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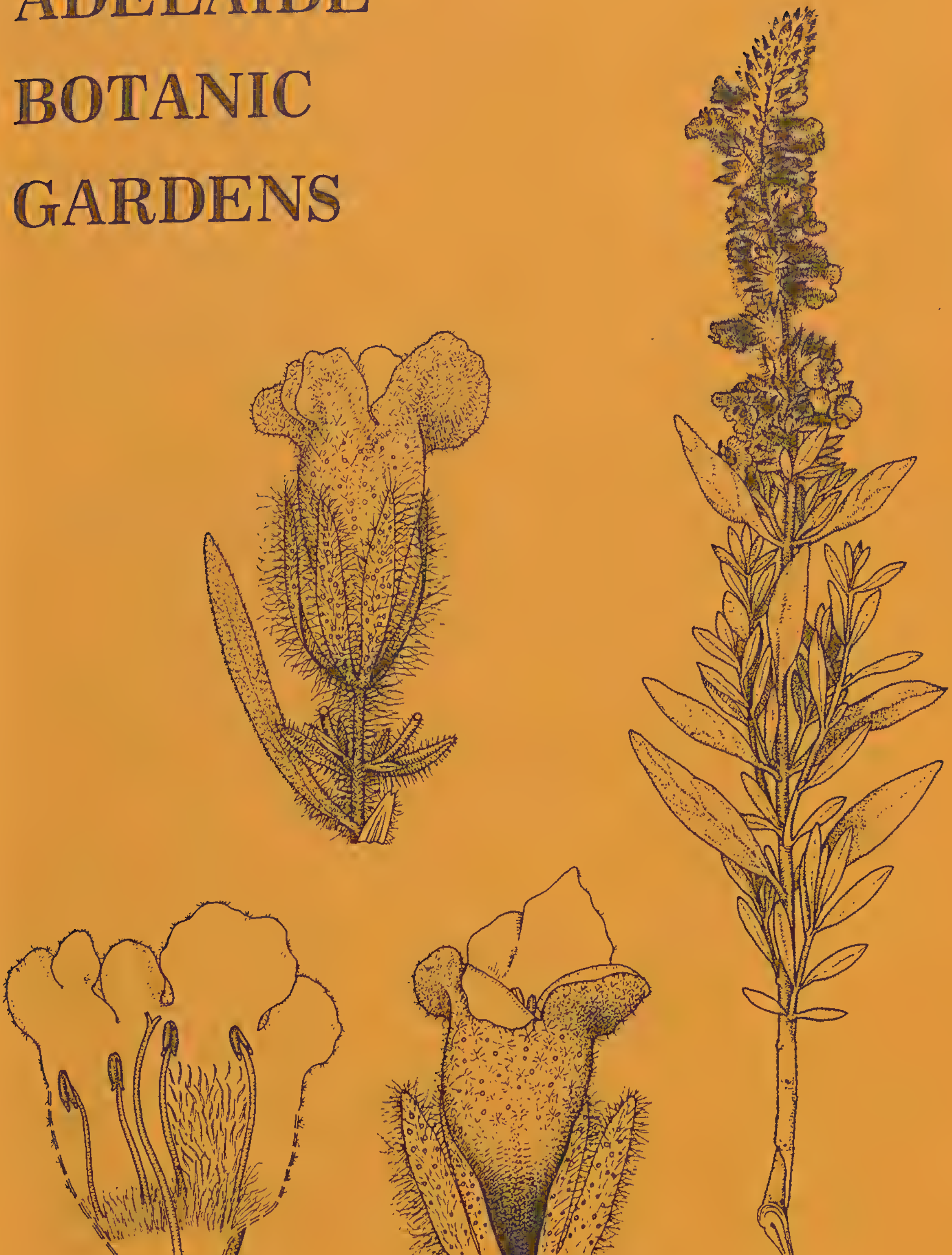

Volume 2 Part 1

21 December, 1979

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Papers will be accepted in the following categories:

(a) Plant systematics (Australian and horticultural groups); (b) Descriptive plant morphology, anatomy and ecology; (c) Obituaries, biography and history; (d) Bibliographic studies, book reviews; (e) Botanical illustrations; (f) Noteworthy horticultural contributions.

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Bentham, G. (1868). "Flora Australiensis", Vol. 4. (London: L. Reeve.)

Baker, J. G. (1898). Liliaceae. In Thiselton-Dyer, W. T. (ed.), "Flora of Tropical Africa", Vol. 7 (Ashford: L. Reeve).

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References may be cited as:

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Benth., *Fl. Austral.* 4: (1868) 111.

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10-30 specimens should be cited for each species (or subspecific taxon), although this may be varied under certain circumstances. The author may decide whether or not to include dates of collections and the sequence, provided a constant pattern is adhered to throughout a paper.

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A TAXONOMIC REVISION OF THE GENUS *PITYRODIA* (CHLOANTHACEAE)*

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Abstract

A taxonomic revision of the genus *Pityrodia* is provided. *Dennisonia* F. Muell. is reduced to synonymy. A key to the genera of the Chloanthaceae is provided. Forty-one species are recognized of which the following 16 new species and one variety are described:— *P. angustisepala, P. augustensis, P. byrnesii, P. chorisepala, P. gilruthiana, P. glabra, P. glutinosa, P. lanceolata, P. lanuginosa, P. megalophylla, P. ovata, P. puberula, P. pungens, P. quadrangulata, P. serrata, P. spenceri* and *P. exserta* var. *lanata*. The new combination of *P. ternifolia* (Syn. *Dennisonia ternifolia* F. Muell.) is made and *P. uncinata* var. *exserta* Benth. is raised to the status of a species.

The affinities and distribution are considered for the genus and each species. A key to the taxa is provided and a detailed description of each species is supplemented by a habit sketch of a flowering branch and analytical drawings of the flowers.

Taxonomic History of the Genus

The genus *Pityrodia* was described by Robert Brown (1810), with a single species, *P. salvifolia*, which he had collected himself in Queensland. It was referred to the Verbenaceae where it has been retained by the majority of botanists. Sprengel (1825) recorded this genus as a synonym of *Premna* L. which he placed in Linnaeus's "Didynamia Angiosperma" without reference to any family. The synonymous position for *Pityrodia* under the genus *Premna* was accepted only by Dietrich (1843) who referred it to the Verbenaceae. Poiret (1826) had, however, maintained *Pityrodia* as a distinct genus in the Verbenaceae. In 1828, Gaudichaud described a species of *Pityrodia* in a new genus *Quoya*, the type of which he had collected himself from Western Australia. It was also referred to the Verbenaceae where it was retained by Endlicher (1838, 1841), Meisner (1840), Spach (1840), Dietrich (1843), Walpers (1845), Lindley (1846), Schauer (1847), Bocquillon (1863) and Black (1870). Excepting Dietrich (1843), all the above named botanists maintained *Pityrodia* and *Quoya* as two distinct genera, though a few of them listed the latter as a "genus dubium". Reichenbach (1828) also accepted *Pityrodia* as a distinct genus which he referred to the tribe Verbeneae in the Verbenaceae, while treating *Quoya* in the tribe Gesnereae of the Bignoniaceae. In 1830, Bartling transferred *Pityrodia* to the tribe Viticeae (Verbenaceae). This new tribe was accepted for the genus by Lindley (1836), Spach (1840), Schauer (1847) and Bentham (1870). Subsequently, Endlicher (1838) placed it in the tribe Lantanae in the Verbenaceae, and this was followed by Meisner (1840), Endlicher (1841) and Walpers (1845).

In 1839, Endlicher described two *Pityrodia* species in a further new genus *Dasymalla*, which he placed in the family Myoporaceae. This was followed by Meisner (1840), Spach

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*The present treatment of the genus *Pityrodia* concludes the series of taxonomic revisions in the family Chloanthaceae (= Dicrastylidaceae) (Munir, 1976-1978). Airy Shaw (1966, 1973) and some others included in this family the albuminous seeded African genera *Acharitea* Benth., *Cyclocheilon* Oliv. and *Nesogenes* DC. After examining representatives of these genera, the present author excluded them from the Chloanthaceae for the following two main reasons (see also Munir, 1978c, pp. 412-416): (1) The ovules in these genera are attached near the base of the ovary and (2) The two bracteoles subtending each flower are absent. A key to the genera of the Chloanthaceae is provided on page 3.

(1840), Endlicher (1841), Dietrich (1843), Walpers (1845), Lindley (1846), de Candolle (1847) and Black (1870). Excepting Dietrich (1843) and de Candolle (1847), all the above authors also retained *Pityrodia* and *Quoya* as distinct genera. In 1859, F. Mueller described a new genus *Dennisonia* with a single species, the type of which he had collected himself from Northern Territory. It was referred to the Verbenaceae where it has been retained by the majority of botanists. During present studies, however, *Dennisonia* F. Muell. has been found to be congeneric with *Pityrodia* and is therefore recorded here as a new synonym of the latter.

From 1859 onwards, F. Mueller regarded *Pityrodia* as a synonym of *Chloanthes* and described 10 new species under it. In 1864 he described one new species under *Quoya* but he later transferred it to the genus *Chloanthes*. A few of F. Mueller's species have since been reduced to synonymy. Turczaninow (1863) also described three *Pityrodia* species one each under *Chloanthes*, *Quoya* and *Pityrodia*. Two of these species are now in synonymy. Bentham (1870) reinstated the genus *Pityrodia* as distinct from *Chloanthes*, and transferred to it all *Chloanthes* species described by F. Mueller and one of the two described by Bartling (1845). He listed *Quoya* Gaud. and *Dasymalla* Endl. as synonyms of *Pityrodia*, and this has been accepted by the majority of botanists. Moreover, he referred this genus to the predominantly Australian subtribe Chloanthinae ("Chloantheae") of the tribe Viticeae in the Verbenaceae, and described a new variety, *P. uncinata* var. *exserta*, which is now raised to the status of a species. In 1876, Bentham & Hooker upgraded the subtribe Chloanthinae to the tribe Chloantheae, without altering the circumscription of its genera. This tribe was accepted for the genus by Bailey (1883, 1890, 1901, 1913), Durand (1888), Post & Kuntze (1904) and Lemèe (1943). Also in 1876, a further new genus *Depremesnilia*, in the Labiatae, was described by F. Mueller for a new species of *Pityrodia*. The new genus was later recognized by F. Mueller (1889) as synonymous with *Chloanthes*.

Briquet (1895) reclassified the Verbenaceae and upgraded the tribe Chloantheae to a subfamily Chloanthoideae. The latter consisted of three tribes: Achariteae, Chloantheae and Physopsideae with *Pityrodia* in the tribe Achariteae. This classification was adopted by Briquet (1896), Dalla Torre and Harms (1904) and Melchior (1964). In 1904, Diels & E. Pritzel revised the Western Australian Verbenaceae comprising only Bentham & Hooker's tribe Chloantheae. They subdivided the tribe into two subtribes namely Lachnostachydinae and Chloanthinae, placing *Pityrodia* in the latter. The genus was subdivided into four sections: *Brachysolenia*, *Chloanthopsis*, *Depremesnilia* and *Eupityrodia*. These sections are found to be artificial and unnatural groups, and are, therefore, not maintained in this revision. Gardner (1931) and Junell (1934) retained *Pityrodia* in Briquet's subfamily Chloanthoideae, but within the subfamily, Junell referred it to Bentham & Hooker's tribe Chloantheae, and Gardner placed it in Diels & E. Pritzel's subtribe Chloanthinae without mention of the tribe Chloantheae. Gardner also adopted the sections proposed within this genus by Diels & E. Pritzel (1904).

Hutchinson (1959) raised the status of Bentham & Hooker's tribe Chloantheae to the family Chloanthaceae, which differed from Verbenaceae (s.str.) chiefly in the albuminous seeds. The new family for the genus was accepted by Bullock (1959, 1960), Takhtajan (1959, 1969), Eichler (1965), Symon (1969), Gardner (1972) and Munir (1965, 1966, 1977, 1978a, 1978b, 1978c). Also in 1959, Moldenke published a résumé of the world Verbenaceae and referred *Pityrodia* and allied genera to the family Stilbaceae. Within this family, the genus was placed in the subfamily Chloanthoideae, tribe Achariteae.

Airy Shaw (1965) referred all genera of Australian Verbenaceae (s.lat.) with albuminous seeds to the family Dicrastylidaceae Drumm.ex Harv. (nom.nud.), a name mentioned incidently by Harvey (1855) but not validated. The family name Dicrastylidaceae, however, has been adopted for the "Australian Verbenaceae" with albuminous seeds by Airy Shaw (1966, 1973), George (1967, 1972), Beard (1970), Maconochie &

Byrnes (1971), Moldenke (1971) and some others.

In the present revision, *Pityrodia* is accepted as belonging to the family Chloanthaceae. Within this family, it is referred to the tribe Chloantheae, a position previously given to it by Briquet (1895) under Verbenaceae.

Key to the genera of the Chloanthaceae

As this is the last paper in the series of revisions of the genera of the Chloanthaceae, a key to the genera has been prepared. Non-Australian genera generally regarded as belonging to this family have been excluded (see footnote on p. 1).

1a. Flowers zygomorphic, heteromerous; corolla mostly more or less 2-lipped or unequally 5-lobed; stamens 4 (Tribe Chloantheae) 6

b. Flowers actinomorphic or nearly so, isomerous; corolla regular or nearly so, 4-8-lobed; stamens 4-8 (Tribe Physopsideae) 2

2a. Perianth 5-8-merous 4

b. Perianth 4-merous 3

3a. Flowers in dense spikes; stamens included; style entire (not lobed) (Munir, 1978c: 578) . . *Physopsis*

b. Flowers in more or less capitate clusters; heads solitary or in corymbose panicles; stamens scarcely exserted; style shortly 2-lobed towards the apex (Munir, 1978: 567) . . . . *Mallophora*

4a. Style deeply 2-branched; corolla usually 5-merous (Munir, 1978c: 437) . . . . . *Dicrastylis*

b. Style entire or very minutely 2-lobed at the end; corolla (5-)6-8 merous 5

5a. Corolla with distinct lobes: stamens inserted between the lobes, included or exserted (Munir, 1978c: 589) . . . . . *Newcastelia*

b. Corolla-tube truncate, not lobed; stamens inserted on the rim of the corolla-tube, exserted (Munir, 1978c: 643) . . . . . *Lachnostachys*

6a. Leaves decurrent (Munir, 1977: 84) . . . . . *Chloanthes*

b. Leaves not decurrent 7

7a. Fertile stamens 2, the lower pair reduced to staminodes (Munir, 1978b: 161) . . . . . *Hemiphora*

b. Fertile stamens 4 8

8a. Fruiting-calyx much enlarged, distinctly venose, toothed; filaments dilated below the anthers in the upper third (Munir, 1978a: 45) . . . . . *Cyanostegia*

b. Fruiting-calyx practically unchanged, neither distinctly venose nor toothed; filaments uniform throughout their length 9

9a. Fruit a succulent drupe; anthers 1-chambered by the confluence of lobes, lobes not appendiculate at the base (Munir, 1976: 3) . . . . . *Spartothamnella*

b. Fruit dry; anthers 2-chambered, lobes separate and appendiculate (often distinctly so) at the base (Munir, 1979) . . . . . *Pityrodia (= Dennisonia)*

PITYRODIA R. Brown

Pityrodia R.Br., Prod.Fl.Nov.Holl.(1810)513; Poiret in Cuvier (Ed.), Dict.Sc.Natur. 41(1826)182; Reichb., Consp.Reg.Veg.1(1828)117, no. 2919; Bartl., Ord.Natur.Pl.(1830) 180; Lindl., Natur.Syst.Bot.edn 2(1836)278; Endl., Gen.Pl.2(1838)636, no. 3702; Meisn., Gen.Pl.Vasc.1, Tab.Diagn.(1840)291; Meisn., Gen.Pl.Vasc.2 Comment.(1840)200; Spach, Hist.Natur.Veg.Phan.9(1840)227; Endl., Ench.Bot.(1841)312; no. 3702; Steud., Nomencl.Bot.2(1841)346; Bartl.in Lehm., Pl.Preiss.1(1845)352; Walp., Rep.Bot.Syst.4 (1845)97; Lindl., Veg.King.edn 2(1847)664; Schauer in DC., Prod.11(1847)628; Bocq., Rev.Verbén.(1863)131; Benth., Fl.Aust.5(1870)46; Pfeiffer, Nomencl.Bot.2(1874)375; Benth.& Hook.f., Gen.Pl.2(1876)114; Bail., Synop.Qld Fl.(1883)374; Durand, Gen.Phan. (1888)319; Briq. in Engl.& Prantl, Pflanzenfam.4, 3a(1895)161; Bail., Qld Fl.4(1901)1168; Dalla Torre & Harms, Gen.Siphon.(1904)431, no. 7166; Diels & E.Pritz., Bot.Jahrb. Syst.35(1904)513; Post & Kuntze, Lexic.Gen.Phan.(1904)443; Bail., Comp.Cat.Qld

Pl.(1913)381; Ewart & Davies, Fl.N.Terr.(1917)236; Gard., Enum.Pl.Aust.Occ.3(1931) 112; Junell, Sym.Bot.Upsal.4(1934)68; Lemée, Dict.Descrip.Syn.Gen.Pl.Phan.8b(1943) 654; Gard. in Parkin.(Ed.), Wildfls West.Aust.(1959)132; Mold., Résumé Verben.etc. (1959)277, 335, 341, 395, 396, 404; Hutch., Fam.Fl.Pl. edn 2, 1(1959)398; Burb., Dict. Aust.Pl.Gen.(1963)234; Beard (Ed.), W.Aust.Pl. edn 1(1965)92; Blackall & G & Grieve, West. Aust.Wildfls 3(1965)560, 567; Airy Shaw, Willis's Dict.Fl.Pl.& Ferns edn 7(1966)885; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Morcombe, Aust.Wildfls (1970) 89, 94; Mold., Fifty Summary Verben.etc. 1 & 2(1971)474, 475, 615, 739, 740, 750; Clifford & Ludlow, Fam. & Gen. Qld Fl.Pl.(1972)124; George, Nuytsia 1(1972)289; Airy Shaw, Willis's Dict. Fl.Pl.& Ferns edn 8(1973)909; Erickson et al.(Eds), Fl.Pl.West.Aust.(1973)187; Gard., Wildfls West Aust. edn 11 (1973)120.

Type Species: P. salvifolia R.Br., Prod.Fl.Nov.Holl.(1810)513.

Quoya Gaudich. in Freyc. (Ed.), Voy.Bot.(1828) t. 66; Gaudich in Freyc. (Ed.), Voy.Bot.(1829)453; Reichb., Consp.Reg.Veg.1(1828)125, no. 3233; Endl., Gen.Pl.2(1838)638, no. 3719; Meisn., Gen.Pl.Vasc.1, Tab. Diagn. (1840)290; Meisn., Gen.Pl.Vasc.2, Comment.(1840)198; Spach, Hist.Natur.Veg.Phan.9(1840)247; Endl., Ench.Bot.(1841)312, no. 3719; Steud., Nomencl.Bot.2(1841)429; Dietr., Synop.Pl.(1843)372, 619, no. 2887; Walp., Rep.Bot.Syst.4(1845)37; Lindl., Veg.King.edn 1(1846)664; Schauer in DC., Prod.11(1847)697; Bocq., Rev.Verbén.(1863)132; Black in Lindl. & Moore, Treasur.Bot.2(1870)953.

Type Species: Q. cuneata Gaud. in Freyc., Voy.Bot.(1829)453, t.66.

Dasymalla Endl. in Endl.& Fenzl, Nov.Stirp.Dec.2(1839)11; Meisn., Gen.Pl.Vasc.1, Tab.Diagn.(1840)292; Meisn., Gen.Pl.Vasc.2, Comment (1840)201; Spach, Hist.Natur.Veg.Phan.9(1840)247; Endl., Gen.Pl.Suppl. 1(1841)1401, no. 3733/1; Steud., Nomencl.Bot.1(1840)484; Dietr., Synop.Pl.3(1843)628; Walp., Rep.Bot.Syst. 4(1845)139; Lindl., Veg.King.edn 1(1846)665; DC., Prod.11(1847)704; Lemair in Orb., Dict.Uni.Hist.Natur. 4(1849)610; Black in Lindl. & Moore, Treasur.Bot.1(1870)385; Pfeiffer, Nomencl.Bot.1(1874)1013.

Type Species: D. axillaris Endl.in Endl.& Fenzl, Nov.Stirp.Dec.2(1839)11, lectotype designated here.

Dennisonia F. Muell., J.& Proc.Linn.Soc.Bot.3(Feb.1859)157; F.Muell., Fragm.1(April, 1859)123, Sphalm. "Denisonia"; Benth., Fl.Aust.5(1870)54; Black in Lindl.& Moore, Treasur.Bot.1(1870)393; Benth.& Hook.f.; Gen.Pl.2(1876)1141; F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)173; Briq.in Engl.& Prantl, Pflanzenfam.4, 3a(1895)161; Dalla Torre & Harms, Gen.Siphon (1904)431, no. 7167; Diels & E.Pritz., Bot.Jahrb.Syst.35(1904)523; Post & Kuntze, Lexic.Gen.Pl.(1904)688; Ewart & Davies, Fl. N.Terr.(1917)236; Junell, Sym.Bot.Upsal.4(1934)76; Lemée, Dict.Descrip.& Syn.Gen.Pl.Phan.8b(1943)654; Mold., Résumé Verben.etc.(1959)404; Burb., Dict.Aust.Pl.Gen.(1963)93; Airy Shaw, Willis's Dict.Fl.Pl.& Ferns edn 7(1966)340; Mold., Fifth Summary Verben.etc.2(1971)751; Airy Shaw, Willis's Dict.Fl.Pl.& Ferns edn 8(1973)909—*syn.nov.*

Type Species: D. ternifolia F. Muell., J.& Proc.Linn.Soc.Bot.3(February 1859)158.

Premna auct.non Linn., sensu Spreng., Linn.Syst.Veg.2, edn 16(1825)755, quoad *P. salvifolia* R.Br.

Depremesnilia, F. Muell., Fragm.Phyt.Aust.10(1876)59.

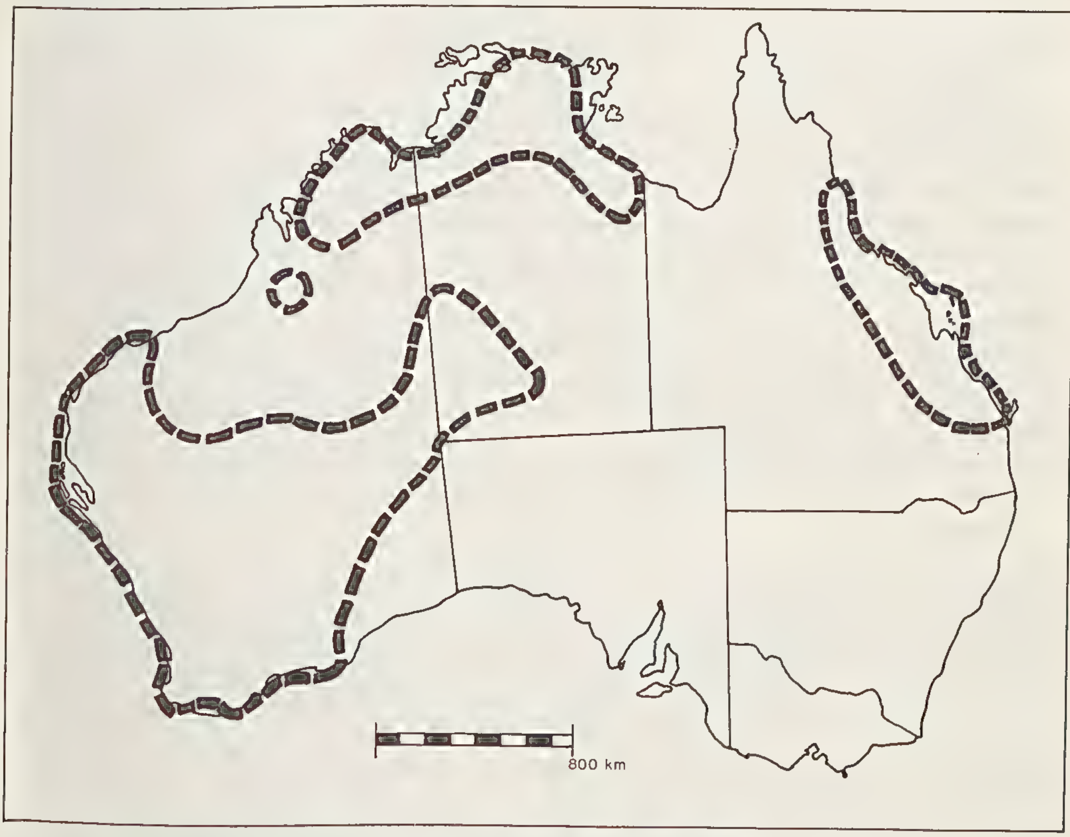
Type Species: D. chrysocalyx F. Muell., Fragm.Phyt.Aust.10(1876)59.

Chloanthes sensu F. Muell., Syst.Cens.Aust.Pl.1(1882)103, p.p. exclud. *C. coccinea* Bartl., *C. parviflora* Walp. and *C. stoechadis* R.Br.; F. Muell., J.Roy.Soc.N.S.W.15(1882)41, p.p.; F. Muell., Sec.Syst.Cens.Aust.Pl.1 (1889)172, p.p.

Number of species: 41.

Perennial shrubs or undershrubs. *Stem* erect, branched, cylindrical or 4-angled, solid and woody. *Leaves* cauline and ramal, exstipulate, simple, reticulate veined, unicostate, decussate, in whorls of 3 or scattered, not decurrent. *Flowers* solitary, or in cymes or clusters, axillary or collected in terminal leafy spikes, racemes or panicles, bracteate, with two lateral bracteoles, complete, zygomorphic, bisexual, hypogynous. *Calyx* of 5 fused sepals, persistent, 5-lobed, tubular below. *Corolla* of 5 fused petals, deciduous, 2-lipped (or unequally 5-lobed in the upper half), tubular below, the upper lip 2-lobed, the lower lip 3-lobed; lobes spreading or those of the upper lip sometimes erect, the anterior (i.e. the middle lobe of the lower lip) rather larger than the others; tube short and broad or long and dilated upwards. Stamens 4, somewhat didynamous, epipetalous, inserted in the corolla-tube; filaments filiform, glabrous, the anterior two (i.e. beside the large middle lobe of the lower lip of corolla) slightly longer than the posterior two; anthers dorsifixed, 2-lobed; lobes free and somewhat divergent in the lower halves, appendiculate at the lower end, longitudinally dehiscent. *Ovary* bicarpellary, syncarpous, 4-locular, with one axile ovule in each cell; style filiform, glabrous, 2-lobed at the top. *Fruit* a dry 4-celled drupe, the endocarp separating into two 2-celled nutlets (cocci); seeds 1 to 2 in each nutlet, albuminous.

Distribution (Map 1 and Table 1)



Map 1. Distribution of the genus *Pityrodia* R. Br.

The genus *Pityrodia* R.Br. is endemic to the Australian mainland. It is known to occur in Western Australia (27 spp.), Northern Territory (16 spp.) and Queensland (1 sp.), but has not been recorded from South Australia, Victoria or New South Wales.

Table 1. *Pityrodia* taxa known to exist in various States/Territories in Australia, where x present ; — absent.

Names of taxa	WA	NT	Qld
P. angustisepala	—	x	—
P. atriplicina	x	—	—
P. axillaris	x	—	—
P. augustensis	x	—	
P. bartlingii	x	—	—
P. byrnesii	—	x	—

Continued page 6

Table 1 (*continued*)

Names of taxa	WA	NT	Qld
P. canaliculata	x	—	—
P. chorisepala	—	x	—
P. chrysocalyx	x	—	—
P. cuneata	x	—	—
P. dilatata	x	—	—
P. exserta var. *exserta*	x	—	—
P. exserta var. *lanata*	x	—	—
P. gilruthiana	—	x	—
P. glabra	x	—	—
P. glutinosa	x	—	—
P. halganiacea	x	—	—
P. hemigenioides	x	—	—
P. jamesii	—	x	—
P. lanceolata	—	x	—
P. lanuginosa	—	x	—
P. lepidota	x	—	—
P. loricata	x	x	—
P. loxocarpa	x	x	—
P. megalophylla	—	x	—
P. obliqua	x	—	—
P. oldfieldii	x	—	—
P. ovata	x	—	—
P. paniculata	x	—	—
P. puberula	—	x	—
P. pungens	—	x	—
P. quadrangulata	—	x	—
P. salvifolia	—	—	x
P. scabra	x	—	—
P. serrata	—	x	—
P. spenceri	—	x	—
P. teckiana	x	—	—
P. terminalis	x	—	—
P. ternifolia	x	x	—
P. uncinata	x	—	—
P. verbascina	x	—	—
P. viscida	x	—	—
Number of species (only) recorded for each State or Territory	27	16	1

Comments

F. Mueller (Feb. 1859) described one of his own collection from near the Gulf of Carpentaria, Northern Territory, as the only species of his new genus *Dennisonia* [J.& Proc.Linn.Soc.Bot.3(Feb. 1859)157]. He regarded it as distinct but nearest in appearance to *Newcastelia* F. Muell. and *Pityrodia* R.Br., but did not give any distinguishing character. About two months later, he republished his new genus as "*Denisonia*" with an addition of a habit sketch of a flowering branch and analytical drawings of the flower [Fragm.1(April 1859)123-124, t.2] This publication has been erroneously accepted by the majority of botanists (except Black, 1870) as the protologue of this genus. During present studies, *Dennisonia* has been found to be congeneric with *Pityrodia* and is, therefore, recorded here as a new synonym of the latter. The original generic spelling is retained.

Bentham distinguished *Pityrodia* from *Chloanthes* on its non-decurrent leaves, shorter and much broader corolla-tube and appendaged anther-lobes. During present investigation, however, the corolla-tube has been found not always to be shorter and much broader, nor the anther-lobes to have distinct appendages in all *Pityrodia* species. The non-decurrent leaves are fairly distinct and constant throughout the genus and the appendages to the anther-lobes are mostly present on at least the two lower stamens. In a few species, however, the appendages are either very minute or not developed at all. The corolla-tube is of three main types distinguishable more clearly when fully expanded. These are shorter and much broader, longer and cylindrical, and of medium length dilating gradually or abruptly within or immediately above the calyx.

E. Pritzel (1904) subdivided *Pityrodia* into four sections which were adopted by Gardner (1931) without altering the circumscription of its species. During present studies, the sections proposed by E. Pritzel have been found to be very artificial because several closely related species have been separated from their nearest allies. Even after the addition of several new species in the present work, the genus *Pityrodia* seems to be fairly homogeneous in all basic characters and cannot be split into natural sections. In view of this, no sections have been maintained within the genus.

Affinities

Pityrodia is closely related to *Chloanthes* R.Br. in having a 2-lipped corolla, 4 stamens inserted in the lower half of the corolla-tube and a dry fruit. Nevertheless, it can easily be distinguished by its non-decurrent leaves and usually distinctly appendaged anther-lobes. *Pityrodia* is also close to *Hemiphora* F. Muell. in having a similar 2-lipped corolla, dry fruit and non-decurrent leaves. However, *Hemiphora* may readily be distinguished by its only 2 fertile stamens without appendages to the anther-lobes.

There are a few characters shared between *Pityrodia* and *Cyanostegia* Turcz. Both genera have non-decurrent leaves, 2-lipped or unequally 5-lobed corolla, 4 stamens inserted in the lower half of the corolla-tube and a dry fruit. Nevertheless, *Cyanostegia* can easily be distinguished by its calyx being much enlarged, spreading and conspicuously veined after anthesis,filaments much dilated below the anthers in the upper third and anther-lobes without appendages.

See key to the genera of the Chloanthaceae on p. 3.

Key to Species and infraspecific Taxa
(Species asterisked are new)

1a. Stem, leaves (the lower surface at least) and calyx covered with scales 2
b. Stem, leaves and calyx without scales, (glabrous or glutinous and/or pubescent-tomentose) . . . 6
2a. Leaves petiolate, lanceolate, 5-13 cm long; flowers sessile, in axillary clusters of 5 or more; stamens and style included or scarcely exserted. Queensland . . . . 1. *P. salvifolia*
b. Leaves sessile, linear, ovate, obovate, oblanceolate, oblong-lanceolate or elliptic-ovate, 0.3-4.5 cm long; flowers subsessile or pedicellate, solitary or in axillary clusters of 3; stamens and style exserted. Western Australia and Northern Territory 3
3a. Leaves broadly ovate or elliptic-ovate, reflexed, smooth and glutinous on the upper non-scaly convex surface, usually 2.5-5.5 mm long; calyx-lobes without scales or hairs inside . . . . 2. *P. chrysocalyx*

b. Leaves linear, oblong-lanceolate or oblanceolate-obovate, spreading or ascending, scaly on both the surfaces, usually 5-30 mm long; calyx-lobes scaly or hairy inside 4

4a. Leaves linear, canaliculate; calyx-lobe up to 1.5 mm long; corolla white with reddish spots in throat; fruit sparsely glandular and puberulous or almost glabrous . . . . . 3. *P. canaliculata*

b. Leaves oblong-lanceolate or oblanceolate-obovate, flat; calyx-lobes more than 1.5 mm long; corolla pale-pink; fruit non-glandular, pubescent all over 5

5a. Scales on stem, leaves and calyx shiny; leaves oblong-lanceolate; calyx-lobes lanceolate, acute, scaly inside; anther-lobes scarcely appendiculate. . . . . 4. *P. loricata*

b. Scales on stem, leaves and calyx dull; leaves oblanceolate-obovate; calyx-lobes more or less deltoid, obtuse, hairy inside; anther-lobes distinctly appendiculate . . . . 5. *P. lepidota*

6a. Stem and branches 4-angled; fruit 4-ridged 7

b. Stem and branches terete; fruit usually terete, sometimes obtusely lobed, never ridged 10

7a. Calyx-lobes at least twice as long as the tube; flowers yellow 8

b. Calyx-lobes as long as the tube or shorter; flowers red or pink 9

8a. Leaves broadest near the middle, glandular, puberulous; calyx-lobes at least 4 times as long as broad . . . . 6. **P. angustisepala*

b. Leaves broadest in the upper part, woolly-tomentose; calyx-lobes about twice as long as broad . . . . 7. **P. quadrangulata*

9a. Leaves ovate, cordate at the base; corolla pink . . . . 8. **P. megalophylla*

b. Leaves narrowly elliptic-lanceolate, cuneate towards the base; corolla red . . . . . 9. **P. lanceolata*

10a. Leaves with strongly revolute margins, distinctly bullate-rugose above and along the margins, (linear, narrow lanceolate or almost terete) 11

b. Leaves flat or with slightly recurved margins, usually smooth above, if rugose-bullate then the rugae concealed by the dense indumentum, various shaped 16

11a. Flowers in lax terminal panicles; corolla open widely with a broad and extremely wide tube, lobes longer than tube, tube glabrous inside; ovary glabrous with a few glands on top; fruit 4-lobed . . . . 10. *P. halganiacea*

b. Flowers in dense terminal spikes or racemes or in sessile clusters in the axil of upper leaves; corolla tubular, lobes shorter than the tube, tube with a dense hairy ring inside; ovary pubescent-tomentose; fruit not lobed 12

12a. Leaves all in whorls of 3; corolla white, 6-9 mm long, glabrous outside, with almost cylindrical tube; calyx-lobes ovate, 2-3 mm long . . . . 11. *P. scabra*

b. Leaves all opposite or some scattered or in whorls of 3 in the same specimen; corolla deep pink or dark red, 10-30 mm long, pubescent outside with non-cylindrical tube; calyx-lobes linear or lanceolate, more than 3 mm long 13

13a. Leaves scabrous; stem glabrescent; stamens and style always exserted . . 12. *P. exserta* var. *exserta*

b. Leaves woolly-tomentose, glabrescent; stem woolly-tomentose; stamens and style included or scarcely exserted 14

14a. Stigma-lobes sagittate; style 3-7 mm long . . . . 13. *P. uncinata*

b. Stigma-lobes linear; style 10-30 mm long 15

15a. Fruit obovoid, oblique, with a thin-walled concavity on one side; flowers in terminal spikes; style up to 14 mm long . . . . 14. *P. bartlingii*

b. Fruit subglobose, symmetrical with evenly thickened walls; flowers in the axil of upper leaves; style 15-30 mm long . . . . 12. *P. exserta* var. *lanata*

16a. Leaves with serrate or dentate margins 17

b. Leaves entire 20

17a. Leaves dentate distally, subsessile; corolla glabrous outside . . . . 15. **P. glabra*

b. Leaves serrate or dentate all along the margin, sessile; corolla pubescent outside at least on the lobes 18

18a. Leaves pubescent, with the reticulate veins raised and honey-combed underneath . . 16. *P. ternifolia*

b. Leaves glabrous, with the reticulate veins neither raised nor honey-combed underneath 19

19a. Leaves serrate with acute mucronate teeth; calyx glabrous outside; corolla white, with cylindrical tube . . . . 17. **P. serrata*

b. Leaves dentate with blunt obtuse teeth; calyx pubescent outside; corolla pale blue or mauve, tube abruptly dilating above the ovary . . . . 18. *P. teckiana*

20a. Peduncles, young branches and upper leaves densely covered with reddish-brown, golden-yellow or pale brownish-yellow indumentum 21

b. Peduncles, branches and leaves glabrous or densely covered with greyish, greenish or white indumentum 23

21a. Leaves ovate or elliptic-ovate, 0.5-1.3 cm long; corolla white, glabrous outside; fruit obovoid-pyriform . . . . 19. **P. chorisepala*

b. Leaves elliptic-obovate, elliptic-oblong or almost rhomboid, 1.5-10 cm long; corolla pink, pubescent outside; fruit elliptic-ovoid or globose 22

22a. Leaves broadly elliptic-obovate or almost rhomboid, very deeply cuneate towards the base; calyx 2-lipped; calyx-lobes oblong-ovate, obtuse; style lateral on fruit; nutlets without humps . . . . 20. *P. oldfieldii*

b. Leaves oblong to elliptic; calyx equally 5-lobed; calyx-lobes linear-lanceolate, acute; style apical on fruit; nutlets with a hump on the back . . . . 21. *P. verbascina*

23a. Leaves narrow-linear with a more or less pungent or mucronate tip 24

b. Leaves oblong, elliptic, ovate, obovate, lanceolate or almost orbicular, obtuse, scarcely mucronate 27

24a. Corolla as long as the calyx or shorter, tube much dilating in the upper half; leaves usually rather pungently mucronate . . . . 22. **P. pungens*

b. Corolla much longer than the calyx; leaves not pungently mucronate 25

25a. Leaves glabrous, glutinous, flat, often in whorls of 3 . . . . 23. **P. gilruthiana*

b. Leaves pubescent, non-glutinous, recurved along the margins, always opposite 26

26a. Stem, leaves and outside calyx pubescent with stellate hairs, intermixed with glands; corolla-tube cylindrical; fruit 1.5-2.5 mm in diameter . . . . 24. **P. puberula*

b. Stem, leaves and outside calyx densely clothed with cineraceous tomentum of non-stellate hairs; corolla-tube not cylindrical; fruit 3-4 mm in diameter . . . . 25. *P. hemigenioides*

27a. Stem, leaves and outside of calyx glabrous 28

b. Stem, leaves (at least on the lower surface) and outside of calyx pubescent to tomentose 29

28a. Leaves sessile, entire, slightly recurved along the distal margins . . . . 26. **P. glutinosa*

b. Leaves subsessile, distally dentate, flat . . . . 15. **P. glabra*

29a. Upper surface of leaves glabrous, viscid and olive green; stem almost glabrous, viscid or invested with a short viscid pubescence . . . . 27. *P. viscida*

b. Upper surface of leaves pubescent to tomentose, neither viscid nor olive green; stem glabrous or invested with non-viscid pubescence or tomentum 30

30a. Leaves petiolate 31

b. Leaves sessile or if shortly petiolate then the lamina not sharply demarcated from the petiole . . 32

31a. Stem and branches longitudinally striate, glabrous or loosely hairy, leaves elliptic-oblong or almost orbicular; fruit obovoid with a thin-walled concavity on one side . 28. *P. loxocarpa*

b. Stem and branches non-striate, densely tomentose; leaves ovate to oblong-ovate; fruit ovoid-globose, with uniformly thickened walls with no concavity . . . . 29. *P. obliqua*

32a. Leaves obovate or oblanceolate 33

b. Leaves linear, oblong, elliptic, ovate, lanceolate or almost orbicular 36

33a. Cymes arranged in lax and more or less pyramidal panicles . . . . 30. *P. paniculata*

b. Cymes arranged in dense non-pyramidal terminal panicles, racemes or spikes 34

34a. Corolla glabrous outside, lobes undulate-denticulate; fruit obovoid with two humps at the top; leaves not constricted . . . . 31. *P. axillaris*

b. Corolla pubescent outside, lobes entire; fruit more or less globose, without humps; leaves constricted about the middle 35

35a. Leaves much dilating at the base, amplexicaul; corolla orange-red, 20-25 mm long, tube curved and gradually dilating upwards; calyx equally lobed . . . . 32. *P. dilatata*

b. Leaves scarcely or not dilating at the base, not amplexicaul; corolla blue, 8-14 mm long, tube abruptly dilating within or immediately above the calyx; calyx distinctly 2-lipped at fructescence . . . . 33. *P. cuneata*

36a. Stem and branches longitudinally striate, glabrous or loosely hairy . . . . 28. *P. loxocarpa*

b. Stem and branches non-striate, densely tomentose 37

37a. Leaves very broadly elliptic or almost orbicular . . . . 34. *P. atriplicina*

b. Leaves linear, oblong, ovate, lanceolate or narrow elliptic-oblong to elliptic-lanceolate 38

38a. Leaves oblong or narrow elliptic-oblong 39

b. Leaves narrow elliptic-lanceolate to ovate 41

39a. Leaves mostly in whorls of 3, acute, glandular with sparsely sprinkled short hairs; flowers crowded towards the end of branches; corolla-tube almost cylindrical . . . . . . 35. **P. byrnesii*

b. Leaves opposite, obtuse, non-glandular, densely tomentose; flowers crowded towards the end of branches (except *P. ovata*); corolla-tube dilating within or immediately above the calyx 40

40a. Leaves with recurved-revolute margins; corolla white, 9-12 mm long; flowers axillary solitary in terminal leafy spikes . . . . 25. *P. hemigenioides*

b. Leaves flat; corolla pink or claret-red, 18-27 mm long; flowers 3-5 in cymes arranged in a terminal raceme . . . . 36. *P. terminalis*

41a. Corolla glabrous outside; ovary glandular, glabrous; leaves flat 42

b. Corolla pubescent or woolly all over outside or at least on the lobes; ovary densely pubescent or tomentose; leaves with recurved margins (except *P. augustensis*) 43

42a. Plant densely covered with a short and dense indumentum of non-glandular pale yellow hairs; leaf-reticulation concealed by the hairs; flowers crowded towards the tip of branches . . . . 19. **P. chorisepala*

b. Leaves and distal parts of branches viscid, covered with minute gland-tipped hairs; leaf-reticulation honey-combed beneath; flowers in the axil of well-spaced leaves . . . 37. **P. ovata*

43a. Leaves narrow-elliptic, cuneate towards both ends; cymes in terminal woolly racemes; calyx purple-lilac when fresh, lobes linear, narrowing towards both ends . . . . 38. **P. augustensis*

b. Leaves ovate-cordate to ovate-lanceolate; flowers axillary solitary, arranged in a spike-like leafy inflorescence; calyx greenish-grey when fresh, lobes lanceolate 44

44a. Leaves narrow-ovate or lanceolate, rounded at the base, flat or slightly recurved along the margins; upper corolla lip enclosed within the calyx, purple-streaked . . . . 39. **P. lanuginosa*

b. Leaves broad-ovate to oblong-ovate, cordate or deep-sinuate at the base; often distinctly recurved-revolute along the margins; upper corolla-lip exceeding the calyx, not streaked . . 45

45a. Stem yellowish-brown tomentose; leaves opposite, appressed against the stem, amplexicaul, crenate or bullate-rugose along the revolute margins; corolla-tube glabrous outside . . . . 40. *P. jamesii*

b. Stem cineraceous-tomentose; leaves in whorls of 3 or scattered, spreading or ascending, not amplexicaul, entire along the margins; corolla-tube pubescent outside . . . . . 41. **P. spenceri*

1. **Pityrodia salvifolia** R.Br., Prod.Fl.Nov.Holl.(1810)513; Walp., Rep.Bot.Syst. 4(1845)97; Schauer in DC., Prod.11(1847)628; Bocq.,Rev.Verbén.(1863)132, t.xv, fig. 8-15; F. Muell., Fragm.4(1864)162 in obs.; F. Muell., Fragm.6(1868)155, 255; Benth., Fl. Aust.5(1870)48; F. Muell., Fragm.9(1875)5; Bail., Synop.Qld Fl.(1883)375; Bail., Cat.Indig.& Natur.Pl.Qld (1890)35; Briq.in Engl.& Prantl, Pflanzenfam.4, 3a(1895)161, fig.61 G & H; Bail.,Qld Fl.4(1901)1169; Diels & E.Pritz., Bot.Jahrb.Syst. 35(1904)517 in key only; Bail., Comp.Cat.Qld Pl.(1913)381 nom.tant.; Mold., Résumé Verben. etc. (1959)210, 335, 339; Mold., Fifth Summary Verben.1 & 2(1971)348, 603, 610.

Type: R. Brown s.n., Port Clinton (Port 2), Northumberland Islands, Queensland, Australia, 22.viii.1802 (BM, lectotype designated here; E 2 spec., FI, K 2 spec., LE, MEL, P 2 spec.—isolectotypes).

Premna salvifolia (R.Br.) Spreng., Syst.Veg.2(1825)755, based on *Pityrodia salvifolia* R.Br. (1810).

Chloanthes salvifolia (R.Br.) F. Muell., Syst.Cens.Aust.Pl.1(1882)103, based on *P. salvifolia* R.Br. (1810); F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172.

Typification

P. salvifolia R.Br. is based on R. Brown's collection (s.n.) from the Northumberland Islands, Queensland, consisting of at least 9 duplicates, all of which remained in Brown's possession until after his death. On his death, his herbarium went to the British Museum where the main set is still held. A complete and well preserved syntype of this species in Herb. BM, annotated by R.Brown, and almost certainly used by him in preparing the original diagnosis of this species, is selected here as the lectotype.

Description (Fig. 1)

An erect spreading shrub to 2.4 m tall. *Stem* and branches densely clothed with peltate fimbriate scales. *Leaves* petiolate, lanceolate, acute or somewhat obtuse, (5-) 6-10 (-13) cm long, (0.5-) 1-2 (-3.3) cm broad, rugose, appearing pubescent above, rusty below, covered all over with peltate scales similar to those on the stem, the midrib prominent underneath; petiole (0.4-) 0.6 - 0.8 (-1.2) cm long. *Flowers* in axillary clusters of (5-) 7-9, shortly pedicellate or almost sessile; pedicel 1-2 mm long; bracts sessile, linear to linear-lanceolate, shorter than calyx, 3-4.5 mm long, c. 1 mm broad; bracteoles sessile linear, 1.5-2 mm long. *Calyx* persistent, turbinate-campanulate, prominently ribbed, divided to rather below the middle into 5 lobes, 5-6 (-7) mm long, clothed outside with peltate fimbriate scales with minute glands, glabrous inside; lobes lanceolate, acuminate, (2.5-) 3-4 (-5) mm long, 1.5 - 2 (-2.5) mm broad at the base; tube 2-3 mm long. *Corolla* white, scarcely exceeding the calyx, 5-7 mm long, glabrous outside excepting a few hairs on the back of the lobes, a dense ring of hairs inside below the stamens; the middle lobe of the lower lip rather larger than the others, narrowly elliptic, obtuse, c. 3 mm long, almost 2 mm broad in the middle; the other 4 lobes ovate-oblong, obtuse, 2-2.5 mm long, c. 1.5 mm broad at the base; tube broadly campanulate, 2-3 mm long. *Stamens* 4; filaments short, 1-2 mm long; anthers included or scarcely exserted, the two lower ones on either side of the large middle corolla-lobe with prominent appendages at the lower ends of the lobes, the two upper ones with only short tubercles; lobes oblong, c. 1 mm long, 0.5 mm broad. *Ovary* more or less globose, c. 1 mm long, densely pubescent; style included, glabrous in the upper half, sparsely hairy towards the base, 2-3 mm long, shortly 2-lobed at the summit. *Fruit* loosely enclosed within the persistent calyx, obovoid-turbinate, rugosely reticulate, puberulous, 3-5 mm long, 2-2.5 mm broad at the top end, 4-celled with only 1 or 2 mature seeds; seeds albuminous.

Specimens examined

QUEENSLAND (23 collections seen): *Bauer s.n.*, Nova Hollandia ora orientali inter tropicos, undated (W). *Beccari s.n.*, Percy Island, 26.i.1878 (FI). *Brown s.n.* ((J.J. Bennett no. 2330), Northumblerland Islands, 1802-5 (BM, lectotype; E 2 spec., K 2 spec., LE, MEL, P 2 spec.) *Carolin 8105*, Kenfield near Baffle Creek, N. of Bundaberg, 24° 25′ S, 152° 0′ E, 11.xi.1972 (SYD). *Cunningham 214*, Cape Cleveland, Cleveland Bay, 14.vi.1819 (BM, FI, K, MEL 2 spec., NY). *Dallachy s.n.*, Rockhampton, Oct. ? 1869 (K). *Dallachy s.n.*, near Mt Hedlow, undated (MEL 69369). *Fielding 12541*, Tully Falls, 2.x.1948 (BRI). *Gittins S/53*, c. 25 miles W.S.W. of Duaringa, Aug. 1964 (NSW). *Heaps s.n.*, Bundaberg, undated (BRI 190699). *Henderson, Durrington & Sharpe H944*, c. 35 km SE of Blackwater, 3.ix.1971 (MEL, NSW). *Herb. Alleizette S762*, Rockhampton, Jan. 1906 (L). *Hyland, s.n.*, Forest reserve, c. 39 miles SW of Cairns, July 1964 (BRI 075075). *L.A.S. Johnson s.n.*, c. 18 miles SW of Dingo, 29.viii.1968 (NSW 135892). *R.W. Johnson 1148*, 12 miles SSE of Bluff, 23.xi.1959 (BRI). *Keys s.n.*, Mt Perry, undated (BRI 190701). *Pegg s.n.*, Mt Morgan, 25.ix.1934 (BRI 190984). *Rasmussen per Parkinson s.n.*, Kolan River, Bundaberg, January 1955 (BRI 190985). *O'Shanesy 94*, near Rockhampton, 12.xii.1867 (MEL). *Telford 5477*, ca. 1 km WSW of Mt Castletower, 2.vi.1977 (CBG). *Thozett 533*, Mt Wheeler, July ? 1869 (M, MEL 2 spec., P, W). *Trapnell & Williams 56*, Blackdown Tableland, 10.viii.1973 (BRI). *Tryon s.n.*, Middle Percy Island, Dec., 1905 (BRI 190700, NSW 135893).

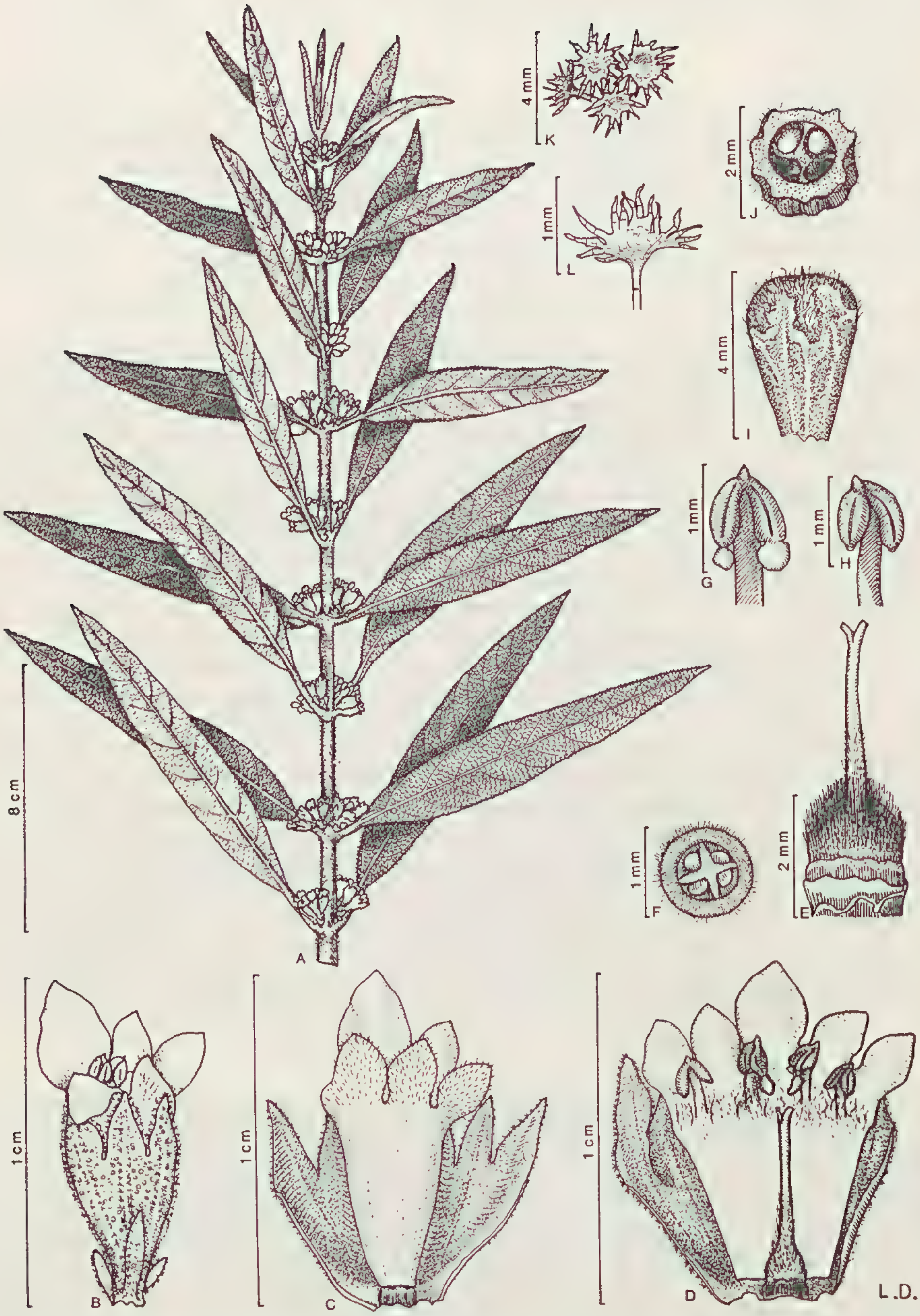
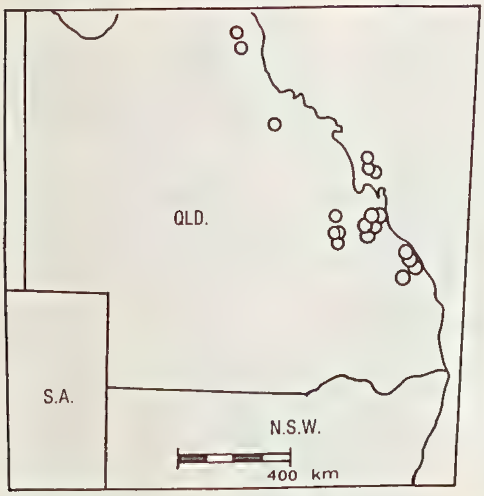


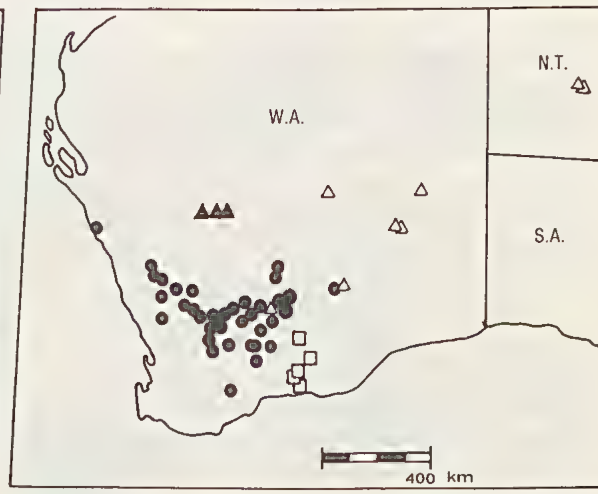
Fig. 1. *Pityrodia salvifolia* R.Br. (*C.H. Gittins S/53*: NSW). A, flowering twig; B, flower with a bract and two bracteoles; C, flower with calyx vertically cut open to show corolla-tube; D, calyx and corolla vertically cut open to show androecium and gynoecium; E, gynoecium; F, transverse section of ovary; G, lower stamen; H, upper stamen; I, fruit; J, transverse section of fruit; K, top view of the leaf-scales; L, side view of a leaf-scale.

Distribution (Map 2A)

P. salvifolia is endemic in the north-eastern tropics of Queensland. Most of the localities are in coastal areas and in the neighbouring Northumberland Islands. The major distribution extends from Bundaberg in the south up to Cairns in the north. A few inland localities are also recorded from south-west Bundaberg, Rockhampton and Townsville.



Map 2A.
P. salvifolia O



Map 2B.
P. loricata △
P. lepidota ●
P. chrysocalyx □
P. canaliculata ▲

Comments

The scaly vestiture of *P. salvifolia* covers all external parts of the plant except the corolla. A somewhat similar vestiture, with almost the same coverage, is also found in *P. lepidota* (F. Muell.) E. Pritz. and *P. loricata* (F. Muell.) E. Pritz. The scales in *P. loricata* (F. Muell.) E. Pritz., however, are more conspicuous and shiny. Such a scaly vestiture is not found elsewhere in the genus.

Bentham (1870) and Bailey (1883, 1901) erroneously recorded the ovary as "glabrous", when in fact it is very densely hairy when fully developed.

Parkinson noted on his collection (BRI 190985) from near Bundaberg, that "the plant is suspected of poisoning stock". Hyland, noted on his collection (BRI 075075) from SW of Cairns, that its "leaves are very aromatic". In Queensland, the plant is locally known as "rosemary".

The duplicate of Thozett's collection of this species in Herb. MEL and P are with his (field labels and) coll. no. "533", but the other duplicates in Herb. M and W are unnumbered.

Affinities

P. salvifolia is allied to *P. loricata* and *P. lepidota* in its stem and calyx being covered with peltate scales, stamens and style exserted above the corolla-tube and fruit obovoid with short pubescence all over. *P. salvifolia*, however, can easily be distinguished by its leaves being petiolate and much larger, measuring (4-) 6-10 (-13) by (0.5-) 1-2 (-3.3) cm, distinctly rugose, the midrib prominent underneath; the dense villous hairy ring in the corolla-tube restricted to its throat only; stamens inserted in the corolla-throat or at the base of corolla-lobes and calyx-lobes neither hairy nor scaly inside. *P. salvifolia* is also near to *P. chrysocalyx* in having peltate scales on stem and calyx, but the latter may be readily identified by its leaves being very small, measuring (1.5-) 2.5-5.5 (-8) by (1-) 1.5-3 (-4) mm, ovate, ternate, reflexed, glutinous and convex above; flowers axillary solitary; corolla hairy inside the tube above the ovary, and stamens inserted within the corolla-tube. *P. salvifolia* is endemic in eastern Queensland, whereas all the other above-named species are restricted to the south and south-west of Western Australia.

2. **Pityrodia chrysocalyx** (F. Muell.) Gard., Enum.Pl.Aust.Occ.3(1931)112; Mold., Résumé Verben.etc. (1959)210, 277; Beard (Ed.), W.Aust.Pl. edn 1(1965)92; Blackall & Grieve, West.Aust.Wildfls 3 (1965)568; Beard (Ed.), W.Aust.Pl. edn 2(1970) 114; Mold., Fifth Summary Verben. etc. 1 & 2 (1971) 347, 425, 475, 603.

Type: A. Dempster s.n., between Esperance Bay and Fraser Range, Western Australia, undated (MEL 880, lectotype designated here; MEL 69299, MEL 69300 - isolectotypes).

Depremesnilia chrysocalyx F. Muell., Fragm.10(1876)59, *basionym*; F. Muell., Syst.Cens.Aust.Pl.1(1882)101.

Type: As for *P. chrysocalyx* (F. Muell.) Gard.

Prostanthera chrysocalyx (F. Muell.) Briq. in Engl. & Prantl, Pflanzenfam. 4, 3a(1895)220, based on *Depremesnilia chrysocalyx* F. Muell. (1876).

Chloanthes depremesnilii F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172, nom.illegit., based on *Depremesnilia chrysocalyx* F. Muell., Fragm.10(1876)59.

Pityrodia depremesnilii (F. Muell.) E. Pritz., Bot.Jahrb.Syst.35(1904)517, based on *Depremesnilia chrysocalyx* F. Muell.; Mold., Résumé Verben. etc. (1959) 210, 251.

Typification

Pityrodia chrysocalyx is based on A. Dempster's (s.n.) collection from Western Australia, consisting of at least 3 duplicates. Since the original author did not select any one of them as a type, it is, therefore, necessary to designate a type for this name. All the syntypes are preserved in Herb. MEL. One of these, with the number MEL 880, is annotated by F. Mueller and almost certainly used by him in preparing the original description of this species. The specimen is particularly complete and well preserved, and is, therefore, selected here as the lectotype for this name.

Description (Fig. 2)

An erect branched shrub 30-75 cm high, with scattered or more often ternate branches. *Stem* and branches densely clothed with fulvous peltate scales. *Leaves* subsessile or shortly petiolate, scattered or more often ternate, reflexed, rarely spreading, broadly ovate or elliptic-ovate, shortly acuminate, margins slightly recurved-revolute forming a shallow concavity on the lower side, (1.5-) 2.5-5.5 (-8) mm long, (1-) 1.5-3 (-4) mm broad in the lower halves, smooth, glutinous and convex above, densely covered with scurfy, peltate, fulvous scales underneath; petiole scaly, ± 1 mm long. *Flowers* almost sessile or shortly pedicellate, solitary in the axil of upper leaves; pedicel densely covered with scales, 1-2 mm long; bracts leaf-life, reflexed, ovate, sessile or shortly petiolate, glutinous above, scurfy-scaly underneath, 2-4 mm long, 1.5-2 mm broad; bracteoles minute, linear, scaly ± 1 mm long. *Calyx* persistent, 5-7 mm long, shortly 5-lobed with a relatively long tube, densely covered outside with peltate scales, glabrous inside; lobes deltoid, 1.5-3 mm long, 1-1.5 (-2) mm broad at the base, tube 3-5 mm long. *Corolla* "white", 9-12 mm long, pubescent outside on the back of the lobes with stellate hairs, glabrous inside excepting the dense hairy ring above the ovary, and sparse hairs extending to the large anterior-lobe of the lower lip; the anterior-lobe broadly elliptic or elliptic-orbicular, 3.5-5 mm long, 3-5 mm broad; the other 4 lobes almost similar, more or less oblong-elliptic or broadly ovate, (2.5-) 3-5 mm long, (1.5-) 2-3 mm broad; tube much broader at the top end, 4-5 mm long, 2-3 mm broad at the top end. *Stamens* exserted

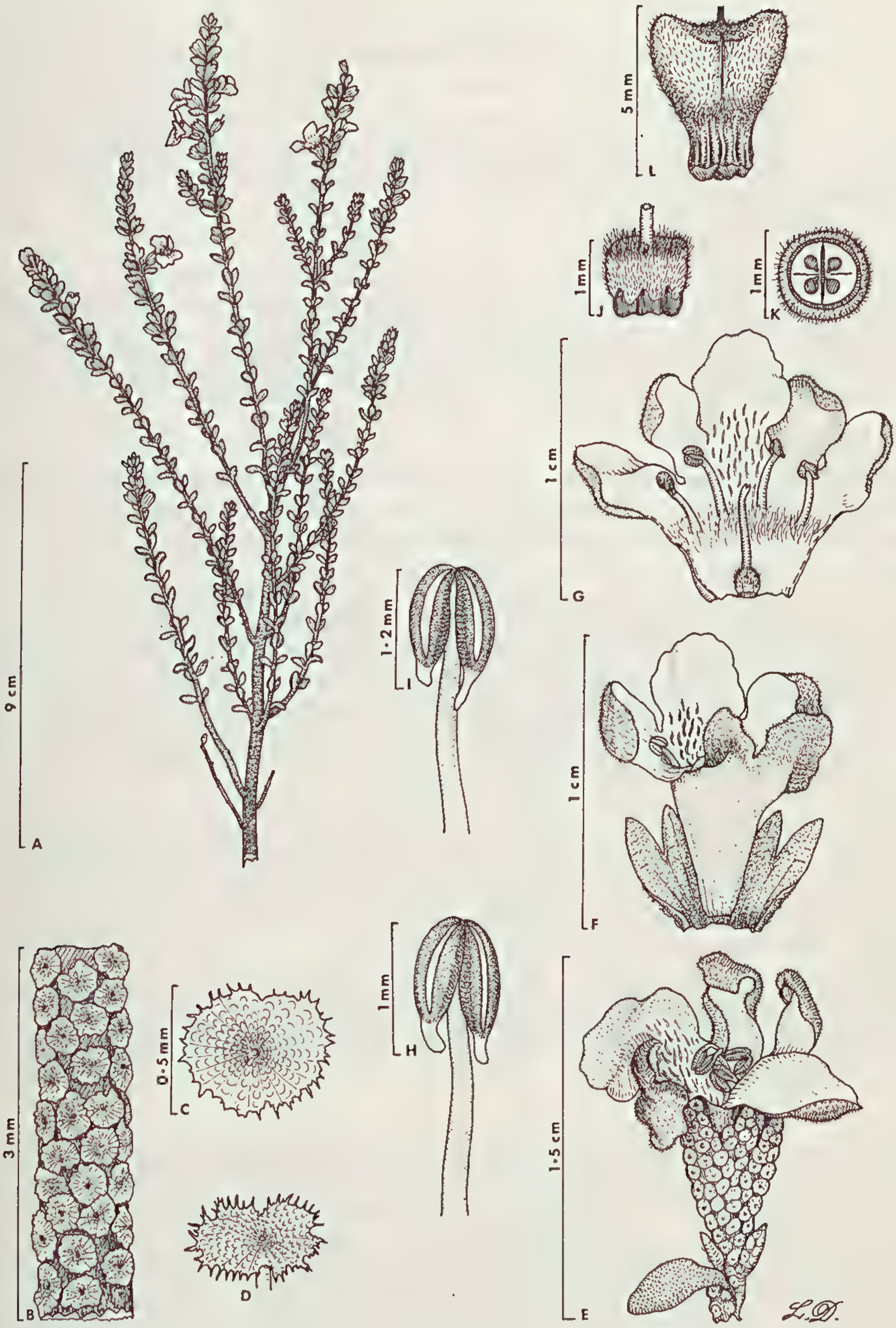


Fig. 2. *Pityrodia chrysocalyx* (F. Muell.) Gard. (A-K, *C.A. Gardner 14223:* PERTH; L, *Wardell & Johnson s.n.*: PERTH). A, flowering branch; B, portion of stem showing scales; C & D, top views of scales; E, flower with a bract and two bracteoles; F, flower with calyx vertically cut open to show corolla-tube; G, corolla-tube vertically cut open to show androecium and gynoecium; H, upper stamen; I, lower stamen; J, ovary; K, transverse section of ovary; L, fruit.

above the corolla-tube; filaments glabrous, filiform, the lower pair 2.5-3 mm long, the upper pair 2-2.5 mm long; anthers more or less orbicular in outline, distinctly appendaged at the lower ends of the lobes, ± 1 mm in diameter; lobes oblong. *Ovary* globose, densely tomentose, seated on a thick disk, ± 1 mm in diameter; style included or scarcely exserted beyond the corolla-tube, glabrous, filiform, 3.5-4.5 mm long, shortly 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, obovoid-pyriform, depressed at the top with two opposite broad based short peripheral projections along the distal end, pubescent all over, 4-5 mm long, 2-3 mm in diameter in the upper half, apparently non-dehiscent; seeds not seen.

Specimens examined

WESTERN AUSTRALIA: *Demarz 6282*, 42 km S of Salmon Gums, 13.xi.1976 (PERTH). *A. Dempster s.n.*, between Esperance Bay and Fraser Range, undated (MEL 880, lectotype; MEL 69299, MEL 69300 - isolectotypes). *Fairall 2444*, near Norseman, 14.x.1967 (PERTH 2 spec.). *Gardner 14223*, near Grass Patch, 5.ix.1962 (PERTH 2 spec.). *Wardell & Johnson s.n.*, Esperance area, 1972 (NSW 138373, PERTH, B, CANB, GH, K, L - not seen). *Wittwer 1873*, 13 km N of Scadden, 13.xi.1976 (PERTH). *Wrigley 5340*, 56 miles from Esperance towards Norseman, 2.xi.1968 (CBG).

Distribution (Map 2B)

P. chrysocalyx is endemic in the southern part of Western Australia, where it seems to occur chiefly between Norseman and Esperance. The type collection came from an unspecified locality between the Fraser Range and Esperance Bay.

Comments

This species was originally described by F. Mueller (1876) as the type of his new genus *Depremesnilia*, in the Labiatae, the species name being *D. chrysocalyx*. He retained the new genus in this family in his first Census of Australian Plants (1882), but in the second Census (1889), he placed it, as a synonym of *Chloanthes*, in the Verbenaceae. The species, however, was renamed as *Chloanthes depremesnilii*, the epithet being derived from the generic name *Depremesnilia*. The leaves are the smallest of any species of *Pityrodia*.

The year "1884" on one isolectotype in Herb. MEL (MEL 69299) should not be mistaken for year of collection, for the species had been described earlier, in 1876. The year "1884" and incorrect information about the locality were written at the bottom of F. Mueller's original annotation in a different hand with a light ink, and seems to have been added much after the actual date of collection.

Moldenke (1959) recorded *P. chrysocalyx* (F. Muell.) Gard. and *P. depremesnilii* (F. Muell.) E. Pritz. as two distinct species, with *Depremesnilia chrysocalyx* F. Muell. and *Chloanthes depremesnilii* as synonyms. In 1971, however, he recognized them both as the same species.

Affinities

P. chrysocalyx is nearest to *P. loricata* and *P. lepidota* in its stem, peduncle and calyx being non-hairy but densely clothed with peltate scales and stamens and style exserted beyond the corolla-tube. Nevertheless, *P. chrysocalyx* may easily be distinguished by the leaves being very small, measuring (1.5-) 2.5-5.5 (-8) by (1-) 1.5-3 (-4) mm, ternate, reflexed, ovate, convex and glutinous dorsally; calyx glabrous inside; fruit with a depression at the top and with two opposite broad-based short peripheral projections at the distal end. *P. chrysocalyx* is also close to *P. salvifolia* in having peltate scales on stem, leaves and calyx, but the leaves in the latter are larger, measuring (4-) 6-10 (-13) by (0.5-) 1-2 (-3.3) cm; flowers (5-) 7-9 in axillary clusters; scales on stem, leaves and calyx mixed with glands and short branched hairs; fruit without any depression at the top. *P. chrysocalyx* is endemic in the south of Western Australia whereas *P. salvifolia* is restricted to eastern Queensland.

3. **Pityrodia canaliculata** George, J.Roy.Soc.W.Aust.50(4)(1967)103; Mold., Fifth Summary Verben. etc. 1(1971)347.

Type: A.S. George 7992, 19 miles west of Sandstone, Western Australia, 12.ix.1966 (PERTH, holotype; K, MEL, PERTH - isotypes).

Description (Fig. 3)

A many stemmed shrub of 1-2.5 m. *Stem* and branches cylindrical, clothed with a close indumentum of peltate, minutely ciliate or fringed scales. *Leaves* almost sessile or narrowed towards the base into a short petiole, linear, almost flat, obtuse, entire, (1-) 1.5-4.5 cm long, 2-4 mm broad, canaliculate-carinate, dark green and becoming glabrous above, pale on the under surface, without conspicuous reticulate nerves, covered all over with a close indumentum of peltate scales. *Flowers* pedicellate, solitary or 3 together in the axil of upper leaves; pedicel scaly, 1.5-3 mm; bracts represented by the upper leaves; bracteoles minute, linear, scaly, 1-1.5 mm long, less than 0.5 mm broad. *Calyx* persistent, campanulate, somewhat angular, 5 lobed at the top, 3-4.5 mm long, densely covered with scales outside and on the inner face of the lobes, glabrous inside the tube; lobes deltoid, 1-1.5 mm long, nearly as broad at the base; tube 2-3 mm long. *Corolla* white with reddish spots in the throat, 8-10 mm long, covered with scales outside excepting the lower half of the tube, a dense hairy ring inside at the base of stamens with some long hairs extending to the large central lobe of the lower lip, a few sparse hairs on the inside of the upper lip; the large central lobe of the lower lip broadly elliptic-orbicular in outline, 4-5.5 mm long, 4-5 mm broad, the lateral lobes of the lower lip ovate or narrowly elliptic-oblong, obtuse, 2-4 (-5) mm long, 1.5-2 (-3) broad; the 2 obtuse lobes of the upper lip oblong, 2.5-4 (-5) mm long, 1.5-2 mm broad; tube 3-4.5 mm long, 2-2.5 mm broad at the top end. *Stamens* exserted, inserted in the corolla-throat; filaments glabrous, filiform, the lower pair 2.5-3 mm long, the upper pair 1.5-2 mm long; anthers more or less orbicular in outline, distinctly appendaged at the lower ends of the lobes, 0.8-1 mm long, nearly as broad. *Ovary* more or less globose, flat topped, densely hirsute-tomentose all over with a few glands at the top $\pm$ 1 mm in diameter; style exserted, filiform, glabrous, 4-5 mm long, shortly 2-lobed at the top. *Fruit* enclosed within the persistent calyx, obovoid-pyriform or almost top-shaped, glandular, and almost truncate or flat at the top, 3-4 mm long, $\pm$ 2.5 mm broad at the top, almost glabrous or sparsely puberulous with a few glands at the top.

Specimens examined

WESTERN AUSTRALIA: *Gardner 2513*, Sandstone, 18.viii.1931 (PERTH 4 spec.). *Gardner & Blackall 485*, between Sandstone and Anketell, August 1931 (PERTH 2 spec.). *George 7992*, 19 miles west of Sandstone, 12.ix.1966 (PERTH, holotype; K, MEL, PERTH - isotypes). *Green 1636*, 4 miles east of Anketell, 27.viii.1957 (PERTH). *Jefferies 578042*, loc. cit. August 1957 (PERTH).

Distribution (Map 2B)

P. canaliculata is endemic in Western Australia where it has been recorded from the area between Sandstone and Anketell.

Comments

C.A. Gardner's collections of this species were annotated as *P. lepidota* var. *longifolia* and *P. lepidota* var. *virgata*. Neither of these varietal names, however, seem to have been published. The confusion of *P. canaliculata* with *P. lepidota* is chiefly on the lepidote indumentum in both the species.

In the protologue, the ovary is described as hirsute only on top. Actually, the ovary is hirsute all over excepting the thick disk on which it is seated. At the fruiting stage, however, the hairs on the ovary become sparse and scarcely visible in the lower half which is covered closely by the persistent calyx.

Fig. 3. *Pityrodia canaliculata* A.S. George (*A.S. George 7992*: PERTH). A, flowering twig; B, portion of stem showing scales; C, cyme in the axil of a leaf; D, flower with calyx vertically cut open to show the corolla-tube; E, corolla-tube vertically cut open showing inside; F, lower anther; G, upper anther; H, ovary; I, transverse section of ovary; J, top view of the fruit; K, side view of the fruit.

Affinities

P. canaliculata is closely related to *P. lepidota*, *P. loricata*, *P. chrysocalyx* and *P. salvifolia* in having a close indumentum of more or less peltate scales. Nevertheless, *P. canaliculata* may easily be distinguished by its leaves being narrow-linear, canaliculate and dark green above; fruit almost flat-topped, sparsely puberulous.

4. **Pityrodia loricata** (F. Muell.) E. Pritz., Bot.Jahrb.Syst.35(1904)516; Gard., Enum. Pl.Aust.Occ.3(1931)112; Mold., Résumé Verben. etc. (1959)210, 251; Beard (Ed.), W.Aust.Pl. edn 1 (1965)92; Blackall & Grieve, West.Aust.Wildfls 3(1965)568; Beard (Ed.), W.Aust.Pl. edn 2 (1970)114; Mold., Fifth Summary Verben.etc. 1(1971)348, 426.

Type: J. Young s.n., Queen Victoria Springs, Western Australia, 30.ix.1875 (MEL 69155, lectotype designated here; M, isolectotype).

Chloanthes loricata F. Muell., Fragm.10(1876)14, *basionym*; F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172; F. Muell.& Tate, Trans.Roy.Soc. S.Aust.16(1896)375.

Type: As for *P. loricata* (F. Muell.) E. Pritz.

Eriostemon argyreus F. Muell.& Tate, Trans.& Proc.Roy.Soc.S.Aust.13(1890) 107 and 97; Wilson, Nuytsia 1(1970)119, syn.nov.

Type: *W.H. Tietkens s.n.*, near Mt Sonder, Northern Territory, 1889 (MEL 4535, holotype).

Pityrodia loricata F. Muell., Fragm.10(1876)14, pro syn.sub *Chloanthes loricata* F. Muell., *nom.invalid.*

Typification

P. loricata is based on J. Young's (s.n.) collection, consisting of at least 2 duplicates. Since the author (of the basionym) did not choose any one of them as a type, it is, therefore, necessary to select a type for this name. The syntype preserved in Herb. MEL (MEL 69155), is annotated by him, and almost certainly used by him in preparing the original description of this species. The specimen is particularly complete and well preserved and is selected here as the lectotype for this name.

Description (Fig. 4)

A much branched low shrub of 30 to 60 cm, glabrous but very densely lepidote all over. *Stem* and branches densely clothed with more or less peltate, sessile, silvery scales, otherwise glabrous. *Leaves* sessile, oblong-lanceolate or narrowly elliptic-lanceolate, rather crowded on the branches, flat, non-decurrent, entire, (5-)8-20(-25) mm long, (2-) 3-5 mm broad, densely clothed with shining scales similar to those on the stem. *Flowers* almost sessile or shortly pedicellate, mostly 3 together in the axil of upper leaves; pedicel densely covered with scales, 1-2 mm long; bracts sessile, linear-lanceolate, scaly on abaxial surface, glabrous but non-scaly on adaxial surface, 3-5 mm long, 0.5-1(-1.5) mm broad; bracteoles linear-lanceolate similar to bracts but shorter, 2-3 (-3.5) mm long, ± 0.5 mm broad. *Calyx* persistent, 5-lobed in the upper half, (4-) 5-7 mm long, densely clothed outside and on the inner face of the lobes with sessile peltate scales, glabrous and non-scaly inside the tube; lobes lanceolate, (2-) 3-4 (-5) mm long, 1-1.5 mm broad at the base; tube 1.5-2.5 mm long. *Corolla* pale pinkish-white, (6-) 7-9 mm long, glabrous all over excepting the dense hairy ring inside above the ovary, and sparse long hairs extending to the large anterior-lobe of the lower-lip; anterior-lobe much larger than the others, more or less broadly elliptic-orbicular or oblong-elliptic, 3-4 mm long, (2-) 2.5-3 mm broad; the other 4 lobes almost equal, more or less oblong-elliptic or ovate, 2-3.5(-4) mm long, 2-2.5 (-3) mm broad at the base; tube (3-) 4-5 mm long, 2-3 mm broad at the top end. *Stamens* exserted; filaments glabrous, filiform, the lower pair longer, (2.5-) 3-4 mm long, the upper pair (2-) 2.5-3.5 mm long; anthers more or less orbicular in outline, scarcely appendaged at the lower ends of the lobes, ± 1 mm long, 0.5-1 mm broad. *Ovary* globose, densely tomentose, seated on a thick glabrous disk, ± 1 mm in diameter; style exserted, filiform, glabrous, 5-7 mm long, shortly 2-lobed at the summit.

Fig. 4. *Pityrodia loricata* (F. Muell.) E. Pritz. (*R. Helms s.n.*: AD 96414089). A, flowering branches; B, cyme; C, flower with a bract and two bracteoles; D, lower stamen; E, upper stamen; F, flower with calyx vertically cut open showing inside scales and corolla-tube; G, corolla-tube vertically cut open to show androecium and gynoecium; H, ovary; I, transverse section of ovary; J, fruit with persistent calyx; K, portion of stem and leaf to show scales; L, single scale.

Fruit enclosed within the persistent calyx, obovoid-pyriform, pubescent, (2.5-) 3-4.5 mm long, 2-3 mm in diameter at the top end, apparently non-dehiscent; seeds not seen.

Specimens examined

WESTERN AUSTRALIA: *George 2877*, 48 miles NE of Cosmo Newbery, 24.vii.1961 (B, NT, PERTH 2 spec.). *George 8456*, 2.7 miles S of Neale Junction, 12.x.1966 (PERTH). *George 11965*, 5 km S of Neale Junction, Great Victoria Desert, 28° 21′ S, 125° 49′ E, 16.vii.1974 (PERTH). *Helms s.n.*, camp 41, Elder Exploring Expedn, 4.ix.1891 (AD 96414089, G, K, LE, MEL 69156, NSW 135941-135944, NSW 142618, PERTH, WU). *Helms s.n.*, Gnarlbine, 12.xi.1891 (K). *Main s.n.*, near Queen Victoria Springs, 25.viii.1960 (PERTH 2 spec.). *Young s.n.*, Queen Victoria Springs, 30.ix.1875 (MEL 69155, lectotype; M, isolectotype).

NORTHERN TERRITORY: *Schomburgk 93*, Central Australia, undated (AD). *Tietkens s.n.*, near Mt Sonder, 1889 (MEL 4535, holotype of *Eriostemon argyreus* F. Muell. & Tate).

Distribution (Map 2B)

P. loricata is endemic to Western Australia and the Northern Territory. In Western Australia, it is very sparsely distributed in the Carnegie, Coolgardie and Eucla districts, and in Northern Territory it has been recorded from near Mt Sonder in the Macdonnell Ranges.

Comments

During present studies, the type of *Eriostemon argyreus* F. Muell. & Tate has been found to be a specimen of *Pityrodia loricata* and the former name is, therefore, regarded as a synonym of the latter. F. Mueller & Tate (1890) considered *E. argyreus* allied to *E. anceps* Spreng. as far as leaves are concerned. In fact, they referred this species to *Eriostemon* Sm. (Rutaceae) only on the basis of its Rutaceae-like leaves, because the type specimen of *E. argyreus* F. Muell. & Tate is a sterile branch with leaves only. Wilson (1970) recognized it as a *Pityrodia* and with some uncertainty identified it as "?*P. lepidota* (F. Muell.) E. Pritzel". However, he expressed his doubt about the type locality "Mount Sonder", because "this genus has not been recorded by G. Chippendale (1972) as occurring in Central Australia". The occurrence of this species in Central Australia has now been confirmed by two separate collections.

The scaly vestiture of *P. loricata* is somewhat similar to those of *P. lepidota* and *P. salvifolia*. Nevertheless, the scales in *P. loricata* are non-stipitate and much less fringed.

Over a period of more than a century, this species seems to have been rarely collected. This may be due to its sparse occurrence in the remote interior parts of the country or to the species itself being rare.

Beard (1965, 1970) recorded this species from the Austin district of the Eremean Province in Western Australia. The present author, however, has not been able to confirm this by any collection from that district.

Affinities

P. loricata is closely allied to *P. lepidota* in its stem, leaves and outside calyx being densely scaly; flowers crowded towards the end of branches into a spicate inflorescence; leaves sessile; stamens and style exserted; fruit obovoid-pyriform, pubescent all over. Nevertheless, *P. loricata* may readily be distinguished by its scaly stem, leaves and calyx being shining (silvery); leaves oblong-lanceolate, calyx-lobes lancelolate, scaly inside and the anther-lobes scarcely appendiculate.

P. loricata is also near to *P. canaliculata* and *P. chrysocalyx* in having a scaly indumentum on the stem, leaves and calyx. *P. canaliculata* can easily be identified by its narrow-linear canaliculate leaves and *P. chrysocalyx* by its leaves being very small, (1.5-) 2.5-5.5 (-8) mm long, reflexed, broadly ovate or elliptic-ovate, smooth and glutinous on the upper non-scaly convex surface.

5. **Pityrodia lepidota** (F. Muell.) E. Pritz., Bot.Jahrb.Syst.35(1904)516; S. Moore, J.Linn.Soc.Lond.45(1920)189; Gard., Enum.Pl.Aust.Occ.3(1931)112; Junell, Sym.Bot. Upsal.4(1934)70, fig. 116; Mold., Résumé Verben. etc. (1959)210, 251; Beard (Ed.), W.Aust.Pl. edn 1(1965)92; Blackall & Grieve, West.Aust.Wildfls 3(1965)568; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben. etc. 1 & 2(1971)348, 426, 603.

Type: *A. Y. Hassell s.n.*, "north-east of Janamonjup", near King George Sound, Western Australia, 1882 (MEL 69343, holotype).

Chloanthes lepidota F. Muell., Syst.Cens.Aust.Pl.1(1882)140, nom.nud.; F. Muell. in Wing, South.Sc.Rec.3 (1883)3, *basionym*; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172.

Type: As for *Pityrodia lepidota* (F. Muell.) E. Pritz.

P. lepidota (F. Muell.) E. Pritz. var. *verticillata* E. Pritz., Bot.Jahrb.Syst.35(1904)516; Mold., Résumé Verben. etc. (1959)210; Blackall & Grieve, West.Aust.Wildfls 3(1965)568; Mold., Fifth Summary Verben.1(1971)348, *syn.nov*.

Type: *L. Diels 5136 & 5138*, "in distr. Austin meridionali Pr. Menzies", Western Australia, ? 1901 (B, n.v.; probably destroyed during the war).

Description (Fig. 5)

A much branched shrub of (20-) 30-70 (-90) cm. *Stem* and branches densely scaly; scales peltate, with fringed margin, cineraceous-brown. *Leaves* sessile, scattered, decussate or more commonly ternate or "verticillate", oblong, oblanceolate or narrowly obovate, flat, obtuse, entire, (3-) 5-10 (-15) mm long, (1.5-) 2-3 (-4) mm broad, densely covered with non-shiny scales similar to those on stem. *Flowers* almost sessile or subsessile, solitary or 3 together in the axil of upper leaves; pedicel short, scaly, 1-2 mm long; bracts leaf-like when supporting single flower, linear-lanceolate and scaly when supporting 3 flowers, the leafy bracts 5-10 by 2 mm, the scaly bracts 1.5-2.5 by 0.5 mm; bracteole minute, linear, scaly, 1-1.5 mm long. *Calyx* persistent, 5-lobed in the upper halves, 5-6 mm long, densely clothed (outside) with peltate scales, glabrous and non-scaly inside the tube and on the lower inner halves of the lobes, hairy in the upper inner halves of the lobes; lobes more or less deltoid, obtuse, 2-3.5 mm long, 1-2 mm broad at the base; tube (1.5-) 2-3 mm long. *Corolla* whitish, "pale lilac", or "pale pink", 7-10 mm long, thinly scaly on the back of the lobes with the aspect of downy pubescence or thin velvet, sparsely stellate hairy inside the large anterior-lobe, glabrous on the inside of other 4-lobes and tube excepting the dense hairy ring above the ovary and sparse long hairs extending to the large anterior-lobe of the lower lip; the anterior-lobe broadly elliptic-orbicular, 4-5 mm long, 3-4.5 (-5) mm broad; the other 4 lobes oblong-obovate, 4-5(-6) mm long, (1.5-) 2-2.5 (-3) mm broad; tube dilated within the calyx, glabrous outside, 3-4 mm long, 2-3 mm broad at the top end. *Stamens* exserted above the corolla-tube; filaments glabrous, filiform, the lower pair (2.5-) 3-4 mm long, the upper pair (1.5-) 2-3 mm long; anthers more or less orbicular in outline; lobes divergent in the lower halves and distinctly appendaged at the lower ends, 0.5-1 mm long, about the same in breadth. *Ovary* globose, densely tomentose, seated on a thick glabrous disk, about 1 mm in diameter; style included or shortly exserted above the corolla-tube, sparsely hairy towards the base, 3-5(-6) mm long, minutely 2-lobed at the apex. *Fruit* enclosed within the persistent calyx, obovoid-pyriform, with the stylar scar deflected to one side, pubescent all over, 3-4 mm long, about 2 mm broad in the upper half, apparently non-dehiscent; seeds not seen.

Representative specimens

WESTERN AUSTRALIA (91 collections seen): *Aplin 2565*, 6 miles west of Kulja on road to Burakin, 27.viii.1963 (PERTH, SYD). *Bailey & Stone 812*, Muntadgin, Sept. 1947 (PERTH). *Baird s.n.*, Kalgoorlie, 1932 (UPS). *Barrow 40*, 10 miles E. of Hyden East Bin, 6.ix.1966 (PERTH, King's Park Perth). *Beard 5153*, Lake Seabrook Survey Area, 23.x.1967 (King's Park Perth). *Blackall 881*, Bronti, east of Southern Cross, 5.x.1931 (PERTH 2 spec.). *Blackall 3327*, 20 miles N of Bencubbin, 6.x.1937 (PERTH 2 spec.). *Blackall 3976*, near Kalannie east of Coorow, Sept. 1938 (PERTH 2 spec.). *Blackall s.n.*, Northampton district, Sept. 1940

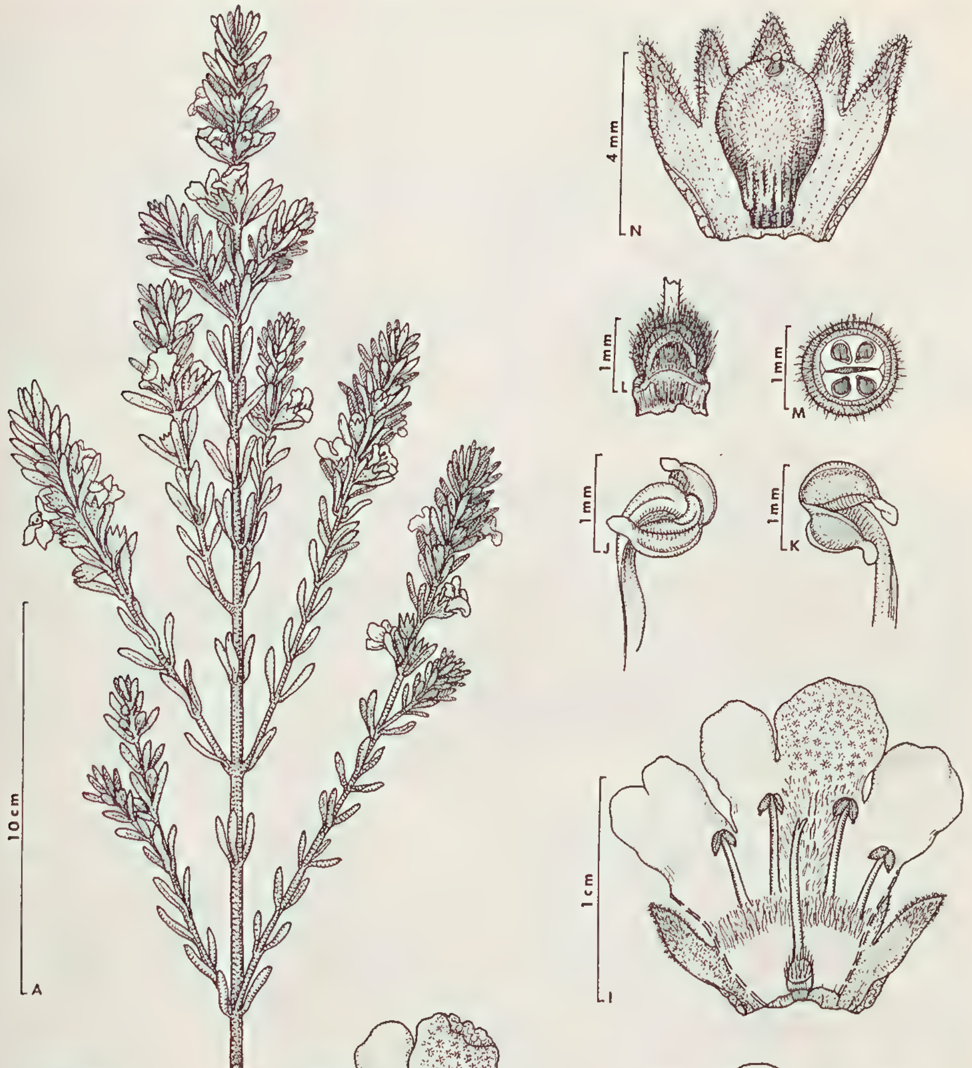


Fig. 5. *Pityrodia lepidota (F. Muell.) E. Pritz.* (A-M, *A.A. Munir 5264:* AD; N, *J.S. Beard 3924:* PERTH). A, flowering twig; B, portion of stem showing scales; C, ventral view of a stem-scale; D, dorsal view of a stem-scale; E, flower with a bract and two bracteoles; F & G, scales from the back of corolla-lobe; H, cyme; I, calyx and corolla vertically cut open to show androecium and gynoecium; J, lower anther; K, upper anther; L, ovary; M, transverse section of ovary; N, fruit with persistent calyx.

(PERTH). *Blackall s.n.*, near Narembeen, Sept. 1929 (PERTH). *Broadbent 1091*, Woolgangie, 26.vii.1953 (BM). *Brooker 2617*, 22 miles N of Cundeelee, 17.vi.1970 (ADW, BRI, PERTH). *Davies 62*, Queen Victoria Rock, mid August 1962 (PERTH). *A. Forrest s.n.*, Boodalin, undated (MEL 531018). *Gardner 128 & 1781*, Carrabin, 7.x.1922 (MEL, PERTH 2 spec.). *Gardner 2693*, Latham, 20.ix.1931 (PERTH). *Gardner 11124*, Comet Vale, 4.xi.1953 (PERTH 3 spec.). *Gardner 12063*, Rabbit Proof Fence eastwards from Perenjori, 8.ix.1953 (AD, L, NSW, PERTH). *Gardner s.n.*, Ballidu, Oct. 1934 (B, PERTH). *Haegi 939*, 15 km north-north-west of Goongarrie on road to Menzies, 14.ix.1976 (AD, BRI, MEL). *Haegi 1117* (? "1119"), 14.5 km north-east of Wubin on road to Payne's Find, 24.ix.1976 (AD). *A. Y. Hassell s.n.*, "north-east of Janamonjup", near King George Sound, 1882 (MEL 69343, holotype of *Chloanthes lepidota* F. Muell.). *Helms s.n.*, Gnarlbine, 12.xi.1891 (AD 96414090). *Keighery 21*, 1 mile W of Mt Hampton, 7.ix.1974 (PERTH, Kings Park Perth). *Keighery 60*, 23 miles east of Muckinbudin-Bullfinch, 6.ix.1974 (PERTH, King's Park Perth). *Kuchel 1779*, 30 km south-east of Londonderry, 14.ix.1964 (AD). *Main 559*, Cundeelee, Queen Victoria Spring area, 25.viii.1960 (PERTH). *Merrall s.n.*, Parker Range, 1892 (MEL 69345, MEL 69157). *Muir 181*, Buntine, 12.vii.1977 (PERTH). *Munir 5255*, 25 km N of Kondinin, 6.ix.1973 (AD). *E. Pritzel 878*, Coolgardie Goldfields, Oct. 1901 (B, BR, E, G 2 spec., GH, HBG, K, L, M, MO, NSW, NY, P, PR, S, US, W). *Royce 5527*, 4 miles S of Queen Victoria Springs, 2.x.1956 (PERTH). *Stacey 75*, 19 miles North of Lake King-Norseman road, on track to Southern Cross, 25.ix.1971 (PERTH). *Stoward 442*, Trayning, 1916 (BM). *Wrigley 5782*, 6 miles from the Humps, towards King Rocks, 10.xi.1968 (CBG, NSW).

Distribution (Map 2B)

P. lepidota is endemic to the south-west of Western Australia where it seems to occur chiefly between latitude 29° and 34° S, and between longitude 116° and 124° E. In addition, one collection has come from some unspecified locality in the Northampton district and another one from "north-east of Janamonjup", an unidentified locality in the King George Sound area. Of the known localities, the major distribution is along the Great Eastern Highway, chiefly between Merredin and Coolgardie. North of the Highway, the distribution extends up to Lake Monger and Lake Moore, and southwards it occurs sparsely in the area between the Great Eastern Highway and the Lake Grace - Lake King road. The western-most locality is near the eastern sources of the Swan River and the eastern-most is near Queen Victoria Springs in the Great Victoria Desert.

Comments

In the protologue, the type-locality is mentioned, "north-east of Janamonjup", but the locality noted on the type label is "near King George Sound". The name "Janamonjup", however, has not been recorded on any recent map, or in any atlas or gazetteer available to the present author. It seems, that either this name has changed subsequent to the discovery of this species or is an error for the locality name Jeramungup which is not very far from King George Sound. This species has been collected from around Jeramungup, but so far there is no record to confirm its occurrence closer to King George Sound.

E. Pritzel (1904) described under this species a new variety, *verticillata*, which he segregated from the typical variety chiefly on its leaves being in whorls of 3-5. The present author has seen a few specimens identified by E. Pritzel as var. *verticillata*, but none of them has leaves in whorls of 5. It seems, that when the internode between the two successive nodes bearing opposite and ternate leaves is very contracted, the number of leaves per node may appear to be 5. During present investigations, both decussate and verticillate leaves were found in the type specimen and in several other specimens. The types of var. *verticillata* are not available for study, probably because they were preserved in the herbarium at Berlin and were destroyed during the war. Nevertheless, the characters on the basis of which E. Pritzel (1904) distinguished var. *verticillata* from the typical variety are not unique. Therefore, the type variety and var. *verticillata* are being regarded here as one and the same taxon.

The inflorescence of *P. lepidota* appears lax when there is only one flower in the axil of upper decussate leaves, and fairly congested when there are 3 flowers in the axil of each ternate leaf. Both types are found commonly within this species. The bracts of the axillary solitary flowers, however, are leafy and of 3-flowered axillary cymes, small and scaly like the bracteoles.

Affinity

P. lepidota is nearest to *P. loricata* in its stem, leaves and outside calyx being densely scaly; inflorescence of densely crowded spicate flower-clusters towards the ends of branches; leaves sessile; stamens and style exserted above the corolla tube and fruit obovoid- pyriform, pubescent all over. Nevertheless, *P. lepidota* may easily be identified by the scales on the stem and leaves not being shiny; leaves cineraceous or dull green; calyx-lobes hairy inside; corolla-lobes scaly on their back and sparsely stellate-hairy inside the large anterior lobe; anther-lobes distinctly appendaged on both pairs of stamens; bracts leaf-like in the axillary solitary flowers. Both the species are restricted in the south-west of Western Australia, but *P. lepidota* is more southern in its distribution.

6. **Pityrodia angustisepala** Munir, sp. nov.

Caules et rami tetragoni, dense pubescentes. Foliorum laminae ellipticae vel elliptico-lanceolatae, glandulosae, puberulae. Calycis lobi linearii vel anguste lineari-lanceolati, (10-) 12-16 (-18) mm longi, 1-3 mm lati; tubus 1-2.5 mm longus. Corolla flava. Stamina exserta. Fructus 4-porcati.

Type: *N. Byrnes 1378*, near U.D.P. Falls, Arnhem Land, Northern Territory, Australia, 20.ii.1969 (NT, holotype; AD, BRI, CANB, DNA, NSW - isotypes).

Description (Fig. 6)

An erect branched shrub of 1-2 metres. *Stem* and branches more or less tetragonal, densely pubescent. *Leaves* petiolate; lamina flat, elliptic or elliptic-lanceolate, crenulate, cuneate towards both the ends, glandular and puberulous all over, rugose-bullate above, reticulation honey-combed beneath, (2.5-) 3-7 (-8.5) cm long, (0.6-) 1-2 (-2.5) cm broad; petiole pubescent, 4-10 mm long. *Inflorescence* cymose in the upper axils, not exceeding the leaves. *Flowers* pedicellate, axillary solitary or 3 in a cyme; pedicel glandular-viscid, pubescent, 1-3 mm long; bract narrowly elliptic, glandular pubescent, 4-7 mm long, 1.5-3 mm broad; bracteoles similar to bract, 1.5-3 (-4) mm long, 1-2 mm broad. *Calyx* persistent, deeply 5-lobed, with a short tube at the base, (12-) 13-18 (-20) mm long, densely glandular and puberulous outside and on the inner surface of the lobes, glabrous and non-glandular inside the tube; lobes linear or narrowly linear-lanceolate, ribbed outside, (10-) 12-16 (-18) mm long, 1-3 mm broad; tube short, 1-2.5 mm long. *Corolla* pale yellow, 18-25 mm long, glandular and sparsely stellate tomentose outside, glabrous inside excepting the dense hairy ring above the ovary, and a few very sparse and long hairs extending to the large anterior lobe; lobes broadly ovate, the anterior lobe 3-5 mm long, 2.5-4.5 mm broad at the base, the other 4 lobes 2.5-4 mm long, nearly as broad at the base; tube gradually dilated upwards, slightly curved, 13-16 (-18) mm long, 5-7 mm broad at the top end. *Stamens* much exserted; filaments glabrous, the lower pair (8-) 10-14 mm long, the upper pair (7-) 8-12 mm long; anthers oblong, 2-2.5 mm long, 1-1.5 mm broad, scarcely appendaged at the lower ends. *Ovary* globose, longitudinally corrugated, densely tomentose, with a thick glabrous disk underneath, 1-1.5 mm in diameter; style much exserted, filiform, glabrous, (18-) 20-30 mm long, shortly 2-lobed at the summit. *Fruit* broadly oblong in outline, more or less 4-ridged or angled in the upper half with longitudinal ridges and corrugation, 3-5 mm long, 2-4 mm broad, pubescent in the upper half, glabrous in the lower half, non-dehiscent, the longitudinal ridges protruding above the top end; seeds not seen.

