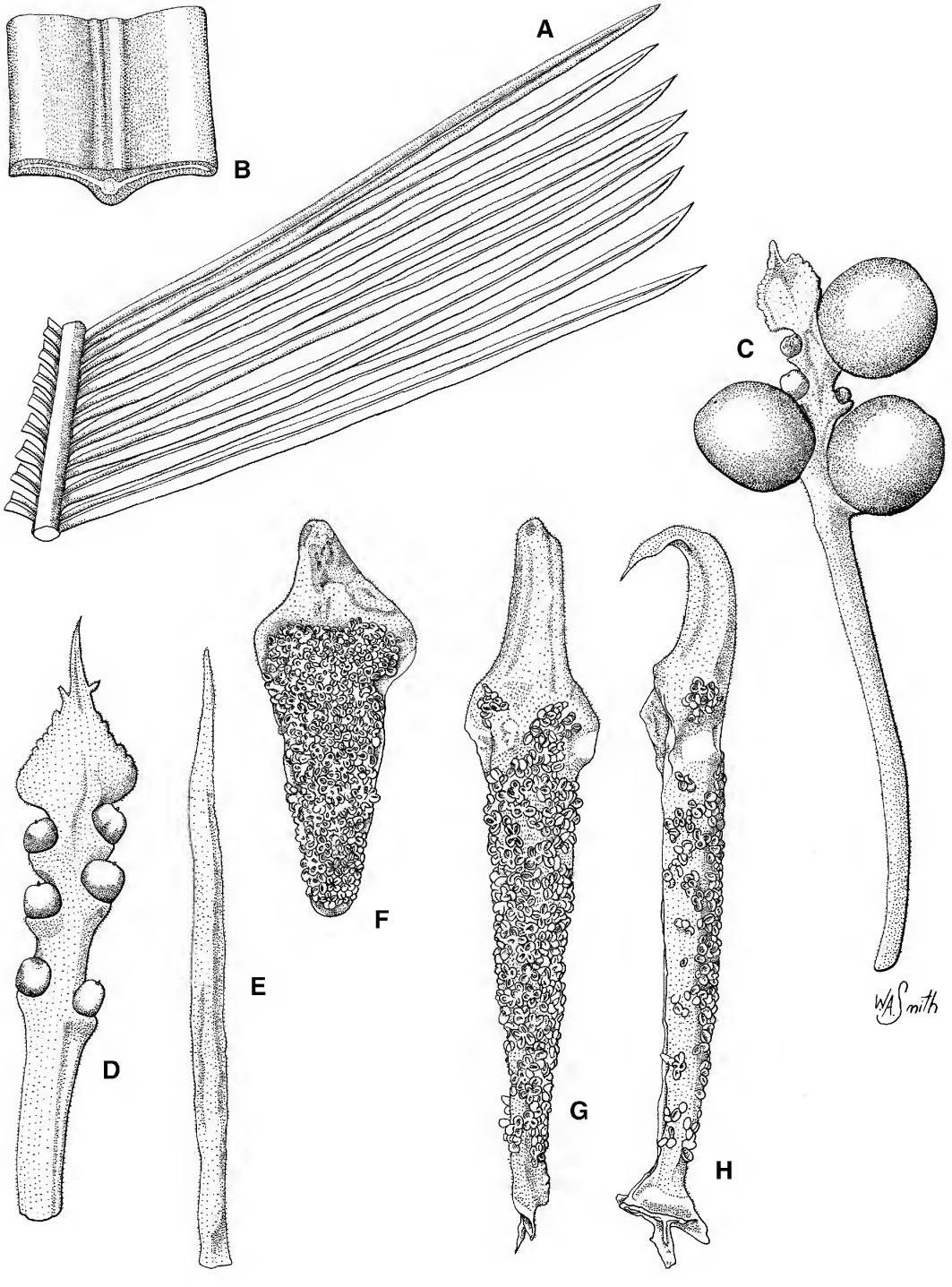

Fig. 1. ***Cycas cupida***. A. median part of leaf where leaflets are at maximum length. × 0.6. B. cross-section of a median leaflet. × 4. C. fruiting megasporophyll. × 0.4. D. immature megasporophyll. × 0.6. E. cataphyll. × 1. F. microsporophyll from near cone apex. × 3. G. & H. microsporophyll from near cone middle. × 3. A–D from *Forster* PIF26540A (BRI); E & F from *Forster* PIF26540B (BRI); G & H from *Forster* PIF26543 (BRI). Del. W. Smith.

Fig. 2. *Cycas cupida* habit.

Key to the species of *Cycas* series *Cairnsianosae*

1. Median leaflets in leaf 2–3 (4) mm wide, margins revolute ..... **C. cairnsiana**
   Median leaflets in leaf 4–7.5 mm wide, margins recurved to more or less flat 2

2. Basal leaflets in leaf not narrowed (80–100% of median leaflets width) ..... **C. cupida**
   Basal leaflets in leaf narrowed (55–80% of median leaflets width) 3

3. New growth with white or grey trichomes; median leaflets 6–7.5 mm wide; .....
   cataphylls narrow-triangular ..... **C. couttsiana**
   New growth with orange-brown trichomes; median leaflets 3.5–6 mm wide;
   cataphylls linear 4

4. Median leaflets 6–7.5 mm wide; cataphylls soft ..... **C. ophiolitica**
   Median leaflets 3.8–6 mm wide; cataphylls pungent 5

5 Short teeth at base of leaf petiole present; leaflets more or less straight,
   120–260 per leaf; median leaflets 90–170 mm long; indumentum covering
   entire cataphyll ..... **C. platyphylla**
   Short teeth at base of leaf petiole absent; leaflets antrorse, 90–136 per leaf,
   median leaflets 180–210 mm long; indumentum only at base of cataphyll ..... **C. desolata**

Fig. 3. ***Cycas cupida*** habit of large plant.

Distribution and habitat: *Cycas cupida* is restricted to the Terrace Range, south of Charters Towers. The Terrace Range is an isolated low-lying sandstone range with occasional low outcrops and clifflines of exposed sandstone rock. The vegetation (Fig. 6) comprises an open woodland dominated by *Corymbia clarksoniana, C. dallachiana* and *Eucalyptus crebra* with a midstorey of *Acacia bidwillii*, *A. salicina*, *Eremophila mitchellii*, *Lysiphyllum hookeri*, *Planchonia careya* and *Terminalia oblongata*. The cycads are widely spread in this habitat, being most abundant on the low hills, but can also be found concentrated in gullies and creeklines where they may occur on sandstone colluvium. Occasionally plants grow in crevices on low sandstone cliffs. The habitat is seasonally dry and very hot in the summer months from reflected heat from the exposed rocks.

Conservation status: This new species is abundant at the type locality and is widely distributed throughout the Terrace Range. An accurate population size is as yet unknown, but thousands of plants exist with no immediate threats to the population from land clearing or agriculture. Under the IUCN Red List Categories (Anon. 1994), *C. cupida* fulfils the criterion of 'vulnerable' under Category D2. It

Fig. 4. ***Cycas cupida*** female plant with megasporophylls.

is estimated that the area of suitable habitat comprises less than 60 km^2 and although diffuse, there is only one large population of this cycad. Blue-leaved cycads are desirous to cycad collectors (cf. Forster 1999) and it is likely that interest in *C. cupida* will be intense.

Etymology: The specific epithet is derived from the Latin *cupidus* (desirous) and alludes to the desirability of this cycad to collectors.

Acknowledgements

Thanks to Tim Perry and Step Lawler for bringing this species to my attention and for guidance in the field; Ron Booth for field assistance; the property owner for access; Peter Bostock for translation of the diagnosis into Latin and comments on the manuscript; and Will Smith for the illustrations.

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Fig. 5. ***Cycas cupida*** male plant with cone.

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Fig. 6. Habitat of ***Cycas cupida***.

New combinations and a new name in Australian Sapotaceae

L.W. Jessup

Summary

Jessup, Laurence W.(2001). New combinations and a new name in Australian Sapotaceae. *Austrobaileya* 6(1): 161–163. Five new combinations made as follows, *Niemeyera whitei* for *Amorphospermum whitei* Aubrev, *Pouteria queenslandica* for *Planchonella queenslandica* P.Royen, *Pouteria myrsinifolia* for *Sersalisia myrsinifolia* F.Muell., *Pouteria myrsinodendron* for *Chrysophyllum myrsinodendron* F.Muell., *Pouteria cotinifolia* var. *pubescens* for *Planchonella cotinifolia* var. *pubescens* P.Royen, while *Pouteria asterocarpon* is a new combination made at a new rank for *Planchonella pohlmaniana* var. *asterocarpon* P.Royen, and *Pouteria pearsoniorum* is a new name provided for *Planchonella macrocarpa* P.Royen.

Keywords: *Niemeyera*, *Pouteria*, Sapotaceae, Australia.

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Introduction

In preparing an account of Sapotaceae for the Flora of Australia, I have encountered several taxa requiring new combinations or new names. Pennington (1991) included *Amorphospermum* F.Muell. as congeneric with *Niemeyera* F.Muell. rejecting the distinction between them proposed by Aubréville (1962) based on thickness of the seed coat. One Australian taxon still requires a new combination under *Niemeyera* and this is provided below. In the same publication, Pennington provided a detailed discussion of the reasons why *Planchonella* Pierre should be included in *Pouteria* Aublet and his conclusions are accepted here. Several taxa currently recognised at species or varietal rank under *Planchonella* have not yet been formally placed under *Pouteria*. To remedy this situation the necessary new combinations are made and new name provided as follows.

Niemeyera whitei (Aubrev.) Jessup, **comb. nov**.

Amorphospermum whitei Aubrév., Adansonia ser. 2, 5: 23, t.2 (1965). **Type**: New South Wales, Whian Whian State Forest, May 1945 *C.T. White* 13043; (holo: BRI; iso: BRI, fide G.P. Guymer, Australian Systematic Botany Society Newsletter 31: 11–13 (1982)).

Pouteria queenslandica (P. Royen) Jessup, **comb. nov.**

Planchonella queenslandica P.Royen, Blumea 8: 341, 430 (1957), fig. 32. *Beccariella queenslandica* (P.Royen) Aubrev., Adansonia ser. 2, 3: 335 (1964). **Type**: Queensland, [South Kennedy District]: Eungella Mts, *H.H. Haines* 136 Q (holo: K).

[*Planchonella laurifolia* auct. non (A.Rich.) Pierre, W.D. Francis, Australian Rain-forest Trees 3rd edition p.350–353. Canberra, Australian Government Publishing Service; P. Royen, Blumea 8: 340, Fig. 31 (1957)].

Note: This tree, found in the rainforests of eastern Queensland and New South Wales, was incorrectly known for many years as *Planchonella laurifolia* (A.Rich.) Pierre. This name, based on *Sersalisia laurifolia* A.Rich., applies to a Northern Territory species now known as *Pouteria richardii* (F.Muell.) Baehni (as *Pouteria laurifolia* (Gomes) Radlk. applies to a different species). The type specimen of the former name was amongst several specimens given by Charles Fraser to Captain Jules Dumont d'Urville following Fraser's

Accepted for publication 13 March 2001

Austrobaileya 6 (1): 161–163 (2001)

expedition to Moreton Bay in 1828. Dumont d'Urville visited Sydney sometime during the voyage of the Astrolabe between 1826 and 1829. Unfortunately at least two specimens amongst this gift to the French visitors did not originate from Moreton Bay and were incorrectly included as part of Fraser's Moreton Bay collection. These specimens ultimately became types of two of Achille Richard's species' names, *Leucocarpum obscurum* A.Rich. (Celastraceae) and *Sersalisia laurifolia* A.Rich. (Sapotaceae). Replicates of these specimens were independently sent to Kew with the locality of origin noted on the label as Melville Island and the communicator as Charles Fraser. There is no evidence that Fraser ever went to Melville Island. The British naval settlement of Fort Dundas was established on Melville Island in 1824 not long after the establishment of Port Essington. Fraser sent a convict gardener, John Richardson, to be in charge of the garden for the new settlement of Port Essington (Barker & Barker, 1990). While there is no evidence that Richardson collected and dispatched specimens to Fraser, Richardson's convict status probably assured his name would not appear with any such specimens, their origin being attributed only to Fraser. Bentham (1863) noted the labelling error evident in the collections of *Denhamia obscura* (A.Rich.)Meisn. ex Walp. (*Leucocarpum obscurum* A.Rich.) but he apparently overlooked it when he examined and described, some years later, the Sapotaceae specimens as *Achras laurifolia* (A.Rich.)Benth.(Bentham, 1869).

Pouteria myrsinifolia (F.Muell.) Jessup, **comb. nov**.

Sersalisia myrsinifolia F.Muell. '*Sarsalisia*', Fragm. 5: 165 (1866). **Type**: [Queensland. Moreton District]: Brisbane River, "20 feet high found on the sides of river, flowers greenish", *W. Hill* [MEL1058112] (MEL, lecto here selected).

Selected additional specimens seen: **Queensland**: Sea Range, Dec 1855, F. Mueller (MEL1515834) (MEL); Moreton District: Moreton Bay, *W. Hill* (MEL1058111, MEL1058113) (MEL);Breakfast Creek, Moreton Bay, Jul 1843, *L. Leichhardt* (MEL1058110) (MEL, P); Brisbane River in 1829, *Fraser* (K). **New South Wales**: Sydney woods, Paris Exhibition, n. 27 and n. 40, 1855, *Moore* (P).

Note: Practically all herbarium specimens previously identified as *Planchonella myrsinoides* (A. Cunn. ex Benth.) S.T. Blake ex W.D. Francis or *Pouteria myrsinoides* (A. Cunn. ex Benth.) Baehni belong here. As the lectotype of *Achras myrsinoides*, basionym of both of the above two names, as selected by P.S. Green (1986) is taxonomically *Pouteria cotinifolia* var. *pubescens* (see below), another name is needed for the other plants Bentham included under that name. As lectotypified here, Mueller's name *Sersalisia myrsinifolia* of 1866 is the earliest legitimate name applying to them hence a new combination under *Pouteria* is required. Thus *Pouteria myrsinifolia* becomes the correct name for the plant called for many years *Planchonella myrsinoides*. I have examined at K and MEL all the specimens cited by Bentham (1869) and all except the Cunningham collection from Rodd's Bay are of *P. myrsinifolia*.

Pouteria cotinifolia var. **pubescens** (P.Royen) Jessup, **comb. nov**.

Planchonella cotinifolia var. *pubescens* P. Royen, Blumea 8: 296, 428 (1957). **Type**: Queensland. Leichhardt District: Duaringa, mixed softwood forest, 23 Nov 1943, *C.T. White* 12462; holo: L; iso: BRI.