Specimens examined

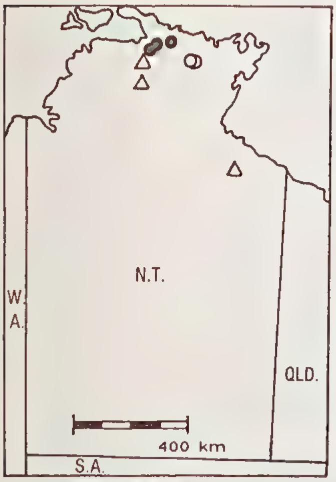
NORTHERN TERRITORY: *Byrnes 1378*, near U.D.P. Falls, Arnhem Land, 20.ii.1969 (NT, holotype; AD, BRI, CANB, DNA, NSW - isotypes). *Craven 3486*, McArthur River area near the Clyde River, Lat.

Fig. 6. *Pityrodia angustisepala* Munir *(N. Byrnes 1378*: NT, holotype). A, flowering branch; B, portion of stem to show its 4 angles; C, flower; D, flower with calyx vertically cut open to show corolla-tube; E, corolla-tube vertically cut open to show the inside; F, lower anther; G, upper anthers; H, ovary; I, transverse section of ovary; J, fruit.

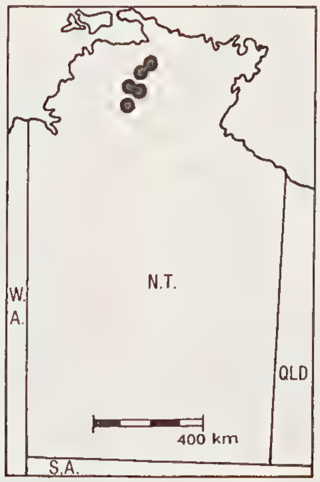
16° 27′ S, Long. 136° 10′ E, 29.i.1976 (AD, BRI, CANB). *Dunlop & Byrnes 2120*, U.D.P. mine area, 17.iii.1971 (AD, BRI, CANB, NT). *Key s.n.*, c. 1.5 km west of Koongarra, 15 km east of Mt Cahill, 29.x.1972 (CANB 233906 and CANB 233911).

Distribution (Map 3A)

P. angustisepala is endemic in the northern part of Northern Territory. So far it has been recorded chiefly from between 12° and 14° S and between 132° and 133° E. One collection from outside the above limit has been gathered from near the Clyde River, east of McArthur River Homestead.



Map 3A.
P. angustisepala △
P. megalophylla ○
P. lanceolata ●



Map 3B.
P. quadrangulata ●

Map 3C.
P. halganiacea ○

Comments

The calyx-lobes of *P. angustisepala* are apparently the longest and among the narrowest within the genus. Similarly, the much exserted stamens and style, and presence of sessile stellate hairs outside the corolla-tube appear to be a peculiarity of this species.

Affinities

P. angustisepala is closely allied to *P. lanceolata, P. megalophylla* and *P. quadrangulata* in its stem being tetragonous; stamens and style exserted above the corolla-tube; anthers oblong, scarcely appendaged at the lower ends of the lobes; fruit distinctly 4-ridged or 4-angled in the upper half. Nevertheless, *P. angustisepala* can easily be distinguished by its leaves being narrow-elliptic, cuneate towards both the ends; calyx-lobes longest and narrowest of all of them, glandular and puberulous all over and corolla-tube with sessile stellate hairs outside. The distinct leaf-petiole, large disk below the ovary and somewhat similar looking fruit bring this species closer to *P. lanceolata* and *P. megalophylla*. However, the rugose-bullate leaves, long and narrow calyx-lobes and pale yellow corolla at once distinguish it. Besides the above-mentioned characters in common with *P. angustisepala* and *P. quadrangulata*, there are a few other identical features in both the species. They seem nearer to each other in having a pale yellow-corolla with tube gradually dilated upwards, lobes ovate and the inside villous hairs extending to the large anterior lobe being few and very sparse. *P. quadrangulata*, however, may easily be identified by its leaves being subsessile, obovate; calyx woolly-tomentose outside and fruit much more sharply 4-ridged or 4-angled.

7. **Pityrodia quadrangulata** Munir, sp. nov.

Caules et rami tetragoni, lanuginoso-tomentosi. Foliorum laminae elliptico-oblongae vel obovatae, lanuginoso-tomentosae. Calycis lobi lanceolati, membranacei, (5-) 8-11 (-13) mm longi, (2-) 3-4 mm lati; tubus (2-) 3-5 mm longus. Corolla flava. Stamina parum exserta. Fructus acute 4-angulati vel 4-costati.

Type: *L.G. Adams 2795*, 38 miles S of Oenpelli, 12° 52′ S, 133° 06′ E, 10.vii.1972 (CANB, holotype; K, L, NT, US - isotypes).

Description (Fig. 7)

A woolly-tomentose shrub of about 1 m. *Stem* and branches distinctly quadrangular, densely clothed with white woolly branched tomentum. *Leaves* shortly petiolate or subsessile, elliptic-oblong or obovate, cuneate towards the base, entire or crenulate, obtuse, flat, (3-) 4-8 (-10) cm long, (1-) 1.5-2.5 cm broad, sparsely glandular and densely woolly-tomentose, thick, bullate-rugose on the upper surface, reticulate underneath; petiole woolly-tomentose, (2-) 3-7 mm long. *Flowers* pedicellate, 3-9 (-12) together in pedunculate axillary cymes towards the end of branches, disposed in a paniculate inflorescence; cyme-peduncle thick, mostly 4-angled, tomentose, (5-) 10-18 mm long; pedicel slender, tomentose, (1-) 2-3 (-4) mm long; bracts leafy, narrowly elliptic-oblong or lanceolate, tomentose on abaxial surface, glabrous on adaxial surface, 4-8 (-10) mm long, (1-) 2-2.5 (-4) mm broad; bracteoles linear-lanceolate, 2-4 (-6) mm long, (0.5-) 1-1.5 mm broad. *Calyx* persistent, divided to below the middle into 5 lobes, tubular towards the base, 10-14 (-15) mm long, glandular and densely woolly-tomentose outside, sparsely so on the inside of the lobes, glabrous inside the tube; lobes lanceolate, membranous, reticulate (5-) 8-11 (-13) mm long, (2-) 3-4 mm broad at the base; tube ribbed, (2-) 3-5 mm long. *Corolla* pale yellow, 14-25 mm long, pubescent outside, glabrous inside excepting the narrow hairy-ring above the ovary, and occasionally a few sparse hairs extending to the large anterior-lobe of the lower-lip, lobes very broadly ovate, obtuse; the anterior-lobe much larger than any of the others, (2-) 3-4 mm long, 4-6 mm broad at the base; the other 4-lobes almost equal, (1-) 2-3 mm long, 2-4 (-5) mm broad at the base; tube gradually dilated upwards, (8-) 12-20 mm long, (5-) 7-10 mm broad at the top end. *Stamens* as long as the corolla-tube or slightly exserted; filaments glabrous, filiform, the lower pair 7-11 mm long, the upper pair 5-9 mm long; anthers oblong, 1.5-2 mm long, 1-1.5 mm broad, with minute appendages at the lower ends of the lobes. *Ovary* globose, pubescent-tomentose, longitudinally 4-ridged or corrugated, 0.5-1 mm diameter, seated on a very thick, circular, glabrous disk of up to 2 mm diameter; style exserted, filiform, glabrous, 15-25 (-30) mm long, shortly 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, tetraquetrous, with 4 distinct longitudinal ridges or sharp angles, narrowly obovoid, depressed at the top, (3-) 4-6 mm long, 2-2.5 (-3) mm broad, puberulous, somewhat corrugated or sculptured between the wings, the wings protruding beyond the apex; seeds not seen.

Specimens examined

NORTHER TERRITORY: *Adams 2795*, 38 miles S of Oenpelli, 12° 52′ S, 133° 06′ E, 10.vii.1972 (CANB, holotype; K, L, NT, US - isotypes). *Byrnes 1649*, Sleisbeck, 18.vi.1969 (DNA, NT). *Byrnes 1826*, Katherine Gorge National Park, 24.iii.1970 (AD, DNA, NT). *Dunlop 4432*, Deaf Adder Gorge, 13° 04′ S, 132° 59′ E, 23.ii.1977 (AD, DNA, K, NT). *Fox 2554*, loc. cit., 13° 05′ S, 132° 51′ E, 24.ii.1977 (AD, CANB, DNA, NT). *Gittins 2672*, 65 km from Pine Creek, UDP Falls road, July 1973 (BRI 2 spec.). *Martensz & Schodde AE 563*, 2 to 3 miles N El Sharana, 15.i.1973 (CANB).

Distribution (Map 3B)

P. quadrangulata is endemic in the Arnhem Land region of the Northern Territory. The known distribution is to the north of Katherine, where it has been recorded from between 12° and 15° S and between 132° and 134° E.

Fig. 7. *Pityrodia quadrangulata* Munir (*L.G. Adams 2795*: CANB). A, flowering twig; B, flower with a bract, two bracteoles and pedicel; C, flower with calyx vertically cut open to show inside; D, corolla-tube vertically cut open to show androecium and gynoecium; E, upper anther; F, lower anther; G, ovary; H, transverse section of ovary; I, fruit; J, top view of fruit showing 4 angles.

Comment

This is one of the most northerly occurring species of this genus.

Affinity

P. quadrangulata is nearest to *P. dilatata* in having similar shaped flat bullate-rugose leaves, pedicellate flowers, membranous and reticulate-veined calyx, gradually upwards dilated corolla-tube, oblong anthers with minute appendages at the base of the lobes, thick glabrous disk below the ovary and 4-angled fruit. However, *P. quadrangulata* can easily be distinguished by its stem and branches being distinctly quadrangular; leaves cuneate towards the base, longer, up to 8 (-10) by 2.5 cm; flowers 3-9 (-12) in a pedunculate axillary cyme, disposed in a more or less paniculate inflorescence; calyx-lobes lanceolate, tomentose inside, with (2-) 3-5 mm long tube; corolla pale yellow, almost glabrous inside at the base of the large non-reflexed anterior-lobe; ovary longitudinally ridged or corrugated; disk smooth and circular; fruit more or less oblong-rectangular, with 4 distinct longitudinal ridges or sharp angles, all over puberulous.

8. **Pityrodia megalophylla** Munir, sp. nov.

Caules et rami plus minusve tetragoni, dense tomentosi. Foliorum laminae ovatae, basi cordatae vel subcordatae, dense tomentosae, (4-) 5-10 (-14) cm longae. Calycis lobi ovati, (7-) 8-12 (-14) mm longi, (5-) 6-8 (-9) mm lati; tubus (7-) 8-10 mm longus. Corolla rosea. Stamina exserta, antheris 2.5-3 mm longis. Fructus apicem versus leviter 4-angulati vel 4-porcati.

Type: *D.E. Symon 7868*, rocky outcrops about 16 km south of Yaimanyi Creek, Arnhem Land, Northern Territory, Australia, 24.vi.1972 (ADW at AD, holotype; AD, CANB, K, NT - isotypes).

Description (Fig. 8)

An erect tomentose shrub of 1-2 m. *Stem* and branches more or less 4-angled, densely clothed with branched tomentum. *Leaves* distinctly petiolate; lamina ovate, acute, entire, more or less cordate at the base, flat, rugose above with distinct reticulation beneath, (4-) 5-10 (-14) cm long, (2-) 3-5 (-6) cm broad, densely greyish tomentose; petiole (0.8-) 1-2 cm long, tomentose. *Inflorescence* cymose; cymes arranged into leafy panicle, densely tomentose, not exceeding the leaves; primary peduncles in the upper axils, 1-1.5 (-2) cm long. *Flowers* pedicellate, 3-7 in a cyme, sometimes axillary solitary; pedicel 2-3 (-4) mm long, tomentose; bracts leafy, narrowly elliptic, cuneate towards the base, glabrous on adaxial surface, tomentose on abaxial surface, flat, entire, 8-12 mm long, (2-) 3-4 mm broad; bracteoles similar to bracts in shape and indumentum coverage, 3-5 mm long, 1-2 mm broad. *Calyx* persistent, divided almost to the middle into 5 lobes, distinctly ribbed, (15-) 18-22 (-24) mm long, densely tomentose outside and on the inner face of the lobes, glabrous inside the tube; lobes ovate, acute, strongly ribbed on the back, (7-) 8-12 (-14) mm long, (5-) 6-8 (-9) mm broad at the base; tube much dilated upwards, (7-) 8-10 mm long. *Corolla* reddish-pink, 22-27 mm long, glandular and woolly-tomentose outside, glabrous inside excepting the dense hairy ring above the ovary and a few sparse hairs extending to the large anterior-lobe; the anterior lobe more or less orbicular in outline, entire, 4-5 mm long, 5-6 mm broad; the other 4 lobes broadly ovate, 2.5-4 mm long, 3-5 mm broad at the base; tube cylindrical towards the base, abruptly dilated above the middle, 18-22 mm long, 6-8 mm broad at the top end. *Stamens* exserted; filaments pubescent in the lower halves, glabrous above, filiform, the lower pair 12-14 mm long, the upper pair 10-12 mm long; anthers oblong, 2.5-3 mm long, 1-1.5 mm broad, the appendages indistinct at the lower ends of the lobes. *Ovary* globose, densely tomentose, seated on a large glabrous disk, 1.5-2 mm in diameter; style exserted, glabrous, filiform, 22-28 mm long, shortly 2-lobed at the summit. *Fruit* oblong or more or less elliptic-oblong,

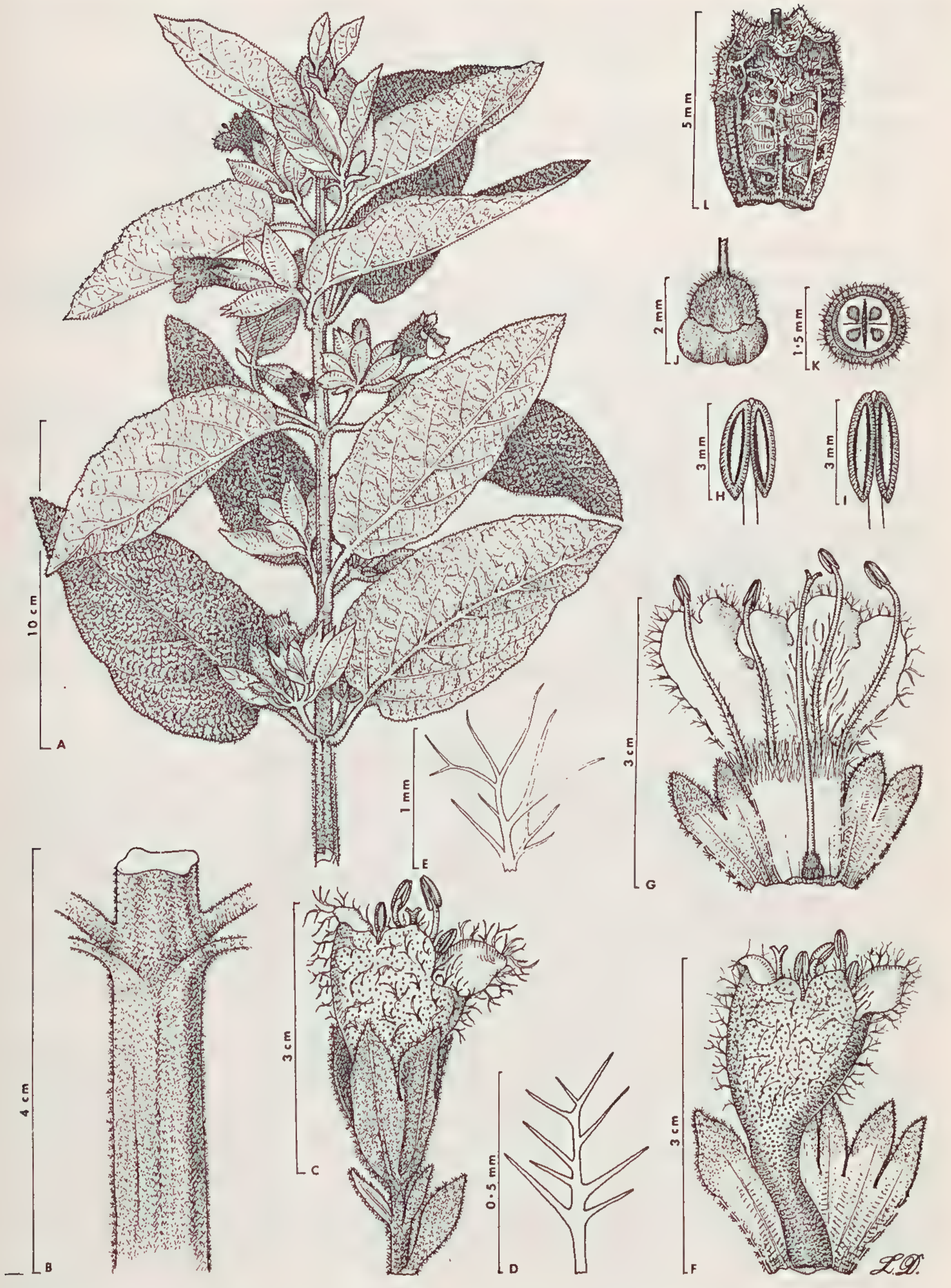


Fig. 8. *Pityrodia megalophylla* Munir (*D.E. Symon 7868*: ADW at AD). A, flowering branch; B, portion of stem showing 4 angles; C, flower with a bract and two bracteoles; D, calyx hair; E, corolla hair; F, flower with calyx vertically cut open to show corolla-tube; G, calyx and corolla vertically cut open to show androecium and gynoecium; H, lower anther; I, upper anther; J, ovary; K, transverse section of ovary; K, fruit.

pubescent and somewhat 4-angled or 4-ridged in the upper half, glabrous in the lower half, all over corrugated, somewhat sculptured in the upper half, (3.5-) 4-6 mm long, (3-) 4-5 mm in diameter, non-dehiscent; seeds not seen.

Specimens examined

NORTHERN TERRITORY: *Basedow 51*, Arnhem Land, loc. incert., April-June, 1928 (AD, K). *Byrnes 2688*, 58 miles NW of Gove - Maningrida Road Junction, 12° 53′ S, 134° 34′ E, 24.vi.1972 (AD, CANB, DNA, K, L, NSW, NT). *Maconochie 1577*, c. 90 miles south of Maningrida, 12° 51′ S, 134° 32′ E, 25.vi.1972 (NT). *Symon 7868*, about 16 km south of Yaimanyi Creek, 12° 53′ S, 134° 34′ E, 24.vi.1972 (ADW at AD, holotype; AD, CANB, K, NT - isotypes).

Distribution (Map 3A)

P. megalophylla is endemic in Arnhem Land, Northern Territory. The only known occurrence is about 93 km north-west of Gove - Maningrida Road junction towards Yaimanyi Creek.

Comments

Of all the *Pityrodia* species, *P. megalophylla* seems to have the largest leaves, calyces and anthers. It is one of the most northerly occurring, and one of the few species of this genus recorded from the Arnhem Land, Northern Territory.

The ovary seems partly imbedded in the glabrous fleshy disk, which in most cases is found to be much larger than the ovary. At infructescence stage, the disk appears to form a fleshy outer covering in the lower half of the fruit, but in the mature dry fruit it becomes irregularly wrinkled or corrugated. The glabrous surface pattern thus formed is different from the hairy sculptured upper half of the fruit, derived from the non-imbedded tomentose portion of the ovary.

Appendages at the lower ends of anther-lobes are not prominent. Similar anthers have also been noticed in a few other species of this genus.

Affinities

P. megalophylla is closely related to *P. obliqua* in its leaves being distinctly petiolate, ovate, cordate at the base; inflorescence (cymes) in upper axils, not exceeding the leaves; corolla pink, glandular and tomentose outside, tube abruptly dilated above the middle; stamens and style exserted above the corolla-tube. Nevertheless, *P. megalophylla* can be distinguished by its stem being distinctly 4-angled; leaves much larger, (3-) 5-10 (-14) by (1-) 2-5 (-6) cm; calyx larger, strongly ribbed, divided to about the middle only into 5 ovate lobes, densely clothed outside with short cineraceous tomentum, tube longer, non-glandular inside; corolla larger; anthers oblong, filaments pubescent in the lower halves; style glabrous all over; fruit more or less oblong with 4 ridges or angles in the upper half, deeply corrugated all over or sculptured in the upper half.

P. megalophylla and *P. quadrangulata* are also close to each other in having 4-angled stems, glabrous calyx-tube inside, exserted stamens and style, oblong anthers with inconspicuous appendages at the lower ends of the lobes and more or less similar looking fruit with distinct 4-angles, corrugations and/or sculpturing. Both the species are endemic in Arnhem Land, Northern Territory. *P. quadrangulata*, however, may readily be distinguished by the presence of long woolly tomentum all over the plant; leaves being subsessile, elliptic-obovate, pronounced bullate-rugose; calyx-lobes lanceolate, membranous when dry; corolla pale yellow, tube gradually dilated upwards, and fruit much more distinctly 4-angled throughout its length.

Another new species, *P. lanceolata*, is very near to *P. megalophylla*. It is found to have similar short cineraceous tomentum all over the plant, 4-angled stem, petiolate leaves, axillary cymes towards the end of branches, strongly ribbed calyx with ovate lobes, reddish-pink corolla with numerous small glands and woolly tomentum outside, exserted stamens and style, pubescent filaments in the lower halves, oblong anthers with inconspicuous appendages at the lower ends of the lobes, and almost similar fruit. Both species are endemic in the Arnhem Land, Northern Territory. *P. lanceolata*, however, can easily be distinguished by its leaves being lanceolate with rounded or narrowed base, calyx pubescent inside, corolla-tube gradually dilated upwards, ovary and fruit more distinctly 4-winged and densely woolly-tomentose in the upper halves.

9. **Pityrodia lanceolata** Munir, sp. nov.

Caules et rami plus minusve tetragoni, breviter tomentosi. Foliorum laminae anguste elliptico-lanceolatae, basi cuneatae, dense tomentosae, (3-) 4-8 (-9) cm longae. Calycis lobi ovati, 5-7 (-8) mm longi, 3-5 mm lati; tubus 5-8 (-10) mm longus. Corolla rubra. Stamina exserta, antheris 1.5-2.5 mm longis. Fructus 4-angulati vel 4-porcati.

Type: *N. Byrnes 2727*, 8 miles south of Oenpelli Mission, Arnhem Land, Northern Territory, Australia, 13.vii.1972 (AD, holotype; CANB, DNA, K, L, NT - isotypes).

Description (Fig. 9)

An erect glaucous shrub of 1-2 m. *Stem* and branches more or less 4-angled, densely clothed with short, greyish, branched tomentum which often becomes yellowish upwards. *Leaves* distinctly petiolate; lamina narrowly elliptic-lanceolate, flat, entire, rounded or cuneate at the base, dark green and rugose above, greyish with distinct reticulation beneath, densely tomentose all over, (3-) 4-8 (-9) cm long, (0.5-) 0.6-2 (-2.5) cm broad; petiole slender, 6-10 (-13) mm long, greyish-tomentose. *Inflorescence* cymose in the upper axils; cymes paniculate, not exceeding the leaves; peduncle short. *Flowers* pedicellate, axillary solitary or 3 in a cyme; pedicel 1-3 mm long, greyish-tomentose; bracts petiolate, about the shape and size of a leaf; bracteoles sub-sessile, oblong or narrowly elliptic-lanceolate, 2-4 (-6) mm long, 0.5-1.5 (-2) mm broad. *Calyx* persistent, divided in the upper half into 5 lobes, distinctly ribbed, 10-16 (-18) mm long, greyish tomentose outside and on the inner face of the lobes, puberulous inside the tube; lobes ovate, acute, ribbed on the back, 5-7 (-8) mm long, 3-5 mm broad; tube dilated upwards, 5-8 (-10) mm long. *Corolla* red, 20-27 mm long, densely glandular and woolly-tomentose outside, inside with a dense hairy ring above the ovary and a few sparse hairs extending to the large anterior lobe; the anterior lobe more or less orbicular in outline, entire, 4-7 mm long, 3-6.5 mm broad; the other 4 lobes broadly ovate, 3-4.5 mm long, 3-5 mm broad at the base; tube gradually dilated upwards, slightly curved, 14-22 mm long, 5-8 mm broad at the top end. *Stamens* exserted; filaments filiform, sparsely hairy in the lower halves, glabrous above, the lower pair 10-12 mm long, the upper pair 8-10 mm long; anthers oblong, 1.5-2.5 mm long, 1-1.5 mm broad, indistinctly appendaged at the lower ends. *Ovary* globose, densely tomentose, seated on a large glabrous disk, 1-1.5 mm in diameter, style exserted, glabrous with a few sparse hairs in the lower half, 20-25 mm long, shortly 2-lobed at the top. *Fruit* more or less oblong in outline with 4 distinct longitudinal ridges or angles, woolly-tomentose in the upper half, glabrous in the lower half, corrugated all over, 4-6 mm long, 3-4 mm in diameter, non-dehiscent; seeds not seen.

Specimens examined

NORTHERN TERRITORY: *Byrnes 2717*, 8 miles south of Oenpelli Mission, 13.vii.1972 (AD, holotype; CANB, DNA, K, L, NT - isotypes). *Key 57920.5*, 15 km south-west by Nimbuwah Rock, 12° 17′ S, 133° 14′ E, 1.xi.1972 (CANB 2 spec.). *Maconochie 1594*, 8 km (5m) west of Rum Bottle Creek, 12° 04′ S, 133° 44′ E, 28.vi.1972 (CANB, NT). *Symon 7958*, loc. cit. 28.vi.1972 (ADW at AD).

Distribution (Map 3A)

P. lanceolata is endemic in Arnhem Land, Northern Territory. The known distribution is to the east of Darwin where it has been recorded from between 12° and 13° S and between 133° and 134° E.

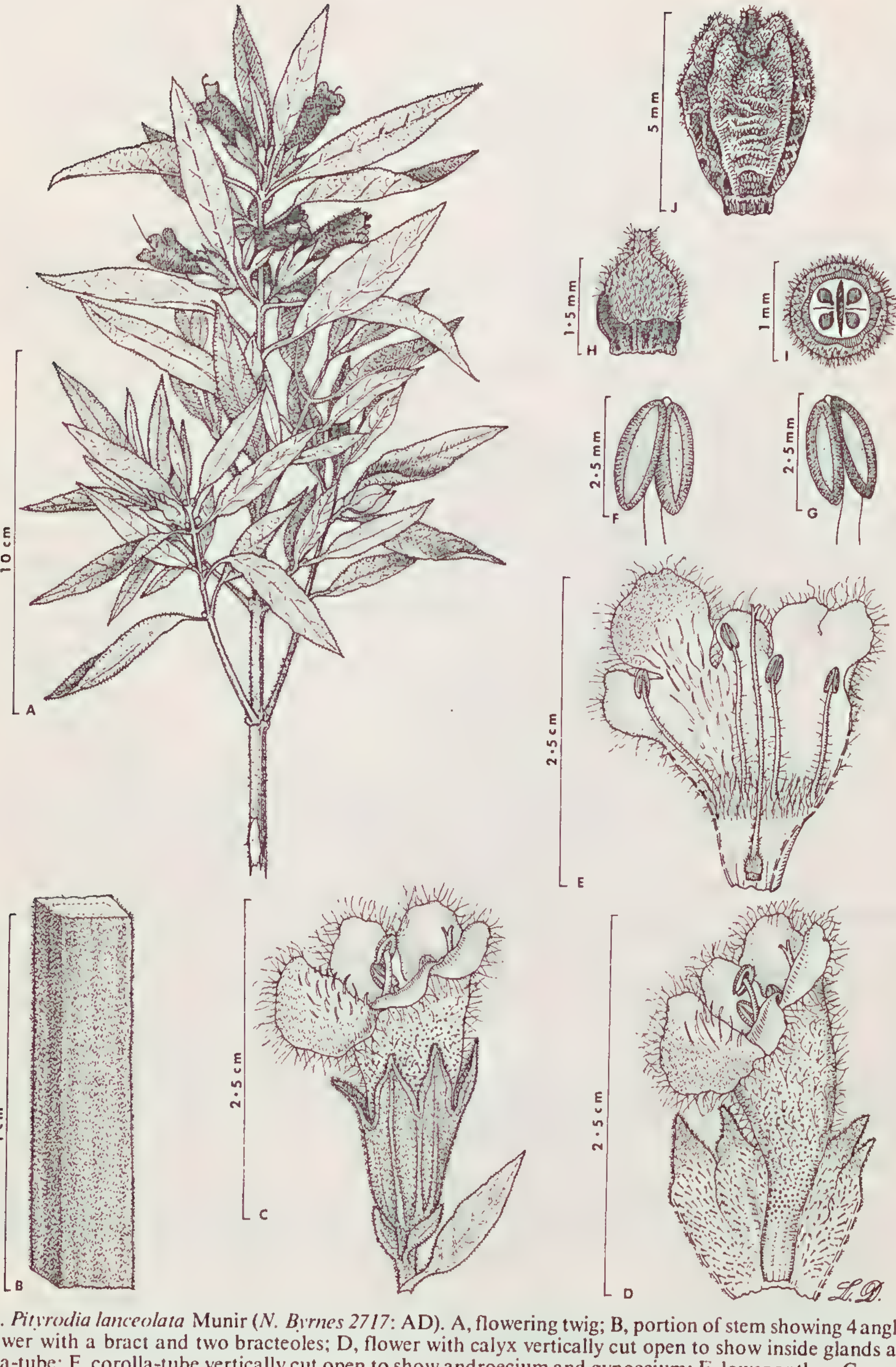


Fig. 9. *Pityrodia lanceolata* Munir (*N. Byrnes 2717*: AD). A, flowering twig; B, portion of stem showing 4 angles; C, flower with a bract and two bracteoles; D, flower with calyx vertically cut open to show inside glands and corolla-tube; E, corolla-tube vertically cut open to show androecium and gynoecium; F, lower anther; G, upper anther; H, ovary; I, transverse section of ovary; J, fruit.

Comment

The greyish hairs outside the calyx are fairly dense, branched and non-glandular, whereas the hairs inside the calyx-tube are more or less transparent, simple, septate and mostly gland-tipped.

Affinity

P. lanceolata is nearest to *P. megalophylla* in having cineraceous tomentum all over the plant, 4-angled stem, petiolate leaves, axillary cymes, strongly ribbed calyx, reddish corolla with numerous glands and branched woolly-tomentum outside, exserted stamens and style, pubescent filaments in the lower halves, oblong anthers without conspicuous appendages and in outline almost similar shaped fruit. Both the species seem to grow under the same ecological conditions in the Arnhem Land. Nevertheless, *P. lanceolata* may easily be identified by its leaves being narrower, lanceolate, cuneate or almost rounded at the base; bracts and bracteoles densely hairy on the adaxial surface as well; calyx pubescent inside the tube; corolla-tube mostly gradually dilated upwards; ovary more densely tomentose, style sparsely hairy in the lower half; fruit more distinctly 4-ridged and woolly-tomentose in the upper half.

10. **Pityrodia halganiacea** (F. Muell.) E. Pritz., Bot.Jahrb.Syst.35(1904)516; Gard., Enum.Pl.Aust.Occ.3(1931)112; Mold., Résumé Verben. etc. (1959)251; Beard (Ed.), W.Aust.Pl. edn 1(1965)92; Blackall & Grieve, West.Aust.Wildfls 3(1965)568; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben. etc.1(1971)348, 425.

Type: *J. Young s.n.*, Mount Churchman, Western Australia, undated (MEL 885, holotype).

Chloanthes halganiacea F. Muell., Fragm.10(1876)14, *basionym*; F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172.

Type: As for *P. halganiacea* (F. Muell.) E. Pritz.

Chloanthes caerulea F. Muell. & Tate, Bot.Centralbl.55(1893)317; F. Muell. & Tate, Trans.Roy.Soc.S.Aust.16 (1896)375, *syn.nov*.

Type: *R. Helms s.n.*, near Gnarlbine, Western Australia, 12.xi.1891 (AD 2 spec., G, K, MEL 2 spec., NSW 4 spec., PERTH - syntypes of *Ch. caerulea* F. Muell. & Tate); *E. Merrall s.n.*, Parkers Range, Western Australia, 1892 (MEL, syntype of *Ch. caerulea* F. Muell. & Tate).

Pityrodia caerulea (F. Muell. & Tate) E. Pritz., Bot.Jahrb.Syst.35(1904)516; Gard., Enum.Pl.Aust.Occ.3(1931) 112; Mold., Résumé Verben. etc. (1959)251; Beard (Ed.) W.Aust.Pl. edn 1(1965)92; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben. etc. 1 & 2 (1971)347, 425, 603,971, based on *Chloanthes caerulea* F. Muell. & Tate.

Pityrodia caerulea (F. Muell. & Tate) Ewart & White, Proc.Roy.Soc.Vict. n.s. 22(1910)324, *comb.superfl.*, later homonym.; S. Moore, J.Linn.Soc.London 45(1920)188; Mold., Résumé Verben.etc.(1959)210; Blackall & Grieve, West.Aust.Wildfls 3 (1965)568, based on *Chloanthes caerulea* F. Muell. & Tate.

Description (Fig. 10)

An erect branched shrub of (20-) 30-90 cm, branching chiefly near the base. *Stem* and branches densely clothed with short cottony-white or cineraceous branched hairs. *Leaves* sessile, somewhat crowded, often ternately or quarternately verticillate, linear-lanceolate or almost terete owing to revolute margins, (0.7-) 1-2.5 (-3.5) cm long, (1.5-) 2-3 (-4) mm broad, smooth and sparsely woolly above, but becoming glabrous when old, densely white woolly underneath, the woolly undersurface often concealed by the revolute margins. *Flowers* pedicellate, mostly 3-7 in a cyme, rarely solitary; cymes pedunculate, arranged into a more or less pyramidal lax panicle; peduncles densely covered with stellate and simple but septate gland-tipped brownish hairs, (0.7-) 1-2 cm long; pedicels densely tomentose with stellate and simple gland-tipped hairs, 2-3.5 (-5) mm long; bracts sessile, narrowly ovate or lanceolate, tomentose all over, (2-) 3-6 mm long, (0.5-) 1-1.5 mm broad; bracteoles linear-lanceolate, tomentose on abaxial surface, sparsely so on adaxial

Fig. 10. *Pityrodia halganiacea* (F. Muell.) E. Pritz. (A-I, *A.M. Ashby 3605*: AD; J, *R.Helms s.n.*: AD). A, flowering branch; B, cyme; C, flower with calyx vertically cut open to show corolla-tube; D, corolla-tube vertically cut open to show androecium and gynoecium; E, upper anther, F, lower anther; G, ovary; H, transverse section of ovary; I, gland-tipped simple and eglandular branched hairs outside the calyx; J, persistent calyx vertically cut open to show fruit.

surface, 2-3 (-4) mm long, ± 0.5 mm broad. *Calyx* "pink", persistent, deeply cleft in the upper half into narrow ovate-lanceolate lobes, tubular in the lower half, 4-6 mm long, tomentose outside with stellate and simple gland-tipped hairs, glabrous inside excepting a few hairs on the upper halves of the lobes; lobes 2-3 (-4) mm long, 1-2 mm broad at the base; tube (1-) 1.5-2 mm long. *Corolla* purplish-blue, wider than long, deeply lobed, (7-) 10-15 mm long, (10-) 12-15 (-20) mm across, pubescent outside on the back of the lobes only, glabrous inside with no hairy ring inside the tube; the anterior-lobe the largest, more or less oblong or broadly elliptic-orbicular, (3.5-) 4-8 (-10) mm long, (2-) 3.5-7 (-10) mm broad; the other 4 lobes almost equal, oblong-orbicular, (2-) 3-5 (-7) mm long, 2-4 (-5) mm broad; tube shorter than the lobes, much broader, 1.5-3 (-4) mm long, 3-5 (-7) mm broad at the top end. *Stamens* exserted, yellow; filaments glabrous, filiform, attached near the base of the corolla-tube, the lower pair 5-8 mm long, the upper pair 4-7 mm long; anthers oblong in bud, almost roundish after dehiscence, without distinct appendages, ± 1 mm long. *Ovary* globose in outline, longitudinally quadrisulcate, glabrous, glandular at the top; style exserted, filiform, glabrous, 5-9 mm long, terminal, arising from between the 4 ovary lobes but not gynobasic, stigma minutely 2-lobed. *Fruit* enclosed within the persistent calyx, globular in outline, deeply 4-lobed, glabrous, glandular at the top, 1.5-2.5 mm long, 2-2.5 mm in diameter, faintly reticulate, splitting into 4 nutlets, each nutlet 1-seeded.

Representative specimens

WESTERN AUSTRALIA (32 collections seen): *Ashby 3605*, Kulja, 6.ix.1970 (AD 2 spec., PERTH). *Beard 2438*, Boorabbin, 8.xi.1962 (King's Park Perth). *Blackall s.n.*, Southern Cross, Sept. 1929 (PERTH 2 spec.). *Blackall & Gardner 830*, near Bencubbin, 29.ix.1931 (PERTH 2 spec.). *Cough 144*, near Duri, 19.xi. 1963 (PERTH). *Cronin s.n.*, between Upper Blackwood River and Lake Lefroy, 1893 (MEL 69303). *Davies s.n.*, near Queen Victoria Rock, August-Sept. & Nov., 1964 (PERTH 3 spec.). *Demarz 5898*, 7 km E Burakin, 28.xi.1975 (PERTH, Kings Park Perth). *Demarz 5610*, c. 12 miles W of Mollerin, 23.ix.1975 (PERTH). *Diels s.n.*, Southern Cross, undated (PERTH). *Gardner 1278*, Westonia, 5.x.1922 (MEL, PERTH 2 spec.). *Gardner 8021*, near Yellowdine, 20.x.1945 (PERTH). *George 11174*, "3 miles" (4.82 km) WSW of Kulja, 30° 30′ S, 117° 15′ E, 13.xi.1971 (PERTH). *Helms s.n.*, near Gnarlbine, 12.xi.1891 (AD 96430052, AD 97608122, G, K, MEL 69304, MEL 69305, NSW 135945, NSW 135946, NSW 138370, NSW 138371, PERTH - syntypes of *Chloanthes caerulea* F. Muell. & Tate). *Keighery 70*, 1 mile E of Yellowdine, 8.ix.1974 (PERTH, Kings Park Perth). *Kuchel 1769*, 25 km south-east of Londonderry Siding, 14.ix.1964 (AD). *Lullfitz 3106*, Bullfinch to Southern Cross, 7.xii.1963 (PERTH, Kings Park Perth). *Merrall s.n.*, Parkers Range, 1892 (MEL 69302, syntype of *Chloanthes caerulea* F. Muell. & Tate). *Munir 5241*, 3 km west of Yellowdine, 5.ix.1973 (AD). *Rogerson 306*, Cleary, N of Kellerberrin & W of Bonnie Rock, Oct. 1966 (PERTH). *Rosier 245*, loc.cit., 24.xii.1959 (PERTH). *Rosier 285*, Wyalkatchem, Oct. 1960 (PERTH). *Rosier 361*, 9 miles S of Mollerin, 27.x.1963 (PERTH). *Selk 1312*, Mundaring near old Stn area, 26.x.1970 (Kings Park Perth). *Stacey 185*, 18 miles east of Southern Cross, 12.x.1972 (PERTH). *Stacey 224*, 2.5 miles E of Kulja, 15.x.1972 (PERTH). *Steward 401 & 458*, Cowcowing, 1916 (BM). *Stoward 378*, Mt Marshall, 1917 (BM). *Young s.n.*, Mt Churchman, undated (MEL 885, holotype of *Chloanthes halganiacea* F. Muell.).

Distribution (Map 3C)

P. halganiacea is endemic in the south-south-west of Western Australia. The main distribution is to the east and north-east of Perth between latitude 29° and 32° S, and between longitude 117° and 121° E. To the east of Perth, it occurs between Coolgardie and Southern Cross along the Great Eastern Highway. A few localities south of the Highway are near Gnarlbine, Queen Victoria Rock and Parker Range. Several localities north of the Highway are in the area between Lake Moore and Kellerberrin. One further locality from east of Perth is near the Old Mundaring Station.

Comments

E. Pritzel (1904) recognized *Pityrodia halganiacea* (F. Muell.) E. Pritz. and *P. caerulea* (F. Muell. & Tate) E. Pritz.. It is not certain, however, whether he did actually see the type specimens or not. Both species have also been accepted by Gardner (1931), Beard (1965, 1970) and Moldenke (1971). During the present investigation, the types of *P. halganiacea* (F. Muell.) E. Pritz. and *P. caerulea* (F. Muell. & Tate) E. Pritz. have been found to be conspecific, therefore, the name *P. halganiacea* (F. Muell.) E. Pritz., based on an earlier validly published name is accepted here for this species. In 1910, Ewart & White erroneously published a superfluous combination *P. caerulea* (F. Muell. & Tate) Ewart & White, based on (*Ch. caerulea* F. Muell. & Tate) the basionym of E. Pritzel's earlier combination. The superfluous combination by Ewart & White has been accepted by S. Moore (1920), Moldenke (1959) and Blackall & Grieve (1965).

Two specimens in Herb. MEL are erroneously labelled as types of *Chloanthes caerulea* F. Muell. & Tate. One of them (MEL 69303) belongs to Miss M. Cronin's (s.n.) collection from between the Upper Blackwood River and Lake Lefroy. This specimen was mentioned by Ewart & White (1910) as having come from a new locality. The other specimen without collector's name or place of collection has the no. MEL 69301. Since the types of *Ch. caerulea* F. Muell. & Tate were collected by R. Helms (s.n.) from Gnarlbine and E. Merrall from Parkers Range, therefore, the above mentioned two specimens in the type folders in Herb. MEL should not be mistaken for the types of *Ch. caerulea* F. Muell. & Tate.

The absence of hairs on the ovary and inside the corolla-tube seems a peculiarity of this species. Similarly, the anther-lobes are very obscurely or not at all appendaged at the lower ends and are found to dehisce sooner after the flowers open than in other species.

Blackall & Grieve (1965) recorded this species from L. Diel's botanical district Irwin. Its occurrence that far north-west has not been confirmed.

According to Ewart & White (1910), this plant has a pleasant fragrance when rubbed or broken.

Affinities

P. halganiacea is nearest to *P. bartlingii* in its leaves being ternate, sessile, linear or narrowly linear-lanceolate, with revolute margins; corolla-tube shallow, much dilated above the calyx and anther-lobes without distinct appendages at the lower ends. However, *P. halganiacea* may easily be distinguished by its inflorescence being a lax pyramidal panicle, ovary and inside corolla-tube glabrous; stamens and style exserted; fruit globular in outline, deeply 4-lobed; tomentum on young branches, peduncles and calyces of stellate and simple gland-tipped hairs. In *P. bartlingii*, the inflorescence is a spike-like woolly raceme; fruit obovoid, oblique, with a thin-walled concavity on the side and tomentum on young branches, peduncles and calyces, hairs neither simple nor gland-tipped.

P. halganiacea is also close to *P. uncinata* in having leaves of similar shape and arrangement, corolla-tube shallow, anther-lobes non-appendiculate and fruit globular in outline. The latter, however, can readily be identified by its spike-like inflorescence, non-glandular hairs on young shoots, peduncles and calyces, included stamens and style, hairy ovary and the inside of corolla-tube, distinctly sagittate stigma and only 2-lobed (i.e. 2 nutlet) fruit.

11. **Pityrodia scabra** George, J.Roy.Soc.W.Aust.50(4)(1967)103; Mold., Fifth Summary Verben. etc. 1(1971)348.

Type: *S.B. Rosier 27*, Cowcowing, between Wyalkatchem and Koorda, Western Australia, May 1958 (PERTH, holotype; K, MEL, PERTH - isotypes).

Description (Fig. 11)

A shrub of about 1 m tall. *Stem* and branches terete, densely clothed with a viscid, golden-rusty indumentum of branched hairs. *Leaves* sessile, in whorls of 3, linear or almost terete, obtuse, with deeply revolute margins, more or less crenulate so as to appear bullate, 5-10 (-15) mm long, 1-2 (-3) mm broad, somewhat viscid, coarsely tomentose,

Fig. 11. *Pityrodia scabra* A.S. George (*S.B. Rosier 27*: MEL, isotype). A, flowering twig; B, portion of stem; C, cyme with a leaf; D, flower with calyx vertically cut open to show corolla-tube; E, corolla vertically cut open to show androecium and gynoecium; F, lower anther; G, upper anther; H, ovary; I, transverse section of ovary; J, fruit; K, abaxial view of leaf.

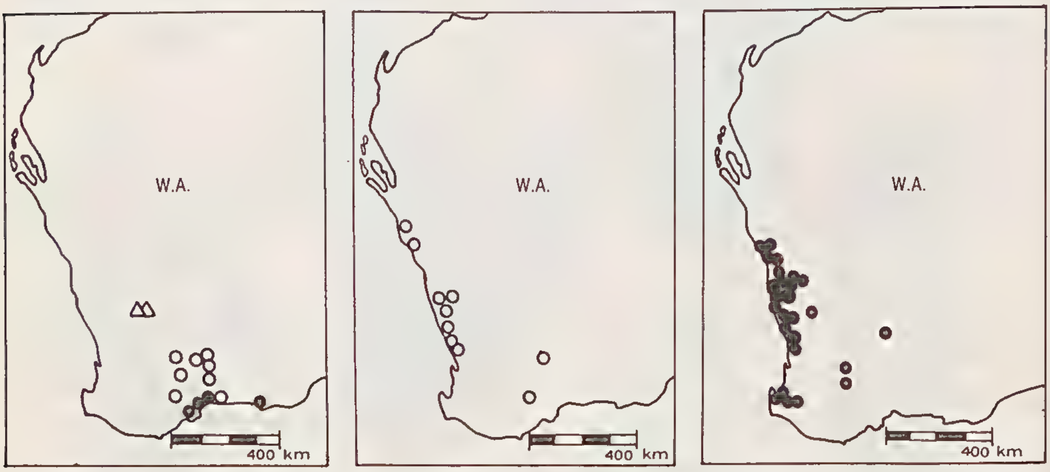
becoming scabrous above, ferrugineous underneath. *Inflorescence* cymose; cymes sessile, verticillate in the upper axils, (3-) 7-9 (-15) flowered. *Flowers* pedicellate; pedicels glandular-pubescent, (2-) 3-5 (-5.5) mm long; bracts linear, glandular-pubescent on abaxial surface, almost glabrous on adaxial surface, 3-5 mm long, 0.5-1 mm broad; bracteoles linear, 2-3 mm long, ± 0.5 mm broad. *Calyx* persistent, 5-lobed in the upper half, tubular below, 4-5 mm long, glandular and pubescent outside and on the inner surface of the lobes, glabrous inside the tube; lobes more or less ovate, obtuse, with recurved margins and prominent midrib, 2-3 mm long, 1-1.5 mm broad at the base; tube 2-2.5 mm long. *Corolla* white, (6-) 7-9 mm long, glabrous all over excepting the dense hairy ring inside around the base of the filaments and a few hairs extending to the mid-lobe of the lower lip; the mid-lobe more or less elliptic-orbicular in outline, ± 2.5 mm across, the side-lobes elliptic-obovate, (2-) 2.5-3 mm long, ± 2 mm broad; the 2 upper lobes more or less oblong, obtuse, 2.5-3 mm long, 1.5-2 mm broad; tube longer than the lobes, almost cylindrical in the lower half, gradually dilated upwards, 3-5 mm long, 1.5-2 mm broad at the top end. *Stamens* exserted; filaments filiform, glabrous, the lower pair (2-) 2.5-3.5 mm long, the upper pair (1.5-) 2-3 mm long; anthers more or less orbicular in outline, with distinct short appendages at the lower ends of the lobes, ± 1 mm long and broad, lobes oblong. *Ovary* globose, 0.5-1 mm in diameter, densely tomentose; style exserted, filiform, glabrous, 4-6 mm long, shortly 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, obovoid, pubescent with distinct reticulate nerves, 2-3 mm long, 1.8-2 mm in diameter at the top, splitting into two 2-celled nutlets with one seed in each.

Specimens examined

WESTERN AUSTRALIA: *George 11641*, ± 1 km south of Cowcowing, 12.xi.1972 (PERTH). *S.B. Rosier 27*, Cowcowing, between Wyalkatchem and Koorda, May 1958 (PERTH, holetype; K, MEL, PERTH - isotypes).

Distribution (Map 4A)

P. scabra is endemic to Western Australia, where it has so far been recorded only from near Cowcowing, north of Wyalkatchem.



Map 4A.
P. scabra △
P. exserta var. *exserta* ●
P. exserta var. *lanata* ○

Map 4B.
P. uncinata ○

Map 4C.
P. bartlingii ●

Comments

P. scabra is one of the rarest species of this genus, known only from the type locality.

In the protologue, the date of collection for the holotype is "Aug. 1959", but the date on the labels of the isotypes in Herb. MEL and PERTH is "May, 1958". The author of this species, however, has confirmed that the published date "Aug. 1959" is an error, and the correct date for the type collection of *P. scabra* is "May, 1958" (Pers. comm. A.S. George, no. 90/76, 1.xii.1978). The date noted on the holotype sheet also agrees with the isotypes. At least 4 duplicates of A.S. George's collection no. 11641 are still to be distributed.

Affinities

P. scabra is closely allied to *P. spenceri* in its leaves being more or less sessile, recurved along the margins; corolla-tube gradually dilated upwards; fruit obovoid, pubescent all over. Nevertheless, *P. scabra* may easily be distinguished by its stem being clothed with a viscid, golden-rusty indumentum; leaves linear, in whorls of 3, bullate and scabrous above; flowers more than one (average 7-9) in a leaf-axil; calyx non-ribbed; fruit almost flat to truncate at the top. *P. scabra* is also nearer to *P. hemigenioides*, but the latter can readily be identified by its leaves being greyish-tomentose, opposite; corolla-tube abruptly dilated above the calyx and fruit elliptic-globose with a somewhat rounded top. In some characters, *P. scabra* and *P. exserta* are also very close to each other. Both the species have scabrous, bullate leaves, gradually upwards dilated corolla-tube, exserted stamens and style, obovate fruit with pubescence all over. Nevertheless, *P. exserta* may easily be separated by its narrow, linear-lanceolate leaves, deep pink corolla with pubescence outside; oblong anthers and more or less conical-tipped fruit with shallow humps on the back of each nutlet.

12. **Pityrodia exserta** (Benth.) Munir, stat. nov.

P. uncinata (Turcz.) Benth. var. *exserta* Benth., Fl.Aust.5(1870)49, *basionym*; Mold., Résumé Verben.etc. (1959)427; Mold., Fifth Summary Verben.etc.1(1971)348.

Type: *G. Maxwell s.n.*, Cape Arid, Western Australia, 1869 (K, lectotype designated here; MEL 69383, MEL 69384 - isolectotypes).

Typification

P. exserta is based on G. Maxwell's (s.n.) collection, consisting of at least 3 duplicates. Since the author of the basionym did not choose any one of them as a type, it is, therefore, necessary to select a type for this name. The syntype preserved in Herb. K, where Bentham's herbarium and types are now preserved (Stafleu, 1967, 1976) is annotated by him, and almost certainly used by him in preparing the original description of this species. The specimen is particularly complete and well preserved and is selected here as the lectotype for this species.

Description (Fig. 12)

A sprawling shrub or undershrub of 15 to 40 cm. *Stem* and branches woolly-tomentose, or becoming glabrescent in the old-parts. *Leaves* decussate, scattered or in whorls of 3, sessile, crowded but non-decurrent, linear or linear-lanceolate, deeply recurved or revolute along the margins, very distinctly scabrous and bullate-rugose above, densely cottony - woolly all over or pubescent underneath when young, later glabrescent, (1-) 1.5-3.5 (-4.5) cm long, (1-) 2-4 (-5) mm broad, the floral leaves mostly exceeding the calyx. *Flowers* pedicellate, solitary or 3 together on short peduncles in the axils of the upper leaves, forming terminal leafy spikes; pedicel slender, hairy, 2-4 mm long; bracts leafy, mostly exceeding the calyx, sessile, linear-lanceolate, recurved along the margin, scabrous-hairy and rugose along the margins and on adaxial surface, hairy on abaxial surface, (8-) 10-15 mm long, 1.5-2.5 mm broad; bracteoles linear, smooth, (4-) 7-9 mm

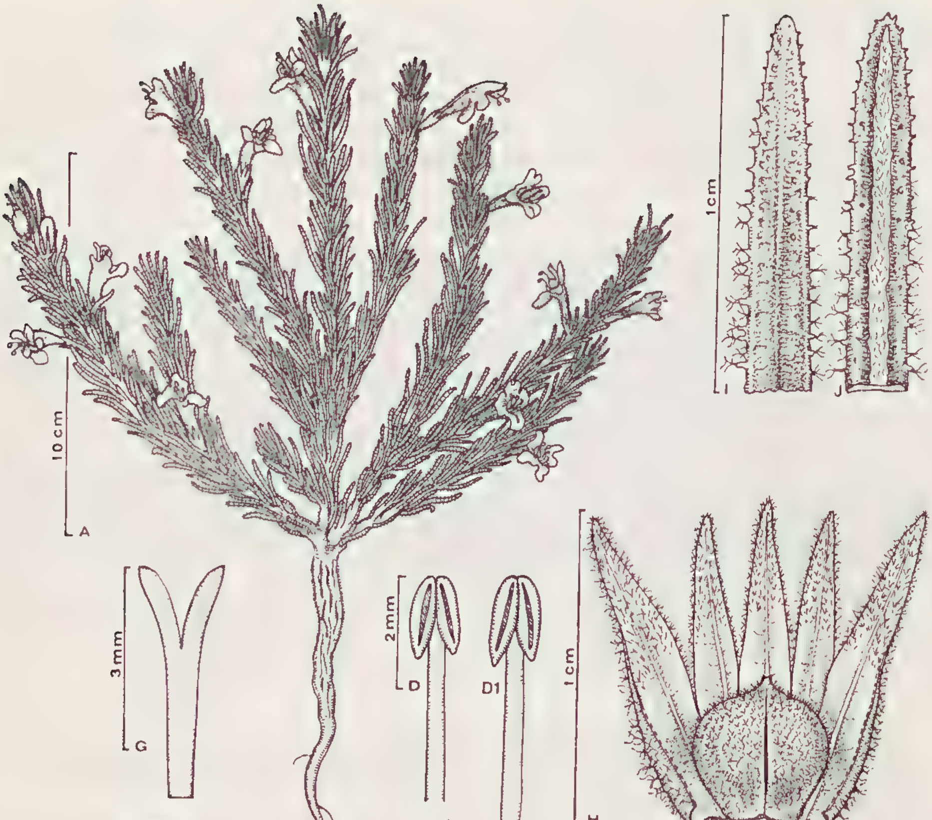


Fig. 12. *Pityrodia exserta* (Benth.) Munir var. *exserta* (*A.S. George 6970*: PERTH). A, habit drawing; B, flower with a bract and two bracteoles; C, calyx and corolla vertically cut open to show androecium and gynoecium; D, upper stamen; D1, lower stamen; E, ovary; F, transverse section of ovary; G, stigma with 2 simple lobes; H, persistent calyx cut open to show fruit; I, & J, adaxial and abaxial views of a leaf-portion.

long, 1-1.5 mm broad. *Calyx* persistent, deeply divided into 5 lobes, shortly tubular towards the base, (6-) 8-12 mm long, scabrous outside and on the inner distal parts of the lobes, glabrous within the tube; lobes lanceolate, acute, slightly recurved along the distal margin, (5-) 6-10 (-11) mm long, 1-2 (-2.5) mm broad; tube 1-2.5 mm long. *Corolla* deep pink or dark red, (15-) 20-30 mm long, pubescent outside, glabrous inside excepting only the dense hairy ring above the ovary; the upper lip shortly 2-lobed, the lower lip of 3 spreading lobes; the anterior lobe almost twice as large as the others, broadly elliptic-orbicular in outline, (7-) 9-11 mm long, nearly as broad; the other lobes almost equal, more or less oblong-ovate, 5-8 (-10) mm long, (3-) 4-6 mm broad; tube gradually dilating upwards, slightly incurved, (10-) 13-17 (-18) mm long, (4-) 5-6 mm broad at the top end. *Stamens* exserted or scarcely so; filaments filiform, glabrous, the lower pair longer, 9-13 (-15) mm long, the upper pair short, 6-8 (-10) mm long; anthers oblong, lobes with obsolete or obscure appendages at the lower end, (1-) 1.5-2 mm long. *Ovary* globose, c. 1 mm in diameter, densely tomentose; ovules attached at or near the top with a very short funicle; style exserted, filiform, glabrous, (15-) 20-30 mm long, shortly 2-lobed at the summit, not sagittate. *Fruit* enclosed within the persistent calyx, sub-globose, shortly concical at the top, (2-) 3-4 (-5) mm long, (2-) 3-4 mm in diameter, pubescent, splitting into two separate nutlets, each with a shallow hump on the back; seeds not seen.

Pityrodia exserta (Benth.) Munir var. **exserta**

Stem and branches tomentose but becoming glabrescent in the old parts. Leaves scabrous and bullate-rugose above, pubescent underneath when young, later glabrescent. Stamens and style exserted beyond the corolla-tube.

Specimens examined

WESTERN AUSTRALIA: *Demarz 154*, E Mt Barren, 25.v.1968 (Kings Park Perth). *Fairall 2398*, east of Barren, 11.x.1967 (PERTH 2 spec., Kings Park Perth). *Gardner 2211*, W Mt Barren, 16.x.1928 (PERTH). *Gardner & Blackall s.n.*, loc.cit., Oct. 1928 (PERTH). *George 584*, SW side of E Mt Barren, 31.i.1960 (PERTH). *George 1783*, near top of W Mt Barren, 29.xi.1960 (PERTH). *George 6970*, W Mt Barren, S coast, SW of Ravensthorpe, 28.x.1965 (B, PERTH). *George 10107*, Mid Mt Barren Res., 16.vii.1970 (PERTH). *G. Maxwell s.n.*, Cape Arid, 1869, (K, MEL 69383 - 4, 2 spec. - syntypes of *P. uncinata* (F. Muell.) Benth. var. *exserta* Benth.). *Newbey 1609*, E. Mt Barren, 25.x.1964 (PERTH). *Stevenson s.n.*, loc.cit., Nov. 1933 (PERTH 2 spec.). *D. Young 296*, loc.cit., 11.x.1967 (Kings Park Perth).

Distribution (Map 4A)

P. exserta var. *exserta* is endemic in the southern part of Western Australia. It occurs near the southern coast, chiefly around East Mt Barren, Mid Mt Barren and West Mt Barren. The only other locality is near Cape Arid, where only one collection was made in 1869, but it has not been recollected from that area since.

Comments

P. exserta var. *exserta* has so far been identified with *P. uncinata* (Turcz.) Benth., because they are almost identical in habit and possess similar leaves and inflorescence. The distinction between these species is based chiefly on their flower characters, namely the length of filaments and the shape of stigma which can more easily be observed in a dissected flower. Many botanists seem to have based their identification on superficial observation of the plants, and others may not have examined the floral parts critically enough to pick up the distinguishing characters. All these characters are presented here in the analytical flower-drawing of both the species.

Affinities

P. exserta is very close to *P. uncinata* in its leaves being scattered or in whorls of 3, narrow-linear with revolute margins, bullate-rugose above; flowers in terminal leafy spikes and anther-lobes with obscure or obsolete appendages. However, *P. exserta* may easily be distinguished by its leaves being much more scabrid; corolla-tube gradually dilating upwards, glabrous in the upper half; stamens and style exserted; anthers mostly 1.5-2 mm long; stigma simply 2-lobed, not sagittate; fruit obovoid, shortly conical at the top.

P. exserta is also related to *P. bartlingii* (Lehm.) Benth. in having almost similar leaves, inflorescence and stigma. Nevertheless the latter can easily be distinguished by its inflorescence being non-leafy; leaves larger, up to 5.5 cm long, less scabrous; inflorescence woolly-tomentose; corolla-tube much dilated within or immediately above the calyx, with a few sparse hairs inside extending from the dense hairy ring to the large anterior-lobe; stamens and style included; fruit obovoid, oblique, with a thin walled concavity on one side.

Pityrodia exserta (Benth.) Munir var. **lanata** Munir, var. nov.

A var. typico caule et foliis supris perdense gossypino-lanuginosis et staminis styloque parum exserto differt.

Type: *J.W. Wrigley s.n.*, 26 miles from Lake King towards Norseman on no. 1 Rabbit Proof Fence, Western Australia, 11.xi.1968 (CBG 030930, holotype; AD, NSW - isotypes).

P. uncinata auct. non (Turcz.) Benth., sensu Benth., Fl.Aust.5(1870)48, 49 (quoad spec. *Maxwell s.n.* from Oldfield River and *Röe s.n.*, loc. incert, W.A., both in Herb. K.).

Var. *lanata* differs from the typical variety by its stem and upper leaves being very densely cottony-woolly, and stamens and style scarcely exserted beyond corolla-tube.

Specimens examined

WESTERN AUSTRALIA: *Ashby 2418*, east of Newdegate, 29.x.1967 (AD). *Barrow 60*, Hyden, 6.ix.1966 (PERTH, Kings Park Perth). *Beard 3851*, 300 mile post on Hyben - Norseman Rd, 24.x.1964 (Kings Park Perth). *Blackall 1264*, between Lake Hope and Mt Hatten, 3.xi.1931 (PERTH 2 spec.). *Chinnock 4344*, Hyden to Lake Cronin, 11.xi.1978 (AD 2 spec.). *Demarz 6339*, 42 km N of Ravensthorpe - Lake King, 33° 10′ S, 120° 00′ E, 19.xi.1976 (PERTH). *George 315*, 25.8 miles N of Ravensthorpe, 13.ix.1959 (PERTH). *George 7012*, Rabbit Proof Fence, NW of Jerramungup, 29.x.1965 (PERTH). *Maxwell s.n.*, Oldfield River, undated (K, MEL 69381). *Newbey 1130*, 44 miles E of Hyden, 13.x.1963 (PERTH). *Röe s.n.*, SW of W.Australia, undated (K). *Wrigley s.n.*, 26 miles from Lake King towards Norseman, on no. 1 Rabbit Proof Fence, 11.xi.1968 (CBG 030930, holotype; AD, NSW - isotypes). *Wrigley s.n.*, 7 miles from Lake King towards Newdegate, 6.xi.1968 (CBG 038180).

Distribution (Map 4A)

P. exserta var. *lanata* is endemic in the southern part of Western Australia. It is restricted between latitude 32° and 34° S and between longitude 118° and 121° E. The major distribution is to the east-south-east of Hyden and north-north-east of Ravensthorpe, towards Norseman. Both var. *lanata* and the typical var. *exserta* seem to occur in the same general area, but they have not been found growing together in the same locality. Actually the var. *exserta* is known from the coastal areas whereas the var. *lanata* comes from somewhat dry inland.

Comments

The majority of collections of var. *lanata* were found to be annotated as *P. uncinata*, and a few as *Chloanthes coccinea*. The latter does occur in the same region and superficially looks the same because of similar leaves and corolla. Nevertheless, the leaves in *Chloanthes* are always decurrent and anther-lobes without any appendage at the lower ends.

Affinities

As mentioned for the typical variety, var. *lanata* is also allied to *P. uncinata* in having similar leaves and inflorescence. The presence of densely cottony-woolly indumentum in the upper leaves and inflorescence bring them both more close to each other. Nevertheless var. *lanata* can readily be distinguished by its corolla-tube being gradually dilating upwards, glabrous in the upper half; stamens and style larger; stigma simply 2-lobed, not sagittate.

13. **Pityrodia uncinata** (Turcz.) Benth., Fl.Aust.5(1870)48, exclud. var. *exserta* Benth.; Briq., Mém.Soc.Phys.Geneve 32(2), no.8(1896)77; Diels & E.Pritz., Bot.Jahrb.Syst.35 (1904)519; Gard., Enum.Pl.Aust.Occ.3(1931)112; Junell, Sym.Bot.Upsal.4(1934)70, fig.117; Mold., Résumé Verben.etc.(1959)210, 251, 335; Beard (Ed.), W.Aust.Pl. edn 1 (1965)93; Blackall & Grieve, West.Aust.Wildfls 3(1965)569; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben. etc.1 & 2(1971)348, 425, 426, 603; Gard., West.Aust. Wildfls B(1972)166, 167 upper plate.

Type: *J. Drummond 4th Coll. no. 160*, Swan River, 1847 (K, lectotype designated here; BM p.p., CGE, G, KW, LE, MEL, P, TCD, W - isolectotypes).

Chloanthes uncinata Turcz. in Bull.Soc.Nat.Mosc.36(2)(1863)194, *basionym*; F. Muell., Fragm.6(1868)156 in obs.; F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172.

Type: As for *Pityrodia uncinata* (Turcz.) Benth.

Chloanthes bullata F. Muell., Fragm.6(1868)156.

Type: *J. Drummond s.n.*, Murchison River, undated (MEL 69375, lectotype designated here; MEL 69225, MEL 69377, MEL 69379, MEL 41218, P, US - isolectotypes).

Typification

P. uncinata (Turcz.) Benth. is based on J. Drummond's 4th collection no. 160, consisting of at least 10 duplicates, all agreeing with the type description. Since the author did not select any one of them as a type, it is, therefore, necessary to choose a type for this name. Of these syntypes, none of which was annotated by Turczaninow, the one preserved in Herb. K is particularly complete and well preserved and is, therefore, designated here as the lectotype for this species.

Description (Fig. 13)

An erect spreading shrub of (15-) 30-60 cm. *Stem* and branches densely clothed with white cottony tomentum. *Leaves* decussate, scattered or in whorls of 3, sessile, crowded but non-decurrent, linear or linear-lanceolate, acute, often terminating in a hooked blunt point, recurved or revolute along the margins, (1-) 1.5-3.5 (-5) cm long, 2-4 (-5) mm broad, tomentose and bullate-rugose above, woolly-tomentose or sometimes almost glabrescent underneath, the floral-leaves mostly exceeding the flowers. *Flowers* pedicellate, solitary or 3 together on short peduncles in the axils of the upper leaves, forming terminal leafy spikes, usually woolly-tomentose; pedicel tomentose, slender, 2-4 mm long; bracts mostly exceeding the calyx, sessile, linear-lanceolate, tomentose on abaxial surface, glabrous on adaxial surface, 7-10 (-14) mm long, 1-2 mm broad; bracteoles similar to bract but much smaller, (4-) 5-7 mm long, 0.5-1 mm broad. *Calyx* persistent, deeply divided into 5 lobes, shortly tubular towards the base, (5-) 6-8 (-9) mm long, tomentose outside with a few sparse hairs on the upper halves of the lobes, glabrous inside the tube; lobes lanceolate, acute, membranous, 4-6 (-7) mm long, 1-2 mm broad near the base; tube 1-2 mm long. *Corolla* deep pink, (10-) 13-15 (-17) mm long, pubescent outside, glabrous inside excepting the dense hairy ring above the ovary, and sparse hairs extending to the anterior lobe of the lower lip; the upper lip very shortly 2-lobed, the lower of 3 very spreading lobes; lobes deeply sinuate or erose, more or less elliptic-orbicular in outline, 4-6 mm long, nearly the same in width; tube much dilated above the calyx, slightly incurved, 7-10 mm long, 5-7 mm broad at the top end. *Stamens* included; filaments short, filiform, glabrous, the lower pair 2-4 mm long, the upper pair 0.5-1 mm long; anthers oblong, lobes apparently without appendages at the lower end, c. 1 mm long. *Ovary*

Fig. 13. *Pityrodia uncinata* (Turcz.) Benth. (A, *F.v. Mueller s.n.*: MEL 69378; B-J, *E. Pritzel 897*: AD). A, habit drawings; B, cyme in the axil of a leaf; C, flower with calyx vertically cut open to show corolla-tube; D, corolla-tube vertically cut open to show androecium and gynoecium; E1, upper anther; E2, lower anther; F, sagittate stigma; G, ovary; H, transverse section of ovary; I, fruit; J, fruit split into two halves.

globose, c. 1 mm in diameter, densely tomentose; ovules attached at or near the top, with a very short or scarcely any funicle; style included, filiform, glabrous, (3-) 5-7 mm long; stigma distinctly sagittate, 0.5-1 mm broad. *Fruit* enclosed within the persistent calyx, more or less globose with a slight depression at the top end, 2-3 mm long, 2.5-3 mm in diameter, pubescent and clearly net-veined all over, splitting into two separate nutlets when mature; seeds not seen.

Representative Specimens

WESTERN AUSTRALIA (27 collections seen): *Andrews s.n.*, Cannington, Perth, Sept. 1904 (PERTH). *Ashby 721*, 30 km W of Moora, Dandarragan Road, 18.xi.1963 (AD). *Baird s.n.*, Kenwick Swamps, 1.xi.1932 (UPS). *Blackall 2969*, Gingin, Sept. 1933 (PERTH) 2 spec.). *J. Drummond 4th Coll. no. 160*, Swan River, 1847 (K, lectotype; BM p.p., CGE, G, KW, LE, MEL, P. TCD, W - isolectotypes). *J. Drummond s.n.*, Murchison River, undated (MEL 69375, MEL 69377, MEL 69225, MEL 41218, MEL 69379, P, US - syntypes of *Chloanthes bullata* F. Mueller). *Fitzgerald s.n.*, Canning Plains, Oct. 1903 (NSW 135897, NSW 135899, SING 044214). *George 7012*, Rabbit Proof Fence, NW of Jeramungup, 29.x.1965 (MO). *Gardner s.n.*, Hill River, 21.vii.1934 (PERTH 3 spec.). *Gardner s.n.*, near Dandaragan, Sept. 1960 (PERTH). *Keighery 123*, Cannington Brook, 18.vii.1975 (Kings Park Perth). *Koch 1540*, Watheroo Rabbit Proof Fence, Oct. 1905 (AD, K, NSW, PERTH). *Morrison 11084*, Cannington, Lower Canning River, 21.ix.1901 (K). *F.v. Mueller s.n.*, Murchison River, undated (C, GH 2 spec., L, MEL 69378, MEL 69380). *F.v. Mueller s.n.*, loc.incert. (probably from Murchison River) undated (M, W 2 spec.). *Phillips s.n.*, 87 miles N of Perth, beyond Gingin, 22.ix.1962 (CBG 011683). *E. Pritzel 897*, Avon district, Nov. 1901 (A, AD, B, BM p.p., BR, E, G, HBG, K 2 spec., L, M, MEL, MO, NSW, NY, P, PR, S, US, W). *Royce 4727*, 15 miles W of Gingin, 15.xii.1953 (PERTH 2 spec.). *Saffrey 173*, 61 mile peg on Gingin to Dandaragan Road, 31.x.1966 (PERTH). *Thorne 24295*, 9 miles W of Moora, 12.ix.1959 (L, UC). *Willis s.n.*, 200 km N of Perth and 45 km E of Jurien Bay, 8.x.1961 (MEL 69385). ? *Leg. s.n.*, Dandarragan, undated (PERTH).

Distribution (Map 4B)

P. uncinata is endemic in the south-south-west of Western Australia. The main distribution is in the area located west of the southern portions of the Geraldton Highway and Great Northern Highway. One disjunct locality in the north is near the Murchison River and two in the south are near the upper sources of Gairdner River and along the road between Hyden and Lake Cronin. A few more collections from south-east of Perth have been recorded from near the Canning River.

Comments

Moldenke (1971) recorded *Chloanthes drummondii* F. Muell. as a synonym of this species, but during present investigations the above name has been found only on a few herbarium labels annotated by Mueller, who is not known ever to have published this name.

According to Bentham (1870), the flowers are solitary in the axils of the upper leaves. During present studies, however, the flowers have been found to be solitary as well as 3 together on short axillary peduncles.

The sagittate stigma of *P. uncinata* is unique in the genus and seems a good character in distinguishing this species from its close allies.

Due to the shape and arrangement of leaves, and very obscure anther-appendages, *P. uncinata* and *P. bartlingii* have often been recognized as *Chloanthes*. Nevertheless, both the species can easily be distinguished from *Chloanthes* by their non-decurrent leaves and broad corolla-tube.

The date (year only) noted with two duplicates of J. Drummond's 4th coll. no. 160, now preserved in Herb. K and TCD, is "1848". Another duplicate of the same collection in Herb. G is annotated "Received July 1848". None of these seem to refer to the collecting date, because the annotation on the herbarium sheet in Herb. G has clearly indicated that "1848" is the date of receipt of specimen by that institution. According to Erickson (1969), however, the 4th collection of Drummond, consisting of 14 sets of 400 species, was sent to Hooker and subscribers in England during July, 1847. The collecting date of this set of plants, therefore, would certainly be before July 1847.

Beard (1965, 1970) recorded this species only from Gardner & Bennett's (1956) botanical district "Avon" in the South Western Province of Western Australia. At present, however, the distribution has extended to Darling, Irwin and Stirling districts. Moldenke (1959, 1971) recorded this species from New South Wales and Queensland, but its occurrence in those states has not been confirmed.

Affinities

P. uncinata is nearest to *P. exserta* in its leaves being scattered or in whorls of 3, narrow-linear with revolute margins, bullate-rugose above; flowers in terminal leafy spikes and anther-lobes with obscure or obsolete appendages. Nevertheless, *P. uncinata* can easily be distinguished by its leaves being less scabrid; stamens and style included; anthers shorter, c. 1 mm long; stigma distinctly sagittate; fruit more or less globose with a shallow depression at the top between the nutlets.

P. uncinata is also closely allied to *P. bartlingii* in having narrow linear leaves with revolute margins, bullate-rugose above; flowers pedicellate in terminal spikes; stamens and style included and anther-lobes with obscure or obsolete appendages. However, *P. bartlingii* can readily be identified by its inflorescence being non-leafy, much more woolly; anther-lobes longer, 1.5-2 (-3) mm long; stigma non-sagittate, shortly 2-lobed; fruit obovoid, oblique, with a thin-walled concavity on the side.

14. **Pityrodia bartlingii** (Lehm.) Benth., Fl.Aust.5(1870)49; F. Muell., Fragm.9(1875) 5; Briq., Mém.Soc.Phys.Geneve 32(3), no.8(1896)76; Diels & E.Pritzel, Bot.Jahrb.Syst. 35(1904)519; Gard., Enum.Pl.Aust.Occ.3(1931)112; Junell, Sym.Bot.Upsal.4(1934)68, figs. 118, 119; Gard., W.Aust.Wildfls edn 8(1951)108; Mold., Résumé Verben. etc. (1959) 210, 251, 335; Gard., Wildfls West.Aust.(1959)131, 132; Blackall & Grieve, West.Aust. Wildfls 3(1965)569, t.28; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben.etc.1 & 2(1971)347, 425, 603.

Type: *Preiss 2340*, in calculosis ad radices jugi montium Darling's Range, 23.xi.1839 (GOET, lectotype designated here; BR, C, FI, G, HBG, L 2 spec., LD, LE 2 spec., M, MEL 2 spec., MO, P 2 spec., S, TCD, W 2 spec. - isolectotypes).

Chloanthes bartlingii Lehm., Ind.Sem.Hort.Hamb.Bot.(1844)8, *basionym*; Bartl. in Lehm., Pl.Preiss.1(1845) 352; Walp., Rep.Bot.Syst.4(1845)134; Schauer in DC., Prod.11(1847)531; Bocq., Rev. Verbén.(1863)131; F. Muell., Fragm.6(1868)156; F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Muell., Sec.,Syst.Cens.Aust.Pl.1 (1889)172.

Type: As for *Pityrodia bartlingii* (Lehm.) Benth.

Typification

P. bartlingii (Lehm.) Benth. is based on L. Preiss's collection no. 2340, consisting of at least twenty-one duplicates. Since the original author did not choose any of them as a type, it is, therefore, necessary to select a lectotype for this name. The syntype preserved in Herb. GOET, where Bartling's herbarium and types are now preserved (Stafleu, 1967), were almost certainly used by him in preparing the original description of this species. The specimen is particularly complete and well preserved. It is chosen here as the lectotype for this species.

Description (Fig. 14)

An erect shrub 30-90 (-150) cm tall. *Stem* and branches densely clothed with greyish-rusty indumentum of branched hairs. *Leaves* sessile, scattered or in whorls of 3, sometimes decussate, linear, lanceolate or almost terete owing to revolute margins, obtuse, (1-) 3-4 (-5.5) cm long, (2-) 3-5 (-7) mm broad at the base, bullate and hairy above and along the recurved margins, densely woolly-tomentose underneath. *Flowers* pedicellate, solitary or often 3 together on short axillary peduncles, forming terminal spike-like woolly racemes

Fig. 14. *Pityrodia bartlingii* (Lehm.) Benth. (*R.D. Royce 3179*: PERTH). A, flowering twig; B, flower with a bract and two bracteoles; C, calyx and corolla vertically cut open to show androecium and gynoecium; D1, lower stamen; D2, upper stamen; E, ovary; F, transverse section of ovary; G, fruit; H, calyx-hair.

of (6-) 10-25 (-35) cm; pedicel slender, tomentose, 2-4 (-6) mm long; bracts leafy, mostly exceeding the calyx, sessile, linear-lanceolate or broadly elliptic, densely tomentose on abaxial surface, glabrous or sparsely hairy on adaxial surface, (1-) 1.5-2.5 (-3) cm long, (3-) 5-8 (-10) mm broad; bracteoles sessile, linear or linear-lanceolate, abaxially tomentose, adaxially glabrescent or sparsely hairy, 7-12 mm long, 1.5-2 mm broad. *Calyx* persistent, divided almost to the base into 5 linear or linear-lanceolate lobes, shortly tubular near the base, densely woolly-tomentose outside, sparsely so inside except near the base, 8-13 mm long; lobes linear, entire, obtuse 7-12 mm long, 1-1.5 mm broad; tube ca. 1 mm long. *Corolla* purplish-pink with brownish dots in throat, (12-) 15-23 mm long, pubescent outside and on the inner upper halves of the lobe, glabrous inside the tube excepting the dense hairy ring above the ovary, and with a few minute and sparse hairs extending to the large anterior lobe of the lower lip; the anterior lobe larger than the others, almost elliptic-orbicular, (5-) 6-9 mm long, (6-) 7-11 m broad; the other lobes more or less ovate, almost equal, 4-8 mm long, 3-7 mm broad at the base; tube much dilated above the ovary into a broad campanulate throat but oblique and somewhat incurved, 8-11 (-14) mm long, 6-12 (-14) mm broad at the top end. *Stamens* included, subdidynamous; filaments 4-7 mm long, the upper pair glabrous, the lower pair hairy in the lower half; anthers oblong, 1.5-2 (-3) mm long, 1-1.5 mm broad, the lower pair always smaller than the upper, shrunken (apparently sterile), with obscure appendages at the lower end, the appendages in the upper (anther) pair almost obsolete. *Ovary* globose, 1-2 mm in diameter, densely tomentose; style included, glabrous, filiform, 10-14 mm long, shortly 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, obovoid, oblique with a thin-walled concavity on one side, apparently non-dehiscent, 3-4 mm long, 2-3 mm in diameter at the top end, puberulous and faintly reticulate.

Representative specimens

WESTERN AUSTRALIA (87 collections seen): *Ashby 1711*, east of Kulin, 13.x.1965 (AD). *Baird s.n.*, Maida Vale, at foot of Darling Range, 20.xi.1932 (UPS). *Blackall 2858*, between Perenjori and Dalwallinu, 25.ix.1932 (PERTH 2 spec.). *Broadbent 1305*, Dinner Hill, 22.viii.1953 (BM). *Brooker 1935*, 3 miles south-west of Mt Lesueur, 24.vii.1969 (PERTH 2 spec.). *Drummond 399*, Swan River, undated (W). *Drummond 1st coll. no. 447*, loc.cit 1843 (A, BM, E, G 2 spec., K 3 spec., MEL 2 spec., P, W 2 spec.). *Drummond 1st coll. s.n.*, loc.cit., 1839 (BM, CGE 3 spec., G 3 spec., GH, K 4 spec.). *Forrest s.n.*, Gingin, 24.iii.1880 (MEL 69234). *Gardner 14248*, near Moore River west of Mogumber, Nov. 1962 (PERTH). *George 280*, 7.8 miles W of Lake Grace, 12.ix.1959 (PERTH 2 spec.). *Hartley 13947*, between Moora and Jurien Bay, 16.viii.1973 (CANB). *Harvey 6203*, east of Allanooka, Oct. 1961 (PERTH). *Havel 205*, east of Yanchep, 3.xii.1965 (PERTH). *Lullfitz 146*, 184 mile peg Buntine, 20.xii.1961 (PERTH). *Milligan s.n.*, Wongan Hills, 11.x.1903 (K). *Morrison s.n.*, Watheroo, 14.i.1905 (BM, E). *Morrison 14236*, Gooseberry Hill to Guildford, 16.vii.1904 (E, K). *F. Mueller s.n.*, Greenough and Irwin Rivers, Nov. 1877 (MEL 69291). *Munir 5241*, 160 km W of Coolgardie near Yellowdine, 5.ix.1973 (AD). *Newbey 1378*, 1.5 miles S of Regans Ford, 26.viii.1964 (PERTH). *Orchard 4222*, 19 km E of Green Head on Jurien - Green Head Road, 28.xi.1974 (AD). *Paust 1177*, 9.6 km E of Jurien, 3.x.1972 (PERTH). *Phillips s.n.*, 60 miles from Moora towards Jurien Bay, 23.9.1962 (CBG 046306). *Phillips s.n.*, 13 miles from Walkaway towards Strawberry, 15.ix.1968 (CBG 035350). *Preiss 2340*, in Calculosis ad readices jugi montium Darling's-Range, 23.xi.1839 (GOET lectotype; BR, C, FI, G, HBG, L 2 spec., LD, LE 2 spec., M, MEL 2 spec., MO, P 2 spec., S, TCD, W 2 spec.). *E. Pritzel 981*, between Moore River and Murchison River, Nov. 1901 (A, AD, B, BM, BR, E, G 3 spec., GH, HBG, K, L, M, MEL, MO, NSW, NY, PR 2 spec., S, US, W). *Royce 3179*, Walsall, S of Busselton, 17.x.1949 (PERTH 2 spec.). *Thorne 24200*, Hill River, on Moora-Badgingarra - Dinner Hill - Watheroo Road, 12.xi.1959 (L, UC). *Whibley 3189 and 3189a*, between Badgingarra and Jurien Bay, 8.x.1969 (AD 3 spec.).

Distribution (Map 4C)

P. bartlingii is endemic to the south-west of Western Australia. It is restricted between latitude 28° and 34° S and between longitude 115° and 120° E. The major distribution is to the north of Perth where it is commonly found in the area between the Swan River and Murchison River. In the south, it is recorded from near the Darling Ranges and between Busselton and Bridgetown. The only other southern localities are near Kulin and Lake Grace. Towards the east it has been collected from near Yellowdine along the Great Eastern Highway. This locality is the easternmost, and disjunct from the main distribution area by over 300 kilometres.

Comments

This species was originally described as *Chloanthes bartlingii* Lehm., and the same genus was accepted by F. Mueller (1868) and others. Bentham (1870) transferred it to *Pityrodia* R.Br. Following this, F. Mueller (1875) accepted the name *P. bartlingii* but subsequently (1882, 1889) recorded it as a synonym of *Chloanthes bartlingii*.

According to Bentham (1870), the upper pair of stamens is usually smaller than the lower, but the examination of many mature flowers has shown that the upper pair is in fact larger than the lower. The anthers of the upper stamens are turgid, full of pollen grains, 2 mm or over in length and without appendages at the lower end. Anthers of the lower stamens, however, are apparently shrunken and/or sterile, less than 2 mm in length and with obscure appendage at the lower end. The filaments of the upper stamens are glabrous and longer while those of the lower stamens are shorter and hairy in the lower halves.

The fruit of *P. bartlingii* seems to resemble that of *P. loxocarpa* in being indehiscent, obovoid, oblique, and puberulous with a thin-walled concavity on one side. The fruit-wall in the latter, however, seems smooth and without any distinct reticulation.

Leaves and flower-bracts are exceedingly variable in size and shape, and unlike several other *Pityrodia* species, the flower-bracts, bracteoles and calyx-lobes are somewhat hairy on the adaxial surface.

The fruit is always enclosed within the persistent calyx and being not visible without removing the calyx it has always been overlooked in the past. Therefore a description of the fruit does not occur in any previously published record of this species.

Moldenke (1959, 1971) recorded this species from Queensland, but so far its occurrence in eastern Australia has not been confirmed.

Affinities

P. bartlingii is closely related to *P. halganiacea* in its leaves being ternate, sessile, linear or narrowly linear-lanceolate, with revolute margins; corolla-tube shallow, much dilated above the calyx, and anther-lobes without distinct appendages at the lower ends. Nevertheless, *P. bartlingii* may easily be identified by its spike-like woolly racemes, larger and prominent leafy flower-bracts, non-glandular hairy ovary, villous hairy ring inside the corolla-tube, included stamens and style, obliquely obovoid fruit and non-glandular hair on young shoots, peduncles and calyces.

P. bartlingii is also close to *P. uncinata* in the shape and arrangement of its leaves, spike-like inflorescences, included stamens and style and non-appendiculate anther-lobes. The former, however, can readily be distinguished by its very woolly inflorescence, prominent leafy flower-bracts, longer anther-lobes (1.5-3 mm), non-sagittate (i.e. simple 2-lobed) stigma and obliquely obovoid non-dehiscent fruit with a thin-walled concavity on the side.

15. **Pityrodia glabra** Munir, sp. nov.

Caules et rami teretes, glabri, strato externo crasso, flavido-ferrugineo. Folia subsessilia; lamina oblonga vel anguste oblongo-obovata, basi cuneata, distaliter obtuse dentata, viscida, glabra, (8-) 10-15 (-20) mm longa, (3-) 5-8 (-10) mm lata. Calycis lobi lanceolati, 3-5 (-6) mm longi, 2-3 (-3.5) mm lati; tubus 2-3.5 mm longus. Corolla extus glaber, alba. Stamina inclusa vel parum exserta. Fructus ellipsoideo-obovoidei, apice glandulosi.

Type: *A.S. George 9561*, 11.27 km along Tamala road from Hamelin - Denham road, Western Australia, 26.viii.1969 (PERTH, holotype; one isotype still to be distributed).

Description (Fig. 15)

Branched glabrous shrub of 50-120 cm. *Stem* and branches densely covered with thick (epidermal) yellowish-rusty layer. *Leaves* subsessile, oblong or narrowly oblong-obovate, narrowed at the base, non-amplexicaul, bluntly dentate at the apex, entire along the margin, (8-) 10-15 (-20) mm long, (3-) 5-8 (-10) mm broad, somewhat viscid and glabrous, brittle when dry. *Flowers* subsessile, axillary solitary towards the end of branches; pedicel viscid, glandular, glabrous, 0.5-1.5 mm long; bracts leafy, subsessile, elliptic-ovate with entire margins or leaf-shaped with a few small teeth at the apex, 6-10 (-15) mm long, (3-) 5-8 mm broad, viscid, glabrous; bracteoles leafy, subsessile, elliptic or ovate-elliptic, entire, viscid, glabrous, 4-7 mm long, 2-3 mm broad. *Calyx* persistent, divided almost halfway down into 5 lobes, 5-8 mm long, glabrous, viscid and sparsely glandular outside; lobes lanceolate, ribbed, mucronate, somewhat scabrid and slightly recurved along the margins, 3-5 (-6) mm long, 2-3 (-3.5) mm broad at the base; tube 2-3.5 mm long. *Corolla* white, 9-12 (-14) mm long, glabrous outside, inside with a dense hairy ring near the throat and sparse long hairs extending to the large anterior-lobe of the lower lip, the hairs protruding outside the corolla-tube; anterior lobe broadly elliptic-orbicular, (3.5-) 4-6 mm long, (2.5-) 3.5-5 mm broad; the other 4 lobes oblong-ovate or narrowly elliptic-oblong (3-) 4-5 mm long, 2-3 mm broad; tube gradually dilated upwards, 4-6 mm long, 3-4 mm broad at the top end. *Stamens* included or scarcely exserted, not distinctly didynamous; filaments glabrous, filiform, the lower pair ± 3 mm long, the upper pair ± 2.5 mm long; anthers orbicular in outline, ± 1 mm across, lobes oblong, free and divergent in the lower halves, appendaged at the lower end. *Ovary* globose, densely pubescent-tomentose, seated on a thick fleshy disk, ± 1 mm in diameter; style included or scarcely exserted, glabrous, filiform, 4-6 mm long, shortly 2-lobed at the summit. *Fruit* ellipsoid-obovoid, sparsely pubescent, glandular at the top, faintly reticulate, 3-4 mm long, nearly as broad in the upper half, splitting into two nutlets; seeds not seen.

Specimens examined

WESTERN AUSTRALIA: *George 9561*, "7 miles" (11.27 km) along Tamala road from Hamelin - Denham road, 26.viii.1969 (PERTH, holotype; one isotype still to be distributed). *F. Mueller s.n.*, Shark Bay, loc.incert., undated (MEL 69336).

Distribution (Map 5A)

P. glabra is endemic in Western Australia where it has been recorded from near Shark Bay.

Comments

P. glabra seems to be one of the rarest species of this genus as it has only recently been rediscovered since its first record probably a century ago. So far, it has been identified with *P. teckiana* from which it can readily be distinguished by its glabrous habit and non-amplexicaul leaves. It is known to occur near the Shark Bay where *P. teckiana* does not grow.

The measurements of various plant organs are taken from the only two available collections which may slightly vary when a wider range of material becomes available for examination.

Affinity

P. glabra is nearest to *P. teckiana* in its leaves being viscid and apparently similar shaped; inflorescence with axillary solitary flowers; stamens and style almost included or scarcely exserted above the corolla-tube and fruit ellipsoid-obovoid. Nevertheless, *P. glabra* can be distinguished by its stem and leaves being glabrous without any distinct glands; leaves subsessile, non-amplexicaul, dentate only at the distal end, entire along the margins; calyx and corolla glabrous outside; calyx-lobes free to about halfway down

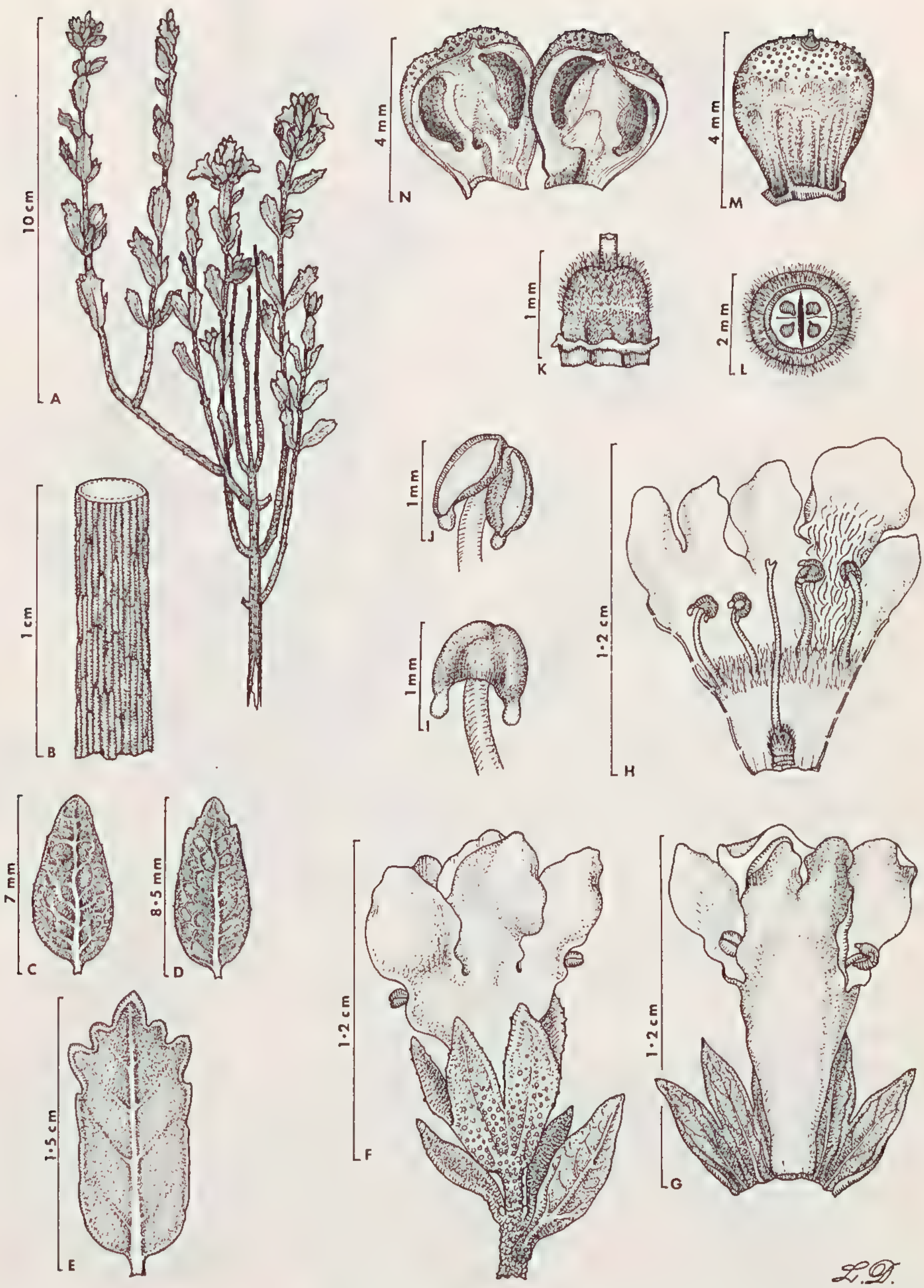
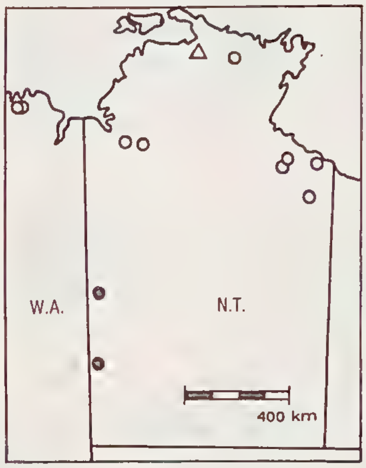


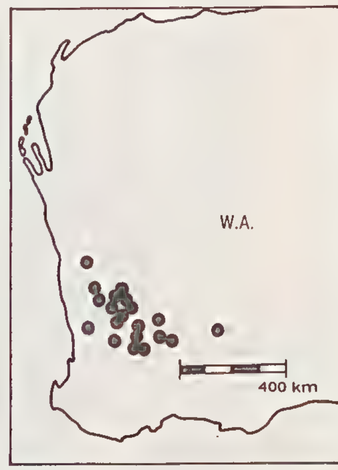
Fig. 15. *Pityrodia glabra* Munir (*F.v. Mueller s.n.*: MEL 69336). A, flowering branch; B, portion of stem to show texture; C, D & E, leaf-shapes and dentation; F, flower with a bract and two bracteoles; G, flower with calyx vertically cut open to show corolla-tube; H, corolla-tube vertically cut open to show androecium and gynoecium; I, lower anther; J, upper anther; K, ovary; L, transverse section of ovary; M, fruit; N, fruit split into two halves.

only; corolla-tube gradually dilated upwards; stamens not distinctly didynamous; fruit sparsely puberulous, glandular at the top.

Map 5A.
P. glabra ●



Map 5B.
P. serrata △
P. ternifolia ○
P. chorisepala ●



Map 5C.
P. teckiana ●

16. **Pityrodia ternifolia** (F. Muell.) Munir, comb. nov.

Dennisonia ternifolia F. Muell., J. & Proc.Linn.Soc.(Bot.)3 (February, 1859)158,*basionym*; F. Muell., Fragm. 1(April, 1859) 124 and 245, t.2 - "Denisonia ternifolia"; Benth., Fl.Aust.5(1870)54; F. Muell., Syst.Cens.Aust. Pl.1(1882)103; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)173; Ewart & Davies, Fl.N.Terr.(1917)236; Junell, Sym.Bot.Upsal.4(1934)76; Mold., Résumé Verben. etc.(1959)208; Mold., Fifth Summary Verben.etc.1(1971) 345; Chipp., Proc.Linn.Soc.N.S.W.96(1971)256. - *syn.nov.*

Type: *F. Mueller s.n.*, Seven Emu "River" (Creek), Gulf of Carpentaria, ?1856 (K, lectotype designated here; GH, K, TCD - isolectotypes; AD, photograph of TCD spec.; W, 2 copies of the original drawings).

Chloanthes denisonii F. Muell., Vic.Natur.6(1889)104; F. Muell., Bot.Centralbl.55(1893)268.

Type: This name was based on *Dennisonia ternifolia* F. Muell. (1859).

Typification

P. ternifolia is based on F. Mueller's two collections from the Gulf of Carpentaria, Northern Territory. One of them, consisting of at least 4 duplicates, has come from Seven Emu "River" (Creek) and the other, with at least 2 duplicates, from McArthur River. Since the author did not choose any one of them as a type, it is, therefore, necessary to select a type for this name. Of all the syntypes, a duplicate from Seven Emu "River" (Creek) collection preserved in Herb. K seems the best representative of this species. The specimen is particularly complete and well preserved, and most likely used by the author in preparing the original description of this taxon. It has, therefore, been selected here as the lectotype.

Description (Fig. 16)

An erect shrub of 60-80 cm. *Stem* and branches terete, densely clothed with a short glandular tomentum intermixed with long and branched spreading hairs. *Leaves* sessile,

Fig. 16. *Pityrodia ternifolia* (F. Muell.) Munir (*C.R. Dunlop 2195*: MEL). A, flowering branch; B, portion of stem; C, flower with a leafy bract and two bracteoles; D, flower with calyx vertically cut open to show corolla-tube; E, corolla-tube vertically cut open to show androecium and gynoecium; F, lower anther; G, upper anther; H, ovary; I, transverse section of ovary; J, fruit.

sticky and prickly, usually in whorls of 3, rarely scattered or decussate, ovate to ovate-lanceolate, more or less cordulate at the base, acute and pungently mucronate, flat, bordered by acute mucronate teeth, (1-) 1.5-5 (-6) cm long, (0.5-) 0.8-2 (-2.5) cm broad, sometimes up to 8.5 by 3-3.5 cm, crustaceous, sprinkled all over with short gland-tipped hairs, nearly smooth above, with very strong raised veins and reticulation underneath. *Flowers* pedicellate, solitary in the axils of upper leaves, usually shorter than the leaves; pedicel slender, densely covered with a short glandular tomentum intermixed with long and branched spreading hairs, (1-) 2-3 (-4) mm long; bracts sessile, represented by the upper leaves; bracteoles sessile, linear-lanceolate or narrowly elliptic, cuneate towards both the ends, entire, acute, covered with short glandular tomentum intermixed with a few long and branched spreading hairs, 3-6 mm long, (0.5-) 1-2.5 mm broad. *Calyx* persistent, narrow campanulate, 10-ribbed, divided to the middle into 5 narrow lobes, 8-10 (-11) mm long, covered all over outside and on the inside of the lobes with a short glandular tomentum intermixed with long and branched hairs, glabrous inside the tube; lobes lanceolate, acute, 4-7 (-8) mm long, 1.5-3 (-4) mm broad; tube narrow campanulate, (2.5-) 3-4 mm long. *Corolla* mauve or pink-red, 11-14 (-15.5) mm long, greyish-pubescent outside the lobes (lips) only, a dense hairy ring inside the tube below the insertion of the stamens and a few long hairs extending to the central lobe of the lower lip; the lower lip 3-lobed, spreading, the central lobe larger than the two lateral, elliptic-obovate or almost orbicular in outline, 4-6 (-7) mm long, (2.5-) 3-4 (-5) mm broad, the lateral lobes more or less elliptic, 3-5 (-6.5) mm long, (2-) 2.5-3.5 (-4) mm broad; the upper lip erect, shortly notched, with 2 spreading lobes, much shorter than the lower lip, the lobes oblong or narrowly elliptic-oblong, with deep purple-red longitudinal streaks, 3-4.5 mm long, 1.5-2 (-2.5) mm broad; tube almost cylindrical or gradually dilated in the upper half, glabrous outside, 6-9 mm long, 1.5-2 (-3) mm broad at the top end. *Stamens* shortly exserted, inserted above the middle of the corolla-tube; filaments filiform, glabrous, the lower pair (2.5-) 3-3.5 mm long, the upper pair (1.5-) 2-2.5 (-3) mm long; anthers more or less orbicular in outline, $\pm$ 1 mm long, nearly as broad; lobes elliptic-oblong, much divergent in the lower halves, minutely appendiculate in the lower pair, almost obsolete in the upper. *Ovary* globose, tomentose, seated on a thick and glabrous disk, $\pm$ 1 mm in diameter; style shortly exserted, filiform, glabrous, (6-) 7-10 mm long, shortly 2-lobed at the top. *Fruit* obovoid or sub-cylindrical-obovoid, cuneate towards the base, pubescent, 3-4.5 (-5.5) mm long, 2-3 mm broad in the upper half, apparently non-dehiscent but may split into two 2-celled nutlets; seeds narrow, tapering at the base.

Specimens examined

NORTHERN TERRITORY: *Byrnes 709*, Victoria River Crossing, 7.v.1968 (DNA, NT, PERTH). *Byrnes 1702*, loc.cit., 12.ix.1969 (BRI, DNA, NT, L, NSW). *Craven 3482*, McArthur River Area, 16° 27′ S, 136° 10′ E, 29.i.1976 (CANB, NT, PERTH). *Dunlop 2195*, Caranbirini Creek, SSW of Borroloola, 16° 17′ S, 136° 04′ E, 4.vi.1971 (BRI, CANB, MEL, NT). *Holtze 1408*, mouth of the Victoria River, 1897 (MEL 73284). *Key 4065.7*, Bukalara Plateau NE of McArthur River Homestead, McArthur River area, 16° 20′ S, 136° 05′ E, 23.iv.1976 (CANB). *F. Mueller s.n.*, sources of the Nicholson River, 1856 (MEL 73283). *F. Mueller s.n.*, Seven Emu "River" (Creek), Gulf of Carpentaria, ?1856 (K, lectotype; GH, K, TCD - isolectotypes; AD, photograph; W, copies of 2 drawings). *F. Mueller s.n.*, McArthur River, Gulf of Carpentaria, ?1856 (MEL 41227, MEL 73282 - syntypes of *Denisonia ternifolia* F. Muell.). *Symon 7897*, about the Cadell River Crossing, 12° 39′ S, 134° 18′ E, 25.vi.1972 (AD, ADW, CANB, NT).