Pouteria myrsinoides (A. Cunn. ex Benth.) Baehni, Candollea 9: 303 (1942); *Achras myrsinoides* A. Cunn. ex Benth., Fl. Austral. 4 (16 Dec. 1868) 283. *Sideroxylon myrsinoides* (A. Cunn. ex Benth.) F.Muell., Systematic Census of Australian Plants 92 (1883); *Planchonella myrsinoides* (A. Cunn. ex Benth.) S.T. Blake ex W.D. Francis, Australian Rain Forest Trees ed. 2, 358 (1951); *Xantolis myrsinoides* (A. Cunn. ex Benth.) Baehni, Boissiera 11: 23, fig 17 (1965); *Sapota myrsinoides* (F. Muell. ex Benth.) Radlk. ex Holle, Thése Erlangen 17 (1892); fide C. Baehni, Candollea 9: 303 (1942); *Sersalisia myrsinoides* (A.Cunn. ex Benth.) Domin, Biblioth. Bot. 89: 508 (1928). **Type:** [Queensland. Port Curtis District]: Rodd's Bay, A. Cunningham 123 (lecto: K, fide P.S. Green (1986));

Note: These changes affect the name of the New Caledonian and Lord Howe Island plant called *Pouteria myrsinoides* subsp. *reticulata* (Baill.) P.S.Green. I hesitate to make a new combination for this plant under either *P. cotinifolia* or *P. myrsinifolia* as I have not examined the New Caledonian specimens to verify Green's conclusion that they and the Lord Howe Island specimens represent the same subspecies (Green 1990). Until further work on the relationships between these Australian and neighbouring island plants is done it seems best to apply the name *Pouteria howeana* (F.Muell.) Baehni to the Lord Howe Island and New Caledonian plants.

Pouteria pearsoniorum Jessup, **nom. nov**.

Planchonella macrocarpa P. Royen, Blumea 8: 320, 429, fig. 27 (1957), non *Pouteria macrocarpa* (Martius) D. Dietrich, Synopsis Plantarum 1:431 (1839) et non *Pouteria macrocarpa* (Huber) A.Ducke, Bol. Técn. Inst. Agron. N. No.8. 11 (1946), nom. illegit.**Type**: Queensland. Cook District: Kaban, *Pearson brothers* s.n. (holo: BRI; iso: BRI, L).

Etymology: The epithet honours the Pearson brothers, collectors of the type specimen.

Note: B. Hyland (pers. comm.) has suggested that the locality Kaban is more likely to be a postal address than the place where the type was actually collected.

Pouteria myrsinodendron (F.Muell.) Jessup, **comb. nov**.

Chrysophyllum myrsinodendron F.Muell., Fragm. 6: 178 (1868). **Type**: [Queensland. North Kennedy District]: Herbert River, *J. Dallachy*." (holo: MEL; iso: BM ex herb. Hance).

Planchonella obovoidea H.J.Lam, Bull. Jard. Bot. Buitenzorg ser.3, 7: 207, fig. 56 (1925). **Type**: [Malesia]. Kai Is., *Jaheri* 134 (holo: ?BO n.v. fide Lam, op. cit.; iso: L). *Pouteria obovoidea* (H.J. Lam) Baehni, Candollea 9: 412 (1942).

Note: Bentham (1869, p.283) referred to Mueller's name as representing a possible form of *Pouteria obovata* (R.Br.) Baehni which he accepted as *Achras obovata* (R.Br.) F.Muell. ex Benth. This may have obscured the plant's true identity from subsequent authors.

Pouteria asterocarpon (P.Royen) Jessup, **comb.** et **stat. nov.**

Planchonella pohlmaniana var. *asterocarpon* P.Royen, Blumea 8: 395, 432, fig. 42 e-f. (1957). **Type**: Queensland. [Cook District]:Atherton district, *Kemp* s.n. [AQ22582] (holo: BRI).

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New species of *Livistona* R. Br. (Arecaceae) from north Queensland and Papua New Guinea

John L. Dowe and Anders S. Barfod

Summary

Dowe, J. L. & Barfod, A. S. (2001). New species of *Livistona* R. Br. (Arecaceae) from north Queensland and New Guinea. *Austrobaileya* 6 (1): 165–174. *Livistona concinna*, *L. surru* and *L. tothur* are described as new. *Livistona concinna* is endemic in north Queensland, and *L. surru* and *L. tothur* are endemic in Papua New Guinea. Each species is illustrated.

Keywords: Arecaceae; *Livistona* – Queensland, New Guinea; *Livistona concinna*; *Livistona surru*; *Livistona tothur*.

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Introduction

Livistona R.Br., with about 33 species, has an unusually widespread distribution for a palm genus, occurring from the Horn of Africa and Yemen, through east Asia to Japan and the Bonin Islands, throughout south-east Asia and Malesia to as far east as the Solomon Islands, and in the north, east and centre of Australia. Australia has about 18 species. New Guinea has about seven species, two of which also occur in northern Australia across Torres Strait, and others which are endemics that are most closely related to species in the Philippines, eastern Indonesia and the Solomon Islands.

The genus *Livistona* in Australia was treated by Rodd (1998) as having 16 species and three subspecies. Dowe and Jones (in press, Flora of Australia) have recognised 18 species following minor adjustment to Rodd's taxonomy. The genus in New Guinea has had no recent treatment, although it has received attention in the past from Beccari (1877, 1921) and Burret (1935, 1939, 1941) who both described new taxa within it. Rodd (1998) recently combined one of Beccari's and three of Burret's taxa with those species that are shared with Australia.

Accepted for publication 20 July 2001

In Australia, many species of *Livistona* are ubiquitous in some areas, forming large colonies that dominate their local environment. Only a few species are considered rare. In New Guinea, the distribution ranges are fragmented and locally most species are rare occuring in scattered groups on isolated ridges and mountain slopes.

The new taxon from north Queensland described here has had some previous recognition as a distinct species. Jones (1984) listed it as "*Livistona* sp. Cooktown", and suggested that it was "similar in many respects to *Livistona benthamii* F.M. Bailey, but the leaves are light green on both surfaces and the lamina has a broad central area where the segments are fused". This 'tag' name was accepted by Irvine (1984) who placed the taxon in a group that included *L. drudei* F.Muell. ex Drude as well as *L. benthamii*, while Tucker's (1988) informal account provided convincing evidence for the taxon's distinctiveness.

The two new taxa from New Guinea described here were discovered during field-work conducted within the framework of the Palms of New Guinea (PONG) project that is currently being coordinated by the Royal Botanic Gardens, Kew, England. This project covers the island of New Guinea, and its aim is to publish an account of the palm flora of this

island in the near future. Both of the above new taxa appear to be confined to Papua New Guinea despite extensive field-work having been carried out in Papua (formerly Irian Jaya) as part of the PONG project. An indication of the lack of recognition of any diversity within *Livistona* in New Guinea was provided by Essig (1977) who quoted unpublished notes by Moore stating: "....the species of *Livistona* in New Guinea are difficult to separate from related species in Australia and the Solomon Islands. Possibly there are no true endemics of *Livistona* in New Guinea.". However, Essig and Young (1981) described from the West Sepik Province "specimens of a large *Livistona* bearing red fruit that we had seen from the helicopter, but found only a few sterile individuals", and Hay (1984) mentioned an uncollected taxon in Madang Province: "...isolated stand near the mouth of the Ramu River has apparently not been collected. Here the Livistonas are growing in a remarkable rain forest dominated almost to the exclusion of dicotyledonous trees by palms...". These populations are indeed of the new taxa described in this account, and illustrate both the cryptic nature of *Livistona* in New Guinea and the need for thorough field-work.

Materials and methods

Field-work was undertaken by the authors in Queensland and Papua New Guinea, between 1996 and 2000. Specimens were examined at AAU, BO, BRI, LAE, K, QRS and SING, and specimens lodged at AAU, BRI, LAE and K.

Taxonomy

Livistona concinna Dowe & Barfod **sp. nov.**, quod in inflorescentias individuorum non fructiferorum ad *L. drudei* F.Muell. ex Drude accedit sed ab ea differt essentialiter inflorescentii fructiferis validioribus et ramosis ad ordinem altiorem. Arbor usque ad 30 m alta, velut dioecia fungens. Lamina foliorum profunde segmentata, segmentis apice cernuo. Inflorescentiae non ramosae intra prophyllum. Inflorescentiae partiales 8 vel 9, individuis non fructiferis 120–180 cm longis, ramosis ad ordinem quartum, individuis fructiferis 160–250 cm longis, ramosis ad ordinem quintum, bracteae in rhachidibus et rachillis glabrae. Flores hermaphroditi solitarii vel 2–4 fasciculati. Pedicellus fructus ad 2 mm longus, fructus globosus, 9–12 mm diametro, epicarpium anthracinum, punctis lenticellularibus dispersis, mesocarpium circa 1 mm crassum, oleosum. **Typus:** Queensland. Cook District: 16 km north of Cooktown, just north of the Cooktown Airport, Barrett Creek, 15°25'S, 145°11'E, 5 m alt., 17 Oct 2000, *J. L. Dowe* 607 (holo: BRI; iso: AAU, K, QRS).

Solitary, functionally dioecious palm. Trunk to 30 m tall, with diameter at breast height 24–35 cm, expanded at the base to 100 cm diam., grey; nodes raised; internodes 2–12 cm wide; petiole bases not persistent. Leaves 50–65 in a globose to hemispherical crown; petioles 120–300 cm long, glabrous, green throughout, proximally 5–11 cm wide, 2.2–3.5 cm wide in mid area and distally c. 2.8 cm wide, triangular in cross-section, adaxially moderately longitudinally ridged, abaxially rounded, margins with solitary symmetric black spines 3–5 mm long congested in the proximal portion with distal margins unarmed, sharp, slightly winged; leaf-base fibres not prominent, coarse, persistent; hastula raised, sharp, papery on the margins; lamina strongly costapalmate, glabrous, adaxially mid-green, abaxially slightly lighter green, glossy on both surfaces, non-waxy, sub-circular in profile, 155–165 cm long, about 200 cm wide, folded; segments 60–78, apices deeply forked, distal portion pendulous; segment free for about 60% of their length, and with apical split about 41% of the length of their free portion; mid-lamina segments 2.6–4 cm wide at the disjunction, with apices acuminate, filamentous; longitudinal veins 9 or 10 each side of midrib, parallel, more prominent than the transverse veins which are thin and extend across 2–4 parallel veins; density of transverse veins about 12 per unit area of 15 × 10 mm. Inflorescence an unbranched axis with several partial inflorescences decreasing in size toward the apex, sexually dimorphic; non fruit bearing (functionally male) inflorescences 120–180 cm long with partial inflorescences 8 or 9; most

proximal partial inflorescences branched to the 4th order, or to the 3rd order in the distal partial inflorescence; partial inflorescences slightly curved; peduncle dorsi-ventrally compressed, c. 25 mm wide and 10 mm thick, glabrous; fruit bearing (functionally female) inflorescences 160–250 cm long with partial inflorescences 8 or 9; most proximal partial inflorescences branched to the 5th order, to the 3rd order in the distal partial inflorescence; partial inflorescences slightly curved, held horizontal to semi-pendulous; peduncle dorsi-ventrally compressed, c. 30 mm wide and 10 mm thick; peduncule lacking empty bracts; prophyll 27–35 cm long, ancipitous, glabrous; bracts on the rachis 30–50 cm long, tubular, tightly sheathing, not disintegrating or splitting with age, glabrous, apically acute with margins entire and lateral splits uneven with one about twice as deep as the other; rachillae 5–20 cm long, glabrous. Flowers solitary or in clusters of 2–4, 1.6–2 mm high and about 2 mm wide, white to cream; sepals basally fused, cupular, 3-lobed with lobes triangular and margins hyaline, to about 1.5 mm high and with apices acute; petals triangular, slightly asymmetric, 2–2.2 mm long, 1.8–2 mm wide at the base, acute at the apex; stamens about 1 mm high; filament subulate; connective very thin; anthers dorsifixed, ovoid, c. 0.2 mm long, didymous; carpels wedged-shaped, rounded; styles fused, c. 1 mm high; stigma erect, trilobed; fruiting pedicel to 2 mm long. Fruit globose, 9–12 mm diam., shiny black; stigmatic remains subapical; epicarp smooth but with scattered lenticellular dots, drying slightly rugose with integumental scar extending from the stigmatic remains for about ¾ the length of the fruit toward the base; mesocarp c. 1 mm thick, moist, oily and gritty in texture; endocarp thin, crustaceous, light brown, 0.1–0.2 mm thick. Seed globose to subglobose; seedcoat intrusion extending to half or less of the width of the seed, contorted, light brown, crystalline and spongy in texture; embryo lateral to sublateral, c. 2 mm long. Eophyll 5-ribbed. Fig. 1.

***Specimens examined*: Queensland.** Cook District: Lakefield National Park, Kennedy Bend, 14°50'S, 144°15'E, 50 m alt., Oct 1997, *Dowe* 415 *with Smith* (JCT); Lakefield National Park, Twelve Mile Waterhole, Oct 1999, *Dowe* 606 *with Barfod* (BRI, JCT, K); Kennedy River, 5.5 km N of New Laura Station, 15°07'S, 144°18'E, 50 m alt., riparian forest, Nov 1981, *Irvine* 2204, 2205 (QRS); near Cooktown airport, Barrett Ck, *Gray* 2764 (QRS); 3.3 km NE of Cooktown Airport, Barrett Creek, NW boundary, 15°25'S, 145°12'E, 0 m alt., riparian evergreen mesophyll vine forest bordering mangroves, Nov 1981, *Irvine* 2178, 2179, 2180 (QRS); near Cooktown, Barrett Creek, 15°33'S, 145°12'E, 0 m alt., Oct 1999, *Dowe* 604 *with Barfod* (BRI, JCT, K); Endeavour River, opposite the SW corner of the Cooktown Airport, 15°27'S, 145°11'E, 3 m alt., Nov 1981, *Irvine* 2181 (QRS); 3.3 km off main road at north side of Cooktown Airport, Aug 1986, *Hind* 4594 *with Hill & Healy* (NSW); Cooktown, S side of Endeavour River, near Anzac Park, 15°28'S, 145°15'E, 10 m alt., Feb 1996, *Dowe* 252 (BRI, FTG, JCT). Cultivation. Queensland. Townsville, Anderson Park Botanic Gardens, Oct 1998, *Dowe* s.n. (JCT).

***Distribution and habitat*:** Australia. Queensland: Flinders Island, drainage area of the Kennedy River and tributaries, Barrett Creek and along the Endeavour River north of Cooktown and Archer Point south of Cooktown; in seasonally moist open forest, seasonally inundated *Melaleuca* swamp, along creek and river banks, and at mangrove margins in non-saline environments; soils usually alluvial. Occurs with *Corypha utan* Lam. in the Kennedy River area and with *L. muelleri* F. M. Bailey in the vicinity of Cooktown. Most populations are regularly affected by fire.

***Phenology*:** Flowering December to March; fruiting April to October.

***Etymology*:** From Latin *concinnus*, neat, well-arranged, in reference to the organised and neat appearance of the petioles in the crown compared to those in other *Livistona* species.

***Conservation*:** Adequately conserved in Lakefield National Park, Endeavour River National Park and on Flinders Island.