WESTERN AUSTRALIA: *Byrnes 2304*, Kalumburu, 20.v.1971 (CANB, DNA, NT, PERTH). *George 13370*, south-east of Cape Londonderry, north Kimberley, 13° 53′ S, 127° 04′ E, 5.viii.1975 (PERTH). *Maconochie 1251*, Kalumburu Mission, 31.v.1971 (AD, CANB, K, NT, PERTH). *Symon 10187*, between Kalumburu Mission and Longini Landing, 14° 16′ S, 126° 37′ E, 26.v.1975 (AD, ADW).

Distribution (Map 5B)

P. ternifolia is known from the northern half of Northern Territory and from the northern-most part of Kimberley in Western Australia. Distribution in Northern Territory is sparse and disjunct, with the majority of localities towards the southern part of the Gulf of Carpentaria, and a few in the north-western part of the Territory near the mouth of the Victoria River. The only other known locality to the far north is in the Arnhem Land area.

Comments

This species is recorded for the first time from Western Australia, where it is the northern-most representative of *Pityrodia*.

Bentham (1870) described the corolla-tube as "rather shorter than the calyx". During present studies, however, the corolla-tube has been found to be almost equal to the calyx or occasionally slightly extending above the calyx-lobes.

According to C.R. Dunlop's note (coll. no. 2195), the foliage of this species is strongly aromatic. In dried plant specimens, however, no fragrance is noticed.

Affinities

P. ternifolia is closely related to *P. serrata* in its leaves being in whorls of 3, ovate, prickly with sharply toothed margins; flowers axillary and solitary; calyx ribbed, glandular outside; corolla-tube almost cylindrical, glabrous outside, with the upper lip erect and streaked purple; stamens and style shortly exserted; anthers almost orbicular in outline and fruit obovoid. Nevertheless, *P. ternifolia* may easily be distinguished by its leaves being cordulate at the base, sprinkled all over with short gland-tipped hairs; calyx with gland-tipped hairs outside; corolla mauve or pink-red, the dense hairy ring inside the tube well below the corolla-throat and the anther-lobes less distinctly appendiculate.

P. ternifolia is also nearest to *P. byrnesii*, *P. gilruthiana* and *P. pungens* in its leaves being in whorls of 3; flowers axillary and solitary; calyx ribbed, glandular and pubescent outside; corolla-tube cylindrical; the upper corolla-lip erect and streaked purple; stamens and style shortly exserted; fruit obovoid, pubescent. From all these species, however, *P. ternifolia* can readily be identified by its ovate leaves with toothed margins, gland-tipped hairs all over the stem, leaves and calyx, and corolla mauve or pink-red. The leaves in the rest of the above species are linear-lanceolate or narrowly elliptic-oblong; entire; stem, leaves and calyx with sessile glands; corolla pale white with only the upper lip with purple streaks.

17. **Pityrodia serrata** Munir, sp. nov.

Caules et rami teretes, dense tomentosi. Folia sessilia, verticillata terna, oblongo-ovata, serrata, mucronata, 5-13 mm longa, 2-4 mm lata, glabra, laevia. Sepala extus glabra; lobi lanceolati, pungentes, margine vix recurvato, 3-5 mm longi, 1-2 mm lati; tubus 2-2.5 mm longus. Corolla subalba. Stamina parum exserta. Fructus obovoidei, pubescentes.

Type: *T.G. Hartley (Leg. R. Schodde) 13821*, Tin Camp Creek, about 20 miles south of Nabarlek mining camp, Lat. 12° 28′ S, Long. 133° 15′ E, Arnhem Land, Northern Territory, Australia, 30.v.1973 (CANB, holotype; NT, isotype).

Description (Fig. 17)

An erect branched shrub to 1 m. *Stem* and branches cylindrical, densely clothed with a short tomentum of more or less stellately branched hairs, the old stem ferruginous - orange. *Leaves* sessile, in whorls of 3, crowded, with the lower ones mostly overlapping the basal part of the next upper, ovate to oblong-ovate, pungently mucronate, sharply serrate along the margins, 5-13 mm long, 2-3.5 (-4) mm broad, glabrous and smooth, coriaceous, midrib and reticulation not raised underneath. *Flowers* sessile or very shortly pedicellate, axillary and solitary; pedicels ± 1 mm long, glandular and pubescent; bracts represented by the upper leaves; bracteoles sessile, lanceolate, entire, acute, pungent, glabrous, 5-7 mm long, 1-1.5 mm broad. *Calyx* persistent, longer than the corolla-tube,

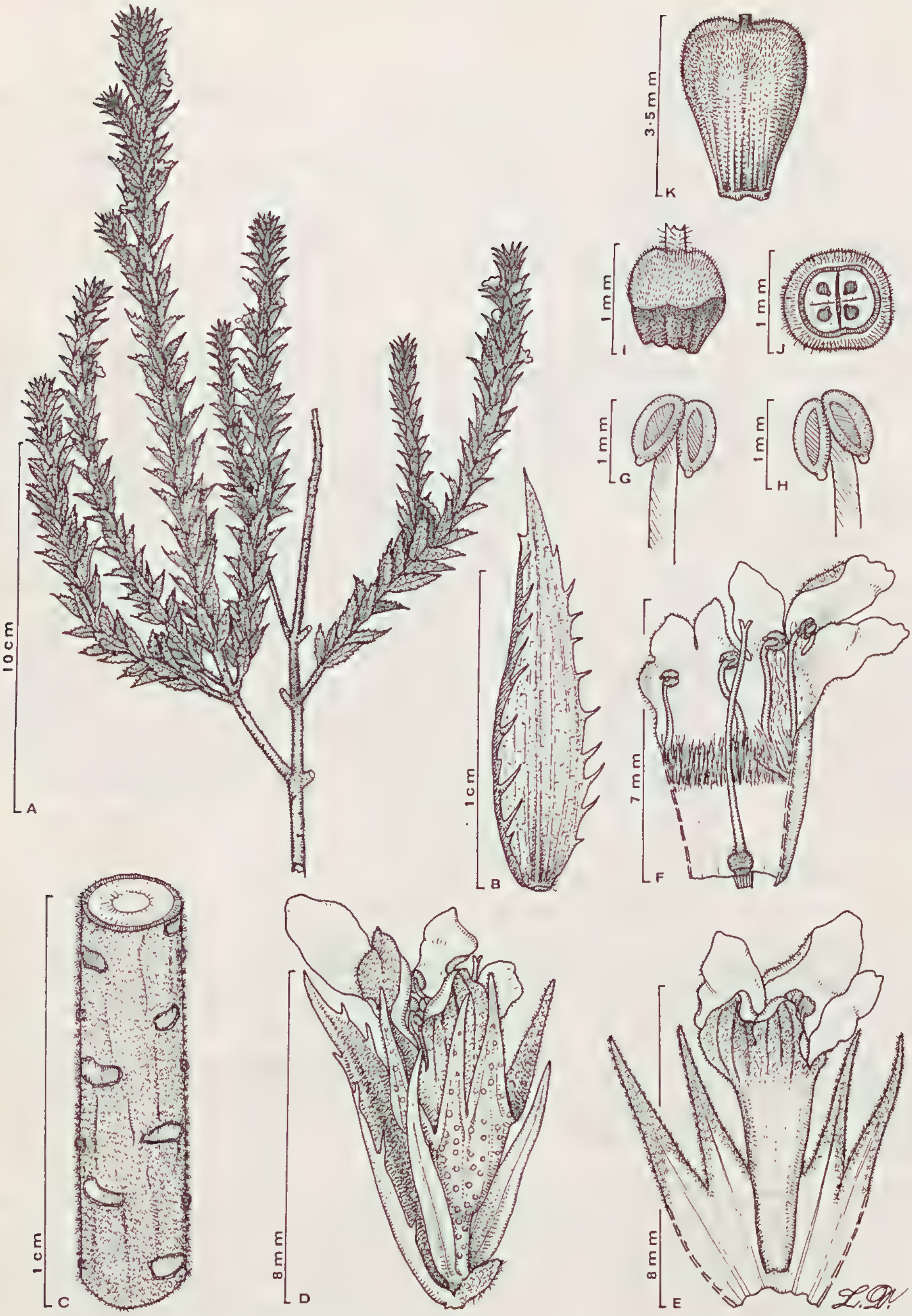


Fig. 17. *Pityrodia serrata* Munir (*T.G. Hartley* [*Leg. R. Schodde*] *13821*: CANB, holotype). A, flowering twig; B, enlarged leaf to show serration; C, portion of stem; D, flower with a leafy bract and two bracteoles; E, flower with calyx vertically cut open to show corolla-tube; F, corolla-tube vertically cut open to show androecium and gynoecium; G, lower anther; H, upper anther; I, ovary; J, lower anther; K, fruit.

more or less campanulate, ribbed, divided more than halfway down into 5 lobes, 6-7.5 mm long, glabrous but sparsely glandular outside, pubescent inside the lobes, glabrous within the tube; lobes lanceolate, with a pungent tip, scarcely recurved along the margin, 3-5 mm long, 1-1.5 (-2) mm broad at the base; tube campanulate, 2-2.5 mm long. *Corolla* off-white with the upper lip streaked purple, scarcely longer than the calyx, 6-8 mm long, pubescent outside the lobes, with a dense hairy ring inside the tube below the insertion of stamens, and a few long hairs extending to the central lobe of the lower lip; the upper lip erect, 2-lobed, shorter than the lower lip, the lobes oblong-ovate, faintly streaked purple, 2-2.5 mm long, 1-1.5 mm broad; the lower lip spreading, 3-lobed, the central lobe larger than the two lateral, narrowly elliptic-obovate, ± 3 mm long, 1.5-2 mm broad, the lateral lobes more or less elliptic-oblong, ± 2.5 mm long, 1.5 (-2) mm broad; tube cylindrical, glabrous outside, 3-3.5 mm long, 1-1.5 (-2) mm broad at the top end. *Stamens* shortly exserted, inserted above the middle of the corolla-tube; filaments filiform, glabrous, the lower pair 1.5-2 (-2.5) mm long, the upper pair 2-2.5 mm long; anthers more or less orbicular in outline, 0.8-1 mm long, ± 1 mm broad; lobes narrowly elliptic-oblong, shortly appendiculate at the lower ends, free and divergent in the lower halves. *Ovary* globose, densely tomentose, ± 1 mm in diameter; style shortly exserted, filiform, glabrous, 4-5.5 mm, shortly 2-lobed at the summit. *Fruit* obovoid, pubescent, 3-3.5 mm long, 2-2.5 mm broad at the top end, apparently non-dehiscent; seeds not seen.

Specimens examined

The type collection is the only material available for examination.

Distribution (Map 5B)

P. serrata is endemic in Arnhem Land, Northern Territory, where it has been recorded from south of Nabarlek near the Tin Camp Creek.

Comments

P. serrata is one of the few *Pityrodia* species with corolla almost equalling the calyx or very shortly exceeding it. Likewise, the filaments of the upper and lower pairs of stamens are usually almost equal or in a few flowers the lower filaments may be a little shorter than the upper. All the anthers, however, are about the same size with a short appendage at the lower ends of the lobes. The leaves of *P. serrata* are glabrous, but unlike several other species of this genus they are neither glandular nor glutinous.

Affinities

P. serrata is nearest to *P. ternifolia* in its leaves being in whorls of 3, ovate, prickly with sharply toothed margins; flowers axillary and solitary; calyx ribbed, glandular outside; corolla-tube almost cylindrical, glabrous outside, with the upper lip erect and streaked purple; stamens and style shortly exserted; anther almost orbicular in outline; fruit obovoid, pubescent. However, *P. serrata* may easily be identified by its leaves being much crowded, glabrous and without any glands, with the marginal teeth smaller but sharper; calyx with sparse sessile glands outside, non-glandular but more densely pubescent inside the lobes; corolla pale white, the dense hairy ring inside the corolla-throat and the anther-cells more distinctly appendiculate.

P. serrata is also related to *P. byrnesii*, *P. gilruthiana* and *P. pungens* in its leaves being in whorls of 3; flowers axillary and solitary; calyx ribbed, glandular outside; corolla pale white with almost cylindrical tube and the upper lip streaked purple; stamens and style shortly exserted; anthers more or less orbicular in outline; fruit obovoid, pubescent. *P. serrata*, however, can readily be distinguished by crowded pungent leaves with sharp serrate margins.

18. **Pityrodia teckiana** (F. Muell.) E. Pritz., Bot.Jahrb.Syst.35(1904)521; Gardner, Enum.Pl.Aust.Occ.3(1931)112; Junell, Sym.Bot.Upsal.4(1934)68; fig.115; Gardner in Parkinson (Ed.), Wildfls West.Aust.(1959)133, in obs.; Mold., Résumé Verben.etc.(1959) 210, 251; Beard (Ed.), W.Aust.Pl. edn 1(1965)93; Blackall & Grieve, West.Aust.Wildfls 3(1965)571; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben. etc.1(1971)348, 426; Gardner in Edmonds (Ed.), Wildfls West.Aust. edn 11(1973)121, in obs.

Type: *J. Forrest s.n.*, near Lake Deborah, 1889 (MEL 69207, lectotype designated here; K, MEL 69208 - isolectotypes).

Chloanthes teckiana F. Muell., Vict.Natural.6(1889)104, *basionym*; F. Muell., Bot.Centralbl.40(1889)268; F. Muell. & Tate, Trans.Roy.Soc.S.Aust.16(1896)375.

Type: As for *Pityrodia teckiana* (F. Muell.) E. Pritz..

Pityrodia maculata Gardner, J.Roy.Soc.W.Aust.27(1942)190; Beard (Ed.), W.Aust.Pl.edn 1(1965)92; Blackall & Grieve, West.Aust.Wildfls 3(1965)570; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben. etc.1(1971)348 - *syn.nov.*

Type: *C.A. Gardner 2708*, near Ballidu south of Pithara, 22.ix.1931 (PERTH, lectotype; PERTH 2 isolectotypes).

Typification

P. teckiana is based on J. Forrest's (s.n.) collection from Lake Deborah, Western Australia, consisting of at least 3 duplicates. Since the author (F. Mueller) did not select any one of them as a type, it is, therefore, necessary to choose a type for this name. Of all the three syntypes, the one preserved in Herb. MEL under the no. MEL 69207 has been annotated by F. Mueller and almost certainly used by him in preparing the original description of this species. This specimen is particularly complete and well preserved, and is designated here as the lectotype for this species.

Description (Fig. 18)

A branched viscid shrub of 30-90 (-150) cm. *Stem* and branches densely covered with sticky exudation from the numerous short gland-tipped septate hairs. *Leaves* sessile, amplexicaul, mostly decussate, sometimes ternate towards the base, brittle, ovate-oblong or narrowly elliptic-oblong, bluntly serrate-dentate at the tip and along the margins, (0.5-) 0.8-2.5 (-3.5) cm long, (3-) 5-10 (-12) mm broad, glabrous, viscid and green on both sides. *Flowers* shortly pedicellate, mostly axillary solitary, rarely 3 together in the axil of upper leaves; peduncle and pedicel viscid, covered with short gland-tipped hairs; pedicel 1-3 (-4) mm long; bracts green, leafy, sessile, amplexicaul, oblong or narrowly elliptic-oblong, entire or somewhat dentate in the upper half, viscid all over, 4-12 (-17) mm long, (2-) 3.5-5 (-7) mm broad; bracteoles green, sessile, semi-amplexicaul, oblong-elliptic or ovate-elliptic, entire, 2.5-5 mm long, 1.5-3 mm broad, viscid all over. *Calyx* persistent, divided to near the base into 5 lobes, 5-8 mm long, viscid all over, outside with numerous short and simple gland-tipped hairs and a few branched hairs chiefly towards the base and along the lobe-margins, glandular viscid inside; lobes lanceolate or narrowly elliptic, 4-7 mm long, (1-) 1.5-2 (-3) mm broad; tube short, 1-1.5 mm long. *Corolla* pale blue-mauve or violet-lilac, 15-25 mm long, sparsely pubescent outside with simple gland-tipped hairs, glabrous inside excepting the dense hairy ring above the ovary, and sparse villous hairs extending to the large anterior-lobe of the lower lip; anterior-lobe nearly rounded and sometimes with a small terminal notch, 4-8 mm long, 6-10 (-12) mm broad; the other 4 lobes semi-orbicular or semi-ovate, (2.5-) 3-5 (-7) mm long, 4-6 (-7) mm broad; tube abruptly dilating above the ovary within the calyx; 10-15 mm long, 5-8 (-11) mm broad at the top end. *Stamens* didynamous, included or the lower pair slightly exserted above the corolla-tube; filaments glabrous, filiform, the lower pair 6-12 mm long, the upper pair 3-5 mm long; anthers broadly elliptic-oblong or almost orbicular in outline, 1.5-2 mm long, 1-1.5 (-2) mm broad, the lower pair with a

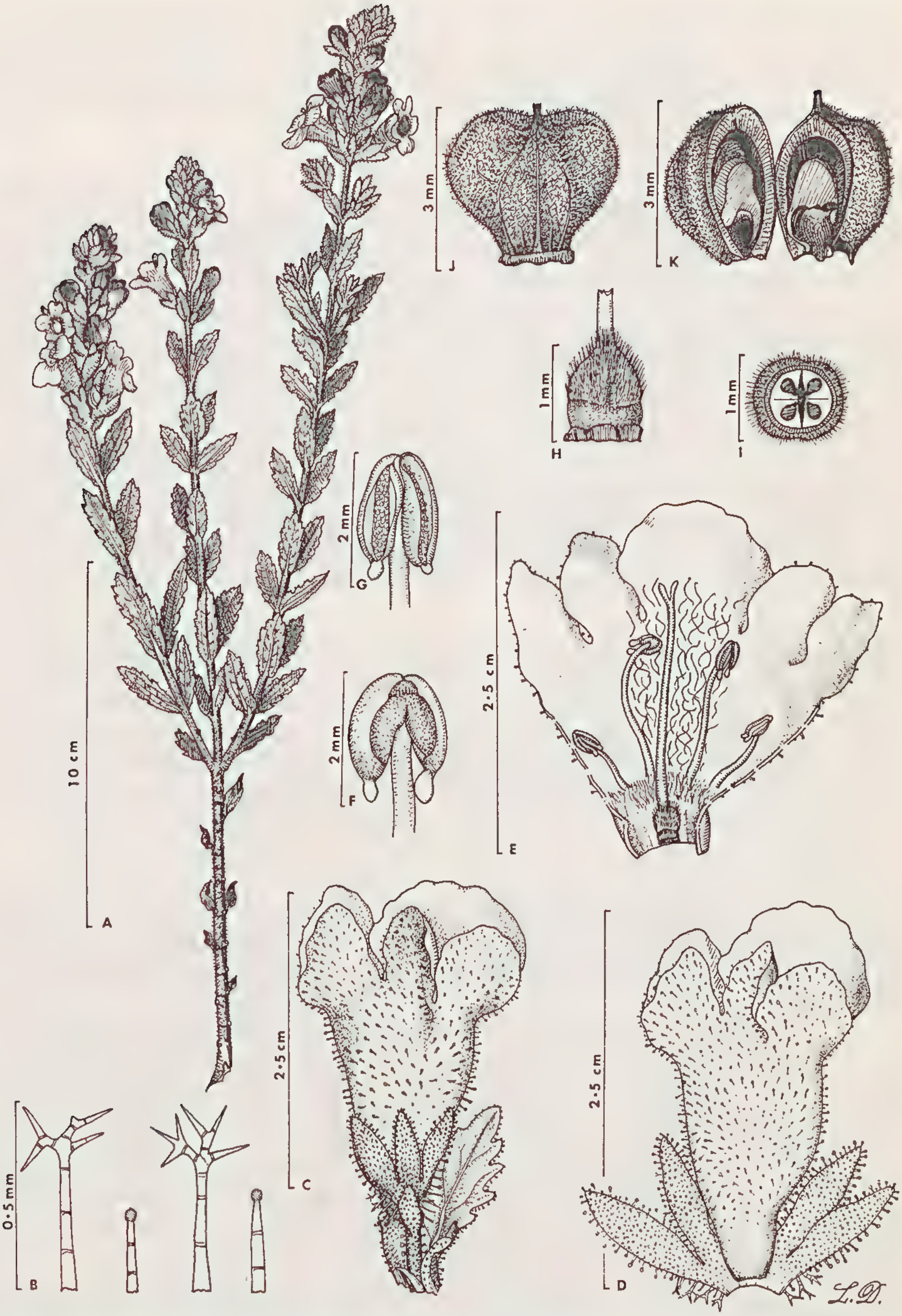


Fig. 18. *Pityrodia teckiana* (F. Muell.) E. Pritz. (A-I, *R.J. Chinnock 4117*: AD; J-K, *C.A. Gardner 13554*: PERTH). A, flowering branch; B, hair-types in calyx; C, flower with a bract and two bracteoles; D, flower with calyx vertically cut open to show corolla-tube; E, corolla-tube vertically cut open to show androecium and gynoecium; F, lower anther; G, upper anther; H, ovary; I, transverse section of ovary; J, fruit; K, fruit split into two halves.

thick mass on the back, the lobes oblong, distinctly appendaged at the lower end. *Ovary* globose, densely tomentose, with a thick disc at the base, ± 1 mm in diameter; style scarcely exserted above the corolla-tube, glabrous, filiform, 10-16 (-20) mm long, shortly 2-lobed at the apex. *Fruit* almost globular or somewhat ellipsoid-obovoid, with a very shallow depression at the top, pubescent, faintly reticulate, 2-3 mm long, 2.5-3 mm broad in the upper half, splitting into two nutlets; seeds not seen.

Representative specimens

WESTERN AUSTRALIA (35 collections seen): *Ashby 3180*, north of Trayning on Bencubbin Road, 28.v.1970 (AD, PERTH). *Bailey 172*, Muntadgin, Sept. 1947 (PERTH). *Baird s.n.*, Kalgoorlie, 1932 (UPS). *Bingold s.n.*, Hill Station, 10 miles N of Broome, Sept. 1939 (MO, PERTH). *Blackall 3529*, near Bencubbin, Sept. 1937 (PERTH). *Blackall s.n.*, near Southern Cross, Sept. 1929 (PERTH). *Blackall s.n.*, loc.incert., Sept. 1930 (PERTH). *Chinnock 4117*, near Roe Dam, 30 km N of Narembeen, 23.ix.1977 (AD). *Davies s.n.*, 5 miles east of Merredin, 30.x.1963 (PERTH). *Dvoretsky s.n.*, Burracoppin, Oct. 1930 (PERTH). *J. Forrest s.n.*, near Lake Deborah, 1889 (MEL 69207, lectotype; K, MEL 69208 - isolectotypes). *Gardner 1791*, "Yorkrakine Rocks", Westonia, 5.x.1972 (MEL, PERTH). *Gardner 2708*, near Ballidu, S of Pithara, 22.ix.1931 (PERTH 3 spec., types of *P. maculata* Gard.). *Gardner 13554*, near Beacon, 10.x.1961 (PERTH). *Gardner s.n.*, near Koorda, Sept. 1963 (PERTH 2 spec.). *Gardner & Blackall 784*, between Pithara and Wongan Hill, 26.ix.1931 (PERTH). *Haegi 1186*, $2^1/_2$ km E of Muntadgin towards Mt Hampton, 3.x.1976 (AD). *Helms s.n.*, 36 miles north-west from Southern Cross, 27.xi.1891 (AD 3 spec., K, MEL 69213, MEL 69214, NSW 135934, NSW 142629). *Koch 2849*, Merredin, 15.x.1923 (K, MEL, MO, NSW). *Lawson s.n.*, Hill Station 10 miles N. of Broome, Sept. 1957 (PERTH). *Lullfitz 3098a*, 4 miles from Warralakin, 6.xii.1963 (PERTH, Kings Park Perth). *Merrall s.n.*, sources of Swan River, 1888 (MEL 69210). *Newbey 1537*, 6 miles W of Muntadgin, 21.x.1964 (PERTH). *Rogerson 311*, Wialki, N of Merredin, Oct. 1966 (PERTH). *Sargent 845*, Burracoppin, 19.vi.1915 (NSW). *Sewell s.n.*, lower Swan River, 1889 (MEL 69212). *Stacey 252*, 6.8 miles N of Cleary, 17.xi.1972 (PERTH). *Weber 5207*, 40 km NE of Cleary, 19.x.1975 (AD). *Went A116*, between Mullewa and Wubin, 9.ix.1962 (MO).

Distribution (Map 5C)

P. teckiana is endemic mainly in the south-west of Western Australia where it has been recorded between latitude 29° and 32° S and between longitude 116° and 120° E. Besides, one disjunct locality is in the north of the state near Broome. The south-western distribution is chiefly to the north of the Great Eastern Highway with a few localities south of the Highway towards Narembeen and Mt Holland. North of the Highway, it has been collected from several localities of which Wubin and Lake Moore are the northern-most. The western-most locality is around the sources of the Swan River and the eastern-most near Kalgoorlie.

Comments

The specific epithet *teckiana* was proposed by F. Mueller after "the Duke of Teck, G.C.B., in appreciation of the powerful support which His Highness, as president of the Royal Horticultural Society of England, afforded to the very meritorious pursuits of that great union".

After examining the types of *P. teckiana* and *P. maculata* Gardner, these taxa are found to be conspecific. Therefore, the latter is being regarded here as a synonym of the former. In the protologue of *P. maculata*, Gardner pointed out its affinity with *P. dilatata* without naming any character common between the two. Similarly, *Chloanthes teckiana* (= *P. teckiana*), has been regarded by F. Mueller as "nearest allied to *Chloanthes denisonii*" (= *Dennisonia ternifolia*), but he too did not mention any character common to both species. The latter species so far has been treated as belonging to a distinct genus *Dennisonia* F. Muell., which is generally accepted as the nearest ally of *Pityrodia*. Both *P. teckiana* and *Dennisonia ternifolia* have somewhat similar shaped leaves and axillary solitary flowers towards the end of branches. However, *Dennisonia ternifolia* can easily be distinguished by the following characters. Plant non-viscid; leaves ternately whorled and provided with sharper mucronate serratures; calyx less deeply cleft with more pointed (or mucronate) lobes; corolla considerably smaller, less turgid and anther-appendages scarcely visible. Gardner's view about the affinity between *P. teckiana* and *P. dilatata* seems less plausible, because the latter is not only a non-glandular, non-viscid and very woolly-tomentose shrub, but has different shaped leaves, flowers and fruit.

Contrary to the general decussate phyllotaxy and axillary solitary flowers, the lower leaves in F.W. & C.W. Went's collection (No. A116: MO) are successively decussate and ternate and flowers mostly 3-together on short axillary peduncles.

Affinity

P. teckiana is closely related to *P. glabra* in its leaves being viscid and apparently similar looking; inflorescence with axillary solitary flowers; stamens and style included or scarcely exserted above the corolla-tube and fruit ellipsoid-obovoid. *P. teckiana*, however, may easily be distinguished by its stem and branches being densely covered with short, gland-tipped, septate hairs; leaves viscid and green on both sides, sessile, amplexicaul, serrate-dentate at the tip and along the margins; calyx and corolla hairy outside with gland-tipped hairs; calyx-lobes almost free to the base; corolla-tube abruptly dilated above the ovary within the calyx; stamens distinctly didynamous; fruit non-glandular, pubescent, with a very shallow depression at the top.

19. **Pityrodia chorisepala** Munir, sp. nov.

Caules et rami teretes, dense tomentosi. Folia sessilia, opposita, ovata vel elliptico-ovata, integra, 0.5-1.3 cm longa, 3-5.5 mm lata, pubescentia vel tomentosa. Sepala extus glandulosa et pubescentes; lobi linearii, subdiscreti, 3-6 mm longi, 0.5-1.5 mm lati; tubus 0.5-1 mm longus. Petala extus glabra, rosea. Stamina exserta. Fructus plus minusve obovoideo-pyriformes.

Type: *P.K. Latz 6543*, south of Mongrel Downs Station, 20° 43'S, 129° 35'E, Northern Territory, Australia, 4.viii.1976 (AD, holotype; AD, CANB, NT, PERTH - isotypes).

Description (Fig. 19)

A rigid branched shrub to 90 cm. *Stem* and branches densely clothed with cineraceous indumentum of short and branched hairs which often becomes yellowish upwards. *Leaves* sessile, ovate or elliptic-ovate, contracted at the base, somewhat crowded towards the apex, obtuse, entire, flat, (5-) 7-15 mm long, 3-5.5 mm broad, densely yellowish-grey-tomentose. *Flowers* pedicellate, solitary or more often 3-together in the axil of upper leaves, sometimes more, forming a spike-like inflorescence towards the end of branches; pedicel densely glandular-puberulous or glandular-glutinous, (2-) 3-5 (-6) mm long; bracts leafy, sessile, ovate or elliptic-ovate, glandular with interspersed short gland-tipped hairs, (4-) 5-6 (-8) mm long, 1.5-2.5 mm broad; bracteoles leafy, sessile, linear or narrowly elliptic-oblong, glandular with branched ciliate tomentum along the margins, 3-4 mm long, 0.5-1 mm broad. *Calyx* persistent, deeply 5-lobed, 4-7 mm long, glandular-puberulous or glandular-glutinous outside, with long branched hairs or ciliate tomentum along the lobe-margins; lobes linear, almost free to the base, somewhat chartaceous when dry, 3-5 (-6) mm l ong, 0.5-1 (-1.5) mm broad; tube short, 0.5-1 mm long. *Corolla* white, 6-8 mm long, glabrous outside with a dense hairy ring inside the tube below the stamens and a few long hairs extending to the large central lobe of the lower lip; the central lobe almost elliptic-orbicular in outline, rounded at the apex, 3-4 mm long, 3-5.5 mm broad; the lateral lobes of the lower lip broadly elliptic, ± 3 mm long, 2-3 mm broad; the 2 lobes of the upper lip more or less oblong, 3-5 mm long, 2-3 mm broad; tube cylindrical in the lower half, dilated at the top within or immediately above the calyx, 3-4 mm long, 1.5-2 mm broad at the top end. *Stamens* exserted; filaments filiform, glabrous or with sparse and short gland-tipped hairs, the lower pair 2.5-3 mm long, the upper pair 1.5-2 mm long; anthers more or less orbicular in outline, distinctly appendiculate at the lower ends of the lobes, 0.5-0.8 (-1) mm long, nearly as broad. *Ovary* globose, glabrous, densely glandular with minute gland-tipped hairs, ± 1 mm in diameter; style exserted, filiform glabrous with a few sparse gland-tipped hairs towards the base, 4-5 mm long,

Fig. 19. *Pityrodia chorisepala* Munir (*P.K. Latz 6543*: AD, isotype). A, flowering twig; B, portion of stem with a leaf; C, cyme in the axil of a leaf; D, flower with calyx vertically cut open to show corolla-tube; E, corolla-tube cut open to show androecium and gynoecium; F, lower stamen; G, stamen; H, ovary; I, transverse section of ovary; J, fruit; K, fruit showing top view.

shortly 2-lobed at the summit. *Fruit* more or less obovoid-pyriform with a shallow depression at the top, and two unequal rounded lobes in the upper half, distinctly corrugated along the reticulate venations, densely pubescent with short gland-tipped hairs, 3-3.5 mm long, 2-2.5 mm broad at the top end, apparently non-dehiscent; seeds not seen.

Specimens examined

NORTHERN TERRITORY: *George 8921*, "12 miles" (19.21 km) west of Sandy Blight Junction, 26.vii.1967 (PERTH). *P.K. Latz 6543*, south of Mongrel Downs Station, 20° 43′ S, 129° 35′ E, 4.viii.1976 (AD, holotype; AD, CANB, NT, PERTH - isotypes).

Distribution (Map 5B)

P. chorisepala is endemic to the Northern Territory where it has been recorded from south of Mongrel Downs and west of Sandy Blight Junction.

Comments

In a few flowers, the number of stamens are found to be five or the number of corolla-lobes four. These variations, however, never occur together in the same flower. So far, such anomalies have not been observed in any other *Pityrodia* species.

According to field notes (*P.K. Latz 6543*) this taxon is "a rare odorous species growing in the narrow dune swale of red sand".

Affinity

P. chorisepala is closely allied to *P. hemigenioides* in its stem and leaves being cineraceous tomentose; leaves sessile, contracted at the base; corolla white, almost glabrous outside, with tube abruptly dilated at the top; stamens and style exserted. Nevertheless, *P. chorisepala* may easily be distinguished by its leaves being ovate or elliptic-ovate, flat; flowers mostly 3-together in the axil of upper leaves; pedicels glandular, longer, (2-) 3-5 (-6) mm; calyx densely glandular outside with branched tomentose hairs along the lobe-margins, lobes linear, almost free to the base; ovary with minute gland-tipped hairs all over, style sparsely hairy towards the base; fruit more or less obovoid-pyriform with a shallow depression at the top forming two unequal rounded lobes in the upper half, distinctly corrugate along the reticulate venations, densely pubescent with short gland-tipped hairs.

20. **Pityrodia oldfieldii** (F. Muell.) Benth., Fl.Aust.5(1870)52; Diels & E. Pritz., Bot. Jahrb.Syst.35(1904)522; Gard., Enum.Pl.Aust.Occ.3(1931)112; Gard., Wildfls West. Aust.(1959)132; Mold, Résumé Verben.etc.(1959)210, 251, 335, 341; Beard (Ed.), W. Aust.Pl. edn 1(1965)92; Blackall & Grieve, West.Aust.Wildfls 3(1965)571; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben.etc. 1 & 2(1971)348, 426, 603, 615; Gard., West.Aust.Wildfls B(1972)162, 163t; Erickson et al., Fls & Pl.West.Aust. (1973)103, t.305; Gard., Wildfls West.Aust. edn 11(1973)120 exclud. fig.

Type: *A. Oldfield s.n.*, Murchison River, undated (K, lectotype designated here; HBG, MEL 881 and MEL 882, W 3 spec. - isolectotypes).

Chloanthes oldfieldii F. Muell., Fragm.1(1859)234, *basionym*; F. Muell. Fragm.2(1861)182; F. Muell., Fragm. 6(1868)157 exclud. syn. *Quoya cuneata* Gaud.; F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Muell., Sec.Syst. Cens.Aust.Pl.1(1889)172.

Type: As for *P. oldfieldii* (F. Muell.) Benth.

Quoya oldfieldii (F. Muell.) F. Muell., Fragm.4(1864)80, based on *Ch. oldfiedii* F. Muell.

Typification

P. oldfieldii (F. Muell.) Benth. is based on A. Oldfield's collection (s.n.), consisting of at least seven duplicates. Since the author did not choose any one of them as a type, it is, therefore, necessary to select a type for this name. Of all the syntypes, the one preserved in Herb. K seems the best representative of this species. It bears the collector's name on his field label and is annotated in the author's hand. The specimen is particularly complete and well preserved and is designated here as the lectotype.

Description (Fig. 20)

An erect branched shrub of 0.5-1.5 m. *Stem* and branches densely woolly-tomentose with branched hairs, often reddish-brown or deep dark brown in the young apical parts, becoming yellowish-brown or pale brown on the older branches. *Leaves* sessile, deeply narrowed towards base, broadly elliptic-obovate or almost rhomboidal, very obtuse, minutely undulate or crenate along the margins, (1.5-) 2-4.5 (-5) cm long, (1-) 1.5-2.5 cm broad, densely woolly-tomentose with branched hairs, greyish-green above, yellowish-green underneath with primary and secondary veins distinct. *Flowers* pedicellate, solitary or more frequently 3-7 (-15) together in pedunculate axillary cymes towards the end of branches, disposed in a more or less leafy spike-like inflorescence; cyme-peduncle rather thick, densely tomentose, (0.5-) 1-2 cm long; pedicel covered with dense branched tomentum, 2-5 mm long; bracts sessile, elliptic or somewhat linear-oblong, tomentose on abaxial surface, glabrous on adaxial surface, 2-4 mm long, 1-1.5 mm broad; bracteoles ovate-oblong or elliptic, 1-2 mm long, 0.5-1 mm broad. *Calyx* clothed with greenish-yellow branched tomentum often changing to deep brown towards the tips, persistent, divided to nearly the middle into 5 lobes, tubular towards the base, 8-10 (-13) mm long, densely tomentose outside and on the inside (of at least the upper half) of the lobes, glabrous inside the tube; lobes more or less arranged in two lips, oblong-ovate, very obtuse, membranous when dry, 3-nerved, (2-) 3-5 (-7) mm long, 2-4 mm broad at the base; tube more or less campanulate, 3-6 mm long. *Corolla* pale pink with purple dots in throat, (15-) 18-23 mm long, pubescent outside, glabrous inside excepting the dense hairy ring above the ovary, and the sparse hairs extending to the large anterior lobe of the lower lip; the anterior lobe about twice the size of other 4-lobes, more or less orbicular in outline, (6-) 7-9 mm long, (7-) 9-10 mm broad; the other 4 lobes nearly equal, more or less orbicular in outline, (3-) 4-6 mm long, 5-6 mm broad at the base; tube much dilated, 12-15 (-17) mm long, 10-13 mm across at the top end. *Stamens* included; filaments filiform, mainly glabrous, the lower pair slightly longer and with a few hairs towards the base, 5-6 mm long, the upper pair 3-4 mm long; anthers (excluding the appendages) more or less orbicular in outline, the lower pair with well developed appendages at the lower ends of the lobes, lobes 2-2.5 mm long including the appendages, the upper pair without appendages or with very minute ones, lobes 1-1.5 mm long. *Ovary* globose, 1-2 mm in diameter, densely woolly-hirsute; style included, filiform, glabrous, 8-10 mm long, shortly 2-lobed at the apex. *Fruit* enclosed within the persistent calyx, elliptic-ovoid or globose, sometimes slightly oblique with the style lateral (as in *P. bartlingii*), densely pubescent with branched hairs, 3-4 mm long, (2-) 3-4 mm broad in the upper half.

Representative specimens

WESTERN AUSTRALIA (37 collections seen): *Ashby 307*, east of Yuna, ca. 34 km E of Northampton, 28.viii.1963 (AD). *Ashby 1901*, south of Eradu, 14.viii.1966 (AD, PERTH). *Beard 2079*, 30 miles E of Murchison River Mouth, 28.ix.1962 (PERTH, Kings Park Perth). *Blackall 2768*, between Geraldton and Mullewa, 23.ix.1932 (PERTH 2 spec.). *Blackall 4548*, 80 km N of Northampton, 3.ix.1940 (PERTH). *Blackall 4793*, between Yuna and Dartmoor, Sept. 1940 (PERTH 2 spec.). *Brockway s.n.*, 21 miles N of Ajana, Oct. 1947 (PERTH). *Burbidge 2213*, Ajana sandplain, 30.ix.1947 (CANB, MEL). *Burns 9*, 3 miles in along Casuarina Road, 14.viii.1966 (PERTH). *Burns 14*, Eradu, E of Geraldton on Mullewa Road, 24.x.1965 (MO, PERTH). *Burns 78*, East Yuna Reserve, 25.ix.1967 (PERTH). *Demarz 3053*, 390 miles N of Perth on NW Coastal Highway, 8.xii.1970 (PERTH, Kings Park Perth). *Drummond 6th coll. no. 139*, Murchison River, 1851 (CGE, G, K, MEL 2 spec., P, W). *Galbraith 554*, near Mullewa on railway line to Wilroy, Aug. 1964 (MEL 2 spec.). *Gardner 1953*, 12 miles NW of Northampton, 24.ix.1926 (PERTH). *Gardner 12730*, near Binnu, 7.ix.1960 (PERTH 2 spec.). *Gardner s.n.*, Baker's Well, N of Northampton, 11.i.1931 (PERTH). *Gardner & Blackall s.n.*, 19 km NW of Northampton, Sept. 1926 (PERTH). *Luff & Birrel s.n.*, 16 km from Three Springs on Eneabba Road, 7.x.1963 (AD). *Lullfitz 1953*, Binnu, 18.xii.1962 (PERTH). *Lullfitz 2961*, 6 miles from Murchison River

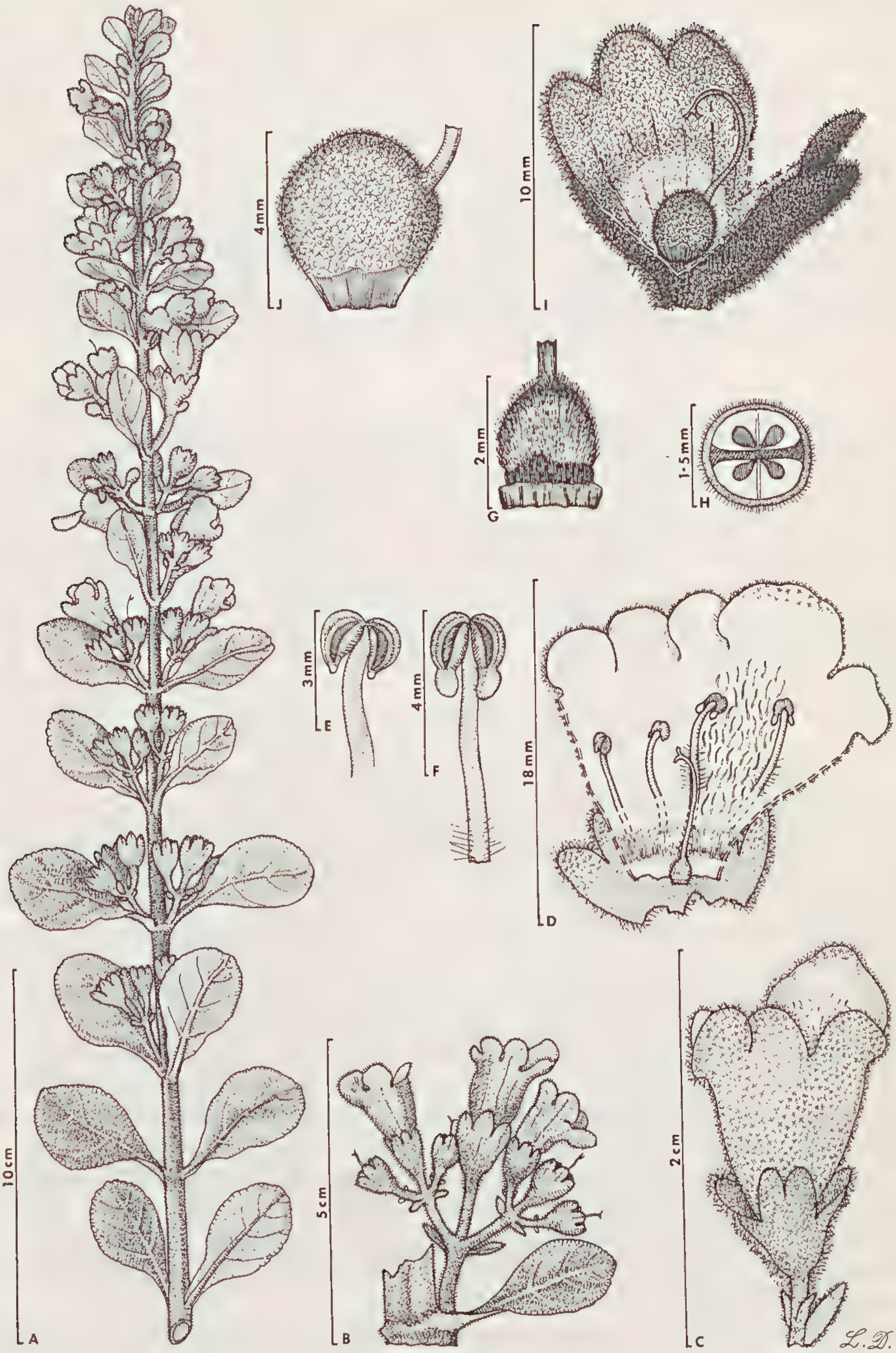


Fig. 20. *Pityrodia oldfieldii* (F. Muell.) Benth. (*J.Z. Weber 5107*: AD). A, flowering branch; B, cyme in the axil of a leaf; C, flower with a bract and two bracteoles; D, flower with calyx and corolla vertically cut open to show androecium and gynoecium; E, upper stamen; F, lower stamen; G, ovary; H, transverse section of ovary; I, 2-lipped persistent calyx cut open to show fruit; J, fruit.

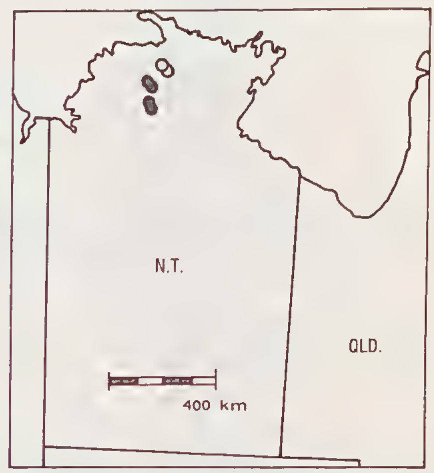
Mouth, 13.xi.1963 (Kings Park Perth). *Lullfitz 2975*, 36 miles E of Geraldton, 14.xi.1963 (Kings Park Perth). *F. Mueller s.n.*, Shark Bay, Oct. 1877 (MEL 69241). *Newbey 2213*, 2 miles E of Yuna, 28.viii.1965 (PERTH). *Oldfield s.n.*, Murchison River, undated (K, lectotype of *Chloanthes oldfieldii* F. Muell.; HBG, MEL 881 and 882, W 3 spec. - isolectotypes). *Phillips s.n.*, 18 miles N of Ogilvie, 26.ix.1962 (CBG 024097). *Shaw 614*, Kalbarri National Park, 20.x.1964 (AD). *Steenbohm & Lullfitz 2824*, 20 miles N of Ajana, 15.xi.1951 (PERTH). *Weber 5107*, c. 50 km E of Geraldton along the road to Mullewa, 15.x.1975 (AD 2 sp.). *Young 491*, 24.7 miles N of Murchison River Bridge, 17.xii.1967 (Kings Park Perth).

Distribution (Map 6A)

P. oldfieldii is endemic in the west-south-west of Western Australia where it seems restricted between latitude 26° and 30° S, and between longitude 114° and 116° E. The main distribution is between Geraldton and just north of the Murchison River along the North West Coastal Highway. It is also frequent around Yuna and between Geraldton and Mullewa. Elsewhere, one collection is known from south-west of Three Springs and another one from an unspecified locality near Shark Bay.

Map 6A.
P. oldfieldii O

Map 6B.
P. verbascina ●



Map 6C.
P. pungens ●
P. gilruthiana O

Comments

P. oldfieldii has the aspect of *P. verbascina* and both occur in the same general area. The former, however, can easily be recognized by its leaves being broadly elliptic-obovate or almost rhomboidal; cyme-peduncle thicker, shorter, (0.5-) 1-2 cm long; calyx divided only in the upper half, the lobes obtuse and arranged in two lips; corolla-lobes almost similar shaped; fruit broadly elliptic-obovoid and somewhat oblique with the apical end often shifted somewhat laterally.

The 2-lipped calyx of *P. oldfieldii* seems similar to that of *P. cuneata*, but the calyx in the latter is much more deeply divided and the lobes more or less acute.

In his key to *Pityrodia* species, Bentham (1870) recorded *P. oldfieldii* as having petiolate leaves. Actually, the leaves in this species are sessile but being narrow cuneate towards the base, appear to have a short petiole.

The date (year only) noted with the duplicates of J. Drummond's 6th collection no. 139 is "1853" or "1854", but according to Erickson (1969) the collecting of Drummond's 6th collection took place during 1851. The year 1853 or 1854 on the specimens, therefore, appear to be when these specimens were sent to or received by the institutions where they are now preserved.

The appendages of the lower pair of anthers are fairly well developed and in some flowers they almost equal the anther-lobes.

This species is locally called "Oldfield's Foxglove".

Affinity

P. oldfieldii is closely related to *P. verbascina* in its leaves being thick and soft with the veins concealed by the dense woolly tomentum, lamina not contracted near the middle; cymes on short peduncles in the axil of upper leaves; peduncles, young branches and upper leaves densely covered with golden-yellow or reddish-brown indumentum of branched hairs. Nevertheless, *P. oldfieldii* may easily be identified by its leaves being broadly elliptic-obovate or almost rhomboidal in outline, deep cuneate towards the base; calyx 2-lipped; calyx-lobes oblong-ovate, obtuse or rounded at the apex; style lateral on fruit and nutlets without humps.

21. **Pityrodia verbascina** (F. Muell.) Benth., Fl.Aust.5(1870)50; F. Muell., Fragm.9 (1875)5; Diels & E. Pritz., Bot.Jahrb.Syst.35(1904)522; Gard., Enum.Pl.Aust.Occ.3 (1931)112; Gard., Wildfls West.Aust.(1959)132; Mold., Résumé Verben.etc.(1959)210, 251, 335, 341; Beard (Ed.), W.Aust.Pl. edn 1(1965)93; Blackall & Grieve, West.Aust. Wildfls 3(1965)571; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Hodgson & Paine, Aust. Wildfls (1971)236; fig.p.237; Mold., Fifth Summary Verben. etc. 1 & 2(1971)348, 426, 603, 615; Erickson et al., Fls & Pl.West.Aust.(1973)187.

Type: *A. Oldfield s.n.*, at the Murchison River in bushy thicket near the Geraldine Mines, Western Australia, undated (MEL 69386, lectotype designated here; K, MEL 69387 - isolectotypes).

Chloanthes verbascina F. Muell., Fragm.1(1859)233, *basionym*; F. Muell., Fragm.6(1868)157; F. Muell., Syst. Cens.Aust.Pl.1(1882)103; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172.

Type: As for *Pityrodia verbascina* (F. Muell.) Benth.

Pityrodia verbascina (F. Muell.) Benth. var. *aurea* E. Pritz., Bot.Jahrb.Syst.35(1904)521; Mold., Résumé Verben. etc. (1959) 210; Blackall & Grieve, West.Aust.Wildfls 3(1965)571; Mold., Fifth Summary Verben. etc. 1(1971)348; Erickson et al., Fl. & Pl.West.Aust.(1973)187 - *syn.nov.*

Type: *L. Diels 5629*, in Irwin district in fruticetis arenosis pr. Champion Bay, W.Aust. ?Nov. 1901 (B, n.v.; probably destroyed during the war).

Pityrodia verbascina (F. Muell.) Benth. var. *leucocalyx* E. Pritz., Bot.Jahrb.Syst.35(1904)522; Mold., Résumé Verben.etc.(1959)210; Mold., Fifth Summary Verben.etc.1(1971)348 - *syn.nov.*

Type: *L. Diels 5775*, crescit in distr. Avon in fruticetis arenoso-glareosis pr. Moora, ?Nov. 1901 (B, n.v.; probably destroyed during the war).

Pityrodia oldfieldii sensu Gard., Wildfls West.Aust. edn 11 (1973) 120 p.p. quoad fig. on p. 120.

Typification

P. verbascina (F. Muell.) Benth. is based on an A. Oldfield (s.n.) collection, consisting of at least 3 duplicates. Since the author did not choose any one of them as a type, it is, therefore, necessary to select a lectotype for this name. Of the three syntypes, the one preserved in Herb. MEL (MEL 69386), where F. Mueller's herbarium and types are now preserved (Stafleu, 1967), was annotated by him and most certainly used by him in preparing the original description of this species. The specimen is particularly complete and well preserved and is selected here as the lectotype for this species.

Description (Fig. 21)

An erect branched woolly-tomentose shrub of 0.5-2.1 m. high. *Stem* and branches densely clothed with deep brownish-red or pale brownish-yellow tomentum of branched hairs, often floccose and assuming a golden-yellow, golden-red or greyish-yellow hue in the upper part of plant. *Leaves* sessile, sometimes contracted into a petiole, exceedingly

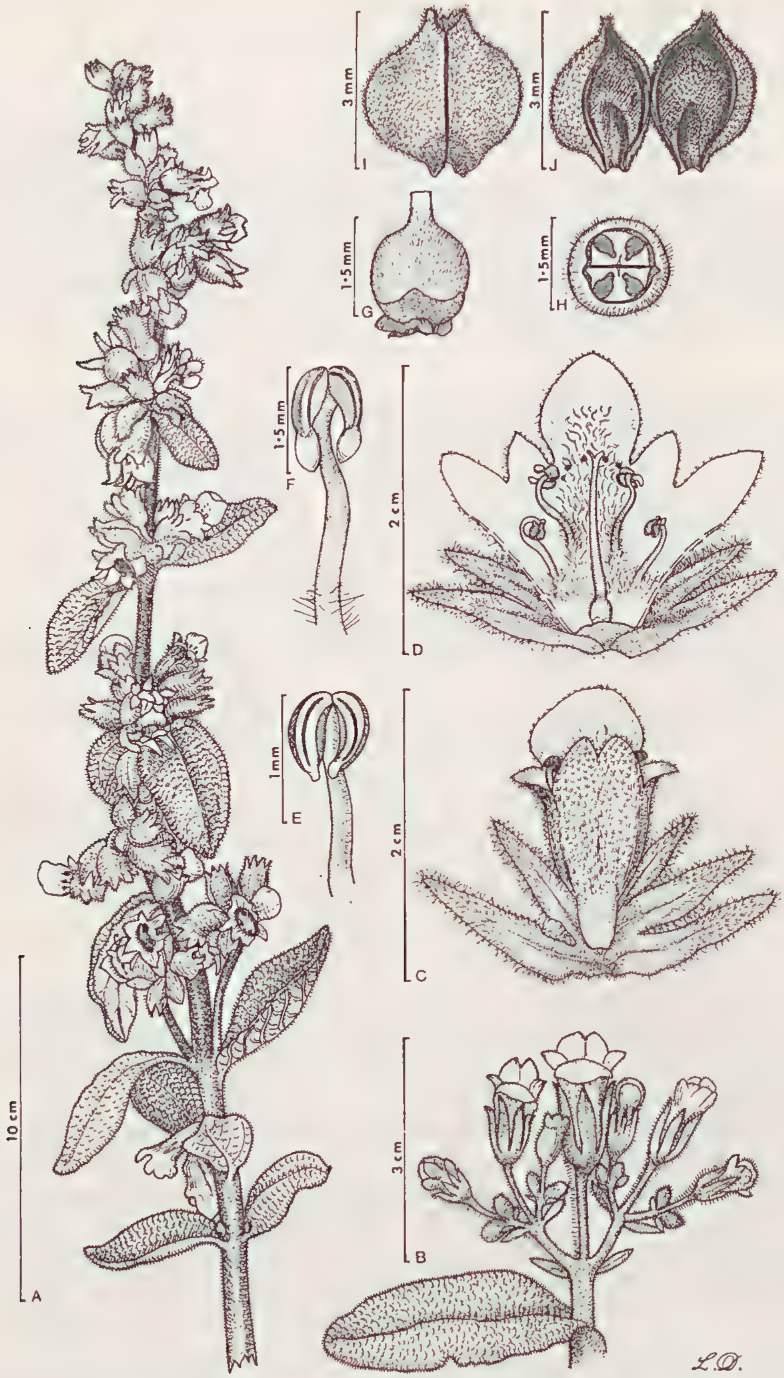


Fig. 21. *Pityrodia verbascina* (F. Muell.) Benth. (*D. & N. McFarland NM 1062*: AD). A, flowering twig; B, axillary cyme; C, flower with calyx vertically cut open to show corolla-tube; D, flower with calyx and corolla vertically cut open to show androecium and gynoecium; E, upper stamen; F, lower stamen; G, ovary; H, transverse section of ovary; I, fruit; J, fruit split open into two halves.

variable in shape and size, mostly elliptic, oblong or elliptic-oblong, obtuse, (2-) 3-7 (-10) cm long, (0.5-) 1-3 (-4) cm broad, thick and soft, the veins concealed by the dense branched woolly tomentum, the floral leaves smaller, the upper ones shorter than the calyx. *Flowers* pedicellate, (3-) 5-9 (-12) together in pedunculate axillary cymes towards the end of branches, disposed in a dense or interrupted more or less leafy spike-like inflorescence; cyme-peduncle thick, densely tomentose, (1-) 2-4 (-5) cm long; pedicel slender, densely tomentose, (2-) 3.5-10 (-15) mm long; bracts linear-lanceolate, tomentose on abaxial surface, glabrous on adaxial surface, 3-5 mm long, 0.5-1 mm broad; bracteoles smaller than bracts, (1-) 2-3 mm long. *Calyx* yellow, persistent, deeply divided into 5 lobes, shortly tubular at the base, 10-13 mm long, densely woolly-tomentose outside, sparsely so on the upper inner surface of the lobes, glabrous inside the tube; lobes linear-lanceolate, acute, 3-nerved, 9-12 mm long, 1-2 mm broad; tube 1-1.5 mm long. *Corolla* pinkish-white with pink spots inside the throat, 12-18 mm long, pubescent outside, glabrous inside excepting the dense hairy ring above the ovary, and the sparse long hairs extending to the large anterior lobe of the lower lip; the anterior lobe white, much larger and more than twice as broad as any of the others, more or less elliptic-orbicular in outline, 6-10 mm long, (6-) 8-12 mm broad; the 2 upper lobes pinkish, short, oblong, 3.5-5 mm long, 3-4 mm broad; the 2 lateral ones pinkish, smaller and triangular 1.5-3 mm long, 2-4 mm broad at the base; tube much dilated, 6-8 mm long, 7-9 mm across at the top end. *Stamens* included or shortly exserted; filaments filiform, glabrous, the lower pair 4-5 mm long, the upper pair ca. 3 mm long; anthers more or less orbicular in outline, the lower pair with well developed white appendages at the lower ends of the lobes, the upper pair without any or with small ones, lobes 1-1.5 mm long. *Ovary* globose, 1-2 mm in diameter, pubescent; style included, filiform, glabrous above, sparsely hairy towards the base, 8-9 mm long, shortly 2-lobed at the apex. *Fruit* enclosed within the persistent calyx, broadly ellipsoid-ovoid, somewhat oblique, densely silky pubescent, 2.5-3 mm long, 2-3 mm broad, splitting into two separate 1-seeded nutlets, each nutlet with a small hump on the back. *Seeds* one in each nutlet.

Representative specimens

WESTERN AUSTRALIA (67 collections seen): *Aplin 1305*, west of Moora, 30.xi.1961 (PERTH). *Ashby 1368*, East Dinner Hill, north of Badgingarra, 17.xi.1964 (AD). *Ashby 1864*, White Peak, c. 25 km N of Geraldton, 31.vii.1966 (AD, PERTH). *Ashby 2658*, Howatharra, 26.ix.1968 (AD, PERTH). *Beard 3027*, 435 mile peg, Carnarvon Highway, 25.viii.1963 (PERTH, Kings Park Perth). *Brockway s.n.*, 41 miles S of Ajana, Oct. 1947 (CANB, PERTH). *Burbidge 2072*, 14 miles N of Geraldton, 2.ix.1947 (CANB, MEL). *Burns 90*, 389 mile post on N.W. Coastal Highway between Geraldton and Carnarvon, 1.x.1967 (PERTH). *Canning 3169*, 13.2 miles towards The Casuarinas, S of Geraldton - Mullewa Road; 20.ix.1968 (CBG 030688). *Demarz 756*, 126 mile post on Eneabba road, 19.xi.1968 (PERTH). *Diels & E. Pritzel 501*, Geraldton, Victoria district, Nov. 1901 (PERTH). *Drummond 6th coll. no. 140*, Murchison River, 1851 (CGE, G, K, MEL, P). *Drummond s.n.*, loc. incert., undated (MEL 69388 & MEL 69395 - probably duplicates of 6th coll. no. 140). *Edmiston 297*, Oakajee Reserve, Feb. 1973 (PERTH). *Fairall 1471*, near Howatharra Gap, Moresby Ranges, 7.v.1964 (Kings Park Perth). *Gardner s.n.*, Baker's Well, Hutt Lagoon ("River"), N of Geraldton, Sept. 1926 (PERTH 2 spec.). *George 3218*, ± 12 miles SW of Three Springs, 10.xii.1961 (PERTH). *Gray s.n.*, Greenough Flats, 1869 (MEL 69392). *Guerin s.n.*, Champion Bay, 1871 (MEL 69394). *Halliday 130*, 15 km south-east of Mingenew on Geraldton Highway, 25.xi.1974 (AD). *Lullfitz 1961*, 410 mile peg NW Coastal Highway, 19.xii.1962 (PERTH 3 spec., Kings Park Perth 2 spec.). *McFarland 1062*, Howatharra Hill Res. ca. 30 km NNE of Geraldton, 25.ix.1977 (AD, PERTH, 3 spec.). *Morrison 13182*, Chapman River, 3.xi.1903 (K). *Oldfield s.n.*, at the Murchison River in bushy thicket near the Geraldine Mines, undated (MEL 69386, lectotype of *Chloanthes verbascina*; K, MEL 69387 - isolectotypes). *Phillips s.n.*, 3 miles from Walkaway towards Ellendale, 15.ix.1968 (AD 96922092, BRI 096160, CBG 025819, MEL 69398). *Phillips s.n.*, 14.5 miles S of Wannoo, 17.ix.1968 (CBG 025851, NSW, PERTH). *Saffrey 188*, Badgingarra Reserve Stn on Watheroo Rd, 22.xii.1968 (B, K, MEL, MO, PERTH). *Shaw 606*, 175 km north of Geraldton, 2.x.1966 (AD). *Spalding s.n.*, Geraldine, 1889 (MEL 69390). *Teakle s.n.*, Northampton district, Nov. 1932 (PERTH).

Distribution (Map 6B)

P. verbascina is endemic in the west-south-west of Western Australia, where it is restricted between latitude 26° and 31° S, and between longitude 114° and 116° E. The major distribution is between Carnarvon and Moora along North West Coastal Highway and Geraldton Highway. The northern-most localities are to the south-south-east of Shark Bay towards the Murchison River, and the southern ones between Watheroo and Jurien Bay. Majority of collections, however, are recorded from around Geraldton.

Comments

P. verbascina was originally described by F. Mueller (1859) as *Chloanthes verbascina*, but in 1864 he considered referring it to *Quoya* Gaudich., if the latter is retained as a genus. Bentham (1870) recognized *Quoya* as a synonym of *Pityrodia* R.Br., and merged *Quoya* and its species into the latter genus. Following this, F. Mueller (1875) accepted the genus *Pityrodia* for *P. verbascina*, but afterwards (1882, 1889) regarded *Pityrodia*, *Quoya* and *Chloanthes* as congeneric and therefore, recorded both *Pityrodia* and *Quoya* as synonyms of *Chloanthes*. As a result, he placed *P. verbascina* back under the genus *Chloanthes*. The majority of subsequent botanists, however, have retained this species under *Pityrodia*.

E. Pritzel (1904) recorded under this species two new varieties viz. var. *aurea* and var. *leucocalyx*. He based both the varieties on L. Diels collections nos. D5629 and D5775, respectively. The specimens were collected by L. Diels from Western Australia and later deposited in the herbarium at Berlin (Herb. B). During the present study, the above (types) specimens are not available for examination; probably destroyed during World War II. In view of this difficulty, the present investigation into the status of these varieties is based chiefly on the information in their protologue and the wide range of material examined from different localities. According to the original descriptions of these taxa, they seem to have been distinguished mainly on the colour of the indumentum of the stem, leaves, inflorescence and calyces; presence or absence of leaves in the inflorescence; interrupted or non-interrupted spikes; sessile or pedunculate flowers and shape of leaves and flower-bracts. During present studies, the examination of wide range of material from different localities has shown that these characters are very variable within the species and apparently of little taxonomic value. The leaves are found to be exceedingly variable in size and shape, and so is the indumentum-colour. The gradation from broad to narrow leaves and whitish-grey to golden-yellow or brownish-yellow indumentum are found to correlate with latitude. Similarly, young inflorescences are generally dense, non-interrupted and without distinct floral-leaves, and their flowers with very short or no peduncle. These characters as a whole are found to prevail throughout this species. Therefore, they are unsuitable for the identification of infra-specific taxa of this species. Consequently, var. *aurea* E. Pritzel and var. *leucocalyx* E. Pritzel are regarded here indentical with the typical variety *verbascina*.

The thick woolly-tomentose indumentum on stem, leaves and other external parts of the plant, spicate inflorescence and somewhat similar looking leaves give this species the aspect of *Lachnostachys verbascifolia* F. Muell. or *Newcastelia hexarrhena* F. Muell. Nevertheless, *P. verbascina* may easily be distinguished by its indumentum being mostly golden-yellow in the upper parts of the branches, flowers zygomorphic, stamens only 4 and usually didynamous, and anthers-lobes with appendages at the lower end.

The date on some duplicates of J. Drummonds' 6th collection no. 141 is "1854", but according to R. Erickson (1869) the collecting of Drummond's 6th collection took place during 1851. The year "1854" with the specimens, therefore, seems to be the one when these specimens were acquired or communicated to those herbaria where they are now preserved.

Moldenke (1959, 1971) recorded the variety *leucocalyx* E. Pritzel only from Queensland, but there is no specimen or other record to confirm its occurrence in that state. As mentioned under the distribution, *P. verbascina* is endemic in the west-south-west of Western Australia, and so far there is no record to support its presence in eastern Australia.

Because of the golden-yellow indumentum on young shoots, inflorescence and calyces, this species is called by some "golden bush" or "golden-flowered bush".

Affinity

P. verbascina is nearest to *P. oldfieldii* in its young branches, peduncles and upper leaves densely covered with golden-yellow or reddish-brown indumentum of branched hairs; leaves thick and soft with the veins concealed by the dense woolly tomentum; cymes on short peduncles in the axil of upper leaves. However, *P. verbascina* may readily be distinguished by its leaves being oblong, elliptic or elliptic-oblong; calyx equally 5-lobed; calyx-lobes linear-lanceolate, acute; style apical on fruit and nutlets with a hump on the back.

22. **Pityrodia pungens** Munir, sp. nov.

Caules et rami teretes, dense glandulo-viscidi, pilis brevibus stellatis adspersis. Folia sessilia, opposita vel plerumque verticillata terna, linearia vel anguste lanceolata, pungentia, integra, margine vix recurvato, 0.8-6 cm longa, 2-6 mm lata, glanduloso-viscida, interdum pilis brevibus stellatis adspersis. Sepala corollam superantia vel aequantia, lobis lanceolatis, 3-6.5 mm longis, 1-2.5 mm latis, tubo 1-2 mm long. Corolla subalba. Stamina breviter exserta. Fructus obovoidei, pubescentes.

Type: *N. Byrnes 1829*, Katherine Gorge National Park, Northern Territory, Australia, 24.iii.1970 (AD, holotype; DNA, NT - isotypes).

Description (Fig. 22)

An erect spreading shrub of 40-75 cm. *Stem* and branches terete, densely glandular-viscid, sprinkled with short stellate hairs, the older stems often densely clothed with a short white tomentum of stellate hairs. *Leaves* sessile, opposite or more often in whorls of 3, sometimes scattered, linear or narrow-lanceolate, pungent, entire, almost flat or slightly recurved along the margins, (0.8-) 1-4 (-6) cm long, 2-4 (-6) mm broad, glandular-viscid, sometimes sprinkled with short stellate hairs, smooth above, with raised midrib underneath. *Flowers* sessile, axillary and solitary, shorter than the leaves; bracts represented by the upper leaves; bracteoles sessile, lanceolate, entire, acute, glandular-viscid all over, 4-9 mm long, (0.5-) 1-1.5 mm broad. *Calyx* persistent, about the length of corolla or slightly longer, more or less campanulate, longitudinally ribbed, divided more than halfway down into 5 lobes, 6-8 mm long, densely glandular all over outside and on the inside of the lobes, sometimes sparsely sprinkled outside and on the inside of the lobes with short stellate hairs, glabrous inside the tube; lobes lanceolate, ribbed, slightly recurved in the lower halves, acute, (3-) 4-6.5 mm long, (1-) 1.5-2.5 mm broad; tube campanulate, 1-2 mm long. *Corolla* off-white with the upper shorter lip streaked purple, almost equalling the calyx or somewhat shorter, (5-) 6-7 mm long, pubescent outside the lips (lobes) only, with a dense hairy ring inside the tube below the insertion of stamens and a few long hairs extending to the central lobe of the lower lip; the upper lip erect with 2 spreading lobes, much shorter than the lower, enclosed within the calyx-lobes, the lobes oblong-ovate with longitudinal deep purple streaks, 2-3 mm long, 1-1.5 mm broad; the lower lip spreading with 3 lobes, the central lobe larger than the two lateral, elliptic-orbicular in outline, 2.5-3 mm long, (2-) 2.5-3 mm broad, the lateral lobes more or less elliptic-obovate, 2.5-3 (-4) mm long, (1-) 1.5-2.5 (-3) mm broad; tube almost cylindrical in the lower half, much dilated at the top end, glabrous outside, 1.5-3 mm long, 1-2 mm broad at the top end. *Stamens* shortly exserted, inserted above the middle of the corolla-tube; filaments filiform, glabrous, the lower pair 2-2.5 mm long, the upper pair (1-) 1.5-2 mm long; anthers more or less orbicular in outline, 0.5-1 mm long, nearly as broad; lobes narrowly elliptic-oblong, shortly appendiculate at the lower ends, divergent in the lower halves. *Ovary* globose, densely tomentose, $\pm$ 1 mm in diameter; style shortly

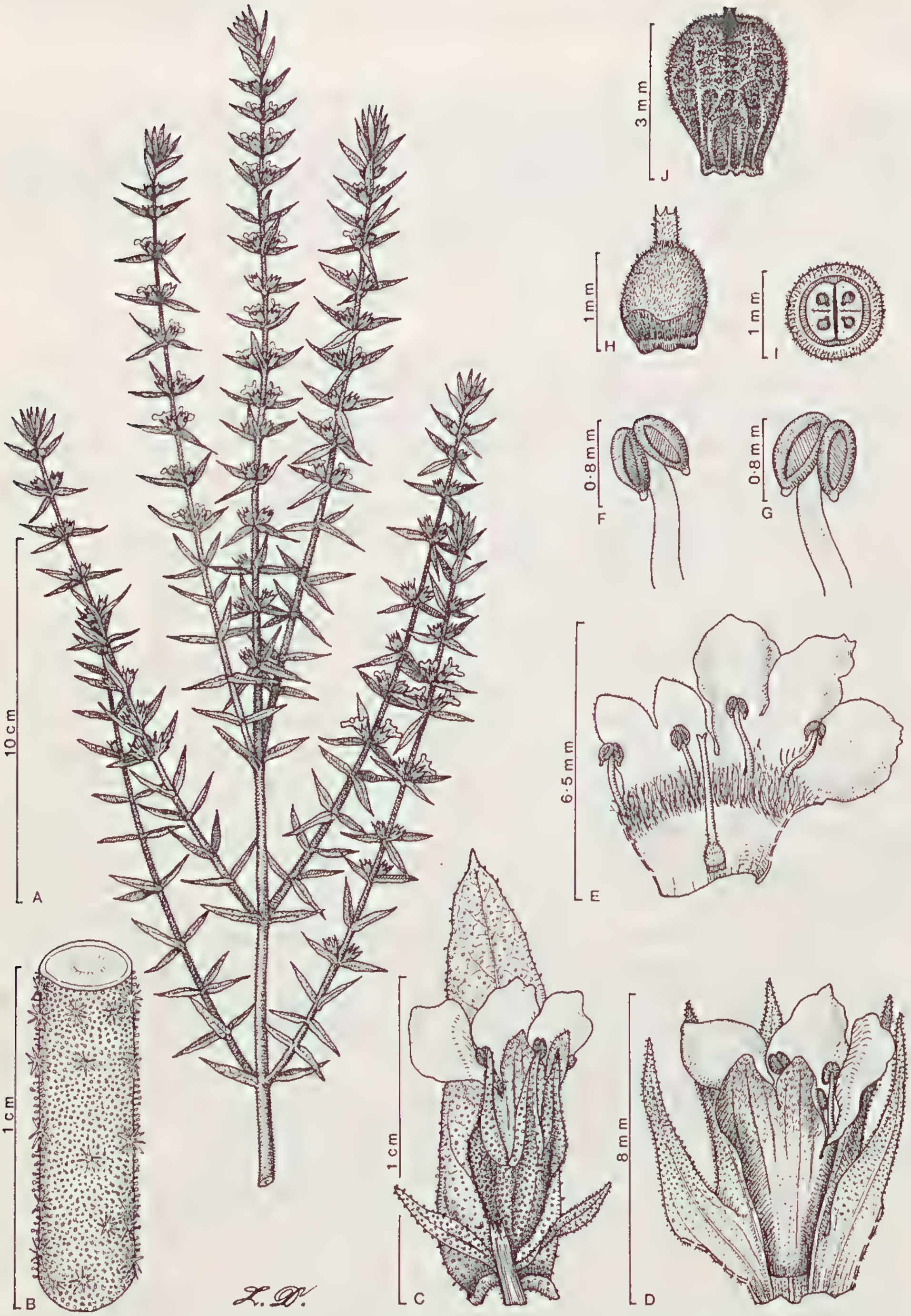


Fig. 22. *Pityrodia pungens* Munir (*N. Byrnes 1829*: DNA, isotype). A, flowering branch; B, portion of stem showing stellate and gland-tipped hairs; C, flower in the axil of leaf with two lateral bracteoles; D, flower with calyx vertically cut open to show short corolla-tube; E, corolla-tube vertically cut open to show androecium and gynoecium; F, upper stamen; G, lower stamen; H, ovary; I, transverse section of ovary; J, fruit.

exserted, filiform, glabrous, (2.5-) 3-4 mm long, minutely 2-lobed at the summit. *Fruit* obovoid, pubescent, 2.5-3 mm long, 1.5-2 mm broad, apparently non-dehiscent; seeds not seen.

Specimens examined

NORTHERN TERRITORY: *Adams 896*, Katherine Gorge, c. 32 km NE of Katherine, 8.iii.1964 (CANB, n.v., L n.v., NSW n.v., NT, US n.v.). *Balgooy & Byrnes 1399*, U.D.P. Falls (Waterfall Creek), W. Arnhem Land, 26.vii.1971 (CANB, L, MO). *N. Byrnes 1382*, U.D.P. Falls, South Alligator River, 20.ii.1968 (CANB, DNA, NT). *N. Byrnes 1829*, Katherine Gorge National Park, 24.iii.1970 (AD, holotype; DNA, NT - isotypes). *Gittins 2694*, above U.D.P. Falls, July 1973 (BRI). *Schodde AE545*, U.D.P. Falls, c. 11 km NW of El Sharana, 24.i.1973 (AD, CANB, DNA, NT).

Distribution (Map 6C)

P. pungens is endemic in the northern part of Northern Territory where it has been recorded from between 13° and 15° S, and between 132° and 133° E. The known distribution is to the north-east of Katherine in the Katherine Gorge National Park, and to the north-west of El Sharana towards the South Alligator River.

Comments

The calyx of *P. pungens* is unique within the genus in being equal to the corolla or in some cases even longer. A somewhat similar situation occurs in a closely related genus *Spartothamnella*, in which the calyx of one species, *S. puberula*, is longer than the corolla.

Of all the specimens examined, the leaves in Balgooy & Byrnes' collection (No. 1399) from U.D.P. Falls are the longest and with more recurved margins, and the main stem cottony-white due to the dense indumentum of short stellate hairs. In the type material, however, the stem and leaves are glandular with mostly sparse and short intermixed hairs. Since there is no difference in the arrangement or shape of vegetative or reproductive parts, therefore, the variation in the density of hairs on stem and leaves may be due to some ecological factor.

Affinity

P. pungens is closely related to *P. ternifolia* in its stem and leaves being glandular-viscid intermixed with hairs; leaves sessile, more or less similarly arranged on stems, pungently mucronate; flowers axillary solitary; calyx campanulate, ribbed, glabrous inside the tube; corolla pubescent outside the lips (lobes), the upper lip erect, with deep purple streaks, much shorter than the lower lip; stamens and style shortly exserted; fruit obovoid, pubescent. However, *P. pungens* may easily be distinguished by its stem and leaves being covered throughout with sessile glands and stellate hairs; leaves linear-lanceolate, 2-4 (-6) mm broad, entire, without strongly raised reticulation underneath; flowers sessile; calyx as long as corolla or slightly longer, tube short, 1-2 mm long; corolla white, tube 1.5-3 mm long; anther-lobes more distinctly appendiculate. In *P. ternifolia*, the leaves have distinctly toothed margins, flowers pedicellate, corolla mauve or pink-red, longer than calyx, glands on stem, leaves and flowers are mostly at the tip of short hairs and the hairs intermixed with the glands are long and irregularly branched, not stellate.

23. **Pityrodia gilruthiana** Munir, sp. nov.

Caules et rami teretes, viscidi, pubescentes. Folia sessilia, verticillata terna, interdum remota, linearia vel anguste lanceolata, integra, mucronata, margine vix recurvato, 6-30 mm longa, 1.5-4 mm lata, glabra, glutinoso-viscida. Sepala glanduloso-viscida, lobis lanceolatis, 4.5-7 mm longis, 1.5-3 mm latis, tubo 2-3 mm longo. Corolla subalba. Stamina breviter exserta. Fructus obovoidei, pubescentes.

Type: *M. Lazarides 8006*, c. 11 miles south-west of Mt Gilruth, Long. 132° 56′E, Lat. 13° 04′ S, Northern Territory, Australia, 14.iii.1973 (CANB, holotype; BRI, CANB, K, L, NSW, NT - isotypes).

Description (Fig. 23)

A dark-green spreading shrub of 1-1.5 m. *Stem* and branches terete, viscid; the main stem usually densely clothed with a short tomentum of sessile stellate hairs sparsely intermixed with long and septate branched hairs; the branches more viscid, covered chiefly with septate hairs. *Leaves* sessile, in whorls of 3, rarely scattered, linear or narrow-lanceolate, entire, mucronate, usually flat, rarely with slightly recurved margins, (6-) 8-25 (-30) mm long, (1.5-) 2-4 mm broad, glabrous, glutinous-viscid all over, smooth above, with raised midrib underneath. *Flowers* sessile, axillary and solitary, usually shorter than the leaves; bracts represented by the upper leaves; bracteoles sessile, leafy, narrow linear-lanceolate, entire, acute, slightly recurved along the margins, glabrous but glutinous-viscid, 3-6 mm long, (0.5-) 1-1.5 mm broad. *Calyx* persistent, shorter than corolla, more or less campanulate, longitudinally ribbed, divided more than halfway down into 5 lobes, 7-10 mm long, glandular-viscid all over with a few gland-tipped hairs outside and on the inner surface of the lobes, glabrous inside the tube; lobes lanceolate, acute, slightly recurved along the margins, ribbed on the back, 4.5-7 mm long (1.5-) 2-3 mm broad at the base; tube more or less campanulate, 2-3 mm long. *Corolla* off-white with the upper lip streaked purple, 10-13 mm log, pubescent outside the lips and near the distal end of the tube, glabrous inside excepting the dense hairy ring below the insertion of stamens and a few long hairs extending to the central lobe of the lower lip; the upper lip 2-lobed, erect, shorter than the lower lip, the lobes oblong-ovate, 2-4 mm long, 1.5-2 mm broad; the lower lip 3-lobed, spreading, the central lobe larger than the two lateral, more or less obovate in outline, 3-4 mm long, ± 2.5 mm broad, the lateral lobes elliptic-oblong, 3-4 mm long, 1.5-2 mm broad; tube nearly cylindrical, projecting above the calyx, glabrous outside excepting the top end, 6-8 mm long, 1.5-2.5 mm broad at the top end. *Stamens* shortly exserted, inserted above the middle of the corolla-tube; filaments filiform, glabrous, the lower pair 2.5-3 mm long, the upper pair 2-2.5 mm long; anthers more or less orbicular in outline, 0.5-0.8 mm long, ± 1 mm broad; lobes narrowly elliptic-oblong, shortly appendiculate at the lower ends, divergent in the lower halves. *Ovary* globose, densely pubescent-tomentose, ± 1 mm in diameter; style shortly exserted, filiform, glabrous with a few sparse hairs towards the base, 6-9 mm long, minutely 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, obovoid, pubescent, 3-4 mm long, 1.5-2 mm broad, apparently non-dehiscent; seeds not seen.

Specimens examined

NORTHERN TERRITORY: *Lazarides 7952*, 7 miles west of Mt Gilruth, 132° 54′ E, 12° 57′ S, 2.iii.1973 (AD, CANB, K, L, NT, US). *Lazarides 8006*, 11 miles south-west of Mt Gilruth, 132° 56′ E, 13° 04′ S, 4.iii.1973 (CANB, holotype; BRI, CANB, K, L, NSW, NT - isotypes).

Distribution (Map 6C)

P. gilruthiana is endemic in Arnhem Land, Northern Territory, where it has been recorded from near Mt Gilruth between the East Alligator and South Alligator Rivers.

Comments

Like a few other newly described *Pityrodia* species, *P. gilruthiana* is also represented by only two recent collections. In view of there being sufficient flowering and fruiting material in these collections, it is fairly easy to distinguish this species. According to collector's notes (*Lazarides 7952 and 8006*), this species is an aromatic shrub with extremely viscid, discolorous leaves and pale white corolla with dark purple strips. The fragrance in the dried leaves can be smelled by crushing.

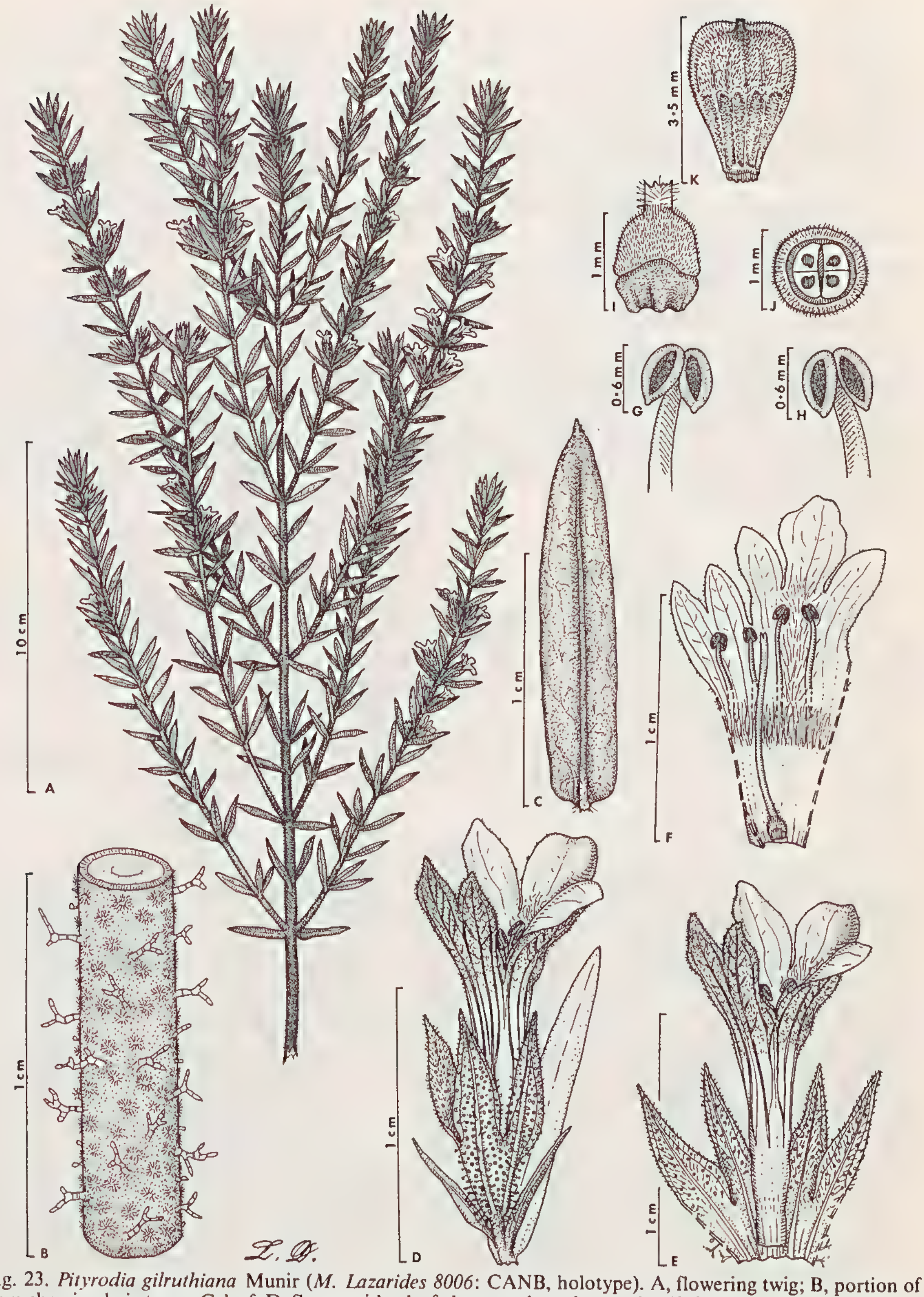


Fig. 23. *Pityrodia gilruthiana* Munir (*M. Lazarides 8006*: CANB, holotype). A, flowering twig; B, portion of stem showing hair-types; C, leaf; D, flower with a leafy bract and two bracteoles; E, flower with calyx vertically cut open to show corolla-tube; F, corolla-tube vertically cut open to show androecium and gynoecium; G, upper stamen; H, lower stamen; I, ovary; J, transverse section of ovary; K, fruit.

Affinities

P. gilruthiana is closely related to *P. pungens* in its leaves being sessile, linear-lanceolate, mostly in whorls of 3, glandular-viscid; flowers axillary and solitary; calyx longitudinally ribbed, glandular and hairy outside; corolla pale white with dark purple streaks on the upper lip; stamens and style shortly exserted; fruit obovoid, pubescent. Nevertheless, *P. gilruthiana* may easily be distinguished by its stem and leaves being much more glutinous; leaves dark green, non-pungent; corolla-tube cylindrical and longer than the calyx. The corolla of *P. pungens* is shorter than or only about the length of the calyx.

P. gilruthiana is also near to *P. puberula* in having more or less similar shaped leaves; flowers and fruit. The latter, however, can readily be distinguished by its stem and leaves being densely covered with a short pubescence of almost stellate hairs; leaves opposite, more deeply recurved along the margins, non-glutinous and the inflorescence more lax.

There is some similarity between *P. spenceri*, *P. ternifolia* and *P. gilruthiana* in their leaves being mostly in whorls of 3, flowers axillary and solitary, calyx ribbed, corolla-tube cylindrical and longer than the calyx-lobes, stamens and style shortly exserted and fruit obovoid. The two former species, however, can easily be identified by their leaves being ovate and more or less cordulate at the base. In *P. spenceri*, the leaves are densely clothed with a short cineraceous tomentum and in *P. ternifolia* they are prickly with toothed margins. Also, the flowers in *P. ternifolia* are pedicellate but they are sessile both in *P. gilruthiana* and *P. spenceri*.

24. **Pityrodia puberula** Munir, sp. nov.

Caules et rami teretes, glandulosi, pubescentes. Folia sessilia, opposita, lineari-lanceolata, mucronata, integra, margine recurvato, 8-40 mm longa, 2-8 mm lata, glandulosa, pubescentia. Sepala extus glandulosa et pubescentia, lobis lanceolatis, 4-6 mm longis, 1-2 mm latis. Corolla subalba. Stamina breviter exserta. Fructus obovoidei, dense pubescenti-tomentosi.

Type: *K. H. L. Key s.n.*, 16 km east of Mt Cahill, Arnhem Land, Northern Territory, Australia, 12° 50′S, 132° 51′ E, 23.v.1973 (CANB 266144, holotype; CANB 2660145, isotype).

Description (Fig. 24)

A straggling shrub of about 0.5 m. *Stem* and branches terete, glandular and densely pubescent with short and branched more or less stellate hairs. *Leaves* sessile, decussate, linear or narrowly lanceolate, mucronate, with entire and recurved margins, (8-) 10-35 (-40) mm long, (2-) 3-6 (-8) mm broad, glandular and densely pubescent with short and more or less stellately branched hairs, smooth above, with raised midrib underneath. *Flowers* sessile, axillary and solitary, arranged in a spike-like inflorescence, usually longer than the floral-leaves (i.e. bracts); bracts represented by the upper leaves; bracteoles sessile, linear-lanceolate, entire, acute, with slightly recurved margins, glandular-viscid with sparse stellate hairs all-over, 3-6 mm long, 0.5-1 mm broad. *Calyx* persistent, shorter than corolla, more or less campanulate, longitudinally ribbed, divided more than half-way down into 5 lobes, 7-8 mm long, densely glandular and pubescent all-over outside and on the inside of the lobes, glabrous inside the tube; lobes lanceolate, slightly recurved along the margins, ribbed on the back, entire, acute, 4-6 mm long, (1-) 1.5-2 mm broad at the base; tube campanulate, 2-2.5 mm long. *Corolla* off-white with the upper lip streaked purple, longer than calyx, 10-13 mm l ong, pubescent outside the lips (lobes) and the distal part of the tube only, glabrous inside excepting the dense hairy ring above the ovary and a few hairs extending to the central lobe of the lower lip; the upper lip shorter than the lower, erect, 2-lobed, the lobes broadly ovate with purple streaks, 3-4 mm long, ± 1.5 mm broad; the lower lip 3-lobed, spreading, the central lobe larger than the two lateral,

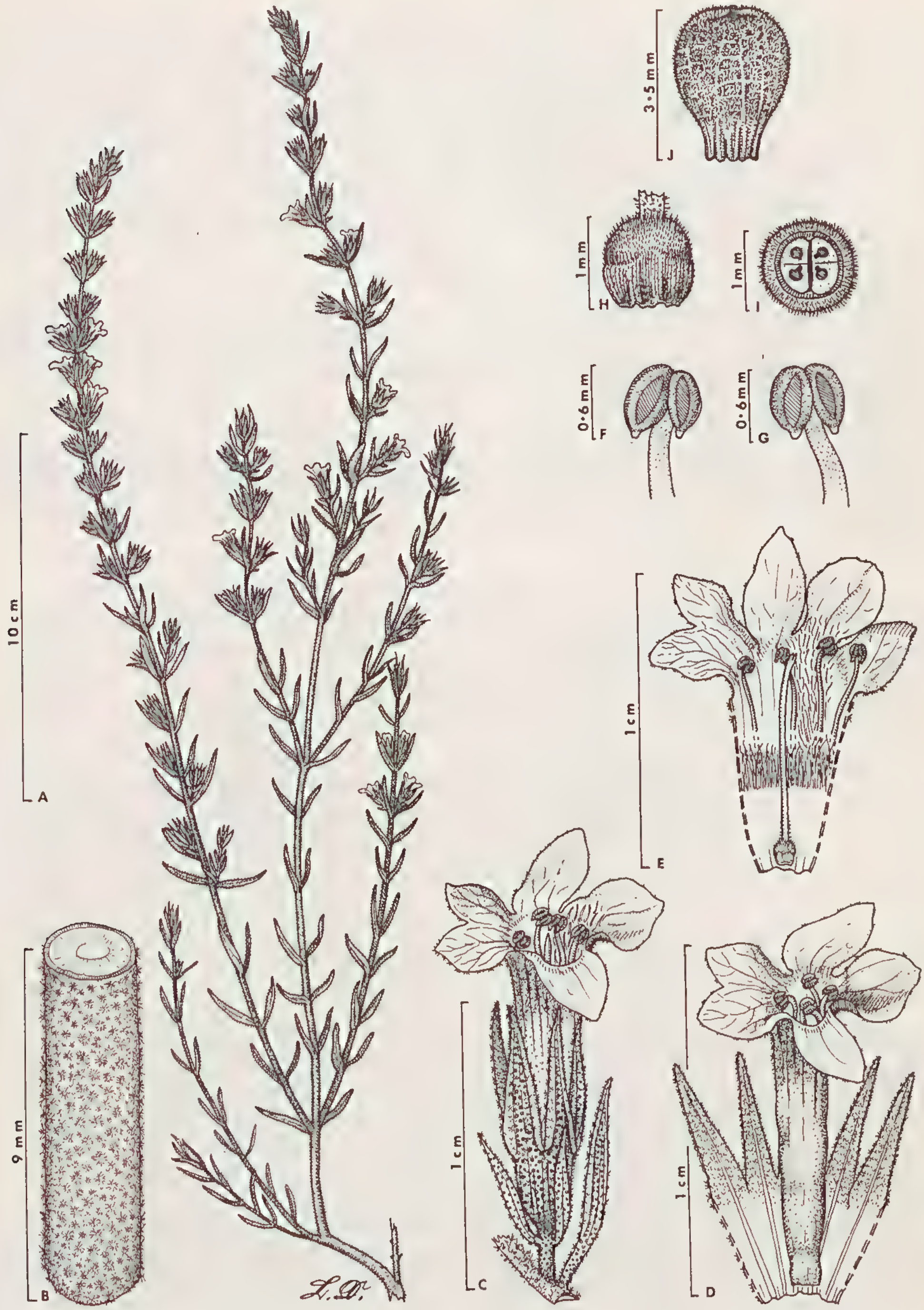


Fig. 24. *Pityrodia puberula* Munir (*K.H.L. Key s.n.*: CANB 233913). A, flowering branch; B, portion of stem showing stellate-hairs; C, flower with a leafy bract and two bracteoles; D, flower with calyx vertically cut open to show corolla-tube; E, corolla-tube vertically cut open to show androecium and gynoecium; F, lower stamen; G, upper stamen; H, ovary; I, transverse section of ovary; J, fruit.

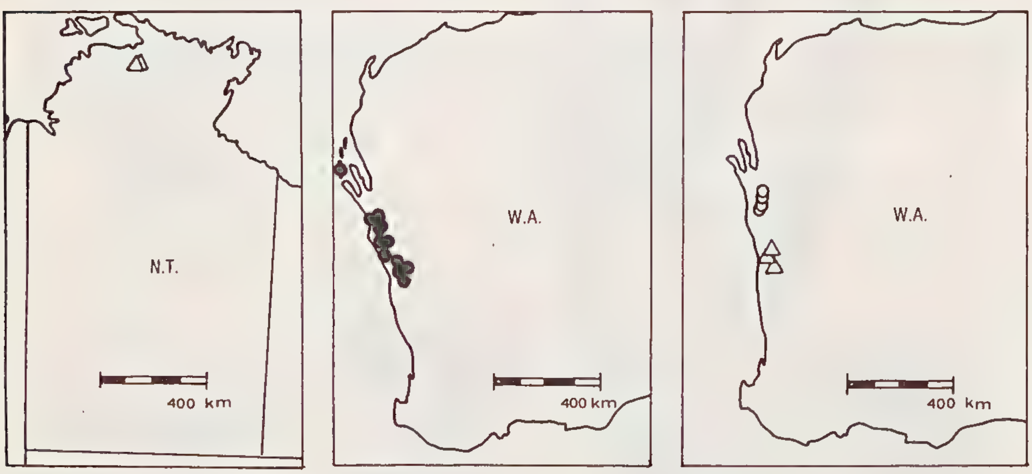
elliptic-orbicular or obovate in outline, (2.5-) 3-4 mm long, 2-3 mm broad, the lateral lobes elliptic-ovate, 3-4 (-5) mm long, 1.5-2 mm broad; tube almost cylindrical, glabrous outside excepting the distal end, 6-8 mm long, 1.5-2 mm broad at the top end. *Stamens* shortly exserted, inserted above the middle of the tube; filaments filiform, glabrous, the lower pair 2.5-3 mm long, the upper pair 2-2.5 mm long; anthers more or less orbicular in outline, 0.5-0.8 mm long, nearly as broad, lobes oblong, shortly appendiculate at the lower ends, divergent in the lower halves. *Ovary* globose, pubescent - tomentose, ± 1 mm in diameter; style shortly exserted, filiform, glabrous with a few hairs towards the base, 5-8 mm long, shortly 2-lobed at the apex. *Fruit* obovoid, densely pubescent-tomentose, somewhat rugulose, (2.5-) 3-4 mm long, (1.5-) 2-2.5 mm broad, apparently non-dehiscent; seeds not seen.

Specimens examined

NORTHERN TERRITORY: *Key s.n.*, near Koongara, 12° 52′ S, 132° 50′ E, Arnhem Land, 7.iii.1973 (CANB 233912, CANB 233913). *Key s.n.*, 16 km east of Mt Cahill, 12° 50′ S, 132° 51′ E, 23.v.1973 (CANB 266144, holotype; CANB 266145, isotype). *Key s.n.*, 15 km east of Mt Cahill, 12° 52′ S, 132° 50′ E, 24.v.1973 (CANB 266146, p.p.; alter parte *P. jamesii* Specht).

Distribution (Map 7A)

P. puberula is endemic in the Arnhem Land region of the Northern Territory, where it has been recorded from between 12° and 13° S, and 132° and 133° E. The main distribution is to the east-south-east of Mt Cahill towards the tributaries of the South Alligator River.



Map 7A. *P. puberula* △

Map 7B. *P. hemigenioides* ●

Map 7C. *P. glutinosa* ○ *P. viscida* △

Comments

A few lower leaves in K.H.L. Key's collection (s.n., CANB 266146) are found to be somewhat flattish, partly or wholly dentate margined and with the primary lateral veins slightly raised on the undersurface. However, the majority of leaves are with entire and recurved margins, and their primary lateral veins not raised on either surface.

Calaby & Key (1973) observed the "late-instar" nymphs of the Australian grasshopper species *Petasida ephippigera* feeding on the foliage of *Pityrodia puberula* and *P. jamesii* Specht.

Affinities

P. puberula is closely related to *P. gilruthiana* in its leaves being sessile, linear-lanceolate; flowers axillary solitary, almost sessile; calyx ribbed, glandular and pubescent outside; corolla-tube cylindrical, protruding above the calyx, the upper lip erect with deep purple streaks; stamens and style shortly exserted; fruit obovoid and pubescent. Nevertheless, *P. puberula* may easily be identified by its stem and leaves being densely covered with a short pubescence of almost stellate hairs; leaves opposite, recurved along the margins, not glutinous-viscid and the upper leaves and inflorescence lax.

P. puberula is also near to *P. spenceri* and *P. ternifolia* in having axillary solitary flowers, ribbed calyx, almost cylindrical corolla-tube, erect and deeply purple-streaked upper lip of corolla, shortly exserted stamens and style and obovoid fruit. However, both the latter species can readily be distinguished by their leaves being ovate with more or less cordulate base..

P. puberula and *P. pungens* are also closely allied in having axillary solitary flowers, linear-lanceolate sessile leaves, ribbed calyx, deeply purple streaked upper lip of corolla, shortly exserted stamens and style and obovoid fruit. *P. pungens*, however, can easily be identified by its leaves being mostly in whorls of 3, glandular-viscid, pungent, flat; stem glandular-viscid, sprinkled with stellate hair and corolla about the length of calyx or more often shorter.

25. **Pityrodia hemigenioides** (F. Muell.) Benth., Fl.Aust.5(1870)48; Briq.in Engl.& Prantl., Pflanzenfam.4, 3a(1895)161; Diels & E. Pritz., Bot.Jahrb.Syst.35(1904)518; Gard., Enum.Pl.Aust.Occ.3(1931)112; Mold., Résumé Verben.etc.(1959)210, 251, 335, 341; Beard (Ed.), W.Aust.Pl. edn 1(1965)92; Blackall & Grieve, West.Aust.Wildfls 3 (1965)569; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben.etc. 1 & 2(1971)348, 425, 603, 615; Chipp., Proc.Linn.Soc.N.S.W.96(1971)256.

Type: *J. Drummond s.n.*, in planitiebus arenosis flumen Murchison versus, Western Australia, undated (MEL 69330, lectotype designated here; K, MEL 69328, MEL 69333, MEL 69334 - isolectotypes). *A. Oldfield 310*, near Barrel Well, Murchison River, undated (MEL 69329, MEL 69331, MEL 69332 - syntypes).

Chloanthes hemigenioides F. Muell., Fragm.6(1868)156, *basionym*; F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172.

Type: As for *P. hemigenioides* (F. Muell.) Benth.

Quoya hemigenioides F. Muell., Fragm.6(1868)156, pro syn., sub *Chloanthes hemigenioides* F. Muell.

Typification

P. hemigenioides is based on two (syntype) collections, one by J. Drummond (s.n.) from near the Murchison River, and another by A. Oldfield (no. 310) from Barrel Well, near the Murchison River. The former consists of at least five duplicates and the latter three. Since the author did not choose any one of these as a type, it is, therefore, necessary to select a lectotype for this name. Both collections agree in all particulars with the type description. Annotations by Mueller indicate that he did examine all the syntypes in MEL. A duplicate of J. Drummond's collection in Herb MEL (no. MEL 69330), where F. Mueller's herbarium and types are now housed (Stafleu, 1967), was one of those almost certainly used by him in preparing the protologue of this species. This specimen is particularly complete and well preserved and is selected here as the lectotype for this species.

Description (Fig. 25)

A spreading shrub (22-) 30-60 (-95) cm. *Stem* and branches densely clothed with a cottony-white or cineraceous tomentum of short and branched hairs. *Leaves* sessile,

Fig. 25. *Pityrodia hemigenioides* (F. Muell.) Benth. (A-J, *M.E. Phillips*, CBG 037734: PERTH; K-T, 10 different collectors). A, flowering twig; B, flower with a leafy bract and two bracteoles; C, flower with calyx vertically cut open to show corolla-tube; D, corolla-tube vertically cut open to show androecium and gynoecium; E, upper stamen; F, lower stamen; G, ovary; H, transverse section of ovary; I, fruit; J, fruit split open into two halves; K-T, leaves from different collections showing range in shapes.

linear-oblong, elliptic or a few leaves almost obovate, contracted towards the base, rather crowded on branches, obtuse, the linear-oblong usually with recurved margins, the obovate scarcely or not recurved along the margins, (5-) 8-15 (-20) mm long, (2-) 4-8 (-11) mm broad, densely clothed with grey or cottony-white tomentum of branched hairs, but becoming glabrous and minutely rugose above, reticulate venation prominent underneath. *Flowers* axillary solitary, shortly pedicellate or almost sessile, forming a spike-like leafy inflorescence towards the end of branches; pedicels densely hairy, 1-2 mm long; bracts nearly leaf-like, sessile, linear-oblong or obovate, with a vestiture similar to leaves, 8-13 (-15) mm long, 3-5 (-7) mm broad; bracteoles linear, linear-lanceolate, leafy, tomentose, 4-8 (-10) mm long, (0.5-) 1-1.5 mm broad. *Calyx* persistent, turbinate-campanulate, divided to below the middle into 5-lobes, tubular towards the base, strongly ribbed, (5-) 7-10 mm long, densely clothed with short, branched, cineraceous tomentum, glabrous inside the tube; lobes lanceolate, ovate-lanceolate or narrowly elliptic-lanceolate, acute, (3-) 4.5-7 mm long, 1.5-2 (-3.5) mm broad near the base; tube 1.5-3 mm long. *Corolla* pale white, 9-12 mm long, puberulous outside, but often becoming glabrous at anthesis, glabrous inside excepting the dense hairy ring above the ovary, and the sparse hairs extending to the large anterior-lobe of the lower-lip; the anterior-lobe larger than the others, more or less elliptic-orbicular, 3-5 mm long, nearly as broad; the other 4-lobes almost equal, more or less elliptic-oblong or ovate, 3-5 (-6) mm long, 2-3 (-4) mm broad; tube dilated within or immediately above the calyx, 4-6 mm long, 3-5 mm broad above the calyx. *Stamens* slightly exceeding the tube (or almost included); filaments glabrous, the lower pair 2.5-3 mm long, the upper pair 1.5-2.5 mm long; anthers more or less orbicular in outline, lobes oblong, distinctly appendaged at the lower ends, ca. 1 mm long, one cell of each of the upper anther occasionally abortive. *Ovary* globose, 1-1.5 mm in diameter, densely tomentose; style shortly exserted, filiform, glabrous, (4-) 5-7 mm long, shortly 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, broadly obovoid or almost globose, pubescent, with reticulate venation (3-) 4 (-5) mm long, 3-4 mm broad, splitting into two separate 2-celled nutlets; seeds not seen.