***Notes*:** Specimens of this taxon were tentatively placed under *L. drudei* by Rodd (1988). Rodd cited three specimens (*Irvine* 2204 & 2205, and *Hind* 4594) that were collected in the distributional range of *L. concinna*. One consists of a fallen dead leaf and an old infructescence. Although there is some gross resemblance of *L. concinna* to *L. drudei*, differences are otherwise significant, particularly in morphology of the inflorescence and fruit. The inflorescence of non fruit-bearing individuals is similar to that in *L. drudei*, but the fruit-bearing inflorescences are more robust and branched to a further order in *L. concinna* than they are in *L. drudei*. Although *L. concinna* occurs with *L. muelleri* in some locations, we

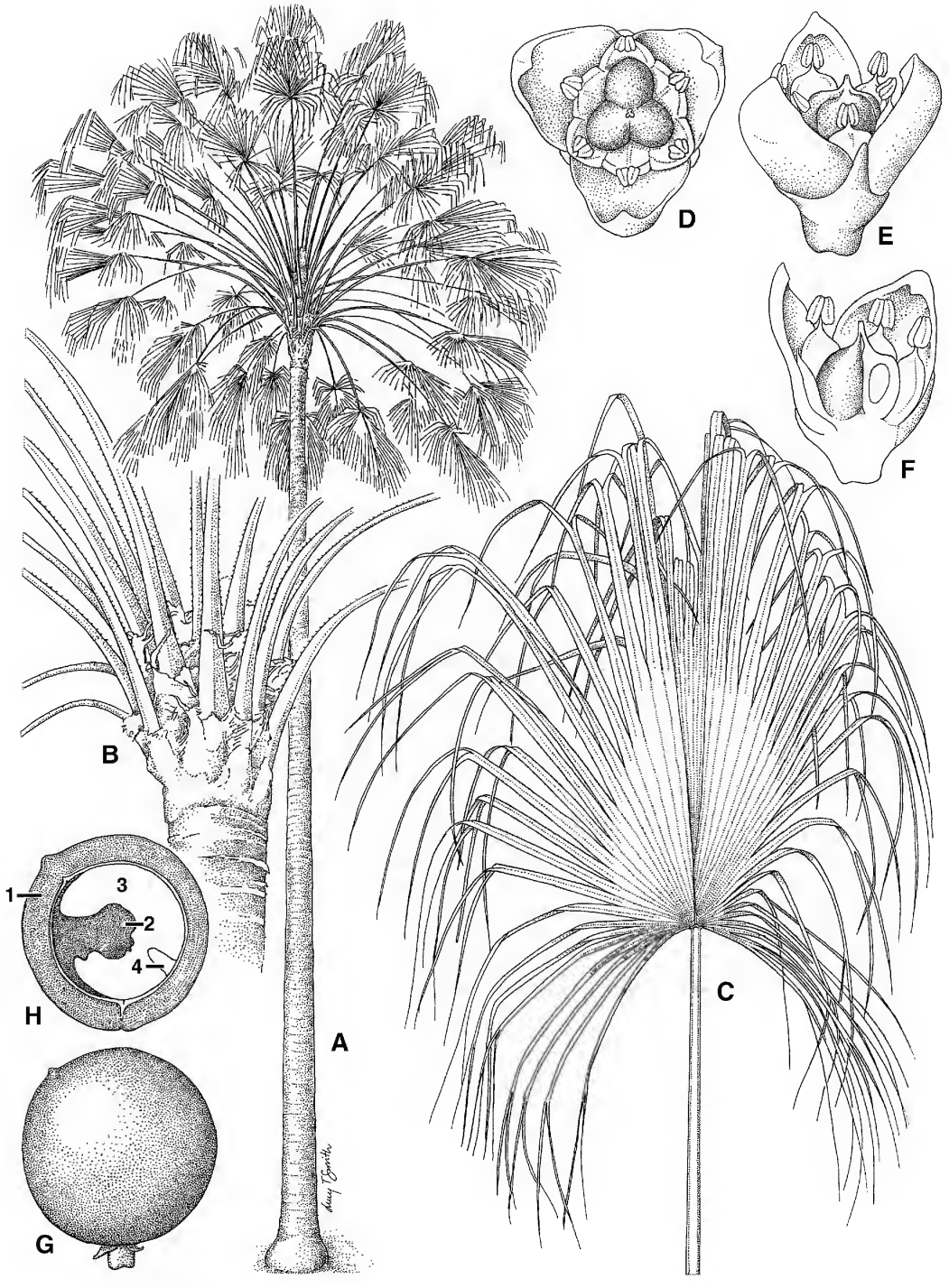

Fig. 1. *Livistona concinna*. A. Habit. B. Leaf-bases and leaf-base fibres of crown × 0.05. C. Leaf in adaxial view × 0.06. D. Flower viewed from above. E. Flower in lateral view. F. Flower in LS view showing orientation of the ovule. D-F × 17.5. G. Fruit in lateral view. H. Fruit in LS view showing mesocarp [1], seedcoat intrusion [2], endosperm [3] and embryo [4]. G-H × 2.7. A-C from *Dowe* 607 (K); D-F from *Dowe* s.n., 17 Oct. 1998 (JCT); G-H from *Dowe* 252 (JCT). Del. Lucy T. Smith.

have not detected, at least by visual means, any putative hybrids between the two.

Livistona surru Dowe & Barfod **sp. nov.** Species haec ab *L. tothur* Dowe & Barfod differt colori laminae foliorium quasi aequali utrinque, apice segmentorum foliorum cernuo, bracteis in pedunculis absentibus, bracteis in rhachidibus fibrosis et dense pubescentibus, paginis axium inflorescentiarum dense pubescentibus, fructibus rubellis aurantiacis ad 65 mm diametro, granis sclerotis longistrorsum parallelis in epicarpio inclusis. Arbor usque ad 20 m alta, velut dioecia fungens. Segmenta laminae foliorum apice cernuo. Inflorescentiae prophyllo ramosae axibus 3 collateralibus subaequalibus, unumquemque inflorescentiis partialibus 5–7, individuis fructiferis ad ordinem secundum divisis, bracteae in rhachidibus et rhachillis dense pubescentes. Flores 2–4 fasciculati. Pedicellus fructus 6–12 mm longus, fructus globosus versus obovoideus, 55–65 mm diametro, epicarpium rubellum aurantiacum punctis lenticellularibus dispersis, mesocarpium latum et carnosum fibris crassis. **Typus:** Papua New Guinea. West Sepik Province: Miwaute, 03° 25'S, 142° 07'E, 950-1000 m alt., 20 Nov 1996, *A. S. Barfod* 390 *with M. D. Ferrero & A. Damborg* (holo: AAU; iso: K, LAE).