Representative specimens

WESTERN AUSTRALIA (40 collections seen): *Ashby 3045*, Casuarina Road, S of Indarra, 17.ix.1969 (PERTH). *Barker 2216*, Kalbarri National Park, 27° 46′ S, 114° 23′ E, 4.ix.1977 (AD). *Beard 2037*, 10 miles E of Murchison River mouth, 27.ix.1962 (PERTH). *Blackall 2724*, near Northampton, sandplains, 21.ix.1932 (PERTH). *Blackall 4721*, 30 miles N of Galena on Carnarvon Rd, 15.ix.1940 (PERTH). *Blackall 4791*, between Yuna and "Dartmoor", NE of Geraldton, 19.ix.1940 (PERTH). *Blake 18137*, 10-20 miles N of Northampton, 3.ix.1947 (BRI, CANB, PERTH). *Burbidge 2190*, 7 miles S of Ajana, 3.ix.1947 (CANB, MEL). *Burns 2*, Wicherina turnoff, Geraldton-Mullewa Rd, 17.vii.1966 (PERTH). *Burns 9*, Eradu, E of Geraldton, 20.x.1965 (PERTH). *Campbell s.n.*, Northampton, Sept. 1901 (PERTH). *Canning 3279*, 3.7 miles from Arrowsmith River Crossing on the Dongara - Three Springs Road, 22.ix.1968 (CBG 052156). *J. Drummond s.n.*, sandy plains towards the Murchison River, undated (MEL 69330, lectotype designated here; K, MEL 69328, MEL 69333, MEL 69334 - isolectotypes). *Fairall 1236*, 15 miles from Kalbarri on Ajana Rd, 5.ix.1963 (PERTH, Kings Park Perth). *Galbraith 502*, W of Mullewa, 23.viii.1964 (MEL 2 spec.). *Gardner 2004*, Ajana, near Murchison River, 27.ix.1926 (PERTH). *Gardner s.n.*, Bakers Well, 11.i.1931 (PERTH). *George 7886*, 24 miles N of Murchison River, 6.ix.1966 (PERTH). *Humphreys s.n.*, Kalbarri, Mouth of Murchison River, 21.ix.1966 (PERTH). *Humphreys s.n.*, 30 miles NE of Mingenew towards Mullewa, near Irwin River, 11.ix.1965 (PERTH). *Jackson 3166*, c. 20 km N of Whelarra, 28° 09′ S, 114° 56′ E, 5.ix.1977 (AD). *Milne s.n.*, Dirk Hartog's Island, undated (K). *F. Mueller s.n.*, Murchison River, Oct. 1877 (MEL 69335). *F. Mueller s.n.*, upper Murchison River, Nov. 1877 (MEL 69337). *A. Oldfield 310*, near Barrel Well, Murchison River, undated (MEL 69329, MEL 69331, MEL 69332 - syntypes of *Chloanthes hemigenioides* F. Muell.). *Phillips 1397*, 10 miles E of Murchison River mouth, 27.ix.1962 (CBG 05041). *Phillips s.n.*, 45 miles S of Wannoo, 17.ix.1968 (CBG 037734, PERTH). *Phillips s.n.*, 11 miles inland from Kalbarri, 19.ix.1968 (CBG 042693, PERTH). *Royce 7780*, Kalbarri National Park, 9.i.1963 (PERTH). *Storr s.n.*, 17 miles E of Murchison River, (PERTH 2 spec.). *Tindale 1343*, 39.6 miles W of Mullewa, March, 1970 (NSW, PERTH). *Wittwer 797*, Wilroy-Morawa, 27.viii.1969 (Kings Park Perth).

Distribution (Map 7B)

P. hemigenioides is endemic to the western part of Western Australia where it seems restricted chiefly between 27° and 30° S and between 114° and 116° E. The major distribution is between Shark Bay and Geraldton, with only a few records further south between Dongara and Three Springs, and between Mullewa and Morawa. A solitary collection from outside the above areas has been collected from the Dirk Hartog's Island in the Shark Bay.

Comments

The specific epithet of this species apparently refers to the genus *Hemigenia*, with which it seems to have some visual resemblance. In the protologue, the epithet is found spelt as *"hemigenoides"*, which was corrected by Bentham (1870) to *hemigenioides*, to conform with the *Hemigenia* spelling. The orthographic correction has since been accepted by F. Mueller (1882, 1889) and all other botanists.

Ewart et al. (1917), Moldenke (1959, 1971) and Chippendale (1971) recorded this species from the Northern Territory, but so far its occurrence in that state has not been confirmed. The record of Ewart et al. (1917) is based on *Spencer et al. s.n.* from Edith Creek, Northern Territory, which is now recognized as a new species, *P. spenceri* Munir. Both Moldenke and Chippendale probably followed Ewart's publication in recording the distribution of this species.

A range of leaf-shape has been observed within this species (see fig. 25, K-T). In the type material and several other collections, the leaves are found to be linear, linear-oblong or narrowly oblong with usually recurved margins. The leaves in *Royce 7780* (PERTH) and *Storr s.n.* (PERTH), however, are broadly oblong or oblong-obovate with very slightly recurved margins. Furthermore, in *Fairall 1236* (PERTH), the leaves are mostly obovate with usually non-recurved margins. The variation in leaf-shape, however, seems to have no effect on the reproductive parts as the flowers are found to be similar throughout the species. Also, there seems no correlation between the variation in leaf-forms and the distribution pattern of this species.

The flower-colour is noted by the majority of collectors as "white", but the herbarium label of *Beard 2037* (PERTH) reads: "Fls pale mauve". The latter seems to be incorrect.

There are numerous minute white glands mixed up with the outside calyx-tomentum. These are only visible under the microscope when examined in the fresh state or after boiling the dried material.

Affinity

P. hemigenioides is closely allied to *P. spenceri* in having branched cineraceous tomentum all over the stem, leaves and calyces; axillary solitary flowers forming a spike-like leafy inflorescence towards the end of branches, and scarcely exserted stamens and style. Nevertheless, *P. hemigenioides* can easily be distinguished by its leaves being sessile, contracted and rounded towards the base; corolla-tube dilated within or immediately above the calyx, glabrous outside, lobes slightly puberulous or almost glabrescent on the back; stamens with distinct appendage at the lower ends of the lobes; fruit broadly elliptic or almost globose, often easily splitting into 2 separate nutlets.

26. **Pityrodia glutinosa** Munir, sp. nov.

Caules et rami teretes, glabri, glutinosi. Folia sessilia, opposita, oblonga vel anguste oblongo-obovoidea, obtusa, integra, margine distali leviter recurvato, 5-15 mm longa, 2-5 mm lata, glabra, glutinosa. Sepala glabra, glutinosa, extus sparsim glandulosa, lobis lanceolatis, 3-4.5 mm longis, 1-2 mm latis. Corolla extus glabra, alba. Stamina breviter exserta. Fructus obovoidei, pubescentes, apice sparsim glanduloso.

Type: *E.A. Shaw 608*, 175 km north of Geraldton, Western Australia, 2.x.1966 (AD, holotype; AD, CANB, MEL, PERTH - isotypes).

Description (Fig. 26)

A spreading shrub of 1-1.5 m. *Stem* and branches glabrous, glutinous all over. *Leaves* sessile, decussate, oblong or narrowly oblong-obovate, obtuse, almost entire, slightly recurved along the distal margins, (5-) 7-10 (-15) mm long, 2-3 (-5) mm broad, glabrous, glutinous all over. *Flowers* shortly pedicellate, solitary in the upper axils; pedicel glabrous, glutinous, 1-2 mm long; bracts leafy, sessile, oblong or narrowly oblong-obovate, entire with a few teeth-like projections towards the apex, flat or slightly recurved along the margins, 5-7 mm long, ± 1.5 mm broad; bracteoles sub-sessile, narrowly elliptic or elliptic-lanceolate, flat, entire, glutinous, 2.5-5 mm long, 0.5-1.5 mm broad. *Calyx* persistent, divided to below the middle into 5 lobes, 6-7 mm long, glabrous but glutinous all over, sparsely glandular outside; lobes lanceolate, 3-4.5 mm long, 1-2 mm broad at the base; tube narrowed towards the base. *Corolla* "white", 10-12 mm long, glabrous outside, with hairy ring inside the tube near the throat, and a few hairs extending to the large anterior-lobe of the lower lip; lobes entire or somewhat undulate; the anterior-lobe broadly elliptic-obovate or almost orbicular in outline, 5-6 mm long, (3-) 4-5 mm broad, the two lateral-lobes elliptic-obovate, 4-6 (-7) mm long, 2-2.5 mm broad, the two upper-lobes narrowly elliptic-oblong, 5-6 mm long, 2-2.5 mm broad; tube gradually dilated upwards, 4-5 mm long, 2.5-3 mm broad at the top end. *Stamens* inserted in the corolla throat, exserted above the tube; filaments glabrous, filiform, the lower pair (2.5-) 3-4 mm long, the upper pair (2-) 2.5-3 mm long; anthers more or less orbicular in outline, lobes oblong, appendaged at the lower end. *Ovary* globose, densely pubescent-tomentose, with a thick glabrous disk at the base; style scarcely exserted, glabrous, filiform, 4-6 mm long, shortly 2-lobed at the summit. *Fruit* obovoid, pubescent, sparsely glandular at the top, 4-5 mm long, 3-4 mm broad in the upper half, dehiscent into 2 nutlets; seeds not seen.

Specimens examined

WESTERN AUSTRALIA: *Bennett 1476*, 436 miles NW Coastal Highway, 2.x.1966 (PERTH). *Davies s.n.*, 50 miles N of Mary Springs HS, NW Coastal Highway, 14.ix.1960 (PERTH 2 spec.). *Goodall 1195*, 135 km N of Northampton on Carnarvon Rd, 14.vii.1964 (PERTH). *Lullfitz 2904*, 425 mile peg on Carnarvon Highway, 12.xi.1963 (Kings Park Perth). *Lullfitz 4331*, loc. cit., 3.xi.1965 (PERTH, Kings Park). *Olsen 568*, 175 miles S of Carnarvon, 4.viii.1967 (NSW 2 spec.). *Phillips CBG 038054*, c. 40.5 miles S of Wannoo, 17.ix.1968 (CBG - n.v., NSW). *Scrymgeour 1476*, 436 miles NW Coastal Highway, 2.x.1966 (PERTH). *E.A. Shaw 608*, c. 175 km N of Geraldton, 2.x.1966 (AD, holotype; AD, CANB, MEL, PERTH - isotypes).

Distribution (Map 7C)

P. glutinosa is endemic in the mid-coastal area of Western Australia where it seems restricted between latitude 27° and 28° S, and between longitude 114° and 115° E. The known distribution is to the north of Geraldton between the Murchison River and Shark Bay.

Affinities

P. glutinosa is closely related to *P. viscida* in its stem, leaves and calyx being viscid; leaves sessile, oblong-obovate; flowers axillary solitary; corolla white, glabrous outside, tube gradually dilated upwards, hairy ring near the throat inside; stamens and style identical, exserted above the corolla-tube; fruit obovoid, often not easily dehiscent. *P. glutinosa*, however, can readily be identified by its stem and ventral surface of leaf being devoid of any pubescence; bracteoles narrowly elliptic or elliptic-lanceolate; calyx glabrous and viscid, without pubescence, sparsely glandular outside; corolla-lobes almost entire or somewhat sub-undulate along the distal margins.

P. glutinosa is also allied to *P. hemigenioides* because both the species have almost similar shaped leaves, axillary solitary flowers and white corolla. The latter, however, may easily be distinguished by the white-cineraceous tomentum on its stem, leaves and calyx; abruptly dilated corolla-tube; scarcely exserted stamens and style; elliptic-obovoid or almost globose non-glandular fruit with faint reticulation all over the surface.

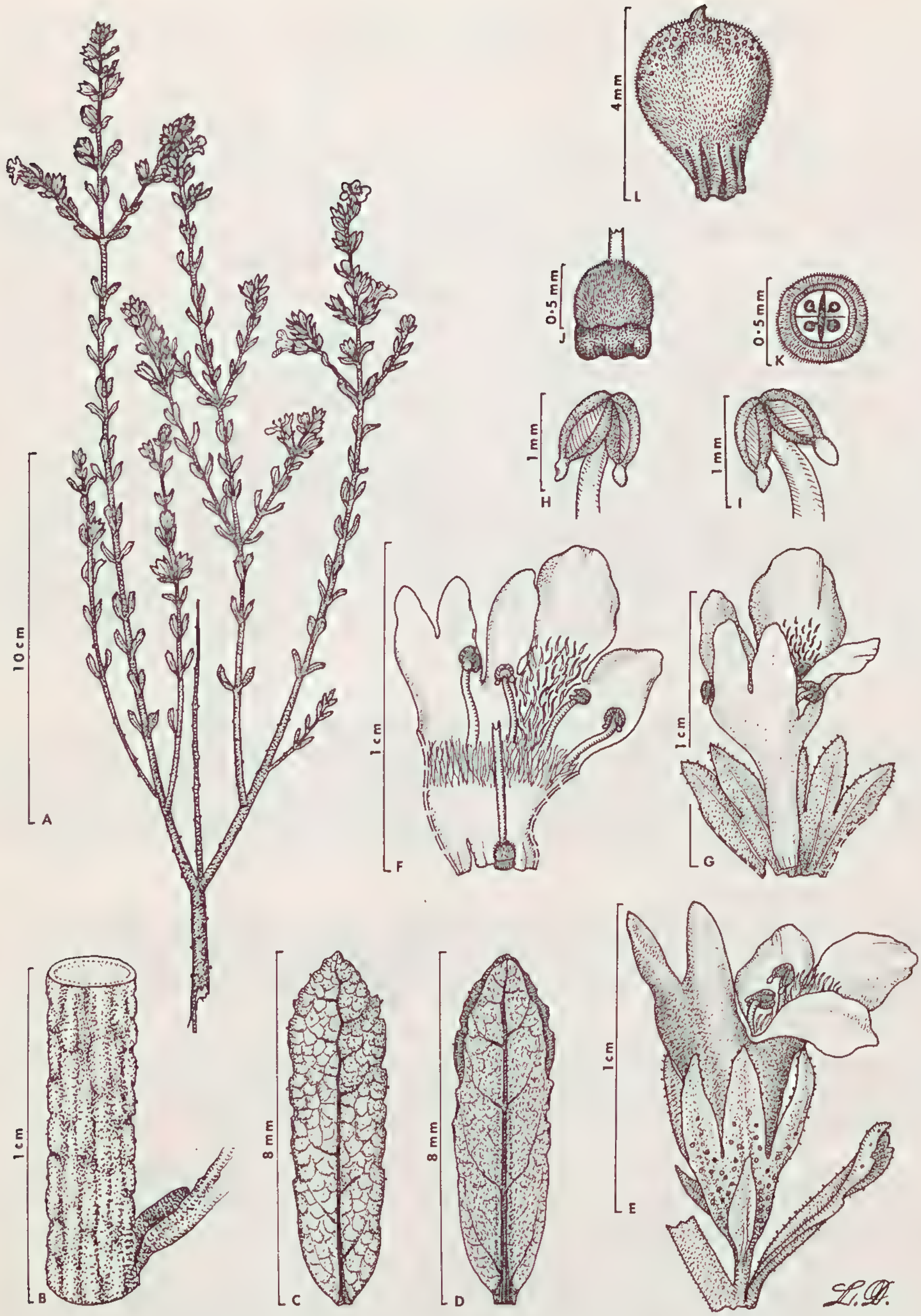


Fig. 26. *Pityrodia glutinosa* Munir (*E.A. Shaw 608*: AD, holotype). A, flowering branch; B, portion of stem showing texture; C & D, adaxial and abaxial views of a leaf; E, flower with a bract and two bracteoles; F, corolla-tube vertically cut open to show androecium and gynoecium; G, flower with calyx vertically cut open to show corolla-tube; H, upper anther; I, lower anther; J, ovary; K, transverse section of ovary; L, fruit.

27. **Pityrodia viscida** W.V. Fitzgerald, J.W.Aust.Natur.Hist.Soc.2(1904)30; Diels & E. Pritz., Bot.Jahrb.Syst.35(1904)517, fig. 58A & B; Gard., Enum.Pl.Aust.Occ.3(1931) 112; Mold., Résumé Verben.etc.(1959)210, 335; Beard (Ed.), W.Aust.Pl. edn 1(1965)93; Blackall & Grieve, West.Aust.Wildfls 3(1965)568; Beard (Ed.), W.Aust.Pl. edn 2(1970) 114; Mold., Fifth Summary Verben.etc.1 & 2(1971)348, 603.

Type: *W.V. Fitzgerald s.n.*, Arrino sand plains, north of Three Springs, Sept. 1903 (PERTH, lectotype designated here; NSW 3 spec., SING - isolectotypes).

P. muelleriana E. Pritz., Bot.Jahrb.Syst.35(1904)517; nom.nud., pro syn.

Typification

P. viscida is based on the author's (W.V. Fitzgerald) own collection consisting of at least 3 duplicates. Since the author did not choose any one of them as a type, it is, therefore, necessary to select a lectotype for this name. The syntype preserved in Herb. PERTH, where Fitzgerald's herbarium and types are now housed (Stafleu, 1976) was annotated by Fitzgerald and almost certainly used by him in preparing the original description of this species. This specimen is particularly complete and well preserved and is chosen here as the lectotype for this species.

Description (Fig. 27)

An erect branched shrub of 30-61 cm. *Stem* and branches invested with a short dingy viscid pubescence. *Leaves* sessile, mostly opposite, sometimes ternate, oblong-obovate or narrow-elliptic, obtuse, flat or with slightly recurved margins towards the apex, (5-) 7-13 (-16) mm long, 3-5 mm broad, glabrous and viscid above, densely covered with a yellowish-white pubescence beneath. *Flowers* subsessile or shortly pedicellate, solitary in the upper axils; pedicel densely covered with dingy viscid pubescence, 1-2 mm long; bracts leafy, sessile, obovate-oblanceolate, entire, glabrous and viscid above, yellowish-white pubescent beneath, 9-12 mm long, 3-4 mm broad; bracteoles sessile, linear, entire, viscid-pubescent all over, 4-5 mm long, ± 0.5 mm broad. *Calyx* persistent, divided to about the middle into 5 lobes, distinctly ribbed, 7-9 mm long, invested outside with dense viscid pubescence, glabrous inside excepting the viscid pubescence on the upper inner face of the lobes; lobes lanceolate, 4-6 mm long, 1.5-2.5 mm broad at the base; tube somewhat narrowed towards the base, 2-3 mm long. *Corolla* "white", 9-12 mm long, outside glabrous, inside with a dense hairy ring in the throat, and a few hairs extending to the large anterior lobe of the lower lip; the lobes unevenly undulate-dentate along the distal margins; the anterior lobe broadly elliptic-obovate or almost orbicular in outline, 5-6 mm long, 4-5 mm broad; the two lateral lobes of the lower lip elliptic-obovate, 3-5 (-7) mm long, 2-3.5 mm broad; the two lobes of the upper lip oblong or narrowly elliptic-oblong, 4-6 mm long, ± 2 mm broad; tube gradually dilated upwards, 4-5 mm long, 2-3.5 mm broad at the top end. *Stamens* inserted in the corolla-throat, exserted above the corolla-tube; filaments glabrous, filiform, the lower pair 3-4 mm long, the upper pair 2-2.5 mm long; anthers more or less orbicular in outline, ± 1 mm across, lobes oblong, distinctly appendaged at the lower end. *Ovary* globose, densely covered with short tomentum, with a thick glabrous disk at the base, ± 1 mm in diameter; style scarcely exserted above the corolla-tube, filiform, glabrous, with a few hairs towards the base, 5-7 mm long, shortly 2-lobed at the summit. *Fruit* obovoid, sparsely glandular and pubescent, 3.5-5 mm long, 2-3.5 mm broad in the upper half, apparently not easily splitting into 2 nutlets; seeds not seen.

Specimens examined

WESTERN AUSTRALIA: *Beard 7238*, 14 miles west of Yandanooka, 31.x.1974 (PERTH). *Blackall 4903*, Three Springs, 24.ix.1940 (PERTH 2 spec.). *Diels 4261*, Mingenew, 12.ix.1901 (PERTH 2 spec.). *Fitzgerald s.n.*, Arrino sand plains, north of Three Springs, Sept. 1903 (PERTH, lectotype; NSW 3 spec., SING - isolectotypes). *F. Mueller s.n.*, upper Irwin River, Nov. 1877 (MEL 886, MEL 69400).

Fig. 27. *Pityrodia viscida* W.V. Fitzg. (*W.E. Blackall 4903*: PERTH). A, flowering twig; B, portion of stem; C & D, adaxial and abaxial views of a leaf; E, flower with a bract and two bracteoles; F, flower with calyx vertically cut open to show corolla-tube; G, corolla-tube vertically cut open to show androecium and gynoecium; H, lower stamen; I, upper stamen; J, ovary; K, transverse section of ovary; L, fruit; M, fruit vertically cut open into two halves.

Distribution (Map 7C)

P. viscida is endemic in the west-south-west of Western Australia where it seems restricted between latitude 28° and 30° S, and between longitude 115° and 116° E. The main distribution is in the area between Mingenew and Three Springs, but the locality of F. Mueller's collection from the upper Irwin River may be a few kilometres north of Mingenew.

Comments

A duplicate of F. Mueller's collection (s.n., MEL 886) from the Upper Irwin River has been erroneously placed in a type folder in the herbarium at Melbourne. The particular specimen and its duplicate are preserved respectively under the numbers MEL 886 and MEL 96400.

As described in the protologue, the leaves in the type and the majority of other specimens examined are found to be "opposite" (decussate). Nevertheless, the leaves in Blackall's collection no. 4903 (PERTH) and F. Mueller's s.n. (MEL 69400) are both decussate and ternate.

Naturally dehisced fruits have not been seen. The present author could not split mature fruit into two halves without cutting.

Affinities

P. viscida is nearest to *P. glutinosa* in its stem, leaves and calyx being invested with a sticky exudation; leaves sessile, oblong-obovate; flowers solitary in the upper axils; corolla white, glabrous outside, its tube gradually dilated upwards, the hairy ring inside the tube near the throat; stamens and style fairly identical in shape, exserted above the corolla-tube; fruit obovoid, apparently non-dehiscent. Nevertheless, *P. viscida* may easily be distinguished by its stem and ventral leaf-surface being covered with yellowish-white viscid pubescence; bracteoles narrow-linear; calyx with viscid-pubescence outside and on the upper inner half of the lobes, non-glandular; corolla-lobes unevenly undulate-dentate along the distal margins.

P. viscida is also close to *P. hemigenioides* in having more or less similar shaped leaves, axillary solitary flowers, linear bracteoles and white corolla. The latter, however, can readily be identified by its stem, leaves and calyx being invested with cottony-white or cineraceous tomentum; corolla-tube abruptly dilated within or immediately above the calyx; stamens and style scarcely exserted; fruit elliptic-obovoid or almost globose with faint reticulation all over the surface, splitting easily into two nutlets.

28. **Pityrodia loxocarpa** (F. Muell.) Druce in Rep.Bot.Exch.Cl.Brit.Isles 1916(1917) 640; Gard., Enum.Pl.Aust.Occ.3(1931)112; Mold., Résumé Verben.etc.(1959)335 pro syn.; Beard (Ed.), W.Aust.Pl. edn 1(1965)92; Blackall & Grieve, West.Aust.Wildfls 3 (1965)571; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben.etc.2 (1971)603 pro syn.

Type: *A. Oldfield s.n.*, "In locis sabulosis ad flumen Murchison", undated (MEL 69314, lectotype designated here; K, isolectotype).

Chloanthes loxocarpa F. Muell., Fragm.2(1861)22, *basionym*; F. Muell., Fragm.5(1865)51 in obs.; F. Muell., Fragm.6(1868)157; F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172.

Type: As for *Pityrodia loxocarpa* (F. Muell.) Druce.

Pityrodia drummondii Turcz. in Bull.Soc.Nat.Mosc.36(2) (1863)213; Benth., Fl.Aust.5(1870)51; Diels & E. Pritz., Bot.Jahrb.Syst.35(1904)521; Mold., Résumé Verben.etc. (1959)210, 251, 335, 341; Mold., Fifth Summary Verben etc. 1 & 2(1971)347, 426, 603, 615.

Type: *J. Drummond 6th coll. no. 141*, between Moore River and Murchison River, 1851 (BM, CGE, K, MEL 2 spec., P - syntypes).

P. petiolaris E. Pritz., Bot.Jahrb.Syst.35(1904)520; Gard., Enum.Pl.Aust.Occ.3(1931)112; Mold., Résumé Verben.etc.(1959)210; Blackall & Grieve, West.Aust.Wildfls 3(1965)570; Beard (Ed.), W.Aust.Pl. edn 2(1970) 114; Mold., Fifth Summary Verben.etc.1(1971)348; Erickson et al., Fl.& Pl.West.Aust.(1973)206 - *syn. nov.*

Type: *L. Diels 3670*, in distr. Austin litorali ad Shark Bay pr. Carnarvon, ?1901 (B, n.v.); *Clark s.n.*, ibidem ad Gascoyne River (B, n.v. - *syntypes*, probably destroyed during the War).

Typification

P. loxocarpa (F. Muell.) Druce is based on A. Oldfield's collection (s.n.), consisting of at least two specimens, both annotated by the author (F.v. Mueller). Since he did not nominate a type, it is, therefore, necessary to choose a type for this name. The syntype, in Herb. MEL (no. MEL 69314), where F. Mueller's herbarium and types are now preserved (Stafleu, 1967), was almost certainly used by him in preparing the protologue of this species. The specimen is particularly complete and well preserved and is selected here as the lectotype for this species.

Description (Fig. 28)

An erect branched shrub of 0.5-1.5 m. *Stem* and branches longitudinally striate, glabrous or loosely covered with branched tomentum. *Leaves* decussate, rarely in whorls of three, distinctly petiolate or contracted towards the base, elliptic-oblong, somewhat triangular or sometimes almost orbicular in outline, obtuse, often irregularly dentate-crenate, rarely entire, (1-) 2-4 (-5) cm long, (0.5-) 1-3 (-4) cm broad, loosely tomentose, becoming glabrescent above due to falling off tomentum, obscurely or distinctly rugose above, the floral-leaves small and smooth. *Flowers* pedicellate, solitary or more often 3-7 together on a slender cyme-peduncle in the upper axils; cymes arranged into lax panicle or sometimes condensed into sessile decussate-clusters forming a long interrupted terminal raceme-like panicle; peduncle glabrous or loosely tomentose, (1-) 2.5-8 (-10) cm; pedicel tomentose, 1.5-3 (-4) mm long; bracts sessile, narrowly elliptic, oblong or lanceolate, tomentose on abaxial surface, glabrous on adaxial surface, 3-5 mm long, 1-2 (-3) mm broad; bracteoles small, linear-oblong, 1.5-3 mm long. *Calyx* persistent, densely clothed outside with purplish branched tomentum, glabrous inside, divided to below the middle into 5 lobes, shortly tubular near the base, 4-6 mm long; lobes linear-lanceolate, acute, membranous, 3-5 mm long, 1-2 cm broad; tube 1-2 mm long. *Corolla* whitish-pink with purple spots in throat, (8-) 12-20 (-24) mm long, pubescent outside, glabrous inside excepting the dense hairy ring above the ovary, and the sparse villous hairs extending to the large anterior lobe of the lower lip; the anterior lobe almost twice as large as the others, more or less orbicular in outline, 5-8 mm long, 7-11 mm broad; the other 4 lobes almost equal, more or less oblong-ovate, 2-4 mm long, 2-3 mm broad at the base; tube much dilated above the calyx, 5-7 mm long, nearly as broad at the top end. *Stamens* included; filaments filiform, glabrous excepting a few hairs towards the base of the lower pair, 3-6 mm long; anthers more or less orbicular in outline, the lower pair with well developed appendages at lower ends of the lobes, the upper pair with short appendages, lobes 1-1.5 mm long including the appendages. *Ovary* globose, pubescent at the top, glabrous below, 1-1.5 mm long, about the same in diameter, usually with only 2 perfect ovules, each one attached to an exceedingly long filiform and several times folded funicle; style included, filiform, glabrous, 5-7 mm long, shortly 2-lobed at the apex. *Fruit* enclosed within the persistent calyx, obovoid, oblique, with a thin-walled concavity on one side, apparently non-dehiscent, 2.5-3 mm long, more or less 2 mm in diameter at the top end, pubescent at the top, smooth all over (i.e. not reticulate); seeds not seen.

Representative specimens

WESTERN AUSTRALIA (72 collections seen): *Andrews s.n.*, Oakabella, Sept. 1904 (PERTH). *Aplin A8*, Doorawarrah Stn, east of Carnarvon, 13.xi.1963 (MEL, NSW, PERTH). *Ashby 2928*, 98.5 miles north from Carnarvon & Gascoyne River Road junction, Onslow Road, 16.viii.1969 (AD, PERTH). *Beard 2965*, 20 miles east of Onslow, 22.viii.1963 (PERTH, Kings Park Perth). *Beard 3475*, 18 miles along road to Quobba from Carnarvon, 18.vii.1964 (PERTH, Kings Park Perth). *Beard 4388*, Kennedy Range, 4 miles west of Merlinleigh

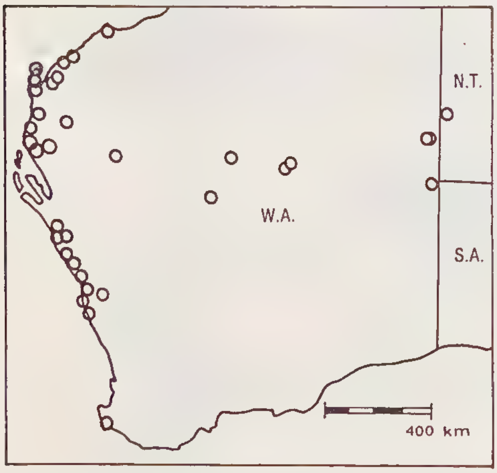
Fig. 28. *Pityrodia loxocarpa* (F. Muell.) Druce (A-I, *R. Goldthorp NM 1250*: AD; J, *D.E. Symon 2413*: PERTH; K, *C.A. Gardner 6067*: PERTH; L, *A.M. Ashby 3860*: AD). A, flowering branch; B, cyme; C, flower with calyx vertically cut open to show corolla-tube; D, corolla-tube vertically cut open to show androecium and gynoecium; E, upper stamen; F, lower stamen; G, ovary; H, transverse section of ovary; I, fruit; J-L, leaves showing different shapes.

Homestead, 23.viii.1965 (PERTH, Kings Park Perth). *Beard 6007*, 54 miles E of Carnarvon, 17.viii.1970 (NSW, PERTH). *Carolin 6283*, 10 miles S of "Bungabiddy", 2.viii.1967 (NSW, SYD). *Chinnock 3839*, 25.2 km S of Onslow, 30.viii.1977 (AD). *Collie s.n.*, Flinders Bay, undated (K). *Drummond 6th coll. no. 141*, between Moore and Murchison Rivers, 1851 (BM, CGE, K, MEL 2 spec., P - syntypes of *Pityrodia drummondii* Turcz.). *Drummond s.n.*, loc. incert. undated (MEL 69320, probably syntype of *P. drummondii* Turcz.). *Forde 1304*, 36 miles NE of Carnegie Homestead, 9.x.1960 (CANB). *A. Forrest s.n.*, Nickol River, 1878 (MEL 82201, W). *George 8299*, 6 miles S of Walter James Range, 4.x.1966 (PERTH). *George 8829*, 14 miles N of Walter James Range, 24.vii.1967 (PERTH). *George 9174*, 20 miles S of Learmouth, 5.viii.1967 (PERTH). *George 1207*, 3 miles E of Giralia Station, 29.viii.1960 (B, MO, PERTH 2 spec.). *Goldthorp for McFarland 1250*, near White Peak, 28° 38′ S, 114° 38′ E, 25.ix.1977 (AD). *Helms s.n.*, Geraldton, Oct. 1898 (M, NSW 142621 - 142622, PERTH). *Latz 884*, 69 miles NNW of Wingelinna Mining Camp, 30.x.1970 (AD, BRI, CANB, MEL, NSW, NT, PERTH). *Morrison s.n.*, Walkaway, S of Geraldton, 8.xi.1903 (E, K). *Morrissey 65*, Wiluna area, Dec. 1970 (PERTH). *F. Mueller s.n.*, Champion Bay, Oct. 1877 (MEL 69321, MEL 69323, MEL 69324, MEL 69326, MEL 69327). *F. Mueller s.n*, Greenough River, Nov. 1877 (MEL 69315, MEL 69319). *Oldfield s.n.*, in sandy places near Murchison River, undated (MEL 69314, lectotype; K). *Phillips s.n.*, near Green Head, 24.ix.1962 (CBG 024949). *Symon 2413*, 6 miles N of the eastern end of the Schwerin Mural Crescent, 128° 50′ E, 24° 50′ S, 2.viii.1962 (AD, ADW, PERTH). *Weber 4934*, c. 5 km N of Exmouth along the road, 3.x.1975 (AD). *Wittwer 1782*, Vlaming Head, 9.viii.1976 (PERTH, 2 spec., Kings Park Perth).

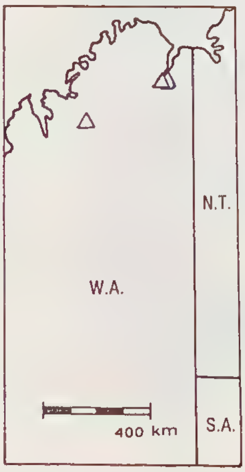
NORTHERN TERRITORY: *Maconochie 1374*, south of Davenport Hills, 23° 43′ S, 129° 17′ E, 8.iv.1972 (NT).

Distribution (Map 8A)

P. loxocarpa occurs mainly in Western Australia with only one record from the far south-western part of the Northern Territory near the Western Australian border. Distribution in Western Australia is mainly to the north of Perth where it has been recorded frequently from the coastal areas between the Hill River and Nickol Bay. One disjunct coastal locality in the extreme south-western tip of the state is near Flinders Bay, from where this species has not been recollected for over a hundred years. A few collections from the interior of the state have come from Wiluna and Carnegie areas and also from some unspecified locality along the Canning Stock Route. Close to the eastern border, it has been collected from the north-western end of Tomkinson Ranges towards the South Australian border, and from the eastern end of the Schwerin Mural Crescent near the Northern Territory border.



Map 8A.
P. loxocarpa ○



Map 8B.
P. obliqua △

Map 8C.
P. paniculata ●

Comments

In the protologue, F. Mueller (1861) considered this species close to *P. atriplicina* (F. Muell.) Benth., but in 1865 (Fragm. 5, p.51), he regarded it as nearer to *Chloanthes stachyodes* F. Muell. (= *P. terminalis* [Endl.] George). In both places, he did not name any character in common with these species.

The labels of the duplicates of J. Drummond's 6th collection no. 141, preserved in Herb. BM and P, have the collecting date "1854". According to Erickson (1969), however, J. Drummond returned to Hawthornden from his 6th and final collecting expedition at the end of 1851, and by the end of 1852 he had prepared 14 sets of 225 species for shipment to W.J. Hooker and other subscribers in England. The date (year only) mentioned with the above two duplicates, therefore, may be the one when these specimens were sent to or received by those institutions where they are now housed.

The obliquely obovoid fruit of *P. loxocarpa*, with a thin-walled concavity on the side, largely resembles the fruit of *P. bartlingii* (Lehm.) Benth. For more information see "Comments" under the latter species.

After examining all the available material, identified as *P. petiolaris* E. Pritz. or *P. loxocarpa* (F. Muell.) Druce, both of them are found to be conspecific. The former, therefore, is being regarded here as a new synonym of the latter. In view of the variation in leaf-shape and length of cyme-peduncles, this species may be mistaken for more than one taxon if a wide range of material from different localities is not examined.

This species is one of the most widespread in the genus.

Affinities

P. loxocarpa is closely allied to *P. paniculata* in its flowers being arranged in lax panicles. The former, however, may easily be distinguished by its stem being longitudinally strate, glabrous or loosely tomentose; leaves elliptic-oblong, distinctly petiolate or contracted towards the base; fruit obovoid, oblique, with a thin-walled concavity on the side. *P. loxocarpa* is also related to *P. bartlingii* in having included stamens and style and obovoid, oblique fruit with a thin-walled concavity on the side. The latter, however, can easily be identified by its linear-lanceolate leaves with revolute margins, spike-like woolly inflorescence and oblong anthers obscurely appendiculate at the lower ends.

29. **Pityrodia obliqua** W.V. Fitzgerald, J.& Proc.Roy.Soc.W.Aust.3(1918)208; Gard., Enum.Pl.Aust.Occ.3(1931)112; Mold., Résumé Verben.etc.(1959)210; Beard (Ed.), W. Aust.Pl. edn 1(1965)92; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben.etc.1(1971)348.

Type: *W.V. Fitzgerald 1648*, Dillon Springs, E. Kimberley, Western Australia, Oct. 1906 (PERTH, lectotype designated here; E, NSW 2 spec. - isolectotypes).

Typification

P. obliqua is based on the author's (W.V. Fitzgerald) own collection from eastern Kimberley, Western Australia, consisting of at least three duplicates, all annotated by the author. Since the author did not choose any one of these as a type, it is, therefore, necessary to select a type for this name. Of all the syntypes, the one preserved in Herb. PERTH where Fitzgerald's herbarium and types are now preserved (Stafleu, 1967) was almost certainly used by him in preparing the original description of this species. The specimen is particularly complete and well preserved. It is selected here as the lectotype for this species.

Description (Fig. 29)

An erect shrub of 60-120 cm. *Stem* and branches densely clothed with greenish-grey

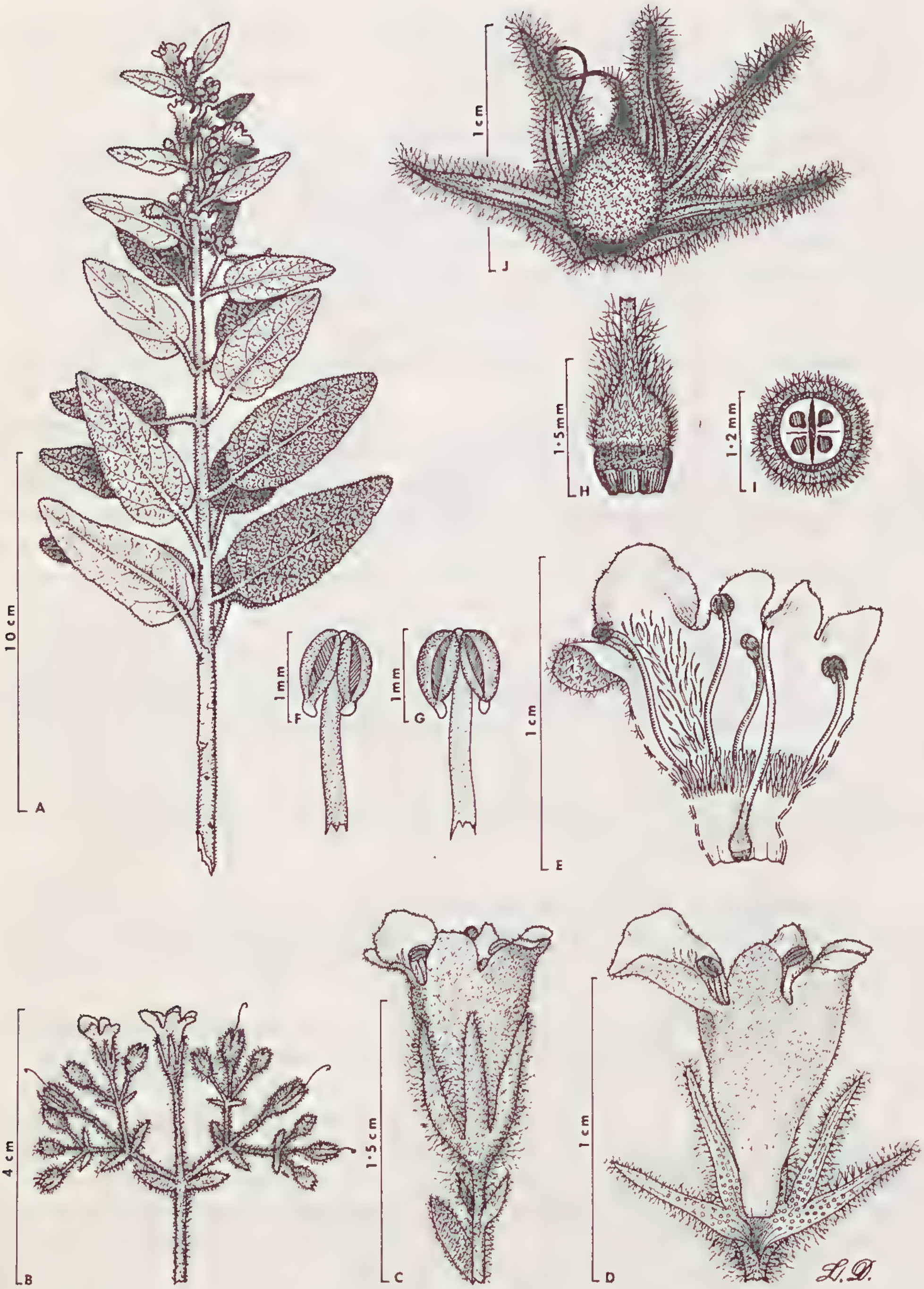


Fig. 29. *Pityrodia obliqua* W.V. Fitzg. (*W.V. Fitzgerald 1648*: E, isolectotype). A, flowering twig; B, cyme; C, flower with a bract and two bracteoles; D, flower with calyx vertically cut open to show corolla-tube; E, corolla-tube vertically cut open to show androecium and gynoecium; F. lower stamen; G, upper stamen; H, ovary; I, transverse section of ovary; J, fruiting calyx cut open to show fruit.

branched tomentum which often becomes yellowish upwards. *Leaves* conspicuously petiolate; lamina ovate or oblong-ovate with rounded or obtuse apices, more or less oblique and cordate or rounded at the base, (2-) 3-6 cm long, (0.7-) 1-2.5 cm broad, flat, crenulate, rugose above, the reticulate nerves conspicuous on the under surface, all over densely greenish-grey tomentose; petiole thick, tomentose, adaxially canaliculate, (0.5-) 1-1.8 cm long. *Inflorescence* cymose in the upper axils; cymes arranged into more or less lax leafy panicle, densely woolly-tomentose, rarely exceeding the leaves; primary peduncles (5-) 7-15 mm long. *Flowers* pedicellate, 3-7 or more in a cyme; pedicel woolly-tomentose, 2-4 mm long; bracts sessile, linear-lanceolate, woolly-tomentose on abaxial surface, glandular and hairy on adaxial surface, flat, entire, (1.5-) 2-4 (-5) mm long, 0.5-1 mm broad; bracteoles sessile, resemble bracts, 1-2 (-2.5) mm long, ± 0.5 mm broad. *Calyx* persistent, divided almost to the base into 5 lobes, 5-7 mm long, woolly-tomentose outside, glabrous but sparsely glandular inside; lobes linear, one-nerved, 4-6 mm long, 0.5-1 mm broad; tube shallow, 0.5-1 mm long. *Corolla* pink with purple streaks in the throat, (7-) 8-12 (-14) mm long, sparsely glandular and tomentose outside, glabrous inside excepting the dense hairy ring above the ovary, and sparse villous hairs extending to the large anterior lobe of the lower lip; the anterior lobe broadly elliptic or almost orbicular in outline, entire, 3-5 mm long, 4-6 mm broad, the two lateral lobes broadly ovate, 1.5-2 mm long, 2-3 mm broad, the two upper lobes oblong-ovate, 2-3 mm long, 2-2.5 mm broad at the base; tube abruptly dilated within the calyx, about as long as the calyx, (5-) 7-9 mm long, 4-5 (-6) mm broad at the top end. *Stamens* slightly exserted; filaments glabrous, filiform, the lower pair (3.5-) 4-6 mm long, the upper pair 3-4 mm long; anthers more or less orbicular in outline, ± 1 mm long, 0.5-1 mm broad, lobes oblong, appendaged at the lower ends of both the cells. *Ovary* globose, densely tomentose, seated on a thick glabrous disk, ± 1 mm in diameter; style slightly exserted, glabrous with a few hairs towards the base, filiform, 6-9.5 mm long, shortly 2-lobed at the apex; ovules attached near the top with short funicles. *Fruit* black, ovoid-globose, tomentose with branched hairs, 2-3 mm long, 2-2.5 mm in diameter, apparently non-dehiscent; seeds not seen.

Specimens examined

WESTERN AUSTRALIA: *Byrnes 358*, Mt Bell, King Leopold Ranges, 25.v.1967 (DNA, NT). *Carr 3304 & Beauglehole 47082*, S side of Cockburn Range, ± 13 km W of King River, 10.vii.1974 (AD, Herb. Beauglehole). *W.V. Fitzgerald 1648*, Dillon Springs, E. Kimberley, Oct. 1906 (PERTH, lectotype; E, NSW 4 spec. - isolectotypes). *Jackson 951*, near summit of Mt Bell, 23.v.1967 (AD). *Maconochie 221*, loc. cit. 23.v.1967 (NT).

Distribution (Map 8B)

P. obliqua is endemic in the Kimberley region of Western Australia, where it has been recorded from the middle section of King Leopold Ranges, north-eastern end of Saw Range and southern side of Cockburn Range.

Comments

P. obliqua was described by W.V. Fitzgerald (1918) who placed it in the Myoporaceae. Previously, however, he had described *Pityrodia viscida* as a new species which he recorded under the family Verbenaceae. Both species were based on the author's own collections from Western Australia.

The duplicates of the type collection in Herb. E and NSW are without collection number, but the syntype, (now lectotype) in Herb. PERTH has the number "1648". The number and other particulars on the herbarium label seem to be in the collector's own handwriting, therefore, the number "1648" is regarded here as the collection number for all the type duplicates.

Affinity

This species is closely allied to *P. paniculata* in its flowers being arranged into panicles; corolla more or less similar coloured with purple streaks or spots in throat, tube dilated within or immediately above the calyx; stamens and style slightly exserted above the corolla-tube and anthers more or less orbicular in outline. Nevertheless, *P. paniculata* may easily be distinguished by its stem, leaves and inflorescence being densely covered with short cineraceous tomentum; leaves sessile, oblong-obovate, non-rugose; inflorescence much more lax; calyx 2-lipped, lobes spathulate or obovate, obtuse, non-glandular but pubescent within, membranous in infructescence.

30. **Pityrodia paniculata** (F. Muell.) Benth., Fl.Aust.5(1870)53; Diels & E. Pritz., Bot. Jahrb.Syst.35(1904)520; Gard., Enum.Pl.Aust.Occ.3(1931)112; Junell, Sym.Bot.Upsal. 4(1934)68; Mold., Résumé Verben.etc.(1959)210, 251, 335, 341; Beard (Ed.), W.Aust.Pl. edn. 1(1965)92; Blackall & Grieve, West.Aust.Wildfls 3(1965)569; Beard (Ed.), W.Aust. Pl. edn 2(1970)114; Mold., Fifth Summary Verben.etc.1 & 2(1971)348, 426, 603, 615; Erickson et al (Ed.), Fl.Pl.West.Aust.(1973)206.

Type: *M. Brown s.n.*, near Shark Bay, 1863 (MEL 9352, holotype).

Quoya paniculata F. Muell., Fragm.4(1864)80, *basionym*.

Type: As for *Pityrodia paniculata* (F. Muell.) Benth.

Chloanthes paniculata [F. Muell., Fragm.4(1864)80, pro syn. sub. *Quoya paniculata* F. Muell.]; (F. Muell.) F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Muell., Trans.& Proc.Roy.Soc.Vic.23(1887)6; F. Muell., Sec.Syst. Cens.Aust.Pl.1(1889)172.

Description (Fig. 30)

A much branched shrub of 0.6-1.5 m, hoary with a dense but close and short greyish-glaucous tomentum. *Stem* and branches mainly greyish-glaucous, sometimes light purplish-red in young flowering shoots. *Leaves* sessile, oblong-oblanceolate or obovate, obtuse, generally entire, very rarely denticulate in the upper half, (1-) 1.5-3.5 (-5) cm long, (5-) 7-12 (-20) mm broad, densely clothed with a short cineraceous tomentum, the venation prominent on the lower surface. *Flowers* pedicellate, solitary or more frequently 3-7 (-15) in a cyme; cymes pedunculate, arranged into more or less pyramidal lax panicle; cyme-peduncles hoary with dense but short greyish tomentum, (0.5-) 1-2.5 (-3) cm long; pedicel hoary with indumentum similar to that of peduncle, 1-3 mm long; bracts sessile, elliptic-oblong, obtuse, hoary, 2-3 (-4) mm long, (0.5-) 1-2 mm broad; bracteoles similar to bracts but smaller, 1-2 mm long, 0.5-1 mm broad. *Calyx* persistent, 2-lipped, deeply divided into 5-lobes, shortly tubular towards the base, (4-) 5-9 mm long, densely clothed with short but branched cineraceous tomentum, glabrous inside the tube; lobes oblong-spathulate or almost obovate, obtuse, membranous in infructescence, (3-) 4-8 mm long, (1-) 2-4 (-5) mm broad; tube short, 0.5-1 mm long. *Corolla* pale mauve or pale lilac with purple spots in the throat, (13-) 15-18 mm long, pubescent outside, glabrous inside excepting the dense hairy ring above the ovary, and the sparse villous hairs extending to the large anterior-lobe of the lower lip; the anterior-lobe almost twice as large as the other 4-lobes, more or less elliptic-orbicular, (6-) 7-10 mm long, (7-) 8-10 mm broad; the other 4-lobes almost equal, more or less ovate, (2-) 3-5 mm long, 2-3 (-4) mm broad; tube dilated within or immediately above the calyx, 5-6 mm long, nearly as broad at the top end. *Stamens* almost included or scarcely exserted; filaments filiform, glabrous, the lower pair longer than the upper, 3-4 mm long, the upper pair 2-3 mm long; anthers more or less orbicular in outline, the lower pair with well developed appendages at the lower ends of the lobes, 1-1.5 mm long, the upper pair with short or obscure appendages, c. 1 mm long. *Ovary* globose, c. 1 mm in diameter, densely tomentose; style included or scarcely exserted, filiform, glabrous with only a few hairs near the base, 5-8 mm long, shortly 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, broadly ellipsoid-obovoid or almost globose, pubescent with branched hairs, (2-) 2.5-3.5 mm long, 2.5-3.5 mm broad, splitting into two separate 2-celled nutlets; seeds not seen.

Fig. 30. *Pityrodia paniculata* (F. Muell.) Benth. (A, *A.M. Ashby 1539*: AD; B-I, *D.E. White 630807*: PERTH). A, flowering branch; B, inflorescence; C, flower; D, corolla-tube vertically cut open to show inside; E, fruit with 2-lipped calyx; F, lower stamen; G, upper stamen; H, ovary; I, transverse section of ovary.

Representative specimens

WESTERN AUSTRALIA (54 collections seen): *Aplin A9*, Doorawarrah Stn E of Carnarvon, 13.xi.1963 (E, PERTH). *Ashby 1539*, Carnarvon Tracking Stn, 26.viii.1965 (AD, B, PERTH). *Beard 2964*, 20 miles E from Onslow, 22.viii.1963 (PERTH, Kings Park Perth). *Beard 4368*, 11 miles N of Gascoyne Junction, 22.viii.1965 (PERTH, Kings Park Perth). *Beauglehole 11625 & 11628*, 70 miles S of Onslow on NWC Highway, 19.viii.1965 (PERTH 2 spec.). *Berstor 68*, Woodleigh Stn near Shark Bay, June 1963 (PERTH). *M. Brown s.n.*, near Shark Bay, 1863 (MEL 9352, holotype of *Quoya paniculata* F. Muell.). *Butler 108*, North West Cape, 1963 (PERTH). *Carey s.n.*, near Roebourne ?Aug. 1884 (MEL 69356, MEL 69359). *Carey s.n.*, near Lyndon River, Lat. 23° 10′ S, Long. 114° 35′ E, 1885 (MEL 69357). *Chinnock 3837*, 25.2 km SE of Onslow, 30.viii.1977 (AD). *Demarz 197*, 48 miles N of Carnarvon, 29.vii.1968 (PERTH, Kings Park Perth). *Demarz 694*, 11 mile stone from Barradale, 15.xi.1968 (Kings Park Perth). *Demarz 701*, 33 mile stone Minilya River, 16.xi.1968 (Kings Park Perth). *Fairall & Lullfitz L281*, 112 m. post from Onslow to Carnarvon, 26.x.1963 (Kings Park Perth). *Diels & Pritzel 438*, Gascoyne Junction, Aug. 1901 (PERTH). *Fitzgerald s.n.*, Carnarvon, Dec. 1906 (NSW 135938). *A. Forrest s.n.*, Nickol River, 1878 (MEL 69360, W731, WU). *J. Forrest s.n.*, Minilya River, N of Shark Bay, 1882 (MEL 69353). *J. Forrest s.n.*, Gascoyne River, 1882 (MEL 69354). *Gardner 3204*, "Mia Mia Minilya River", 28.viii.1932 (PERTH 5 spec.). *Gardner 6068*, 8 miles SE of Carnarvon, 19.xi.1941 (PERTH 3 spec.). *George 1193*, 45 miles E of Bullara HS, 29.viii.1960 (PERTH). *Jones s.n.*, Gascoyne River, 1880 (MEL 69361). *King s.n.*, between the Gascoyne and Fortesque River, 1885 (MEL 69362). *Morrissey 65*, Wiluna area, Dec. 1970 (PERTH). *Morrison s.n.*, between Minderoo and Globe Hill, 29.ix.1905 (BRI, E, K, PERTH 3 spec.). *Pollack s.n.*, Gascoyne River, 1882 (K, M, MEL 69355). *E. Pritzel 543*, Shark Bay, Aug. 1901 (A, AD, B, BM, BR, E, G 2 spec., HBG, K, L, M, MO, NSW, NY, P, PR, S, US, W). *Tyson s.n.*, Mt Narryer Murchison River, Feb. 1901 (K). *Weber 4865*, on N.W. Coastal Highway between Yanray and Towera, Lat. 22° 54′ S, Long. 114° 56′ E, 1.x.1975 (AD).

Distribution (Map 8C)

P. paniculata is endemic in the west-north-west of Western Australia. The major distribution is along the North West Coastal Highway between Port Hedland and the south-eastern end of Shark Bay. One inland collection is known from an unknown locality in the Wiluna area, and a few others have come from the upper reaches of the Gascoyne and Murchison River.

Comments

Bentham (1870) recorded *P. paniculata* and *P. atriplicina* as two distinct but nearly allied species. However, he did point out that the former is perhaps a variety or even a different state only of the same species. This may have been because Bentham knew this species only from a small fragment of the type material. During present studies, these species were found to be fairly close to each other because both of them have paniculate inflorescences and close cineraceous indumentum on stem and leaves. However, their leaf-shape and some flower and fruit characters do differ. Both the species are known to grow in the same general area, though they are not found growing together in any single locality. The most northern distribution limit of *P. atriplicina* is just below the most southern distribution limit of *P. paniculata*.

The leaves of *P. paniculata* are generally entire and mostly up to 3.5 by 1.2 cm. However, a few leaves in Gardner's collection (no. 6068) in Herb. PERTH are found to be denticulate at the apex and measure up to 5 by 2 cm. The denticulate leaf apices are also noticed in some leaves of Tyson's collection (No. 21) in Herb. MEL and in Beauglehole's collection no. 11727 in Herb. PERTH.

The locality of Gardner's collection (no. 3204) in Herb. PERTH is noted: "Mia Mia Minilya River", which seems to be either a mix up of two localities or an error in its record. The place Mia Mia is in fact more close to Lyndon River than Minilya River. Mia Mia is located to the north of the Lyndon River, and the Minilya River is about 50 to 60 km south of the Lyndon River. The distribution of this species, however, is recorded from around both the rivers.

Affinities

P. paniculata is closely allied to *P. atriplicina* in the majority of flower characters, and with the same dense cineraceous-indumentum on stem and leaves. Nevertheless, it can readily be distinguished by its leaves being oblong-oblanceolate, never orbicular; inflorescence much more lax with longer cyme-peduncle; calyx deeply divided into lobes; lobes distinctly arranged into 2 lips, oblong-spathulate or almost obovate, with close cineraceous indumentum on both surfaces; fruit elliptic-obovoid or almost globose, without distinct conical top.

P. paniculata is also related to *P. cuneata* in having more or less similar shaped leaves and flowers. The 2-lipped calyx seems to be a peculiarity of both the species. The latter, however, may easily be identified by its leaves being bullate-rugose with venation prominent underneath; cyme-peduncle shorter; pedicel much longer, mostly 3-5 mm long; calyx-lobes oblong-ovate, with distinct reticulate veins on the inner face.

31. **Pityrodia axillaris** (Endl.) Druce, Rep.Bot.Exch.Cl.Brit. Isles 1916 (1917) 640, exclud.syn. *Dasymalla terminalis* Endl., *Quoya racemosa* Turcz. and *Pityrodia racemosa* (Turcz.) Benth.; Gard., Enum.Pl.Aust.Occ.3(1931)112 p.p. exclud. syn. *P. racemosa* (Turcz.) Benth.; Gard., Wildfls West.Aust.(1959)130, 132 p.p. exclud. descr. and fig. p. 130; Mold., Résumé, Verben. etc. (1959)210; Blackall & Grieve, West.Aust.Wildfls 3 (1965)570 p.p. exclud. syn. *P. racemosa* (Turcz.) Benth., descr. and fig.; Beard (Ed.), W. Aust.Pl. edn 2 (1970) 114 p.p. quoad descr. and distrib.; Mold., Fifth Summary Verben. etc. 1 & 2 (1971)347, 367, 426, 475, 603, 615-p.p. exclud. syn. *Chloanthes stachyodes* F. Muell., *Dasymalla terminalis* Endl., *P. racemosa* (Turcz.) Benth. and *Quoya racemosa* Turcz.; Gard., West.Aust.Wildfls Vol. B(1972)158 p.p. excl. descr. and fig. p. 159 bottom half; George, Nuytsia 1(1972)289.

Type: *J.S. Röe s.n.*, interior of Western Australia, undated (W, holotype; MEL 41226).

Dasymalla axillaris Endl. in Endl. & Fenzl, Nov.Stirp. Dec. 2(1839) n. 12, *basionym*; Walp., Rep.Bot.Syst.4 (1845)139; DC., Prod.11(1847)704.

Type: As for *Pityrodia axillaris* (Endl.) Druce.

P. racemosa sensu Benth., Fl.Aust.5(1870) 50 p.p. quoad syn. *Dasymalla axillaris* Endl.

P. spectabilis Gard., J.Roy.Soc.W.Aust.47(1964)63; Blackall & Grieve, West.Aust.Wildfls 3(1965)572; Beard (Ed.), W.Aust.Pl. edn 2(1970) 114; Mold., Fifth Summary Verben. etc. 1(1971)348; Gard., West.Aust.Wildfls Vol.B(1972)164, 165.

Type: *C.A. Gardner 12033*, prope Buntine in arenosis apertis, 2.xii.1958 (PERTH, holotype).

Description (Fig. 31)

Diffuse tomentose undershrub up to 30 cm high. *Stem* and branches densely clothed with white-woolly indumentum of branched hairs. *Leaves* sessile, obovate or oblong-obovate, cuneate towards base, obtuse, entire, (1.5-) 2-4 (-5) cm long, (0.5-) 1-1.5 (-1.8) cm broad in the upper half, densely woolly-tomentose, rugose under the indumentum. *Flowers* axillary solitary or often in cymes of 3 to 5, pedicellate, forming terminal leafy raceme; pedicel 3-6 (-8) mm long, woolly tomentose; bracts sessile, oblong-obovate, obtuse, abaxially tomentose, adaxially glabrous, 5-8 mm long, 2-3 (-4) mm broad; bracteoles sessile, more or less similar to bracts in shape and vestiture, 2-4 mm long, 1-1.5 mm broad. *Calyx* persistent, 5-partite almost to the base, shortly tubular near the base, (12-) 14-18 mm long, densely woolly-tomentose outside, glabrous inside; lobes oblong-oblanceolate or oblong-obovate, obtuse, entire, reticulate, 10-15 mm long, (2.5-) 3-5 mm broad; tube 1-2 (-3) mm long. *Corolla* deep red or yellowish-scarlet, (2-) 2.5-3 (-3.5) cm long, almost glabrous outside, glabrous inside excepting the dense hairy ring above the ovary, and with minute clavate hairs extending to the large central lobe of the lower lip; lobes spreading, more or less sub-orbicular, undulate-denticulate, the central lobe of the lower lip somewhat larger than the others, 7-12 mm long, 9-15 (-18) mm broad, the other lobes almost equal, (5-) 6-10 mm long, (7-) 9-15 mm broad; tube dilated within or immediately above the calyx, 11-15 (-18) mm long, (7-) 8-15 mm broad near the top

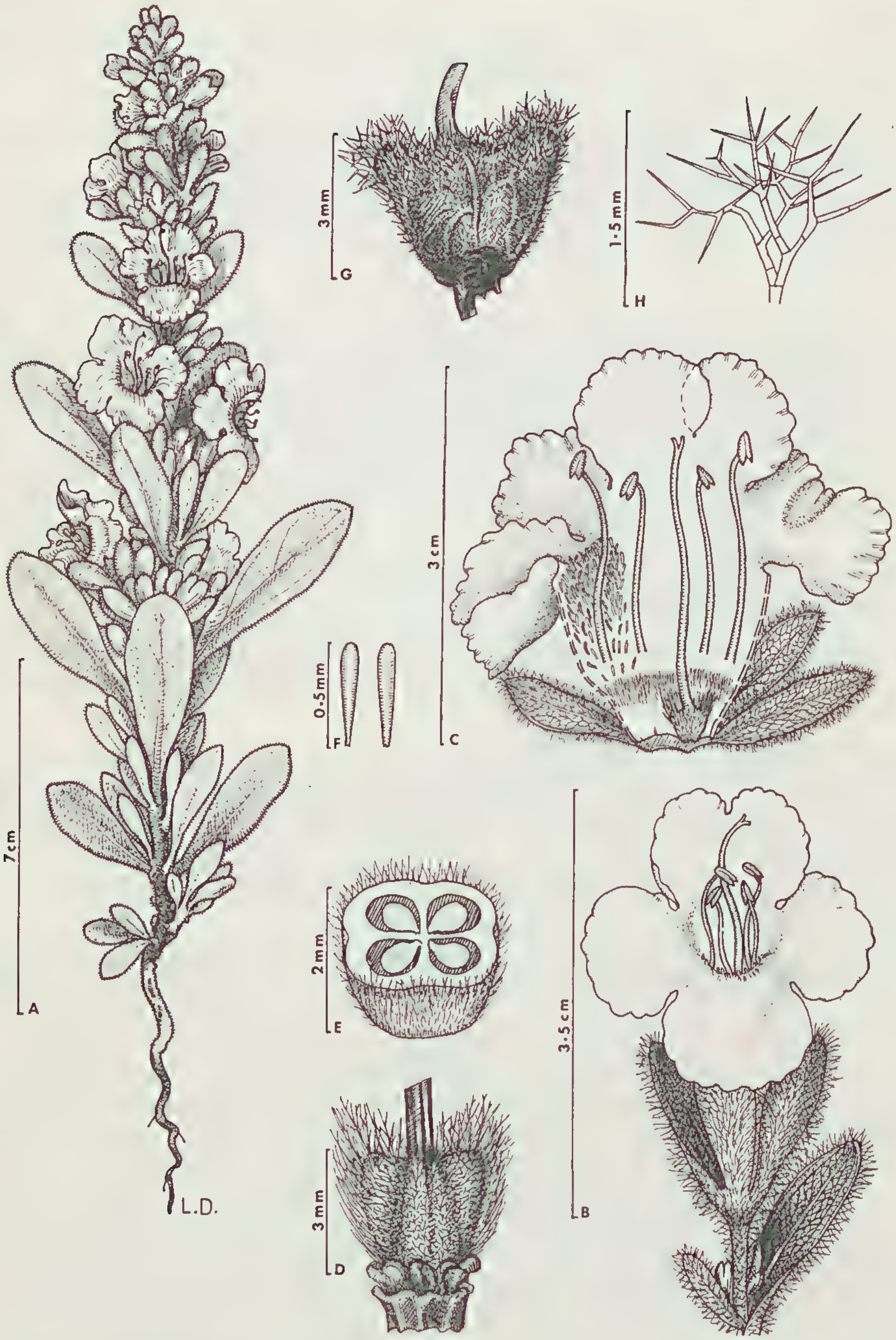


Fig. 31. *Pityrodia axillaris* (Endl.) Druce) A, *C.A. Gardner 12023*: PERTH; B-H, *W.E. Blackall 2860*: PERTH). A, habit drawing; B, flower with a bract and two bracteoles; C, flower with calyx and corolla cut open to show androecium and gynoecium; D, ovary; E, transverse section of ovary; F, clavate hairs from corolla-throat; G, fruit; H, calyx-hair.

end. *Stamens* exserted, sub-didynamous; filaments glabrous, filiform, (10-) 12-16 (-18) mm long; anthers oblong, c. 2 mm long, 1 mm broad, lobes linear, free in the lower halves, each with a short appendage at the lower end. *Ovary* more or less globose when young, with two lateral humps when old, 1-2 mm in diameter, densely tomentose; style exserted, glabrous, filiform, (13-) 16-27 (-30) mm long, shortly 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, somewhat obovoid, slightly compressed, with two opposite short humps at the top, densely tomentose, splitting into two separate two-celled nutlets, 2-3 mm long, 2-4 mm broad at the top end.

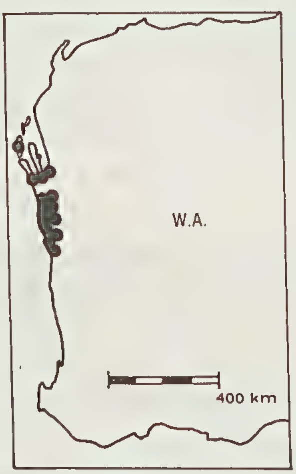
Specimens examined

WESTERN AUSTRALIA (15 collections seen): *Blackall 2860*, between Perenjori and Dalwallinu, 25.ix.1932 (PERTH 2 spec.). *Burns 52*, 205 mile peg Wongan road, 9.ix.1971 (PERTH). *Gardner s.n.*, Buntine, July 1927 (PERTH 3 spec.). *Gardner 12023*, prope Buntine in arenosis lutosis, 2.xii.1958 (PERTH, holotype of *Pityrodia spectabilis* Gard.). *Herbert s.n.*, Pithara, 2.x.1961 (PERTH 2 spec.). *Humphreys s.n.*, Maya, 23.ix.1961 (PERTH). *Lullfitz 1626*, above Perenjori towards Morawa, 2.x.1962 (PERTH, Kings Park Perth). *Lullfitz 1457*, Wubin near 2000 acre reserve, 31.vii.1963 (Kings Park Perth). *O'Grady s.n.*, "Guangarra", 1953 (PERTH). *Perry s.n.*, near Caron, Oct. 1961 (PERTH 2 spec., paratypes of *Pityrodia spectabilis* Gard.). *Robinson 277*, Lake Moore, 27.x.1966 (PERTH). *Phillips 1737*, N. of Wubin, 2.x.1962 (CBG). *Röe s.n.*, interior of South West Australia, undated (W, holotype; MEL 41226 isotype - of *Dasymalla axillaris* Endl.). *Rogerson 8027*, between Bunjil and Latham, Oct. 1961 (PERTH). *Sargent s.n.*, Latham, 23.x.1921 (PERTH). *Stacey 217*, 1 mile S. of Caron, 15.x.1972 (PERTH).

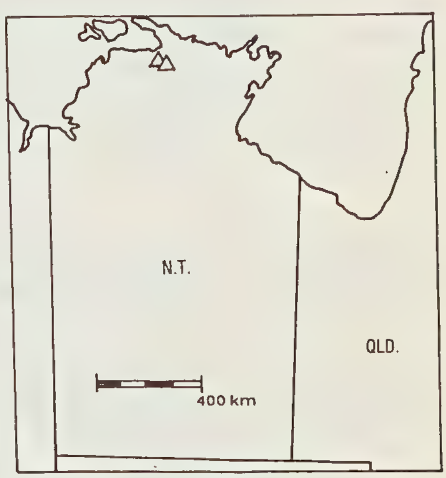
Distribution (Map 9A)

P. axillaris is endemic in the south-west of Western Australia where it is restricted between latitude 29° 31° S, and between longitude 116° and 118° E. The main distribution is between Pithara and Morawa, with only one record from near Lake Moore.

Map 9A.
P. axillaris △
P. dilatata ○
P. cuneata ●



Map 9B.
P. atriplicina ●



Map 9C.
P. byrnesii △

Comments

Bentham (1870) recorded this species as a synonym of his illegitimate combination *P. racemosa* (Turcz.) Benth. (= *Quoya racemosa* Turcz.).

Druce (1917) identified *Dasymalla axillaris* Endl. as a *Pityrodia* R.Br. and made a new combination *P. axillaris* (Endl.) Druce within which he treated *Dasymalla terminalis* Endl. as a synonym. The correct application of the name *P. axillaris* (Endl.) Druce was realized by George (1972) who, after examination of the types and original descriptions, distinguished *P. axillaris* (Endl.) Druce and *P. terminalis* (Endl.) George as two separate species. (For more details see "comments" under *P. terminalis*).

The detailed English description, habit sketch and analytical drawings of its flowers are the first published for this species. The majority of previously published coloured plates, labelled *P. axillaris* are of *P. terminalis*. A coloured plate of *P. axillaris* was published by Gardner (1972, p. 165) as *P. spectabilis* Gard. which is regarded here as a synonym of this species.

Moldenke (1959, 1971) recorded this species from Queensland and New South Wales, but no collection has been made outside Western Australia. *P. axillaris* seems to be one of the rarest species in the genus.

According to Gardner (1964), this species is by far the largest flowered member of the genus.

Affinities

P. axillaris is closely related to *P. terminalis* in its flowers being pedicellate, arranged in a raceme-like terminal inflorescence; calyx tomentose outside, lobes almost free to the base; corolla-tube abruptly dilated within or immediately above the calyx; anthers oblong and fruit with two opposite humps. Nevertheless, *P. axillaris* may be easily distinguished by its leaves being oblong-obovate; calyx-lobes obovate; corolla deep red or yellowish-scarlet, tube almost glabrous outside and with clavate hairs inside below the central lobe of the lower lip, lobes undulate-denticulate; stamens and style much exserted; fruit ± obovoid with two opposite humps at the top.

P. axillaris is also allied to *P. augustensis* in having similar indumentum on stem and leaves, deeply lobed calyx and the corolla-tube abruptly dilated within or immediately above the calyx. Nevertheless, *P. augustensis* can readily be identified by its leaves being narrowly elliptic, cuneate towards both ends; calyx-lobes linear-oblong; corolla deep lilac with branched villous hairs inside the tube, tube glandular and sparsely woolly outside, lobes entire; stamens and style included; fruit more or less globular without any hump, pubescent all over.

32. **Pityrodia dilatata** (F. Muell.) Benth., Fl.Aust.5(1870) 51; Briq., Mém.Soc.Phys. Genéve, 32(2), no. 8 (1896)78; Diels & E. Pritz., Bot.Jahrb.Syst.35(1904)521; Gardner, Enum.Pl.Aust.Occ.3(1931)112; Junell, Bot.Upsal.4(1934)68, fig. 114; Mold., Résumé Verben.etc.(1959)210, 251, 335, 341; Beard (Ed.), W.Aust.Pl. edn 1(1965)92; Blackall & Grieve, West.Aust.Wildfls 3(1965)570; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben.etc.1 & 2(1971)347, 367, 425, 603, 615; Gard., West.Aust.Wildfls vol. B(1972)160, 161t.

Type: *J. Drummond 2nd coll. no. 210*, near Murchison River, ?1843 (K, lectotype designated here; A, BM, E, G, K 2 spec., LE, M, MEL 2 spec., P, W, WU - isolectotypes).

Chloanthes dilatata F. Muell., Fragm.6(1868)157, *basionym*; F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Meull., Sec.Syst.Cens.Aust.Pl.1(1889)172.

Type: As for *P. dilatata* (F. Muell.) Benth.

Quoya dilatata F. Muell., Fragm.6(1868)157, pro syn. sub. *Chloanthes dilatata* F. Muell.

Typification

P. dilatata is based on J. Drummond's 2nd coll. no. 210, from Western Australia, consisting of at least 14 duplicates all agreeing with the type description. Since the author did not select any of them as a type, it is, therefore, necessary to select a lectotype for this name.

Only the duplicates in K have both the collector's number and Mueller's annotation. Other specimens (in MEL) although annotated by Mueller have not been considered due to the lack of the Drummond number necessary to ensure that the specimen is a duplicate of the type collection. A specimen at K, which is particularly complete, is selected as the lectotype.

Description (Fig. 32)

A low spreading shrub of 30-60 cm. *Stem* and branches densely clothed with a branched woolly white tomentum. *Leaves* sessile, obovate or oblong-spathulate, narrowed below the middle, dilating and stem-clasping at the base, entire when young, later crenate, obtuse, flat or nearly so, (1-) 1.5-3 (-3.8) cm long, (4-) 7-11 (-15) mm broad, woolly-tomentose, glabrescent when old, thick and bullate-rugose on the upper surface, reticulate underneath. *Flowers* mostly solitary or on short axillary peduncles, pedicellate, forming a long spike-like leafy inflorescence towards the end of branches; peduncle (2-) 3-6 (-10) mm long, tomentose; pedicel slender, densely tomentose, 2-4 mm long; bracts leaf-like, of the shape and size of the upper smaller leaves; bracteoles short, leafy, linear-lanceolate, tomentose on abaxial surface, glabrous on adaxial surface, 3-5 mm long, 1-2 mm broad. *Calyx* persistent, divided almost to the base into 5 narrow lobes, very shortly tubular at the base, 8-12 mm long, very thickly woolly-tomentose outside, glabrous inside; lobes oblong-spathulate, narrowed below the middle, membranous, reticulate, non-ribbed, 8-11 mm long, 1-2 mm broad; tube 0.5-1 mm long. *Corolla* orange-red, 2-2.5 cm long, densely pubescent outside, glabrous inside excepting the dense hairy ring above the ovary, and a few subulate and clavate hairs only at the base of the largest anterior-lobe of the lower lip; anterior-lobe much larger than any of the others, more or less ovate-deltoid, reflexed, 5-7 mm long, 4-6 mm broad at the base; the other 4-lobes almost equal, the upper two more or less ovate, erect, the lateral deltoid, reflexed, (2-) 3-4 (-5) mm long; tube gradually dilated upwards and slightly curved, 12-15 mm long, 6-9 mm broad above the calyx. *Stamens* exserted; filaments glabrous, filiform, the lower pair longer, (9-) 10-14 mm long, the upper pair (5-) 6-8 (-9) mm long; anthers oblong, with minute appendages at the lower ends of the lobes, 1-1.5 (-2) mm long, c. 1 mm broad. *Ovary* globose, very densely tomentose, seated on a thick glabrous disk, 1-1.5 mm in diameter; style exserted, filiform, glabrous with a few hairs towards the base, (12-) 15-22 (-28) mm long, shortly 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, almost globose in outline but somewhat tetracristate or tetraquetrous with almost round or blunt short edges, 2-3 mm long, 2-2.5 mm in diameter, all over tomentose; seeds not seen.

Representative specimens

WESTERN AUSTRALIA (31 collections seen): *Andrews 681*, Northam, 30.ix.1902 (BM, K). *Beard 3142*, 2 miles S. of Mogumber, 25.xi.1963 (Kings Park Perth). *Blackall 2937*, between Moora and Gingin via Mogumber, 20.ix.1932 (PERTH 2 spec.). *Cleland s.n.*, Moora, Oct. 1908 (NSW 89905). *J. Drummond 2nd coll. no. 210*, near Murchison River, ? 1843 (K lectotype; A, BM, E, G, K 2 spec., LE, M, MEL 2 spec., P, W, WU - isolectotypes). *J. Drummond s.n.*, loc.cit., undated (MEL 41259, MEL 41260, MEL 69390 probably type duplicate, MEL 69310, MEL 69311, MEL 69312). *Fitzgerald s.n.*, Mogumber, Oct. 1903 (NSW 135886, NSW 135887). *Gardner s.n.*, 6 miles W. of Watheroo, Sept. 1926 (PERTH). *Gardner s.n.*, Coomberdale, Sept. 1963 (PERTH). *George 6825*, 1 mile S. of Mogumber, 17.ix.1965 (PERTH). *George 6837*, 5 miles E. of Wannamal, 25.ix.1965 (MO, PERTH). *Gimenez 792*, New Norcia, Oct. 1923 (PERTH). *Koch 2443*, Cowcowing, 1904 (PERTH). *Kretchmar s.n.*, Babilion Hills near Moore River, Nov. 1961 (PERTH 2 spec.). *Morrison 13181*, between New Norcia and Mogumber, near Moore River, 15.x.1903 (K, PERTH). *Morrison 16104*, Carnamah, 2.xi.1906 (K). *Morrison s.n.*, Carnamah, 7.xi.1906 (BM, BRI, E, PERTH). *Morrison s.n.*, Watheroo, 9.xi.1906 (BM, K). *Maiden s.n.*, Perth, Aug. 1909 (G). *Maiden s.n.*, district Murray, Sept. 1909 (G). *E. Pritzel 737*, Moore River, Oct. 1901 (A, AD, B, BR, E, G 2 spec., HBG, K 2 spec., L, M, MO, NSW, NY, PR, S, US, W). *E. Pritzel s.n.*, Watheroo, 1901 (B). *Rogerson 7*, Badingarra, Jan. 1963 (PERTH). *Royce 9751*, Watheroo National Park, W. of Watheroo, 8.x.1971 (PERTH). *Staer s.n.*, Mogumber, Oct. 1905 (E). *Steedman s.n.*, Watheroo, Sept. 1932 (PERTH). *Whibley 4879*, 15 km N. of Moora, 2.xi.1974 (AD).

Fig. 32. *Pityrodia dilatata* (F. Muell.) Benth. (A-H, *R.D. Royce 9751*: PERTH; I, *A. Morrison 16104*: K). A, flowering branch; B, flower with a bract and two bracteoles; C, flower with calyx cut open to show androecium and gynoecium; E, upper stamen; F, lower stamen; G, ovary; H, transverse section of ovary; L, fruit.

Distribution (Map 9A)

P. dilatata is endemic in the west-south-west of Western Australia. The major distribution is to the north of Perth, chiefly between Perth and Carnamah. However, one collection from east-north-east of Perth has come from Northam, and another from near Cowcowing. The presence of this species in the vicinity of the Murchison and the Murray Rivers has not been confirmed by any collection since the type collection, ? 1843.

Comments

The flower arrangement, corolla colour and gradual upwards dilation of the corolla-tube give this species the aspect of *Chloanthes*. However, it may easily be identified by its non-decurrent flat leaves and appendaged anther-lobes. Inside the corolla-tube, there is no extension of hairs from the hairy ring to the anterior-lobe of the lower-lip. Instead, there are a few subulate and clavate (villous) hairs at the base of the anterior-lobe.

The calyx of *P. dilatata* is so deeply divided that there is hardly any tube at the base.

One of Drummond's collection in Herb. MEL (no. MEL 69309) is probably a duplicate of his 2nd collection no. 210 from the Murchison River (the type of *P. dilatata*), but it lacks a collector's number. Otherwise, it matches well with all the type duplicates of this number. In fact, this is the only specimen of Drummond's collection of *P. dilatata* in MEL with the author's determination, and it has, in addition, copious descriptive notes by Mueller. It also contains dissected flowers and some loose plant material enclosed in two packets with the species name written by F. Mueller. This particular specimen seems, therefore, to have been used by Mueller in preparing the original description of this species and to be likely to belong to the type collection.

Affinity

P. dilatata is closely allied to *P. quadrangulata* in having more or less similar looking flat bullate-rugose leaves, pedicellate flowers, membranous and reticulate calyx, gradually upwards dilated corolla-tube, oblong anthers with minute appendages at the base of the lobes, thick glabrous disk below the ovary and more or less tetraquetrous fruit. Nevertheless, *P. dilatata* can easily be identified by its leaves being dilated and stem-clasping at the base, shorter, measuring up to 3 (-3.8) by 1.1 (-1.5) cm; flowers mostly axillary, solitary, arranged into a spike-like leafy inflorescence; calyx-lobes oblong-spathulate, glabrous inside, with hardly 1 mm long tube at the base; corolla orange-red, with subulate and clavate (villous) hairs inside at the base of the largest reflexed anterior-lobe; ovary neither ridged nor corrugated; disk corrugated and flat; fruit almost globose in outline, densely tomentose.

33. **Pityrodia cuneata** (Gaudich.) Benth., Fl.Aust.5(1870)51; Diels & E. Pritz., Bot. Jahrb.Syst.35 (1904)521; Gard., Enum.Pl.Aust.Occ.3(1931)112; Mold., Résumé Verben. etc. (1959)210, 335, 341; Blackall & Grieve, West. Aust.Wildfls 3(1965)570; Beard (Ed.), W.Aust.Pl. edn 2 (1970)114; Mold., Fifth Summary, Verben.etc.1 & 2(1971)347, 603, 615; Burbidge & George, J.Roy.Soc.W.Aust.60(1978)83.

Type: *C. Gaudichaud s.n.*, Shark Bay, Western Australia, 1817-20 (P, lectotype designated here; FI, G Herb. DC - isolectotypes).

Quoya cuneata Gaudich. in Freyc. Voy.Bot.(1828) 11, 12, t. 66; ibid(1829)454, *basionym*; Presl, Rep.Bot.Syst.1 (1834)143; Walp., Rep.Bot.Syst.4(1845)37; Schauer in DC., Prod.11(1847)697; Bocq., Rev.Verbén.(1863)133, t,3, fig. 1-7.

Type: As for *Pityrodia cuneata* (Gaudich.) Benth.

Chloanthes cuneata (Gaudich.) F. Muell., Syst.Cens.Aust.Pl.1(1882)103, based on *Quoya cuneata* Gaudich.; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172.

Chloanthes oldfieldii sensu F. Muell., Fragm.6(1868)157 p.p. quoad syn. *Quoya cuneata* Gaudich.

Typification

The protologue of this species, which is based on *Quoya cuneata* Gaudich. comprises plate 66 and the particulars of its drawings on pages 11 and 12 (Gaudich. in Freyc.Voy. Bot.(1828)t.66, p.11 & 12). Over a year later, the name *Quoya cuneata* reappeared on page 454 of the above publication with a reference to plate 66. It also contained brief information about the place of (type) collection and mention of the name of the Surgeon-major, Doctor Quoy, who accompanied the author during the expedition as a zoologist, and after whom the new genus was named.

The above plate appears to be of a fresh specimen bearing flowers and fruit, but the syntypes in Herb. FI, G-DC and P are leafy twigs without any flower or fruit. Bentham (1870), therefore, regarded the above (Gaudichaud's) type specimens as "far advanced" and Schauer (1847) considered the one in Herb. G-DC as "imperfect". In view of this, Bentham (1870) took the flower details chiefly from Gaudichaud's above plate and perhaps a similar procedure was adopted by Schauer (1847). During present investigation, the flowering specimen upon which the plate 66 was based is not available from the herbaria where Gaudichaud's types or their duplicates are now preserved. It seems, therefore, that the specimen was probably discarded after preparing the drawings and is not extant. The available syntypes, however, certainly belong to the type collection of which the one in Herb. P is well preserved and can be easily identified. This specimen is designated here as the lectotype for this species.

Description (Fig. 33)

A divaricate shrub of 0.6-3.5 m high. *Stem* and branches densely clothed with branched woolly tomentum of pale white or brownish hairs. *Leaves* sessile, obovate or cuneate, obtuse, entire or denticulate along the distal end, contracted below the middle, sometimes dilated at the base, bullate-rugose on both surfaces, woolly tomentose, (6-) 8-15 (-25) mm long, (3-) 5-7 (-10) mm broad above the middle, the venation prominent underneath. *Flowers* pedicellate, axillary solitary or 3 together in pedunculate cymes; pedicel 3-5 mm long, densely tomentose; bracts sessile, elliptic-ovate or somewhat oblong-obovate, obtuse, shorter than pedicel, tomentose on abaxial surface, glabrous on adaxial surface, 2-3 mm long, 1-1.5 mm broad; bracteoles short, sessile, oblong-ovate, tomentose on abaxial surface, c. 1 mm long, c. 0.5 mm broad. *Calyx* persistent, 5 lobed with a very short tube at the base, 5-6 (-7) mm long, reticulate inside, densely clothed with branched woolly tomentum outside, sparsely hairy inside on the free portions of the lobes; lobes more or less distinctly arranged into two lips, membranous and more deeply 2-lipped in fruit, oblong-ovate, obtuse, (2-) 3-5 mm long, 1.5-2 mm broad; the 3-lobed upper lip larger than the lower lip; tube short, 0.5-1 mm long. *Corolla* blue, but becoming white, with purple spots in throat and tube, 8-12 (-14) mm long, pubescent outside, villous inside on the large lower lip with a few sparse and short hairs running down into the tube, a dense hairy ring inside the tube above the ovary; the anterior lobe of the lower lip much larger than the other 4 lobes, broadly elliptic or almost orbicular in outline, 5-6 (-8) mm long, 6-7 (-9) mm broad; the other 4 lobes elliptic-ovate or broadly ovate, 2-3 (-4) mm long, 2-3 mm broad at the base; tube dilating within or immediately above the calyx, broadly campanulate above the inner ring of hairs, c. 5 mm long, 4-6 mm broad at the top end. *Stamens* shortly exserted; filaments glabrous, filiform, 2-3 (-4) mm long; anthers more or less orbicular in outline; lobes oblong, free in the lower halves, 1-1.5 mm long, c. 0.5 mm broad, lobes of the two lower anthers with prominent appendages at the lower ends, the upper anthers with short tubercles at the lower tip. *Ovary* more or less globose, c. 1 mm long, nearly as broad, densely woolly; style included or scarcely exserted, filiform, glabrous with a few sparse hairs towards the base, 5-7 mm long, shortly 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, broadly ellipsoid-globose, slightly compressed, splitting into two separate 2-celled hemispherical nutlets, pubescent

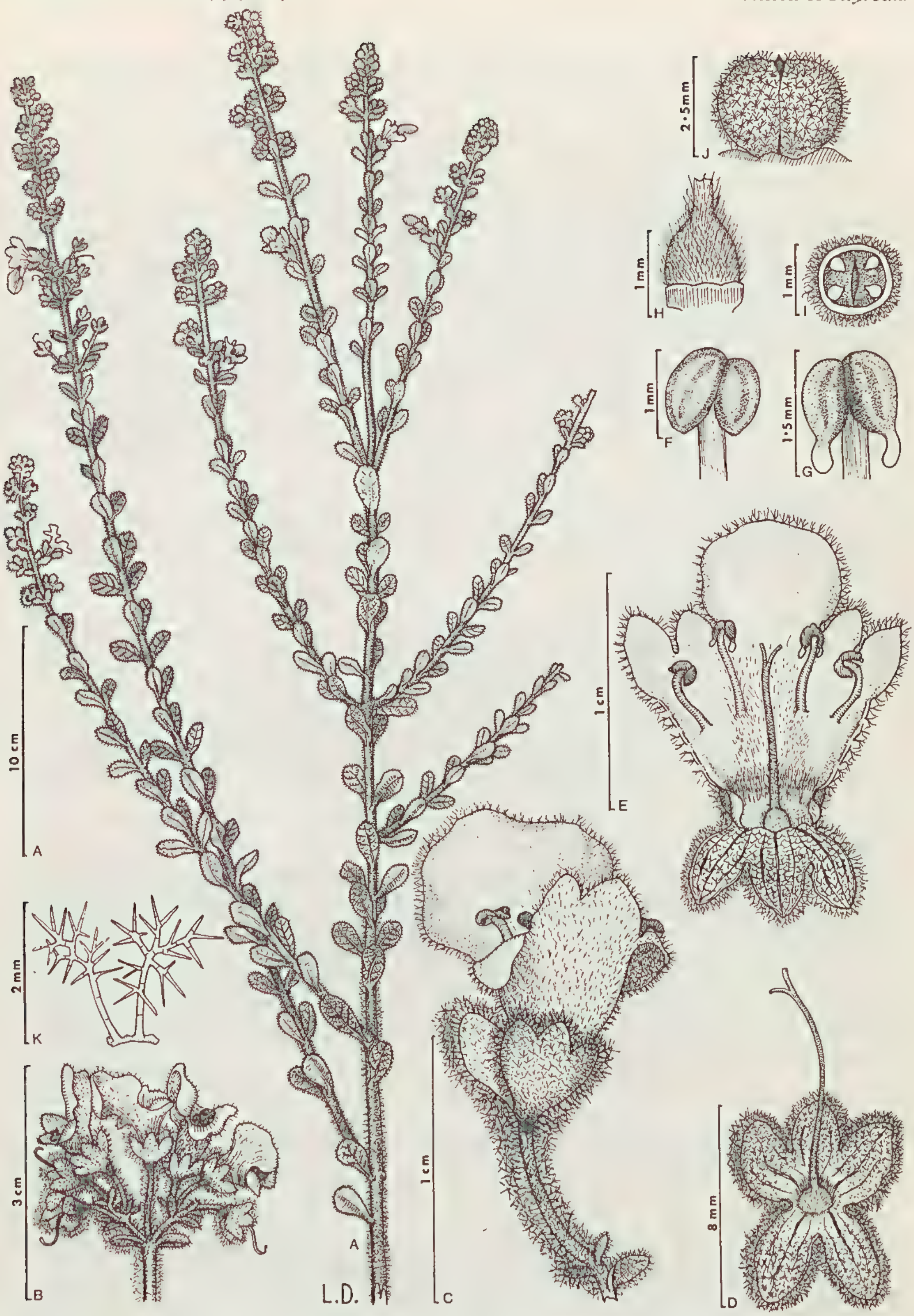


Fig. 33. *Pityrodia cuneata* (Gaudich.) Benth. (*A.M. Ashby 2193*: AD). A, flowering branch; B, cyme; C, flower with a bract and two bracteoles; D, calyx spread open to show its 2-lips and gynoecium inside; E, flower with corolla-tube vertically cut open to show androecium and gynoecium; F, upper stamen; G, lower stamen; H, ovary; I, transverse section of ovary; J, fruit; K, calyx-hairs.

with faint reticulation all over, 2-2.5 mm long, 2-3 mm broad in the upper half.

Specimens examined

WESTERN AUSTRALIA (23 collections seen): *Ashby 2193*, 185 km north of Geraldton, 30.vii.1967 (AD). *Beard 3025*, 468 miles Carnarvon Highway, 25.viii.1963 (Kings Park Perth). *Beard 6784*, Nanga Station, 10.x.1973 (NSW, PERTH). *Bennett 1475*, 436 miles N.W. Coastal Highway, 2.x.1966 (PERTH). *Blackall 4619*, Shark Bay, 6-7.ix.1940 (PERTH). *Burns 25*, 430 m.p. on Great Northern Highway, 11.viii.1968 (PERTH). *Carr 378*, 1.5 miles from turnoff from Denham road on Tamala Station road, 16.iii.1968 (PERTH). *Clyne s.n.*, half-way between Carnarvon and Geraldton, Sept. 1969 (NSW 138372). *Demarz 4038*, Shark Bay road, 38 miles from turn-off, 17.x.1972 (PERTH, Kings Park Perth). *Gardner 2572*, 20 miles south of Shark Bay, 29.viii.1931 (PERTH 3 spec.). *Gardner 13196*, Murchison River, 19.viii.1961 (PERTH 2 spec.). *Gardner 13518*, near Peron Peninsula, 24.viii.1961 (PERTH 2 spec.). *Gardner & Blackall 568*, 70 miles S. of Hamelin Pool, N. of Geraldton, 28.viii.1931 (PERTH). *Gaudichaud s.n.*, Shark Bay, 1817-20 (FI, G-DC, P - syntypes of *Quoya cuneata* Gaud.). *George 11555*, Dirk Hartog Island, 5.ix.1972 (PERTH). *George 11615*, c. 56 km S of Denham, 9.ix.1972 (PERTH). *George 9551*, 34 miles S of Denham, 26.viii.1969 (PERTH). *George 10364*, 4 miles N of Wannoo Roadhouse, ± 114° 35′ E, 26° 44′ S, 9.ix.1970 (PERTH). *Milne s.n.*, Shark Bay, waste places, undated (K, PERTH). *F. Mueller s.n.*, loc.cit., Oct. 1877 (MEL 2 spec.). *Rogerson 296*, Peron Peninsula, road from Shark Bay to the Overlander, Oct. 1966 (PERTH). *Shaw 611*, 175 km north of Geraldton, 2.x.1966 (AD). *Short 399*, near the bridge on N.W. Coastal Highway, 27° 05′ S, 114° 38′ E, 9.viii.1977 (AD 3 spec.).

Distribution (Map 9A)

P. cuneata is endemic to Western Australia. The main distribution is restricted around Shark Bay with only one record near the Murchison River along the North West Coastal Highway.

Comments

In Blackall & Grieve (1965), all four stamens in the cut open flower-drawing are shown to have an appendage at the lower end of their lobes. Actually, only the lower two stamens beside the large middle corolla-lobe are appendiculate.

The fruit of *P. cuneata* closely resembles that of *Chloanthes* R.Br., but its 2-lipped persistent calyx is not found in any member of the latter genus. The 2-lipped calyx seems similar to those in the Lamiaceae, but the rest of the flower characters resemble more closely *Pityrodia* than Lamiaceae.

Affinities

P. cuneata seems nearest to *P. atriplicina* and *P. paniculata* in the majority of flower characters, but its 2-lipped calyx place it more close to *P. paniculata*. From both of these species, however, *P. cuneata* may readily be distinguished by its stem and leaf indumentum being woolly, pale white or brownish; leaves bullate-rugose on both surfaces, with distinct venation underneath; cyme-peduncle shorter; pedicel longer, mostly 3-5 mm long; calyx distinctly 2-lipped as in *P. paniculata*, but the lobes oblong-ovate with distinct reticulate venation on the inner surface. Calyx-lobes in *P. paniculata* are oblong-spathulate or obovate and without distinct venation.

34. **Pityrodia atriplicina** (F. Muell.) Benth., Fl.Aust.5(1870)52; F. Muell., Fragm.9 (1875)5; Briq., Mém.Soc.Phys.Genéve, 32(2), no. 8 (1896)78; Diels & E. Pritz., Jahrb.Syst.35(1904)522; Gard., Enum.Pl.Aust.Occ.3(1931)112; Gard., Wildfls West. Aust.(1959)132; Mold., Résumé Verben.etc. (1959)210, 251, 335, 341; Beard (Ed.), W. Aust.Pl. edn 1(1965)92; Blackall & Grieve, West.Aust.Wildfls 3(1965)572; Beard (Ed.), W.Aust.Pl. edn 2(1970)114; Mold., Fifth Summary Verben.etc.1 & 2(1971)347, 425, 603, 615; Burb. & George, J.Roy.Soc.W.Aust.60(1978)83.

Type: *A. Oldfield s.n.*, "In campsi arenosos ad flumen Murchison", undated (MEL 69245, lectotype designated here; BR, GOET, K, MEL 41219, MEL 69246, W - isolectotypes).

Chloanthes atriplicina F. Muell., Fragm.1(1859)235, *basionym*; F. Muell., Fragm.2(1860)23, in obs; F. Muell., Fragm.6(1868)157; F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172; Ewart & Davies, Fl.N.Terr.(1917)239, in obs.

Type: As for *Pityrodia atriplicina* (F. Muell.) Benth.

Typification

P. atriplicina (F. Muell.) Benth. is based on A. Oldfield's collection (s.n.), consisting of at least seven duplicates. Since the author did not select any one of them as a type, it is, therefore, necessary to choose a lectotype for this name. The syntype preserved in Herb. MEL(no. MEL 69245), where F. Mueller's herbarium and types are now housed (Stafleu, 1967), was annotated by F. Mueller and almost certainly used by him in preparing the original description of this species. The specimen is particularly complete and well preserved. It is chosen here as the lectotype for this species.

Description (Fig. 34)

A much-branched shrub 1-2.5 m tall. *Stem* and branches canescent-hoary with dense but close and short tomentum, sometimes looser and almost floccose on the branches. *Leaves* sessile or contracted into a short petiole, broadly elliptic or almost orbicular, obtuse, entire, 1-2.5 (-3.5) cm long, (0.5-) 1-2.5 (-3) cm broad, the venation often concealed by the short cineraceous tomentum. *Flowers* pedicellate, usually 3-7 together in pedunculate axillary cymes towards the end of branches, rarely solitary, forming often a short broad leafy panicle; cyme-peduncle densely canescent-hoary, (5-) 8-15 mm long; pedicel densely covered with canescent-hoary tomentum, 2-4 (-5) mm long; bracts sessile, narrowly elliptic-oblong or ovate, tomentose on abaxial surface, glabrous on adaxial surface, (1.5-) 2-3 mm long, more or less 1 mm broad; bracteoles smaller but similar to bracts, 1-1.5 mm long, ca. 0.5 mm broad. *Calyx* persistent, divided to above the middle into 5 lobes, tubular towards the base, 6-8 (-10) mm long, densely canescent-hoary outside and on the upper inner halves of the lobes, glabrous inside the tube; lobes oblong-ovate, obtuse, 3-5 mm long, 2-3 mm broad at the base; tube narrowing towards the base, 2-3.5 (-5) mm long. *Corolla* pink with purple spots in throat, 1.5-2.5 cm long, pubescent outside with branched tomentum, glabrous inside excepting the dense hairy ring above the ovary, and the sparse villous hairs extending to the large anterior lobe of the lower lip; the anterior lobe almost twice as large as the others, more or less orbicular in outline, 6-10 mm long, (6-) 8-11 (-12) mm broad; the other 4 lobes nearly equal, more or less ovate, 3-5 (-6) mm long, 4-5 (-6) mm broad at the base; tube much dilated within or immediately above the calyx, 6-9 mm long, 8-11 mm broad at the top end. *Stamens* included or shortly exserted; filaments filiform, glabrous, the lower pair with a few hairs towards the base, 4-5 mm long, the upper pair 3-4 mm long; anthers (excluding appendages) more or less orbicular in outline, the lower pair of anthers with well developed appendages at lower ends of the lobes, lobes oblong, 2-2.5 mm long (including appendages), the upper pair of anthers usually without enations, lobes 1-1.5 mm long. *Ovary* globose, 1-1.5 mm in diameter, densely tomentose; style included, filiform, glabrous, 6-8 mm long, shortly 2-lobed at the apex. *Fruit* enclosed within the persistent calyx, more or less ellipsoid or ovoid, densely hairy with branched tomentum, 3-4 mm long, nearly the same in diameter, splitting longitudinally into two separate nutlets.