Solitary, functionally dioecious palm. Trunk to 20 m tall, 18–25 cm diameter at breast height, erect, slightly broader at the base, light grey, usually covered by crustaceous lichens; nodes slightly raised, internodes to 5 cm wide, lacking longitudinal fissures, petiole bases not persistent. Leaves 17–29 in a spherical to vertically oblong crown; petiole 140–180 cm long, slightly arching, green, proximally about 19 cm wide and triangular in cross section, adaxially flat, abaxially rounded, glabrous except for scattered lepidote scales that are brown in the centre and grey at the margin, more densely so on the abaxial surface with margins with single or grouped black spines 5–10 mm long, largest and more closely inserted in the proximal portion, becoming smaller and wider spaced in the distal portion; leaf-base fibres in 2 layers, the outer with thick fibres, the inner with thin coir-mat like fibres, reddish brown, persistent until leaf fall then deciduous in sheets; ligule to 1 m long, to 10 mm thick; hastula very prominent, raised c. 2 cm, 5 cm wide, thick edged; lamina sub-circular to ovate, 180–224 cm long, 143–160 cm wide, undulate, adaxially mid green, abaxially similar green, pendulous in the distal portions; segments 70–90, free for 45–80% of their length and apically split about 6% of length of their free portion; mid-lamina segments 4.5–7 cm wide at the disjunction; parallel veins 5 or 6 on each side of midrib, more prominent than transverse veins which are thin and extend across 2–6 parallel veins with a density of about 22 per unit area of 15 × 10 mm. Inflorescences basally branched within the prophyll with 3 subequal axes about 120 cm long; each axis bears 5–7 partial inflorescences which are branched to the 3rd order on non fruit-bearing plants, to the 2nd order on fruit-bearing plants but otherwise similar; prophyll to 37–42 cm long, 12.5–15 cm wide, glabrous, lacerate-fibrous at the apex; peduncle of individual axes subterete, to 3 cm wide, lacking bracts; bracts on rachises 40–45 cm long, loosely tubular, fibrous, disintegrating at the apex with maturity, pubescent throughout but more densely so toward the apex; rachillae subterete to angular, 14–24 cm long, densely covered with long coarse red appressed scales in the proximal portion, with long white scales distally; scales less dense to absent in the extreme distal portions. Flowers in clusters of 2–4; fruiting pedicel 6–12 mm long, c. 3 mm across, green, with prominent scars from fallen flowers. Fruit globose to obovoid, 55–65 mm long, 50–55 mm diam., orange-red, shiny; epicarp with scattered lenticellular dots and c. 3 mm long lines pointed toward the fruit apex; stigmatic remains present apically; longitudinal stripe of suberised epidermal tissue usually visible for full length of fruit; mesocarp fleshy with fibres thick, distributed throughout but more densely aggregated toward the endocarp and shallowly embedded in the surface of the endocarp; endocarp to 2 mm thick, bony. Seed globose to subglobose, 30–40 mm diam.; endosperm intruded by the seedcoat to about two-thirds across; intrusion broadly kidney-shaped, crystalline/spongy, orange; embryo lateral. Fig. 2.

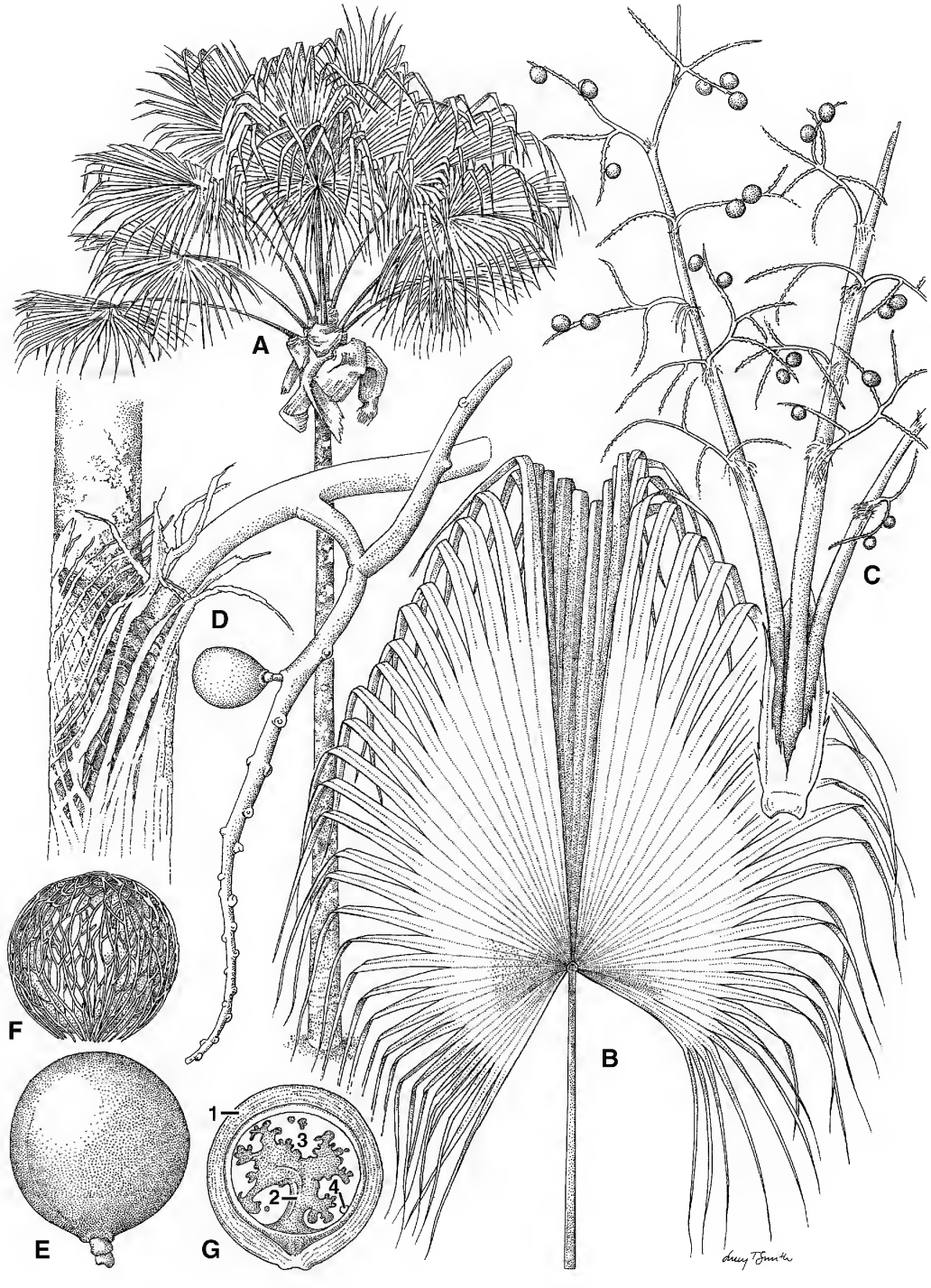

Fig. 2. *Livistona surru*. A. Habit. B. Leaf in adaxial view × 0.06. C. Infructescence × 0.09. D. Basal portion of partial infructescence showing rachis bract apex and immature fruit × 0.4. E. Fruit in lateral view. F. Fruit with epicarp removed exposing mesocarp fibres. G. Fruit in LS view showing mesocarp [1], seedcoat intrusion [2], endosperm [3] and embryo [4]. E-G × 0.4. A, C, D & E from *Barfod* 390 (K); B, F & G from *W.J. Baker* 582 (K). Del. Lucy T. Smith.

***Specimens examined*: Papua New Guinea**. WEST SEPIK PROVINCE: Miwaute, 142° 07'E, 03° 25'S, 950-1000 m alt., Nov 1996, *Barfod* 399 *with Ferrero & Damborg* (AAU, K, LAE); Upper Freida River, Mt Ekwai, 1200-1300 m alt., Feb 1998, *Ferrero* 980029 (LAE). MADANG PROVINCE: Bosmun village at mouth of Ramu River, 04°07'S, 144°43'E, 10-20 m alt., Nov 1996, *Damborg* 354 *with Ferrero & Barfod* (AAU, LAE, K); Goinbang, near Bosmun 2, mouth of Ramu River between Bogia and Bosmun 2, Jan 1996, *Baker* WJB582 (K).

***Distribution and habitat*:** Papua New Guinea. West Sepik Province, Miwaute area and Mt Ekwai; Madang Province, in the vicinity of the mouth of Ramu River.

***Phenology*:** Flowering November to January; fruiting March to June.

***Etymology*:** From the native Olo language vernacular name *surru*, used in the Miwaute area for this plant.

***Ethnobotany*:** Leaves are used for roof thatching and umbrellas, stem portions for axe handles and house frames, and leaf sheath fibres for brooms and sago strainers.