Representative specimens

WESTERN AUSTRALIA (52 collections seen): *Ashby 303*, west of Yuna ca. 34 km east of Northampton, 28.viii.1963 (AD). *Ashby 1832*, Kalbarri, Murchison Sand Plain Reserve, 15.vii.1966 (AD, PERTH). *Beard 6743*, 24 m. N of Murchison River on N.E. Coastal Highway, 7.x.1973 (NSW, PERTH). *Beard 6791*, between Hamelin and Tamala, 10.x.1973 (NSW, PERTH). *Blackall 4673*, Nilemah, near Shark Bay, Sept. 1940 (PERTH). *Blackall & Gardner 579*, 48 km N of Ajana, 28.viii.1931 (PERTH 2 spec.). *Brockway s.n.*, 32 km N of Ajana, Oct. 1947 (CANB, PERTH). *M. Brown s.n.*, near E. shore of Western Harbour, Shark Bay, 1863 (MEL 69249). *Burbidge 2210*, Ajana sand plain, 2.ix.1947 (AD, CANB, MEL). *Burns 1*, Murchison River Reserve, Kalbarri, 22.x.1965 (PERTH). *Burns 7*, Spalding Park, 3 m. N of Geraldton, 7.ix.1965 (PERTH). *Burns 40, 41*,

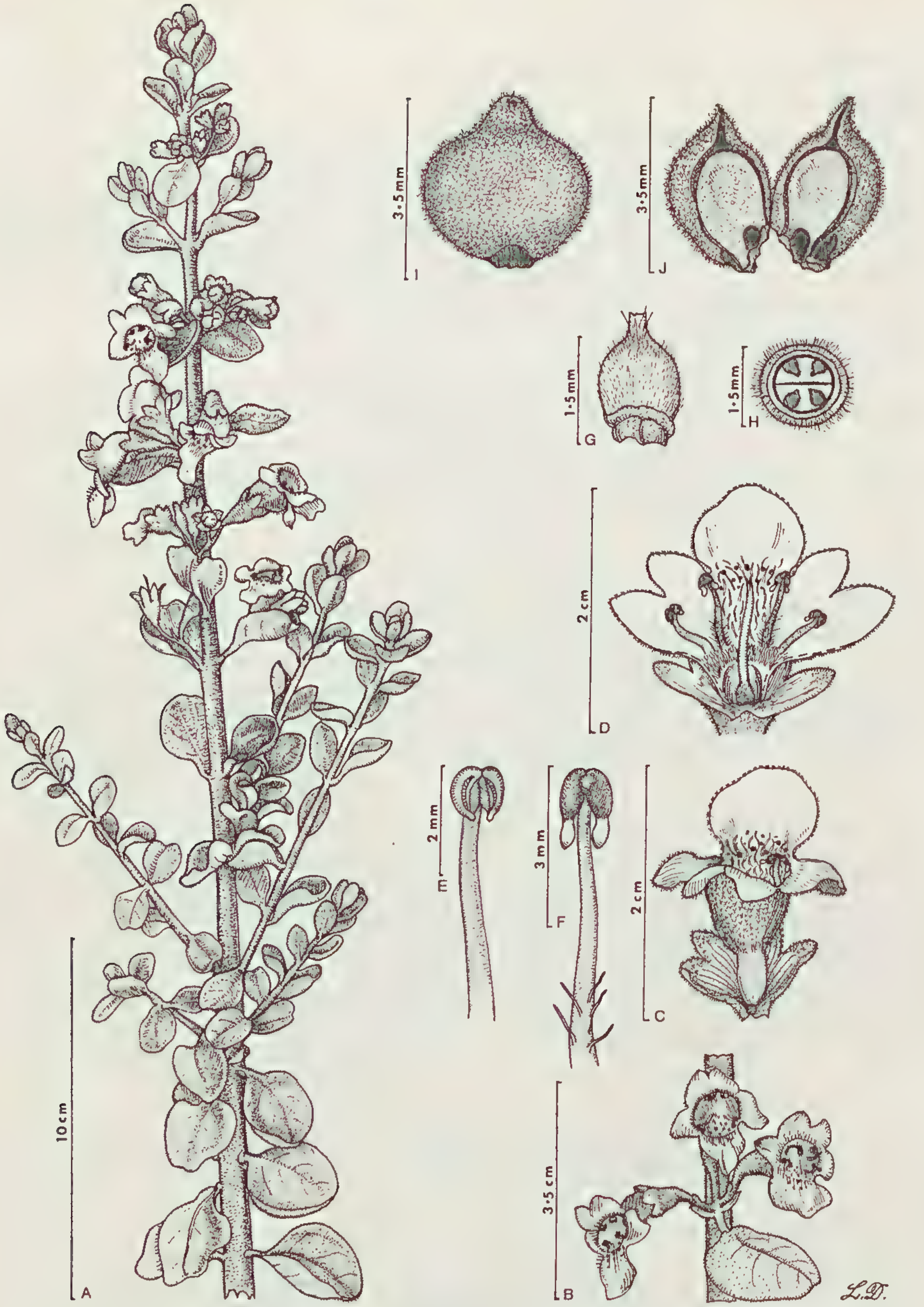


Fig. 34. *Pityrodia atriplicina* (F. Muell.) Benth. (*D & N. McFarland NM 1238*: AD). A, flowering branch; B, cyme; C, flower with calyx vertically cut open to show corolla-tube; D, flower with calyx and corolla vertically cut open to show androecium and gynoecium; E, upper stamen; F, lower stamen; G, ovary; H, transverse section of ovary; I, fruit; J, fruit split open into two halves.

42, between Mumby and Balline, W of Northampton, 27.ix.1970 (PERTH). *Cunningham 249*, Dirk Hartog Island, 1821-2 (BM). *Demarz 732*, 30 mile post on Kalbarri Road, 18.xi.1968 (PERTH). *Drummond 6th coll. no. 138*, Murchison River, 1851 (CGE, E, G, K, MEL 2 spec., NSW, P, W). *Gardner 2582*, lower Murchison River, 30.viii.1931 (PERTH 4 spec.). *Gardner 6002*, 29 m. N of Galena, Murchison River, 17.ix.1941 (PERTH). *Gardner 8598*, Ajana sand plain, 2.ix.1947 (PERTH). *George 11549*, Dirk Hartog Island, 5.ix.1972 (PERTH). *George 9560*, 7 miles along Tamala road from Hamelin-Denham road, 26.viii.1969 (PERTH). *Gray s.n.*, Greenough Flats, undated (MEL 69250). *Lullfitz 4296*, 410 mile peg S of Carnarvon, 20.x.1965 (L, PERTH, Kings Park Perth). *McFarland 1238*, Howatharra Hill Reserve, 28° 32′ S, 114° 38′ E, 25.ix.1977 (AD 4 spec.). *F. Mueller s.n.*, Murchison River, Oct. 1877 (MEL 69251-2). *F. Mueller s.n.*, Shark Bay, Oct. 1877 (MEL 69228). *F. Mueller s.n.*, Greenough Flats, undated (M). *Oldfield s.n.s*, in sandy plain towards Murchison River, undated (MEL 69245, lectotype of *Chloanthes atriplicina* F. Muell.; BR, GOET, K, MEL 41219, MEL 69246, W - isolectotypes). *Phillips 1314*, 11 miles inland from Kalbarri, 19.ix.1968 (CBG). *E. Pritzel 637*, in the thicket between the Moore River and Murchison River, Sept. 1901 (B, BM, BR, E, G, GH, HBG, K, L, M, MO, NSW, S, US, W). *Went 30*, N of Northampton, 7.ix.1962 (GH, MO, PERTH, US). *Wittwer 1813*, Tamala, 12.viii.1976 (PERTH).

Distribution (Map 9B)

P. atriplicina is endemic in the west-south-west of Western Australia where it seems to be restricted between 26° and 29° S, and between 113° and 115° E. The main distribution is between Geraldton and Shark Bay. Elsewhere, it is known from Greenough Flats, south of Geraldton, and from Dirk Hartog Island in the Shark Bay.

Comments

P. atriplicina was originally described by F. Mueller (1859) as a species of *Chloanthes* R.Br., but in 1875 he noted it as *Pityrodia* R.Br. species. In his subsequent publications, however, F. Mueller (1882, 1889) recorded all *Pityrodia* species under the genus *Chloanthes*. (See further "Comments" under *P. verbascina*).

Bentham (1870) considered the calyx-lobes shorter than the tube, but in fact the calyx-tube is found to be shorter than its lobes. The misunderstanding seems to have been caused by the dense woolly calyx tomentum which completely fill the space between the lobes in the lower halves, and superficially gives the aspect of a calyx-tube.

Abnormal leaves are noticed in F. Mueller's collection (no. MEL 69252) from the Murchison River in which some leaves are found to be up to 5.5 by 3 cm. This is more than double the average leaf-size in the species.

P. atriplicina seems to grow in the same general area where *P. cuneata*, *P. oldfieldii* and *P. verbascina* are found. Nevertheless, *P. atriplicina* has been recorded from neighbouring Dirk Hartog Island where none of these species occur.

According to Ewart & Davies (1917), this species is "recorded from Northern Australia in National Herbarium Census". During present investigations, *P. atriplicina* is found to grow nowhere outside Western Australia. Even within Western Australia, the distribution is limited to the west-south-west.

Beard (1965, 1970) recorded this species from Gardner & Bennett's (1956) botanical district Darling in the South Western Province. This area seems too far south from its known habitat and there is no record to confirm its occurrence there. The main distribution is found to be in the Irwin district of the South Western Province and in its adjacent areas of the Austin district in the Eremean Province.

Affinity

P. atriplicina is nearly allied to *P. paniculata* in the majority of flower characters and in having the same close cineraceous indumentum on stem, leaves and peduncle. Nevertheless, it can easily be identified by its leaves being broadly ovate-obovate or almost orbicular; inflorescence not lax; cyme-peduncle shorter; calyx divided into lobes to above the middle only; lobes not arranged into 2-lips, oblong-ovate, glabrous on the lower inner halves; fruit elliptic-ovoid, shortly conical at the top.

35. **Pityrodia byrnesii** Munir sp. nov.

Caules et rami teretes, dense glandulosi et pubescentes; pilis ferrugineo-aurantiacis. Folia sessilia, verticillata terna, oblonga vel anguste elliptica, integra, breviter mucronata, 1.2-3 cm longa, 4-10 mm lata, glanduloso-viscida, sparsim pubescentia. Sepala extus glandulosa et pubescentia, lobis lanceolatis, acutis, 4-7 mm longis, 1.5-3 mm latis, tubo 3-4.5 mm longo. Corolla albi; tubus subcylindricus. Stamina breviter exserta. Fructus obovoidei, glandulosi, pubescentes.

Type: *V. Balgooy & N. Byrnes 1306*, 5 km south-east of East Alligator River Crossing, Arnhem Land, Northern Territory, Australia, 27.vii.1971 (L, holotype; CANB, MO - isotypes).

Description (Fig. 35)

A branched glandular shrub of about 1 m. *Stem* and branches terete, densely clothed with an indumentum of glands and more or less short stellate hairs interspersed with long-stalked septate hairs branching at the top, the old stem ferrugineous-orange. *Leaves* sessile, in whorls of 3, oblong or narrowly elliptic, flat, entire, shortly mucronate, (1.2-) 1.5-3 cm long, 4-10 mm broad, glandular-viscid, sparsely sprinkled with short and branched hairs, smooth above, with raised midrib underneath. *Flowers* sessile or shortly pedicellate, axillary and solitary, shorter than the leaves; pedicel glandular and tomentose, 1-2 mm long; bracts represented by the upper leaves; bracteoles sessile, oblong-lanceolate, entire, acute, glandular, sparsely sprinkled with a short pubescence, 6-11 mm long, 1.5-2.5 mm broad. *Calyx* persistent, more or less campanulate, longitudinally ribbed, divided more than half-way down into 5 lobes, 8-12 mm long, densely glandular and pubescent outside, pubescent inside the lobes, glabrous inside the tube; lobes lanceolate, ribbed on the back, acute, 4-7 mm long, 1.5-3 mm broad; tube campanulate, 3-4.5 mm long. *Corolla* off-white with deep purple streaks on the upper lip, 11-13 mm long, pubescent outside on the lobes only, with a dense hairy ring inside the tube below the insertion of stamens and a few sparse villous hairs extending to the central lobe of the lower lip; the upper lip erect, 2-lobed, shorter than the lower, the lobes oblong-elliptic or ovate-elliptic, with longitudinal purple veins, 3-4 mm long, 1.5-2 mm broad; the lower lip spreading, 3-lobed, the central lobe larger than the two lateral, more or less oblong-elliptic, 4-5 mm long, 1.5-2 mm broad, the lateral lobes narrowly elliptic-oblong, 3.5-4 (-5) mm long, 1.5-1.8 mm broad; tube almost cylindrical, glabrous outside, 5-8 mm long, 1.5-2.5 mm broad at the top end. *Stamens* shortly exserted, inserted in the corolla throat; filaments filiform, glabrous, the upper pair 2-2.5 (-3) mm long, the lower pair 2.5-3 mm long; anthers more or less orbicular in outline, 0.8-1 mm long, nearly as broad; lobes narrowly elliptic-oblong, shortly appendiculate at the lower ends, free and divergent in the lower halves. *Ovary* globose, glandular and densely pubescent-tomentose, 1-1.3 mm in diameter; style shortly exserted, filiform, glabrous, 7-10 (-12) mm long, minutely 2-lobed at the top. *Fruit* obovoid, glandular and pubescent, 3-4 mm long, 2.5-3 (-3.5) mm broad, apparently non-dehiscent; seeds not seen.

Specimens examined

NORTHERN TERRITORY: *Balgooy & Byrnes 1306*, 5 km south-east of East Alligator River Crossing, Arnhem Land, 27.vii.1971 (L, holotype; CANB, MO - isotypes). *Byrnes 916*, north bank of East Alligator River, 12° 25′ S, 133° 00′ E, 4.ix.1968 (BRI, DNA, L, NT).

Distribution (Map 9C)

P. byrnesii is endemic in Arnhem Land, Northern Territory, where it has been recorded from about 10 km south-west of Oenpelli near the East Alligator River.

Comment

The shrubs of this species are fragrant (*Van Balgooy & Byrnes 1306*).

Fig. 35. *Pityrodia byrnesii* Munir (*V. Balgooy & N. Byrnes 1306*: CANB, isotype). A, flowering twig; B, portion of stem showing hair types; C, flower in the axil of a leaf with two bracteoles; D, flower with calyx vertically cut open to show corolla-tube; E, corolla-tube vertically cut open to show androecium and gynoecium; F, lower stamen; G, upper stamen; H, ovary; I, transverse section of ovary; J, fruit.

Affinities

P. byrnesii is closely related to *P. ternifolia* in its stem being densely clothed with a short glandular tomentum intermixed with long and branched spreading hairs; leaves sessile, in whorls of 3, glandular; flowers axillary and solitary; calyx campanulate, ribbed, glandular and hairy outside; corolla-tube almost cylindrical, with the upper lip erect and streaked purple; stamens and style shortly exserted; anthers more or less orbicular in outline; fruit obovoid, pubescent. Nevertheless, *P. byrnesii* may easily be distinguished by its stem and leaves being covered with sessile glands, much less sticky; leaves entire, ovate-oblong, or narrowly elliptic; calyx-lobes not glandular inside; corolla pale white; stamens inserted in the corolla-throat; anther-lobes more distinctly appendiculate; ovary and fruit with glands mixed with the pubescence. In *P. ternifolia*, the glands are mostly on the tip of short hairs, leaves are very sticky and prickly with dentate margins, calyx-lobes glandular on the inside as well, corolla mauve or pink-red and ovary and fruit without any glands.

P. byrnesii is also close to *P. gilruthiana* and *P. pungens* in its leaves being sessile in whorls of 3; flower axillary and solitary; calyx ribbed; corolla pale white with the upper lip erect and deeply streaked purple; stamens and style shortly exserted; anther more or less orbicular in outline and fruit obovoid. However, both *P. gilruthiana* and *P. pungens* differ from *P. byrnesii* in their leaves being narrowly linear-lanceolate and ovary and fruit without any glands. *P. pungens* may be further distinguished by its very pungent leaves and corolla equal to the calyx or shorter.

36. **Pityrodia terminalis** (Endl.) George, Nuytsia, 1(1972) 289; R. Erickson et al., Fl. Pl.West.Aust.(1973)114, t.342; Gard., Wildfls West.Aust. edn 11(1973)119, 120.

Type: *J.S. Röe s.n.*, interior of Western Australia, undated (W, holotype).

Dasymalla terminalis Endl., in Endl. & Fenzl, Nov.Strirp. dec.2(1839) n. 12, *basionym*; Walp., Rep.Bot.Syst.4 (1845)139; DC., Prod.11(1847)705.

Type: As for *Pityrodia terminalis* (Endl.) A.S. George.

Pityrodia racemosa (Turcz.) Benth., Fl.Aust.5(1870)50 exclud.syn. *D.axillaris* Endl.; Briq., Mém.Soc.Phys. Genéve 32(2), no. 8(1896)78; Diels & E. Pritz., Bot.Jahrb.Syst.35(1904)521; S. Moore, J.Linn.Soc. London 45 (1920)189; Mold., Résumé Verben.etc. (1959)210.

Type: *J. Drummond 3rd coll. no. 141*, Swan River Colony, Western Australia, 1845 (BM, G, K, LE, MEL 2 spec., W - syntypes); *J. Drummond Suppl. 5th coll. no. 73*, loc.cit, 1848 (BM, FI, G 2 spec., K 3 spec., LE, MEL 3 spec., P, PERTH, W - syntypes).

Quoya racemosa Turcz., Bull.Soc.Nat.Mosc.36(2) (1863)194, *basionym* of *P. racemosa* (Turcz.) Benth. .

Type: As for *Pityrodia racemosa* (Turcz.) Benth.

Chloanthes stachyodes F. Muell., Fragm.5(1865)50; F. Muell., Fragm.6(1868)158 exclud. syn. *Dasymalla axillaris* Endl.; F. Muell., Syst.Cens.Aust.Pl.1(1882)103; F. Muell., Syst.Cens.Aust.Pl.1, edn 2(1889)172; Mold., Résumé Verben.etc. (1959)251.

Type: *F.v. Mueller s.n.*, near Mt Walter, Lat. 30° 15′ S, Long. 118° 45′ E, undated (MEL 69254, holotype).

Quoya stachyodes F. Muell., Fragm.5(1865)50, nom.nud. pro syn. *Chloanthes stachyodes* F. Muell.

Chloanthes grandiflora Mold., Phytologia 2(1947)310; Mold., Résumé Verben. etc. (1959)208; Mold., Fifth Summary Verben. etc. 1(1971)345.

Type: *J. Mauritzon s.n.*, Western Australia, Sept. 1936 (S, holotype; LD, isotype).

Pityrodia axillaris sensu Druce, Rep.Bot.Exch.Cl.Brit.Isles 1916 (1917)640 p.p. quoad syn. *Quoya racemosa* Turcz. and *Dasymalla terminalis* Endl.; Gard., Enum.Pl.Aust.Occ.3(1931)112 p.p. quoad syn. *P. racemosa* (Turcz.) Benth.; Gard., Wildfls West.Aust. (1959)132 p.p. quoad description and t. page 130; Blackall & Grieve, West.Aust.Wildfls 3(1965)570 p.p. quoad syn. *P. racemosa* (Turcz.) Benth. and t. at the front; Beard (Ed.), W.Aust.Pl. edn 2 (1970) 114 p.p. quoad descrip. et distrib.; Mold., Fifth Summary Verben. etc. 1 & 2 (1971) 475, 603 p.p. quoad syn. *D. terminalis* Endl. and *P. racemosa* (Turcz.) Benth.; Gard., West.Aust.Wildfls Vol. B (1972)158, 159 lower plate.

Description (Fig. 36)

An erect shrub of about 0.5-1 (-1.5) m high. *Stem* and branches densely covered with white woolly indumentum of branched hairs. *Leaves* sessile, sometimes stem-clasping, oblong or narrowly elliptic-oblong, obtuse, entire, (1.5-) 2-3.5 (-5) cm long, rarely up to 7.5 cm long, (0.5-) 0.8-1.5 (-2) cm broad, thick and soft, rugose, the rugae concealed by the dense indumentum of branched hairs. *Flowers* axillary solitary or more frequently in cymes of 3 to 5, pedicellate, forming an interrupted terminal leafy raceme; pedicel 3-5 (-7) mm long, densely tomentose; bracts sessile, elliptic-ovate or oblong-lanceolate, abaxially tomentose, adaxially glabrous, 4-6 mm long, 1-2.5 mm broad; bracteoles sessile, oblong-ovate or more or less lanceolate, tomentose on abaxial surface, glabrous on adaxial surface, 2-4 mm long, 0.5-1 mm broad. *Calyx* persistent, 5-partite almost to the base, shortly tubular at the base, 1-1.2 (-1.5) cm long, densely clothed with branched woolly tomentum outside, glabrous inside with sparse hairs on the upper-inner half; lobes linear-lanceolate, reticulate, (6-) 8-10 mm long, 2-3 mm broad; tube 1-2 mm long. *Corolla* deep purple-pink to claret-red, occasionally pale pink, 1.8-2.7 cm long, puberulous outside, glabrous inside excepting the dense hairy ring above the ovary, and with minute sparse hairs extending to the large anterior lobe; the central lobe of the lower lip almost twice as broad as the other 4 lobes, more or less orbicular in outline, 4-7 mm long, 6-10 mm broad; the other 4 lobes nearly equal, spreading, broadly ovate-suborbicular, (2-) 3-5 (-6) mm long, 4-6 mm broad at the base; tube dilated within or immediately above the calyx, (14-) 15-20 mm long, 8-10 mm broad in the upper half. *Stamens* included; filaments glabrous, filiform, 5-8 (-9) mm long; anthers oblong, (1-) 1.5-2 mm long, c. 1 mm broad, the two anterior somewhat smaller than the two posterior, lobes linear, free in the lower halves, at length diverging, each with a short appendage at the lower end. *Ovary* globose, with two lateral humps when old, 1-1.5 mm in diameter, pubescent in the upper half, glabrous below; style included or scarcely exserted, glabrous, filiform, (14-) 16-20 mm long, 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, somewhat isodiametric, conical at the tip and with a hump on the back of each carpel, splitting into two separate 2-celled hemispherical nutlets, 4-5 mm long, nearly as broad, pubescent.

Representative specimens

WESTERN AUSTRALIA (248 collections seen): *Adams s.n.*,"Nangowine", 1891 (MEL 69221). *Anway 507*, 38 miles east of Southern Cross, 10.x.1965 (AD, NY, PERTH). *Aplin 1930*, 470 km E of Perth on Gt East. Hway, 11.ix.1962 (L, PERTH). *E. Ashby 2707*, Kojonup to Collier, Sept. 1930 (BM, NSW). *Bailey 304*, 1 mile N of Tandagin, Sept. 1947 (CANB, PERTH). *Barrow 53*, Hyden, 6.ix.1966 (Kings Park Perth, PERTH). *Beard 5180*, 10 m E of Southern Cross, 23.x.1967 (PERTH, Kings Park Perth). *Blockley 464*, 50 m S. of Payne's Find, 28.x.1966 (PERTH, Kings Park Perth). *Brockway s.n.*, Murchison district, Oct. 1947 (CANB, PERTH). *Burbidge 4696*, 2 mile N Perenjori, 8.xii.1955 (CANB, PERTH). *Burns 1053*, 390-394 mile peg N of Geraldton, 23.x.1966 (MO, PERTH). *Canning 2725-6*, 22.5 mile W of Moorine Rock, 10.ix.1968 (CBG 2 spec.). *Demarz 3181*, 229 mile post Newdegate Rd, 17.i.1971 (PERTH, Kings Park Perth). *Donner 1391*, 2 km W of Nulla Nulla, 30.ix.1965 (AD). *Drummond Suppl. 5th Coll. no 73*, Swan River Colony, 1848 (BM, FI, G 2 spec., K 3 spec., LE, MEL 3 spec., P, PERTH, W - syntypes of *Quoya racemosa* Turcz.). *Drummond 3rd coll. no. 141*, Swan River colony, 1845 (BM, G, K, LE, MEL 2 spec., W - syntypes of *Quoya racemosa* Turcz.). *Fontteroy & Grasby s.n.*, Dowerin, 5.i.1918 (BRI 190697-8, NSW 135905). *Forrest s.n.*, near Lake Deborah, 1889 (MEL 69268, NSW 135904). *Gardner 2027*, Bendering, 15.xi.1923 (PERTH). *George 121*, 3.4 km W of Bullaring, 7.ix.1976 (PERTH). *Haegi 998*, 90 km NE of Lake King on track to Norseman, 16.ix.1976 (AD). *Helms s.n.*, Elder Expl.Exped., near "Warangering" Wallangering, Nov. 1891 (AD 96323029, AD 97608116, AD 97726002, MEL 69270, NSW 135902). *Koch 1539*, Cowcowing, Oct. 1904 (AD, K, MEL, NSW). *Lullfitz 5563*, W of Lake King, 8.x.1966 (PERTH, Kings Park Perth). *Mauritzon s.n.*, loc. incert. Sept. 1936 (S, holotype of *Chloanthes grandiflora* Moldenke; F photo of holotype; LD, isotype). *F. Mueller s.n.*, near Mt. Walter "Lat. 30° 15′ S, Long. 118° 45′ E", undated, probably 1864 (MEL 69254, holotype of *Chloanthes stachyodes* F. Muell.). *Munir 5239*, 95 km W of Coolgardie, 5.ix.1973 (AD). *Munir 5265*, 25 km S of Narembeen, 7.ix.1973 (AD). *Newby 994*, 1 mile S of Kukerin, 29.ix.1963 (PERTH). *Paust 1022*, 9.2 mile E of Bindi Bindi towards Ballidu, 28.ix.1971 (PERTH). *Phillips s.n.*, 3 mile from Bencubbin towards Trayning, 19.ix.1962 (CBG 012029). *J.S. Röe s.n.*, interior of Western Australia, loc.incert., undated (W, holotype of *Dasymalla terminalis* Endl.). *Stoward 392*, Kununoppin, 1916 (BM). *Thiselton-Dyer 120*, between Cunderdin and "Wedari", 1903 (K). *J. Young s.n.*, near Mt Churchman, undated (MEL 69281).

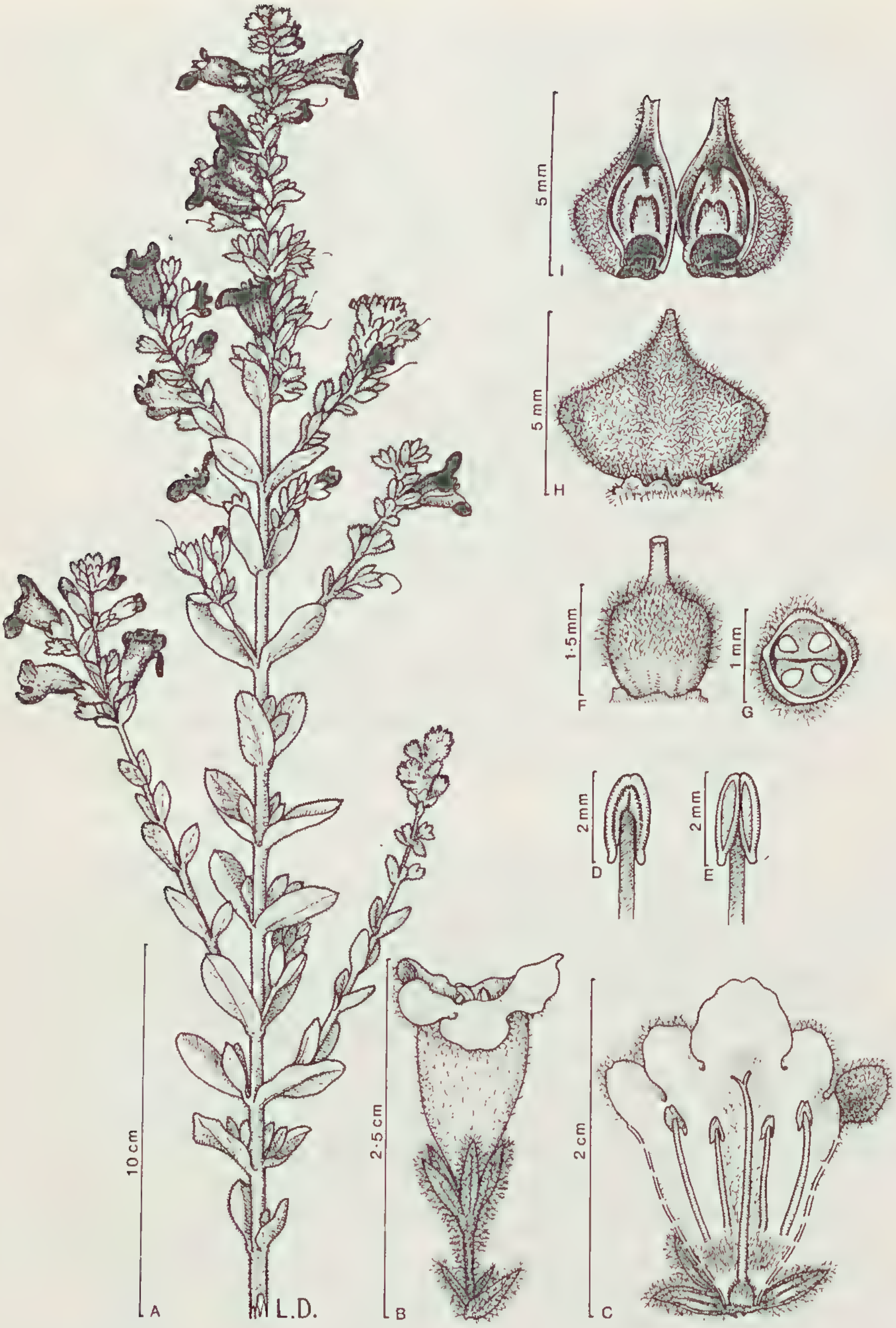
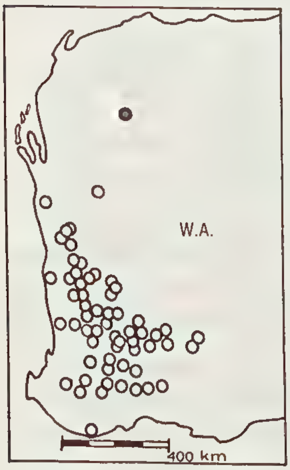


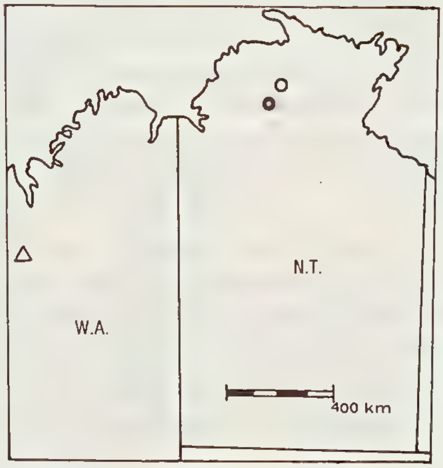
Fig. 36. *Pityrodia terminalis* (Endl.) A.S. George (*J.Z. Weber 5111*: AD). A, flowering branch; B, flower with a bract and two bracteoles; C, flower with calyx and corolla vertically cut open to show androecium and gynoecium; D, lower stamen; E, upper stamen; F, ovary; G, transverse section of ovary; H, fruit; I, fruit split open into two halves.

Distribution (Map 10A)

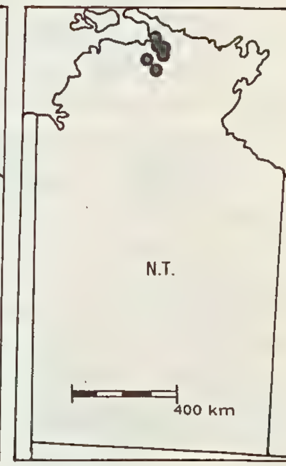
P. terminalis is endemic to south-west of Western Australia. The main areas of its occurrence are in the South Western Province (as defined by Gardner & Bennetts, 1956) and in the Austin and Coolgardie districts of the Eremean Province. The distribution within these areas seems to be restricted between latitude 26° and 35° S, and between longitude 114° and 122° E. In the north it is known from around the Murchison River, extending southwards to King George Sound. The western-most records are from near Geraldton and Perth, spreading eastwards to Kalgoorlie and Lake Lefroy.



Map 10A.
P. terminalis ○
P. augustensis ●



Map 10B.
P. ovata △
P. lanuginosa ○
P. spenceri ●



Map 10C.
P. jamesii ●

Comments

For many years, *P. terminalis* (Endl.) George, *P. axillaris* (Endl.) Druce and *P. racemosa* (Turcz.) Benth., which are based respectively on *Dasymalla terminalis* Endl. (1839), *D. axillaris* Endl. (1839) and *Quoya racemosa* Turcz. (1863) have been erroneously regarded as conspecific. These taxa therefore, have been incorrectly referred to as *P. axillaris* (Endl.) Druce, and before the publication of that combination as *P. racemosa* (Turcz.) Benth. The latter combination was found to be illegitimate because it was not based on Endlicher's earliest available epithet in *Dasymalla* Endl. Therefore, Druce (1917) made a new combination *P. axillaris* (Endl.) Druce, based on *D. axillaris* Endl., with *P. racemosa* (Turcz.) Benth. (= *Quoya racemosa* Turcz.) as a synonym, and following Bentham (1870) and Index Kewensis (1895), incorrectly merged *D. terminalis* Endl. into *D. axillaris* Endl. The name *P. axillaris* (Endl.) Druce, however, was accepted for the species by many subsequent botanists.

The treatments of this species by Bentham (1870) and Druce (1917) indicate that either they had a broad concept of this species or else they could not distinguish these taxa from their original description. Apparently, they did not see the types of *Dasymalla* which are preserved in Herb. W.

George (1972) examined the types and original descriptions of both *Dasymalla* species and segregated them as two distinct taxa. Consequently, he made a new combination *P. terminalis* (Endl.) George, based on *D. terminalis*, with *P. racemosa* (Turcz.) Benth. as a synonym. This combination is accepted in the present revision.

This is one of the most widespread and common species of this genus. Moldenke (1959, 1971) recorded it from Queensland and New South Wales, but so far its occurrence in these states has not been confirmed.

The pedicels of the terminal flowers are always longer than the laterals. Similarly, the filaments of the two anterior stamens beside the large anterior corolla-lobe are longer than those at the posterior. The anthers of the two anterior stamens, however, are smaller than the two at the posterior.

Bentham (1870) described the calyx-lobes as "3-nerved segments". Actually, each calyx-segment (or lobe) has a main central vein with two less prominent veins running parallel along the margin. This seems no peculiarity as such a venation pattern is also present in the calyx-segments of other species of this genus.

Transverse sections of ovary and fruit show that their humps are due to the thickening of their walls along the distal (parietal) ends of septa.

A detailed description and illustration of fruit are presented here for the first time.

This species is popularly called "Native Foxglove" or "Woolly Foxglove".

Affinities

P. terminalis is closely allied to *P. augustensis* in its flowers being pedicellate, arranged in a raceme-like terminal inflorescence of more or less similar shape and colour; stem, leaves and outside calyx densely clothed with similar indumentum; calyx-lobes almost free to the base; corolla-tube abruptly dilated within or immediately above the calyx; stamens and style included; anthers oblong. Nevertheless, *P. terminalis* may easily be distinguished by its leaves being elongate-ellipsoidal and somewhat stem-clasping; calyx and corolla without glands and fruit somewhat isodiametric with a conical tip and a hump on the back of each nutlet.

P. terminalis is also near to *P. axillaris* in its stem and leaves having a similar indumentum, inflorescence terminal, raceme-like, calyx-lobes almost free to the base, corolla-tube abruptly dilated within or immediately above the calyx. However, *P. axillaris* can readily be identified by its leaves being oblong-obovate; calyx-lobes obovate; corolla deep red or yellowish-scarlet, tube almost glabrous outside and with clavate hairs inside below the central lobe of the lower lip, lobes undulate-denticulate; stamens and style much exserted; fruit obovoid with two opposite humps at the top.

37. **Pityrodia ovata** Munir, sp. nov.

Caules et rami teretes, dense tomentosi. Folia sessilia, opposita, ovata, integra, obtusa, marginibus raro leviter recurvatis, 5-15 mm longa, 3-6 mm lata, viscida, pilis densibus glandiferis. Sepala extus glandulosa, lobis lineatis vel lineari-oblongis, fere discretis, lobis linearibus vel lineari-oblongis, margine ciliato, 3-4 mm longis, 0.5-1 mm latis, tubo 0.5-1 mm longo. Corolla alba. Stamina exserta. Ovarium globosum, dense glandulosum; pilis minutis glanduliferis. Fructus visus non.

Type: *J.S. Beard 5686*, 16 km west of McLarty Hill's Oil Camp, Western Australia, 4.vii.1968 (PERTH, holotype; Kings Park Perth, isotype).

Description (Fig. 37)

Dense shrub to 1.21 m. *Stem* and branches cylindrical, densely clothed with a dense yellowish-grey indumentum of branched hairs. *Leaves* sessile, decussate, ovate, entire, obtuse, flat, rarely slightly recurved along the margins, (5-) 7-12 (-15) mm long, 3-6 mm broad, somewhat viscid, densely covered all over with short gland-tipped hairs, smooth above, honey-combed beneath. *Flowers* sessile or shortly pedicellate, solitary or more often 3 together in the axil of upper leaves; pedicel glandular-glutinous, ±1 mm long;

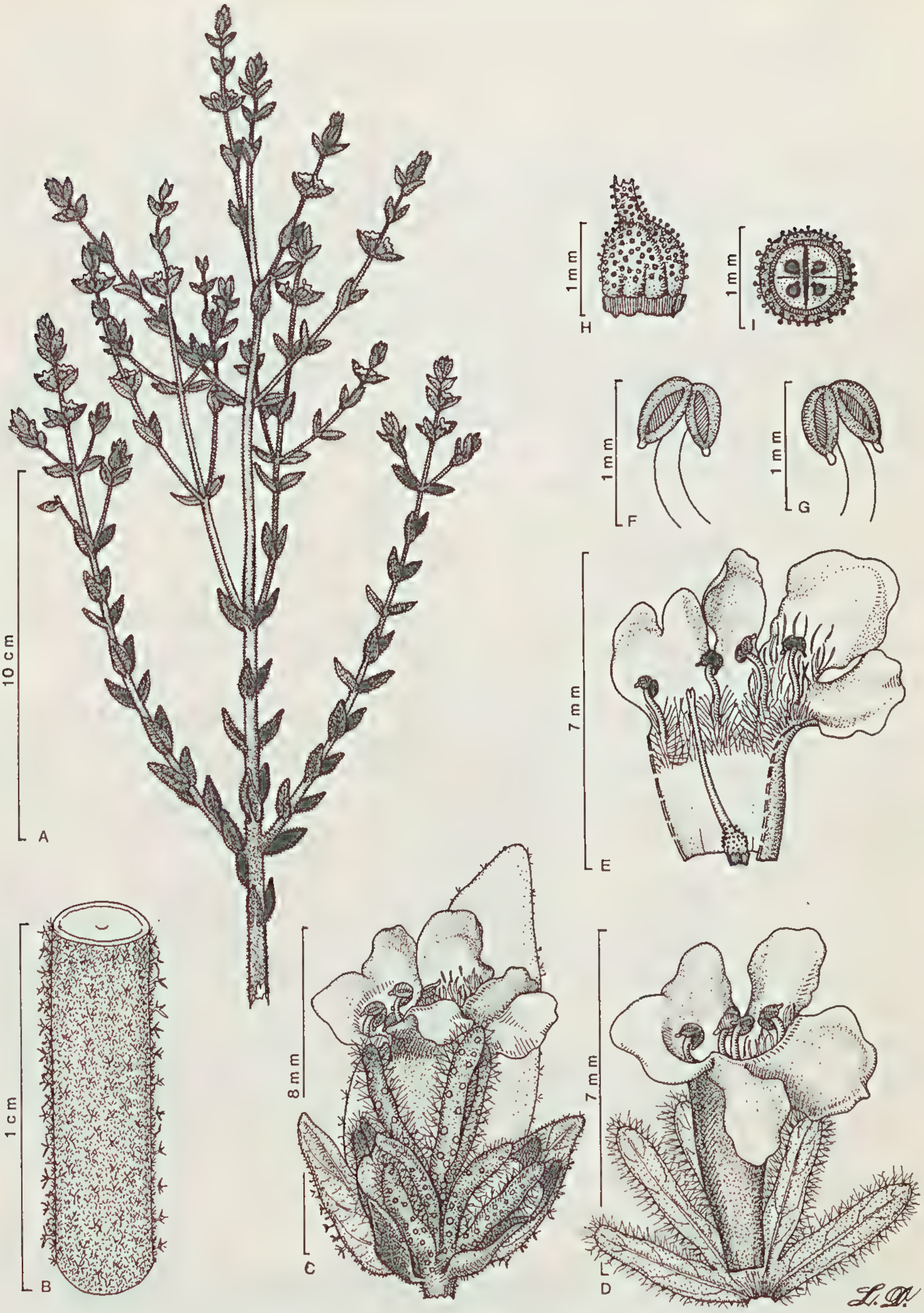


Fig. 37. *Pityrodia ovata* Munir (*J.S. Beard 5686*: PERTH). A, flowering twig; B, portion of stem showing indumentum; C, cyme in the axil of a leaf; D, flower with calyx vertically cut open to show corolla-tube; E, corolla-tube vertically cut open to show androecium and gynoecium; F, upper stamen; G, lower stamen; H, ovary; I, transverse section of ovary.

bracts leafy, sessile, ovate, densely covered with minute gland-tipped hairs, 4-6 mm long, 2-3 mm broad; bracteoles smaller than the bracts, 3-3.5 mm long, 1-1.5 mm broad. *Calyx* persistent, deeply 5-lobed, 3.5-5 mm long, glandular outside excepting the ciliate lobe-margins, glabrous inside the tube; lobes linear or linear-oblong, almost free to the base, obtuse, flat, 3-4 mm long, 0.5-1 mm broad; tube 0.5 (-1) mm long. *Corolla* white, 5-7 mm long, glabrous outside, with a dense hairy ring in the throat below the stamens and a few villous hairs extending to the large central lobe of the lower lip; the central lobe almost elliptic-orbicular in outline, rounded at the apex, 2.5-3 mm long, 2-2.5 mm broad; the lateral lobes of the lower lip narrowly elliptic-oblong, rounded at the apex, 2-2.5 mm long, ± 1.5 mm broad; the lobes of the upper lip ovate, obtuse, 1-1.5 mm long, nearly as broad at the base; tube more or less cylindrical in the lower half, dilated at the top within or immediately above the calyx, 3-3.5 mm long, 2-2.5 mm broad at the top end. *Stamens* exserted; filaments filiform, with a few sparse short gland-tipped hairs, the lower pair 2-2.5 mm long, the upper pair 1-1.5 mm long; anthers more or less orbicular in outline, 0.5-0.8 mm long, nearly as broad, lobes free and divergent in the lower halves, appendiculate at the lower ends. *Ovary* globose, densely covered with glands and minute gland-tipped hairs, ± 1 mm in diameter; style exserted above the corolla-tube, filiform, glabrous, with a few gland-tipped minute hairs towards the base, 4-5 mm long, shortly 2-lobed at the top. *Fruit* not seen.

Specimens examined

The type collection is the only material available for examination.

Distribution (Map 10B)

P. ovata is endemic to the north-north-west of Western Australia, where it has been recorded from west of McLarty Hills in the Great Sandy Desert.

Comments

The description of *P. ovata* was prepared from the type material which lacks fruit. However, the major flower characters, especially the ovary, so closely resemble *P. chorisepala* that it is very likely that their fruits may also be similar.

The location of the dense hairy ring in the corolla-throat is a peculiarity of this species because the hairy ring inside the corolla-tube is generally just above the ovary.

Affinity

P. ovata seems nearest to *P. chorisepala* in its leaves being sessile and more or less of the same shape and size; flowers often 3 together in the axil of upper leaves; pedicel and outside of calyx glandular-glutinous; calyx-lobes linear-oblong, almost free to the base, with tomentum of branched ciliate hairs along the margins; corolla white, glabrous outside; stamens and style shortly exserted, filaments and basal portion of style with a few sparse gland-tipped hairs; ovary glandular with minute gland-tipped hairs. Nevertheless, *P. ovata* may easily be distinguished by its leaves being honey-combed underneath, not contracted at the base, covered all over with short gland-tipped hairs; leaves and inflorescence lax, not crowded towards the apex; pedicel short, ± 1 mm long; calyx-lobes obtuse with rounded tip.

38. **Pityrodia augustensis** Munir, sp. nov.

Caules et rami teretes, pilis densibus, ramosis, viridi-albis. Folia opposita, sessilia, anguste elliptica vel elliptico-lanceolata, versus extrema amba cuneata, obtusa, integra, 3-6 cm longa, 0.6-1.5 cm lata, dense lanuginosa-tomentosa. Sepala atropurpurea, fere discreta; lobis lineari-oblongis, cuneatis, 8-11 mm longis, 2-3 mm latis, tubo 0.5-1 mm longo. Petala extus glandulosa et sparsim lanuginoso-tomentosa, violacea. Stamina inclusa vel interdum vix exserta. Fructus plus minusve lobosi, pubescentes, vix depressi saepe apice.

Type: *J.Z. Weber 4834*, northern slopes of Mount Augustus, North-West Division, Western Australia, 29.ix.1975 (AD, holotype; CANB, K, MEL, PERTH - isotypes).

Description (Fig. 38)

A branched tomentose shrub of about 1 m. *Stem* and branches terete, densely clothed with greenish-white indumentum of branched hairs. *Leaves* opposite, sessile, narrowly elliptic or elliptic-lanceolate, cuneate towards both ends, obtuse, entire, 3-6 mm long, 0.6-1.5 cm broad, thick and soft due to dense woolly tomentum, the reticulation concealed by the tomentum. *Flowers* pedicellate, solitary or more frequently in cymes of 3 to 5, forming terminal woolly racemes of 5-15 cm long; pedicel woolly-tomentose, glandular, usually 2-5 mm long, sometimes more; bracts sessile, narrowly elliptic, glandular and woolly-tomentose on abaxial surface, sparsely so on adaxial surface, usually 3-8 mm long, 1.5-4 mm broad; bracteoles sessile, narrowly elliptic or linear-lanceolate, glandular and woolly-tomentose on abaxial surface, almost glabrous or sparsely hairy on the adaxial surface, usually 2-4 mm long, 0.5-1.5 mm broad. *Calyx* deeply purple-lilac, persistent, divided almost to the base into 5 3-nerved lobes, shortly tubular at the base, 9-12 mm long, glandular and woolly-tomentose outside and on the inner surface of the lobes, glabrous inside the short basal tube; lobes linear-oblong, slightly narrowed at both ends, entire, reticulate, 8-11 mm long, 2-2.5 (-3) mm broad; tube 0.5-1 mm long. *Corolla* deep lilac, 18-25 mm long, 2-lipped, with a broad tube, the upper lip 2-lobed, the lower lip 3-lobed, lobes and tube glandular and sparsely woolly hairy outside, glabrous inside excepting the dense hairy ring above the ovary and a few villous hairs extending to the large central lobe of the lower lip; lobes spreading, more or less sub-orbicular in outline; the central lobe of the lower lip almost twice as broad as the other 4 lobes, 5-7 mm long, 8-11 mm broad; the other 4 lobes almost equal, 3.5-5.5 mm long, 4-5 mm broad; tube abruptly dilated within or immediately above the calyx, 13-16 mm long, 7-10 mm broad. *Stamens* included, sometimes shortly exserted, sub-didynamous; filaments filiform, glabrous, the upper pair 5-7 mm long, the lower pair 8-10 mm long; anthers oblong, the upper pair longer than the lower, ± 3 by 1-1.5 mm, the lower pair 2-2.5 by 1-1.5 mm, lobes in all anthers linear-oblong, free and divergent in the lower halves, shortly appendiculate at the lower ends. *Ovary* globose, pubescent-tomentose, 1-1.5 mm in diameter; style included, sometimes shortly exserted above the corolla-tube, filiform, glabrous, 14-18 mm long, 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, more or less globular, pubescent, with often a shallow depression at the top, 2-3.5 mm long, 2-3 mm broad, apparently non-dehiscent; seeds not seen.

Specimens examined

WESTERN AUSTRALIA: *Weber 4834*, northern slopes of Mt Augustus, North-West Division, 24° 19′ S, 116° 53′ E, 29.ix.1975 (AD, holotype; CANB, K, MEL, PERTH - isotypes). *Wittwer 1089*, loc. cit. 24° 20′ S, 116° 50′ E, 19.viii.1973 (PERTH, Kings Park Perth). *Wittwer S.1761 (43)*, loc. cit. western summit, Sept. 1971 (Kings Park Perth).

Distribution (Map 10A)

P. augustensis is endemic to Western Australia where it has been recorded only from the Mount Augustus area in the North West Division.

Comments

Superficially this species may be mistaken for its closest allies *P. axillaris* and *P. terminalis*, both of which have somewhat similar inflorescence and flowers. Nevertheless, *P. augustensis* can readily be identified by its narrowly elliptic leaves cuneate towards both ends. *P. augustensis* occurs in the North West Division, while the other two species grow in the South West Division.

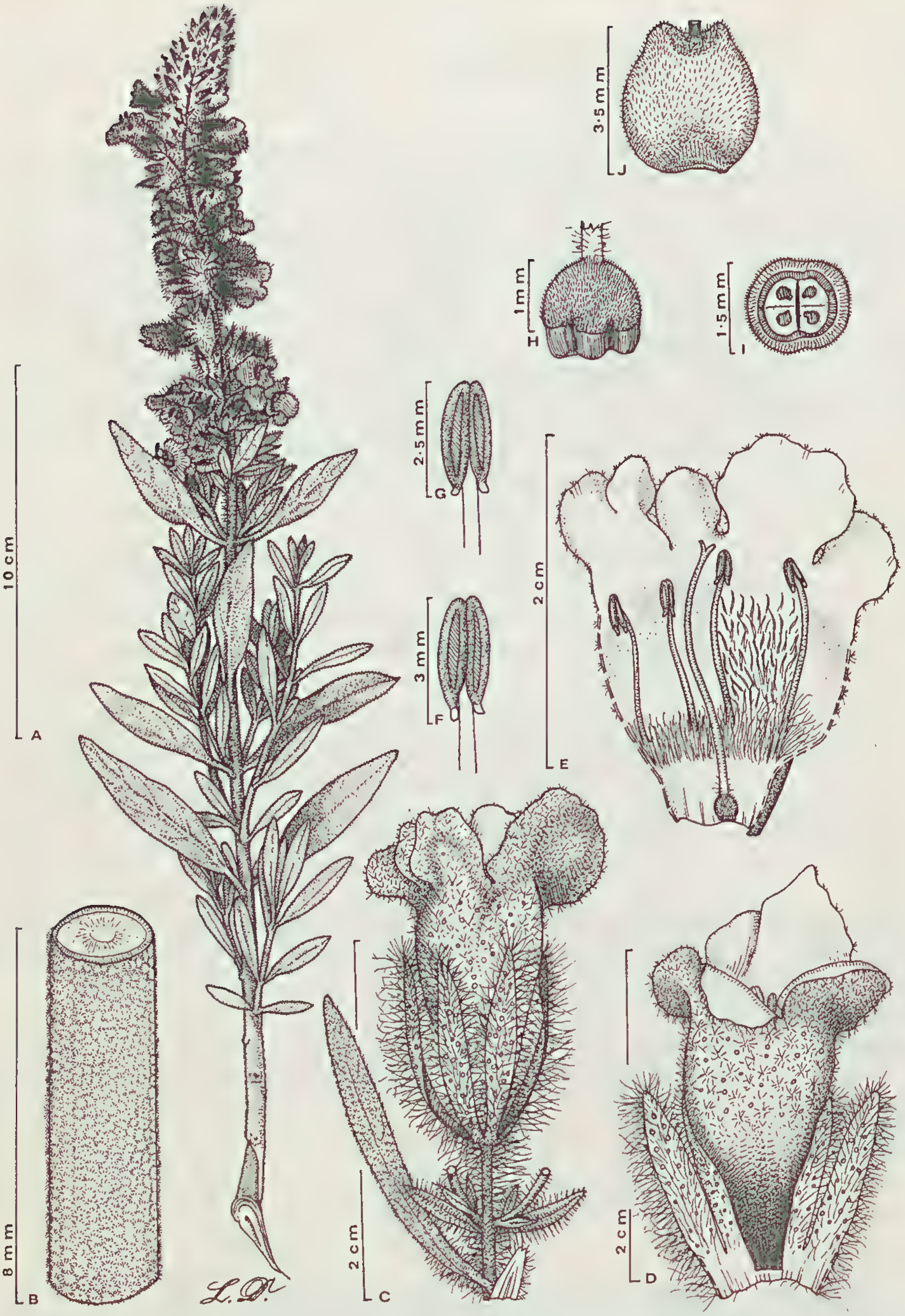


Fig. 38. *Pityrodia augustensis* Munir (A-I, *E. Wittwer 1089*: PERTH; J, *J.Z. Weber 4834*: AD). A, flowering branch; B, portion of stem; C, cyme with two lateral flowers removed; D, flower with calyx vertically cut open to show corolla-tube; E, corolla-tube vertically cut open to show androecium and gynoecium; F, upper stamen; G, lower stamen; H, ovary; I, transverse section of ovary; J, fruit.

Unlike several other *Pityrodia* species, the anthers on the upper pair of stamens are longer than the lower pair. The filaments of the lower pair, however, are longer than the upper pair which is in common with the rest of the species.

Affinities

P. augustensis is closely related to *P. terminalis* in its pedicellate flowers being arranged in a terminal raceme-like inflorescence of more or less similar shape and colour; stem and leaves densely clothed with similar indumentum of branched hairs; calyx tomentose outside with the lobes almost free to the base; corolla-tube abruptly dilated within or immediately above the calyx; stamens and style included; anthers oblong. Nevertheless, *P. augustensis* may easily be distinguished by its leaves being narrowly elliptic, cuneate towards both ends; calyx-lobes glandular and tomentose outside and inside; corolla-tube glandular and sparsely woolly outside; fruit more or less globular. The leaves in *P. terminalis* are mostly elongate-ellipsoidal and somewhat stem-clasping, and the fruit is isodiametric with a conical tip and a hump on the back of each nutlet.

P. augustensis is also allied to *P. axillaris* in having similar indumentum on stem and leaves, terminal raceme-like inflorescence, deeply lobed calyx and abruptly dilated corolla-tube within or immediately above the calyx. *P. axillaris*, however, can easily be identified by its leaves being oblong-obovate; calyx-lobes obovate; corolla deep red or yellowish-scarlet, with clavate hairs inside below the central lobe of the lower lip, tube almost glabrous outside; lobes undulate-denticulate; stamens and style much exserted; fruit obovoid but slightly compressed and with two opposite short humps at the top, tomentose all over.

39. **Pityrodia lanuginosa** Munir, sp. nov.

Caules et rami teretes, dense lanuginoso-tomentosa. Folia opposita, sessilia, anguste ovato-lanceolata, integra, acuminata, 8-25 mm longa, 2-6.5 mm lata, sparsim lanuginoso-tomentosa, glandulis adspersis. Sepala extus glandulosa et sparsim tomentosa, lobis lanceolatis, 3-5 mm longa, 1.5-2 mm lata, tubo 1.5-2 mm longo. Corolla subalba. Stamina exserta. Fructus obovoidei, pubescentes.

Type: *Martensz & Schodde AE579*, 2-3 miles (c. 4 km) north of El Sharana, Arnhem Land, Northern Territory, Australia, 25.i.1973 (NT, holotype; BRI 2 spec., CANB, DNA - isotypes).

Description (Fig. 39)

A woolly-tomentose spreading shrub to 30 cm. *Stem* and branches terete, densely clothed with woolly tomentum of dendriform hairs. *Leaves* sessile, decussate, narrowly ovate-lanceolate, entire, acuminate, almost flat or slightly recurved along the margins, (8-) 10-20 (-25) mm long, (2-) 3-5 (-6.5) mm broad, sparsely woolly-tomentose, sprinkled with minute glands, smooth above, the midrib and primary lateral veins raised underneath. *Flowers* sessile, axillary and solitary, shorter than the leaves; bracts represented by the upper leaves; bracteoles sessile, lanceolate, entire, acute, sparsely glandular and tomentose, 3-7 mm long, 1-1.5 mm broad. *Calyx* persistent, longer than the upper corolla-lip, more or less campanulate, ribbed, divided more than halfway down into 5 lobes, 5-7 mm long, glandular and sparsely tomentose outside, sparsely hairy on the inner surface of the lobes, glabrous inside the tube; lobes lanceolate, slightly recurved along the margins, acute, 3-5 mm long, 1.5-2 mm broad; tube more or less campanulate, 1.5-2 mm long. *Corolla* off-white with the upper lip streaked dark purple, 7-9 mm long, pubescent outside on the back of lobes, a dense hairy ring inside the tube below the insertion of stamens and a few villous hairs extending to the central lobe of the lower lip; the upper lip erect, 2-lobed, shorter than the calyx, the lobes oblong-ovate with dark purple streaks,

Fig. 39. *Pityrodia lanuginosa* Munir (*Martensz and R. Schodde AE 579*: NT, holotype). A, flowering twig; B, portion of stem showing branched hairs; C, flower in the axil of a leaf; D, flower with calyx vertically cut open to show short corolla-tube and the short upper lip; E, corolla vertically cut open to show androecium and gynoecium; F, lower stamen; G, upper stamen; H, ovary; I, transverse section of ovary; J, fruit.

3-3.5 mm long, ± 1.5 mm broad; the lower lip 3-lobed, spreading, the central lobe larger than the two lateral, more or less obovate, 3.5-5 mm long, 2.5-3.5 mm broad, the lateral lobes more or less elliptic-oblong, 3-5 mm long, 2-2.5 mm broad; tube much shorter and dilated within the calyx, glabrous outside, 2-2.5 mm long, 1.5-2 mm broad at the top end. *Stamens* exserted, inserted in the corolla-throat; filaments filiform, glabrous, the upper pair 1.5-2 mm long, the lower pair 2-2.5 mm long; anthers more or less orbicular in outline, 0.6-0.8 mm long, 0.8-1 mm broad; lobes narrowly elliptic-oblong, shortly appendiculate at the lower ends, divergent in the lower halves. *Ovary* globose, tomentose, ± 1 mm in diameter; style shortly exserted, filiform, glabrous, (2.5-) 3-4 mm long, minutely 2-lobed at the top. *Fruit* obovoid, pubescent, 3-4.5 mm long, ± 2 mm in diameter, apparently non-dehiscent; seeds not seen.

Specimens examined

The type collection is the only material available for examination.

Distribution (Map 10B)

P. lanuginosa is endemic to Arnhem Land, Northern Territory, where it has been recorded from north of El Sharana near the South Alligator River.

Comments

P. lanuginosa is unique in its upper corolla-lip being much shorter than the lower, enclosed within the calyx-lobes and the corolla-tube only slightly longer than the calyx-tube. The upper corolla-lip is also much more deeply streaked purple than in any other closely related species.

Affinities

P. lanuginosa is closely related to *P. pungens* in its flowers being axillary and solitary; the upper corolla-lip erect, streaked purple, shorter than the lower lip, enclosed within the calyx-lobes; stamens and style shortly exserted; anthers more or less orbicular in outline; fruit obovoid, pubescent. Both the species are endemic to the northern part of Northern Territory. Nevertheless, *P. lanuginosa* may easily be identified by its stem, leaves and calyces being woolly-tomentose; leaves decussate, ovate-lanceolate and non-pungent. The stem and leaves in *P. pungens* are glandular-viscid and sprinkled with stellate hairs; leaves mostly in whorls of 3, linear-lanceolate and pungent.

P. lanuginosa and *P. jamesii* are also near to each other in their stem, leaves and calyces being covered with dendriform hairs; leaves sessile, ovate-lanceolate, with their midrib and primary lateral veins prominent underneath; flowers axillary and solitary; stamens and style exserted and fruit obovoid. Both the species are endemic to the northern part of Northern Territory. *P. jamesii*, however, can readily be identified by its stem-tomentum being dendriform hairs, interspersed within a dense mat of fulvous and appressed stellate hairs; leaves appressed against the stem, amplexicaul, cordate at base; corolla-tube nearly twice in length; the upper corolla lip almost equalling the lower, not enclosed within the calyx-lobes; anther-lobes oblong, longer and very minutely appendiculate at the lower ends.

40. **Pityrodia jamesii** Specht in Specht & Mountford (Ed.) Rec. Amer.-Aust.Sc. Exped.Arnhem Land, 3, Bot.& Pl.Ecol.(1958)289, fig. 17, t. 5; Chipp., Proc.Linn.Soc. N.S.W.96(1971)256; Calley & Key, J.Aust.Entom.Soc.12(1973)163.

Type: *Stewart James s.n.*, Oenpelli, 12° 18′ S, 133° 04′ E, Arnhem Land, Northern Territory, Australia, March, 1951 (BRI, holotype; NSW, isotype).

Description (Fig. 40)

A divaricate shrub of 0.5-1.82 m. *Stem* and branches cylindrical, yellowish-brown,

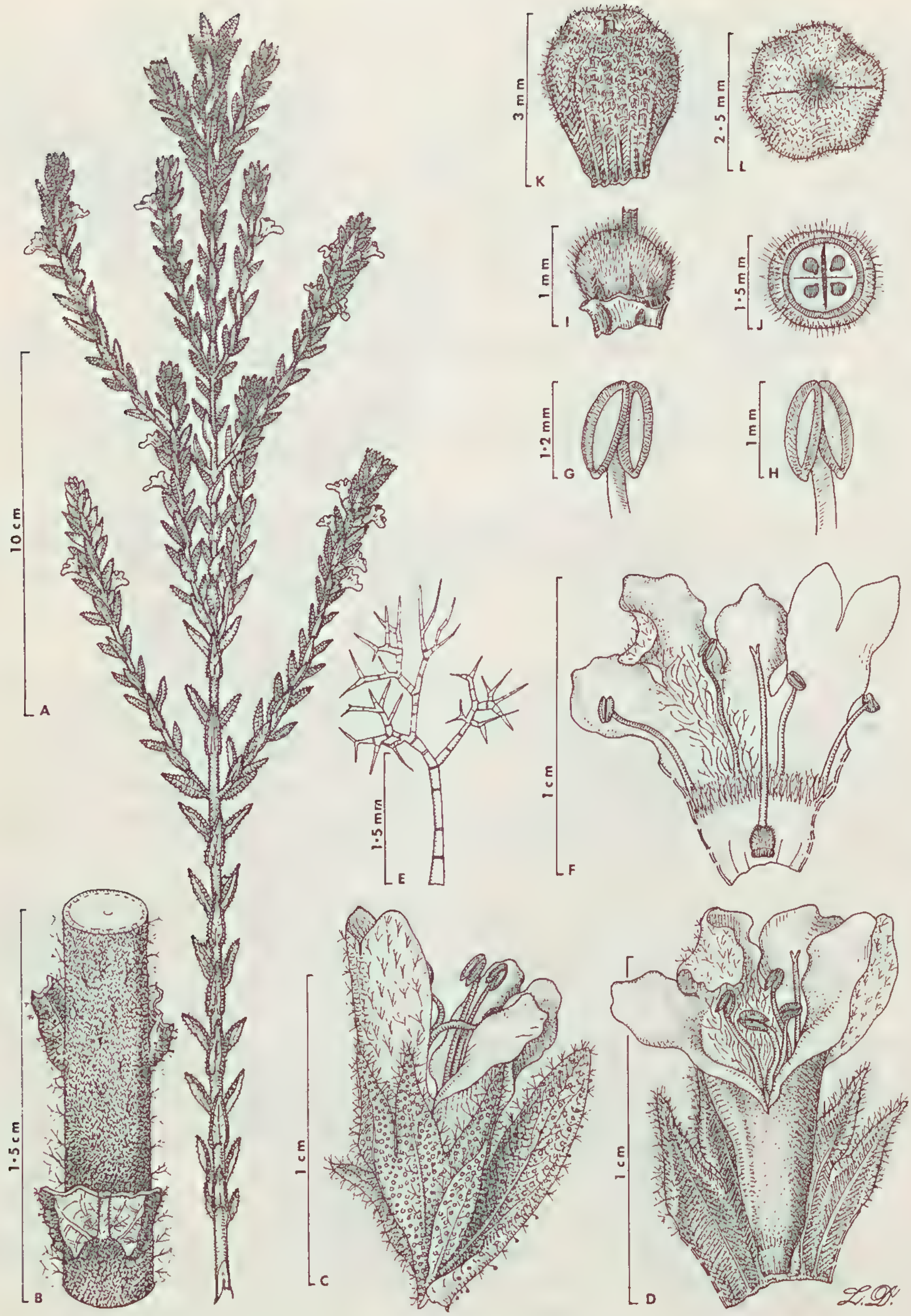


Fig. 40. *Pityrodia jamesii* R.L. Specht (*N.M. Henry 872*: AD). A, flowering branch; B, portion of stem with amplexicaul leaf-bases; C, flower with a leaf and two bracteoles; D, flower with calyx vertically cut open to show corolla-tube; E, hair from a leaf; F, corolla-tube vertically cut open to show androecium and gynoecium; G, lower stamen; H, upper stamen; I, ovary; J, transverse section of ovary; K, fruit; L, top view of fruit.

pubescent-tomentose with branched hairs, interspersed within a dense mat of fulvous and appressed stellate hairs. *Leaves* sessile, ovate, oblong-ovate or ovate-lanceolate, with an amplexicaul cordate base, acute at the apex, recurved-revolute along the crenate margins, appressed against the stem, overlapping and crowded towards the apex, (0.5-1) 1.5-3.5 (4-7.5) cm long, (2-) 3-8 (10-15) mm broad, crustaceous, viscid all over when fresh, glandular underneath, pubescent with spreading, branched hairs, the midrib and reticulate nerves prominent on the under surface. *Flowers* arranged in a spike-like inflorescence, solitary in the axils of the upper leaves, shortly pedicellate or nearly sessile; pedicel pubescent, glandular, ± 0.5 mm long; bracts leaf-like, sessile, about the size and shape of a small leaf, 7-12 mm long, 2-3 mm broad; bracteoles leafy, elliptic-lanceolate, recurved along the margins, glandular and pubescent on abaxial surface, almost glabrous or puberulous on adaxial surface with long, branched tomentum on the recurved margins, 3-5 (-6) mm long, (1-) 1.5-2.5 mm broad. *Calyx* persistent, more or less campanulate, strongly ribbed, divided to about the middle into 5 lobes, 6-8 mm long, densely glandular and tomentose outside, glabrous inside the tube, non-glandular and tomentose along the margins and distal inside parts of the lobes; lobes lanceolate, 3-5 mm long, 1.5-3 mm broad; tube 1.5-3 mm long. *Corolla* white, 8-12 mm long, pubescent outside the lobes, glabrous inside excepting the dense hairy ring below the stamens and a few villous hairs extending to the anterior-lobe of the lower lip, the lobes longer than the tube, oblong-elliptic or obovate, obtuse; the 3 lower (i.e. anterior) lobes are free and mostly shorter than the 2 upper, 3.5-6 (-7) mm long, 2-4 mm broad; the 2 upper (i.e. posterior) lobes united to greater part of their length, 5-8 mm long, 2-2.5 (-3) mm broad; tube almost cylindrical or gradually dilated upwards, shorter than the calyx, 3-4.5 (-5) mm long, 2-3 mm broad at the top end. *Stamens* exserted; filaments filiform, glabrous, the lower pair 4-6 (-7) mm long, the upper pair 3-4 (-5) mm long; anthers more or less orbicular in outline, minutely appendaged at the lower ends of the lobes, 1-1.2 mm long, about the same wide, lobes more or less oblong. *Ovary* globose, 1-1.5 mm in diameter, densely tomentose; style exserted, filiform, glabrous, (5-) 6-11 mm long, shortly 2-lobed at the top. *Fruit* enclosed within the persistent calyx, obovoid, flat or almost truncate at the top, rugose-corrugate, pubescent, 3-4 mm long, 2-3 mm in diameter at the apex, splitting into two 2-celled nutlets with one seed in each nutlet.

Specimens examined

NORTHERN TERRITORY: *Byrnes 1906*, 10 miles N of Mudginbarry, 12° 36′ S, 132° 52′ E, 14.v.1970 (BRI, CANB, DNA, NSW, NT). *Chippendale 8090*, Cooper Creek, 28 miles N of Oenpelli, 15.vii.1961 (BRI, CANB, NSW, NT). *Fox 2520*, Deaf Adder ("Gorge") Creek, 13° 02′ S, 133° 05′ E, 22.ii.1977 (AD, BRI, CANB, DNA, NT). *Henry 872*, Nourlangie Rock Area, 12° 52′ S, 132° 50′ E, 4.vii.1973 (AD, NT, PERTH). *Key s.n.*, 15 km east of Mt Cahill, 12° 52′ S, 132° 50′ E, 24.v.1973 (CANB 266146, p.p.; alter parte *P. puberula* Munir). *Key s.n.*, ca. 1.5 km W of Koongarra, Noranda Mining Camp area, 29.x.1972 (CANB 2 spec.). *Lazarides 7753*, east of Oenpelli, 133° 26′ E, 12° 20′ S, 17.ii.1973 (CANB, NSW). *Lazarides 7772*, south-east of Oenpelli, 133° 19′ E, 12° 32′ S, 19.ii.1973 (CANB). *Lazarides 7937*, south-east of Mt Cahill, 133° 02′ E, 13° 03′ S, 28.ii.1973 (AD, CANB). *Martensz & Schodde AE712*, 1¹/₄ mile east-south-east of Cannon Hill, 12° 23′ S, 132° 57′ E, 3.ii.1973 (BRI, CANB, DNA, K, NT). *Specht, R.L. s.n.*, Oenpelli, 12° 18′ S, 133° 04′ E, 23.x.1948 (AD, BRI, NSW). *Stewart James s.n.*, loc. cit., March, 1951 (BRI, holotype; NSW, isotype). *Story 7717A*, 140 miles, 88° from Darwin, undated (CANB).

Distribution (Map 10C)

P. jamesii is endemic to Arnhem Land, Northern Territory, where it is known to occur between 12° and 14° S, and between 132° and 134° E. The main distribution, however, has been recorded from the area between the sources of the East and the South Alligator Rivers.

Comments

In the original description, the corolla-lobes was said to be "about as long as the tube". During present investigations, however, the corolla-tube has been found to be not only much shorter than the lobes, but in a few cases almost half the length of the longest lobes.

It has also been noticed, that unlike several other *Pityrodia* species, the anterior (i.e. middle) corolla-lobe of the lower lip is not always the largest in this species.

According to Calaby & Key (1973), the "late-instar" nymphs of the Australian grasshopper species *Petasida ephippigera* feed on the foliage of *Pityrodia jamesii*.

Affinities

P. jamesii shows close affinities with *P. hemigenioides* in its stem, leaves and calyx being tomentose; leaves sessile with usually recurved margins; flowers axillary solitary forming a spike-like leafy inflorescence; calyx turbinate-campanulate, strongly ribbed; corolla white, deeply lobed; anthers more or less orbicular in outline. Nevertheless, *P. jamesii* may readily be distinguished by its stem being clothed with a yellowish-brown or fulvous mat of appressed hairs with interspersed branched hairs; leaves crustaceous, ovate-lanceolate with an amplexicaul cordate base and acute apex; calyx with numerous sessile glands interspersed between the outside tomentum; corolla-tube almost cylindrical, apparently not dilated upwards, shorter than the lobes, the anterior-lobe scarcely larger than the others; stamens and style much exserted, anther-lobes minutely appendaged at the lower ends; fruit distinctly obovoid, almost flat topped.

P. jamesii seems also near to *P. spenceri* in having more or less similar shaped leaves, inflorescence, calyx, anthers and fruit. The latter, however, can easily be identified by its stem being covered with a cineraceous mat of appressed hairs; calyx-lobes often with slightly recurved margins, pubescent on both the surfaces; corolla-tube much longer than the lobes, gradually dilated upwards, densely pubescent outside; stamens and style scarcely exserted; fruit with more or less domed top.

41. **Pityrodia spenceri** Munir, sp. nov.

P. hemigenioides auct.non (F. Muell.) Benth.: sensu Ewart et al., Fl.N.Terr.(1917)236 (quoad *Spencer & Gilruth s.n.*: Edith Creek, N.T., July-August, 1911)

Caules et rami teretes, dense cineraceo-tomentosi. Folia breviter petiolata, verticillata terna vel remota; laminae ovatae, cordatae, mucronatae, margine recurvato, 8-22 mm longae, 3-8 mm latae, dense cineraceo-tomentosae. Sepala extus breviter cineraceo-tomentosa, lobis lanceolatis, 4-5 mm longis, 1.5-2 mm latis, tubo 2-3 mm longo. Corolla extus pilosissima, alba. Stamina breviter exserta. Fructus obovoidei, pubescentes.

Type: *W.B. Spencer et al. s.n.*, Edith Creek, Northern Territory, Australia, July-August, 1911 (NSW 135940, holotype; MEL 69338, NT 30264, NT 30265 - isotypes).

Description (Fig. 41)

An erect branched shrub, densely clothed with branched cineraceous tomentum. *Stem* and branches terete. *Leaves* shortly petiolate or subsessile, in whorls of 3 or scattered, cordate or ovate-cordate, mucronate, recurved along the margins, (8-) 10-20 (-22) mm long, (3-) 5-8 mm broad, densely clothed with a short tomentum of branched and cineraceous hairs, the midrib and reticulate nerves prominent on the under surface; pedicel 1-2 mm long, densely tomentose. *Flowers* axillary solitary, sessile in the axils of the upper leaves; bracts leaf-like, of the shape and size of the upper smaller leaves; bracteoles linear, leafy, 3.5-5 mm long, 1-1.5 mm broad. *Calyx* persistent, turbinate-campanulate, 5-lobed in the upper half, tubular towards the base, strongly ribbed, 7-8 mm long, densely clothed with short cineraceous tomentum, glabrous inside the tube; lobes lanceolate, 4-5 mm long, 1.5-2 mm broad near the base; tube 2-3 mm long. *Corolla* white, 8-10 mm long, pubescent outside, glabrous inside excepting the dense hairy ring above the ovary, and the villous hairs extending to the large anterior-lobe of the lower lip; the anterior-lobe elliptic-obovate, ca. 3 mm long, ± 2 mm broad; the other 4-lobes narrowly ovate-elliptic or oblong, (1-) 2 (-3) mm long, 1-2 mm broad; tube almost

Fig. 41. *Pityrodia spenceri* Munir (*W.B. Spencer et al. s.n.*: NSW 135940). A, flowering twig; B, flower with two bracteoles; C, flower with calyx vertically cut open to show corolla-tube; D, corolla-tube vertically cut open to show androecium and gynoecium; E, lower stamen; F, upper stamen; G, ovary; H, transverse section of ovary; I, fruit.

cylindrical or gradually dilated upwards, 5-6 mm long, 2-3 mm broad at the top end. *Stamens* slightly exceeding the corolla-tube; filaments glabrous, 1.5-3 mm long; anthers more or less orbicular in outline, lobes oblong, with a minute or no appendage at the lower end. *Ovary* globose, ca. 1 mm in diameter, densely tomentose; style slightly exserted, filiform, glabrous, 5-7 mm long, shortly 2-lobed at the summit. *Fruit* enclosed within the persistent calyx, obovoid, pubescent, 3-4 mm long, 2-3 mm broad in the upper half.

Specimens examined

The type collection, consisting of four duplicates, is the only material available for examination.

Distribution (Map 10B)

This species is endemic to the northern part of the Northern Territory. The only known locality is near Edith Creek, which is about 200 km south-east of Darwin along the Stuart Highway.

Comments

The type of *P. spenceri* is the earliest *Pityrodia* collection from the Northern Territory. The species is one of the most northerly in the genus. In view of its resemblance to *P. hemigenioides*, it was erroneously identified by Ewart et al. (1917) with that species.

Affinity

P. spenceri is nearest to *P. hemigenioides* in having similar indumentum all over the plant, axillary solitary flowers forming a spike-like leafy inflorescence, and scarcely exserted stamens and style. Nevertheless, *P. spenceri* may easily be distinguished by its leaves being shortly petiolate, cordate; corolla-tube gradually dilating upwards, densely pubescent outside, lobes pubescent on the back; stamens with minute or no distinct appendages at the ends of the lobes; fruit obovoid, often not easily splitting into 2 nutlets.

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Collectors' names are in alphabetical order, and their numbers (in Arabic numerals) are followed by the number (in Roman numerals) given below to each species. T represents holo-, lecto- or syn- types of the species indicated.

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P. chrysocalyx	= II	*P. gilruthiana*	= XXIII
P. canaliculata	= III	*P. puberula*	= XXIV
P. loricata	= IV	*P. hemigenioides*	= XXV
P. lepidota	= V	*P. glutinosa*	= XXVI
P. angustisepala	= VI	*P. viscida*	= XXVII
P. quadrangulata	= VII	*P. loxocarpa*	= XXVIII
P. megalophylla	= VIII	*P. obliqua*	= XXIX
P. lanceolata	= IX	*P. paniculata*	= XXX
P. halganiacea	= X	*P. axillaris*	= XXXI
P. scabra	= XI	*P. dilatata*	= XXXII
P. exserta	= XII	*P. cuneata*	= XXXIII
P. uncinata	= XIII	*P. atriplicina*	= XXXIV
P. bartlingii	= XIV	*P byrnesii*	= XXXV
P. glabra	= XV	*P. terminalis*	= XXXVI
P. ternifolia	= XVI	*P. ovata*	= XXXVII
P. serrata	= XVII	*P. augustensis*	= XXXVIII
P. teckiana	= XVIII	*P. lanuginosa*	= XXXIX
P. chorisepala	= XIX	*P. jamesii*	= XL
P. oldfieldii	= XX	*P. spenceri*	= XLI
P. verbascina	= XXI		

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Names

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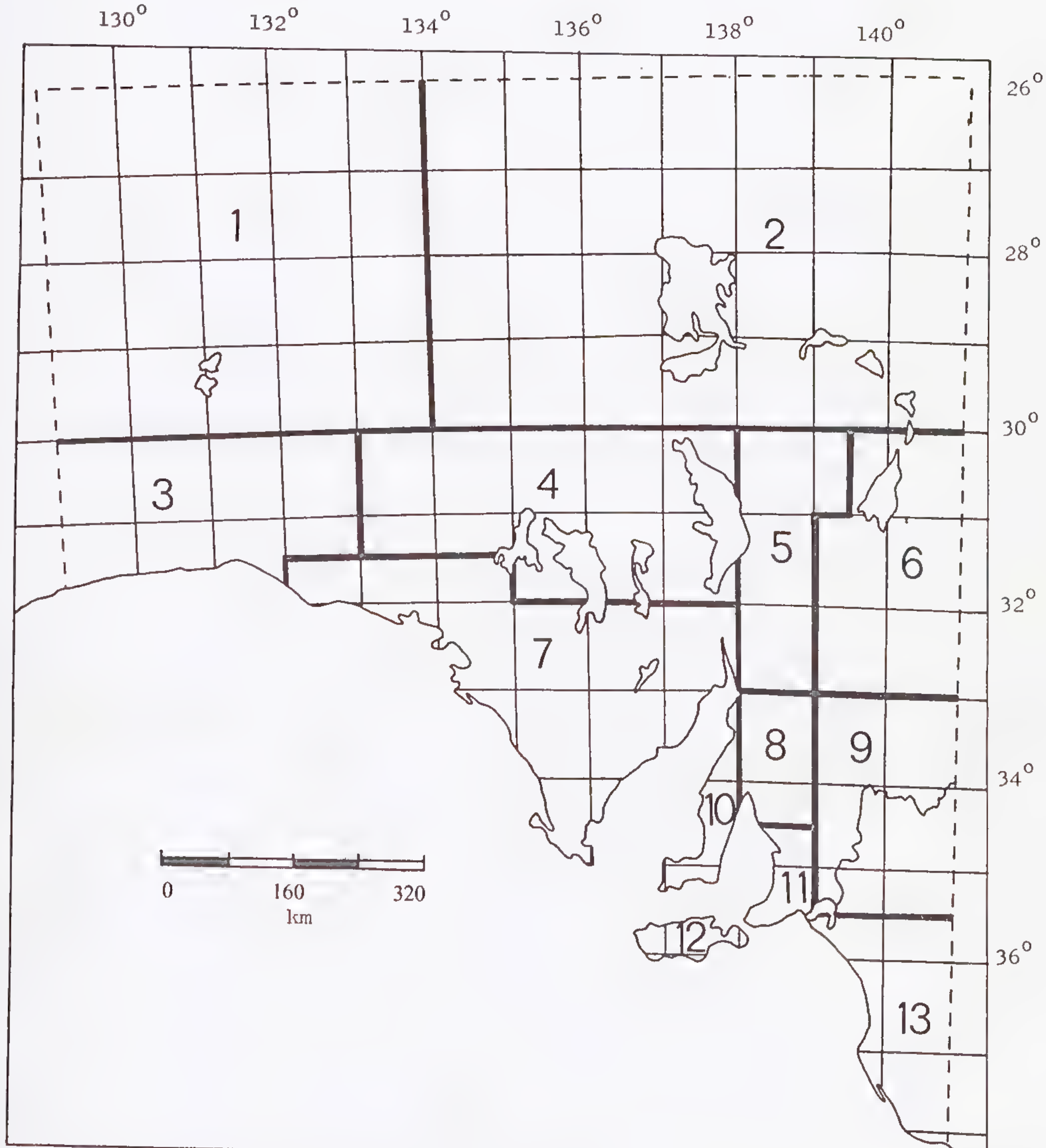
REGIONS OF SOUTH AUSTRALIA ADOPTED BY THE STATE HERBARIUM — ADELAIDE

1. North-western
2. Lake Eyre Basin
3. Nullarbor
4. Gairdner-Torrens Basin
5. Flinders Ranges
6. Eastern
7. Eyre Peninsula
8. Northern Lofty
9. Murray
10. Yorke Peninsula
11. Southern Lofty
12. Kangaroo Island
13. South-eastern



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JOURNAL of the ADELAIDE BOTANIC GARDENS

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JOURNAL of the ADELAIDE BOTANIC GARDENS

Volume 2 Part 2

13 May, 1980

Instructions to Authors

Topics

Papers will be accepted in the following categories:

(a) Plant systematics (Australian and horticultural groups); (b) Descriptive plant morphology, anatomy and ecology; (c) Obituaries, biography and history; (d) Bibliographic studies, book reviews; (e) Botanical illustrations; (f) Noteworthy horticultural contributions.

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Smith, L. L. (1879). The species of *Danthonia* found in pastures in Victoria. *Austral. J. Bot.* 65: 28-53.

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Baker, J. G. (1898). Liliaceae. In Thiselton-Dyer, W. T. (ed.), "Flora of Tropical Africa", Vol. 7 (Ashford: L. Reeve).

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References may be cited as:

Benth., *Fl. Austral.* 4: 111 (1868) OR

Benth., *Fl. Austral.* 4: (1868) 111.

Citation of specimens

10-30 specimens should be cited for each species (or subspecific taxon), although this may be varied under certain circumstances. The author may decide whether or not to include dates of collections and the sequence, provided a constant pattern is adhered to throughout a paper.

Authors wishing to cite all specimens seen may list them all in an index to collectors after the style of the "Flora Malesiana" identification lists. Collections not identifiable by a collection number (assigned by either the collector or herbarium) should cite dates.

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THE GENUS *MALACOCERA* R.H. ANDERSON (CHENOPODIACEAE)

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Abstract

The endemic Australian genus *Malacocera* is revised and four species are recognized, namely *M. albolanata* (Ising) Chinnock, comb. nov. (syn. *Bassia albolanata*), *M. biflora* Ising, *M. gracilis* Chinnock sp. nov. and *M. tricornis* (Benth.) R.H. Anderson.

Descriptions, illustrations and distribution maps are provided, together with notes on ecology and relationships.

Introduction

When Anderson described *Malacocera* in 1926, he based it on *Chenolea tricornis*, which had been described by Bentham in 1870. In 1882, Mueller transferred the species to *Bassia* All. and he was followed by Black (1924). Ewart (1931), however, continued to follow Bentham, including *Malacocera* in the synonomy. Black (1948) accepted *Malacocera* and subsequent writers, e.g. Willis (1973), Wilson (1975) and Scott (1978), have also adopted this view.

A second species of *Malacocera*, *M. biflora*, was described by Ising in 1955, differing significantly from *M. tricornis* in the smaller, triangular, more irregular processes on the fruiting perianth and in the presence of two flowers in each leaf axil.

In 1964 Ising described a number of new species of *Bassia* including *B. albolanata*, which he compared with *B. chippendalei*, also newly described. However, an examination of the type of *B. albolanata* and the many other collections now at hand has satisfied me that this species should be included in *Malacocera*. Indeed, most specimens of *B. albolanata* in herbaria were identified as *M. tricornis* (see further comments under the species).

Relationships

Malacocera is distinguished from *Sclerolaena* R.Br.* by the relatively unhardened fruiting perianth, and by the presence of radiating, soft, tomentose processes in a tepaline position. *Sclerolaena* possesses a hardened fruiting perianth with radiating spines in a intertepaline position. In *Malacocera* these processes, which develop after anthesis, are attached to the full length of the fruiting perianth. They are flattened in either the vertical or horizontal plane and are oblong to triangular with obtuse apices. In *M. albolanata* a number of processes are more tapered and spine-like but they are never pungent. In this species one of the processes is usually flattened and often bifid at the apex. Occasionally in *M. gracilis* two or more processes may fuse to form plate-like structures.

The four species of *Malacocera* are vegetatively very similar in having striate, densely lanate branches with spiral, villous leaves. However, *M. gracilis* differs significantly from the other three in its more slender branches and appressed leaves. The number of flowers in the leaf (bract) axil varies from 1 to 2, but the number per axil is constant for each species. The size of the fruiting perianth and the number and shape of its tepaline processes vary considerably in the four species. *Malacocera albolanata* and *M. biflora*

*Until recently all Australian species of *Sclerolaena* were included by Australian authors in the genus *Bassia* (See Scott, 1978).

possess paired flowers. These flowers are symmetrically identical for a particular branch. (For further details on orientation of flower and fruit in subtribe Kochiinae see Wilson, 1975, p. 12.) *Malacocera gracilis* and *M. tricornis* have solitary flowers.

Species with paired flowers do not appear to be more closely related to one another than to those species with solitary flowers; *M. albolanata* is probably more closely related to *M. tricornis* as the processes (especially when only three are developed in the former species) are very similar in shape and size. In *M. biflora* the processes are small and triangular and differ markedly from the above two species. *M. gracilis* does not appear to be closely related to the other species as the (major) processes are orientated in a reverse direction to form an (inverted-Y) configuration. In this species the radicular slit is situated between the two lower major processes, while in the others it is adjacent to the base of the lowermost lobe.

Distribution

Malacocera is most common in the arid areas of eastern South Australia where all four species occur and two are endemic. It is also particularly common in western New South Wales (see Fig. 6).

M. tricornis, the most widespread species, is common in South Australia, western New South Wales and the extreme north-west of Victoria, but it is rare in Queensland, Northern Territory and Western Australia. There is one certain locality in Western Australia. A second specimen, in Herb. PERTH, was collected by W.V. Fitzgerald at "Skirmish Hill", but, all attempts to locate this site in Western Australia have failed. Mr. P.G. Wilson, however, (pers.comm.) has examined Fitzgerald's manuscript Flora of Western Australia in which there is recorded a collection of *M. tricornis* made by himself at Nannine. As the Nannine specimen has not been located, it is possible that "Skirmish Hill' and Nannine refer to the same locality.

M. albolanata is also quite widespread, extending from the Lake Eyre Basin Region in South Australia to south-western Queensland and western New South Wales, while *M. gracilis* and *M. biflora* both have very restricted distributions in South Australia.

All species appear to favour heavy clayey soils and are most frequently encountered along river systems on alluvial flats or around salt lakes or saline depressions in chenopodiaceous shrublands.

MALACOCERA R.H. Anderson

(Greek *malakos*, soft; *ceras*, horn)

Malacocera R.H. Anderson, Proc.Linn.Soc.N.S.W.51: 382(1926); J.M. Black, Fl.S.Aust.ed.2: 308(1948); P.G.Wilson, Nuytsia 2,1: 9(1975); A.J. Scott, Feddes Rep. 89, 2-3: 118(1978).

Type species: Malacocera tricornis (Benth.) R.H. Anderson.

Shrubs ephemeral or perennial, to 80 cm high; main stem woody at least near ground level; branches lanate, terete, striate. *Leaves* spiral, sessile, linear, appressed or spreading and often recurved, scattered or clustered. *Flowers* solitary or paired in the leaf axils, bisexual or female. *Perianth* small, globose, lanate, tepals 5; stamens 5; style 2 or 3. *Fruiting perianth* flattened, with the 3-5 tepaline processes forming a Y, inverted-Y or star-shaped configuration; tube unhardened except near the base; vertical slit prominent, opposite the radicle; processes 3-5, tepaline, flattened or sub-cylindrical, linear to triangular, lanate or sparsely lanate above and towards the tips, attached to the whole length of the perianth tube, three of the processes usually larger (major) with 1 or 2 smaller processes (minor) developed opposite the remaining tepals or all processes of similar length. *Pericarp* membranous. *Seed* horizontal, radicle centrifugal, perisperm abundant.

Key to Species

1. Flowers paired in leaf axils 2
   Flowers solitary in leaf axils 3
2. Processes linear, >2 mm long, two or more, filiform, appearing blackish-brown through tomentum . . . . *M. albolanata* 1
   Processes triangular, c. 1.5 mm long, flattened, appearing yellowish through tomentum . . . . *M. biflora* 2
3. Stems weak, <1 mm thick, leaves appressed, processes 4-5, major ones forming an inverted-Y configuration . . . . *M. gracilis* 3
   Stems robust, >1 mm thick, leaves spreading, processes 3 rarely 4 forming a Y configuration . . . . *M. tricornis* 4

1. Malacocera albolanata (Ising) Chinnock, comb.nov.

Bassia albolanata Ising, Trans.Roy.Soc.S.Aust.88: 95(1964).

Sclerolaena albolanata (Ising) Scott, Feddes Rep. 89, 2-3: 111(1978).

Holotype: Between Mungeranie and Cowarie, South Australia, *J.B.Cleland s.n.*, 17.ix.1956 (AD 95820121!). See Fig. 2A.

Shrub to 40 cm high; branches densely white-lanate, finely ribbed. *Leaves* scattered, linear, 6-18 mm long, c. 1 mm broad, densely villous at first, becoming almost glabrous with age, spreading, recurved or sometimes curled. *Flowers* paired in the leaf axils, densely lanate; styles 2. *Fruiting perianth* flattened, depressed above, forming a Y or star configuration; processes 3-5, 2.5-4.5 mm long, with 3 major and 2 minor ones or all of

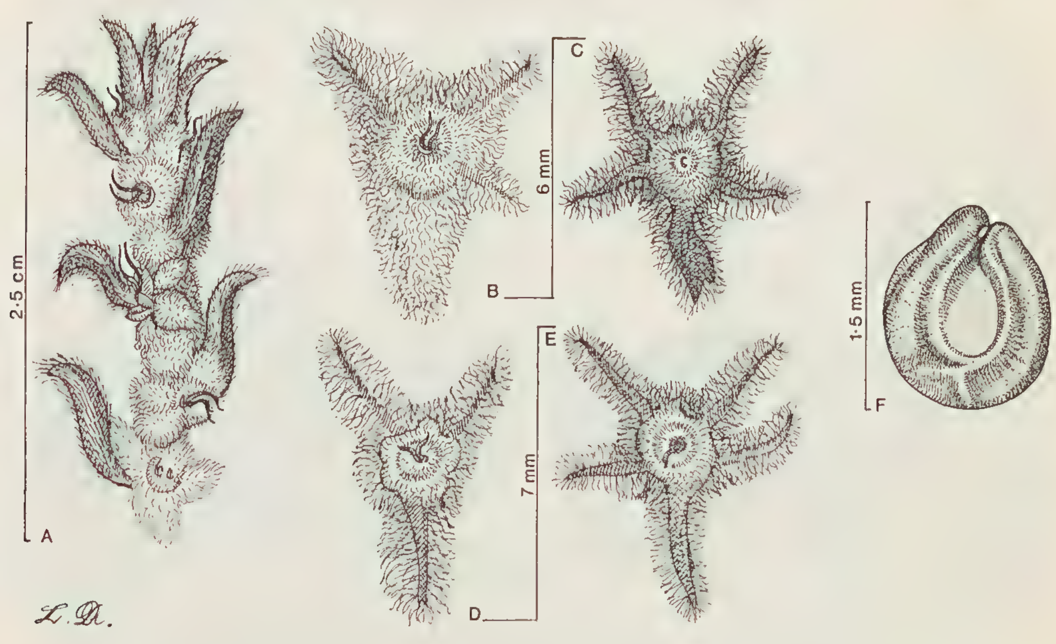

Fig. 1. *Malacocera albolanata* (Ising) Chinnock. A, habit of branch showing densely clustered flowers; B-E, variation in fruiting perianths; F, seed. (A-C, based on type; D-F, *Weber 4549*)

Fig. 2A. Holotype of *M. albolanata* (*J.B. Cleland s.n.*, AD 95820121).

Fig. 2B. Holotype of *M. biflora* (*E.H. Ising 3616*, AD).

similar length; with one or more filiform towards the tip but not pungent, 1(-2) bifid at the apex; densely white-lanate, often becoming sparsely lanate at maturity, the surface blackish-brown with short glandular hairs; style base rarely persistent. *Seed* sub-orbicular, pale yellow-brown, c. 1.5 mm diameter. (Fig. 1.)

Distribution

North-east South Australia, south-west Queensland and western New South Wales. See Fig. 6.

Specimens examined

SOUTH AUSTRALIA: *R.H. Kuchel 2866*, 3 m W of Lake Harry, 1.ix.1971 (AD); *J.Z. Weber 2148*, between Curraworra Bore and Starvation Lake, 29.vii.1971 (AD); *J.Z. Weber 4549*, 5 km N of Wathakertie Waterhole, 17.viii.1975 (AD).

QUEENSLAND: *S.L. Everist 4065*, Cuddapan c. 80 m WSW of Windorah 26.viii.1949 (BRI); *C.T. White 12004*, Dynevor Downs, 2.iv.1941 (BRI).

NEW SOUTH WALES: *R.J. Chinnock 3482*, 31.4 km N of Hawkers Gate, NSW/SA border, 6.v.1977 (AD); *E.F. Constable 4641*, Buckanbee Homestead c. 10 m E of Tilpa, 27.x.1963 (NSW); *G.M. Cunningham 518*, Booligardie Paddock, Delalah Downs, 17.viii.1972 (NSW); *Dorman s.n.*, near Fromes Waterhole W end of Olive Downs, 5.ix.1967 (NSW); *S. Jacobs 3082*, 35 km N of Hawkers Gate, NSW/SA border, 7.v.1977 (AD, NSW); *P.L. Milthorpe 529*, Lake Stewart between Grey and Binera Downs, 11.ix.1971 (AD); *T.H. Riches 45*, Tchelery 28.x.1949 (CANB).

Ecology

Malacocera albolanata appears to favour saline depressions or clay pans on heavy clay soils subjected to occasional flooding. One collection, *White 12004*, stated, however, that it grew on the edge of a freshwater lake.

Notes

The illustration, identified as *B. albolanata* in Ising's paper (loc.cit. 69), does not appear to be of that species. It is not consistent with the manuscript sketches made by Ising and his note under the species (loc.cit. 95) states "*B. albolanata* is near to *B. chippendalei* Ising which has less dense indumentum" but the illustrations of the two species loc.cit. (Figs. 8 & 9) imply the reverse. Furthermore, although *B. albolanata* is said to have "one spine usually obtuse and toothed at the apex", this is not evident in Figs 9a and 9b of his paper.

2. **Malacocera biflora** Ising, Trans.Roy.Soc.S.Aust.78: 113(1955); Hj. Eichler, Suppl. Fl.S.Aust.119(1965).

Type: Evelyn Downs, 90 miles SW of Oodnadatta, South Australia, *E.H. Ising 3616*, 27.x.1953 (holo., AD!; iso. CANB!, K n.v., NSW!). See Fig. 2B.

Shrub to 25 cm tall, 50 cm diameter; branches erect or the laterals decumbent, densely white-lanate, striate. *Leaves* alternate, sessile, linear to oblong, subterete, acuminate, clustered, 5-12 (-25) mm long, white-to brown-villous. *Flowers* paired in the leaf axils, bisexual, densely lanate; tepals 5, covering the ovary; styles 2. *Fruiting perianth* flat, c. 5 mm long, 3 mm broad including the processes and forming a Y configuration; processes 3-4(-5), flattened, ± triangular, c. 1.5 mm long, densely lanate; the 4th and 5th process, if present, smaller than the major ones and often irregular in shape; style base usually not persistent; radicular slit adjacent to the base of the lowermost process. *Seed* brown, sub-orbicular, c. 1.5 mm diameter. (Fig. 3.)

Distribution

Restricted to the Lake Eyre Basin Region of South Australia. See Fig. 6.

Specimens examined

SOUTH AUSTRALIA: *Lake Eyre Basin Region*: Herb. *J.B. Cleland s.n.*, 25 km NW of Oodnadatta,

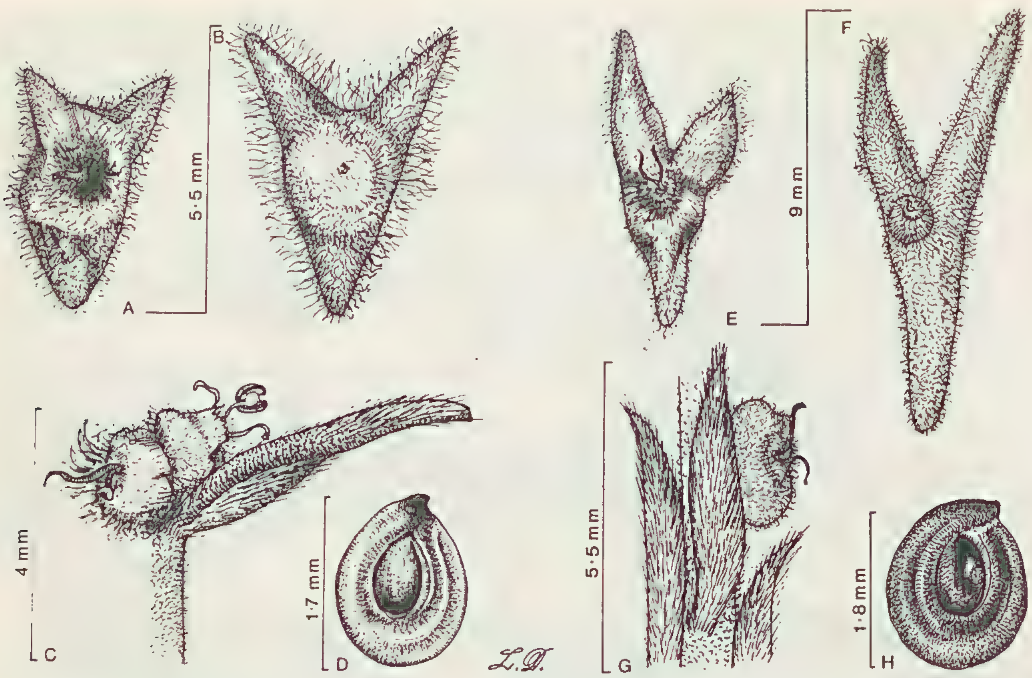

Fig. 3. *Malacocera biflora* Ising. A-B, fruiting perianths; C, portion of branch with paired flowers in the leaf axil; D, seed. *Malacocera tricornis* (Benth.) Anderson. E-F, fruiting perianths; G, portion of branch with leaves and a flower; H, seed. (A-D based on the type; E, *Chinnock 1471*; F-H, *Ising* 96620205).

22.viii.1933 (AD 966041008); *E.H. Ising s.n.*, Evelyn Downs, Oct. 1949 (AD 96621051); 13.x.1953 (AD 96621059, AD 97038014); 27.x.1953 (AD 96620204, 96929690, 96929692-96929698); 19.viii.1954 (AD 96228187); 26.viii.1954 (AD 97038012); 2.vii.1955 (AD 97038008); 12.viii.1955 (AD 97038007); 13.viii.1955 (AD 97038009); 10.x.1955 (AD 97038011); 17.x.1955 (AD 97038010); 29.x.1955 (AD 97038013); *E.H. Ising 3617*, Evelyn Downs, 27.x.1953 (AD, MEL); *E.H. Ising s.n.*, 30 km E of Evelyn Downs, 16.ix.1953 (AD 96929691, 96929699); *E.H. Ising s.n.*, Mt Barry Station, 7.viii.1954 (AD 97038115); c. 20 km W of Mt Barry, 12.xi.1955; (AD 97038116); *B. Lay 614*, Engenina Creek, c. 50 km SE of Coober Pedy, 10.x.1971 (AD, MEL).

Ecology

Little is known of the ecology of *M. biflora*. None of Ising's many collections from the Evelyn Downs region has any information on the environment but the label on one collection, *Lay 614*, does state that the species was growing on a "sandy arid treeless plain near a watercourse", which suggests soil preferences similar to the other species.

3. **Malacocera gracilis** Chinnock, sp. nov.

Planta ephemera vel breviter perennis, ramis erectis gracilibus, 0.5-0.8 mm diametro, lanatis. Folia et perianthia fructicantia ramos appressa. Perianthium fructificans processibus tribus usque quinque, lanatis, complanatis. Semen brunneum, nitens, c. 1.5 mm diametro.

Type: Near small salt lake on road to Chinaman Creek, west of Nectar Brook, South Australia, 32° 42′ S, 137° 54′ E, *R.J. Chinnock 1695*, 5.ix.1974 (holo., AD; iso. AD, B, BRI, CANB, K, MEL, NSW, NT, PERTH, US). See Fig. 5A.

Ephemeral or short lived perennial herb to 25 cm tall, 10-20 (-40)cm broad, with a woody rootstock; branches erect or the laterals decumbent, thin and flexible, 0.5-0.8 mm diameter, striate, densely white-lanate. *Leaves* spiral, sessile, linear, acuminate, subterete, appressed to branches, 2.5-4 (-5) mm long, white silky-villous. *Flowers* solitary, axillary, densely lanate; tepals 5, covering the ovary; styles 2. *Fruiting perianth* flattened,

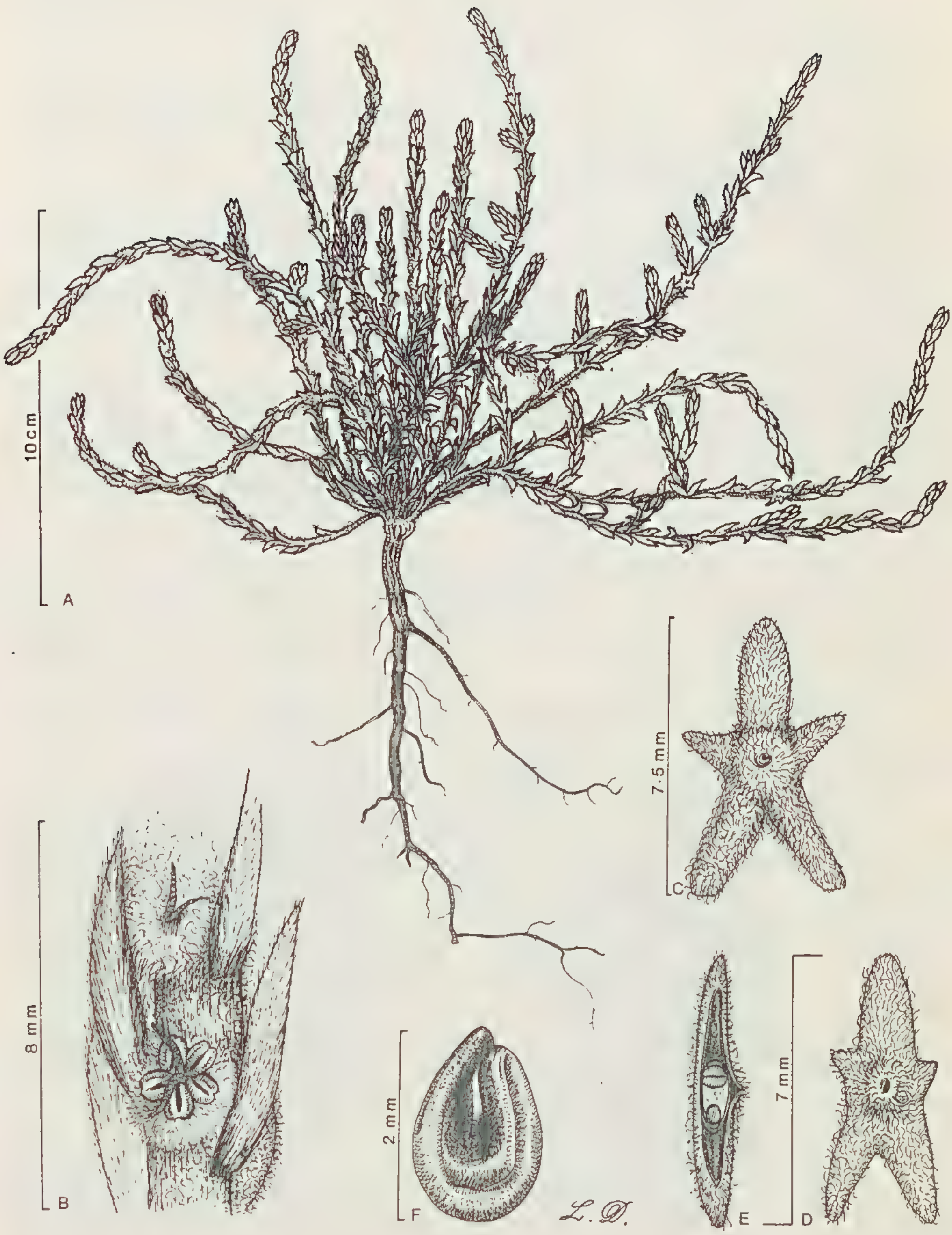

Fig. 4. *M. gracilis* Chinnock. A, habit; B, enlargement of branch with flowers and leaves; C, D, fruiting perianth; E, fruiting perianth in cross-section showing position of seed; F, seed. (A-F, based on type).

appressed to branch, forming an inverted-Y or star configuration; processes 3-5, the three major processes flat, 2 minor usually present but smaller, often irregularly formed and fused with the major processes to form plate-like expansions; radicular slit situated between the two lowermost processes; style not persistent. *Seed* sub-orbicular or ovoid, brown, shiny, smooth, c. 1.5 mm diameter. (Fig. 4.)