***Notes*:** *Livistona surru* is distinguished by its leaf lamina with almost equal colour on both surfaces; leaf segment apices pendulous, the absence of bracts on the inflorescence peduncle, the presence of densely pubescent, fibrous bracts subtending the basal branches of the partial inflorescences, the surfaces of the inflorescence axes being densely pubescent, and by its large orange-red fruit to 65 mm diameter with thick mesocarp fibres and prominent longitudinally parallel sclerids embedded in the epicarp.

Livistona tothur Dowe & Barfod **sp. nov.** differt a *L. surru* Dowe & Barfod colore argenteo glauco in latere abaxiali laminae foliorum, apice segmentorum foliorum rigido, praesentia bracteae ad basim uniuscujusque axium inflorescentiae, bracteis in rhachidibus chartaceis et glabris, paginus axium inflorescentiarum glabris vel moderate pubescentibus, fructibus rubellis aurantiacis ad 43 mm diametro. Arbor usque ad 20 m alta, velut dioecia fungens. Pagina adaxialis laminae foliorum aeruginosa, pagina abaxialis argentea glauca, segmenta laminae foliorum rigida ad apicem, inflorescentiae prophyllo ramosae axibus 3 collateralibus subaequalibus, unumquemque inflorescentiis partialibus 5 vel 6, in individuis fructiferis ramosis ad ordinem tertiam, bracteae in rhachidibus et rhachillis fere glabrae. Flores solitarii rubrae. Pedicellus fructus 2.5–5 mm longus, fructus globosus, 35–43 mm diametro, epicarpium rubellum aurantiacum, punctis lenticellularibus dispersis, mesocarpium latum, fibris tenuibus. **Typus**: Papua New Guinea. WEST SEPIK PROVINCE: Onake Mts, on road to Niau Kono from Vanimo, 2°45.89'S, 141°04.06'E, 500 m alt., 26 Nov 1996, *A. Damborg* 418 *with A. S. Barfod* (holo: AAU; iso: K, LAE).

Solitary, functionally dioecious palm. Trunk to 20 m tall, 15–20 cm diameter at breast height, erect, slightly swollen at the base, grey, nodes slightly raised, c. 1 cm wide, dark grey, internodes to 15 cm long; petiole bases not persistent. Leaves 24–40 in an open spherical crown; petiole 150–200 cm long, proximally about 10 cm wide, distally about 15 mm wide, adaxially flat, abaxially rounded, arching, green, glabrous, margins with single, recurved, green spines 1–2 mm long throughout its length, but largest and more closely spaced in the proximal portion; margins lacerate fibrous in extreme proximal portion; leaf-base fibres prominent, in 2 layers of more or less equal coarseness, persistent in sheets, chestnut brown; ligule to 60 cm long; hastula raised to c. 10 mm, semi-circular; lamina sub-circular, 150–200 cm long, 120–150 cm wide, adaxially bluish-green, abaxially silvery glaucous; segments 60–75, rigid with apex becoming pendulous only with age or damage, free for 62–85% of their length and apically split for 1–3% of the length of their free portion, 3–4 cm wide at the disjunction; segments not overlapping in the hastula region; parallel veins 6 or 7 on each side of midrib, more prominent than transverse veins which are very thin and extend across 2–7 parallel veins with a density of c. 33 per unit area of 15 × 10 mm. Inflorescences basally branched with 3 similar collateral axes, each about 200 cm long with 5 or 6 partial inflorescences which in fruit-bearing plants are branched to the 3rd order; prophyll c. 30 cm long and 10.5 cm wide,

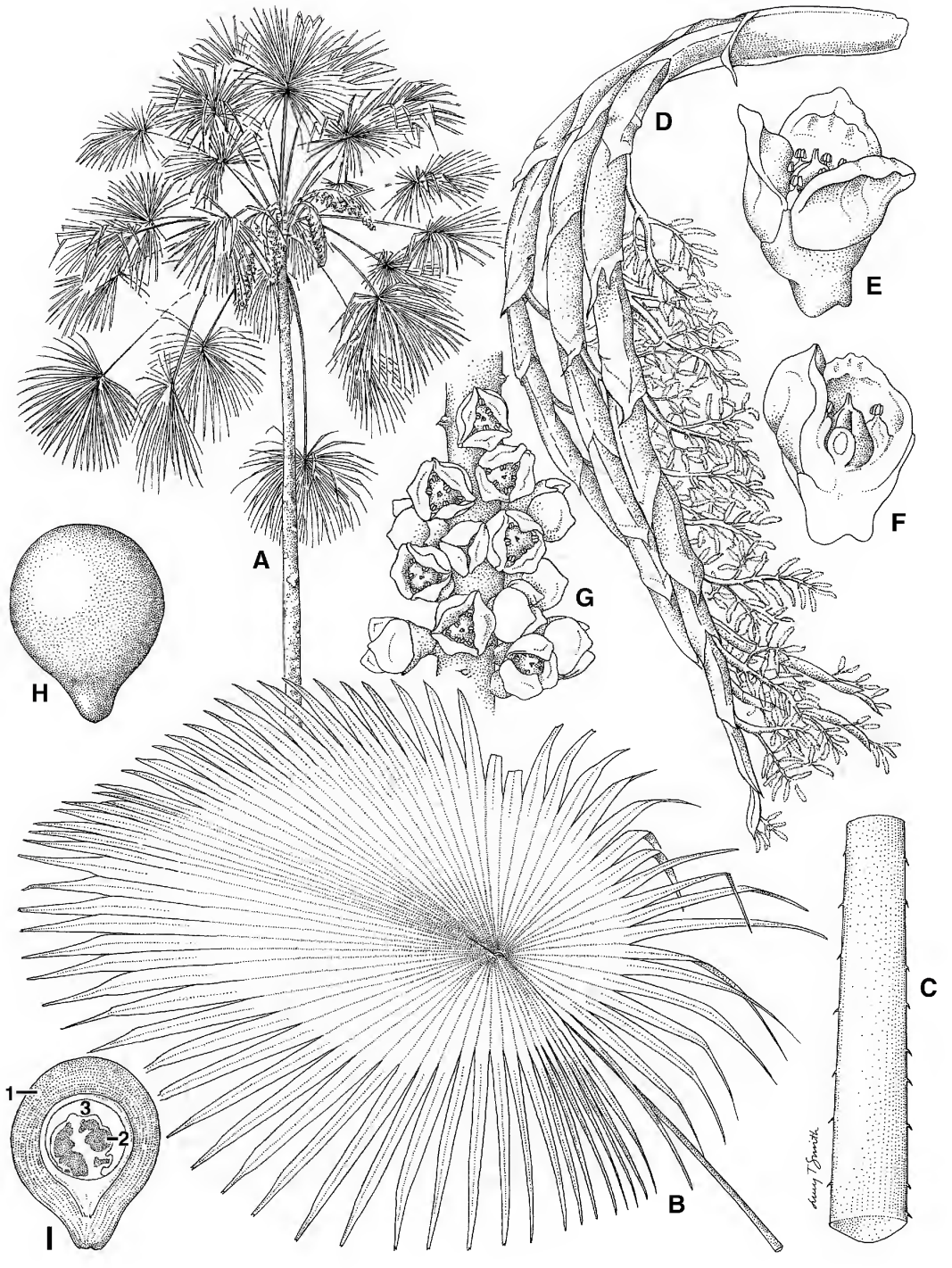

Fig. 3. *Livistona tothur*. A. Habit. B. Leaf in adaxial view × 0.05. C. Mid-section of petiole × 0.2. D. Inflorescence × 0.08. E. Flower in lateral view. F. Flower in LS view showing orientation of the ovule. E-F × 20. G. Flowers attached to rachilla × 7. H. Fruit in lateral view. I. Fruit in LS view showing mesocarp [1], seedcoat intrusion [2], and endosperm [3]. H-I × 0.5. A, D, E, F & G from *Barfod* 510 (K); B from *Dowe* 516 (JCT); C, H & I from *Damborg* 418 (K). Del. Lucy T. Smith.