Distribution

This species is known only from South Australia where it occurs on the coastal strip between Port Augusta and Mt Grainger, Yalata Harbour and on the southern shores of Lake Callabonna. See Fig. 6.

Specimens examined

SOUTH AUSTRALIA: *Lake Eyre Basin Region*: *S. Jacobs 3564*, 103 km SW of Hawker Gate, S end of Lake Callabonna, 13.v.1979 (NSW, AD).

Eyre Peninsula Region: *R.J. Chinnock 2105*, gypseous rises around salt lake on road to Chinaman Creek, 32° 42′ S, 137° 54′ E, 30.ix.1974 (AD); *E.H. Ising s.n.*, Port Augusta, 5.viii.1954 (AD 96620181); *D.J.E. Whibley 5459*, between Point Patterson and Redcliff Point, 32° 36′ S, 137° 50′ E, 9.i.1975 (AD).

Ecology

M. gracilis is restricted entirely to powdery gypseous mounds in *Arthrocnemum* shrubland in the Port Augusta vicinity. This ephemeral species occurs in large numbers on these mounds and is associated with halophytic species such as *Disphyma clavellatum* (Haw.) Chinnock and *Angianthus* aff. *brachypappus* F.Muell.. At Lake Callabonna the species was growing on saline clay soils.

4. **Malacocera tricornis** (Benth.) R.H. Anderson, Proc.Linn.Soc.N.S.W.51: 382 (1926); J.M. Black, Fl.S.Aust. ed.2.: 308(1948); J.H. Willis, Hb.Pl.Vic.2: 192(1973).102

Chenolea tricornis Benth., Fl. Austr.5: 190(1870); Ewart, Fl.Vic. 458(1931). *Bassia tricornis* (Benth.) F. Muell., Syst.Census Aust.1: 30(1882); J.M. Black, Fl.S.Aust.ed.1.: 192(1924); Blackall & Grieve, West.Aust.Wildfls 1: 152(1954).

Lectotype designated here: Clay Flats, Darling River, *Dallachy s.n.* (MEL 1514717!) See Fig. 5B.

Illustration: F. Muell., Icon.Austr.Salsol.Pl.: Pl.63(1891).

Shrub erect, to 80 cm high; branches striate, densely white-lanate. *Leaves* alternate, scattered, sessile, linear to subterete, acute, (4.5-) 8-13(-17) mm long, spreading, the tips recurved, densely white or pale golden brown-villous. *Flowers* solitary, axillary, lanate; tepals 5; styles 2 or 3. *Fruiting perianth* forming a Y configuration; processes 3 rarely 4, 3.5-6.0 mm long, sub-cylindrical, compressed in horizontal or vertical plane, often curved upwards towards their tips, lanate; radicular slit adjacent to the base of the lowermost process. *Seed* ovoid to sub-orbicular, pale brown, 1.5-2 mm diameter.

Distribution

South Australia, Northern Territory, south-western Queensland, western New South Wales, north-western Victoria. (Fig. 6.)

Representative specimens (total specimens examined 64)

WESTERN AUSTRALIA: *W.V. Fitzgerald s.n.*, Skirmish Hill, 1898 (PERTH); *A.A. Mitchell s.n.*, 40 km E of Mt Vetters, 24.iv.1975 (PERTH).

SOUTH AUSTRALIA: *H.D. Andrewartha s.n.*, 31 m from Parakylia NW of Lake Torrens, 18.iii.1939 (ADW 11699); *R.J. & S.L.M. Chinnock 1471*, Redcliff Point road, W of Nectar Brook, 26.vii.1974 (AD); *M. Crisp 262*, Koonamore, 8.vii.1971 (AD); *E.H. Ising s.n.*, Evelyn Downs, 13.x.1953 (AD 96620205); *Max Koch s.n.*, Mt Lyndhurst, Sept. 1899 (NSW); *R.H. Kuchel 2647*, c. 10 km E of Moolawatana HS, 22.viii.1968 (AD); *R. Swinbourne 203*, 5 km N of Arcoona HS, 11.ix.1968 (AD); *M.C. Willcocks 21*, Glen Benda, Mt Mary, 6.ix.1971 (AD).

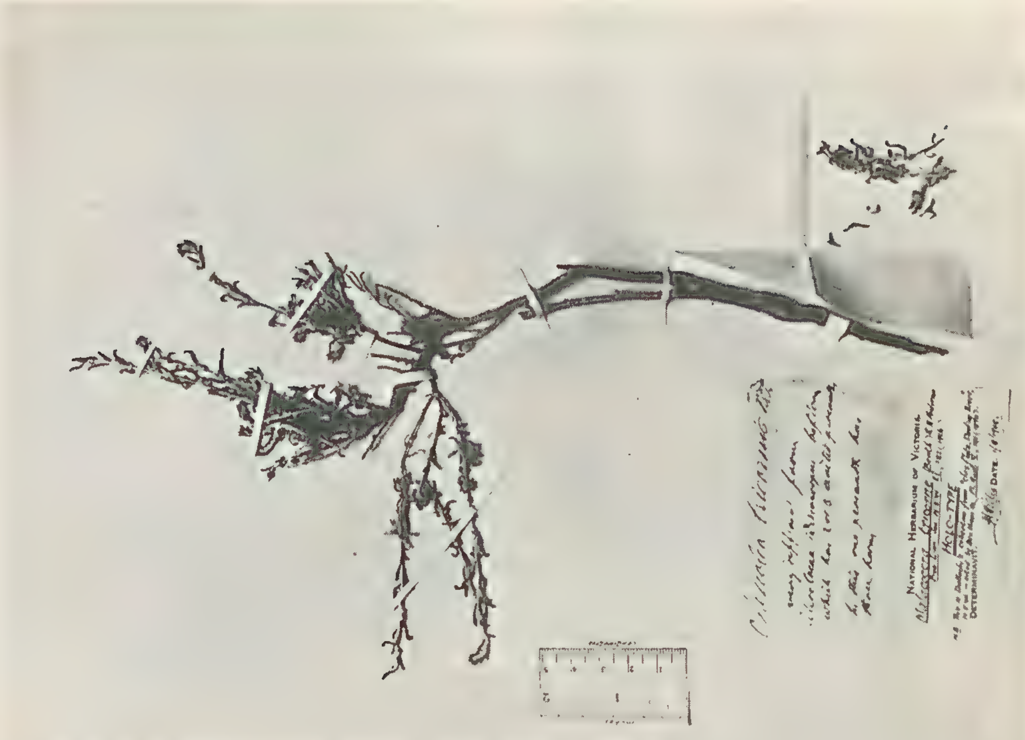

Fig. 5B. Lectotype of *M.tricornis* (*Dallachy s.n.*, MEL).

Fig. 5A. Holotype of *M. gracilis* (*R.J. Chinnock 1695*, AD).

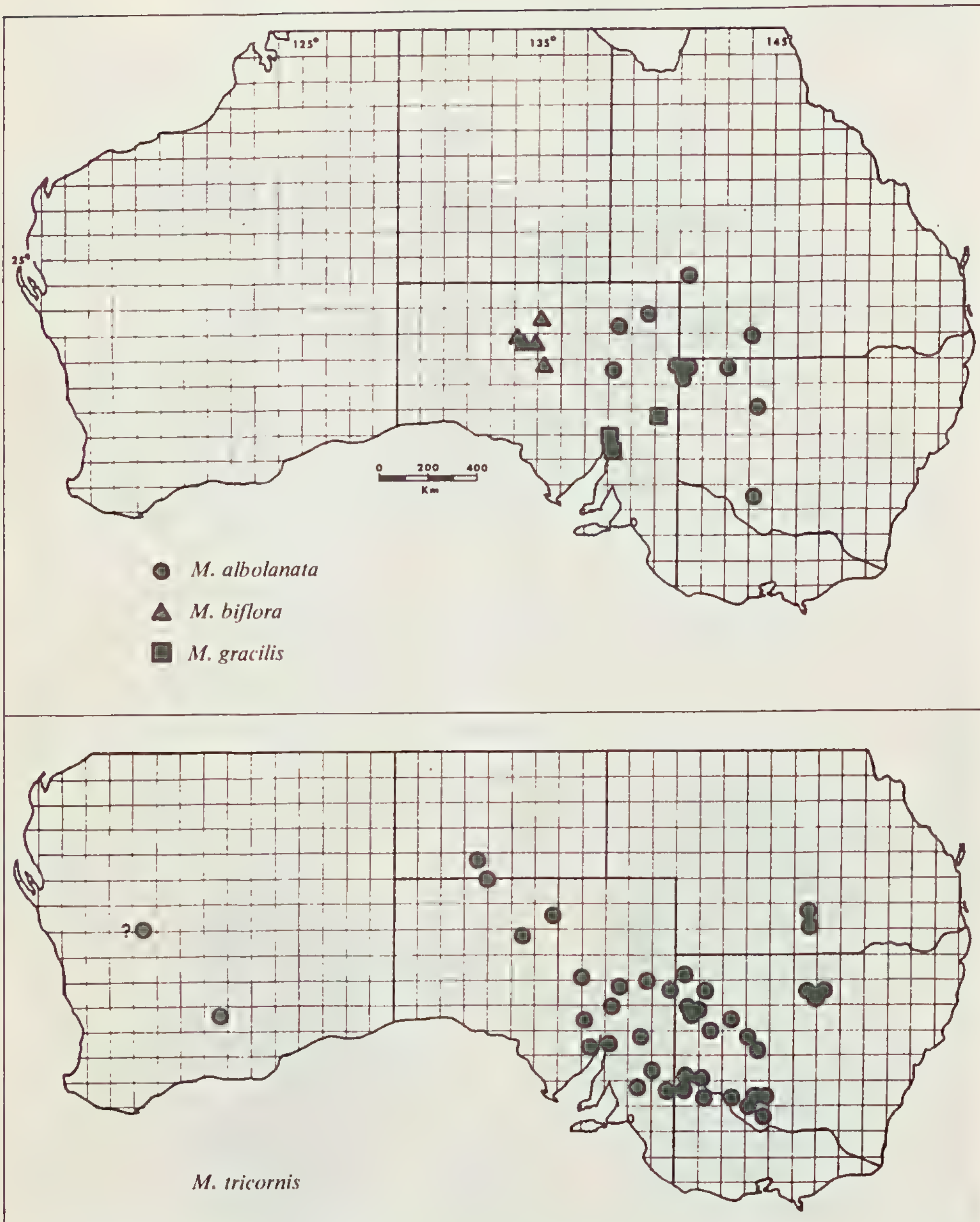

Fig. 6. Distribution of *Malacocera* species.

NORTHERN TERRITORY: *T.S. Henshall 1001*, Mt Ebeneyer, 30.iv.1975 (NT); *A. Nicholls 935*, 2 m E of Victory Downs, 18.ix.1968 (AD, NSW, NT).

QUEENSLAND: *I.M. Arthur s.n.*, "Bluegrass" via Cunnamulla, 30.xi.1970 (BRI 243311); *R.W. Purdie s.n.*, 7 km S of "Bluebank", 9.v.1977 (BRI 224289).

NEW SOUTH WALES: *E.H. Collier s.n.*, Yandama, Sept. 1910 (NSW 143876); *E.F. Constable s.n.*, Byrnedale S of Broken Hill, 16.xi.1947 (NSW); *G.M. Cunningham s.n.*, Willamurra, Gongalgon, April 1967 (NSW); *J.C. De Nardi 827*, c. 4 km ESE of Cobham HS, 28.ix.1971 (NSW); *J.C. De Nardi 1117*, 16 m E of Ivanhoe on Conoble road, 25.x.1972 (NSW); *R.B. Harvey s.n.*, Junction of the Darling and Murray Rivers, 1896 (MEL); *S. Jacobs 2199*, Fowlers Gap, 7.x.1975 (AD, NSW); *A. Morris s.n.*, Pine Creek, 25.viii.1928 (ADW 16162,BRI 243313); *J.H. Riches 42*, Tchelery, Moulamein, 28.x.1949 (CANB); *O.B. Williams 64*, Wanganella, 18.viii.1949 (CANB).

VICTORIA: *A.C. Beauglehole 40571*, Kulkyne Forest, 14.x.1972 (MEL); *J. Cullimore 37*, 3 m E of Redcliff, 15.viii.1967 (MEL); *T.S. Henshall Sy 4/6614*, Sandalong Park, 3 m E of Mildura, 24.ix.1966 (NSW); *T.S. Henshall s.n.*, NW Redcliffs, river flat behind pumping station, 12.viii.1967 (NT 41060); *J.H. Willis s.n.*, 1.5 m E of Berribee Tank, 31.viii.1948 (MEL).

Ecology

M. tricornis, the most widespread species, appears to have a far greater tolerance to different soil types and variable drainage than do the other species. It is common on alluvial flood plains, along major drainage systems, e.g. Murray River, and it is frequent around saline depressions on heavy clay soils. In addition it has been observed growing amongst *Pachycornia tenuis* (Benth.) J.M. Black on transitional soils between estuarine mudflats and the alluvial outwash plain on the upper reaches of Spencer Gulf while *Nicholls 935* records the species as growing on a "treeless stony rise amongst chenopodiaceous shrubs".

Acknowledgements

I thank Paul Wilson and Surrey Jacobs for their discussion and comments on *Malacocera*, Ludwik Dutkiewicz for the illustrations and John Jessop for his criticism of this manuscript; the Directors of the following herbaria for consultation or loan of specimens: ADW, BRI, MEL, NSW, PERTH, NT.

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THE NOMENCLATURE OF AND A KEY TO SOME CULTIVATED SPECIES OF *MONTANOA* CERVANTES (COMPOSITAE)

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Abstract

The names *Montanoa bipinnatifida* (Kunth) C. Koch, *M. heracleifolia* Brongn. and *M. pyramidata* Sch. Bip. ex C. Koch are typified or discussed in relation to plants grown in gardens. The three names relate to the same taxonomic species, with *M. bipinnatifida* having nomenclatural priority. The synonymy of *M. bipinnatifida* is given together with an illustration and comments on the allied cultivated species *M. grandiflora* (DC.) Sch. Bip. ex C. Koch and *M. hibiscifolia* (Benth.) Sch. Bip. ex C. Koch. The status of *M. elegans* C. Koch and *M. wercklei* A. Berger is also discussed.

Introduction

The earliest review of the genus *Montanoa** is Koch (1864). Robinson and Greenman (1899) reviewed the genus, Standley (1926) prepared a flora treatment of the Mexican species, and Nash (1976) did likewise for those from Guatemala. However, none of this literature enabled flowering material of a *Montanoa* grown in Adelaide Botanic Garden (Fig. 3) to be satisfactorily identified, material which originated from cultivation in Teneriffe as seed of plants labelled *M. bipinnatifida*.

In gardens this species has also been called *Montanoa heracleifolia* Brongn., *Polymnia grandis* Kunth, *Polymnia heracleifolia* auct., and *Montagnaea* (sic) *heracleifolia* (Brongn.) Brongn. Using the key in Standley (1926), Adelaide flowering material keys out to be *M. pyramidata* Sch. Bip. ex C. Koch, with Standley placing the names *M. bipinnatifida* and *M. elegans* C. Koch as taxonomically doubtful. *M. heracleifolia* tends to have been a name used only in a horticultural context (see typification). Using the key in Robinson and Greenman (1899), no clear distinction is possible between *M. pyramidata* and *M. bipinnatifida* and *M. elegans* is once more queried.

Mr. C. Jeffrey (personal communication 21 July, 1976) writes, "There are three distinct *Montanoa* species in cultivation, to all of which the name *M. bipinnatifida* has at one time or another been applied. *M. grandiflora* (DC.) Sch. Bip. ex C. Koch seems to be the least frequently met with . . .", and, ". . . is easily distinguished from the others by the petiole being broadly winged to the very base. *M. pyramidata* . . . has pinnately or bipinnately lobed leaves and petioles not or irregularly and narrowly winged; it is probable that this is the species to which the name *M. bipinnatifida* . . . properly applies, though the type will have to be checked to confirm this". The third species is "*M. hibiscifolia* (Benth.) Sch. Bip. . . .", with, ". . . palmately lobed leaves . . . very characteristic auricle-like lobes at the apex of the petiole, unwinged petioles and also smaller flowers than the other two".

As it seems likely that Standley did not have access to the European types of these names, herbarium material and types from GH, P, G, W, C, K, BM and US were examined to determine their relationship. Material was unavailable from KIEL, LZ, TCD, S, H, B, and L.

**Montanoa* commemorates the physician and naturalist from Puebla, Mexico, Don Luis Montaña. The genus comprises about 50 species (Airy Shaw, 1973).

Key to *Montanoa* in cultivation*
(classification after Robinson & Greenman, 1899)

1a. Ray florets 2 to 5, to about 7 mm long. . . . . *M. tomentosa* (subg. *Eriocarpha*)
b. Ray florets more than 5 and more than 10 mm long 2

2a. Lower leaves deeply pinnatifid 3
b. Lower leaves not pinnatifid 5

3a. Petioles broadly winged to base. . . . . *M. grandiflora* (subg. *Uhdea*)
b. Petioles unwinged, or not winged to base 4

4a. Leaves longer than broad. . . . . *M. bipinnatifida* (subg. *Uhdea*)
b. Leaves almost as long as broad. . . . . "M. elegans".

5a. Leaves deeply palmate-lobed; ligulate florets c.1.0-1.5 cm long. *M. hibiscifolia* (subg. *Acanthocarpha*)
b. Leaves shallowly lobed, angulate or ovate; ligulate florets c.1.5-2.5 cm long. *M. guatemalensis* (subg. *Acanthocarpha*)

* No key has been previously published for *Montanoa* in cultivation; see Chittenden (1951).

Observations

1. **Montanoa bipinnatifida** (Kunth) C. Koch. *Wochenschr. Gärtn. 7* : 407 (1864).

Uhdea bipinnatifida Kunth, *Ind. Sem. Hort. Berol.* 13 (1847). *Basionym.*

Neotype: *Herb. Schultz Bip. s.n.*, ex Hort. 25.ii.1864 (P).

Polymnia grandis Hort. ex Kunth, *Ind. Sem. Hort. Berol.* 13 (1847), nomen nudum.

Montanoa heracleifolia Brongn., *Rev. Hort.* Sér. 4, *5* : 544 (1857), nomen nudum.

Montagnaea heracleifolia André, *Rev. Hort.* 370 (1863), c. descr., orthographic variant of generic name.

Neotype: *Herb. Mus. Paris s.n.*, ex Hort. 1865, (P).

Montanoa elegans C. Koch, *Wochenschr. Gärtn.* 7 : 408 (1864).

Type: unknown.

Montanoa pyramidata Sch. Bip. ex C. Koch, l.c. 408.

Lectotype: *Oliva s.n.*, pr. Guadalajara, Mexico. 1853 (P).

Eriocoma pyramidata (Sch. Bip. ex C. Koch) Kuntze, *Rev. Gen. Pl. 1* : 336 (1891).

Polymnia heracleifolia auct. Hort., nomen nudum.

Kunth's (1847) description of *Uhdea bipinnatifida* also represents the type description of the genus *Uhdea*, at that time monotypic. The description includes the following reference.

"*Uhdea* Kth. in Verhandl. d. Vereins zur Berförd. d. Gartenbaues in den Preuss. Staaten 1847" (neither the Kew library nor the Deutsche Staatsbibliothek, Berlin are able to assist with the location of this work).

This taxon was based on a specimen raised from seed discovered at Matameros in Mexico by the Prussian Consul Uhde (Koch, 1864), "an active amateur collector, but perhaps only of seeds, bulbs, and scraps of herbarium material" (McVaugh, personal communication, 4 May, 1977). The seed was introduced to the Berlin Botanic Garden in 1845 from whence plants were distributed amongst European gardens initially under the informal name *Uhdea pinnatifida* Kunth. In the autumn of 1847 Kunth published the combination *Uhdea bipinnatifida* (*Ind. Sem. Hort. Berol.* 13).

Examination of all available herbarium material other than that from Berlin, where material was destroyed in the Second World War (personal communication), demonstrates that only one specimen in the Schultz Bipontinus Herbarium in Paris corresponds very closely with the morphology described in publication of the name *M. bipinnatifida*. This specimen comprises one leaf, three capitula (one in fruit on part of an inflorescence), and a paper capsule containing a leaf tip and florets. The specimen is from the "Herbarium

E. Cosson 18 - Herb. Mus. Paris" with the following inscriptions in the hand of Schultz Bipontinus:

"Montagnea [sic] (pinnatifida) hirtiflora Sch. Bip. - Uhdea pinnatifida Hort. -22/xii/63 Hort. Berol. C. Koch."

"Montanea [sic] bipinnatifida C. Koch! - 25/ii/64 Hort. Deinely [?] Sz. Bip. - Herb. Schultz Bip."

The interpretation placed on this specimen is that it derives from original plants known to Koch and grown in Berlin in 1863, and known to Schultz Bipontinus and grown in France in 1864. Koch may have been instrumental in sending voucher material or offsets of living plants from Berlin to Paris in 1863 as suggested by the use of the inscription "Hort. Berol. C. Koch", and on "22/xii/63", more than a year prior to Koch's December 1864 review of *Montanoa*. Koch was probably working on the genus at this time (1863) but may not have sorted out the nomenclature, thus explaining Schulz Bipontinus use of the combination "*Montagnea* (*pinnatifida*) *hirtiflora* Sch. Bip."

Schulz Bipontinus inscription "*Montanea bipinnatifida* C. Koch!" and date "25/ii/64" surely refers to manuscript information sent to Paris by Koch prior to publication of the December review of the genus; "Hort. Deinely [?]" refers to the cultivation of material in a garden (in France ?) the name of which being somewhat illegible.

That the specimen in the Schultz Bipontinus Herbarium represents the same taxon introduced to Berlin as seed 16 years earlier is possible because it seems unlikely that Berlin stocks of an easily grown rarity would have died out so quickly. Independent support for the view that the Paris material probably represents clonal material from the type plant comes from Drs McVaugh and Lourteig (personal communications May 4, 1977 and December 13, 1976, respectively). It is also possible that Paris had previously received material from the Berlin clone which provided Kunth's type of the name *Uhdea bipinnatifida*.

As the existence of the Kunth type material of *M. bipinnatifida* elsewhere is doubtful according to McVaugh (personal communication), as it has not been located after considerable enquiry amongst European herbaria and as the Paris specimen corresponds closely with the type description, the Paris specimen is here designated *neotype* of the name *M. bipinnatifida* (Fig. 1).

Montanoa heracleifolia Brongn. (1857) was published as a *nomen nudum* following cultivation of three seed samples collected by M. Ghiesbreght in Mexico in 1843 (Groenland, 1857); (the other two samples of seed relate to *M. purpurea* Brong. (a *nomen nudum*), and *M. mollissima* Brongn. (possibly synonymous with *M. grandiflora*, q.v., according to Robinson and Greenman (1899)). After requesting loan of possible specimens pertaining to the name *M. heracleifolia* which was validated by reference to cultivated living plants without citation of a voucher by André (1863), examination of all available material demonstrates that only one specimen in Paris derived from cultivation, bears that name. I am inclined to agree with Lourteig (personal communication December 13, 1976) that, "Sûrement ils sont issus des mêmes clons de la plante décrite par Brongniart . . ."

The sterile specimen comprises two expanding leaves and two more emerging from bud on a stem fragment; the petioles are incompletely winged and the abaxial lamina scabrously puberulent. The inscriptions are in an unknown hand and are as follows:

"Montagnaea bipinnatifida C. Kch - M. heracleifolia Brongt. H. var. H. var. cult. 1865".

"Herb. Mus. Paris - Uhdea".

Although the label on this specimen postdates the publication of the name (in 1857) by

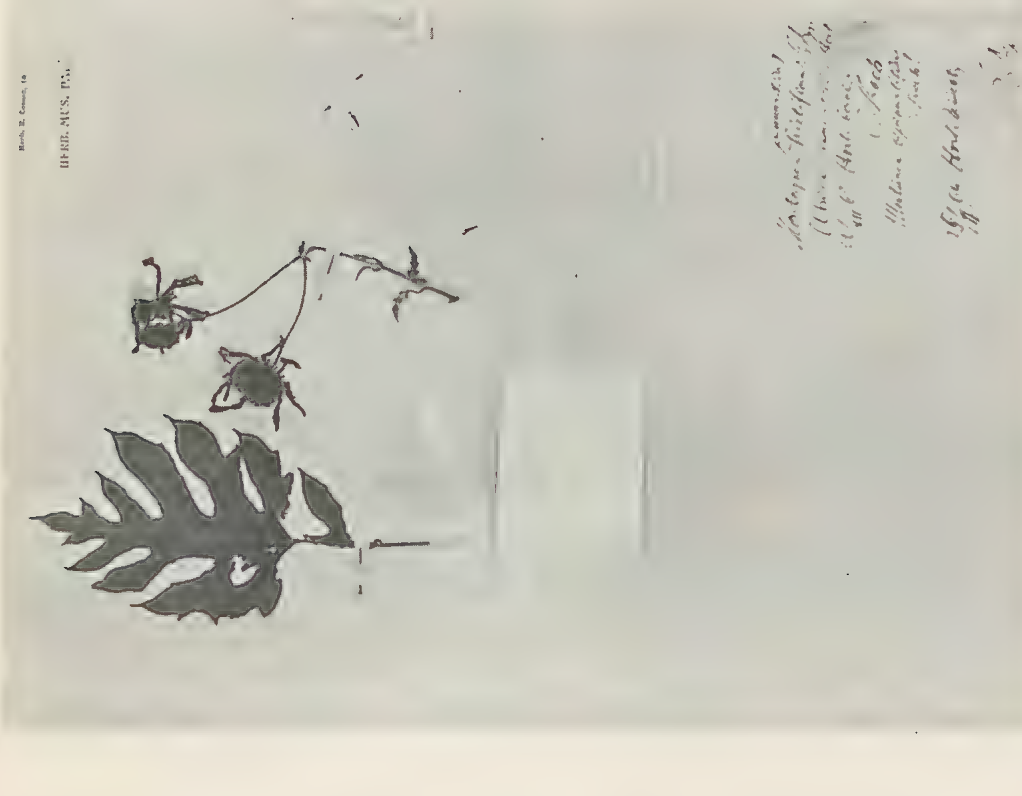

Fig. 1. Neotype of the name *Montanoa bipinnatifida* (Kunth) C. Koch; Herb. P.

Fig. 2. Specimen labelled *Montanoa heracleifolia* Brongn.; Herb. P.

8 years and description (in 1863) by 2 years, there is, in view of circumstancial evidence and a lack of other specimens, the distinct possibility that the leaves of this specimen came from the same cultivated stock which was known by Brongniart, (Fig. 2); on this basis the specimen is designated *neotype* of the name *M. heracleifolia*.

Unlike *M. bipinnatifida* and *M. heracleifolia*, the name *M. pyramidata* was not applied to plants in cultivation, but to collections made in Mexico by Oliva in Guadalajara, and another by Alwin Aschenborn. There is no evidence to suggest that seed was grown from these collections.

Koch's (1864) brief initial description of *Montanoa pyramidata* includes:

"22. M. pyramidata C.H. Schultz-Bip. n. sp. Eine vom Dr Oliva am Guadalajara und ausserdem von Aschenborn in Mexico entdeckte und den beiden letzten Arten im Habitus ähnliche Art".

Examination of all available herbarium material demonstrates the existence of but one specimen in Paris collected by Oliva and partly annotated by Schulz Bipontinus, partly by an unknown hand. The inscriptions read:-

"L.j.G.Don Oliva - pr. Guadalajara Mexico - ligulae albescentis flavesci - let. D. Schaffaer 1853".
Herb. E. Cosson 18 - Herb. Mus. Paris".
"349 - Montagnaea pyramidata - strigosa [deleted] Sz. Bip. - fol. prope strigosa infra glara - n. sp. 29/1863".
"Montagnaea spec. - karwinski affn. speciosa DC."
[Determinavit slip] Dr R. McVaugh 1970 "M. pyramidata Sch. Bip. ex Klatt".

The interpretation placed on this Schulz Bipontinus (Paris) specimen is that, if a unicate, it may have been communicated to Berlin and hence Koch, the Berlin specimen of Aschenborn having been subsequently destroyed there in the Second World War (vide Lanjouw and Stafleu 1954, p. 43). Koch did not nominate a holotype from the Oliva and Aschenborn collections. The date "29/1863" on the Paris specimen predates publication of the combination *M. pyramidata*, so that only manuscript names may have been known to Schulz Bipontinus as supported by deletion of the epithet "strigosa", presumably done after publication, or at least in the final stages of manuscript preparation by Koch. However, there is no evidence to show that Koch saw the Oliva specimen if it was communicated to him as there are no obvious annotations in his hand on the Paris specimen. There is a remote possibility that a duplicate Oliva specimen once existed in Berlin but this is speculation.

The attribution of publication of the combination to Klatt on the McVaugh determinavit slip is in error according to McVaugh (personal communication, August 29, 1977).

The Paris specimen is relatively complete comprising the terminal part of an inflorescence, some capitula, and two upper foliage leaves about 7 cm long. As the collection data and specimen morphology corresponds with that in the type description, and annotations are in the hand of Schultz Bipontinus, the specimen is here designated *lectotype* of the name *M. pyramidata*. (Fig. 4).

Both Robinson and Greenman (1899) and Standley (1926) treat *M. elegans* as an unknown entity. The former authority states "of unknown country and characterized only as to leaf contour, . . . most nearly related to if not identical with *M. pyramidata* Sch. Bip., from which so far as known it differs only in the absence of the inconstant petiolar appendages". None of the herbaria from which loans were requested supplied material which could be associated with the name *M. elegans*. Koch (1864) stated "Wie sie nach Europa gekommen, wissen wir nicht; in den Handel kam sie aber von Wien aus

Fig. 3. *Montanoa bipinnatifida* (Kunth) C. Koch; a. leaf; b. disk floret; c. immature achene; d. capitulum; e. sketch of inflorescence and upper stem leaves. Illustration by L. Dutkiewicz.

durch den Handelsgärtner Abel unten den Namen *Uhdea bipinnatifida* vera". If a Viennese herbarium specimen once existed in Berlin collections known to Koch, it may have since been destroyed. The name is here placed in synonymy with *M. bipinnatifida* on the basis of the comments of Koch (1864) and Robinson and Greenman (1899), the description being based on material in cultivation.

Adelaide Botanic Garden material clearly belongs with the species to which the names *Montanoa bipinnatifida*, *M. heracleifolia* and *M. pyramidata* have variously been attributed by Koch (1864) and Robinson & Greenman (1899). On the basis of the morphological similarity between such types of these names as exist, the correct name for the species is the first one published, *M. bipinnatifida*, with *M. heracleifolia* and *M. pyramidata* synonyms. As well as being illustrated in Fig. 3, *M. bipinnatifida* is shown in vegetative state in Robinson (1889) p. 616 under the caption "*Polymnia grandis* syn. *Montagnea heracleifolia*".

When in flower *M. bipinnatifida* serves as a useful 'spot plant' in the herbaceous border and larger shrubbery, and its young foliage also has sculptural quality as was realised by gardeners of the Victorian era. In Adelaide, the species flowers in June or July and is propagated by seed or division of the rootstock or soft tip-cuttings under mist. As a perennial it requires a frost-free growing season and ample sunshine in order to flower, when it constitutes an arresting display of white capitula with yellow disc florets surmounting boldly lobed, dark green foliage. The species is a native of Mexico.

This species which fits into subg. *Uhdea*, as contrued by Robinson & Greenman (1899), is one of a group of large ornamental montanoas once more commonly grown in European gardens than at present, and was referred to by Robinson (1889) as "second to no other . . . for its dignified and finished effect in the flower garden". Speaking of the species in western Europe Robinson said it "is best planted out at the end of May, and should be in every collection". The even larger arborescent composite from Mexico, *Podachaenium eminens* (Lag.) Sch. Bip. flowers later, cannot fail to command attention, and these two composites are presently being used at Adelaide in conjunction with *Dahlia imperialis* Roezl ex Ortg. and *Arundo* in an experimental double herbaceous border of large proportions.

Specimens examined

MEXICO: pr. Guadalajara, *Oliva 349* (Lectotype P. *M. pyramidata*); Barranca, 3.xii.1889, *Pringle 2930* (GH); el Colesio to Las Palmas, 30.xii.1926, *Mexia 1323* (A); S. Naranjillo, 26.xi.1938, *Hinton 12684* (GH); Huajuapam, 19.xi.1894, *Nelson 1984* (GH); Temascal to Huetamo, 13.xi.1949, *Moore et all 5694* (GH).

CULTIVATED: Hort. Berol., 22.xii.1863, *Koch s.n.*? (neotype P); Hort. Harvard University, 1870, (GH); Hort, Adelaide Botanic Garden, 27.v.1966, *Potter 368* (AD); Hort. Paris, 1865, (neotype ? P as *M. heracleifolia*).

2. **Montanoa grandiflora** (DC.) Sch.Bip. ex C.Koch, *Wochenschr. Gärtn. 7* : 408 (1864).

Montagnaea grandiflora DC., *Prodr. 5* : 565 (1836). *Basionym.*

Holotype: *Alaman s.n.*, Mexico, 1831 (G.DC.)

In relation to Jeffrey's comments quoted previously, the holotype of *M. grandiflora* has been seen in a microfiche edition of the DeCandolle Herbarium in Geneva; it is a collection by Alaman, dated 1831, gathered from Mexico and cited in DeCandolle's type description (1836). There is an illustration of *M. grandiflora* based on plants cultivated in the garden of M.R. Roland-Gosselin of Villefranche-sur-Mer in *Rev. Hort.* (1910) p. 176-177.

The descriptions of *M. mollissima* Brongn. in Chittenden (1951), Hutchinson (1907) and Groenland (1857) nowhere refer to lobing of lower leaves which is implied by

Fig. 4. Lectotype of the name *Montanoa pyramidata* Sch. Bip. ex C. Koch; Herb. P. Fig. 5. Lectotype of the name *Montanoa wercklei* A. Berger; Herb. K.

Robinson & Greenman (1899) in reduction of the binomial to synonymy with *M. grandiflora*. The type description in Groenland (1857) contains no reference to a specimen, except that plants were raised from seed collected by Ghiesbreght. A thorough search in Ghiesbreght collections might produce type material, but I have sighted no such specimen. In the interim, I follow Robinson & Greenman (1899), who place the species in subg. *Uhdea*.

3. **Montanoa hibiscifolia** (Benth.) Sch.Bip. ex C. Koch, *Wochenschr. Gärtn. 7* : 407 (1864).

Montagnaea hibiscifolia Benth. in Oerst. *Vid. Medd. Kjoeb.* 1852 : 89 (1852). *Basionym.*

Lectotype: *Oersted (235)*, "In provincum Segovia" Nicaragua, 1851 (K); *Oersted (134)*, "Ad Barba nr. Costarica" 1851 (syntype K); *Oersted 9051*, "In prov. Segovia", Nicaragua (2 isosyntypes C).

Montanoa wercklei A. Berger, *Gard. Chron.* Ser. III *50* : 122 (1911).

Lectotype: *Berger s.n.*, Hort. La Mortola, ex Santiago, Costa Rica, leg. C. Werckle 1905 (teste Berger, 1911), 3.i.1908 (K).

The types of *M. hibiscifolia* have been seen, being collections housed in Copenhagen and Kew made by Oersted from Segovia in Nicaragua (No. 235), and Volcan de Barba, Costa Rica (No. 134).

This Bentham name has not previously been lectotypified, and it now seems appropriate to do so. The specimens cited in the type description are as follows:- "fandt jeg i Bjergskovene i Segovia i Naerheden af Matagalpa (4500′) og paa den sydlige Skraaning af Vulkanen Barba i Costa-Rica (6000′)". Clearly no holotype was nominated.

The type specimen folder for *M. hibiscifolia* at Copenhagen contains two sheets both inscribed "In. prov. Segovia", but with little other data corresponding with that given in the type description.

The equivalent folder at Kew contains two sheets, both from Herbarium Benthamianum, one inscribed "Ad Barba nr. Costarica", the other "In provincum Segovia" and numbered 134 and 235 respectively. There is also good evidence, in the way the shoot base has been torn away in the larger Copenhagen specimen, that Bentham's collection (from Segovia) provided the source of the Danish voucher. These circumstances are coupled with the fact that Bentham's annotation of all specimens demonstrate he described the new species using vouchers later kept in his personal herbarium. As the Segovia collection is a fruiting specimen but more complete than the Costa Rican, which is flowering, the Segovia collection 235 at Kew is here nominated *lectotype* of the name *M. hibiscifolia*, Fig. 6, with the Copenhagen specimens here designated isosyntypes. The Costa Rican specimen at Kew is here designated a syntype.

The status of *M. wercklei* A. Berger, the type description of which was made from cultivated flowering material grown in Sir Thomas Hanbury's garden of La Mortola, Ventimiglia, Italy, can also be appropriately dealt with at this point. The curator of La Mortola, Alwin Berger, stated that C. Werckle communicated seed which was collected in 1905 in Costa Rica, Berger (1911). Plants raised from the seed first flowered on January 3 1908, and two herbarium specimens, one fertile and one vegetative were sent to Kew, where they were received on July 31, 1908. Berger also stated that the colloquial name for the plant in Costa Rica was "Toona quirita". In 1911 Berger described the introduction as a new species, *M. wercklei*, but nominated no holotype. It is possible to typify *M. wercklei* because the taxon is represented by several good herbarium specimens from La Mortola at Kew, dated January 3 1908, January 4 1910 (received May 28 1910), and May 1910. The 1908 specimen is chosen as *lectotype* because it closely corresponds

Fig. 6. Lectotype of the name *Montanoa hibiscifolia* (Benth.) Sch. Bip. ex C. Koch; Herb. K.

with the morphology in the type description, and unlike other vouchers, bears collection and introduction data cited in the type description, Fig. 5.

Examination of the *M. wercklei* lectotype strongly suggests the taxon is closely allied to, if not conspecific with *M. hibiscifolia*, with which species it is made synonymous for the purposes of the present limited study.

The distinctive palmate 5 to 7 lobed leaves of this material contrasts with the essentially pinnatifid lobing of leaves found in other species under discussion here. There is an illustration of the vegetative state of *M. hibiscifolia* in Robinson (1889) p. 738 under the caption "*Uhdea bipinnatifida*", (see also Fig. 5). Robinson & Greenman (1899) place the species in subg. *Acanthocarpha*, and it is recorded as having been cultivated.

Specimens examined

NICARAGUA: Segovia, 1851, *Oersted (235)* (Lectotype K, isosyntypes C as *Oersted 9051*);

COSTA RICA: Barba, 1851, *Oersted (134)* (syntype K);

MEXICO: Yajalon, Chiapas, 21.xi.1895, *Nelson 3417* (GH).

HONDURAS: Morazan, 15.i.1951, *Molina 3898* (GH).

CULTIVATED: Hort. ex Santiago, 3.i.1908, *Berger s.n.* (Lectotype K. *M. wercklei*).

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DAVIESIA ARENARIA (FABACEAE), A NEW SPECIES FROM THE MALLEE LANDS OF SOUTH-EASTERN AUSTRALIA

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Abstract

Daviesia arenaria, a new species from sandy soils of inland South Australia, New South Wales and Victoria, is described. It was previously confused with the widespread *D. ulicifolia* Andr. A diagnosis to separate the two species is given, along with an illustration, distribution map and notes on its ecology.

Introduction

The new species is not a new discovery. It has long been confused with the widespread, closely related *D. ulicifolia*. The two species can easily be distinguished by three consistent morphological characters. *D. arenaria* typically occurs on deep sandy soils where it may be edaphically isolated from *D. ulicifolia*.

In 1864, Bentham included material of the new species in his concept of *D. ulicina* Sm. forma *ruscifolia* (A. Cunn. ex Benth.) Benth. (eg. Mueller's collection of 7 Oct 1851 from St Vincent's Gulf). However, the type of the base-name, *D. ruscifolia* A. Cunn. ex Benth., is a single collection from New South Wales near the present site of Canberra, which clearly belongs to *D. ulicifolia* (syn. *D. ulicina*). Hence there is no question of the new species being involved in the original concept of *D. ruscifolia*. Black (1924) raised the epithet *ruscifolia* to varietal level, but misapplied it to material wholly belonging to *D. arenaria*.

I am working towards a complete revision of the genus *Daviesia*, but will not complete it soon. Meanwhile, I am publishing *D. arenaria* in advance so that the name will be available for the new handbook to the Plants of western New South Wales by Cunningham et al., currently in press.

Daviesia arenaria M.D. Crisp, sp. nov.

D. ulicifoliae Andr. arte affinis sed ob folia supra complicata et sulco centrale in longitudinem, vexillum omnino postice praeter ad centrum marroninum, carinam angustiorem et apice incurvam apiculatam acutam differt.

D. ulicina Sm. forma *ruscifolia* (A. Cunn. ex Benth.) Benth. pro parte, Flor. Aust. 2(1864)81; *D. ulicina* Sm. var. *ruscifolia* (A. Cunn. ex Benth.) J.M. Black, Flor. S. Aust. (1924)296; non *D. ruscifolia* A. Cunn. ex Benth., Comment. Legum. Gen. (1837)75.

Holotype: New South Wales, 31.5 km W of Euston along Sturt Highway towards Mildura (Victoria), 34° 26′S, 142° 28′E, *M.D. Crisp 5720*, 18.viii.1979, fl., photos, spirit material (CBG). *Isotypes*: AD, K, L, MEL, NSW.

The specific epithet refers to the sandy soils of its habitat.

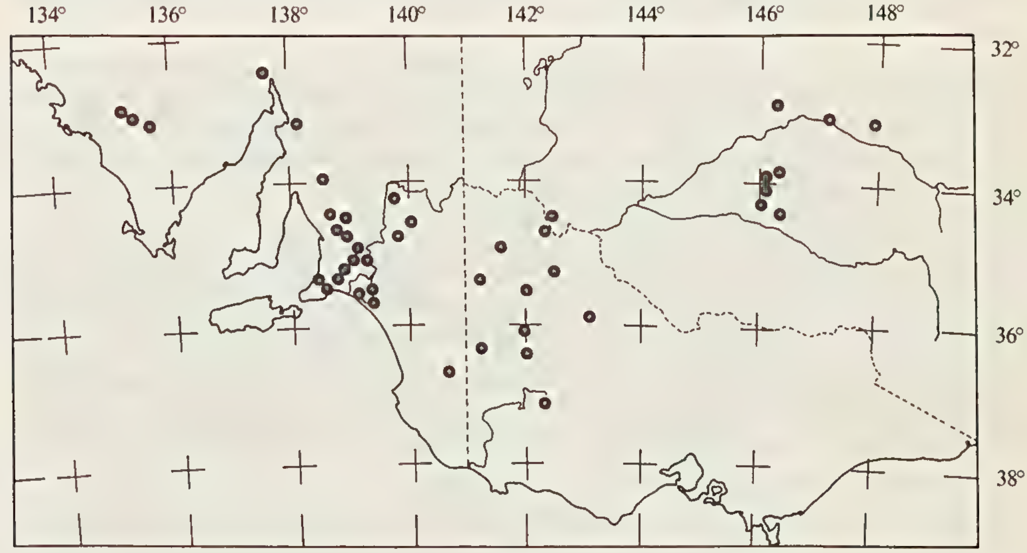
Shrub, generally low, spreading and hummocky, to 1.5 m tall and 2.5 m broad; the vegetative parts rather stiffly pubescent or rarely glabrous. *Branchlets* numerous, divaricate, short, longitudinally ridged, rigid and spiny. *Leaves* alternate, ascending, sessile, articulate with the branchlet, commonly very broad-ovate and cordate, occasionally narrow- to broad-elliptic and attenuate towards the base, rarely obovate, cuspidate, pungent, rigid, 2.5-10 x 1.5-8 mm; upper surface grooved along the midrib and slightly folded upwards to give a V transection; lower surface with thickened, raised marginal nerves and midrib; lateral venation finely reticulate. *Flowers* 1(-2) per axil;

Fig 1. *Daviesia arenaria*. a, flowering branchlet, nat. size; b, typical leaf, from below, x 3; c, same, obliquely from above, x 3; d & e, leaves showing variation in shape and pubescence, x 3; f, standard, x 4; g, wing, x 4; h, keel x 4; j, legume, x 3. *D. ulicifolia*. i, keel, x 4. (a-c & f-h from *M.D.Crisp 5720* (type); d from *D.N.Kraehenbuehl 479*; e from *G.R.Harris s.n.*, ADW21554; i from *J.H.Helmsley 6243* [MEL]; j from *L.Haegi 687*.)

pedicel 2-3 mm long, with several imbricate barren bracts towards the base, stiffly pubescent or glabrous. *Calyx* articulate with the pedicel, oblique-campanulate, 2.5-3.5 mm long, abruptly contracted at the base into the c. 0.5 mm receptacle; lobes subequal, triangular, acute, minutely fimbriate at the margins, c. 1 mm long, each with a raised midnerve extending up from the base of the tube; upper 2 lobes slightly broader and lowermost one slightly longer than the others. *Corolla* papilionaceous; *standard* 6-7 x 5-6 mm, thickened and sigmoid along a line running up the claw to the base of the lamina; lamina depressed-ovate, shortly decurrent with the 1-2 mm claw, orange-pink in front, intense maroon on the back, except for a yellow central line on both sides; *wings* narrow-obovate, falcate, rounded at the apex, auriculate at the base, 6-7 mm long including the 2 mm claw, maroon in the upper half; *keel-petals* connate along the lower margin except the claws, narrow-elliptic, incurved, beaked, slightly auriculate, slightly saccate near the centre, 6-7 mm long including the 2 mm claw, maroon in the upper half. *Stamens* more or less uniform, completely free; *anthers* basifixed, transverse-broad-elliptic in outline. *Ovary* shortly stipilate, narrow-elliptic, attenuate into the incurved style; ovules 2; stigma terminal, minute. *Legume* exserted from the calyx, compressed, asymmetrically transverse-obtriangular, beaked with persistent style, sigmoid along upper suture, 6-7 x c. 4 mm, dehiscing elastically; *seed* 1, ellipsoid, conspicuously arillate, c. 3 mm long, brown with black markings. Fig. 1.

Distribution

Widespread in mallee districts of south-eastern Australia, from near Minnipa on the Eyre Peninsula (South Australia), south-east to the Grampians (Victoria), and east to Bogan Gate in New South Wales, (Map 1).



Map 1. Distribution of *Daviesia arenaria*.

Representative specimens (total examined 89)

SOUTH AUSTRALIA: Spring Gully [Conservation] Park, Clare, *R. Bates 349*, ix.1978, fl. (AD); pine forest between Gawler town and Light River, *H.H. Behr 190*, xi.18?, fl. (MEL); 20 km north-east of Blanchetown on Waikerie rd, 34° 16′S, 139° 48′E, *L. Haegi 687*, 5.x.1975, fr. (AD, P, PR, RSA); roadside, Naracoorte-Bordertown rd, near The Gap, *D. Hunt 5*, 31.viii.1961, fl. (AD); near Yatala Vale, *D.N. Kraehenbuehl 479*, 25.ix.1961, fl. (AD, NSW, W); sand scrub, Tanunda, *D.N. Kraehenbuehl 655*, 22.ix.1962, fl. (AD, MEL, NSW); St Vincents Gulf, *F. Mueller s.n.*, 7.x.1851, fl. & fr. (MEL); between Kimba and Minnipa, *K.B. Warnes 116*, 31.viii.1969, fl. (AD).

NEW SOUTH WALES: Shepherds Hill, Euabalong West., *G.M. Cunningham & P.L. Milthorpe s.n.*, 2.ix.1974, fl. (NSW, Soil Conserv. Serv. N.S.W.); 1 mile [1.5 km] east of Bogan Gate on Forbes-Condoblin rd, *M.D. Tindale & C.K. Ingram s.n.*, 3.x.1956, fl. (NSW).

VICTORIA: 10 km S of Murrayville, Big Desert, *A.C. Beauglehole 57061*, 19.xi.1977, fr. (CBG, MEL); 90 km SSW of Mildura, 2.7 km WSW of Mt. Crozier, 35° 54'S, 141° 40'E, *M.D. Crisp 3387*, 11.x.1977, fl., fr., photo (CBG); near Moora-Moora Reservoir, Grampians, *P. Mathews s.n.*, 3.i.1977, fr. (MEL).

CULTIVATED: National Botanic Gardens, Canberra (ex. N.S.W., 36 km from Euston along rd to Mildura, *M.D. Crisp 3281*, x.1977), *M.D. Crisp 5667*, 19.ii.1979, seedling (CBG).

Affinity

The closest relative of *D. arenaria* is *D. ulicifolia*. The latter is the most widespread and one of the most variable species in the genus. It extends from Cape York south to Tasmania and west to the Great Victoria Desert. There are at least 6 morphologic-geographic forms which show variation mainly in the leaf and inflorescence. Comparisons of all these forms with *D. arenaria* give consistent differences between the two species in three characters.

The leaf of *D. ulicifolia* varies in shape and size, but always the upper surface is convex (to nearly flat) with a prominent raised midrib. Its standard is infused with brownish pink towards the centre but is always paler (yellow to orange) towards the margins on the back. Most importantly, the keel is broader, more or less obtuse and not incurved or apiculate at the apex (Fig. 1).

In addition, the leaves of *D. ulicifolia* are never cordate, although in two forms they are ovate-acuminate. The plants are rarely pubescent, the inflorescence in some forms is umbelliform with up to 4 flowers, while the standard-lamina is not usually decurrent with the claw, and is sometimes cordate.

Ecology

Daviesia arenaria, although widespread, is seldom common. It typically occurs on deep sand, often on the crests of dunes, in association with mallee vegetation. At the type locality, the vegetation is dominated by the mallees *Eucalyptus dumosa* A. Cunn. ex Schau. and *E. foecunda* Schau., while the understorey is characterised by *Triodia* hummock-grasses. *D. arenaria* plants sprout vigorously from the base after fire, and appear to favour openings in the vegetation canopy.

In the wetter limits of its range, the new species is found in open-forest dominated by *Callitris* spp. or eucalypts such as *E. dealbata* A. Cunn. ex Schau. and *E. sideroxylon* A. Cunn. ex W. Woolls (N.S.W.) or *E. leucoxylon* F. Muell. and *E. macrorhyncha* F. Muell. (S.A.). In such places it may extend to skeletal soils on ridge-tops.

D. arenaria is not presently in danger of extinction. It occurs in the Wyperfeld and Hattah Lakes National Parks in Victoria. However, it can no longer be found in the localities close to Adelaide. The species is in cultivation in the National Botanic Gardens.

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ACACIA SYMONII, A NEW SPECIES FROM THE NORTH-WESTERN REGION OF SOUTH AUSTRALIA

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Abstract

A new species of *Acacia* (Leguminosae; Mimosoideae), *A. symonii*, is described and illustrated from South Australia. The species belongs to series *Juliflorae* sensu Bentham (1864). Further relationship is uncertain but the resemblance to *A. longissima* H.Wendl. is discussed.

Acacia symonii Whibley, sp. nov.

Frutices elati vel *arbores* parvae, 3-4(-8) m altae; ramuli teretes, apicaliter resinosicostati. *Phyllodia* linearia, 8-14 cm longa, 1.5-3 mm lata, non rigida, plana, sparsim et minute appressipubescentia; nervi longitudinales resinosi et distantes 3 (usque ad 5 in phyllodia lata), nervus centralis normaliter prominentior quam ceteri; glans basalis 1-2 mm super pulvinum. *Inflorescentiae* simplices, axillares, plerumque solitariae; spicae nonnihil interruptae ca 15 mm longae. *Flores* 5-meri; calyx longitudine quinta parte corollae. *Legumina* linearia, 3-6 cm longa, ca 2 mm lata, chartacea, pallide brunnea, glabra. *Semina* in legumine longitudinalia. (Fig. 1).

Type: *D.E. Symon 3327*, South Australia, North-Western Region, Everard Ranges creek line about Mt Illbillie, graceful shrub to 2 m, 17.ii.1965 (holotype AD 97934152; isotypes ADW, BRI; K, MEL, PERTH).

This species is named in honour of Mr David Symon, Senior Lecturer, University of Adelaide, Waite Agricultural Research Institute, and the first person to collect this species.

Tall *shrubs* or small *trees* 3-4(-8) m high, with a single trunk or several stems ascending from ground level; *branchlets* terete, apically resinous-ribbed with a sparse appressed pubescence between them, reddish-brown but becoming grey with age. *Phyllodes* linear but tapering slightly at each end, 8-14 cm long, 1.5-3 mm broad, straight or slightly curved, not rigid, flat, viscid when young, glabrous to sparsely and minutely appressed-pubescent; apices delicately hooked; longitudinal nerves resinous and distant, 3 (to 5 on broad phyllodes) with the central one normally more pronounced than the rest, margins resinous and nerve-like; *gland* basal, 1-2 mm above the pulvinus, lamina swollen about gland, usually with a raised resinous rim and a distinct central orifice; pulvinus short, transversely wrinkled. *Inflorescence* simple, axillary, usually solitary; spikes interrupted, yellow, ca 15 mm long; peduncles minutely pubescent, 3-4 mm long; receptacles glabrous; bracteoles 0.4 mm long, hood-shaped, almost sessile, thickened abaxially near their bases. *Flowers* 5-merous, slightly viscid, sessile or minutely pedicellate; calyx ca $^1/_5$ the length of corolla, divided about $^1/_3$ into broad-triangular minutely ciliolate lobes; petals free, ca 2 mm long, glabrous, finely 1-nerved; ovary white-pubescent. *Legumes* linear, 3-6 cm long, ca 2 mm broad, straight or slightly curved, acute at both ends, flat but raised over and slightly constricted between seeds, firmly chartaceous to slightly cartilaginous, light brown, glabrescent, obscurely reticulate; margins yellowish. *Seeds* longitudinal in legume, obloid, light brown, shiny, 3 mm long, 1.5 mm broad; pleurogram obscure, open towards hilum; areole U-V shaped, ca 0.5 mm long; funicle short, folded once or twice and thickening into a whitish aril.

Distribution (Map 1)

South Australia; known only from two localities in the North-Western Region around Victory Basin in the Everard Ranges, and from Mt Lindsay in the Birksgate Range. It is possible that further collecting could extend the range into Western Australia and/or Northern Territory.

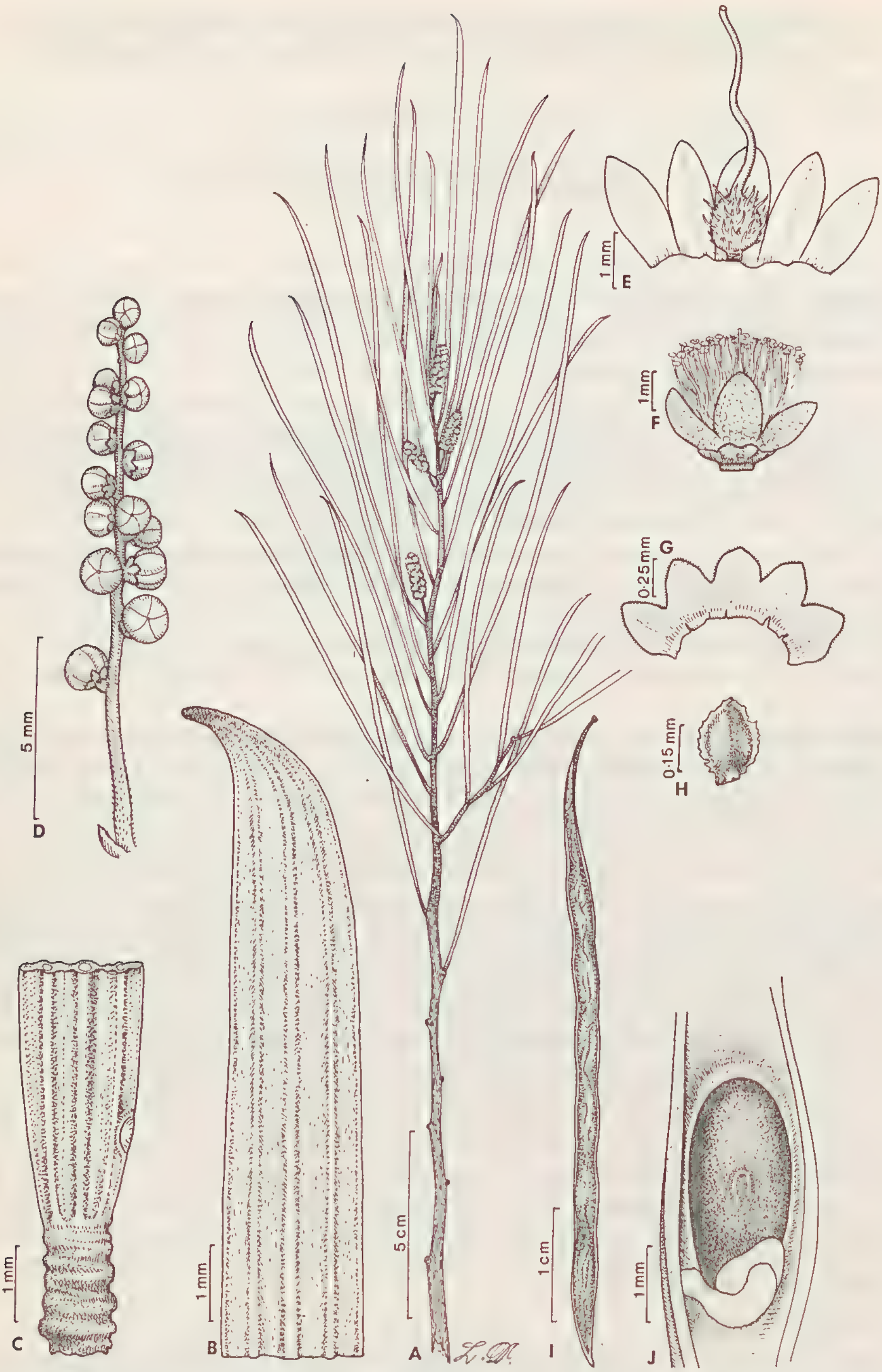
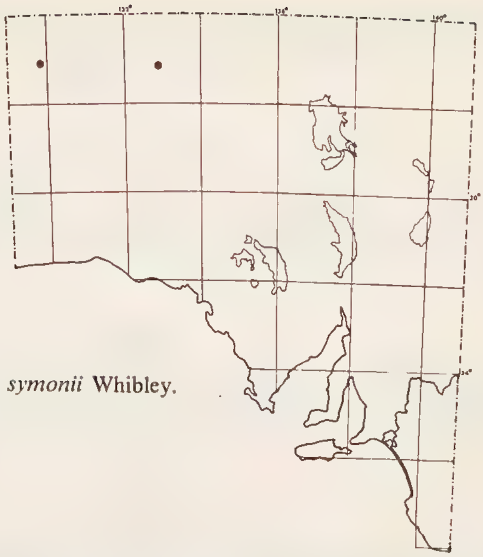


Fig. 1. *Acacia symonii* Whibley. A, flowering twig; B, upper portion of phyllode; C, lower portion of phyllode with pulvinus; D, inflorescence; E, portion of open flower with ovary; F, flower; G, calyx; H, bracteole; I, legume; J, seed and funicle. (*Symon 3327*, AD, holotype)



Map. 1. Distribution of *Acacia symonii* Whibley.

Habitat

On hillsides amongst granitic rocks associated with *Acacia olgana* Maconochie.

Flowering and fruiting period

Herbarium material of flowering specimens has been collected in August and February, with a flowering and fruiting specimen collected in December.

Affinities

The precise relationship of *Acacia symonii* is obscure. According to Bentham's (1864) classification *A. symonii* would be placed in the series *Juliflorae* but it is difficult to place satisfactorily in any of the subdivisions of this series. On most characters it could best be aligned with *Rigidulae*, *Tetramerae* or *Stenophyllae* but with none of these does it agree in all respects.

Although its relationship is uncertain at this stage, in general appearance *A. symonii* most closely resembles *A. longissima* (*Tetramerae*) which occurs in Qld and N.S.W. Both species have linear, non-rigid phyllodes with delicately hooked apices, interrupted spikes and very short calyces. *Acacia longissima* differs in that its phyllodes have a prominent non-resinous central nerve and several other less prominent and likewise non-resinous nerves, its spikes are 2-5 cm long and its flowers are 4-merous and pale yellow.

Specimens examined

SOUTH AUSTRALIA: North-Western Region. *Shurcliff* s.n., Everard Ranges, 8 m trees, grove on north facing slope of southernmost range of hills above Victory Basin, 16.xii.1975 (AD); *Evans & Reid* s.n., Mt Lindsay, 26.vi.1967 (AD); *Stove 349*, Mt Lindsay, near summit of southernmost ridge ca. 1/2km south of Watarunya Rockhole, 31.viii.1978 (AD); *Whibley 6580 & 6581*, Mt Lindsay, eastern slopes of Mt Lindsay proper about gorge running south-east from summit, 31.viii.1978 (AD); *Symon 2594*, valley on south side of Mt Lindsay, 6.viii.1962 (AD).

Acknowledgements

I am grateful to Bruce R. Maslin for assistance during the preparation of this paper; Dr J.P. Jessop for the Latin diagnosis and Mr L. Dutkiewicz for preparing the illustrations.

Reference

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J. Adelaide Bot. Gard. 2(2): 171-185 (1980)

THE GENUS *TRACHYMENE* (APIACEAE) IN THE NORTHERN TERRITORY AND A NEW SPECIES FROM WESTERN AUSTRALIA

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Abstract

A revision of the species of *Trachymene* in the Northern Territory is provided, with a key and descriptions. Five new species are described, *T. hispida*, *T. inflata*, *T. lacerata*, *T. longipedunculata*, *T. psammophila*, and one new combination *T. rotundifolia* is made for the Northern Territory. A new species from the Kimberleys, W. Australia, *T. dendrothrix* is described.

Introduction

The genus *Trachymene* Rudge is distributed throughout the Australian mainland, Tasmania, New Caledonia and the Malesian area (Papua New Guinea, Borneo and Indonesia). The latter area has some 8 species (Buwalda, *J.Arn.Arb.* 32, 1951: 59), whilst Australia has some 30 or more species.

All types cited were examined by the author.

Northern Territory Species

Trachymene Rudge

Annual or biennial herbs with perennial rootstock; stems glabrous or pubescent, sometimes weakly striate; radical leaves ternately divided or rarely toothed, indumentum of glandular, dendroid or simple hairs rarely glabrous; petiolate, exstipulate, cauline leaves often deeply 3-lobed towards the base, becoming less dissected and eventually entire, ovate or linear towards the apex of the stem. Inflorescence and umbel of numerous white or pink or blue flowers. Involucre of linear bracts usually shortly united at the base. Calyx teeth minute or inconspicuous, subulate; corolla of 5 (4 in *T. inflata*), entire, obovate petals. Fruit a pair of mericarps, sometimes one aborted, mericarps semicircular, laterally flattened, with abaxial wing or wingless, smooth, tuberculate, hirsute or vesiculate.

Key to species

1.	Leaves glabrous or with few setae along margins or veins	2
	Leaves pilose, glandular or villous	7
2.	Fruits with villous or glandular indumentum	*T. gilleniae* 4
	Fruits glabrous, smooth or tuberculate	3
3.	Plants prostrate creeping	*T. psammophila* 12
	Plants erect	4
4a.	Basal leaves obovate-suborbicular	*T. rotundifolia* 13
b.	Basal leaves triangular-sub-rhombic to trilobed	*T. didiscoides* 2
c.	Basal leaves trisected with long setae on veins and margins	*T. microcephala* 11
d.	Basal leaves palmatisect	5
5.	Leaf lobes ovate, inflorescence 8-10 mm diam., peduncles 50-80 mm long	*T. longipedunculata* 10
	Leaf lobes narrow obovate to cuneate, inflorescence 20-25 mm diam., peduncles 60-120 mm	6
6.	Mericarps wingless or with a narrow flat wing	*T. glaucifolia* 6
	Mericarps with two divergent wings, wings crenulate	*T. bialata* 1

7. Mericarps with broad wing 2-3 mm wide . . . . *T. villosa* 14
   Mericarps wingless or wing less than 1 mm 8
8. Foliage, stems and leaves with glandular hairs, strongly aromatic 9
   Foliage, stems and leaves without glandular hairs 10
9. Mericarps glabrous, laterally flattened . . . . *T. glandulosa* 5
   Mericarps villous and with inflated lateral vesicles . . . . *T. inflata* 8
10. Foliage with short dense indumentum of asperulate or scabrid dendroid setae . . . . . . *T. dusenii* 3
    Foliage with non dendroid or segmented setae or hairs 11
11. Foliage with short dense pilose indumentum or curved hairs, leaves orbicular-rhombic . *T. hispida* 7
    Foliage with long setae, leaves lacerate trilobed, the central lobe 3 times size of lateral, dentate . . . . *T. lacerata* 9

1. **Trachymene bialata** (Domin) B.L. Burtt, J.Bot. 79:45 (1941).

Basionym: *Didiscus bialatus* Domin, Sitz. Boehm. Ges. Wiss. Prag. 51 (1908).

Holotype: *R. Helms s.n.*, Barrow Range, 17.viii.1891(K).

Isotype: NSW.

Description

An erect but spreading annual herb to 50 cm high. Radical leaves petiolate, lamina palmatisect into 3 or 5 lobes, each lobe further segmented, glabrous occasionally slightly glaucous, petiole 20-50 mm long, lamina 25-30 mm long, 25-40 mm broad. Cauline leaves deeply 3 lobed towards the base, becoming less dissected and eventually entire and ovate towards the apex of the stem. Stems glabrous except just above bract and branch insertion where some glandular hairs occur. Inflorescence an umbel, 15-25 mm in diameter, flowers white and numerous. Mericarps 4.5-5 mm long, completely surrounded by two crenate to dentate wings ca 0.5 mm wide, and numerous papillae on lateral sides.

Specimens examined

NORTHERN TERRITORY: *C. Dunlop 2001*, Mann Range, 48 km E.N.E. Mt Davies Camp 26° 02′S, 129° 39′E, 31.x.1970 (NT); *M. Lazarides 8305*, 86 km S.E. of Docker River Mission on Ayers Rock road, 8.v.1977 (CANB, NSW, NT).

Distribution

Known only from the south-west corner of Northern Territory and adjacent Western Australia.

2. **Trachymene didiscoides** (F. Muell.) B.L. Burtt, J.Bot. 79:46 (1941).

Basionym: *Hemicarpus didiscoides* F. Muell., Hook. Kew Journ. 9:18 (1857); Benth., Fl. Aust.3:351 (1866), incorrectly cited vol.6.

Lectotype: "Providence Hill, F. Muell." (K).

Description

An erect herb with a perennial root, stems ribbed. Radical leaves glabrous or sometimes with few setae along veins or at base of petiole, trilobed, cuneate or triangular. Lower cauline leaves trisected to base, lobes pinnatisect, lobes 30-40 mm long, 5-15 mm wide, upper trilobed, each lobe narrow 5-20 mm long, 0.5-2 mm wide. Inflorescence an umbel ca 10 mm diameter, peduncle 20-45 mm, involucre with linear lobes 3 mm long, pedicel 4-5 mm long. Fruit a paired mericarp, usually one aborted, tuberculate, wingless or if present only 0.5 mm wide, laterally flattened 4-5 mm long x 3 mm broad.

Specimens examined

NORTHERN TERRITORY: *G.W. Carr & A.C. Beauglehole 46557*, Jasper Gorge, 3.vii.1974 (NT); *C. Dunlop 2938*, Maria Island, 14° 53′S, 135° 43′E, 26.vii.1972 (AD, BRI, CANB, MEL, NT, PERTH), this collection is a good match for the type; *T.S. Henshall 1827*, Wangi Station, 13° 10′S, 130° 42′E, 30.v.1978

(CANB, DNA, K, NT); *M. Schultz s.n.*, Port Darwin (MEL 78178); *D.E. Symon 7873*, 10 km S. of Yaimanyi Creek, 26.vi.1972 (AD, ADW, NT).

WESTERN AUSTRALIA: *G.W. Carr & A.C. Beauglehole 46833*, 1.5 km W. of Lake Argyle turn-off, 6.vii.1974 (NT); *G.W. Carr & A.C. Beauglehole 47747*, Lennard River Gorge, King Leopold Range, 22.vii.1974 (NT).

Distribution

This species is found across the tropical end of the Northern Territory and extends into the Kimberleys of Western Australia.

3. **Trachymene dusenii** (Domin) F.M. Bailey, Comprehensive Catalogue of Queensland Plants:228 (1913).

Basionym: *Didiscus dusenii* Domin, Sitz. Boehm. Ges. Wiss. Prag. 64-65 (1908).

Holotype: *Johnston 1885*, near Cambridge Gulf (K).

Isotype: MEL.

Domin l.c. incorrectly ascribed the type locality to Queensland. Cambridge Gulf is in northern Western Australia.

Synonym: *Didiscus setosus* O. Schwarz, Feddes Repertorium 24:92 (1927); type, *Bleeser no.347* (B) destroyed.

Description

A rhizomatous perennial to 60 cm high. Radical leaves triangular obovate to cuneate with a dense indumentum of short dendroid setae, apex of lamina dentate, 20-25 mm wide and 25-30 mm long, three almost equal veins. Petiole 40-50 mm long, covered with dense indumentum. Cauline leaves absent or narrow-linear bract-like when present. Inflorescence an umbel, many-flowered, 20-30 mm in diameter, involucral lobes linear, ca 5 mm long, forming a distinctive "plate" at their base 3-5 mm in diameter. Mericarps laterally compressed ca 5.5 mm long and 4 mm wide, with minute papillae.

Specimens examined

NORTHERN TERRITORY: *C. Dunlop 3580*, Negri-Stirling area, 17° 17'S & 129° 40'E, 4.v.1974 (CANB, DNA, NT); *Johnston s.n.*, (type); *R.A. Perry 2319*, 35 km S.S.E. of Waterloo Station (CANB, MEL, NT).

Distribution

Known only from the western Victoria River District and adjacent Western Australia.

4. **Trachymene gilleniae** (Tate) B.L. Burtt, J.Bot. 79:46 (1941).

Basionym: *Didiscus gilleniae* Tate, Report of Horn Scientific Expedition pt 3:188 (1896).

Lectotype: *R. Tate s.n.*, Mt Gillen, 1894 (K).

Description

A small annual herb to 50 cm high, mostly 20 cm high. Leaves flat, 3-5-lobed, each cuneate lobe 10-30 x 4-6 mm, again segmented or tridentate, sparsely covered with setae mostly on the veins. Petiole 40-100 mm long, mostly glabrous. Inflorescence an umbel 10-20 mm diameter, larger when in fruit, flowers numerous white to pink. Mericarps laterally flattened, wingless, 2 mm long and 1-2 mm broad, densely hirsute, bristles 1-1.5 mm long.

Specimens examined

NORTHERN TERRITORY: *A.C. Beauglehole 44852*, Trephina Gorge, Macdonnell Ranges, 1.vi.1974 (NT); *A.C. Beauglehole 45144A*, Red Bank Gorge, Heavitree Range, 10.vi.1974 (NT); *D. Boerner s.n.*, White Range Goldfield, 3.vi.1956 (NT); *C.R. Dunlop 2613*, Ormiston Gorge, nth ridge, 23° 38'S; 132° 44'E, 19.vi.1972 (AD, BRI, CANB, MEL, NSW, NT, PERTH); *P.K. Latz 3133*, Benstead Range, 23° 43'S, 134° 10'E, 27.vii.1972 (AD, CANB, DNA, K, L, NT); *P.K. Latz 4884*, Simpsons Gap National Park, 23° 41'S, 133° 43'E, 18.vi.1974 (CANB, NT).

Distribution

Known only from the ranges of central Australia (N.T.).

5. **Trachymene glandulosa** (F.Muell.) Benth., Fl.Aust.3:350(1866).

Basionym: *Didiscus glandulosus* F. Muell., Proc. Roy. Soc. Tasm.3:238 (1857).

Holotype: "On the sandy banks of the Nicholson River, Gulf of Carpenteria," *F. Muell. s.n.*, (MEL).

Isotypes: K (2 sheets).

Description

Annual herb 20-50 cm high, indumentum hirsute with glandular hairs. Radical leaves not known. Cauline leaves 3-lobed, lobes oblong-cuneate, apices mostly 3 toothed with the central toothed lobe much larger than laterals. Lower leaves petiolate, upper sessile. Inflorescence an umbel, 10-12 mm in diameter, flowers numerous, purple. Fruiting umbel 15-20 mm in diameter. Peduncles 40-100 mm long. Mericarps laterally flattened, wingless, 4-5 mm long and 3 mm wide, covered with minute papillae.

Specimens examined

NORTHERN TERRITORY: *F. Muell. s.n.*, Nicholson River (Gulf of Carpenteria) 1857 (K); *N.M. Henry 802*, China Wall, Calvert Hills Station, 2.vi.1973 (CANB, DNA, NT).

Distribution

Known only from the Nicholson River area (N.T.).

6. **Trachymene glaucifolia** (F. Muell.) Benth., Fl.Aust.3:350(1866).

Basionym: *Didiscus glaucifolius* F. Muell., Linnaea 25:395(1852).

Holotype: "Elders Range, latitude 31° S Oct. 1851", *F. Muell. s.n.* (K).

Isotype: MEL.

Description

An erect mostly glabrous and usually glaucous annual to 1 m high. Both cauline and radical leaves palmatisect of 3-5 lobes, lobes oblong-cuneate, again divided in threes. Petiole much longer than lamina, with occasional setae at the base. Inflorescence an umbel, 15-25 mm in diameter, flowers numerous, white or pale pink. Peduncles rather long. Mericarps laterally flattened, papillate, wingless, 5-6 mm long and 4-5 mm wide.

Selected specimens

NORTHERN TERRITORY: *G. Chippendale s.n.*, (NT 6588) Simpson Desert, 113 km N. Andado H/S, 7.ix.1959 (AD, BRI, CANB, MEL, NSW, NT); *C. Dunlop 1969*, Bloods Range, 28.x.1970 (NT, PERTH); *M. Lazarides 5819*, 25 km N.N.E. Barrow Creek Township, 24.viii.1956 (CANB, NT).

An eremaean species widely distributed in all mainland states except Victoria.

7. **Trachymene hispida** J.R. Maconochie sp.nov.

Herba erecta, caudico perenni, foliis radicalibus rosulatis, rosula interdum sursum secus caulem aliquot extensa. Caules teretes, striati, basi parce hispidi, superne glabri. Folia radicalia et caulina inferiora petiolata, orbicularia usque rhombico-cuneata, 20-40 mm longa, 20-50 mm lata, 1-3 nervosa, utrinque hispida, denticulata. Petiolus supra sulcatus, basi ampliatus, hispidus, 30-80 mm longus. Inflorescentia simpliciter umbellata, 10-15 mm diametro, pedunculo 20-100 mm bracteis anguste linearibus acuminatis 2-4 mm longis suffulto. Flores lutei vel flavi, pedicellis 5-7 mm longis. Involucrum e lobis linearibus 4 mm longis sistens. Fructus e mericarpiis binis lateriliter complanatis tuberculatis 4-5 mm longis 3.5-4 mm latis sistens, ala nulla vel angustissima.

Holotype: *D.E. Symon 7980*, ca 11 km W. of East Alligator River crossing on road to Oenpelli, 29.vi.1972 (NT).

Fig. 1. *Trachymene hispida* J.R. Maconochie, from type, *D.E. Symon 780*. (Del. J. Church.)

Isotypes: ADW, CANB, K, L.

Description (Fig. 1)

Erect herb with perennial rootstock and the rosette of radical leaves sometimes extending some distance up the stem. Stems terete, striate, sparsely hispid at the base, glabrous in the upper part. Radical and lower cauline leaves petiolate, orbicular to rhombic-cuneate, 20-40 mm long, 20-50 mm wide, 1-3 nerved, hispid above and below, denticulate. Petiole channeled above, diverging at the base, hispid, 30-80 mm, subtended by narrow-linear tapering bracts 2-4 mm long. Flowers yellow or white, pedicels 5-7 mm long. Involucre of linear lobes 4 mm long. Fruit of paired mericarps, each laterally flattened, tuberculate, wingless or with very narrow wing, 4-5 mm long, 3.5-4 mm wide.

Specimens examined

NORTHERN TERRITORY: *P.K. Latz 3795*, Munmalary Stn, 12° 14'S, 132° 35'E, 10.vi.1973 (BRI, CANB, DNA, NT); *G. Chippendale NT8217*, 4 km S.S.W. Raffles Bay, 19.vii.1961 (CANB, BRI, K, NSW, NT); *Martensz and R. Schodde AE803*, 4 km S. Cannon Hill turnoff, Oenpelli Road, 8.ii.1973 (BRI, CANB, NT); *D.E. Symon 7176*, 11 km W. of East Alligator River crossing on road to Oenpelli, 8.vi.1971 (AD, CANB, NT); *G.C. Taylor 76*, 1.6 km S. of East Alligator River, 10.vi.1971 (AD, DNA, NT).

Distribution

Found in the east Alligator River area and adjacent parts in Arnhem Land (N.T.).

8. **Trachymene inflata** J.R. Maconochie sp.nov.

Herba erecta, viscida, odora, usque 50 cm alta. Caules leviter costati, pilis glandulosis 1-1.5 mm longis. Folia petiolata, flabellata usque subreniformia, basi cuneata vel subtruncata, in lobos primarios 3 divisa quoque lobo iterum trisecto vel dentato, apicibus segmentorum incrassatis. Lamina 15-20 mm longa, utrinque glanduloso-hirsuta, petiolo tereti 20-55 mm glanduloso-hirsuta. Folia caulina superiora ubi inflorescenties suffulceunt sessilia. Inflorescentia simpliciter umbellata, 15-20 flora, pedunculo 10-30 mm longo 1 mm crasso, involucro e lobis linearibus basi connatis sistente, pedicellis 4-7 mm longis, calyce obsoleto, corolla alba 4-partita, lobis dorso hirsutis 1.5 mm longis 1.5 mm latis staminibus 4. Fructus in mericarpia 2 secedentes (altero plerumque aborto); mericarpia 2-3 mm longa, 2 mm lata, 2 mm crassa, ala c. 1 mm lata, vesiculis lateralibus pilis numerosis glandulosis cooportis.

Holotype: *C. Dunlop 2470*, Kurundi W.H., 20° 29'S, 134° 41'E, 15.ii.1972 (NT).

Isotypes: BRI, CANB, NSW.

Description (Fig. 2)

An erect odorous viscid herb to 50 cm high. Stems weakly ribbed with glandular hairs 1-1.5 mm long. Leaves petiolate, flabellate to subreniform, cuneate or subtruncate at the base, primary division into 3 lobes, each lobe further trisected or dentate, apices of segments thickened. Lamina 15-20 mm long, glandular hirsute above and below; petiole terete, 20-55 mm, glandular hirsute. Upper cauline leaves becoming sessile when associated with flowers. Inflorescence a simple umbel of about 15-20 flowers, peduncle 10-30 mm long, 1 mm diam., involucre of linear lobes united at base, pedicel 4-7 mm long, calyx obsolete; corolla white, 4 partite, lobes hirsute on back, 1.5 mm wide; stamens 4. Fruit separating into 2 mericarps, one usually aborting, 2 mm wide and 2 mm thick with wing about 1 mm wide, with lateral vesicles covered with numerous glandular hairs 2-3 mm long.

This taxon is unusual in that it has 4-partite flowers and not the typical 5-partite of the genus.

Specimens examined

NORTHERN TERRITORY: *C. Dunlop 2470* (type), (L. Gee) Warden, Tanami, vii-ix.1910 (NSW); *C.H. Gittens 2436*, Inningarra range, Mongrel Downs, 20° 30'S; 129° 00'E (NSW, NT).

Distribution

Known only from two disjunct localities in N.T., where it is associated with quartzitic ranges.

Fig. 2. *Trachymene inflata* J.R. Maconochie, from type, *C. Dunlop 2470*. (Del. J. Church.)

9. **Trachymene lacerata** J.R. Maconochie sp.nov.

Herba erecta, radice perenni, c. 1 m alta, caulibus teretibus glabris. Folia radicalia lacerata usque palmatim 3-loba; lamina 35-45 mm longa, 30-35 mm lata utrinque indumento pilosa e pilis simplicibus sursim curvatis sistente cooperta. Petiolus gracilis, 35-45 mm longus, setis longis c. 1 mm longis sparse usque modice indentus. Inflorescentia simpliciter umbellata, 8-12 mm diametro pedunculo 15-45 mm; flores numerosi, albi, pedicelli lineares, 5-6 mm longi; lobi involucrales lineares, 3-4 mm longi. Fructus e mericarpiis binis sistens quoquo mericarpio lateraliter plano fere exalato 3.5-4.5 mm longo 2.5-3 mm lato tuberculato, tuberculis plerumque extra costem interiorem sitis.

Holotype: *D.E. Symon 7738*, 32 km north east Doingi Camp, Arnhem land, 13° 09′S, 134° 51′E (NT).

Isotypes: AD, ADW, CANB, K.

Description (Fig. 3)

An erect perennial rooted herb about 1 metre high. Stems glabrous, terete. Radical leaves lacerate to palmately 3 lobed, lamina 35-45 mm long, 30-35 mm broad, covered above and below with pilose indumentum of simple upward curving hairs. Smaller leaves rhombic to orbicular. Central lobe ovate, pinnatisect 20-25 mm wide, laterals narrow ovate, 8-10 mm wide, apices of lobes tridentate. Petiole slender 35-45 mm long sparsely to moderately covered with long setae ca. 1 mm long. Inflorescence an umbel 8-12 mm in diameter, peduncle 15-45 mm; flowers numerous, white, pedicels linear, 5-6 mm long; involucral lobes linear 3-4 mm long. Fruit of paired mericarps, each laterally flat almost wingless, 3.5-4.5 mm long, 2.5-3 mm wide, tuberculate with tubercles predominantly outside the inner ridge.

This species is allied to *T. microcephala* which only has setae along veins and margins and narrower lobes of the leaves.

Specimens examined

NORTHERN TERRITORY: *J.R. Maconochie 2170*, Elcho Island, 12° 01′S, 135° 37′E, 10.vii.1975 (CANB, DNA, K, NSW, NT); *D.E. Symon 7738* (type); *D.E. Symon 7851*, 80 km N.N.W. of turnoff junction to Maningrida from Gove road, 24.vi.1972 (AD, CANB, K, NT).

Distribution

Known only from Elcho Island and adjacent part of Arnhem Land.

10. **Trachymene longipedunculata** J.R. Maconochie sp.nov.

Herba annua erecta, caulibus glabris. Folia palmatim 3-4 lobata, fere usque ad basim divisa, lobis ovatis glabris basi leviter emarginatis fere cordatis, petiolo glabro gracili 15-50 mm longo; 5 mm diametro; lobus centralis anguste trullatus, acutiuscule pinnatifidus, utrinque 5-6 segmentatus, 30-60 mm longus et 20-30 mm latus, lobis lateralibus brevioribus inaequalibus, lamina margine inferiore latius evoluta 25-40 mm longa et 10-30 mm lata. Inflorescentia simpliciter umbellata, 30-35 flora, axillaris, pedunculo gracili 40-80 mm longo 0.5 mm diametro. Involucrum e bracteis anguste linearibus basi breviter connatis sistens. Flores albi, calyce obsoleto, corolla 5-partita, lobis obovatis 1 mm x 0.75 mm, pedicello 3-5 mm longo. Fructus e mericarpiis binis lateraliter complanatis exalatis tuberculatis 2 mm longis x 1 mm latis sistens.

Holotype: *P.K. Latz 3237*, Wessel Islands, 11° 12′S, 136° 43′E, 28.ix.1972 (NT).

Isotypes: AD, BRI, CANB.

Description (Fig. 4)

An erect annual herb, stems glabrous. Leaves palmately 3-4-lobed, almost divided to base, lobes ovate, glabrous, base weakly marginate almost cordate; petiole glabrous, slender, 15-50 mm long by 5 mm diameter. Central lobe narrowly trullate, rather sharply pinnatifid, 5-6 segments on each side, 30-60 mm long x 20-30 mm wide. Inflorescence an umbel of 30-35 flowers, axillary on long slender peduncle 45-80 mm long, 0.5 mm diam. Involucre of narrow linear bracts shortly united at base. Flowers white, calyx obsolete, corolla 5 partite, lobes obovate 1 mm x 0.75 mm, pedicel 3-5 mm long. Fruits of paired mericarps, laterally flattened, wingless, 2 mm long x 1 mm broad, tuberculate.

Fig. 3. *Trachymene lacerata* J.R. Maconochie, from type, *D.E. Symon 7738*. (Del. J. Church.)

Fig. 4. *Trachymene longipedunculata* J.R. Maconochie, from type, *P.K. Latz 3237*. (Del. J. Church.)

Specimens examined

NORTHERN TERRITORY: *P.K. Latz 3237* (type); *P.K. Latz 3545*, Wessel Islands, 11° 09'S, 136° 44'E, 2.x.1972 (AD, DNA, NT).

Distribution

Known only from the type locality.

11. **Trachymene microcephala** (Domin) B.L. Burtt, J. Bot. 79:45 (1941).

Basionym: *Didiscus microcephalus* Domin, Sitz. Boehm. Ges. Wiss. Prag.56(1908).

Type: Domin briefly cited the type as "North Coast, ex herb. R. Brown comm. Bennett," presumably the K sheet is the holotype with the Bennett distribution number 4524. The isotype at BM has the following label details, "Umbellat: Arnheim's Sth. Bay, Middle Point, Febr. 4-Disc. 4. 1803".

Isotypes: BM, E (2 sheets), W.

Description

Annual herb to 50 cm high, radical leaves 3 lobed, lobes narrow and subequal and often dividing again in 3's, with sparse setulose indumentum along the veins, lamina 20-30 mm long, 25-30 mm wide, setae 1-2 mm long; petiole 15-35-60 mm long. Cauline leaves linear or absent. Inflorescence an umbel 8-10 mm in diameter, flowers white, fruiting umbel 12-15 mm in diameter. Mericarps laterally flattened, with a narrow wing 0.5 mm wide, 3-4 mm long and 2-3 mm wide, weakly papillate.

One of the syntypes of *Hemicarpus didiscoides* (MEL 78172) "In campis at ostium fluminus Victoriae, *Didiscus setulosis* F.M. Sept. 1855, Ferd. Mueller," is *T. microcephala*.

Specimens examined

NORTHERN TERRITORY: *R. Brown Distr. N 4524* (type); *N.M. Henry 154*, 21 km S.S.W. Bing Bong Homestead, 9.vi.1971 (NT); *R.A. Perry 1802*, 26 km E. of Borroloola Station, 28.vii.1948 (CANB, K, NT); *D.E. Symon 7792*, 19 km W. of Grays Bay in Caledon Bay, 26.vi.1972 (AD, CANB, K, NT).

Distribution

Found on the eastern side of Arnhem Land to the lower Gulf area and at the mouth of the Victoria River.

12. **Trachymene psammophila** J.R. Maconochie sp.nov.

Herba annua, prostrata, diffusa, foliis basalibus rosulatis. Folia basalia glabra, flabellata, triloba, lobis vel integris vel utrinque acute lobulatis basi cuneata, petiolo 5-8 mm leviter applanato 12-15 mm longo 8-15 mm lato. Folia caulina inferiore petiolata tripartita, obovata, superiora sessila et angusta. Ad basin pedunculorum et petiolarum pili glandulosi apice rubri fasciculatim congregati. Inflorescentia simpliciter umbellata, 15-25 flora, axillaris, pedunculo crasso 20-40 mm longo 1 mm lato. Involucrum e lobis anguste ovatis sistens margine dentibus sentiformibus praedito. Flores albi, calyce obsoleto, pedicellis 2-3 mm longis interdum superne bifidis, corolla 5-partita, petalis glabris 1 mm x 0.5 mm. Fructus e mericarpiis binis laevibus lucidis glutinosis exalatis 1.5-2 mm x 1.5-1.8 mm sistens, facie laterali costa semi circulari ornata.

Holotype: *P.K. Latz 3275*, Wessel Islands, 11° 11'S, 136° 44', 28.ix.1972 (NT).

Isotypes: AD, CANB, K.

Description (Fig. 5)

A prostrate spreading annual with a basal rosette of leaves. Radical leaves glabrous, flabellate, trilobed with lobes either entire or sharply lobulate on each side, base cuneate, petiole 5-8 mm slightly flattened, 12-15 mm long and 8-15 mm wide. Cauline leaves petiolate tripartite obovate on lower part of stem, sessile and narrow at the upper end. At the base of peduncles and petioles there are clusters of red capped glandular hairs 0.5 mm long. Inflorescence an umbel of 15-25 flowers, axillary on thick peduncles 20-40 mm long,

Fig. 5. *Trachymene psammophila* J.R. Maconochie, from type, *P.K. Latz 3275*. (Del. J. Church.)

1 mm wide. Involucre of narrow ovate lobes with seta-like teeth on margin. Flowers white, calyx obsolete, pedicels 2-3 mm long, sometimes bifid in upper half, corolla 5-partite, petals glabrous 1 mm x 0.5 mm. Fruit of paired mericarps, smooth, shiny, glutinous, not winged with semi-circular ridge along lateral face, 1.5-2 mm x 1.5-1.8 mm.

Distribution

This species is known only from the type collection.

13. **Trachymene rotundifolia** (Benth.) J.R. Maconochie comb. et stat. nov.

Basionym: *Trachymene hemicarpa*? var. *rotundifolia* Benth., Fl. Aust. 3:351 (1866).

Type: *Armstrong 390*, Port Essington (K).

Description

An erect herb to almost 1 m; root perennial; inflorescence yellow. Radical leaves petiolate, lamina orbicular to cuneate with denticulate apex, 1-3 main veins, glabrous or with few setae along veins, 20-40 mm long x 12-25 mm wide. Petiole 20-50 mm long, with sparse slender setae 3 mm long. Cauline leaves linear, almost filiform, mostly glabrous, 20-40 mm long. Inflorescence umbellate, with numerous flowers, 10-13 mm diam., pedicel 4-6 mm long, peduncle 30-50 mm long, involucre of linear bracts 4 mm long.

Specimens examined

NORTHERN TERRITORY: *G. Chippendale NT 6201*, Fogg Dam, 65 km S.E. Darwin, 18.v.1959 (NT); *G. Chippendale NT 8080*, 2.5 km N. Oenpelli, 15.vii.1961 (NT); *J.R. Maconochie 560*, 72 km S. Darwin, 17.ii.1968 (NT); *D.J. Nelson 1163*, Stuart Highway, 14.5 km E. Darwin, 14.vi.1964 (AD, K, NT, PERTH); *D.J. Nelson 1192*, Acacia Gap turnoff, 65 km S. Darwin, 15.vi.1964 (AD, BRI, K, NSW, NT); *R. Schodde AE71*, Nourlangie Billabong, 8.vi.1972 (CANB, DNA, K, L, NT); *M. Shultz s.n.*, Port Darwin (MEL 78178); *M. Shultz s.n.*, Colletts Creek, near Port Darwin (MEL 37095).

Distribution

Found mostly around the Darwin area and extending to Oenpelli (N.T.).

14. **Trachymene villosa** (F. Muell.) Benth., Fl. Aust. 3:349 (1866).

Basionym: *Hemicarpus villosus* F. Muell., Hook. J. Bot. Kew Garden Miscell. 9:18-19 (1857). "In collibus arenoso-rupestribus ad rivum Sturt's Creek rarissimus". *F. Mueller s.n.*

Holotype: K.

Description

Annual herb to 1 m high, covered with villous indumentum, setae 5-7 mm long. Radical leaves 3-lobed, setae along veins and margins, sparse in the inter-veinal areas. Cauline leaves 3-lobed, lobes becoming linear towards the apex. Inflorescence an umbel 20-25 mm in diameter, flowers white to pale pink. Fruiting umbel 30-45 mm in diameter, mericarps laterally flattened strongly winged (1-2 mm wide), 7-8 mm long and 4 mm wide.

Specimens examined

NORTHERN TERRITORY: *G. Chippendale NT 2262*, 63 km S. Hooker Creek, 12.vii.1956 (BRI, CANB, MEL, NSW, NT); *G. Chippendale NT5744*, 71 km S.W. Hooker Creek Settlement, 15.vi.1959 (NT); *J.R. Maconochie 1114*, 67 km S.W. Hooker Creek, 18° 40'S, 130° E, 18.vi.1971 (AD, CANB, DNA, NSW, NT, PERTH); *D. Symon 6936*, 80 km S.W. Hooker Creek, 19° 00'S, 130° E (AD, CANB, K, NT).

Distribution

Known from the Hooker Creek area of the Victoria River District (N.T.) and adjacent Western Australia.

A new species from northern Western Australia

Trachymene dendrothrix J.R. Maconochie sp. nov.

Herba erecta, usque 50 cm alta, caulibus glabris vel subglaucis. Folia radicalia lacerata, triloba, dentata, lobo media 30-40 mm longo et 20 mm lato, lobis lateralibus 30-35 mm longis et 25 mm latis, parte inferiore lobi quam pars superior latiore. Petiolus 20-60 mm longus, lamina et petiolo indumento dendroideo indutis. Folio caulina superiora triloba, lobis anguste ovatis 30-60 mm longis 3-8 mm latis indumento dendroideo indutis. Inflorescentia simpliciter umbellata, 9-12 mm diametro, floribus albis, calyce obsoleto. Involucri lobi lineares, glabri, 3-4 mm longi, pedunculis 20-40 mm. Fructus in mericarpia duo secedens; mericarpia tuberculata, 3.5-4 mm longa, 2-2.5 mm lata, ala deficiente vel angustissima (0.3-0.5 mm).

Holotype: *J.R. Maconochie 1223*, Gibb River Crossing, Kimberleys, W.A., 28.v.1971 (PERTH).

Isotypes: BRI, K, NT.

Description (Fig. 6)

An erect herb to 50 cm high, stems glabrous to slightly glaucous. Radical leaves lacerate, 3 lobed, dentate, central lobe 30-40 mm long and 20 mm wide, lateral lobes 30-35 mm long and 25 mm wide, with the lower part wider than upper part of lobe. Petiole 20-60 mm long, both lamina and petiole covered with a dendroid indumentum. Upper cauline leaves 3 lobed, lobes narrow ovate 30-60 mm long, 3-8 mm broad, covered with dendroid indumentum. Inflorescence an umbel 9-12 mm in diameter, flowers white, calyx obsolete. Involucral lobes linear, glabrous, 3-4 mm long, peduncles 20-40 mm. Fruit separating into two mericarps, 3.5-4 mm long by 2-2.5 mm wide, tuberculate, wing absent or very narrow, 0.3-0.5-1.0 mm.

This species has the leaf shape and segmentation of *T. microcephala* but its characteristic dendroid indumentum allies it with *T. dusenii* which has a non-segmented triangular obovate to cuneate lamina. Both *T. dendrothrix* and *T. dusenii* occur within the Kimberley and adjacent range complexes of W.A. and N.T. which would suggest that they are sympatric species and have evolved from a common ancestor.

Specimens examined

WESTERN AUSTRALIA: *J.S.Beard 5534*, 21 km S. turnoff Hall's Creek to Biluna, 19.vii.1968 (PERTH); *G.W.Carr and A.C.Beauglehole 47505*, ± 10 km S. of Hall's Creek, 15.vii.1974 (NT); *G.W.Carr and A.C.Beauglehole 48036*, Allcock Gorge, Kimberleys, 26.vii.1974 (NT); *F.M.House s.n.*, W. Kimberleys, F.G. Brockman Expedition, 1901 (PERTH); *K.F.Kenneally 4792*, Camp Creek, Mitchell Plateau, 14° 52'S, 125° 46'E, 13.vi.1976 (CANB, PERTH); *J.R.Maconochie 1223* (type); *E.M.Scrymgeour 1830*, 21 km W. Durack River, 20.v.1967 (NSW, PERTH); *D.E.Symon 7077*, on quartzite rocks adjacent to Gibb River Crossing ± 40 km N. of Gibb River Station, 16° 08'S, 126° 30'E, 28.v.1971 (AD, CANB, K, PERTH); *P.G.Wilson 10988*, Bat Isle, Bonaparte Archipelago, 15° 55'S, 124° 54'E, 26.vi.1973 (PERTH).

Distribution

Found in the lower and central Kimberleys area of Western Australia.

Acknowledgement

I wish to thank Mr A.K. Airy Shaw for preparing the Latin descriptions, and Mr C. Jeffrey for his comments on leaf shape. The bulk of this paper was prepared during my tenure as A.B.L.O., Kew 1976/77 and I am grateful for the facilities made available by the Director. I am also grateful for the assistance received from all Australian herbaria.

Fig. 6. *Trachymene dendrothrix* J.R. Maconochie, from type, *J.R. Maconochie 1223*. (Del. J. Church.)

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A NEW SPECIES OF *SAMOLUS* (PRIMULACEAE)

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Abstract

A new species of *Samolus*, *S. eremaeus*, is described from Central Australia. A key to the Australian species is provided.

Introduction

While I was examining material of *Samolus valerandii* for a treatment in the Central Australian Flora it became obvious that the Central Australian specimens differed markedly from the numerous more coastal specimens which, in turn, seemed to differ little from the European *S. valerandii* L. A new species, *Samolus eremaeus*, is described here for the Central Australian specimens. A key is provided to distinguish the new species from other Australian species of *Samolus*.

Key to Australian species of *Samolus*

1a. Mature plants with few or no leaves. If leaves present these either normal sized and basal or very reduced and cauline . . . . *S. junceus* R.Br.
b. Mature plants with basal and/or cauline leaves well developed 2

2a. Stoloniferous or rhizomatous perennials with erect lateral branches and mainly cauline leaves; plants in or near saline swamps or marshes near the coast, or around mound springs in arid areas . . . . *S. repens* (Forst. et Forst. f.)Pers.

b. Erect annual or perennial tufted herbs with basal and/or cauline leaves; plants of either fresh water areas or of dry habitats in arid regions 3

3a. Calyx lobes acute, approximately twice as long as entire part; anthers narrower than long, about 1 mm long with a terminal appendage of about the same length *S.eremaeus* S.W.L. Jacobs
b. Calyx lobes obtuse (rarely acute?), much shorter than the entire portion; anthers globose, less than 0.5 mm long, without a terminal appendage . . . . *S. valerandii* L.

Samolus eremaeus S.W.L. Jacobs, sp. nov.

S. valerandii L. affinis sed floribus majoribus, lobis calycis quam tubo longioribus, appendicula apicalis antherae aequanti differt.

Holotype: NORTHERN TERRITORY: Finke R., Glen Helen Valley, *G. Chippendale NT784*, 4.ii.1955 (NSW).

Glabrous erect perennial or annual tufted *herb* up to 60 cm tall (usually 30-50 cm). *Leaves* basal and/or cauline, alternate; basal leaves spathulate, mucronate to obtuse, up to 11 cm long and 3 cm wide; cauline leaves spathulate to ovate, mucronate to obtuse, up to 5 cm long and 2.5 cm wide. *Inflorescence* a simple raceme or occasionally the racemes forming a panicle, with flowers on pedicels up to 2 cm long with a bract approximately half way along. Flowers 5-6 merous. *Calyx* lobes acute, approximately 2 mm long, about twice the length of the tube. *Corolla* almost white, pale pink or blue; tube 3-4 mm long; lobes 3-4 mm long. *Stamens* opposite and equal in number to corolla lobes, alternating with staminodes which may not be all developed. Filaments fused to the full length of the corolla tube. Anthers 2-locular, approximately 1 mm long with a terminal appendage of about the same length. *Fruit* a capsule with obtuse valves.

This species has similar leaves, inflorescence and habit to *S. valerandii* but differs in having larger flowers, acute calyx lobes (although, judging by some published diagrams, *S. valerandii* may occasionally have acute lobes) and a staminal appendage. The flowers are very similar to *S. repens* but *S. eremaeus* has a much longer inflorescence, the plants

Fig. 1. *Samolus eremaeus* S.W.L. Jacobs. A, habit (portion of plant only); B, intact flower showing acute calyx lobes and staminodes (x6); C, dissected flower showing stamens, staminal appendages and staminodes (x6). (*Chippendale NT 784*: NSW holotype).

are tufted and erect whereas *S. repens* is stoloniferous with erect lateral branches. Leaf width varies on any one plant in both species, becoming narrower, shorter and less ovate up the stem but leaves from comparable parts of the plant are always much broader and more spathulate in *S. eremaeus*. Even though *S. repens* is a very variable species and it is possible to find occasional specimens with broad leaves and inadequate specimens or poor collection notes not indicating the habit, I have not seen any specimens of *S.repens* which combine the inflorescence, leaf, habit and habitat characteristics of *S. eremaeus*.

Distribution

Known only from the Ranges of Central Australia, and from near Adelaide. Apparently occuring near creek and river banks in those ranges. I have not seen any Victorian material of *S. valerandii* but the grids cited by Willis are near areas where only true *S. valerandii* occurs in N.S.W. Any of the wetter coastal areas would be more likely to have *S. valerandii*. If *S. eremaeus* were present in Victoria it could be expected in areas like the Otway Ranges.

Selection of specimens examined

WESTERN AUSTRALIA: Fort Mueller, Cavenagh Range, 24.vi.1956, *R.L. Crocker & D. Adamson 157* (SYD).

NORTHERN TERRITORY: Simpsons Gap, Alice Springs district, 27.ii.1961, *H.S. McKee 8648* (NSW). Palm Valley, Central Australia, 17.viii.1929, *J.B. Cleland s.n.*, (AD, 966042187). Palm Valley, 14.xii.1968, *P.K. Latz 393* (AD).

SOUTH AUSTRALIA: Rocky Hill, Ernabella, 24.ix.1945 and 25.ix.1945, *J.B. Cleland s.n.* (AD 97207257). Ernabella Station, ? vii.1936, *E.H. Ising s.n.* (AD 966040429). Onkaparinga Gorge, 25 km S. of Adelaide, 8.ii.1959, *E.N.S. Jackson* 43 (AD 96051134).

Acknowledgements

I would like to thank Karen Wilson for supplying the Latin diagnosis and K. David MacKay for the diagrams.

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CALLITRICHE (CALLITRICHACEAE) IN SOUTH AUSTRALIA

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Abstract

Two new records for the State, *C. hamulata* Ktzg., a European species previously known only from Victoria, and *C. umbonata* Hegelm., a native species previously known only from southern New South Wales, Victoria and northern Tasmania, are documented. A key and descriptions are provided for the four species now recognised as occurring in South Australia.

Black (1953) recognised only one species of *Callitriche* L. for South Australia, *C. verna* L. Eichler (1965), following Mason (1959) increased this to two, adding the native *C. sonderi* Hegelm., and correcting the name to be applied to the other species from *C. verna* to *C. stagnalis* Scop. Aston (1973), who also based her account largely on that of Mason, made no further additions. Recently, collections have been made which add a further two species to the State's *Callitriche* flora, the native *C. umbonata* Hegelm. and the adventive *C. hamulata* Ktzg. The four species can be distinguished as follows. Mature fruits are essential.

1a. Fruit broader than long, less than 1 mm long . . . . 1. *C. sonderi*
b. Fruit round or longer than broad, 1-1.6 mm long.

2a. Lower leaves 3-nerved, ± spathulate; fruit faces ± flat . . . . .2. *C. stagnalis*
b. Lower leaves 1-nerved, linear.

3a. Fruit umbonate at base, with inner margins of carpels distinctly appressed and raised at base . . . . .3. *C. umbonata*
b. Fruit no umbonate, with ± flat faces . . . . 4. *C. hamulata*

The descriptions below are based largely on those of Mason (1959), with minor alterations for some measurements. Specimens examined (all from AD) have been annotated.

1. **C. sonderi** Hegelm., Verh. bot. Ver. Brandenb. 9:18 (1867).

Published illustrations: Mason (1959) fig. 2 (a-d), fig. 2A (a-b); Aston (1973) fig. 18a.

Minute plant, terrestrial in areas subject to inundation, leaves all linear-obovate, 0.8-1.7 mm long, 0.4-0.7 mm wide, obscurely 3-nerved, the upper leaves not forming a rosette. Male and female flowers together in axils of both leaves of a pair, bracteoles present, linear-triangular, 0.2-0.3 mm long, pale. Stamen 0.4-1.0 mm long. Styles erect, 0.1-0.3 mm long. Fruit dark brown to greyish, ± cordate, 0.5-0.6 mm long, 0.7-0.8 mm wide, keeled and weakly winged, commissural groove shallow, bases of the nutlets at inner edge thickened and pushing against each other to form a small umbonate swelling. (Fig. 1, A-C.)

A minute species, mainly from inland areas of Queensland, New South Wales and Victoria. In South Australia it is only recorded from Cordillo Downs in the far north-east and from the floodplains of the River Murray near Loxton and Berri.

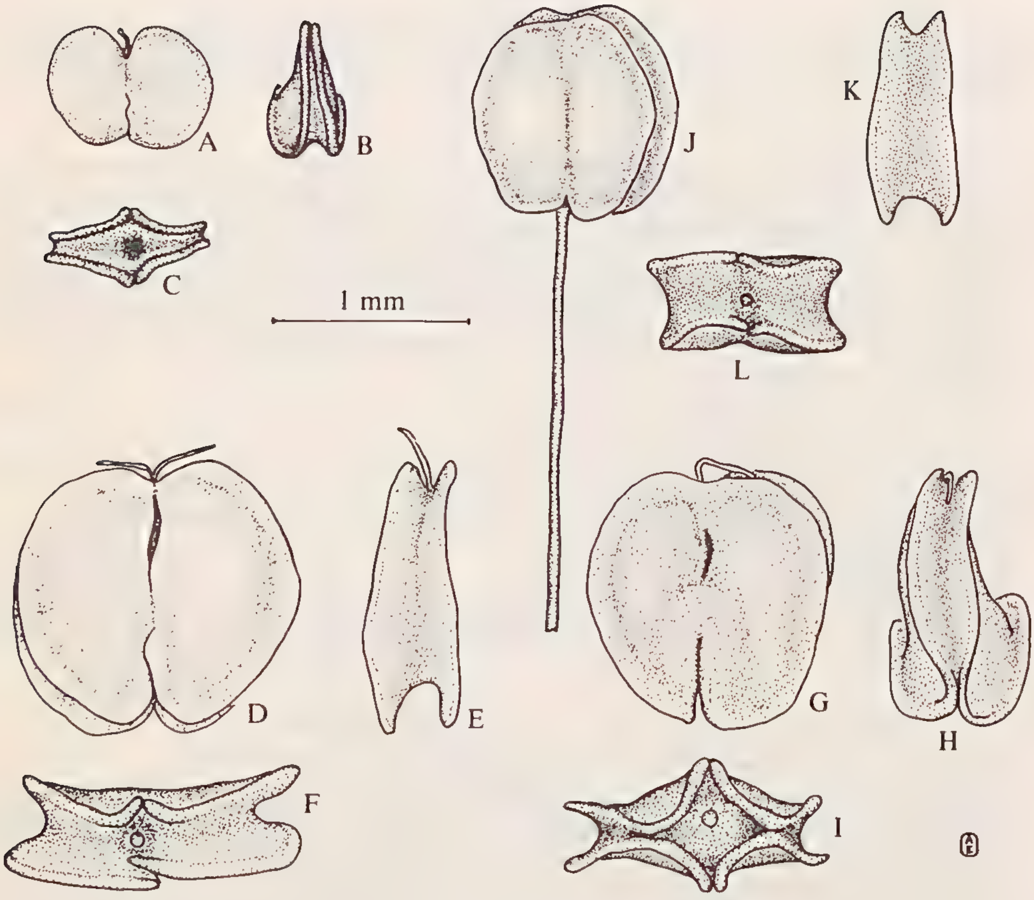

Fig. 1. Fruits of South Australian *Callitriche* (all to same scale). A-C, *Callitriche sonderi*. A, face view. B, side view. C, viewed from below. D-F, *Callitriche stagnalis*. D, face view. E, side view. F, viewed from below. G-I, *Callitriche umbonata*. G, face view. H, side view. I, viewed from below. J-L, *Callitriche hamulata*. J, face view. K, side view. L, viewed from below. (A-C. *Alcock s.n.*, AD 97041044. D-F. *Eichler 14337*. G-I. *Kraehenbuehl 476*. J-L. *Alcock 5*.)

2. **C. stagnalis** Scop., Fl. carniolica ed. 2, 2:251(1772).

Published illustrations: Schotsman (1954) pl. 9a; Mason (1959) fig. 10 (a-b), fig. 10A (a-e); Aston (1973) fig. 20 (a-g); Burbidge & Gray (1976) fig. 245.

Relatively robust plant, amphibious, leaves variable, from linear-spathulate through obovate to almost circular, (2.5-)7(-25) mm long, (1-)6(-9) mm wide, 3-, 5- or 7-nerved, upper leaves forming a rosette. Flowers solitary or male and female occurring together, bracteoles conspicuous and persistent, lanceolate, 0.8-1.5 mm long, white. Stamens 1.4-2.0 mm long. Styles 2.5-3.5 mm long, erect, becoming recurved in fruit. Fruit pale buff, about as long as broad, 1.2-1.7 mm diam., wing broad and running around the base and also usually the top of each nutlet, commissural groove wide and deep, faces of fruit ± flat. (Fig. 1, D-F.)

The largest of the *Callitriche* species in Australia, probably introduced, and found throughout the temperate regions of all States in damp places. In South Australia *C. stagnalis* is confined to the Mt Lofty and southern Flinders Ranges.

3. **C. umbonata** Hegelm., Verh. bot. Ver. Brandenb. 9:19 (1867).

Published illustrations: Mason (1959) fig. 5 (a-c), fig. 5A (a-b); Aston (1973) fig. 18d.

Amphibious herb, leaves in aquatic plants of two types. Lower leaves linear, 5-10 mm long, 0.4-0.5 mm wide, tapering to tip, emarginate, with a single midvein. Upper (rosette) leaves (± orbicular to) obovate, 6-8 mm long, 1.5-2.0 mm wide, with a broad petiole, 3-5-nerved. Flowers solitary in the axils of opposite leaves, bracteoles conspicuous and persistent, ca 0.7 mm long, white. Stamen with filament lengthening up to 3.5 mm long. Styles (0.6-) 1-2 mm long, spreading, deciduous. Fruit dark brown to grey, usually slightly longer than broad 1.1-1.5 mm long, 1.0-1.2 mm wide, wing narrow, pale brown and running around top, base and lower, inner edge of nutlets; the wings and edges of nutlets at base somewhat swollen and pressed against each other to form a prominent projection. (Fig. 1, G-I.)

Formerly known only from southern New South Wales, Victoria and northern Tasmania. There is one undoubted record from the south-east of South Australia (*Kraehenbuehl 976*, Wandillo road turnoff from main Mt Gambier to Glencoe West highway, 10.x.1963) and three other collections from the southern Mt Lofty Range that are somewhat intermediate between this species and *C. stagnalis* (*Cleland s.n.*, National Park, 8.xii.1962, AD 97233002. - *Cleland s.n.*, Mt Compass, 23.ii.1963, AD 96405205. - *Ising s.n.*, Stirling West, 26.xii.1956, AD 95707004).

The distinction between *C. umbonata* and *C. stagnalis* rests on two characters: the lower (submerged) leaves which in *C. umbonata* are linear and 1-nerved compared with spathulate and 3-nerved in *C. stagnalis*, and the umbonate swelling on the lower face of the *C. umbonata* fruit compared with the ± flat faces of the *C. stagnalis* fruits. The intermediate specimens referred to above have umbonate fruits but no sign of the lower linear leaves. I believe that they are anomalous specimens of *C. umbonata*, perhaps growing in a non-inundated situation. *Callitriche* is notoriously variable in its vegetative characters, and it has been shown experimentally (Schotsman, 1954) that some European species which, like *C. umbonata*, have linear leaves in the lower parts of the stem when growing in water sometimes fail to develop them when growing in a terrestrial environment.

4. **C. hamulata** Ktzg. in Koch, Synops. Fl. germ. et helv. ed. 1, 1:246 (1835)

Published illustrations: Schotsman (1954) pl. 7a, 13a, 14a, 16a; Mason (1959) fig. 11 (a-b); fig. 11A (a-c); Aston (1973) fig. 19 (a-d).

Aquatic or terrestrial herb, leaves in aquatic plants of two types. Submerged leaves linear, 6-30 mm long, 0.5-1.0 mm wide, deeply notched at tip, with a single midvein. Rosette leaves spathulate, ca 3-4 mm long, 1.3-1.7 mm wide, ± emarginate, 3-nerved. Leaves of land form linear-elliptic to elliptic, 1(-3)-nerved. Flowers solitary in the leaf axils, bracteoles absent or rarely present. Stamen 0.6-1.0 mm long, styles deflexed close to fruit, deciduous. Fruit sessile or on pedicel to 15 mm long, dark brown to greyish, longer than broad, or nearly circular, 1.1-1.2 mm long, 0.9-1.0(-1.4) mm wide, pale narrow wing running around top and base of nutlets, commissural groove broad and shallow, face of fruit ± flat. (Fig. 1, J-L.)

A European species introduced to New Zealand, Victoria and now South Australia. Only one South Australian collection has been made so far, from the south-eastern part of the State near the Victorian border (*Alcock 5*, Comaum, Dec. 1973). Aquatic plants of this species are easily identified as in the key. Terrestrial plants might key to *C. stagnalis* but are distinguished by their lack of bracteoles and dark coloured, usually pedicellate fruits.

Acknowledgements

This account is based on specimens held in the State Herbarium of South Australia only. I wish to thank the Chief Botanist for kindly making them available to me.

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DR RICHARD SCHOMBURGK'S 'NATURALISED WEEDS' (1879)

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Abstract

The pamphlet entitled "On the Naturalised Weeds and other Plants in South Australia" (Schomburgk, 1879) is reprinted with detailed explanatory annotations. Suggested misidentifications and other errors are pointed out. Early records and other complementary data have been provided.

The place of the pamphlet in South Australian botany is discussed. It is shown that the text was amalgamated from earlier writings of Schomburgk and was heavily based on the 'Flora Australiensis' rather than contemporary field observations or reports. There were major omissions and other errors. A number of plants were included although they were at that time, and in some cases even since then, uncommon or even unknown in South Australia. Publication details, contemporary reviews and later developments are noted.

Introduction

One hundred years ago, Dr Richard Schomburgk, Director of the Adelaide Botanic Gardens, published a small pamphlet entitled "On the Naturalised Weeds and other Plants in South Austalia" (13 pp., Adelaide; Government Printer). This pamphlet was the first South Australian study of introduced plants and one of the first in Australia as a whole. At first glance, it would be expected that this paper should be regarded as a milestone in South Australian botany and possibly the foundation of all future such studies. In fact, at its publication, whilst it received approval from the lay press, it earned gentlemanly but nevertheless severe criticism from qualified reviewers. An expanded version was published ten years later (Schomburgk 1889) but the paper has been almost ignored ever since. However, at this distance we are so short of any contemporary account of the weed flora, that in spite of its inadequacies the paper must be carefully considered. The present paper is an attempt to interpret this pamphlet and to set it in its botanical and historical context.

The first part of this paper consists of a reprint of the pamphlet with explanatory annotations supplied by the present writer. The background, composition and reactions to this pamphlet are discussed in the second part.

Attention is drawn to typographical and orthographical errors, but errors in author citations, which are extensive, have not been considered, unless the error is relevant to some point under discussion.

ON THE NATURALISED WEEDS AND OTHER PLANTS IN SOUTH AUSTRALIA

[1]It is an historical fact that whenever man settles in a new country he not only carries the weeds that are most troublesome in cultivated ground along with him, but he also exercises a potent influence over the indigenous vegetation, especially when he engages in agricultural and pastoral pursuits. The plough, the axe, the flocks and herds, are enemies to the existing vegetation, and as cultivation advances each representant of the herbaceous flora, perennial and annual, succumbs to the foreign influence. But the plough, axe, and herds are not the sole destroyers of the native herbage, for with cultivation are introduced noxious weeds, and the new-comers, finding a suitable soil and climate, spread with alarming rapidity, and become possessors of the ground, ejecting the indigenous herbaceous plants, and taking their places.

From the past and present constant intercourse with Europe and other parts of the world, and the abundant importation of seeds into Australia for agricultural and horticultural purposes, it is no wonder that a very great number of the weeds most troublesome at home are now naturalised in South Australia.

Our temperate climate and soil suit their growth, and such atmospheric influences, as hot winds, unseasonable, &c., do not check their spread. Another cause of their extension is to be found in the extent of unoccupied ground, which is alone sufficient to account for the predominance and migration of so many of the worst European weeds. Some of these, viz.:- The Cockspur,[2] *Centaurea melitensis*, Linn.; the Bathurst bur, *Xanthium spinosum*, Linn.; the Scotch thistle, *Onopordon Acanthium*, Linn.;[3] the Variegated thistle, *Carduus Marianus*, Linn.;[4] the Stinkaster, *Inula suaveolens*, Jacq.;[5] the Sheep weed, *Lithospermum arvense*, Linn.;[6] and the Cape dandelion, *Cryptostema calendulacea*, R. Br.,[7] already cover immense tracts of pasture land, and extend farther and farther to the destruction of the native herbage.

Notwithstanding that thousands of pounds[8] have been expended legislation[9] has not succeeded in extirpating the most troublesome of intruders, viz., the Scotch thistle and Bathurst bur, the burs of which are so dangerous to the sheep from their fastening themselves in the wool so firmly as to be removed only with difficulty.

It remains to be seen whether the altered circumstances of the acclimatised weeds, which seem to be so favourable to their growth, will prove permanent, or, by an over-stimulation, a change gradually effected in the constitution of the intruders, bringing about degeneracy and subsequent extinction. But such an influence is not yet observable, for they extend farther and farther, and grow just as luxuriantly in the districts whence they spread as far back as from eighteen to twenty five years.

Grasses from other countries have also become domiciled in South Australia, which, no doubt, have materially improved the pasture near the coast.

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1. This opening paragraph originally appeared in Schomburgk (1874) and reappeared in Schomburgk (1875, 1879, 1889).
2. Maltese cockspur.
3. Spear thistle, *Cirsium vulgare* (Savi) Ten. (see note 62).
4. *Silybum marianum* (L.) Gaertn.
5. Stinkwort, *Dittrichia graveolens* (L.) W. Greuter, (syn. *Inula graveolens* (L.) Desf.).
6. *Buglossoides arvensis* (L.) Johnston.
7. Capeweed, *Arctotheca calendula* (L.) Levyns.
8. One pound is nominally equivalent to two Australian dollars but because of inflation, one pound in Schomburgk's time had the spending power of about $40 today.
9. 1851 Act and 1862 Act (see note 67).

But not only weeds and grasses, but also cultivated garden plants, perennial and annual, begin to spread and become acclimatised in pasture land.

It will not, therefore, be uninteresting to give a list of both weeds and other plants naturalised in South Australia, and, as far as possible, the dates and particular circumstances of their introduction, in order, as Sir J. Hooker remarks[10], to record their increase and migration, and to afford to succeeding observers the means of comparing their future with their present condition.

DICOTYLEDONS

PAPAVERACEAE

Common Fumitory[11] - *Fumaria officinalis*, Dec.[12] A native of European introduction[13]: now a troublesome weed in gardens.[14]

CRUCIFERAE

Common Shepherds Burse[15] - *Capsella Bursa-Pastoris*, Moench and *Caps. procumbens* Fr.,[16] both well-known European weeds. Have been in the colony for the last thirty years[17] and have spread with rapidity, especially in abandoned places and on roadsides.[18]

Hedge Mustard - *Sisymbrium officinale*, Scop. A native of Europe. Has found its way probably from Tasmania,[19] and is now abundant[20]. Common and Narrow-leafed Pepperwort - *Lepidium sativum*, Linn. and *Lep. ruderale*, Linn.[21] Of European origin, an early introduction, spreading on roadsides and in abandoned places.

Watercress - *Nasturtium officinale*, R.Br.[22]. A native of Europe introduced about 1846[23], is now found in the streamlets near the coast.

Common Winter Cress - *Barbarea vulgaris*, Linn.[24] A well-known European plant, found near the coasts, and considered by some to be an introduced plant, but also said to be evidently indigenous.

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10. Hooker (1860, p. cv).
11. Now usually placed in the separate family Fumariaceae.
12. This name was used loosely to cover a number of *Fumaria* spp. including *F. officinalis* L.s.s. On the basis of existing herbarium specimens *F. densiflora* DC., *F. muralis* Sond. ex Koch and *F. officinalis* L. are known to have been present in South Australia at the time.
13. *F. officinalis* was collected by Mueller in Adelaide c. 1850 (MEL!). The same species was listed as growing in the Adelaide Botanic Gardens in 1859 (Francis, 1859).
14. Recorded by Bentham (1863) as a weed of cultivation.
15. Usually "purse".
16. Syn. for *Hymenolobus procumbens* (L.) Nuttal ex Schinz & Thell.
17. *C. bursa-pastoris*, was collected by Mueller about Adelaide in July 1848 and *H. procumbens* was collected by Mueller at Wellington in October (both specimens at MEL!).
18. The latter species was considered to be native by Tate (1890) and Black (1924, 1948).
19. In grain or attached to fleece.
20. A sheet collected November 1848 by Mueller (MEL!), is annotated - "In waste places and roadsides about Adelaide".
21. Neither of these species are present in South Australia apart from a record of *L. campestre* (L.) R.Br. (Black, 1920) associated with experimental flax plots near Penola, which appeared as *L. sativum* L. in Black (1948). *L. ruderale* was incorrectly used by Mueller for the native species *L. hyssopifolium* Desv., *L. pseudo-ruderale* Thell. and *L. fasciculatum* Thell. (Black, 1948; Eichler, 1965). The locations given by Schomburgk are typical of some of the present habitats of *L. hyssopifolium*.
22. Syn. for *Rorippa nasturtium-aquaticum* (L.) Hayek.
23. This species collected by Mueller from R. Torrens c. 1850 and from Crystal Brook in November 1851. A second species, *R. islandica* (Oeder) Borbas, was collected by Mueller on a number of occasions from 1847 onwards. This was recorded as a native by Bentham (1863) as *N. palustre* DC. (syn. *R. terrestre* R. Br.). Eichler (1965) corrected its status, noting it as a native of Europe and West Asia.
24. This species does not occur in South Australia and there is no other evidence that it ever has. It is suggested that this was a misidentification of *Sisymbrium orientale* L. which it superficially resembles.

CARYOPHYLLEAE[25]

The weeds of this order, except the first, are not dangerous, as they are eaten by cattle and sheep and only troublesome in gardens.

French Catchfly - *Silene gallica*, Linn. A native of South France. This troublesome weed found its way to South Australia about twenty-five years ago,[26] and spread most rapidly, especially in poor, sandy agricultural land[27] and waste places. The cattle will only eat it when pressed by hunger.

Chickweed - *Stellaria media*, Dec. Is a well known native of Europe, and an early introduction[28]. This troublesome weed is ubiquitous in gardens and is also met with in the fields.

Thyme-leaved Sandwort - *Arenaria serpillifolia*, Linn.[29] A native of Europe and North America. Has been naturalised[30] in South Australia for more than twenty years.

Common Mouse-ear Chickweed - *Cerastium vulgatum*, Linn.[31] From the South of Europe and introduced in the early days[32] of the colony.

Corn Spury[33] - *Spergula arvensis*, Linn. This well known cornfield weed at home, which has made its appearance in South Australia within the last twelve years[34]. *Spergula rubra*, Pers.[35] is also spreading fast near the coast[36].

Gypsophylla tubulosa, Boiss. A native of the Mediterranean, which was introduced in the early days of the colony[37].

PORTULACEAE[38]

Oleraceus Purslane - *Portulaca oleracea*, Linn. Known in the early days of the colony, and a very troublesome weed in gardens during the summer months. By some considered to be indigenous[39].

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25. Caryophyllaceae.

26. In fact specimens were collected by Mueller from the Mt Lofty Ranges in 1848 (MEL!). A specimen in AD! collected by Tepper *s.d.* is annotated "Introduced by first settlers about 1840". Probably introduced in contaminated grain.

27. Used for cereal-growing in the early days.

28. Collected by Mueller near Adelaide in 1848. A congener *S. palustris* Retz. (syn. *S. glauca* With.), appears to have been more widespread even in Mueller's time.

29. A specimen in MEL collected at Clare village in 1851 identified as this species has since been redetermined as *A. leptoclados* (Rchb.) Guss., which is also naturalised in S.A.

30. Bentham (1863) records it as "now almost naturalised". Specimens in MEL! and AD! suggest that *Arenaria* spp. only became common later. It is not certain which species Schomburgk is referring to, but it may be *Polycarpon tetraphyllum* (L.) L. which has been recorded widely since early settlement.

31. Syn. of *C. glomeratum* Thuill.

32. Collected widely by Mueller in South Australia in 1848 (MEL!).

33. Currently spelt "spurry".

34. Actually it had been collected by Mueller at Macclesfield in 1848 (MEL!), where it had probably contaminated cereal grain for sowing.

35. In error for *Spergularia rubra* (L.) J. & G. Presl.

36. Both *S. rubra* and *S. media* (L.) Presl. (syn. *S. marginata* (DC.) Kittel) were collected widely by Mueller from 1847 onwards (MEL!).

37. This species is not known from South Australia. That being referred to is a native, *G. australis* (Schldl.) A. Gray.

38. Portulacaceae.

39. The introduced weedy form found mainly in southern areas differs in appearance from the apparently indigenous native form. The earliest specimen located of the introduced weedy form is *Tepper 1210*, Ambleside, 1885 (AD!). However as cultivated forms of the species were already growing in the Botanic Gardens by 1859 (Francis, 1859), it is possible that it had already become well established, but not collected, by 1879.

GERANIACEAE

Hemlock-leaved Heron's Bill - *Erodium cicutarium*, L'Her. A native of Europe, Africa and Asia; was introduced early[40] and has widely spread in the colony, especially in pasture grounds. Cattle and sheep are fond of it[41].

Drooping Yellow Woodsorrel[42], called in the colony Sour-sop[43]. - *Oxalis cernua*, Thunb.[44] A native of the Cape of Good Hope, and introduced into the colony about 1840 as a garden plant[45]. What the black oats[46] are to the wheat fields, the *Oxalis cernua* is to the gardens. The effects of this scourge are strikingly apparent in every garden where it has been planted, and has notorious pre-eminence over all weeds introduced, since it is next to impossible to eradicate when it has obtained a footing. The young bulbs penetrate every year deeper into the ground, often two feet, and so multiply that every young plant will produce next year from twenty to thirty bulbs, until the ground is matted over, and all other herbage choked.

Experiments[47] were made in burying the plants from three to four feet deep but the young bulbs came up the next year. It has found its way into the wheat fields, and spreads there most alarmingly.

It is said that the first bulbs were sold in the colony at 2s 6d. per bulb[48].

LEGUMINOSAE

The following introduced fodder-plants[49] have also spread over some of the pasture lands, improving them materially viz:-

White Clover[50] - *Trifolium repens*, Dec.
Golden-flowered Clover[51] - *Trifolium agrarium*, Dec.[52]
Common Clover[53] - *Trifolium pratense*, Dec.
Small-flowered Melilot[54] - *Melilotus parviflorus*, Desf.[55]
Lucerne - *Medicago sativa*, Dec.[56]

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40. Collected by Mueller c. 1850; so widespread that it was considered native by Bentham (1863).

41. A congener *E. moschatum* (L.) L'Her. ex Ait. was also collected by Mueller in 1848. Bentham (1863) notes that it was established as a weed. This species was grown in the Adelaide Botanic Gardens (Francis 1859).

42. Now placed in the separate family *Oxalidaceae*.

43. The common name changed from "soursop" to "soursob" about 1900 for unknown reasons, but the former name persisted until World War II.

44. Syn. for *O. pes-caprae* L.

45. First recorded as flowering in the old Botanic Gardens in June 1841 (Bailey, 1841).

46. *Avena fatua* L. See note 140.

47. In the Botanic Garden.

48. 2s 6d. is equivalent to 25¢ but in real value probably over $5! (See note 8.) The source of Schomburgk's assertion is not known.

49. Apart from white clover and lucerne, the other species are considered to be inferior pasture legumes which thrive under low soil phosphate conditions. Where phosphatic fertilizer is used, better producing species are available.

50. Introduced by very earliest settlers (Capper, 1838) who were attempting to establish the white clover/perennial grass pastures with which they were familiar in Britain and northern Europe generally.

51. Current common name is hop clover.

52. *T. agrarium* Huds. is a *nomen ambiguum*. The correct name is *T. campestre* Schreb. (syn. *T. procumbens* L.) Recorded as naturalised in S.A. by Bentham (1863) but no specimens have been located. A Tate specimen of 1877 at AD (!) originally identified as *T. agrarium* is *T. tomentosum* L.

53. Current common name is red clover which is not well adapted to South Australia and is rather uncommon. It is not certain which species is really meant. A highly speculative suggestion is cluster clover (*T. glomeratum* L.) which has pink globular flowers and has been widespread since last century.

54. Commonly known as melilotus or King Island melilot. Collected by Mueller in 1847 (MEL!).

55. Syn. for *M. indica* (L.) All.

56. Recorded as growing in the old Botanic Gardens in 1841 (Bailey, 1841) and collected by Mueller at North Adelaide in 1848 (MEL!).

Toothed Medick[57] - *Medicago denticulata*, Willd.[58]
Common Vetch[59] - *Vicia sativa*, Linn.; and *Vicia hirsuta*, Fisch. Natives of Europe and N. America.

UMBELLIFERAE

Common Fennel - *Foeniculum vulgare*, Linn. A native of Europe. This useful medicinal plant was introduced at an early date[60], and has spread amazingly over the country[61], especially on the banks of creeks and water-courses, growing to an immense size, often four to six feet high, forming thickets and choking the herbaceous plants.

COMPOSITAE

The order has supplied the most troublesome of the introduced weeds[62]. Scotch Thistle - *Onopordon Acanthium*, Linn.[63] A native of Europe. Made its appearance in the south, at Cape Jervis, about 1845[64], and has since spread extensively over the country. It prefers a rich soil, and shows such a luxuriant growth that in some places it has formed impenetrable thickets, throwing up flowerstalks of from four to six feet high, and destroying the native herbage entirely. Plants have been seen as far as two hundred miles north, for the winged seeds can be carried a great distance if they are taken up by the whirlwinds[65].

Cattle and sheep do not eat the plant, and its extension became so rapid and injurious to the pasture lands[66], that the Legislature, on October 21st, 1862, passed an Act[67] for preventing the further spread of the Scotch thistle, including two other noxious foreign weeds equally dangerous to the herbage, viz., the variegated thistle, *Carduus Marianus*, Linn.[68], and the Bathurst-bur, *Xanthium spinosum*, Linn.

According to the Act every owner or occupier of land upon which, or upon the adjacent half of any road, the above-mentioned thistles are growing is obliged, in twenty-one days after notice, signed by any Chairman of a Road Board or District Council[69], has been served upon such owner, to destroy the thistles on his land, otherwise he is liable to a penalty not exceeding ten pounds. The Government must, on all unoccupied Crown

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57. Burr medic - probably introduced by the earliest settlers in sheep's fleeces. Collected by Mueller by R. Torrens in 1848 (MEL!).

58. Syn. for *M. polymorpha* var. *vulgaris* (Benth.) Shinners.

59. There is a newspaper reference to vetch (*V. sativa*) in 1845 and *V. angustifolia* L. was collected by Mueller on the plains between Adelaide and Gawler in 1847 (MEL!). It was recorded by Bentham as *V. sativa* var. *segetalis*. *V.hirsuta* was collected by Mueller in the Bugle Ranges in 1850 (MEL!). It is not a very common species.

60. This plant was being grown in the Adelaide Botanic Gardens in 1859 under this name and also as *Anethum foeniculum* L., but it was recorded as being introduced before 1856 (Francis, 1859).

61. Collected by Tate at Fifth Creek in September 1880 (AD 97619229!) and noted as growing wild around Adelaide, chiefly on the banks of watercourses (Garden and Field (1882), 7:164).

62. The first noxious Weeds Acts were aimed entirely at species of Compositae.

63. This species is very rare in South Australia and always has been. The species referred to, is spear thistle, *Cirsium vulgare* (Savi) Ten. (syn. *C. lanceolatum* and *C. lanceolatus*). It is also locally known as black thistle.

64. A. Molineux in 1879 recalled that the first time he saw the plant was close to the residence of the Governor of the gaol on the banks of the Torrens in 1841 (Garden & Field (1879) 5: 92). The banks were grazed so it is likely to have been introduced in sheep's fleece or perhaps fodder from Tasmania where it was an early introduction (Bentham, 1867).

65. This may be so, but a more prosaic explanation could lie in the observation that they were common along railway lines (Garden & Field (1875) 7: 182).

66. By 1850 it was reviled as an "atrocious thistle, (the) curse of the Colony" (Yelland, 1970).

67. This was in fact the second such Act. The first "An Act for preventing the further spread of the Scotch Thistle" was enacted in December 1851 and received Royal Assent on January 2, 1852. The 1862 Act repealed the earlier Act and among other things included Bathurst burr, *Xanthium spinosum* L. as a noxious weed.

68. Syn. for *Silybum marianum* (L.) Gaertn. The plant was also known locally as *C. benedictus* which is an entirely different species, never recorded from South Australia.

69. Or a number of other designated officials.

lands, employ the necessary labor to eradicate the thistles. This stringent measure, it is true, has decimated the plants, but without effecting the object desired. Although thousands of pounds[70] have been spent for the purpose, the destruction of thistles is generally commenced too late[71] to prevent the dispersion of the developed seed.

Variegated Thistle - *Carduus Marianus*, Linn.[68] a native of South Europe also wrongly styled Scotch Thistle[72], is said to have been introduced as a garden plant in 1846[73], and has spread to the same extent as the foregoing. In good soil it will grow from four feet to seven feet high. The only advantage it has, is that it is eaten by the cattle when young.

Bathurst Bur[74] - *Xanthium spinosum*, Linn. A native of South and West Europe[75], is as dangerous a weed as the sheepfarmers have to contend with. It was first observed in the colony about 1850[76], and for the first few years it was confined to the roadsides and the reserves used for travelling stock, but it spread from thence with alarming rapidity into the interior, assisted by the sheep and horses, in whose wool, and manes and tails, the bur is carried about and spread in all directions. It is said that as many as a hundred burs have been taken off the head of a sheep. The bur adhers so tenaciously to the wool until it is shorn, that it is difficult to pull it off without pulling the wool with it, and so it depreciates the value of the fleece 2d. to 3d. per pound[77].

Artichoke - *Cynara scolymus*, Linn.[78] A native of South Europe, has been introduced about twenty-five years[79]. It has found the South Australian climate so genial that it begins to spread throughout the colony[80]. It is found especially on the banks of rivers and creeks. It grows in good soil to an enormous size, choking, like the variegated thistle, the surrounding herbage.

Cockspur[81] - *Centaurea melitensis*, Linn. A native of the Mediterranean region, was introduced as far back as 1844[82], and has spread with rapidity, over cultivated as well as waste ground and pasture land, and appears abundant in various parts of the colony[83]. Like the Bathurst bur, it was first observed on the roadsides, and the wind, as is the case with most of the compositae, carries the winged light seed to a great distance. Stock will eat the plants when young, but will not touch it after the appearance of the flower stalks. On fallow and pasture land it forms thick swaths, and chokes the more tender indigenous herbs.

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70. See note 8.
71. This comment is equally true today and it applies to all weeds.
72. The 1851 Act (Section 11) expressly states that "'Scotch Thistle' shall be held to mean and include ..... the variegated thistle ..... ."
73. No evidence exists for this date. It was known to be growing in the Adelaide Botanic Gardens in 1859 (Francis, 1859) but as it was included in the 1851 Act, it must have been naturalised and rampant by that time.
74. Nowadays spelt "burr".
75. Actually a native of South America and reputedly introduced to the Bathurst area of New South Wales about 1840 in the tails of horses imported from Valparaiso, Chile, (Anon., 1852).
76. It did not warrant attention from the 1851 Act but 11 years later was included in the 1862 Act.
77. A 25% reduction or greater in value.
78. In error for *C. cardunculus* L. *C. scolymus* is the botanical name for the globe artichoke, but in S.A. has been used interchangeably with *C. cardunculus* which is cardoon, a vegetable in its own right. Both species were early introductions to S.A. (Stevenson, 1839) but only *C. cardunculus* became naturalised.
79. It was already known by 1839 that the species grew well in Adelaide (Stevenson, 1839)
80. In 1881 it was recorded as being both naturalised and readily cultivated (Garden & Field 7: 116).
81. Now called "Maltese cockspur".
82. No evidence for this date has been found but it appears to have been common by c.1850 when it was collected around Adelaide by Mueller and Blandowsky (MEL!).
83. There are occasional references to its value as fodder when young and it is recorded as being deliberately sown in the scrub at Stansbury for sheep fodder in 1890 (Anon., 1890). It may have been used for this purpose earlier. Loudon (1855) lists it as an ornamental.

The following three species of Horse Thistle, viz., *Cirsium lanceolatum*, Scop., *C. palustre*, Scop., and *C. arvense*, Scop.[84], natives of Europe, also become troublesome to the agriculturists. It is said they have been introduced from Victoria and Tasmania.

Stinkaster[85] - *Inula suaveolens*, Jacq.[86] A native of South Europe is the most noxious and dangerous plant ever introduced[87]. Neither cattle nor sheep will touch it, and it increases with most alarming rapidity. This plague was first noticed in the Onkaparinga district[88] as far back as 1863, and it is said, was introduced with seed wheat from home[89]. Not knowing its dangerous character[90], no notice was taken of the plant until its fast spreading became apparent, and that no cattle would touch it, probably not liking the disagreeable odour the plant emits.

Its winged light seed flies with the prevailing winds to a great distance. It forms a thick swath, and smothers the indigenous herbage. The pasture land taken possession of by it becomes valueless, as the weed cannot be extirpated without heavy cost. Although only an annual, this useless plant is a prolific seed-bearer, and keeps its vitality for years. Thousands of acres of pastures land towards north and south, extending sixty to eighty miles from its starting point, has been taken possession of by this pest, and such lands are covered with this weed have a most desolate appearance.

In cultivated land it is not so dangerous; the seed begins first to germinate in September and October, and the young plants are choked by the growing crops; but the haylands suffer, because the young plants spring up after the hay has been mown.

Cape Dandelion[91] - *Cryptostemma calendulacea*, R.Br.[92] A native of the Cape. It was in the year 1850 that I first noticed a few isolated plants on the side of the road leading through the Gawler Plains[93]. The following year a few made their appearance on the banks of the Gawler River. From year to year it is rapidly taking possession of the pastures as well as cultivated land, and is now found quite two hundred miles towards the north from its starting point, covering even the untimbered mountain ranges to their summits. When in bloom the country presents a peculiar appearance, and as far as the eyes reach a yellow carpet only is seen. It is an annual, and although doing much harm to the more tender indigenous herbage, it is much liked by cattle and sheep, which eat it eagerly, preferring it even in a dry state to wheaten hay, and licking the large and very

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84. It is uncertain which species are referred to here. *C. lanceolatum*, mentioned earlier, is a synonym of *C. vulgare*. *C. palustre* is a biennial, not known from S.A., and *C. arvense* is a perennial not recorded locally until 1888 (Anon., 1888). *Onopordon acaulon* L., stemless horsethistle, was a very early introduction as an ornamental and had escaped into the Adelaide Parklands by 1845 (Anon., 1897), so this species may have been intended.

85. Now known as "stinkwort".

86. Used in error for *I. graveolens* (L.) Desf. which is a synonym of *Dittrichia graveolens* (L.) W. Greuter.

87. This was the most serious weed of cereal growing areas around the turn of the century, but is a minor plant of little consequence today associated with infertile, waste land.

88. On the property of a Mr Spoehr, not far from the Balhannah bridge (W.C. Grasby, quoted by Maiden, 1920).

89. Germany.

90. Schomburgk, apparently upon identifying the plant, said "that it was a common weed in Germany and Central Europe, but not dangerous, and he persisted in this view for some time until the pest got a firm hold" (W.C. Grasby quoted by Maiden, 1920).

91. Now called "capeweed" although there is a local South Australian name "dandelion" which still persists widely. Presumably this is an abbreviated form of "Cape dandelion".

92. Syn. for *Arctotheca calendula* (L.) Levyns.

93. This was the area in which Schomburgk farmed at the time. However earlier records exist. According to A. Molineux it first appeared on the banks of the Torrens, 300 yd. (approx. 270 m) above the first dam in 1841. He knew it originally as "Cape marigold" (Garden & Field (1880) 5: 92). A report in 1882 records its introduction as "about 38 years ago", when it was introduced from the Cape as a fodder plant (Garden & Field (1882) 7: 116). Mueller noted it as frequent in places around Adelaide in 1848 (MEL!) and it was recorded as a common plant on the Adelaide parklands in 1862 (Farm & Garden (1862) 5: 21).

abundant seed from the ground. When in bloom many people consider it injurous to the lungs, from the inhalation of the pollen by which the air is impregnated. This circumstance may also be attributed to the moist atmosphere prevailing when the dandelion is in flower. Though the plant has taken possession of the land for the last twenty-five years, it grows as vigorously as ever, and it seems that over stimulation fails to bring about degeneracy and subsequent extinction. It is said that the plant was introduced from Tasmania[94].

Goat's Beard[95] - *Tragopogon porifolius*, Linn.[96] A native of Britain. With the last few years this weed, introduced from England[97], seems to have found a genial climate in South Australia, as it spreads everywhere, the profusely winged seeds being each carried about by the wind. Its large taproot, which proves to be an edible vegetable, takes hold in any soil[98]. The plants are eaten by cattle when young.

Chicory - *Cichorium intybus*, Linn. A native of Europe, and introduced into South Australia about sixteen years ago[99], and is now abundantly found growing on the roadsides, especially on the Brighton Road, and along the railway to Glenelg[100]. Although spreading fast in these places it will not become dangerous to our pasture lands, being a plant eaten eagerly by stock. As the plant has taken so well to our climate the culture of the chicory for manufacture would, no doubt, be a profitable undertaking.

Common Groundsel - *Senecio vulgaris*, Linn. Known here for the last sixteen years[101]. Becomes rather a nuisance in gardens, but improves pasture, as the cattle relish it much.

Golden Cornflower - *Chrysanthemum segetum*, Linn.[102] A native of Britain - probably introduced from Tasmania - also begins to spread much.

Common stinking Maruta[103] - *Maruta Cotula*. Dec., (*Anthemis Cotula*, Linn.)[104]. A native of Europe. From its unpleasant odour is not at all an agreeable addition to our flora[105]. It increases rapidly, as stock do not eat it.

Sow-thistle - *Sonchus oleraceus*, Linn., was introduced in the early days of the colony[106], and has become a very troublesome weed in cultivated ground just as obiquitious as we see it in the old country, and this is also the case with the two following species, viz.:

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94. The earliest collections are from Western Australia from where it may have been introduced to S.A. but also see previous note.
95. Now called "oyster plant" or "salsify".
96. *Tragopogon porrifolius* L.
97. Recorded as growing in the Adelaide Botanic Gardens in 1859 (Francis, 1859).
98. Today it is an inconsequential weed of roadsides and waste places in moist areas.
99. Earlier records exist. It was sown as a pasture species in 1837 (Capper, 1838) and collected at Gawler River and Tanunda in 1848 by Mueller (MEL!).
100. Possibly remnants of the original plantings by the first settlers.
101. This species was being grown in the Adelaide Botanic Gardens in 1859 (Francis, 1859) but no specimens collected from the field last century have been located. However Black (1909) implies that it was widespread by the turn of the century.
102. This species is not known ever to have occurred in South Australia. Presumably some other yellow-flowered plant was misidentified. Both *Calendula officinalis* L. and/or *C. arvensis* L. particularly the former, could have been intended. Both species were collected by Mueller around Adelaide in 1848 (MEL!).
103. Known as "stinking mayweed".
104. The South Australian specimens are currently identified as *Anthemis cotula* L. In my opinion they appear to be *A. arvensis* L. Robertson (1957) has previously drawn attention to this possibility.
105. The earliest extant specimen is from 1881 collected by *Tepper 321* from riverflats and wet gullies at Clarendon (MEL!). Its inclusion here by Schomburgk is an error carried forward from earlier publications (Schomburgk, 1874, 1875) when *Anthemis cotula* was given in error as the botanical name for stinkaster i.e. *Dittrichia graveolens*.
106. Collected widely by Mueller between 1848 and 1850 (MEL!) to such an extent that he suggested that it was "perhaps truly indigenous".

Rough-leafed Sow-thistle - *Sonchus oleraceus*, Linn., var. *asper*[107]. A native of Europe; and the

Cornfield Sow-thistle - *Sonchus arvensis*, Linn.[108] A well known European weed.

PRIMULACEAE

Red-flowered Pimpernel[109] - *Anagallis arvensis*, Linn.[110] A native of Europe, Asia and N. America; has become settled as an introduced plant in waste and cultivated ground.

BORAGINEAE[111]

Corn Cormwell, known in the colony under the name of Sheepweed[112] - *Lithospermum arvense*, Linn.[113] A native of Europe and established in the colony for about fifteen years;[114] and in some districts spreading most alarmingly in the wheatfields, injuring the young wheat plants, by choking them entirely[115].

SOLANEAE[116]

Blackberried Nightshade - *Solanum nigrum*, Linn. This well-known European noxious weed, was introduced in the early days of the colony[117] - probably from Tasmania - and has spread with amazing rapidity in all directions far into the interior. Stock will not eat it.

Blackspined Nightshade[118] - *Solanum sodomeum*, Linn.[119] A native of the Mediterranean[120]. Has for the last two years been found growing in waste places and on rubbish heaps[121].

Light Blue Tornapple[122] - *Datura tatula*, Linn.[123] From the South of Europe. This noxious weed has during the last twenty years[124] appeared in South Australia in waste places, but especially on the banks of creeks and watercourses. A good many horses have already been poisoned by it, the plants having been mixed with the hay, and the seeds, the most dangerous part, having fallen into the manger.

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107. *Sonchus asper* (L.) Hill, collected at Gawler by Mueller c. 1850 (MEL!).
108. This species is very rare in S.A. Possibly a native *Sonchus* sp. or subsp. or *Embergeria* sp. (see Eichler, 1965) was intended.
109. Known as "scarlet pimpernel".
110. Introduced as a garden plant very early and apparently well established by 1848 when Mueller collected both blue and red forms (MEL!).
111. Boraginaceae.
112. Cormwell is a misspelling of gromwell, a name used in other parts of Australia. Sheepweed is the generally used name in S.A. today.
113. Syn. for *Buglossoides arvensis* (L.) Johnston.
114. One specimen was collected by Mueller at Clare in 1851, possibly from a garden (MEL!). In 1875, it was noted as being common in neglected (Adelaide) suburban gardens (Garden & Field (1875) 1: 65). From 1875 it was collected widely (MEL!).
115. This may still apply where crops are late sown on a fine seedbed and no control measures are instituted.
116. Solanaceae.
117. Recorded as flowering in the old Botanic Gardens in 1841 under the name of *S. luteum*. (Bailey, 1841). Collected by Mueller in 1848 (MEL!) from the vicinity of Adelaide.
118. Now called "apple of Sodom".
119. Syn. for *S. hermanii* Dunal.
120. Introduced from Asia Minor into the Adelaide Botanic Gardens during the period 1856-59 (Francis, 1859).
121. First local specimen was collected c. 1880 by Tepper at Victor Harbor (MEL 14063!).
122. Thornapple.
123. Probably common thornapple, *D. stramonium* L. was intended, although *D. inoxia* Mill. and *D. wrightii* Regel were probably present by this time. The former species was the most widespread and *D. tatula* was used in error for *D. stramonium* (Haegi, 1976).
124. Bailey (1906) recalls children eating the plant and becoming very sick in Adelaide in 1839.

Common Henbane - *Hyoscyamus niger*, Linn.[125] This well-known noxious European plant has appeared since the last few years on rubbish heaps and abandoned places, as at home.

PLANTAGINEAE[126]

Ribgrass[127] - *Plantago lanceolata*, Linn.[128], *Pl. major*, Linn.[129], and *Pl. coronopus*. Linn.[130], all natives of Europe, were introduced early and have spread over the pasture grounds and have much improved the pastures, as the cattle and sheep eat it greedily.

POLYGONACEAE

Knotgrass, and bears the colonial name hogweed[131] - *Polygonum aviculare*, Linn. A native of Europe, is one of the first of the troublesome introductions[132], and is now spread over a large part of South Australia, and especially in cultivated land and gardens. It forms a thick matting, and chokes the surrounding herbage. Cattle and sheep relish it[133].

Sheep's sorrel - *Rumex acetosella*, Linn.[134], and the Curled Dock *Rumex crispa*, Linn.[135] Both dangerous European introductions, which monopolise cultivated land and gardens, to the entire exclusion of other herbs. They are not easily eradicated in consequence of their long roots penetrating deep in the ground, and if a small piece of one of these remain it will grow again[136].

EUPHORBIACEAE

Warbwort Spurge - *Euphorbia aviculare*, Linn.[137] A native of Europe has also found its way from Tasmania into South Australia, and is found growing on rubbish heaps and in abandoned places.

URTICEAE

Common and Small Nettle - *Urtica urens*, Linn., and *Urtica dioica*, Linn.[138] are said to have been brought over from Tasmania in the hay imported from there nearly forty years ago[139]. They are mostly found growing on rubbish heaps and in abandoned places, and become troublesome in gardens.

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125. It is not known which species was meant. It was growing in the Adelaide Botanic Gardens in 1859 (Francis, 1859) but no herbarium specimens exist. The first collection was from Wolseley in 1921 (Black, 1935). Two later collections from Murray Bridge in 1927 and Jamestown in 1935 are recorded but it has not been collected since. It probably failed to become naturalized.

126. Plantaginaceae.

127. Ribgrasses were a favoured pasture species and were among the first species sown in 1837 (Capper, 1838). Although it is used here for three species, the true ribgrass of Britain is *P. lanceolata*.

128. This species was introduced into the Adelaide Botanic Gardens during the period 1856-59 (Francis, 1859). The earliest collection is from near the Torrens weir in 1879 (AD!). However in 1859 it was being advocated and sown successfully as a pasture species, seed being distributed by Mr Robert Davenport (Farm & Garden, (1859) 1: 200).

129. This is not, and appears never to have been, common in S.A. The earliest certain record is a collection found by the Torrens in 1879 (AD!).

130. This was collected at Holdfast Bay by Mueller in 1851 (MEL!). Other collections indicate that this was the most widespread species. It was the most successful introduction of *Plantago* by the early settlers.

131. In S.A. almost always called "wireweed".

132. Collected by Mueller in 1848 (MEL!). The sheet is annotated "on roads, waste places and cultivated land around Adelaide".

133. Recognised as being valuable summer feed (Farm & Garden (1859) 1: 153).

134. *R. acetosella* L. now considered to be a different species *R. angiocarpus* Murb. (see Eichler, 1965).

135. *R. crispus* L.

136. *R. angiocarpus* was collected in 1847 by Mueller who noted it as "rare". However by 1862 it was a problem in the Mt Gambier area for which advice was being sought (Farm & Garden (1862) 4: 115). By the 1890's it was a bad weed in many places enjoying high rainfall. *R. crispus* was collected in 1850 by Mueller from Mt Barker township where it was "adventive". No other early collections exist.

137. The only species of *Euphorbia* that was widespread was petty spurge, *E. peplus* L. which occupies the habitats described. The earliest extant specimens, however are those of J.M. Black collected after 1902 (AD!).

138. This is probably the native species *U. incisa* Poir. which is closely allied to *U. dioica*.

139. i.e. about 1840. It was collected "around buildings and sheds" in 1848 by Mueller (MEL!).

MONOCOTYLEDONS

GRAMINEAE

Black Oat[140] - *Avena sativa*, Linn., var. *melanosperma*[141] was undoubtedly either introduced with the original seed wheat from England, or from Tasmania[142], which latter we have to thank for the introduction of a number of noxious weeds, as in the early days of the colony a great deal of hay was shipped from thence to South Australia. The black oat has the most notorious pre-eminence of all the introduced weeds[143] and the effects of this intruder are most ruinous to the farming community, as it finds its way into all the cultivated land, and having once got a footing is the most troublesome weed to eradicate, its seed ripening and being shed some time before the wheat ripens. It is a fact that the seed lies six or eight years in the ground, if covered one foot with soil, but by next year's ploughing if the seed comes near the surface it will spring up so abundantly before the sown wheat does as to choke the young wheat plants. It is almost impossible to cleanse the land thoroughly foul with black oats in less than several years, even by repeated ploughings. The rapid increase of this injurious plant is an object of serious concern to the farming community. Thousands of acres of arable land, especially such as have been in cultivation for some years, are totally ruined by the black oats for the purpose of wheat growing. At the present time the yield of wheat of many of the farms is diminished quite by two-thirds, or one, in consequence of the black oats, and often the crops can only be used for hay.

Darnel Grass, or Drake - *Lolium temulentum*, Linn.[144], probably an introduction from Britain. In the cereal fields, also, this spreads with alarming rapidity, as the seeds mostly ripen and drop before the wheat harvest[145].

The following European grasses have also found their way to Australia, but are less dangerous to cultivation - in fact, they have improved the native pasture near the coast materially, viz:-

Wild Oatgrass[146] - *Avena fatua*, Linn. A native of Europe.[147]
Early Flowering Hairgrass - *Aira praecox*. Linn.[148] A native of Britain.
Sweetscented Springgrass[149] - *Anthoxanthum oderatum*, Linn.[150] A native of Europe[151].

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140. Generally known as wild oats, although the name "black oats" is occasionally used.

141. Syn. for *A. fatua* L.

142. According to a report in 1858, wild oats was probably introduced with the original seed wheat (Farm & Garden (1858) 1: 38). Specimens collected by Blandowsky and Mueller in 1851 around Adelaide are at MEL!

143. In 1858, regarded as the pre-eminent weed of S.A., found in all cultivated land (*Ibid*).

144. *L. temulentum* is a very rare plant in South Australia at present, if not extinct. There are few herbarium specimens in the collection at MEL!, NSW!, AD! or ADW! The Mueller material at MEL!, originally determined as *L. temulentum* is actually a mixture of *L. multiflorum*, *L.perenne* and *L. rigidum*, i.e. members of the annual *Lolium* complex (*L. multiflorum* and *L. perenne* behaving as annuals). The past and present status of *L. temulentum* in Australia is obscure and is presently being investigated.

145. This suggests that *L. temulentum* is not the species being considered. *L. temulentum* is harvested with the crop and is in fact a grain contaminant.

146. This is the same wild oats, *Avena fatua*, as the black oat. Schomburgk's distinction is based on two situations in which one species was found.

147. Wild oats was a highly regarded fodder grass. The oaten hay being made to the west of Adelaide in 1850 (Yelland, 1970) could well have been *A. fatua*. In 1891 it was so well adapted as a fodder plant that it was considered that no other fodder species was necessary in the Maitland area. (Anon., 1891). The following year seed was sent from Stansbury and distributed in the Mundoora area (Anon., 1892). It is highly likely that seed had been distributed in a similar way in earlier years.

148. This species is unknown in S.A., although it was tried and rejected as a potential pasture grass (Francis, 1859a). The common annual *A. caryophyllea* L. could be intended but the earliest specimen located is one collected by Tepper in 1882 at Clarendon (MEL!). It is noted on that sheet as 'rare'.

149. Francis (1859a) called it sweet-scented vernal grass, which is its current common name.

150. *A. odoratum* L.

151. There are no early specimens of this species, but Francis (1859a) stated that it grew here "better than most of them (i.e. other English pasture grasses) and is most valuable . . . . . ."

Cocksfoot Panic[152] - *Panicum Crus-galli*, Linn.[153] A native of Europe[154].

Glaucous Setaria - *Setaria glauca*, Beauv. A native of South Europe[155].

Creeping Dogstooth Grass, or Couch Grass[156] - *Cynodon Dactylon*, Pers. A native of Europe and other parts of the world[157].

Annual Meadowgrass[158] - *Poa annua*, Linn. A native of Britain[159].

Ryegrass - *Lolium perenne*, Linn.[160] A native of Europe.

Rough Cocksfoot[161] - *Dactilis glomeratus*, Linn.[162] A native of Europe[163].

Floating Foxtail-Grass[164] - *Alopecurus geniculatus*, Linn. A native of Britain[165].

Wall barley[166] - *Hordeum murianum*, Linn.[167] A native of Europe.

Small and Greatspiked Quaking-Grass[168] - *Briza minor*, Linn.; and *Briza maxima*., Linn. European species[169].

Barren Broom-Grass[170] - *Bromus sterilis*, Linn.[171] A native of Europe.

Downy Rye[172] - *Bromus commutatus*, R. & P.[173] A native of Europe.

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152. Barnyard grass.

153. *Echinochloa crus-galli* (L.) Beauv.

154. Tate (1883) notes that this species had been collected by Mueller near Hahndorf and by himself at the Reedbeds but these specimens have not been located.

155. Both *S. glauca* and *S. viridis* Beauv. were recorded as natives of Central Australia by Tate (1880) based on the records given by Bentham (1878), but Tate also records *S. viridis* from the Adelaide area.

156. In Australia known as couch grass.

157. More likely to have originated in Africa but very widely distributed. Collected by Mueller around Adelaide in 1848 (MEL!) who noted it growing on roadsides. Francis (1859a) promoted it as pasture grass but it seems to have been more commonly associated with gardens as the "only suitable lawn grass for Adelaide" (Schomburgk, 1870), and being strongly recommended as a lawn grass (Heyne, 1871), who also noted it as growing wild in places around Adelaide. From 1880 it was noted at various times and places as a garden weed e.g. Garden & Field (1880) 6: 187.

158. Commonly known now as "winter grass".

159. Collected by Mueller around Adelaide in 1848 who noted it as frequent (MEL!). This species is never considered as a pasture grass but as a lawn and garden weed.

160. This probably refers to perennial ryegrass *L. perenne* in the wetter areas and to the annual ryegrass complex *Lolium* spp. in the greater part of the State (See note 144).

161. Now called "cocksfoot".

162. *Dactylis glomerata* L.

163. Introduced originally by Thomas Williams of the Hermitage, but the date is not stated (Farm & Garden (1859) 1: 270-272). It would have been before 1856 (Francis, 1859).

164. Currently known as "marsh foxtail".

165. Collected so widely and so early that Bentham (1878) suggested it may be truly indigenous. Black (1942) still followed that opinion. However Vickery (1953) concluded that it was an early introduction to Australia. It is still very widespread, particularly in the pastoral areas.

166. Invariably known as "barley grass".

167. *H. murinum* L. This species does not occur in S.A. but the name was used erroneously for both *H. leporinum* Link and *H. glaucum* Steud. Both species were collected widely very early (see Cocks *et al.*, 1976). It was early acknowledged as a weedy grass because of its awns (Francis, 1859a), although its virtues as a fodder (except at seeding) were also appreciated (W. Guilfoyle cited by Anon., 1881).

168. Known respectively as "lesser quaking grass" and "large quaking grass".

169. The former species was collected widely by Mueller and others in the Adelaide region c.1850 (MEL!); the latter species was sown as an ornamental (e.g. Heyne, 1877) but was collected by Mueller in 1848 at Echunga and in 1849 by the River Torrens (MEL!). They are both common in cooler and moist areas particularly the Mt Lofty Ranges.

170. Known as "great brome", but also known as "ripgut brome".

171. *B. diandrus* Roth, but other prominently awned species were lumped under this name last century especially *B. madritensis* L. No early specimens are extant; however by 1859 the awned bromes were sufficiently widespread to be well known as weedy grasses (Francis, 1859a).

172. Downy-rye brome grass (Loudon, 1855).

173. Not recorded for S.A. Possibly confused with plants of the following which are very variable.

Soft Broom-Grass[174] - *Bromus mollis*, Linn.[175] A native of Britain[176].

Hard Fescue-Grass - *Festuca duriuscula*, Linn.[177] *Festuca bromoidis*, Linn.[178] Both European grasses.

Small Canary-Grass - *Phalaris minor*, Retz.[179] *Phalaris canariensis*, Linn. Natives of South Europe[180].

Catstail Koeleria[181] - *Koeleria phleoides*, Pers.[182] A native of South Europe[183].

GARDEN PLANTS

The following plants cultivated in the gardens have found their way to the pasture lands surrounding towns and villages, and have become acclimatised viz:-

Oenothera suaveolens, Desb.[184]
Delphinium consolida, Linn.[185]
Linaria bipartita, Willd.[186]
Eschscholtzia californica, Cham.[187]
Scabiosa atropurpurea, Linn.[188]
Bellis perennis, Linn.[189]
Anchusa officinalis, Linn.[190]
Malva rotundifolia, Linn.
Malva parviflora, Linn.

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174. Soft brome grass.

175. This species is uncommon in S.A. The species which is usually called *B. mollis* is probably *B. hordeaceus* L., but other closely related species couild also be present.

176. An early but undated specimen determined as *B. mollis* at MEL! is annotated "common on waste fields of St. Vincent's Gulf".

177. It is suggested that this is in error for *Catapodium rigidum* (L.) Hubbard (syn. *Festuca rigida* Kunth) which was collected very widely at an early date. Collected by Mueller around Adelaide and St Vincent's Gulf in 1848 (MEL!). The species cited by Schomburgk is not known from S.A.

178. *F. bromoides* syn. for *Vulpia bromoides* (L.) S.F. Gray, but both Mueller and Bentham (1878) included *V. myuros* (L.) Gmel. within the species. Both species were collected widely and frequently by Mueller and others c.1850 (MEL!).

179. Collected by Mueller about Adelaide in 1848 on roadsides and in fields (MEL!). Noted as "common" in 1859 (Farm & Garden (1859) 2: 27).

180. Bentham (1878) records that it is naturalized on the seashore at Bremerhaven, but the specimen could not be located. Many specimens identified as *P. canariensis* by Mueller have since been redetermined as *P. minor* (MEL!). *P. canariensis* is very rare in S.A. Schomburgk was possibly confused by the use of the common name 'canary grass' for *P. minor*.

181. Annual cat's tail.

182. Syn. *Lophochloa* spp.

183. A very common weedy grass collected by Mueller in the vicinity of Adelaide c. 1850. It spread rapidly and had already reached Fowler's Bay by 1880 (MEL!).

184. Probably *O. striata* Ledeb. ex Link, which was collected by Mueller around Adelaide c. 1850 but misidentified (Bentham, 1867) as *O. biennis* L. (MEL!).

185. Syn. for *Consolida regalis* S.F. Gray ssp. *regalis*. This species has never been recorded as having escaped in South Australia. At least one species of *Delphinium* (larkspur) was widely promoted as being toxic to locusts and grasshoppers e.g. Heyne (1882).

186. This refers to *Kickxia elatine* (L.) Dumort., and/or *K. sieberii* Dorfl. The latter is actually more common, although most early S.A. literature lumps them both under *Linaria elatine*. Its inclusion here by Schomburgk agrees with other records of the increasing frequency of the plant about this time.

187. This is a common garden plant (Californian poppy) but is a very rare escape and then only in the Mt Lofty Ranges.

188. Already collected by Mueller in 1851 (MEL!) and noted as being spontaneous in places near the Lofty Ranges. It was identified at that time as *S. maritima*.

189. Never recorded as a naturalized plant in S.A.

190. This species has never been recorded with certainty in S.A. Schomburgk was probably referring to *A. capensis* Thunb. which was a garden plant that subsequently escaped in the south-east of S.A. A specimen of *A. capensis* collected at St. Vincent's Gulf at an unknown date was determined by Mueller as *A. officinalis*.

Malva crispa, Linn.[191]
Verbascum thapsis, Linn.[192]
Verbascum blattaria,[193]
Sparaxis tricolor, Kerr.[194]
Ixias[195] - in fact most of the bulbs[196] introduced from the Cape of Good Hope[197] begin to spread in pasture lands near gardens.

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191. There are only two *Malva* spp. naturalized in S.A., *M. parviflora* L. and *M. nicaeensis* All. (Barker, 1977). The first record of the latter is this State, data from 1906, but specimens of *M. parviflora* L. in MEL! date from 1847. Mueller notes that it occurred in waste places in Adelaide. Other species *M. verticillata* L. and *M. pusilla* Sm. for which *M. crispa* and *M. rotundifolia* are synonyms respectively, have been recognised in the past (see Black, 1948; Eichler, 1965) but Barker considers all our material previously determined as separate species to be included in *M. parviflora*.

192. *V. thapsus* L. This species was not collected in S.A. until this century but it had been introduced before 1856 as a garden plant (Francis, 1859) so it may have already escaped locally in Schomburgk's time.

193. Syn. for *V. virgatum* Stokes in With. This had been collected by Mueller at Brownhill Creek c. 1848 (MEL!). The specimen was seen by Bentham but was not recorded for S.A. (Bentham, 1868).

194. Noted by Bentham (1873) as a garden escape but no localities are given. The specimens were not located. They were already introduced by 1845 (Bailey, 1845).

195. *Ixia* spp. had also been introduced by 1845 (Bailey, 1845) but even in 1909, Black recorded them as only very locally naturalized.

196. Some other bulbous plants that had escaped by then include *Gladiolus undulatus* L. (*G. cuspidatus* in err.) *Tate*, 1879 (AD!); *Gynandriris setifolia* (L.f.) Foster, *Tate*, 1881 (MEL!); *Watsonia bulbillifera* Matth. & Bolus (syn. *W. angusta* Ker). These are recorded by Bentham (1873) but no localities are given, and there were possibly others.

197. Many were introduced very early, see Bailey (1845) and Francis (1859).

An Assessment of the Pamphlet's Place in South Australian Botany

Early Records of Introduced Flora

Casual references to introduced plants are found in the contemporary lay press, journals, letters and other documents of early settlers and travellers. However, these references are sparse and scattered. They must be used with care because of uncertainties of common names and errors of identification.

The Australian botanical literature of the nineteenth century is not well endowed with material concerning introduced plants. The novelty of the indigenous flora excited the attention of the early botanists and comments about the introduced flora were usually appended as afterthoughts to the main work e.g. Behr (1847), Mueller (1852) and Francis (1855). Hooker (1860) briefly discussed the naturalized plants of Australia and he appended a list of such species. However his list refers almost entirely to the Melbourne area. Woolls (1867) published a study entitled "Plants introduced accidentally" which discussed many alien species but he concentrated almost entirely on plants found in New South Wales and particularly around Sydney.

The 'Flora Australiensis' (1863-1878) rec ded considerable information about introduced plants but the South Australian data almost entirely derives from the period of 1847-1852 when Behr, Blandowsky and Mueller collected. Occasional collections of introduced plants by Waterhouse from the early 1860's were also recorded in the 'Flora Australiensis'. Until Schomburgk wrote his pamphlet there had been no study of alien plants in South Australia, apart from the almost thirty-year old information scattered through the 'Flora Australiensis'. Undoubtedly the subject was waiting to be treated and the leading botanist of the State at the time would appear to have been the appropriate person to attempt it.

Schomburgk's earlier writings on weeds

Schomburgk was appointed to his position as Director of the Botanic Gardens in 1865 following the death of the first Superintendent, G.W. Francis. In the Annual Reports of his first years he contented himself with detailing the business of the gardens and the associated activities such as the library, herbarium and zoological collection. Even so, he still commented on plants grown in the gardens which could be useful for fodder, perfumes, medicinal uses and other purposes. In his Annual Report for 1873 he commented on the general disappearance of the native flora in South Australia and in connection with this matter he included a paragraph which subsequently became the standard opening paragraph to his writings on weeds (Schomburgk, 1874, 1875, 1879, 1889). In it he expressed alarm at the disappearance of the indigenous flora as a result of a number of processes including the plough, axe and herds but also including the arrival of foreign plants which "became possessors of the ground, ejecting the indigenous herbaceous plants, and taking their place". He then went on to list seven weeds which were particularly serious. They were:-

"Dandelion *Cryptostemma calendulacea* R.Br. Cockspur *Centaurea melitensis* Lin. French catchfly *Silene gallica* Lin. Stinkaster *Anthemis cotula* Lin. Bathurst bur *Xanthium spinosum* Lin. Scotch thistles *Carduus Marianus* Lin. & *Onopordon acanthium* Lin."

(These are actually the following species:- Capeweed *Arctotheca calendula* (L.) Levyns. Maltese cockspur *Centaurea melitensis* L. French catchfly *Silene gallica* L. Stinkwort *Dittrichia graveolens* (L.) W. Greuter. Bathurst burr *Xanthium spinosum* L. Variegated thistle *Silybum marianum* (L.) Gaertn. Spear thistle *Cirsium vulgare* (Savi) Ten.

In 1875 he published a booklet 'The Flora of South Australia' which was written to be included in Harcus (1876). In his essay, Schomburgk included a section on 'The Naturalized Plants of South Australia'. This piece commenced with the same opening paragraph referred to earlier, then went on to list the same seven species (in a different order) and added "the so-called sheepweed, *Lithospermum davuriaum* Lehm; and *arvense* Lin." (the first name is a misspelt synonym for *Mertensia dahurica* G. Don, a native of Eastern Europe not known from South Australia. *L. arvense* is a synonym for *Buglossoides arvensis* (L.) Johnston, sheepweed).

Schomburgk then continued by wondering whether the infestations would be permanent or that by "an overstimulation" the intruders will degenerate and become extinct. This paragraph was also carried intact into his later writings.

He then listed a number of "the more troublesome weeds naturalized in South Australia, in addition to those already mentioned". This list is reproduced *verbatim* in Column 1 of Table 1; in Column 2 the correct name is shown where this is different from Schomburgk's and in Column 3 some clarifying comments are given when needed. It is noteworthy that up to this point, no grasses are included as weeds although *A. fatua* and *Lolium* spp. were known to be serious pests and indeed Schomburgk himself (1879) says so.

The 1875 treatment concludes with a short paragraph stating that a good many introduced grasses have improved the pasture near the coast, which presumably means the settled areas in general. This sentence was also used intact in later versions, but was attached to other material which has been published elsewhere.

Table 1. Schomburgk's "more troublesome weeds" (1875)

Schomburgk's name	Current name	Comments
Lepidium ruderale Lin.	native *Lepidium* spp.	See Note 21*
Capsella bursa-pastoris Lin.		See Note 17
Atriplex patula Lin.		Collected from Gawler River in 1848 by Meuller (MEL.) Omitted from Schomburgk (1879)
Urtica urens Lin.		See Note 139
Polygonum aviculare Lin.		See Note 132
Cnicus lanceolatus	*Cirsium vulgare* (Savi) Ten.	See Note 84
arvensis Hoffm.		See Note 84
palastris Willd.	*Onopordon acaulon* L.(?)	See Note 84
Cynara scolymus Lin.	*C. cardunculus* L.	See Note 78
Anagallis arvensis Lin.		See Note 110
Gnaphalium luteo-album Lin.		Introduced from England before 1859 but generally considered to be native. Its status is very difficult to determine (Drury, 1970). Omitted from Schomburgk (1879).
Portulaca oleracea		See Note 39
Foeniculum vulgare		See Note 61
Sonchus asper		See Note 107
Solanum nigrum		See Note 117
Cirsium lanceolatum Scop.	*Cirsium vulgare* (Savi) Ten.	Both species have already appeared in the list above as *Cnicus* spp.
arvense Scop.	?	See Note 84.

* Notes - refer to footnotes in the first part of this paper.

Other relevant writings by Schomburgk

Schomburgk read a paper to the Chamber of Manufacturers in Adelaide on 15 December 1873 entitled "The grasses and fodder plants which may be beneficial to the squatter and agriculturalist in South Australia". This was subsequently published (Schomburgk, 1874a) as a pamphlet and republished in its entirety in other publications. Even in this paper, Schomburgk again inserted his paragraph about weeds referred to earlier and included the original seven "particularly serious" weeds.

He also included as pasture grasses and fodders most of the grasses subsequently listed as improving the native pasture (Schomburgk, 1879). Furthermore he listed the three species of *Plantago*, *Melilotus alba*, *M. officinalis* and *M. lupulina* as such desirable plants. *Plantago* spp. was treated in the first part of this paper (See Notes 127 *et seq.*). *Melilotus alba* was an early pasture species (Francis, 1859) and *M. officinalis* almost certainly refers to *M. indica*. Early specimens (e.g. at MEL!) were originally determined as *M. officinalis* in error. *M. lupulina* (sic) refers to *Medicago lupulina* which was a fodder plant in Britain and elsewhere (Loudon, 1855) and introduced early to South Australia (Anon. 1858). However this reference here could well have been to *M. polymorpha*, which was widespread by that time, rather than to *M. lupulina* which apparently has been always somewhat localised in South Australia.

By 1876 it appears that the skeleton of the 1879 pamphlet was more or less ready. From the list of 28 weedy species already mentioned, four were omitted in 1879 (see Table 1) and only another 16 added to bring the number to 40. Of the naturalised desirable plants, two legumes had been noted - this was increased to eight, the eight grasses were enlarged to 21 and the three other species (*Plantago* spp.) has already been covered. Hence, 35 more species of which 13 were grasses were added to those included in earlier writings.

Publication of the Pamphlet

There is no indication in records and documents examined, why Schomburgk published the pamphlet. He had already published a pamphlet on grasses and fodders (Schomburgk, 1874a) and a paper on the agricultural potential of various parts of the State (Schomburgk, 1875a). Both of these papers were reprints of addresses given on separate occasions before the Adelaide Chamber of Manufacturers during 1873. Both of these were held in high regard, perhaps because they dealt with possibilities rather than concrete matters. It would appear that Schomburgk's approach to his writing was highly theoretical and based little on field experience or observation. In fact in the paper in which he proposed a multitude of agricultural industries for various parts of the State, he stated *inter alia* that he had never been to Mount Gambier, the South and Encounter Bay although he had lived in South Australia for 21 years. (Schomburgk, 1875a). As at the time he was already 62 years of age it is most unlikely that he travelled widely afterwards.

His actual motives in publishing the article are not apparent. His Victorian counterpart, von Mueller, was publishing prolifically at this time, apart from being involved in the 'Flora Australiensis', and perhaps Schomburgk was emulating his illustrious colleague. It is pointed out that the material which became the basis of his paper, was originally prepared with a different intention, a most honourable one of promoting the conservation of native vegetation.

The period in which he prepared the paper is not certain but he was also preparing a paper on his South American studies (Schomburgk, 1879a) at the same time. Both pamphlets were published about the same date. Molineux (1879) reviewed them together as did the reviewers in the daily press.

In the return of the Government Printer for the year ending June 1880, 935 "folded and stitched" articles were printed for the Botanic Gardens. It is presumed that these articles are copies of Schomburgk's two pamphlets. The publication date was probably Thursday 16 October 1879. The reviews in the daily press were published on Monday 20 October 1879 and a copy of the pamphlet in the Adelaide Botanic Gardens Library has an inscription by Schomburgk which is dated 16 October 1879.

Reaction to the Pamphlet

The appearance of Schomburgk's pamphlet aroused passing interest in the lay, agricultural and scientific press. The Register reviewed the publication in its issue of Monday 20 October 1879. The reviewer, in completely uncritical acceptance, noted that it was all arranged and classed with Dr. Schomburgk's carefulness and accuracy. The contents were briefly summarised. This review was re-published in the 'Adelaide Observer' of 1 November 1879.

The 'South Australian Advertiser' received it with more honour, making the pamphlet the subject on an editorial in its issue of Monday 20 October 1879. The editoralist summarised the paper noting the rapidity of the spread of some weeds and ended by exhorting his readers that, had the first plants that appeared been exterminated then the weeds could not have spread. This review was reprinted as an item in the Farm & Garden section of the 'South Australian Chronicle and Weekly Mail' of 25 October 1879. It is noteworthy that whereas Schomburgk had artificially separated wild oats as a crop weed and a fodder plant, the editoralist did not do so but noted the difference was not in the plant but in the situation in which it grew.

However A. Molineux, the editor of 'The Garden and Field' when reviewing the pamphlet in the issue of November 1879 found faults on a number of points. The "Scotch thistle" and the "Cape marigold" (i.e. Capeweed) were introduced about 1841, much earlier than Schomburgk had given. The common iceplant (*Gasoul crystallinum* (L.) Rothm.) had been omitted. Molineux obviously considered the work incomplete for he concluded "Doubtless a second edition will be published in a short time, when the worthy Doctor's useful labours will be aided by colonists acqainted with other introduced "settlers" in our field. Every useful work must have a beginning, and we consider ourselves indebted to Dr. Schomburgk for the very good work he has commenced in this instance" (Molineux, 1879).

Professor Ralph Tate, the President of the Royal Society of South Australia, referred to the pamphlet at the meeting held on November 1, 1879. He "considered the list to be incomplete, as many aggressive weeds had been overlooked. Of these he mentioned particularly a species of *Diplotaxis*, a *Salvia*, *Chenopodium murale*, *Trifolium agrarium*, etc." On the other hand, "undue prominence was given to such species as *Bellis perennis*, *Eschscholtzia californica* etc." He thought that such a work could not be accomplished single-handedly and he trusted that the Society would assist by encouraging observers to furnish records (Tate, 1879).

It is quite clear that to competent and experienced readers there were serious errors and omissions in the work. It may be significant that in his Annual Report for 1879 (Schomburgk, 1880), Schomburgk did not mention the publication of the pamphlet though in previous years, other publications were recorded.

The pamphlet is not referred to again in the botanical or agricultural literature until it appears in an expanded version as Appendix C. of the Annual Report for 1888 (Schomburgk, 1889). The title was changed slightly to "The Naturalised Noxious Weeds and Other Plants in South Australia". The introductory material is identical to the previous edition except for a short paragraph placed at the very beginning. This paragraph is of interest for a number of reasons and is reprinted here.

"In 1879 I published a pamphlet on 'The naturalised noxious weeds and other plants which have been introduced into South Australia'. The list contained about eighty species. Since this period a good many more have found their way into the colony: some of them are very troublesome to agriculturalists and squatters, and some at the same time are useful, improving our pasturage lands. In my pamphlet I had omitted several plants which had already been introduced by the early colonists. I now republish the paper with the additions, the number having been increased from 82 to 126 species but there may still be some species overlooked."

The quoted title is incorrect - Schomburgk was probably writing from memory and it could be for this same reason that many of his botanical names and authority citations in all his writings are incorrect. He also showed a stubborness that in the 1889 publication the only species that he included, of those stated to be omitted by Molineux and Tate in 1879, was *Chenopodium murale* L.

Later Developments

Schomburgk's 1889 revision has already been mentioned. The Annual Report for 1888 to which this revision was attached as an Appendix was the last that Schomburgk prepared. He died in April 1891.

Schomburgk's pamphlet was entirely ignored. Tate who was a prolific author on botanical (and other) matters, apart from commenting upon it soon after publication (Tate, 1879) never refers to it again and even more surprisingly Black (1909) did not mention it either. Maiden (1920), quotes from it, in connection with capeweed but wrongly attributes the passage to the 1875 Annual Report.

More recently the paper was cited by Dr P.W. Michael who referred to it when detailing the history of *Oxalis pes-caprae* L. in Australia (Michael, 1964) and again in a more general way when summarising the history of weeds in Australia (Michael, 1972).

Retrospect

Two questions present themselves. Was Schomburgk's assessment of the weeds of South Australia at that time, reasonable? Why was the paper virtually ignored? The answers to both questions illuminate each other.

It is clear from the criticisms of Molineux and Tate that there were significant errors in and omissions from the work. The work is based heavily on 'Flora Australiensis' and therefore was unavoidably out of date, and no better example can be produced than of the treatment of the Leguminosae. Schomburgk's list does not include one species more or less, or by any other name than those recorded in the second volume of the 'Flora Australiensis' (Bentham, 1864). Similarly the Caryophyllaceae are the same as those listed by Bentham (1863). In families with numerous species, Cruciferae, Compositae and Gramineae, Schomburgk appears to have confused species e.g. *Barbarea vulgaris* for *Sisymbrium* sp., *Chrysanthemum segetum* for *Calendula* spp. and *Aira praecox* for *A. caryophyllea*.

One error carried through from earlier writings, was the inclusion of "Common Stinking Maruta - *Maruta Cotula* Dec. (*Anthemis cotula* Linn.)" This was included because, in earlier writings, Schomburgk (1874, 1874a, 1875) wrongly attributed the botanical name *Maruta cotula* to stinkwort (*Dittrichia graveolens*). *Anthemis cotula* was not recorded in S.A. until later.

Another error was the inclusion of the same species more than once under different names. The following species are involved:-

Cirsium vulgare	as *Onopordon acanthium*, *Cirsium lanceolatum*
Dittrichia graveolens	as *Inula suaveolens*, *Maruta cotula*
Avena fatua	as *A. fatua*, *A. sativa* var. *melanosperma*
Bromus hordeaceus	as *B. mollis*, *B. commutatus*
Malva parviflora	as *M. parviflora*, *M. rotundifolia*, *M. crispa*

With hindsight, of his 75 distinct species, four are considered native (*Lepidium* spp., in error for *L. hyssopifolium*, *Gypsophylla tubulosa* in error for *G. australis* and *Urtica dioica* for *U. incisa*). Of the remainder, 12 are considered insignificant or not even present today and from the specimens available and other evidence have been uncommon or never occurred in South Australia. These are:-

Capsella procumbens (syn. for *Hymenolobus procumbens*)

Vicia hirsuta	*Plantago major*
Cirsium palustre	*Alopecurus geniculatus*
Cirsium arvense	*Delphinium consolida*
Chrysanthemum segetum	*Eschscholzia californica*
Anthemis cotula	*Bellis perennis*
Hyoscyamus niger	

It is clear from the reviews of Tate and Molineux that conspicuous species were omitted. Nearly thirty years earlier Mueller (1852) had estimated that almost 100 species had become naturalised in South Australia "beyond the possibility of extirpation". Thirty years after Schomburgk's pamphlet, Black (1909) included 368 plants as naturalised in South Australia and propagating themselves spontaneously.

Following the departure of Mueller for Melbourne in 1852, botanical activity virtually ceased in South Australia. Any collections that were made have since been dispersed or lost. There are almost no extant specimens from the period 1852-1875 collected from South Australia generally and the agricultural areas in particular. However from about 1877 onward the Tate and Tepper collections were started and from them, it is possible to piece together a more accurate picture of the naturalised flora at the time. Tepper (1879) included a list of naturalised plants in his study of the Ardrossan flora. His list consists of 35 species, although a number of introduced species were included as natives e.g. *Alyssum linifolium* Steph. ex Willd., *Nicotiana glauca* R.Grah. (as *N. suaveolens* Lehm.). Of his list, 27 were included by Schomburgk. The remaining eight were: *Senebiera didyma* (L.) Pers., *Cucumis myriocarpa* Naud., *Erigeron linifolius* Willd., *Gnaphalium luteo-album* L., *Hypochoeris glabra* L., *Picris hieracioides* L., *Orobanche cernua* Loefl. and *Chenopodium murale* L. Of these *O. cernua* is probably a misidentification of the native *O. australiana* F.Muell. ex Tate and the status of *G. luteo-album* is equivocal.

Tate (1883a) recorded *Lagurus ovatus* L., *Marrubium vulgare* L., *Celsia cretica* Murr., *Sagina apetala* Ard. and *Mesembryanthemum* spp. as being naturalised on Kangaroo Island at that time.

Other additions may be made by thorough examination of the Mueller collections at MEL and Tate collections at AD. A few examples that were yielded by this search were:-

Papaver hybridum L. - in cornfield Lower North Road, Adelaide, x,1879 Tate, AD 97618618!
Physalis peruviana L. - two specimens 1849 MEL!, also noted as growing freely and fruiting at Second Valley in 1850 (Yelland, 1970).
Atriplex patula L. - "fluvii Gawleri", Mueller 1848 (MEL!). Erroneously recorded by Bentham (1870) as Gawler Ranges.

On the other side, Schomburgk did give definite opinions as to the status of some plants upon which earlier writers, particularly Bentham had equivocated. For example, *Capsella procumbens*, *Portulaca oleracea*, *Cryptostemma calendulaceum* and *Solanum nigrum* hitherto considered to be definitely native species were listed as introduced. Should it be argued that Tate (1880, 1890) and other writers intended native species of *Spergularia* and *Portulaca* respectively when including these species in later censuses of native plants, there are ample herbarium specimens to support the inclusion of *S. rubra* as a well-established introduction. Similarly, Schomburgk's note that *Portulaca oleracea* is a troublesome weed in gardens is sufficient to indicate that he is referring to our introduced species rather than the indigenous plant that bears the same name but is hardly known from the settled areas, let alone from gardens.

From this discussion it is clear that Schomburgk's contemporaries and successors judged this paper and correctly found it wanting. It was incomplete, contained many errors of identification, errors of fact and raised a number of plants to undeserved attention whilst underemphasising other plants known to have been important at the time. From our vantage point a century later, it gives us perhaps, a deeper insight into Schomburgk than into his "naturalized weeds".

When Black (1909) published his work on introduced plants, his motive was to complement Tate's (1890) coverage of the native flora. Black's work is a genuine milestone in South Australian botany. Apart from the intrinsic merit of the book itself, which was based on sound observation in the field, it was the forerunner of his Flora of South Australia which was the first State flora to be produced that was not based on the 'Flora Australiensis'. Black's work is still relevant, and his data and figures are being carried forward to a third edition of the "Flora", seventy years and more after they first appeared.

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Index to Scientific Names

Synonyms, misapplied, misspelt or illegitimate names are in italics.

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THE IDENTIFICATION OF THE TYPE LOCALITY AND COLLECTOR OF *ACACIA PEUCE* F. MUELL.

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Abstract

The first possible records of *Acacia peuce* are investigated. It is concluded that while Burke and Wills (1861) saw this species at its northernmost locality, the type collection was collected by Howitt and Murray (1862) at a more southerly site near the present town of Birdsville.

Introduction

In his type description of *Acacia peuce*, Mueller (1863) stated that the specimen on which it was based had been collected by Murray and Howitt from the vicinity of, "Wills' Creek, lat. 25° 30'" (see Fig. 1). There has been some doubt as to where this locality is and even who made the type collection.

Willis (1962) referred to Howitt's journals and showed that during July 1862, Howitt and Murray were in a region near Birdsville where the species is known to occur. Although the name of Wills' Creek does not occur on recent maps of this area, Willis was satisfied that it was the site of the type population.

However, a few years later Cleland (1968) raised doubts about the source of Mueller's specimens in the belief that Howitt did not proceed further north than Cooper Creek. He believed that Wills discovered the species on the expedition with Burke in 1861 (near their Camp 88 close to the Tropic of Capricorn), collected the specimen and that, despite Wills' death on the trip, it was this specimen which eventually reached Mueller.

Consequently, there is some doubt as to the identity of the collector of the type. There is also doubt as to the location of the Wills' Creek to which Mueller referred. The name Wills' Creek is shown on maps some 50 km north of Boulia but, although on the route followed by Burke and Wills, it is far north of any point reached by Howitt and *Acacia peuce* has not been found in the area. It clearly cannot be the Wills' Creek to which Mueller referred.

Acacia peuce is one of the tallest and most conspicuous of the Eremaean *Acacia* species (Fig. 2), and is known from only three small and highly isolated localities (Fig. 3). One site is in the Northern Territory, located about 60 km north of Andado at 25° 05′ S, 135° 20′ E; a second, in Queensland, is in the vicinity of Mt Lewis (at 25° 50′ S, 139° 22′ E) near Birdsville; and the third, also in Queensland, is about 370 km north of Birdsville on the Bedourie to Boulia road near Montagu Downs, at 23° 02′ S, 139° 18′ E. It is unlikely, in view of the conspicuous appearance of the tree, that any further localities have been overlooked. It should, therefore, be possible to determine with some certainty the populations from which Howitt and Murray or Wills could have collected the type.

The Burke and Wills Expedition

As was pointed out by Cleland (1968), from the entry in Wills' journal dated the 8th January 1861, it is evident that Wills saw what today we call *Acacia peuce* at the locality known to them as Camp 88. This locality is close to the Tropic of Capricorn near the present town of Boulia and one of the three known localities of this species.

Wills did not say whether he collected the plant or not, and no collection of plants made by the advance party has ever been recorded. Cleland (1968) attempted to show that

Fig. 1. *Acacia peuce*. Believed to be the type specimen, annotated by G. Bentham: "The appearance of a forest oak. The bark like that of a *Casuarina*. The trees are from 15 to 30 feet high. The stems are a foot to eighteen inches in diameter," (MEL 30632; photo

Fig. 2. *Acacia peuce* near Birdsville.

Wills did collect the type material and at least got it back to Cooper Creek (via the Gulf of Carpentaria!). Were Cleland correct, this would be the only Wills collection known. Why this tree should have been singled out for collection by the exhausted men on their slow return to Cooper Creek in searing heat and having to shed articles to lighten loads, is hard to understand. On the return to Cooper Creek, Wills (in his journal; cf. Wilson & Mackinnon, 1861) stated on March 25th that the country they had formerly traversed near Camp 88 (close to where *Acacia peuce* had been observed) was to the west of their present position, and it is thus unlikely that a collection of the trees was made on the return trip. Before their eventual return to Cooper Creek, Gray died and most of the animals had been slaughtered for food. Howitt rescued the sole survivor, King, and recovered the bodies of Burke and Wills. In his diary he recorded details of what he found, but these did not include mention of any plant specimens (Willis, pers. comm.). These circumstances perhaps support doubts as to whether plant specimens were retained, even if previously collected.

The geographical details of Wills' journal were lithographed in a map by A.J. Stopps, of the Lands and Survey Department, Melbourne, dated 1862. A Wills' Creek is shown on Stopps' map in the vicinity of 26° latitude. Just to the south of Wills' Camp 88 position, a creek was named Wills' Creek by Burke but, as pointed out by Willis (pers. comm.) the use of this name was inconsistently used even by Burke and Wills, therefore the use of this name is not necessarily significant.

The only known locality of *A. peuce* passed by Burke and Wills was the one near Camp 88, the most northerly record known for this species. They did not pass through either of the other localities and there is no evidence that they collected any specimens.

Howitt's expedition

On his first trip in search of Burke and Wills, Howitt travelled no further north than Cooper Creek. However, what Cleland (1968) overlooked is that Howitt, this time accompanied by Murray, made a second trip to the region (Stopps, 1862). After establishing a base camp at Cooper Creek, Howitt made several excursions to adjacent areas particularly to the Diamantina and beyond to a north-western position (Fig. 3) of about latitude 25° 30′S. It seems most probable that it was on this journey that Murray and Howitt collected the type specimens from the Birdsville population.

In July 1862, Howitt had not only returned to the Cooper Creek area to exhume the bodies of Burke and Wills, but was well advanced in carrying out a number of wide-ranging surveys of the area. During July, Howitt was in the vicinity of where Birdsville now stands, and in a segment of his journal dated the 23rd July 1862, and just having left his Camp 74 (on "Wills Creek"), Howitt says,

> "This morning I rode across to some sandstone hills visible N 25 W from near the camp and named them after Mr. W.H. Sampson of the Contingent Exploring Party. Found them to be about four miles off and very stony. From the top could see across stony plains for some miles, to another elevation - but whether stone or sand it was impossible to say owing to the haze. In this range I saw a new tree, which resembling a she-oak in appearance - but growing higher and looking disproportional at a distance, like trees seen through mirage. It bears a flat pod containing several hard black seeds."

Although the description of the tree is brief, there can be no doubt that in this region it was *Acacia peuce* to which Howitt referred.

Further to this, William Howitt (father of A.W. Howitt the explorer) wrote a book (1865) that gives an account of his son's activities in the region of where Birdsville now stands. He says,

"From camp 74, latitude 25° 52′, longitude 139° 19′, Mr. Howitt rode northward to

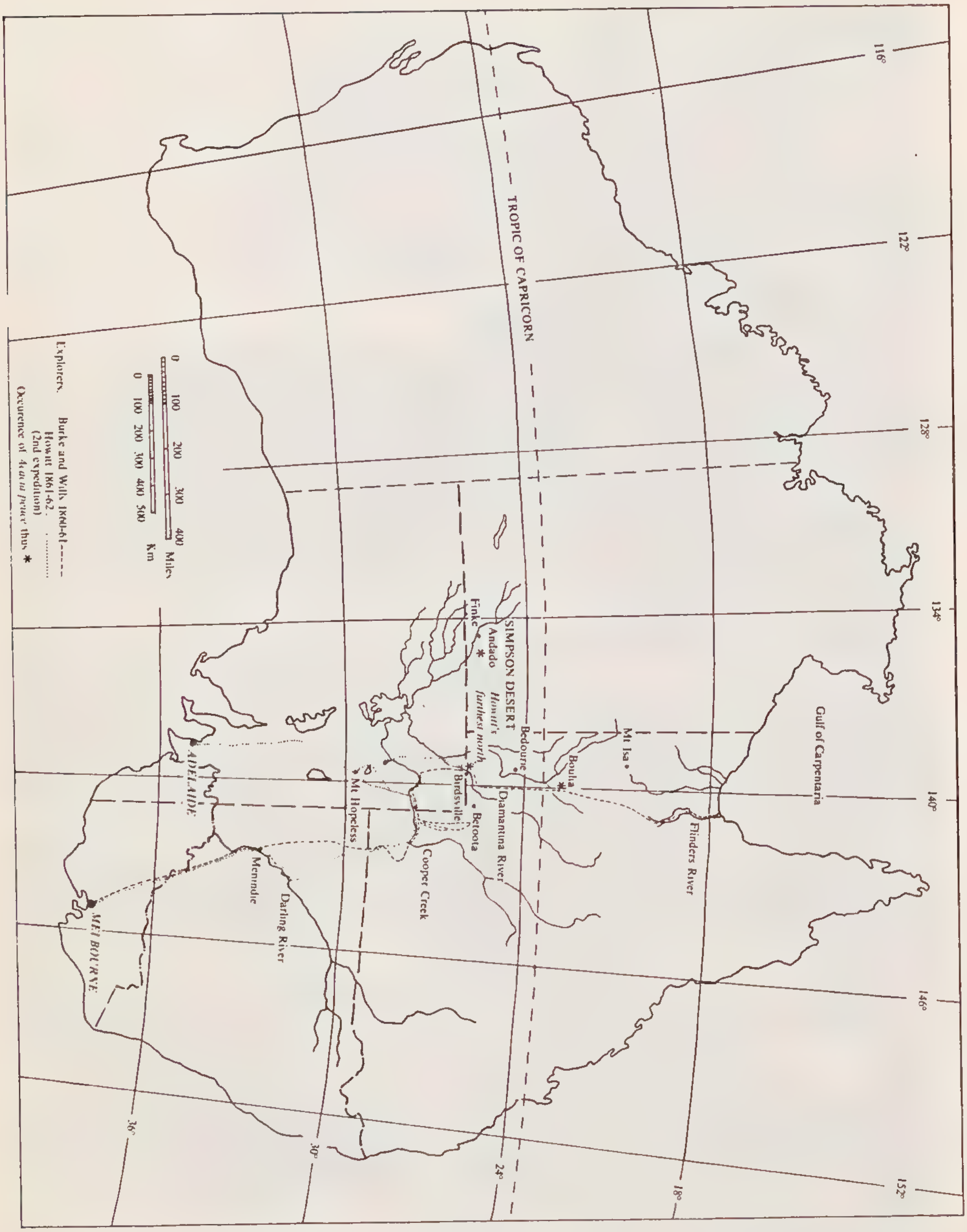

Fig. 3. Map of Australia showing routes of Burke and Wills and of Howitt and occurrences of *Acacia peuce*.

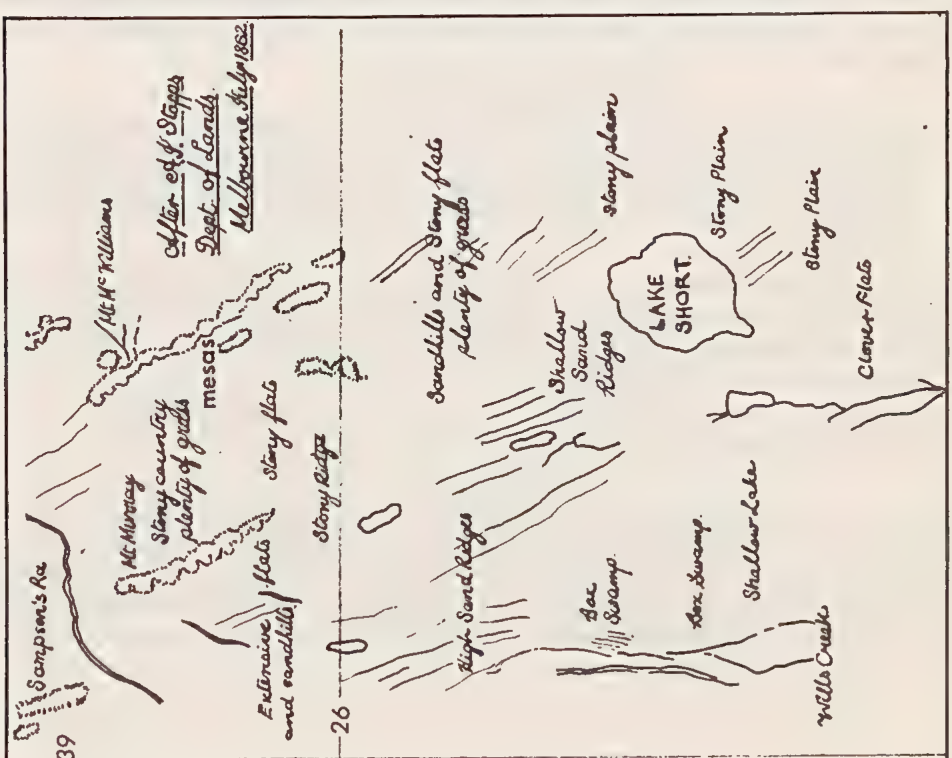

Fig. 4A. Portion of Stopp's map (redrawn) to show Wills' Creek and the area (north of 26° lat.) where Murray is believed to have collected *Acacia peuce*.

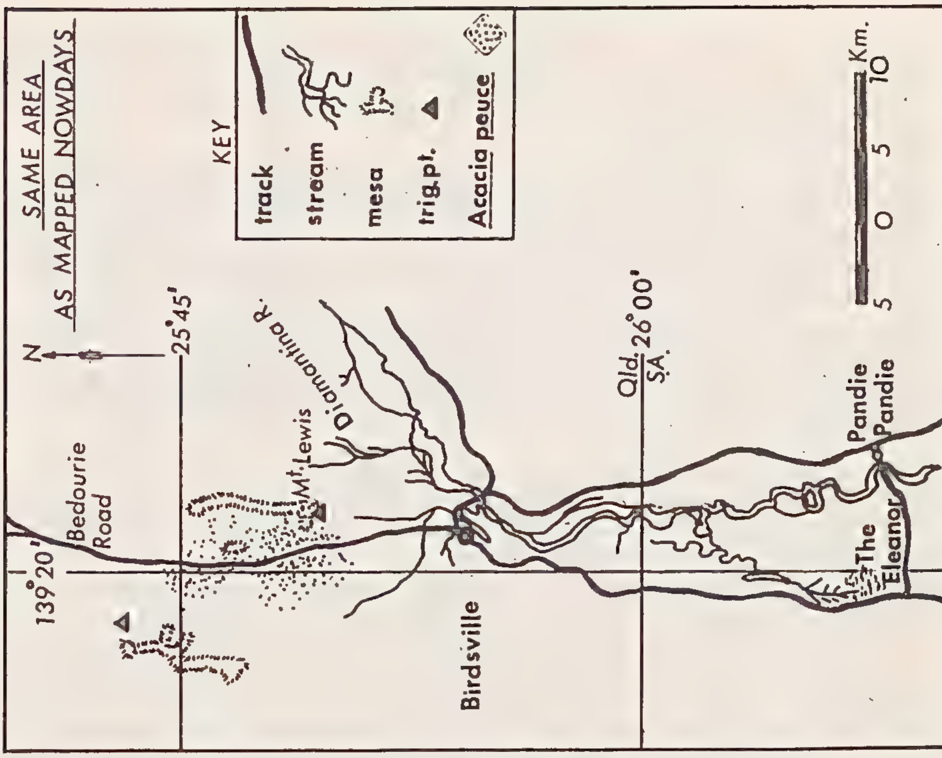

Fig. 4B. Modern map of the same area as shown in Fig. 4A for comparison.

some sandstone hills, which he named Sampson's Range, after Mr. Sampson of the contingent exploring party, and then forward again some miles, where he saw still before him stony plains, with plenty of grass, and beyond them, and from east to west a second stony desert. Returning to the camp, they now set off south again, as their provisions were nearly exhausted."

Not only does this passage mention Howitt's Camp 74 and Sampson's Range (see portion Stopps' map, fig 4A) but most importantly the latitude and longitude of that camp. As Howitt rode several miles to the north, he would have easily reduced the latitude to about 25° 50′ and hence come upon *Acacia peuce*. This appears to be in accord with both his description of the trees and the position of Sampson's Range.

Howitt's positioning of latitude and longitude appear to be accurate, so did the 25° 30′ shown on the type represent their northern most position before returning south to the camp? All available indications are that this was the case and was considered close enough to the actual locality for the occurrence of *Acacia peuce* to be listed as such.

Specimens collected on this trip, including one of this *Acacia* collected by Murray, (Mueller 1862/63), became part of a collection subsequently sent to Mueller. A report on the botanical collection of Murray, which was presented to both Houses of the Victorian Parliament in the 1862-63 session, included *A. peuce*.

Stopp's map, which included data from the Howitt and Murray expedition as well as from Wills' diary, marked a Wills' Creek at about latitude 26° 10′ S (Fig. 4A). Just to the east and north of Wills' Creek are indicated shallow lakes and "swamp box" (*Eucalyptus microtheca*, coolibah). The only stream large enough to support noteworthy clusters of the species of tree in this area is the Diamantina River. As the expedition moved northward from Wills' Creek towards the only area where they could have collected *A. peuce*, they probably passed over the land occupied today by Birdsville. A comparison of Stopp's map with modern maps suggests that Wills' Creek was a segment of the Diamantina. (Fig. 4B).

Summary and Conclusions

There is good reason to believe that Burke and Wills saw *A. peuce* near Boulia in 1861 but, even if they did make a collection, as suggested by Cleland (1968), no specimen is known to have survived. Cleland failed to perceive that Howitt was sent on a second relief expedition in 1862, and his comments regarding the collection of *Acacia peuce* by Wills are questionable.

In the following year Murray and Howitt collected the first specimen still in existence near Birdsville. There is no doubt that this comprises the type specimen cited by Mueller. The Wills' Creek mentioned by Mueller was probably a channel of the Diamantina close to the present town of Birdsville.

The exact locality of the type population is $9^1/_2$ km (6 miles) north of Birdsville on the Bedourie road and extending about 16 km (10 miles) along the track.