yellow and coriaceous proximally, brown and chartaceous distally, glabrous apart from a ferrugineous woolly tomentum along the carinae; peduncle with one tubular, papery and loosely sheathing bract, densely scaly at the apex, glabrous; peduncle of individual axes proximally subterete, becoming dorsi-ventrally compressed distally with edges angular, furfuraceous in parts enclosed in bracts, otherwise patchily furfuraceous or glabrous on exposed surfaces; bracts on rhachises tubular, papery, loosely sheathing, glabrous apart from some irregular pubescence toward the apex; apices more or less non-fibrous showing only minor disintegration; rachillae rigid, terete, 6–12 mm long, to 3 mm diam., glabrous, red, irregularly disposed. Flowers solitary; sepals fused, red, tri-lobed with lobes to 1.2 mm long; petals broadly triangular, about 2 mm long, basally connate for about half their length, thick, fleshy, red with apical margins recurved, the inner surface bearing the impression of the stamens, the outer surface minutely warty; stamens much shorter than petals, basally fused to petals; filaments very short; anthers c. 0.2 mm long, cream; fruiting pedicel 2.5–5 mm long, c. 2 mm wide. Fruit globose but with a basal constriction, 35–43 mm diam., orange-red with stigmatic remains present apically; epicarp with scattered lenticellular dots, glossy with a longitudinal stripe of suberised epidermal tissue usually visible for the full length of the fruit; mesocarp 13–15 mm thick, softly fibrous, mealy, orange; endocarp to 2 mm thick, bony. Seed globose, 22–28 mm diam.; endosperm deeply intruded by the seedcoat; intrusion kidney shaped with an orange pulpy tissue; embryo lateral. Fig. 3.

***Specimens examined*: Papua New Guinea.** West Sepik Province: Onake Mts, Apol area, on road to Niau Kono from Vanimo, 02°45.89'S, 141°04.06'E, 500 m alt., Feb 1998, *Dowe* 516 *with Ferrero* (JCT, LAE); Onake Mts, Niau, 2°46.276'S, 141°03.611'E, 425 m alt., Mar 2000, *Barfod* 510 *with Banka & Kjaer* (AAU, BRI, JCT, K, LAE).

***Distribution and habitat*:** Papua New Guinea: West Sepik Province, Onake Mts, 400–600 m alt., in rainforest on ridges of limestone and metamorphic rocks.

***Phenology*:** Flowering November to January; fruiting March to June.

***Etymology*:** From the native Bewani language vernacular *tothur*, pronounced 'tot-her', and used in the Niau area for this plant.

***Ethnobotany*:** Bows and roof struts are fashioned from the petioles, umbrellas are made from the leaves and salt is extracted from the ash of burned petioles.

***Notes*:** *Livistona tothur* is distinguished by the silver glaucous bloom on the abaxial surface of its leaf lamina, the leaf segments with rigid apices, the presence of a bract at the base of each axis of the inflorescence and papery and glabrous bracts on the inflorescence rachis, glabrous or moderately pubescent inflorescence axes, and orange-red fruit to 43 mm diameter.

Acknowledgments

We thank the PNG Forest Research Institute for permission to use the drying facilities in the Lae Herbarium. We appreciate our interaction with Roy Banka, curator of the living collections in the Lae Botanic Garden, who joined us in field studies in 1999 and 2000. Field-work was funded by the Danish Natural Science Research Council (Grant 9600861) and the Carlsburg Foundation (Grant 980298/10 – 1150). This paper was written during Anders S. Barfod's sabbatical leave in 1999-2000 while based at the Queensland Herbarium. We are grateful to Gordon Guymer, Director of the Queensland Herbarium, for making this possible. A special thanks goes to Lucy T. Smith who skilfully rendered the line drawings.

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Note

Kentrophora S.M.Wilson & Kraft, a new name for an algal genus in tribe Amansieae (Rhodomelaceae, Rhodophyceae)

In an account of selected genera of the algal tribe Amansieae (Wilson & Kraft 2000), the name *Plectrophora* S.M.Wilson & Kraft was published for a genus erected to accommodate two distinctive species, one occurring in Western Australia, eastern Queensland, Lord Howe Island and Norfolk Island, and the other in Natal, South Africa. Since this generic name was published, however, it has come to our attention that H.C. Focke had previously published the name *Plectrophora* for a genus in the phanerogamic family Orchidaceae (Focke 1848), which therefore renders the more recent *Plectrophora* illegitimate and hence unusable (Greuter *et al.* 2000, Article 53.1). To provide a legitimate name for the new algal genus recognised by Wilson and Kraft in 2000 and acceptable names for the species belonging in it, the following are proposed.

Kentrophora S.M.Wilson & Kraft, **nom. nov.**,

Plectrophora S.M.Wilson & Kraft, *Aust. Syst. Bot.* 13: 353 (2000), nom. illeg. non *Plectrophora* H.Focke (1848, p.212). **Typus:** *Kentrophora pectinella* (Harvey) S.M.Wilson & Kraft; *Dictyomenia pectinella* Harvey

Etymology: *Kentrophora* from Greek κεντρον (*Kentron*), a cock's spur/porcupine's quill, and the feminine adjectival suffix *-phora*, -carrying, in reference to the acute spurs borne dorsally on each of the marginal teeth on the fronds.

1. **Kentrophora pectinella** (Harvey) S.M.Wilson & Kraft, **comb. nov.**

Dictyomenia pectinella Harvey, *Trans. Roy. Irish Acad.* 22: 538 (1855); *Kuetzingia pectinella* (Harvey) Falkenb., *Fauna und Flora des Golfes von Neapel, Monographie 26.* XVI (Berlin): 454-455 (1901); *Plectrophora pectinella* (Harvey) S.M.Wilson & Kraft, *Aust. Syst. Bot.* 13: 353 (2000). **Type:** Australia. Western Australia: Garden Island, presumably from drift, *Harvey* 290 (holo: TCD; icon: Wilson & Kraft 2000, p.354, fig.17A).

Enantiocladia robinsonii (J.Agardh) Falkenb., *Fauna und Flora des Golfes von Neapel, Monographie 26.* XVI (Berlin): 441 (1901); *Amansia robinsonii* J.Agardh, *Lunds Universitets Årsskrift.* Afd. 2, 3(6): 174 (1892). **Type:** Norfolk Island. [?] Kingston, *Isaac Robinson* 13 (holo: LD [LD42655-42659a]; icon: Wilson & Kraft 2000, p.354, fig.17B [LD42655]).

2. **Kentrophora natalensis** (J.Agardh) S.M.Wilson & Kraft, **comb. nov.**

Kuetzingia natalensis J.Agardh, *Species Genera et Ordines Algarum* 2(3): 1099 (1863); *Plectrophora natalensis* (J.Agardh) S.M.Wilson & Kraft, *Aust. Syst. Bot.* 13: 358 (2000). **Type:** South Africa. Port Natal, *Krauss* (holo: LD [LD42572], n.v., fide P. Lassen pers. comm.; iso: MEL [MEL603052]).

Acknowledgements

We thank Dr Per Lassen, Curator, Botanical Museum, Lund, for information on the type specimens of *Amansia robinsonii* J.Agardh and *Kuetzingia natalensis* J.Agardh, and Dr Alan Millar, Senior Research Scientist, National Herbarium of New South Wales, Sydney, for kindly communicating with Dr Lassen on our behalf. Gea Zijlstra, Nationaal Herbarium Nederlands, Utrecht University, Utrecht, Netherlands is also thanked for providing information regarding Focke's publication.

Accepted for publication 20 July 2001

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