Acknowledgements

I am grateful to all those who, by discussion and criticism, have shown an interest in this paper, but more especially, David Whibley, State Herbarium of South Australia, Adelaide, Bruce Maslin, Western Australian Herbarium, Perth, and in particular Jim Willis, formerly of the Royal Botanic Gardens, Melbourne, who has searched Howitt's diary in the La Trobe Library and thus enabled me to piece together the final details of this story.

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J. Adelaide Bot. Gard. 2(2): 229-234 (1980)

BOOK REVIEWS

Plant science for everyone: Kosciusko's new alpine 'Flora'

Costin, A.B., Gray, M., Totterdell, C.J. & Wimbush, D.J.
'Kosciusko Alpine Flora', 1979, C.S.I.R.O. & Collins.

'Kosciusko Alpine Flora' is a book of which the authors can feel justly proud. The depth and breadth of coverage of the current knowledge of taxonomy, biology and ecology of their subject has been surpassed in Australia only in the small and better known animal groups, such as the birds and mammals. Of the Australian Floras of current times the 'Flora of the ACT' (ca. 1300 spp. in ca. 2,000 square km) and 'The Flora of the Sydney Region' (ca. 2,500 spp. in ca. 20,000 square km) are the smallest, and in their 450 and 725 pages, respectively, it has been impossible to include other than the briefest descriptions and additional data for each species and minimum of other information. Kosciusko's alpine region, about 100 square km in area, is tiny in comparison, but bears a rich flora of about 230 well-defined taxa (including at least 27 naturalized aliens and 21 endemics). In a volume of the size of this work there is much room for additional fare of wider appeal, and the authors have provided this admirably.

The book is divided into three main sections. In an introductory chapter Dr Costin details the physical and climatic character of the region and its evolution, and the history of human influence on the vegetation, starting with the earliest evidence of aboriginal occupation only 4,000 years ago, and ending with the resurrection of the flora by the cessation of more than 50 years of grazing sheep and cattle and the new dangers of increased tourist activity. Among the early European visitors to the region are the botanical collectors, among whom Ferdinand von Mueller deservedly rates a lengthy mention. As is typical of the whole text, Dr Costin avoids the superficial dogmatic approach to his subject which detracts from some popular works. Thus in the discussion of the geomorphological development of the region he introduces the reader to the way in which various bits of evidence have been pieced together to provide our picture of the past and present-day of the region. The text is supported by ample illustrations, maps and diagrams, but the plates in this chapter are unfortunately un-numbered and not referred to in the text.

The second chapter, "The plants and plant communities", written by Dr Costin and Mr Wimbush, initially deals with adaptations of the plants to habitation of their general alpine and local environment (growth form, life form and habit, physiological attributes). The systematic affinities with other regions of the world and the means by which the strong southern and cosmopolitan links were attained are touched on. The main plant communities are then described, using text, tabulation with predominant species and local physical distribution, and photographs and diagrams. Examples of the dynamic nature of the vegetation are given.

The final and largest chapter is the taxonomic treatment of the alpine flora by Mr Gray, which takes up 151 pages of text and 289 separate colour plates, one for almost all species described. The text is written for the professional, although the uninitiated are invited to learn to use the keys and descriptions rather than simply resort to the alternative of matching with the plates. Some technical words used in the text are not included in the glossary, e.g. placenta (p. 209), papillate (p. 209, 225: papillose appears in the glossary), pyrene (p. 225), but most used seem to have been included. There is no explanation of the bracketed rare extreme range of variation in quantitative characters. The explanatory notes relating to the Flora were found with some difficulty by the reviewer under the heading "Identification and description" within the previous chapter. It would seem much more appropriate to place this section at the start of the Flora treatment where the explanation of the use of keys is located.

Other annoying features are the removal of basionyms and relevant synonyms to the index. With so much blank space and large type within the Flora treatment, there would have been no increase in the number of pages in accommodating them there. The method of referring to colour plate numbers is difficult to understand, when the usual abbreviation "pl." would have taken little more room overall and saved several readers considerable time working out what was meant - it was particularly frustrating for one person initially happening upon them on pp. 74 and 83 where they appear inexplicably in captions to the unnumbered black and white plates. Generic treatments are absent, which is perhaps justifiable in so small a flora, but data on distribution might have been of interest to the general reader.

All these criticisms, however, are minor. The lay-out of the Flora treatment is very clear. The marginal headings in the descriptions for distribution, notes and habitat are an innovation worth noting for future Floras, although it does take up space.

Descriptions are admirably detailed, including chromosome numbers and characters such as flower and fruit colour arising from the author's extensive field knowledge. Many references are given to scientific literature on the groups. In addition to the usual notes on distribution and local ecology, there are a wealth of notes outlining or providing reference to available knowledge on breeding systems, growth characteristics, physiology, hybridism, affinities, affect of cessation of grazing pressure, etc. Clear dichotomous keys are given to taxa at all levels, often with several characters in each lead (commonly including vegetative ones).

Most importantly Mr Gray has made the reader aware of the deficiences in our knowledge. A wide array of problems, cited in about 10% of the taxa, exist in this small flora. These are described by notes, non-treatment at species level of two genera (*Cardamine*, *Celmisia*), and a usual preference for avoiding misapplication of names to undescribed species, which are nevertheless treated separately with full descriptions and notes. This approach is vital in Flora writing, for Floras can so easily give the impression that everything taxonomic is known.

The book abounds with illustrations, mainly colour plates, but also black and white plates, maps and diagrams. The photographs, almost entirely by Mr Totterdell, form a beautiful collection. A certain flatness in reproduction of the colour plates is evident. Only a few plates show significant lack of colour-registration. It is annoying that where up to 7 plates occur across a two-page spread, they are often not consistently arranged in the order of numbering.

This is a book which will have a wide appeal. For the inquiring mind, it will be pleasurable to read from cover to cover and provide a wealth of up-to-date information supplemented by many references to additional literature. The notes under the Flora treatment made this chapter a delight to read. For those who enjoy a well-illustrated book it provides a splendid, varied and well-annotated pictorial fare. To be sure these four Kosciusko alpine enthusiasts have realized their aim "to combine scientific merit and popular appeal". As one who shares their love of Australia's alpine regions, I believe they will help to win over many converts to the conservation of these delicately balanced areas.

Costin, A.B., Gray, M., Totterdell, C.J. & Wimbush, D.J. 1979 (November 5*). 'Kosciusko Alpine Flora', pp. 408, 351 numbered colour plates, 6 numbered figures, 5 tables and many additional un-numbered colour and black/white plates, figures and maps. (Simultaneously published by Commonwealth Scientific and Industrial Research Organization, East Melbourne, and William Collins, Sydney.) Hard-bound $25.00; paper-bound, referred to inside front of dust-jacket but not produced in first printing*.

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*From letter from B.J. Walby, Editor-in-Chief, CSIRO Editorial and Publications Service, 29 November, 1979.

The lichens of South Australia

Filson, R.B. & Rogers, R.W. 'Lichens of South Australia' 1979
Government Printer, South Australia.

As a result of the growing interest in lichens in South Australia during the past decade, it has become obvious that there has been a lack of information on this group and very often difficulty in finding what relevant information has been published. This book not only brings together a great deal of what is already known about South Australian lichens, presenting it in a form in which it is accessible to a wide public, but also includes much hitherto unpublished information.

The chapter "Structure of lichens" is well presented and written in such a form that it should be easily understood by anyone wanting to develop a knowledge of lichenology. The text is supported by very good line-drawings and detailed photographs (pp. 12 and 14).

Further chapters deal with such chemical tests as are essential for the indentification of some lichens, with lichen ecology, with the collection and curation of lichens and finally with the classification.

The principal part of the text deals not only with nearly two hundred species known to occur in South Australia but also with many other genera and species thought likely to be found there in the future.

Three keys are given, one to families and two to genera. The second key to genera is the most practical, and has useful divisions into sections, according to the thallus type. Descriptions are arranged by genus in alphabetical order. Keys are provided to the species. The text of the descriptions of the species is condensed but easy to follow, including the appropriate chemical reactions in addition to the necessary morphological characters.

Distribution is provided only in the form of lists of specimens examined. The small number of such specimens cited is partly an indication of the very limited field work done in this State on lichens. Some localities were, however, overlooked through the authors not making full use of the collections in the State Herbarium of South Australia. It is to be regretted that the localities are not grouped into geographical regions to assist the user in visualising the known range or that distribution maps were not provided. A map "showing principal localities mentioned in the text" does little to assist the reader unfamiliar with South Australian place names.

Black and white photographs are of a very good quality and detailed; however, the colour plates are unfortunately not of the same quality. The glossary is compiled in such a manner that it may be comprehended without difficulty.

As the first handbook on lichens to be published in Australia, this book should have a wide use throughout the southern parts of the country and the authors are to be congratulated on this excellent and important work.

Filson, R.B. & Rogers, R.W. 1979 (November 1). 'Lichens of South Australia', pp. 197, 16 pp. colour plates, 12 pp. monochrome photographs, 10 plates of line-drawings, 7 maps. (Published by Handbooks Committee, printed by Government Printer, South Australia.) Paperbound $10.50.

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Colonial landscape architecture

Tanner, H. & Stringer, R. 'Converting the Wilderness: The Art of Gardening in Colonial Australia', 1979, Australian Gallery Directors Council.

There has been, in the past 20 years, a quickening of interest in historic gardens, their design, their plant content and their conservation in Europe, North America and Australia. The Garden History Society, formed in 1965, is one of the driving forces in Europe together with the practical experience accumulated, and enthusiasm demonstrated by the British National Trust. In Australia the publication of Howard Tanner and Jane Begg's 'The Great Gardens of Australia' (1976) complemented Beatrice Bligh's 'Cherish The Earth; The Story of Gardening in Australia' (1973) and both may be taken as an overdue token of increasing national awareness of historic and heritage gardens.

The National Heritage Commission of Australia has, in the past two years, provided funds to State National Trusts in order that surveys of historic gardens may be carried out, the data being included in the National Estate inventory. In 1979 at a meeting convened by the Heritage Commission, held in Launceston, Tasmania, representatives of these survey teams agreed to investigate the foundation of an Australian Garden History Society.

The Australian Gallery Directors Council have showed vision in deciding to mount a travelling exhibition on colonial gardens and is to be applauded. The well produced catalogue to this exhibition comprises, in its own right, a useful text on colonial Australian gardens. The Guest Curator of the exhibition and author of the *Catalogue*, is Howard Tanner who is referred to above, and is an architect based in Sydney. The photographic illustrations are largely those of Richard Stringer, who is Guest Photographer to the exhibition.

After a preface by the Chairman of the Heritage Council of New South Wales, R.M. Hope, and a short introduction by Brett Rogers, Exhibitions Co-ordinator of the Australian Gallery Directors Council, the text of the *Catalogue* is arranged under the headings, "The first gardens", "Gardens for propagation and scientific purposes", "Arcadian landscapes", "The picturesque landscape", "Gardens of the Victorian Era", and "Private nurseries and horticultural handbooks". These headings, together with the titles listed in "References" and "Selected bibliography", bear witness to the main weakness of the *Catalogue*, which is an undue emphasis on landscape architecture at the expense of plants. There is only a sporadic and passing mention of commoner garden plants, including "*Victoria regia*", p. 19, which has long been more correctly *Victoria amazonica*, and but passing mention of the reciprocal sea trade between Australia and Europe which on the one hand did much to determine (even today) the range of exotics grown here, and on the other stimulated European-based research into the cultural requirements and botany of Australian native plants to the extent that George Bentham was able to write the only "Flora" of Australia, still to be superceded; yet he never visited the country! Colonial gardens were basically gardens in which exotic plants were grown and species and cultivar lists, however brief, would have been helpful in this *Catalogue*.

Tanner's writing will have lasting significance for Australian garden history as a subject, and it is to be hoped that his projected full history of gardening in Australia will contain more adequate and informed treatment of plants *per se*, and also be more comprehensive in its geographical coverage. The present *Catalogue* reflects Tanner's researches in being better documented in New South Wales, Victoria, and perhaps Tasmania, than other states. While it is probably true that these eastern states hold the most significant part of Australia's garden heritage, the erroneous information on, for example, Adelaide Botanic Garden was avoidable.

As an example of the 'gardenesque' style, Adelaide Botanic Garden in Schomburgk's era was remarkable and contrary to the *Catalogue* statement, p. 19, perfectly good photographic prints in the Archives of that institution show what the Garden looked like in the 1870's. On the same page, James Shaw's painting dated 1865, for all its historical interest, hardly shows the extent of "Schomburgk's endeavour" as Schomburgk was only appointed in that year!

Similarly no mention is made of the not unattractive glasshouses at Adelaide prior to the erection of the still extant Tropical House, the date of opening of which is in error, 1877 not 1874. The Adelaide Victoria House was opened in 1868 not 1860, and the Museum of Economic Botany with its memorable stencilled ceiling in 1881 not 1880. The year of establishment of the Adelaide Botanic Garden was 1855, as stated on p. 19, not 1862 as stated on p. 24.

On p. 29 *Melia azedarach* var. *australasica*, not "*australiasia*" as stated, was not the only deciduous tree in Australia even excluding monsoonal species: a few others include *Nothofagus gunnii* from Tasmania. On the same page *Macleaya* is not a variety of *Bocconia*: both are accepted as different genera in the Papaveraceae, although *B. cordata* is a nomenclatural synonym for *M. cordata*.

William Robinson, p. 62, was not born in England, but in Ireland where his first job was as garden-boy to the Vicar of Stradbally, Sir Hunt-Jackson Walsh. England was where Robinson made his fortune and became famous together with Gertrude Jekyll, for advocation of the well orchestrated wild-garden and herbaceous border. No mention is made of Robinson's "The English Flower Garden" (1883) which I suspect influenced Australian pleasure gardens at the turn of the century, as had the Loudons earlier in the nineteenth century. Robinsonian garden elements are still evident today.

Tanner, H. & Stringer, R. 1979. 'Converting the Wilderness: The Art of Gardening in Colonial Australia', pp. 95, monochrome endpapers, coloured cover, 12 coloured plates, 138 monochrome illustrations. (Australian Gallery Directors Council, Sydney.) Paper-bound $4.00 (available from exhibitions in Brisbane, October 1979: Ballarat, November-December 1979: Sydney, January 1980: Melbourne, February 1980: Launceston, March 1980: Hobart, April-May 1980: Adelaide, June 1980 or A.G.D.C., P.O. Box 369, Royal Exchange, Sydney, 2000).

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Australian native plants

Wrigley, J.W. & Fagg, M., 'Australian Native Plants', 1979, Collins.

During the past few years a number of books have appeared concerning the cultivation and propagation of Australian plants. These have ranged from a quasi-ecological approach to the more empirical listing of species and evidence concerning their requirements under cultivation.

A bench mark has now been established by the appearance of the long awaited volume by John Wrigley entitled 'Australian Native Plants'. His writings have been supported by a magificent series of coloured plates by Murray Fagg. Over 2500 species are described together with more than 140 colour photos and 300 black and white plates and line drawings.

Chapter headings include "Why Native Plants?", "Collection of Material" - which rightly draws attention to the importance of correct techniques - "Propagation" (with excellent drawings of the life cycle of the fern), "Landscape", "Pests and diseases" and "Plant management". In addition the bookmark provided explains the symbols used in descriptions, which is a novel and useful feature.

Then follows nine chapters covering all the information the home and professional gardener wants on the utilisation of native plants. The descriptions are first class, detailed and clear, with notes on the propagation and the uses of the particular species. It is pleasing to see major chapters devoted to water and container plants, two groups of native plants almost neglected by most writers.

Considerable care has been taken over the nomenclature (although with the numerous revisions by botanists at present taking place it is virtually impossible to be totally up to date). This is borne out on at least two occasions, namely *Acacia osswaldii* and *Pittosporum phillyraeoides.* Neither spellings are generally accepted and in spite of the derivation of the last name the spelling is different from that recorded.

The text is clearly set out; no obvious errors were noted, although the lack of a title under some of the black and white photos within the text could be confusing and a few of these lack definition (pp. 86, 361, 388, 389). Overall the black and white photos are of poor quality which contrast markedly with the colour. It is a pity that pot-grown specimens had to be photographed; these generally are of poor quality. However, there are some very good black and white illustrations, e.g. pp. 90, 138 and 233. The photograph of *Araucaria* on page 309 appears to be out of vertical.

Under the planting notes on page 49 no mention is made of possible later planting in frost affected areas, i.e. planting in spring, although elsewhere reference is made to frost protection.

It is surprising that very few of the lower rainfall species of *Eucalyptus* are listed; an obvious omission is *Eucalyptus pyriformis.* There are numerous others of the "gold field mallee group" which are traditionally planted in South Australia and which have been omitted. *E.* 'Torwood' is also widely grown in the arid parts; the greatest collection to be seen is probably at Leigh Creek and Woomera. Also only one species of *Xanthorrhoea* is mentioned; a species which can either lack or have a short trunk, and yet there are numerous other species cultivated all of which always have a trunk.

It is pleasing to note that cultivars have been thoroughly dealt with and undoubtedly these will cause some confusion to growers of Australian plants. It is a pity that there is a restricted use of common names, especially as these have tended to become standard over the past decade or so; they are helpful to gardeners.

Overall the book will remain for many years to come as the most important handbook and all growers of Australian plants will be grateful to John Wrigley for making available the results of his numerous researches; to quote one example, the use of *Westringia* stock for prostantheras which allow these to be grown in *Phytophthora cinnamomi* affected soils. It is to be hoped that all will use this information to improve their collections of native plants and so increase the pleasure they derive from growing them.

Wrigley, John W. & Fagg, Murray. 1979. 'Australian Native Plants', pp. 222, 25 pp. index, 140 colour plates and 300 black and white plates and line drawings. (Published by Collins, Sydney.) Hard-bound $30.00.

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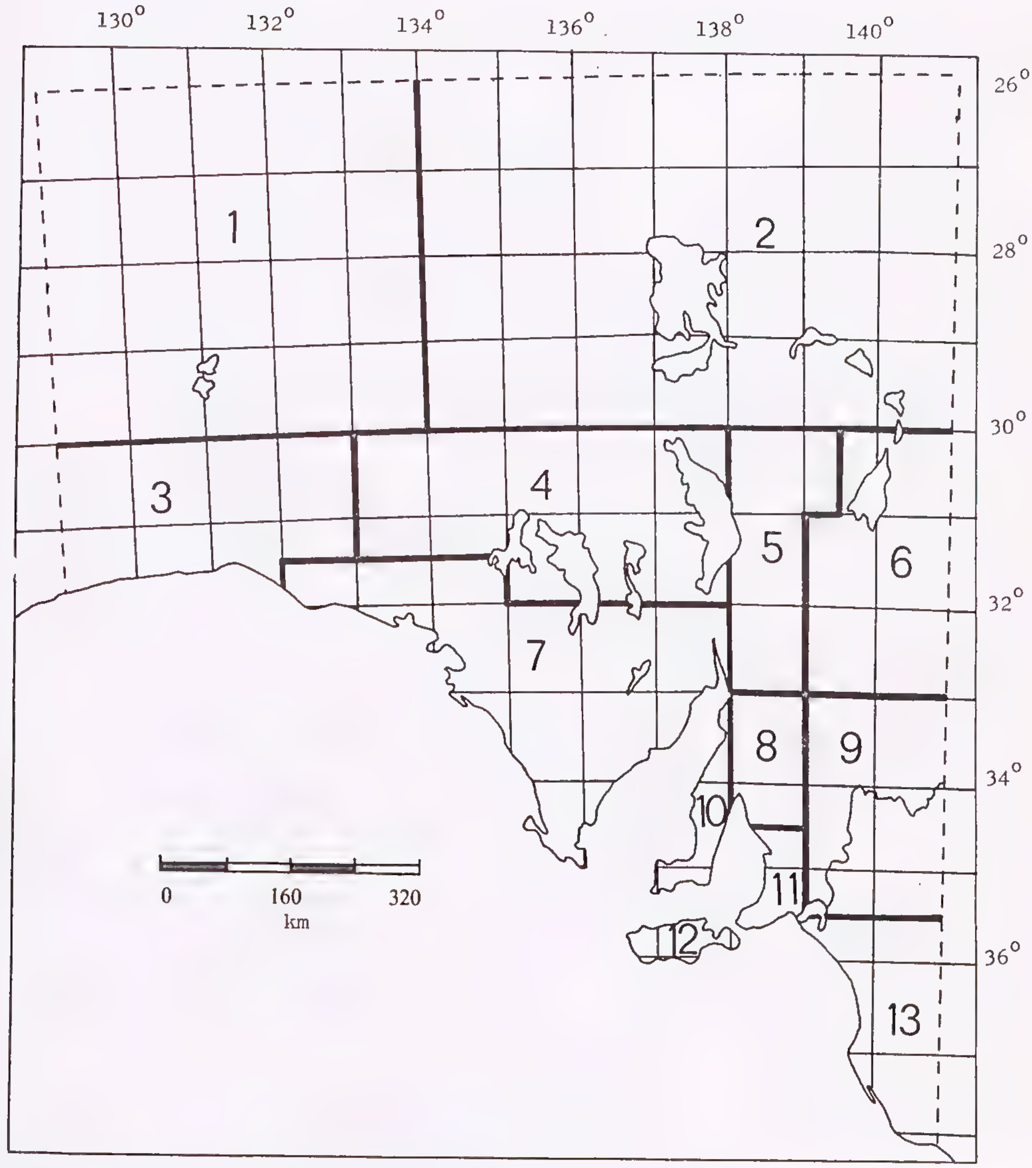
REGIONS OF SOUTH AUSTRALIA ADOPTED BY THE STATE HERBARIUM — ADELAIDE

1. North-western
2. Lake Eyre Basin
3. Nullarbor
4. Gairdner-Torrens Basin
5. Flinders Ranges
6. Eastern
7. Eyre Peninsula
8. Northern Lofty
9. Murray
10. Yorke Peninsula
11. Southern Lofty
12. Kangaroo Island
13. South-eastern



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JOURNAL of the ADELAIDE BOTANIC GARDENS

CONTENTS

JOURNAL of the ADELAIDE BOTANIC GARDENS

Volume 2 Part 3

3 June, 1980

Instructions to Authors

Topics

Papers will be accepted in the following categories:

(a) Plant systematics (Australian and horticultural groups); (b) Descriptive plant morphology, anatomy and ecology; (c) Obituaries, biography and history; (d) Bibliographic studies, book reviews; (e) Botanical illustrations; (f) Noteworthy horticultural contributions.

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Manuscripts must be typed, with double spacing and margins at least 3 cm wide, on one side of the paper only. Three copies must be submitted. Captions must not be italicized, underlined or typed in capitals. All scientific names of generic or lower rank must be underlined.

The print area for illustrations is 20 x 13 cm (including captions). Half-tone material should be submitted this size if possible, but will be reduced by the printers, if necessary.

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The pattern of the paper should generally be:

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Text references to publications should be indicated as follows: (Smith, 1959), (Smith, 1959, p. 127), Smith (1959) or Smith (1959, pp. 125-208). The final section of the paper, headed 'References', should include only those titles referred to in this way. It should be laid out as follows:

Smith, L. L. (1879). The species of *Danthonia* found in pastures in Victoria. *Austral. J. Bot.* 65: 28-53.

Bentham, G. (1868). "Flora Australiensis", Vol. 4. (London: L. Reeve.)

Baker, J. G. (1898). Liliaceae. In Thiselton-Dyer, W. T. (ed.), "Flora of Tropical Africa", Vol. 7 (Ashford: L. Reeve).

Journal abbreviations must be consistent within a paper and authors are recommended to follow "Botanico-Periodicum-Huntianum". Journals not cited in B-P-H should be abbreviated to conform with this general pattern. The following abbreviations for Australian states should be used: WA, NT, SA, Qld, NSW, ACT, Vic., Tas.

Text references to specimens should be italicized, for example *Kock 276*.

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When required, follow the pattern on, for example, p. 106 of vol. 1, pt. 2.

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Authors are requested to include in the synonymy only references to publications containing information additional to that to be published in the paper being submitted. Within this section journal and book titles must be consistently abbreviated. B-P-H journal abbreviations and book titles abbreviated in a similar way are desirable. Authors of references cited in the synonymy should be abbreviated.

References may be cited as:

Benth., *Fl. Austral.* 4: 111 (1868) OR
Benth., *Fl. Austral.* 4: (1868) 111.

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10-30 specimens should be cited for each species (or subspecific taxon), although this may be varied under certain circumstances. The author may decide whether or not to include dates of collections and the sequence, provided a constant pattern is adhered to throughout a paper.

Authors wishing to cite all specimens seen may list them all in an index to collectors after the style of the "Flora Malesiana" identification lists. Collections not identifiable by a collection number (assigned by either the collector or herbarium) should cite dates.

Correspondence

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DICHROMOCHLAMYS, A NEW GENUS IN ASTERACEAE (ASTEREAE)

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Abstract

A new monotypic Australian genus, *Dichromochlamys*, is described in the tribe Astereae. The species *D. dentatifolia* (syn. *Pterigeron dentatifolius* F. Muell.), is described and illustrated and a distribution map is provided. The relationships of the genus are discussed.

Introduction

In a recent revision of the genus *Pterigeron* (DC.) Benth. (= *Streptoglossa* Steetz in F. Muell.) (Dunlop, *ined.*) of the tribe Inuleae, *Pterigeron dentatifolius* F. Muell. was recognised as distinct from the rest of the genus. Its position within Inuleae was also seen to be anomalous, possessing as it does characters usually associated with the Astereae rather than the Inuleae. All other species currently recognised under *Pterigeron* are rightly placed in the Inuleae and with the exception of one species, will be transferred to *Streptoglossa* in a forthcoming paper.

Pterigeron dentatifolius was described by F. Mueller (1875) and based on a collection of Christopher Giles' from Central Australia. Black (1929, 1957) in his account of *Pterigeron* in the 'Flora of South Australia' was aware that *P. dentatifolius* stood apart from the other species of the genus, distinguishing the achenes as flattened rather than terete. He also made drawings on a herbarium sheet, now in AD, of the conical receptacle of *P. dentatifolius* but failed to note this distinctive and aberrant (in *Streptoglossa*) feature in his 'Flora'.

Dichromochlamys Dunlop, gen. nov., *Ixiochlamydi* F. Muell. et Sond. ex Sond. affinis, a qua receptaculo conico, pappo sessili et involucris veteribus incurvis differt.

Herba annua. *Folia* simplicia, caulina, alterna, sessilia. *Capitula* heterogama, solitaria. *Phyllaria* multiserialia imbricata. *Receptaculum* conicum, epaleaceum. *Flosculi* numerosi, omnes fertiles. *Flosculi marginales* albi, feminei, multiseriales, ligulati. *Flosculi disci* flavi, hermaphroditi; corollae 5-lobatae; antherae sine caudis; apices steriles lineati ramorum stylorum. *Achenia* complanata, laevia; pappus persistens, multiserialis, setis breviter plumosis.

Typus: *D. dentatifolia* (F. Muell.) Dunlop.

Annual *herb*. *Leaves* simple, cauline, alternate, sessile. *Capitula* heterogamous, solitary. *Phyllaries* in several series, imbricate, not reflexed at maturity. *Receptacle* conical, epaleaceous. *Florets* numerous, all fertile. *Marginal florets* white to pink, female, multiseriate, ligulate. *Disc florets* yellow, bisexual; corollas 5-lobed; stamens 5, anthers without tails; sterile apices of style branches linear. *Achenes* flattened, smooth; pappus persistent, multiseriate, the bristles shortly plumose.

The generic name, meaning cloak of two colours, refers to the involucre in which the dark coloured backs of the phyllaries contrast with the white scarious margins.

Dichromochlamys dentatifolia (F. Muell.) Dunlop, comb. nov.

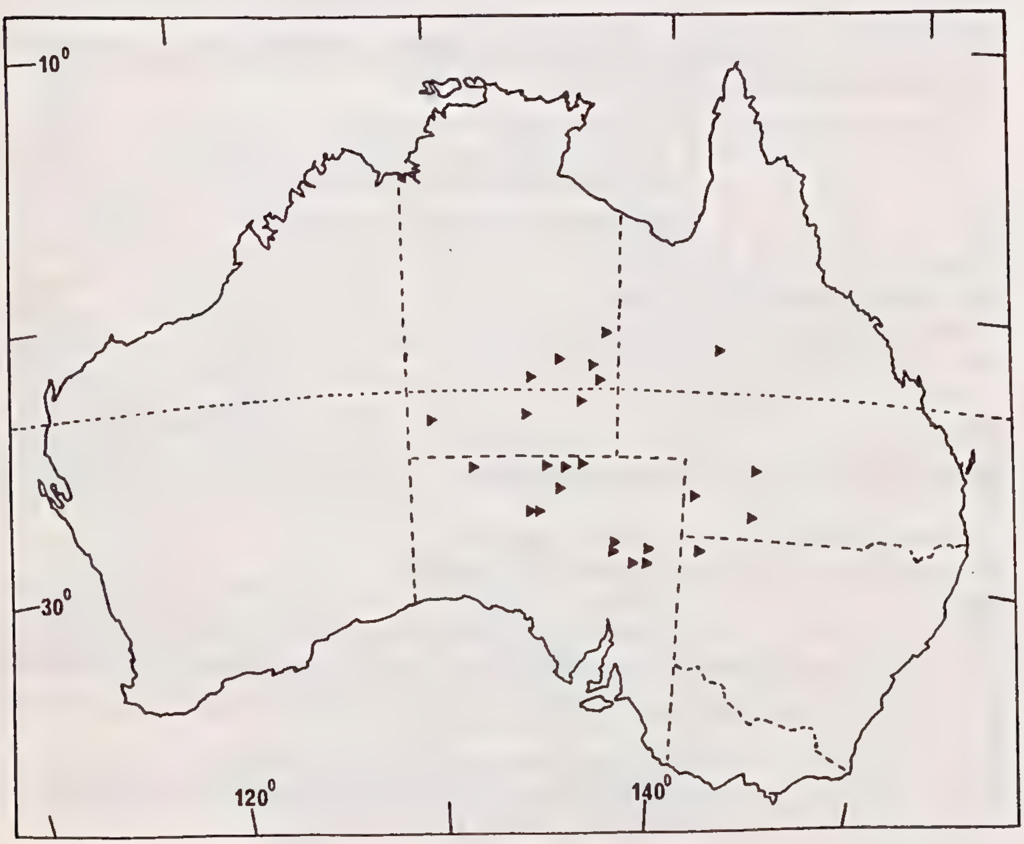
Pterigeron dentatifolius F. Muell., Fragm. 9:119 (1875); Black, Fl. S. Austral. ed. 1:616 (1929), ed. 2:894 (1957); *basionym*.

Type: between Alice Springs and Charlotte Waters, *C. Giles s.n.*, v. 1875 (MEL 42554, holotype).

Herb to c. 25cm high. Stems and leaves villous to woolly, rarely glabrous; glandular. *Stems* branched from the base, decumbent. *Leaves* spathuiate, coarsely toothed at apex, rarely entire; 1—3.5cm long, 2—10mm wide at apex, tapering to c. 1mm at the base. *Capitula* held above the foliage on long peduncles; peduncles and involucres densely glandular, dark purple to pale brown. Outer *phyllaries* lanceolate, flat; the median and inner narrower, channelled, with broad white scarious margins. *Receptacle* densely glandular, the edge beset with fine hairs to c. 3mm long. *Florets* 100—150; marginal florets more numerous than disc florets. Ligules of *marginal florets* white to pink, c. 3mm long, c. 0.3mm wide. Corollas of *disc florets* yellow, 4—5mm long, glandular. *Achenes* obovate, symmetrical, constricted below the pappus, sericeous on lower three-quarters with minute scattered glands below the apex; pappus c. 5mm long, bristles uneven with the outer series shortest. (Fig. 1.)

Distribution

Dichromochlamys is restricted to the inland arid regions of the Northern Territory, Queensland, New South Wales and South Australia. (Map 1.)



Map 1. Distribution of *Dichromochlamys dentatifolia* (F. Muell.) Dunlop.

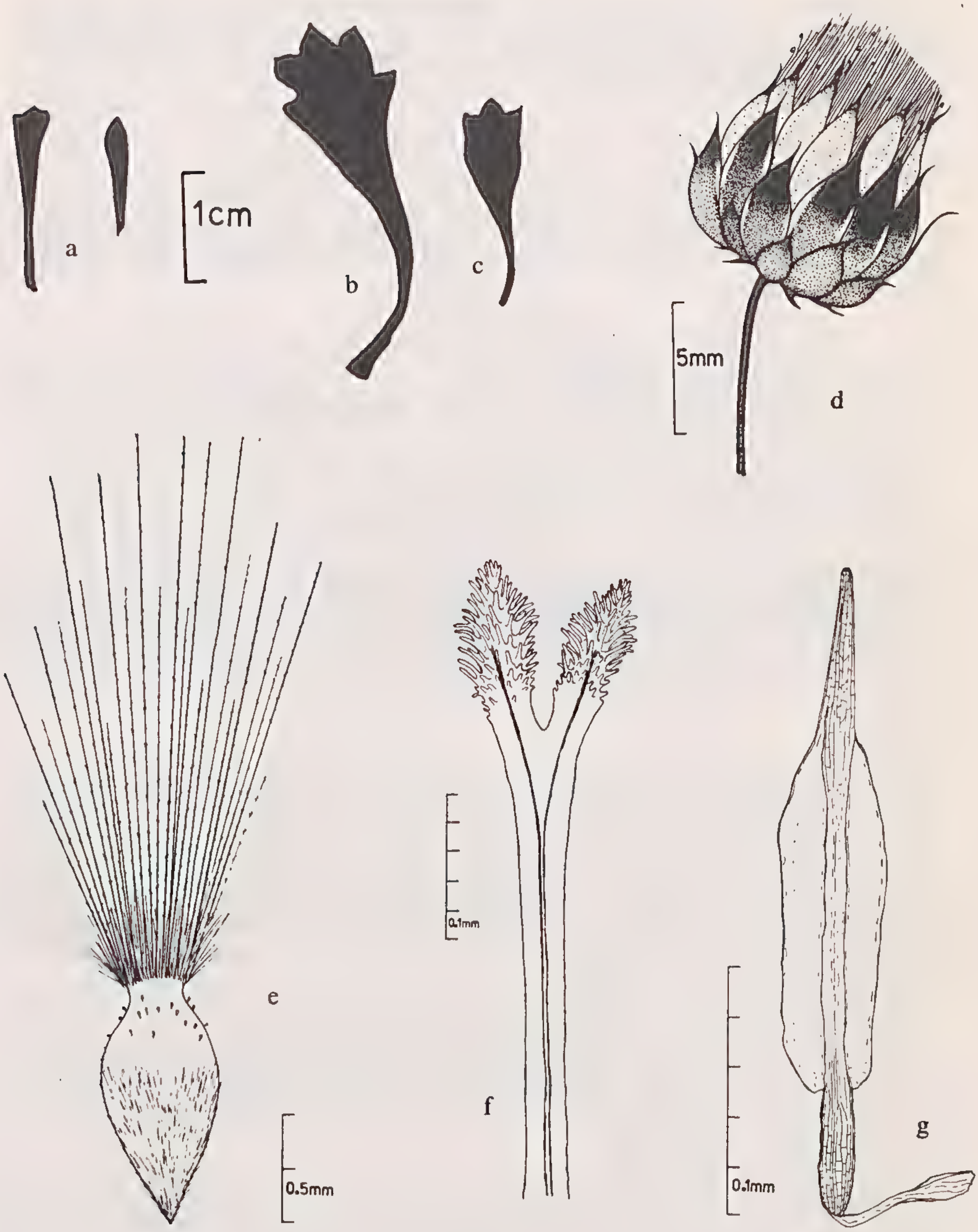


Fig. 1. *Dichromochlamys dentatifolia* (F. Muell.) Dunlop. Leaf outlines: a, from *Ising 3765*; b, from *Lothian 1515*; c, from *Latz 4389*. d, capitulum; e, achene; f, style; g, stamen (d-g from *Latz 3154*).

Ecology

Specimens from Queensland and the Northern Territory have been recorded from clay soils with a pebbly surface, associated in several instances with gidgee (*Acacia cambagei* R.T. Baker). The species has also been recorded from calcareous clays, saline soils, sandy loam and rocky sites.

Notes

A minor variant with glabrous leaves was noted amongst collections from South Australia (e.g. *Ising 3735a*, *Symon 9371*). It is neither geographically, nor ecologically distinct (*Symon 9371* consists of glabrous and hairy plants) and in other respects is typical of the species.

Selection of Specimens Examined

NORTHERN TERRITORY: 20 miles N. Georgina Downs Homestead, *P.K. Latz 1689*, 28.vii.1971 (DNA, K, NT, PERTH); Mt Riddock Stn, *P.K. Latz 3154*, 2.vii.1972 (DNA, L, NT, PERTH); NW. Simpson Desert, *P.K. Latz 4389*, 29.ix.1973 (AD, ADW, NT).

QUEENSLAND: Elderslie Stn, *S.T. Blake 10035*, 29.x.1935 (BRI); Willies Ra., *R.S. Dick WQ349*, iii.1979 (BRI); Greenmulla, *S.L. Everist 7546*, 4.ix.1963 (BRI).

NEW SOUTH WALES: near Depot Glen, *W.E. Mulham 1309*, 9.ix.1978 (NSW). Only record for this State.

SOUTH AUSTRALIA: Oodnadatta, *E.H. Ising 3765*, 16.vii.1955 (AD): c.61km E. Dalhousie Springs, *T.R.N. Lothian 1515*, 9.viii.1963 (AD): 75km W. Maree, *A.E. Orchard 628*, 29.vi.1968 (AD); near Mt Attacherrikanna, *D.E. Symon 9257*, 23.ix.1974 (ADW); Dalhousie Springs area, *D.E. Symon 9371*, 26.ix.1974 (ADW).

Affinities

The position of *Dichromochlamys* within Asteraceae is clearly with the tribe Astereae. The genus has the typical ecaudate anthers and sterile style appendages of the tribe as outlined by Grau (1977) in the most recent review of the tribe. In common with other Australian members of Astereae (e.g. *Vittadinia*, *Ixiochlamys*), *Dichromochlamys* has decidedly flattened achenes with a combination of duplex and glandular hairs. By contrast, *Streptoglossa* (Inuleae), with which this taxon was originally placed by Mueller, has tailed anthers and terete achenes with duplex hairs. The conical receptacle and yellow disc florets of *Dichromochlamys* further distinguish it from *Streptoglossa* which has a flat receptacle and purple disc florets.

Within Astereae, *Dichromochlamys* is most closely allied to *Ixiochlamys* F. Muell. et Sond. ex Sond. with which it bears a superficial resemblance in habit and foliage. Both have similar achenes which are flattened and smooth, without striations or protuberances of related genera such as *Vittadinia*, *Brachycome* and *Calotis*. The achenes of *Ixiochlamys* are consistently beaked, presenting the most obvious character for distinguishing the two genera.

Dichromochlamys is also distinguished by the conical receptacle and the characteristic way in which the involucral bracts remain incurved after fruiting. In *Ixiochlamys* the receptacles are flat and the involucres reflexed on drying. The form and texture of the involucral bracts are also markedly different. In *Ixiochlamys* the bracts are flat with a relatively uniform, thin, texture while those of *Dichromochlamys*, particularly in the median and inner series, are inward curved or channelled along the bony and rigid central part and have flat, scarious margins.

Acknowledgements

I am indebted to Dr Hj. Eichler for the opportunity to undertake this study at Herbarium Australiense during October 1979. My stay in Canberra was both profitable and enjoyable and I thank Dr Eichler and the staff of the herbarium for their hospitality. Mr Lyn Craven deserves my special thanks for his advice and help which in many ways contributed to this study.

I would like to thank the heads of the following herbaria for the loan of material and, in the case of several herbaria, for the opportunity to visit their institutions: AD, ADW, BRI, CBG, MEL, NSW, NT.

My thanks are also due to my wife, Adrianne, for preparing the illustrations.

References

Black, J.M. (1929). "Flora of South Australia" ed. 1:616. (Government Printer: Adelaide.)
Black, J.M. (1957). "Flora of South Australia" ed. 2:894. (Government Printer: Adelaide.)
Grau, J. (1977). Astereae-systematic review. In Heywood V.H., Harborne J.B and Turner, B.L. (eds), "The Biology and Chemistry of the Compositae", vol. 1:539-565. (Academic Press: London.)
Mueller, F.J.H. v. (1875). "Fragmenta Phytographiae Australiae" 9:119. (Government Printer: Melbourne.)

Index to Collections

The following index is to all specimens examined. Herbaria from which specimens have been seen are indicated by the usual acronyms.

Basedow 306 (NSW); *s.n.* (AD). *Blake 10035* (BRI). *Chalmers s.n.* (AD). *Chippendale NT2736* (CANB, MEL, NT). *Dick WQ349* (BRI). *Dunlop 2553, 2601* (NT). *Everist 7546* (BRI). *Giles s.n.* (MEL). *Henry s.n.* (MEL). *Hill 237, 1538* (AD). *Ising 3735* (AD); *3735a* (ADW); *3764, 3765* (AD); *s.n.* [1931 (AD); 23, 28.vii.1936 (AD); ix.1950 (ADW); x.1950 (AD, ADW); viii.ix.1952 (AD); i.x.1953 (AD); 8.x.1953 (ADW); 1954 (AD); vii, viii.x.1955 (AD)]. *Koch 349/399* (NSW); *s.n.* (AD). *Latz 1689* (DNA, K, NT, PERTH); *3154* (DNA, L, NT, PERTH); *4241* (DNA, NT); *4389* (AD, ADW, NT). *Lothian 1064* (AD); *1086* (AD); *1515* (AD); *1590* (AD). *Mulham 1309* (NSW). *Orchard 628* (AD). *Richards s.n.* (MEL). *Symon 5596, 5739, 5909B, 5921A, 9103, 9257, 9371* (ADW).

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A REVISION OF *IXIOCHLAMYS* (ASTERACEAE:ASTEREAE)

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Abstract

The Australian endemic genus *Ixiochlamys* F. Muell. et Sond. ex Sond. is revised. Four species are recognised, two of which are newly described, viz. *I. filicifolia* Dunlop and *I. integerrima* Dunlop. Illustrations, maps showing distribution and ecological notes are provided for each species.

Introduction

Ixiochlamys was described by Mueller and Sonder in Sonder (1853). The type of *Ixiochlamys*, *I. cuneifolia*, was based on *Podocoma cuneifolia* R.Br., the type species of *Podocoma* R.Br. Brown's name, published in 1849, was a later homonym of a South American genus (also in Asteraceae), described by Cassini (1817).

Curiously, Bentham (1867) believed the South American and Australian genera of the same name to be congeners, placing *Ixiochlamys* in synonymy with *Podocoma*. He mistakenly attributed the latter name to Lessing.

Subsequent authors regarded *Podocoma* as a genus of South America and Australia until Grau (1975) showed that the species of the two continents belonged to separate genera. *Podocoma* Cass. is thus regarded as extra-Australian and *Podocoma* R.Br., the later homonym, is replaced by the first legitimate name for the Australian species, *Ixiochlamys* F. Muell. et Sond. ex Sond.

Ixiochlamys F. Muell. et Sond. ex Sond.

Ixiochlamys F. Muell. et Sond. ex Sond., Linnaea 25:466(1853).

Type: *Ixiochlamys cuneifolia* (R.Br.) F.Muell. et Sond. ex Sond. (≡ *Podocoma cuneifolia* R.Br.

Podocoma R.Br. in Sturt, Exped.Centr.Aust. 2, app 80 (1849), *nom. illeg.*, non Cass. (1817).

Type: *Podocoma cuneifolia* R.Br.

[*Podocoma* auct. non Cass., Bull. Soc. Philom. 137(1817):Benth., Fl. Aust. 3:492(1867); Bailey, Queensl. Fl. 3:808 (1900); Black. Fl. S. Aust. edn 1:596(1929), edn 2:866 (1957).]

Annual or perennial *herbs* or *sub-shrubs*. Stems and leaves covered to varying degrees in multiseptate trichomes and glands or in one species glabrescent to glabrous and eglandular. *Leaves* simple, cauline, alternate, sessile. *Capitula* heterogamous, solitary, on long axillary peduncles. *Phyllaries* narrow-lanceolate to linear, in several series, imbricate; reflexed after fruiting. *Receptacles* flat or slightly convex, epaleaceous. *Florets* numerous. *Marginal florets* mauve to white, in several series, female, fertile, ligulate. *Disc florets* yellow, usually fewer than marginal, bisexual with fertile achenes or functionally male; anthers without tails. *Achenes* flattened, smooth, with a filiform beak supporting the pappus; body of the achenes glabrous or covered to varying degrees with duplex hairs, glandular or eglandular. *Pappus* persistent, uni- or multiseriate; bristles very shortly plumose.

Distribution

In arid areas of the Northern Territory, Queensland, New South Wales, South Australia and Western Australia.

Affinities

Ixiochlamys is here considered to belong to the tribe Astereae where it has been placed by Grau (1977). Within Astereae, *Ixiochlamys* is readily distinguished from other Australian members by the smooth, beaked achenes and persistent pappus. With the exception of *Dichromochlamys* Dunlop, none of the Australian genera of Astereae could be considered to be closely related to *Ixiochlamys*. The relationship between these two genera is discussed in a separate paper on *Dichromochlamys* (Dunlop, 1980). The following key is provided to distinguish *Ixiochlamys* and *Dichromochlamys*:

Achenes beaked; receptacles flat or nearly so; involucres reflexed after fruiting.............. *Ixiochlamys*
Achenes without beaks; receptacles conical; involucres remaining incurved after fruiting. *Dichromochlamys*

Podocoma Cass., probably the closest relative of *Ixiochlamys* outside Australia, is separated by Grau (1975) on a number of characters including achene structure, flower colour and shape of the style in the disc florets.

Within *Ixiochlamys*, *I. filicifolia* and *I. nana* stand together: both are annual with similar foliage and both have fertile disc florets. *I. cuneifolia* and *I. integerrima* are not closely related to each other or to the above species. They have in common pseudo-hermaphrodite disc florets and a perennial life-form but differ markedly in their foliage, vestiture and involucres.

Notes

The occurrence of the annual species, *I. filicifolia* and *I. nana* is shown on Maps 1 and 2 in relation to the zero isohyet for the month of May (Plumb, 1977). The configuration of this isohyet is similar in June. The isohyet represents the limit of early winter rains (May, June), which are responsible for the germination of many of the annual forbs, particularly the composites (Slatyer, 1962; Mott and McComb, 1975). The occurrence of *I. filicifolia* and *I. nana* is clearly determined by this early winter rainfall pattern. The distribution of *I. cuneifolia*, a perennial, is apparently also influenced by the rainfall pattern (Map 1). As will be discussed under that species, its occurrence is also dependent on topography.

I. integerrima, besides being independent of early winter rainfall (Map 2), has a different life-form from the other species. This relationship between life-form and geographical occurrence will be examined more fully under the species treatment.

Key to the Species

1. Leaves entire; leaves and involucres eglandular or almost so .... 2. *I. integerrima*
   Leaves lobed; leaves and involucres glandular...2
2. Sub-shrub; leaves lobed at distal end only ....1. *I. cuneifolia*
   Annual; leaves deeply divided or lobed from the base 3
3. Achenes sparsely sericeous; leaves finely bi- or tripinnatisect .... 3. *I. filicifolia*
   Achenes glabrous; leaves pinnatifid or bipinnatifid.....................................4. *I. nana*

1. **Ixiochlamys cuneifolia** (R.Br.) F.Muell. et Sond. ex Sond., Linnaea 25:466(1853).

Podocoma cuneifolia R.Br. in Sturt, Exped. Centr. Aust. 2, app. 81(1849).

Type: "In Herbario D. Sturt absque ulla indicatione loci vel stationis". (BM, holotype, (n.v.); DNA, photo).

Sub-shrub to c. 30cm high. Stems and leaves glandular, conspicuously hirsute with spreading white hairs, rarely glabrous. *Stems* decumbent to erect. *Leaves* crowded, spathulate, rarely almost linear, 3-9mm wide near the apex, tapering abruptly below to c. 1mm at base; apex irregularly lobed. *Phyllaries* glandular; inner series 1.3—1.6cm long.

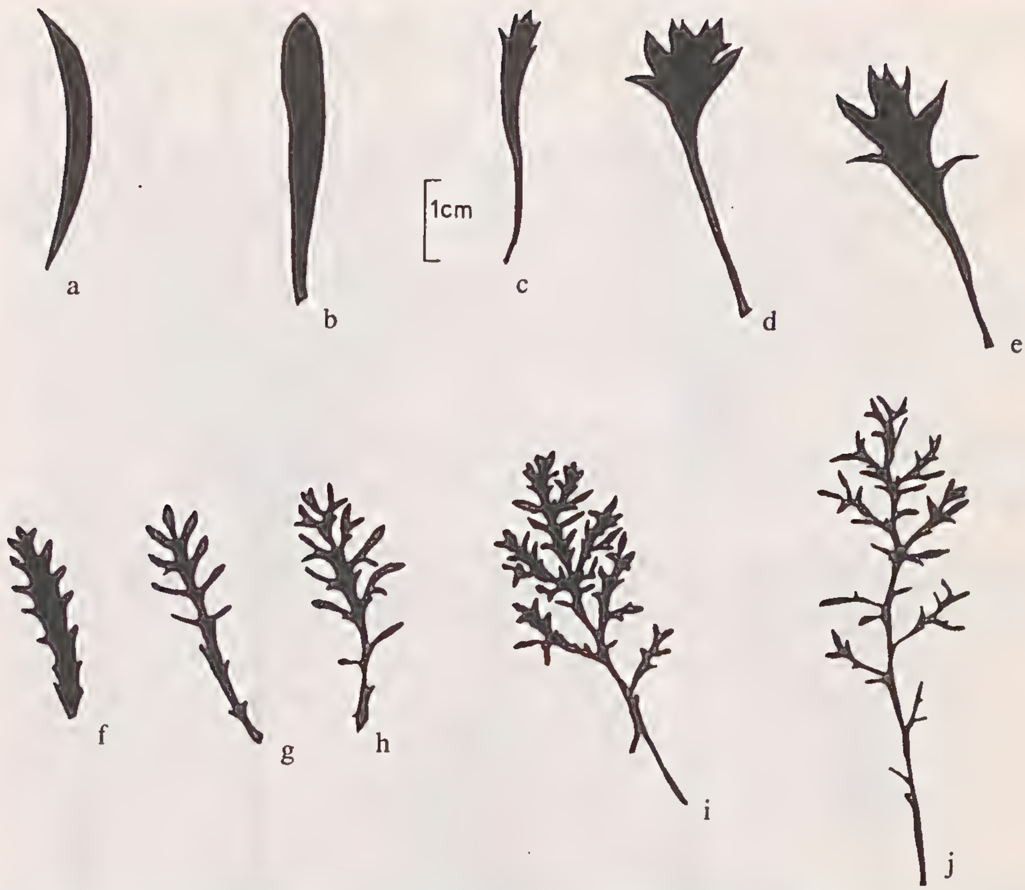


Fig. 1. Leaf outlines in *Ixiochlamys* spp. a, b, *I. integerrima*: a, from *Chippendale NT1456*; b, from *Chippendale NT6410*. c, d, e, *I. cuneifolia*: c, from *Symon 6784*; d, from *Ising 618*; e, from *Cooper s.n.* f, g, h, *I. nana*: f, from *Nelson 2215*; g, from *Lothian 1376*; h, from *Osborn s.n.* 1925. i, j, *I. filicifolia*: i, from *Symon 2190*; j, from *Donner 4487*.

Receptacle 4—10mm wide. Ligules of *marginal florets* c. 0.5mm wide, 3—5mm long, entire. *Disc florets* pseudo-hermaphrodite; ovary vestigial; corollas glandular, 5—6mm long. *Achenes* obovate, c. 2mm long, thinly sericeous in lower three quarters, glabrous above with minute scattered glands; beaks sparsely and minutely glandular, 6—12mm long. *Pappus* of marginal florets 6.5—11mm long, of disc florets 4.5—8mm long; multiseriate, uneven. (Figs 1 & 2.)

Distribution (Map 1)

Northern Territory, New South Wales, South Australia and Western Australia.

Selection of Specimens Examined

NORTHERN TERRITORY: Finke R., *G. Chippendale NT780*, 4.ii.1955 (ADW, CANB, NSW, NT); 12 miles SW. Tempe Downs, *M. Lazarides 6119*, 4.x.1956 (AD, BRI, CANB, NT); Giles Ck, *D.J. Nelson 2157*, 23.ix.1971 (AD, CANB, NSW, NT).

NEW SOUTH WALES: Silverton, *E.F. Constable 4679*, 27.xi.1947 (NSW): Fowlers Gap, *S. Jacobs 1932*, 18.x.1974 (NSW); Depot Glen, *J. Pickard 3127*, 30.x.1976 (NSW).

SOUTH AUSTRALIA: about 50km N. Marree, *R. Hill 1145*, 9.ix.1963 (AD); Parachilna Gorge, *M.C.R. Sharrad 1401*, 31.viii.1963 (AD); W. Brachina Gorge, *D.E. Symon 1382*, 7.ix.1961 (AD); Mt Morris, *D.J.E. Whibley 1015*, 7.ix.1963 (AD).

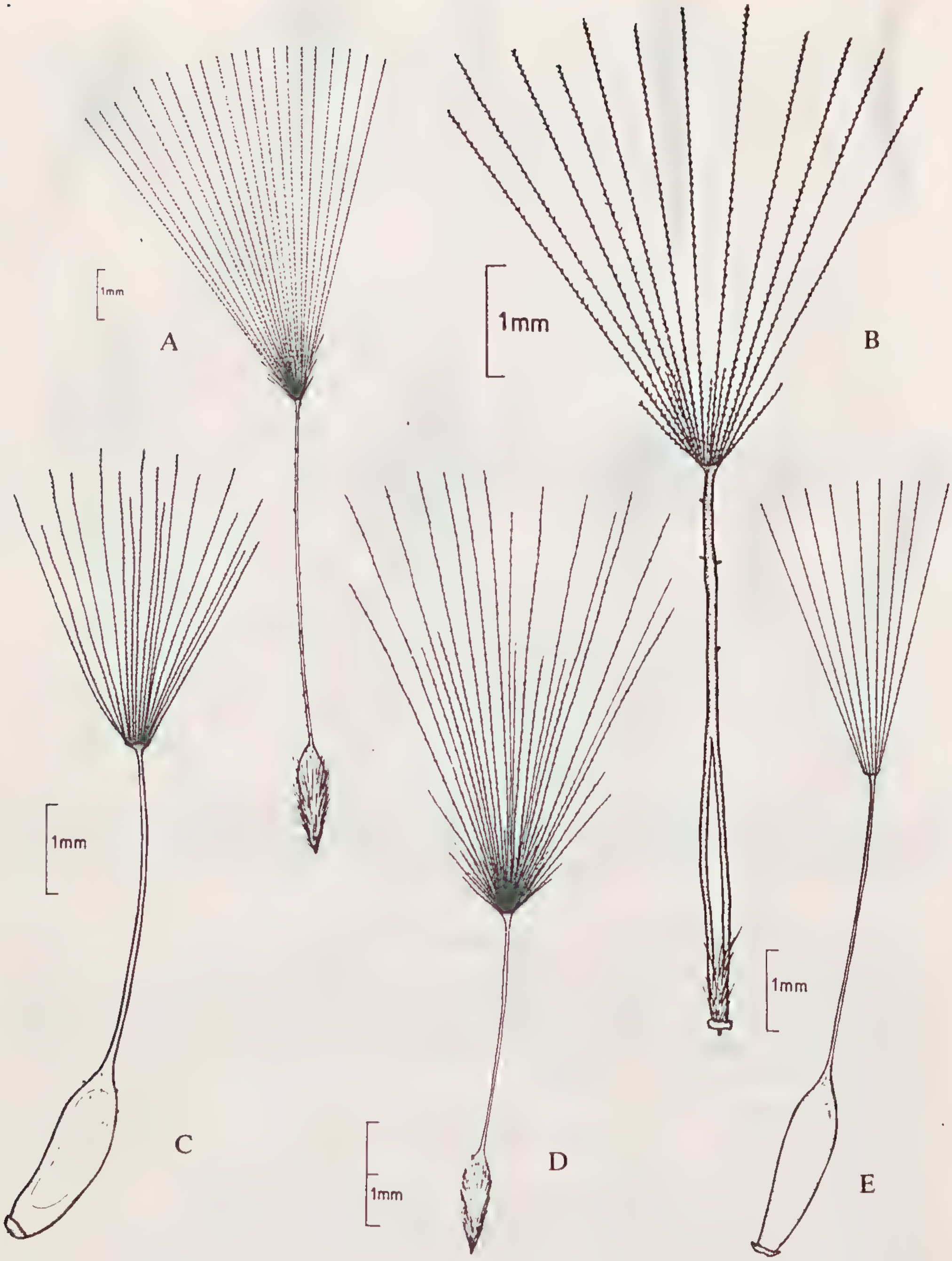


Fig. 2. Achenes of *Ixiochlamys* spp. A, B, *I. cuneifolia* from *Chippendale NT780*: A, marginal achene. B, disc achene (undeveloped). C, *I. integerrima* from *Chippendale NT6410*. D, *I. filicifolia* from *Latz 3163*. E, *I. nana* from *Latz 5125*.

WESTERN AUSTRALIA: 12 miles N. Roy Hill, *J.S. Beard 2807*, 15.viii.1963 (PERTH); Dampier Archipelago, *R.D. Royce 7404*, 13.vi.1962 (PERTH); Mount Augustus Station, *E. Wittwer 1058*, 18.viii.1973 (PERTH).

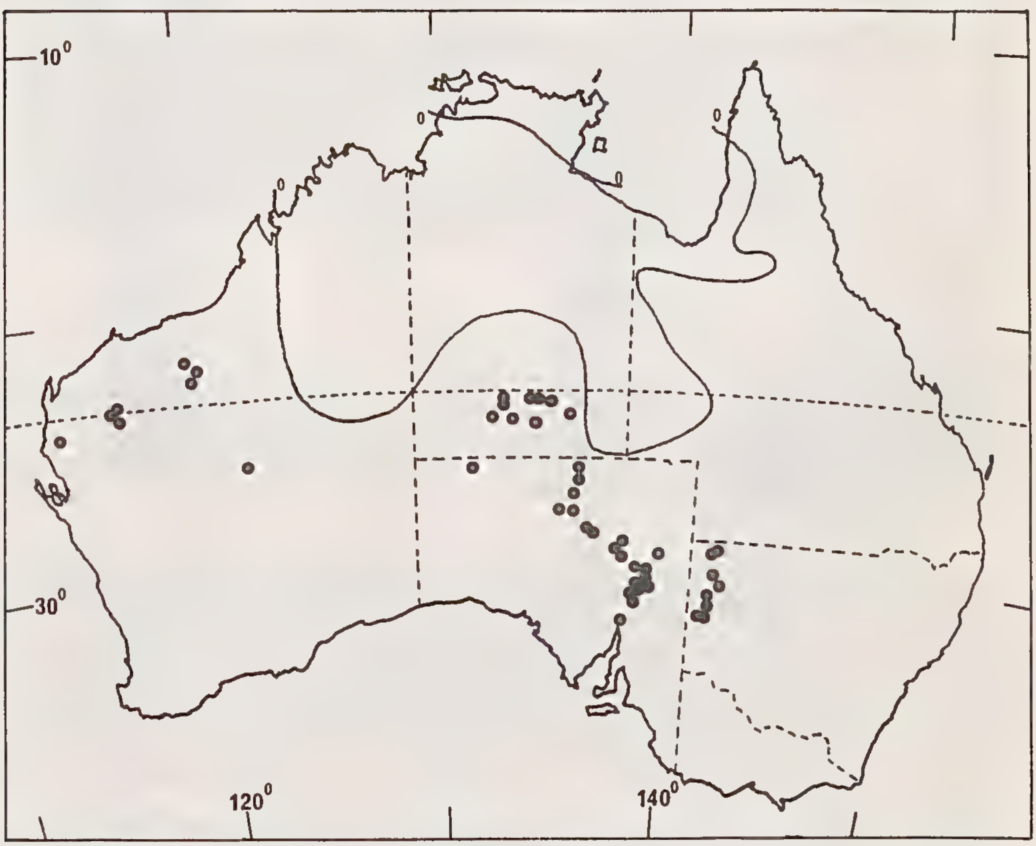
Notes

The type specimen of *Podocoma cuneifolia*, as cited by Brown, was without a locality. A photograph of the type specimen lodged at the British Museum, shows a more recent label with the locality: "On the return, about 32° S Lat. D. Sturt". This locality, reckoned from Sturt's journal (1849), would be in the Barrier Range, New South Wales.

Grau (1975) has detected two types of stigma in the disc florets: one with a short stigmatic region and one without. The implication is that a proportion of the disc florets will produce achenes. In this revision, only the sterile type of stigma has been seen in the central florets and from the mature heads examined it would appear that the disc florets never develop achenes.

In *I. cuneifolia* the vestiture of stiff white hairs on the leaves and stems is a good diagnostic character. In only two specimens examined, *Sharrad 1401* and *Symon 1382*, were these hairs absent. Both collections are from the same area in the Flinders Ranges, South Australia.

The preferred habitats of *I. cuneifolia*, as recorded on specimen labels, are stony and sandy beds of seasonal creeks associated with ranges, and in crevices in rock faces. This preference is reflected in its distribution which is centred in the Barrier Ra. (N.S.W.),



Map 1. Distribution of *Ixiochlamys cuneifolia*.

Flinders and Musgrave Ras (S.A.), MacDonnell Ra. (N.T.) and the Hamersley Ra. in Western Australia. Its absence from the channel country of south western Queensland, an area which would climatically be within its range, is probably due to the absence of this rocky habitat.

2. **Ixiochlamys integerrima** Dunlop; species nova, a congeneris foliis integerrimis eglandulatis differt.

Herba perennis. Caules et folia glabrata, pilis dispersis multiseptatis, basibus latis complanatis et caudis flagelliformibus; axillae foliorum superarum interdum villosae. *Caules* erecti. *Folia* oblanceolata, folia supera lineata, leviter falcata; 0.5—7mm lata, 1.2 –9.5cm longa; integra, margines apparenter denticulati praesentia basium latarum pilorum; acuta ad acuminatis. *Phyllaria* linearia, glabra, eglandula vel glandibus minutis sparsis in seriebus externis. *Receptaculum* circa 6mm latum. Ligulae *flosculorum marginalium* conspicuae, 0.5—1mm latae, 5—8mm longae, integrae vel minute lobatae. *Flosculi disci* pseudo-hermaphroditi, ovario vestigiali; corollae circa 3mm longae, glandulosae, glandes filiformes, praecipue in lobis et in medio infra expansam superam partem; corolla persistens. *Achenia* oblonga ad obovatis, leviter curvata et asymmetrica, circa 2mm longa, sparsis perpusillis pilis prope apices. *Pappi* marginalium flosculorum circa 4mm longi uniseriati, inaequales; discorum flosculorum absentium vel redactorum ad unico vel plus rudimentalibus setis.

Typus: 20 miles NW. Georgina Downs H.S., *G. Chippendale NT 6410*, 16.vii.1959 (CANB 285758, holo; AD, BRI, K, NT).

Perennial *herb* to c. 30cm high. Stems and leaves glabrescent with scattered multiseptate hairs with broad flattened bases and long whip-like tails; axils of upper leaves sometimes villous; eglandular. *Stems* erect. *Leaves* oblanceolate, the upper ones linear, slightly falcate; 0.5—7mm wide, 1.2—9.5cm long; entire, the margins appearing finely toothed by the presence of broad hair bases; acute to acuminate. *Phyllaries* linear, glabrous, eglandular or with minute scattered glands on the outer series; inner series c. 8mm long. *Receptacle* c. 6mm wide. Ligules of *marginal florets* conspicuous, 0.5—1mm wide, 5—8mm long, entire or minutely lobed. *Disc florets* pseudo-hermaphrodite; ovary vestigial; corollas persistent, c. 3mm long, glandular, the glands filiform, mainly on lobes and in the middle below the expanded upper part. *Achenes* oblong to obovate, slightly curved and asymmetrical, c. 2mm long with scattered, very short hairs near the apices. *Pappus* of marginal florets c. 4mm long, uniseriate, ± even; of disc florets absent or reduced to one or more rudimentary bristles. (Figs 1, 2, 3.)

Distribution (Map 2)

Northern Territory and Queensland.

Specimens examined

NORTHERN TERRITORY: Hamilton bore to Kunoth Well, *N.T. Burbidge & M. Gray 4348*, 26.ix.1955 (CANB); about 20 miles N. Lake Nash H.S., *G.M. Chippendale NT 1456*, 12.viii.1955 (BRI, MEL, NSW, NT); 20 miles NW. Georgina Downs H.S., *G.M. Chippendale NT 6410*, 17.vi.1959 (AD, BRI, CANB, K, NT).

QUEENSLAND: 2 miles W. Duchess, *C.H. Gittins 725*, v.1963 (BRI, NSW); 43.5km E. Boulia, *G.W. Trapnell & K.A.W. Williams 167*, 22.viii.1973 (BRI).

Notes

I. integerrima is the only species of the genus outside the early winter rainfall zone (Map 2); it occurs just within the monsoonal belt, receiving a regular dry season from May to September (Plumb, 1977). Significantly, the life-form of *I. integerrima* is one commonly seen in the monsoonal region of northern Australia. By the classification of Raunkiaer (1934), *I. integerrima* would be termed a Suffruticose Chamaephyte; the aerial parts of the plant grow during the favourable season, dying back to the perennial root and stem base during the unfavourable (dry) season. Other composites in northern Australia with the same life-form include *Eurybiopsis macrorhiza* DC. and *Vittadinia brachycomoides* F. Muell.

Of the collections examined, only two had data on habitat. The species has been recorded from clay loam and limestone-derived soils.

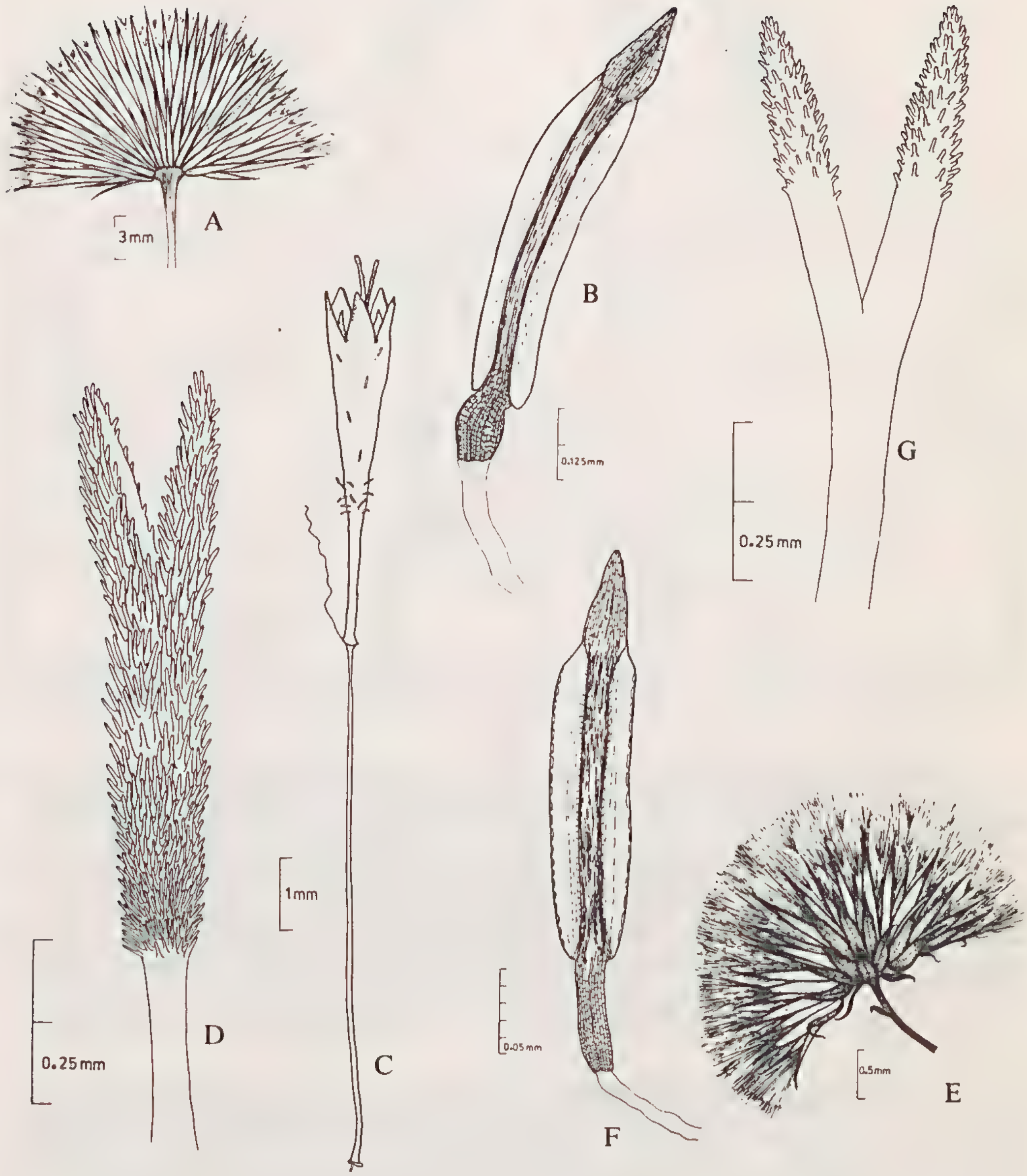
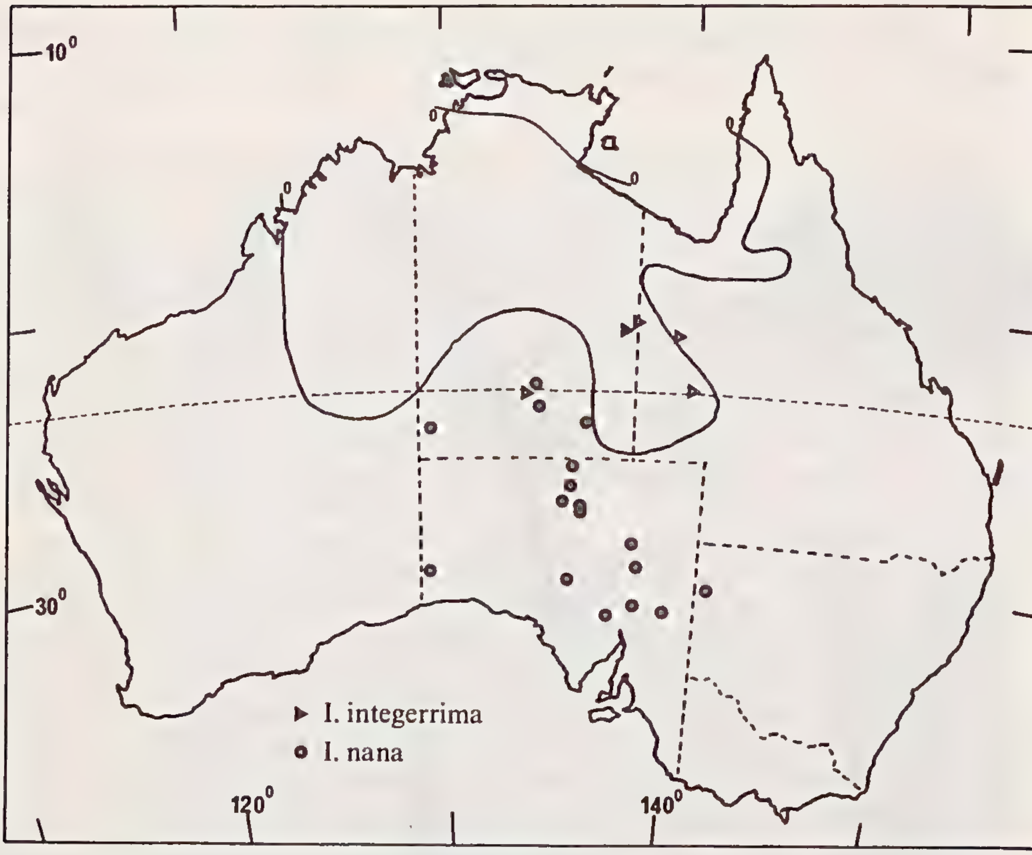


Fig. 3. A-D, *Ixiochlamys integerrima*, from *Chippendale NT6410*. A, capitulum; B, stamen; C, disc floret with undeveloped achene; D, style of disc floret. E-G, *I. filicifolia*, from *Latz 3163*. E, capitulum; F, stamen; G, style of disc floret.



Map 2. Distribution of *Ixiochlamys nana* and *I. integerrima*.

3. **Ixiochlamys filicifolia** Dunlop; species nova, species affinis *Ixiochlamydi nana* (Ewart et J. White) Grau a qua acheniis sericeis sparsim, capitulis grandibus et foliis tripinnatisectis differt.

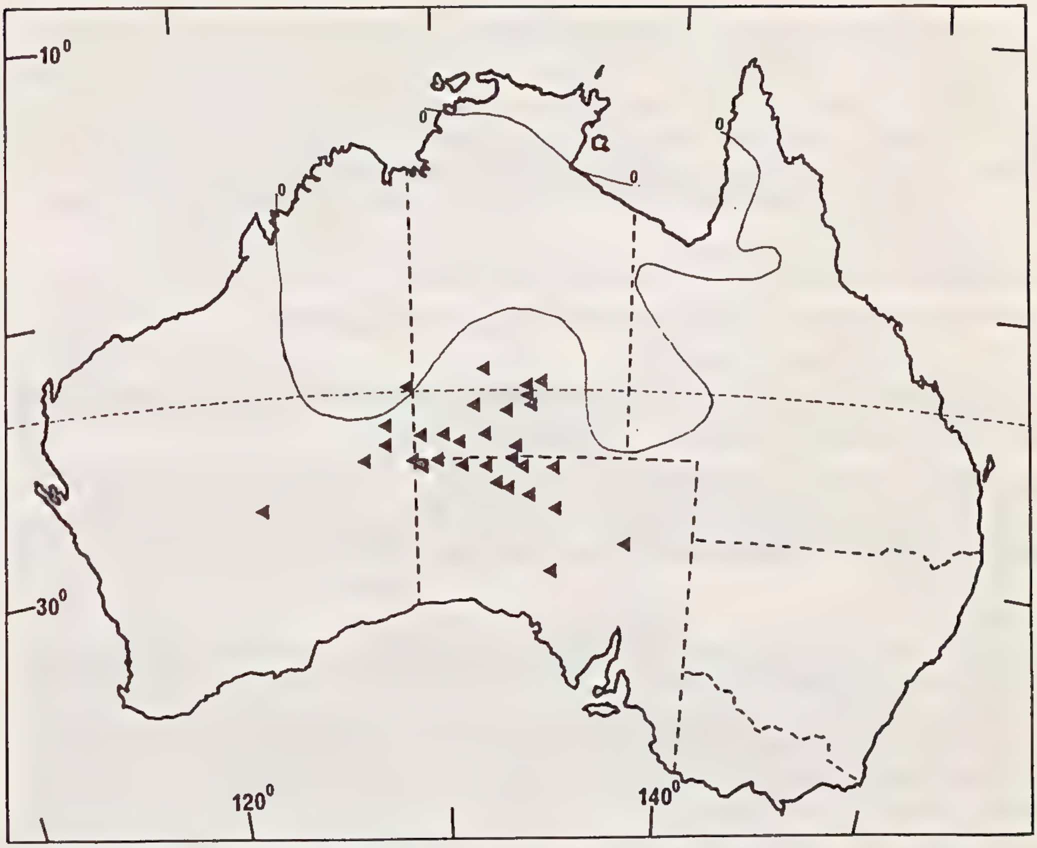
Herba annua, ad circa 25cm alta. Caules et folia glandulifera, pilosa ad villosa. *Caules* erecti. *Folia* ad circa 2.5cm lata et 7cm longa, in ambitu oblanceolatus ad spatulatum, subtiliter bi- vel tripinnatisecta. *Phyllaria* glandulifera; series intima circa 10mm longa. *Receptaculum* 4—8mm latum. Ligulae *flosculorum marginalium* circa 0.3mm latae, 1—2mm longae, integerae vel minute lobatae. *Flosculi disci* fertiles, corollae 5—6.5mm longae. *Achenia* 2—2.5mm longa, anguste obovata, sparsim sericea; rostra 2.5—5mm longa. *Pappi* 6—9mm longi, multiseriati, inaequales.

Typus: Mt Riddock Stn, *P.K. Latz 3163*, 3.viii.1972 (CANB 286036, holo; AD, K, NT, PERTH).

Annual *herb* to c. 25cm high. Stems and leaves pilose to villous, glandular. *Stems* erect. *Leaves* oblanceolate to spathulate in outline, to c. 2.5cm wide and 7cm long, finely bi- or tripinnately divided. *Phyllaries* glandular; inner series c. 10mm long. *Receptacle* 4—8mm wide. Ligules of *marginal florets* c. 0.3mm wide, 1—2mm long, entire or minutely lobed. *Disc florets* fertile, corollas 5—6.5mm long. *Achenes* 2—2.5mm long, narrow obovate, thinly sericeous; beaks 2.5—5mm long. *Pappus* 6—9mm long, multiseriate, uneven. (Figs 1, 2, 3.)

Distribution (Map 3)

Northern Territory, South Australia and Western Australia.



Map 3. Distribution of *Ixiochlamys filicifolia.*

Selection of Specimens Examined

NORTHERN TERRITORY: 6 miles E. Irving Ck, *P.K. Latz 1756*, 23.ix.1971 (BRI, MEL, NSW, NT); Harry Ck, *D.J. Nelson 2220*, 9.vi.1972 (DNA, NT); 5 miles N. Mt Cavanagh Stn, *R.A. Perry 5499*, 12.ix.1955 (CANB, NT); 5 miles S. Alice Springs, *R.E. Winkworth 1254*, 22.viii.1955 (CANB, NSW, NT).

SOUTH AUSTRALIA: N. Mt Eba, *B. Copley 2140*, 1.ix.1968 (AD); Mt Harriet, *Hj. Eichler 17254*, 5.ix.1963 (AD); Lake Harry, *R. Hill 287*, 29.vii.1955 (AD); De Rose Hill Stn, *T.R.N. Lothian 811/54*, 1954 (AD).

WESTERN AUSTRALIA: Wingelinna, *A.S. George 8761 B*, 18.vii.1967 (PERTH); Mt Tietkens, *A.S. George 8954*, 26.vii.1967 (PERTH); 78 miles S. Giles, *D.E. Symon 2190*, 31.vii.1962 (AD, ADW); 6km S. Bandya H.S., *P.G. Wilson 7344*, 27.viii.1968 (PERTH).

Notes

I. filicifolia has been collected mainly from loams and clay loams in Mulga (*Acacia aneura* F. Muell. ex Benth.) communities.

4. **Ixiochlamys nana** (Ewart et J. White) Grau, Mitt. Bot. Staatssamml. München 12:186 (1975).

Podocoma nana Ewart et J. White, J. & Proc. R. Soc. N.S.Wales 42:192 (1909).

Type: Mount Lyndhurst, *M.Koch 347*, ix.1899 (MEL 9059, 9061 p.p., syntypes; NSW); Mount Lyndhurst, *M. Koch 348*, ix.1899 (MEL 9061 p.p., syntype; NSW); Torrens Plains, *R. Tate s.n.*, 29.viii.1883 (MEL 9060, syntype).

Annual *herb* to c.25cm. Stems and leaves pilose or glabrous, glandular. *Stems* erect or prostrate. *Leaves* oblong to elliptic in outline, to c. 1cm wide and 4cm long, pinnately or bipinnately lobed; lower leaves with attenuate bases, upper leaves broad-based, almost stem-clasping. *Phyllaries* glandular; inner series 6—9.5mm long. *Receptacles* 2.5—5mm wide. Ligules of *marginal florets* filiform, c. 1mm long, minutely lobed. *Disc florets* fertile; corollas glandular, 3—4mm long. *Achenes* narrow obovate, slightly curved, 1.8—2mm long, glabrous; beaks 1.8—4.5mm long. *Pappus* c. 3mm long, uniseriate, ± even. (Figs 1 & 2.)

Distribution (Map 2)

Northern Territory, New South Wales and South Australia.

Selection of Specimens Examined

NORTHERN TERRITORY: north west Simpson Desert, *P.K. Latz 4653*, 30.ix.1973 (AD, BRI, CANB, DNA, NT); 65km W. Mt Ebenezer, *P.K. Latz 5125*, 16.v.1974 (DNA, K, NT); 9 miles SE. Alice Springs, *D.J. Nelson 2215*, 6.vi.1972 (ADW, DNA, K, NSW, NT, PERTH).

NEW SOUTH WALES: Fowlers Gap, *G.M. Cunningham & P.L. Milthorpe 1347*, 30.viii.1973 (NSW); Fowlers Gap, *L.R. Richley F38*, 20.ix.1973 (AD); Fowlers Gap, *M. Westoby 51*, viii.1978 (NSW).

SOUTH AUSTRALIA: Kingoonya, *herb. J.M. Black s.n.*, 24.ix.1920 (AD); Koonamore Stn, *M. Crisp 554*, 8.ix.1973 (AD, CBG); Muloorina Stn, *R. Hill 244*, 25.vii.1955 (AD); Evelyn Downs, *E.H. Ising s.n.*, 3.viii.1955 (AD).

Notes

The collection of Tate (MEL, 9060) was cited incorrectly with the original description of *Podocoma nana* with the date 1893. The date of collection on the specimen is 1883.

Habitat data from herbarium labels would suggest that *I. nana* occurs mainly on clayey soils in areas liable to flooding. It has also been recorded from a variety of other sites including Mulga (*Acacia aneura*) communities in sandy loam, on desert loams and gibber plains.

5. **Ixiochlamys**? sp. nov.

The following collection possibly represents a new species. Although it is distinct from the four named species, one collection was considered inadequate for description. In general facies the plants resemble *I. nana*, having the small heads of that species and similar foliage. The main differences are in the achenes which in *Latz 4652* are hairy and have a shorter beak than is normal for *I. nana*.

NORTHERN TERRITORY: north west Simpson Desert, *P.K. Latz 4652*, 30.ix.1973 (AD, DNA, NT).

Acknowledgements

To Dr Hj. Eichler, Curator, Herbarium Australiense, I am grateful for the opportunity to work on this revision at his institution during October 1979. The help of the staff of Herbarium Australiense, particularly that of Mr Lyn Craven is gratefully acknowledged.

I would like to thank the heads of the following herbaria for the loan of material and, in the case of several herbaria, for the opportunity to visit their institutions: AD, ADW, BRI, CBG, MEL, NSW, NT, PERTH. To Dr A.A. Munir, Australian Botanical Liaison Officer, Kew, I owe my thanks for photographs of specimens at Kew and the British Museum. My thanks also to my wife Adrianne, for the illustrations.

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Index to Collections

In the following list the taxon to which each collection is referred is denoted by the initial letter of the specific name as follows: c = *Ixiochlamys cuneifolia*, f = *I. filicifolia*, i = *I. integerrima*, n = *I. nana*. Herbaria from which specimens have been seen are indicated by the usual acronyms.

Andrews s.n. (NSW):c. *Anon. s.n.* [n.d. (MEL, CANB), 1887 (MEL)]:c; *s.n.* (AD):c. *Ashby 4146* (AD): c. *Barker 216* (AD):c. *Beard 2807*, *4495* (PERTH), *6071* (NSW, PERTH):c. *Beauglehole 10546* (NT):c. *Beck s.n.* (AD):c. *Bennett s.n.* (AD): c. *herb. Black s.n.*, 1926 (AD):c; *s.n.*, 1920 (AD):n. *Blaxell 648* (NSW):c. *Burbidge s.n.* (CANB):n. *Burbidge & Gray 4137* (CANB):c; *4356* (CANB):f; *4348* (CANB):i. *Byrne s.n.* (MEL):c. *Caldwell s.n.* (NT):c. *Callen s.n.* (AD):c. *Carrodus s.n.* (AD):c. *Chippendale NT780* (ADW, CANB, NSW, NT), *NT2118* (MEL, NT):c; *NT2549* (NSW, NT), *NT2859* (DNA, NT), *NT2886* (NT), *NT7449* (CANB, NT):f; *NT 1456* (BRI, MEL, NSW, NT), *NT 6410* (AD, BRI, CANB, K, NT):i. *Cleland s.n.* [16, 26.viii.1931 (AD); 29, 30.v.1937 (AD); 15, 20, 23.ix.1956 (AD); 1957 (AD)]:c; *s.n.* [1932, 1933, 1951, 25.viii.1954, viii.1954 (AD)]:f. *Constable 4679*, *10778* (NSW):c. *Cooper s.n.* (AD):c. *Copley 2140* (AD):f. *Cornwall 84*, *282* (AD):c. *Crisp 154*, *223* (CBG), *554* (AD, CBG):n. *Cunningham & Milthorpe 1081*, *4016* (NSW):c; *1041*, *1347* (NSW):n. *De Beuzeville 66* (NSW):c. *Demarz 2421*, *4441*, *4460* (PERTH):c. *De Nardi 836* (NSW):c. *Dittrich s.n.* (MEL):c. *Donner 4487* (AD):f. *Dunlop 1416* (CBG):c; *2978* (NT):f. *?Eapea s.n.* (MEL):c. *Eichler 12560*, *17332* (AD):c; *17246*, *17254*, *17363*, *17515* (AD):f. *Fairall 1936* (PERTH):c. *Filson 3468* (AD):c. *Fox 7905012*, *7905046* (NSW):c. *Forrest s.n.* (MEL):c. *Gardner 3295* (PERTH):c. *George 8761B*, *8954* (PERTH):f. *C. Giles s.n.* (MEL):c. *E. Giles s.n.* (MEL):c. *Gittins 725* (BRI, NSW):i. *Henshall 947* (NT):c. *Hill 78*, *98*, *1145* (AD):c; *287* (AD):f; *244* (AD):n. *Hilton 1262*, *1454* (ADW):c. *Hutchinson 87* (PERTH):c. *Irvine s.n.* (MEL, NSW):c. *Ising 618* (AD), *s.n.* [1918, 1931, 1950 (AD), 3, 10.ix.1952 (AD), 1953 (ADW), viii.x.1955 (AD)]:c; *s.n.* [1931, 1950 (AD)]:f; *1570*, *3454* (AD), *s.n.* [8, 24.ix.1920 (AD); 1931, 1951 (AD); 9, 27, 30.viii.1952 (AD); vii.1955 (AD); 3, 12, 29.viii.1955 (AD)]:n. *Jacobs 1932* (NSW):c. *L. Johnson 648* (NSW):c. *U. Johnson NSW 128020* (AD, NSW):c. *Kemp s.n.* (MEL):c; *330* (MEL):f. *Kennedy s.n.* [1885, 1886 (MEL)]:c. *King s.n.* (MEL):c. *Koch 219* (AD, BRI, MEL, NSW):c; *347*, *348* (MEL, NSW):n. *Kraehenbuehl 13* (AD):c; *14* (MEL):f. *Kuchel 892*, *2679*, *2927*, *3112* (AD):c; *94* (AD):f. *Lander 80* (AD, NSW):c. *Lange 23* (AD):f. *Latz 1870* (BRI, NT, PERTH), *5235* (NT):c; *1756* (BRI, MEL, NSW, NT), *1796* (NT), *3148* (NT), *3163* (AD, CANB, K, NT, PERTH), *4135* (AD, NT), *4149*, *4281* (NT):f; *4193* (AD, NT), *4653* (AD, BRI, CANB, DNA, NT), *5125* (NT):n; *4652* (AD, DNA, NT):*sp. aff.* n. *Lawrie 1697* (NSW):c. *Lazarides 6119* (AD, BRI, CANB, MEL, NSW, NT):c. *Lothian 1050*, *3098* (AD):c; *1954* (AD):f; *1058* (AD), *1376* (AD, NT), *1623*, *2176* (AD):n. *Lullfitz & Fairall 2696* (PERTH):c. *Malony 4* (NSW, NT):c. *McLeod s.n.* (A.D.):c. *Mills s.n.* (AD):c. *Morris 321* (ADW, BRI), *261/22* (NSW), *780* (ADW, BRI), *4274/20* (NSW):c. *Mulham W510* (NSW):c. *Mueller s.n.* (MEL 9064, 9079):c. *Nelson 1551* (AD, NSW), *2157* (AD, CANB, NSW, NT):c; *2220* (DNA, NT), *2386* (NT):f; *2215* (ADW, DNA, K, NSW, NT, PERTH), *2225* (BRI, NT):n. *Nicholls 928* (AD, MEL, NSW, NT):f. *Orchard 714* (AD):f. *Osborn s.n.* [1925 (AD), 1928 (CANB, NSW)]:n. *Perry 5499* (CANB, NT):f. *Pickard 3127* (NSW):c. *Richards s.n.* (MEL):c. *Richley 1125* (AD):c; *F38* (AD):n. *Robjohns s.n.* (AD):c. *Rogerson 192* (PERTH):c. *Royce 7404* (PERTH):c. *Schodde 474* (AD, CANB):f. *herb. Schomburgk s.n.* (AD):c. *Setler 430* (ADW):c. *Sharrad 1401* (AD):c. *Sikkes 838* (CBG, NSW):c. *Sikkes & Ollerenshaw 933*, *958* (CBG):c. *Specht 2837* (AD):n. *Symon 1382*, *1433* (ADW), *6010* (AD), *6784* (AD, CANB), *7547* (AD), *9094* (AD, NSW), *9264* (AD), *11399*, *11416c* (ADW):c; *2178* (AD, ADW), *2190* (AD, ADW):f. *Tate s.n.* [vi.1883 (AD), viii. 1883 (MEL)]:c; *s.n.* (MEL):n. *Telfer 80* (AD):c. *Tepper 9*, *s.n.* (MEL):c. *Thompson NSW127693* (AD, NSW):c. *Thornton s.n.* (MEL):f. *Tietkens s.n.* (MEL):c. *Trapnell & Williams 167* (BRI):i. *Turvey 12908* (NSW), *s.n.* (AD, CBG):f. *Vasek 34* (CANB):f. *Warren 2506* (AD):c. *Weber 2580*, *2689* (AD):c. *Westoby 51* (NSW):n. *Whibley 1015*, *2287*, *3942*, *3984*, *5613* (AD):c; *1155* (AD):f.

White 96 (AD), *s.n.* [1915 (AD); 11, 13.x.1917 (AD); 1920 (AD)]:c; *88*, *s.n.* [vii.1914 (MEL); viii. 1914 (AD); 10.viii.1914 (AD)]:f. *Whitman ANU4064* (CANB):f. *Williams 6598* (AD):c. *Willis s.n.* [19.vii.1966 (MEL)]:c; *s.n.* (MEL):f. *Wilson 7344* (PERTH):f. *Winkworth 792* (BRI, NT):c; *1254* (CANB, NSW, NT):f. *Wittwer 1058* (PERTH):c.

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AN ANOMALOUS SOUTH AUSTRALIAN *HALORAGIS* (HALORAGACEAE)

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Abstract

Plants from South Australia formerly referred to *Haloragis digyna* are now considered to constitute a distinct species, *H. eyreana* Orchard, sp. nov. This species has a number of features unusual in the genus, amongst which are its single style and unilocular ovary. Flowers on all collections made so far are male sterile, and reproduction appears to be entirely vegetative. With removal of the South Australian populations, *H. digyna* is now considered to be endemic to southern Western Australia.

In a previous treatment of the genus *Haloragis* (Orchard, 1975), *H. digyna* Labill. was considered to extend in isolated populations from near Busselton in Western Australia to southern Eyre Peninsula in South Australia. More recently (Orchard, 1977) *H. digyna* was re-examined in relation to *H. hamata* Orchard, and the suggestion was made then that the South Australian plants of *H. digyna* were distinct in some respects from true *H. digyna* from Western Australia. More material of the South Australian plants is now available, and this, plus re-examination of other collections, shows that "*H. digyna*" of South Australia is distinct from Western Australian plants of the same name, and I propose the name *H. eyreana* for this species, which differs from other *Haloragis* taxa in a number of unusual characteristics.

Haloragis eyreana Orchard, sp. nov.

Herbae perennes 10-30cm alti, caudex stolonibus. *Caules* ascendentes arcuate, ramosi copiose, scabri sparsim trichomatibus ± conicis 0.05-0.1mm longis. *Folia* alterna linearia 0.5-2.0cm longa, 0.1-0.2cm lata, margines integri vel foliis infimis minime 1-2-dentatis, scabra. *Inflorescentia* spicata indeterminata, dichasiis florum 3-5 in axillas bractearum foliiformium primariarum. *Flores* 3-meri insidens pedicellis 0.1-0.2mm longis. *Sepala* 3, deltata, 0.7-0.8mm longa, 0.6mm lata, scabra. *Petala* 3, cucullata, carinata, 2.0mm longa, 0.7mm lata (carinis ad marginem), unguiculata, scabra. *Stamina* 6; filamenta 0.2mm longa; antherae anguste oblongae, 1.1-1.5mm longae, 0.2-0.3mm latae, indehiscentes. *Stylus* 1, conicus, 0.7mm longus; stigma alba, fimbriata. *Ovarium* obconicum, 0.5mm longum, 0.5mm latum, dense scabrum, 1-loculatum ovulo uno pendulo. *Fructus*, ubi praesens, irregulariter obpyriformis, 1.3-1.5mm longus (sepala exclusa), 0.8-1.0mm latus; semina 0.

Typus: *C. Ray Alcock 2553*, South Australia, Eyre Peninsula, road between Sections 13 & 16, Hundred of Cummins, 12.xi.1968. Holotypus: AD 96930327. Isotypus: ADW (Fig. 1).

Perennial *herbs* 10-30cm tall; rootstock stoloniferous. *Stems* arcuate ascending, freely branched, ± woody only at extreme base, smooth below, weakly ribbed in upper parts, sparsely scabrous with conical or upward-curving unicellular hairs 0.05-0.1mm long. *Leaves* alternate, linear, 5-20mm long, 1-2mm wide, margins entire, or some of the lowermost leaves very shortly 1-2-toothed, apex acute, veins indistinct, lamina sparsely scabrous, mainly on margins, with hairs as for the stems. *Inflorescence* spicate, indeterminate, with dichasia of up to 5 flowers in the axils of the primary bracts, but all except 1-3 flowers in each dichasium abort at an early stage. Primary bracts green, alternate, indistinguishable from the upper leaves. Secondary bracts straw-coloured, linear, 1.2-1.4mm long, 0.2mm wide, acute, scabrous on margins, deciduous. Tertiary and higher order bracts as for secondary bracts, but progressively smaller. *Flowers* predominantly 3-merous, on pedicels 0.1-0.2mm long. *Sepals* 3 green, deltoid, 0.7-0.8mm long, 0.6mm wide, scabrous. *Petals* 3, greenish-yellow tipped red, hooded, keeled, 2.0mm long, 0.7mm wide (keel to margin), unguiculate, scabrous on keel. *Stamens* 6; filaments 0.2mm long; anthers yellow, linear-oblong, 1.1-1.5mm long, 0.2-0.3mm wide,

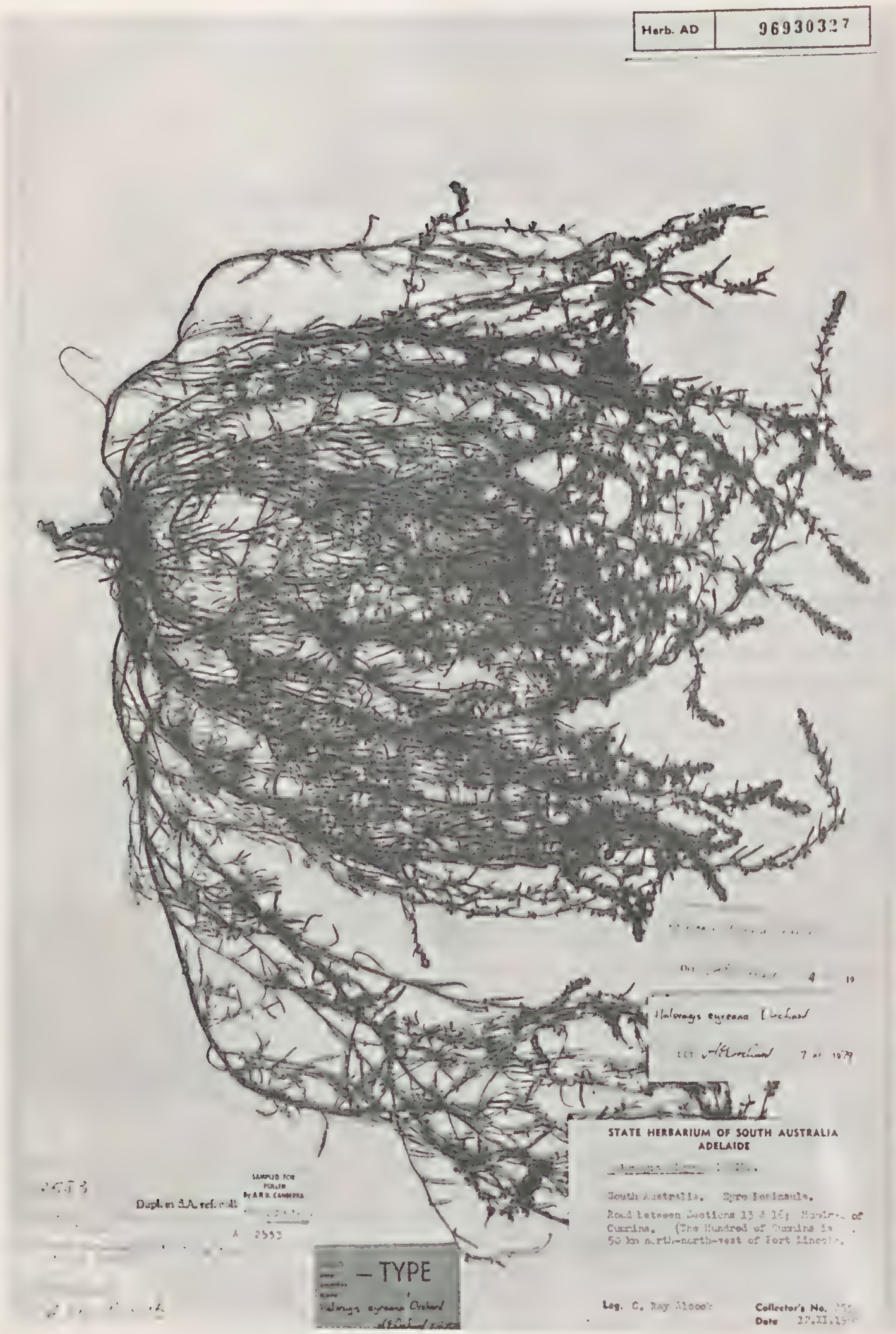

Fig. 1. Holotype of *Haloragis eyreana*. (*Alcock 2553*, AD).

antisepalous anthers ca 0.4mm longer than antipetalous ones, non-apiculate, apparently all indehiscent. *Style* 1, conical, 0.7mm long; stigma white, fimbriate, occupying upper 1/2 of style. *Ovary* obconical, 0.5mm long, 0.5mm diameter, densely scabrous; 1-locular with a single pendulous ovule. *Fruits* usually not formed, but if present somewhat irregular in shape, usually ± obpyriform, 1.3-1.5mm long (excluding the persistent sepals), 0.8-1.0mm diameter; seeds 0. (Fig. 2.)

Distribution

H. eyreana is endemic to South Australia, and is confined to an erea of a few square kilometres in the southern part of Eyre Peninsula between Cummins and Butler Tanks.

Ecology

All collections are from somewhat disturbed areas (roadside banks, railway culverts) usually on heavy clay-loam soils, in association with grasses. All of the plants collected so far are male sterile. The anthers develop fully but do not dehisce. Pollen from the type collection (*Alcock 2553*) was mounted during a pollen survey conducted by the Research School of Pacific Studies, Australian National University in 1972. A duplicate slide held at AD has been examined on my behalf by Dr J.P. Jessop, who reported that the grains measured 16-26µm and most appeared as if they had contained cytoplasm. This size is smaller than the range for most *Haloragis* species, but well within the range of *Gonocarpus* species. Style and stigma development appears to be normal, and an apparently functional ovule is formed in the ovary. In most plants there is no expansion of the ovary after anthesis, but in some an occasional flower will give rise to a pseudo-fruit. The ovary increases in size to form an apparently normal (if somewhat irregular) fruit, but these "fruits" contain no seed, only the shrivelled remains of the unfertilised ovule. Reproduction in this plant is therefore apparently entirely vegetative by means of its deep stoloniferous rootstock. Flowering and "fruiting" occur from October to January.

Specimens examined

SOUTH AUSTRALIA: *Alcock C17A*, SAR culvert, Cockaleechie Rd, ca 8km from Cummins, 30.x.1964 (AD). - *Alcock 2553*, road between Sections 13 & 16, Hundred of Cummins, 12.xi.1968 (AD). - *Copley 2459*, ca 6km west of Butler Tanks, 25.i.1969 (AD). - *Copley 2978*, 16 miles east of Yeelanna, 1.i.1970 (AD). - *Orchard 2993*, ca 13km west of Ungarra on road to Yeelanna, 30.xii.1970 (AD, AK).

Comments

A minor change is necessary to the key to *Haloragis* in Orchard (1975) to accommodate this species. On page 67, the result of the second lead number 29 should be changed from "24. *H. digyna*" to "22a. *H. eyreana*". The second occurrence of *H. digyna* in the key (lead 30) remains unchanged. Figure 157 (Orchard, 1975) is *H. eyreana*, Figure 158 is *H. digyna*.

This is an unusual plant for several reasons. Whilst its unilocular ovary might suggest that it should be referred to *Gonocarpus*, the dichasia of up to 5 flowers, the lack of a columella in the ovary, and the increase in size of the ovary in the formation of the "fruit", all point to the fact that this is a *Haloragis* species with a very reduced flower. The stoloniferous rootstock and relatively thick ovary wall support this conclusion.

The apparently complete male sterility in this species has not been found in any other *Haloragis* species. In *Gonocarpus* several species have occasional male sterile plants in populations of otherwise normal hermaphrodite-flowered plants (Orchard, 1975) but none are known in which all plants have non-functional anthers.

Most flowers in this species are basically 3-merous, as described above. However, in *Orchard 2993* some flowers are 4-merous, but here the functional arrangement of the flowers has broken down even further. All flowers, both 3- and 4-merous, lack styles, and

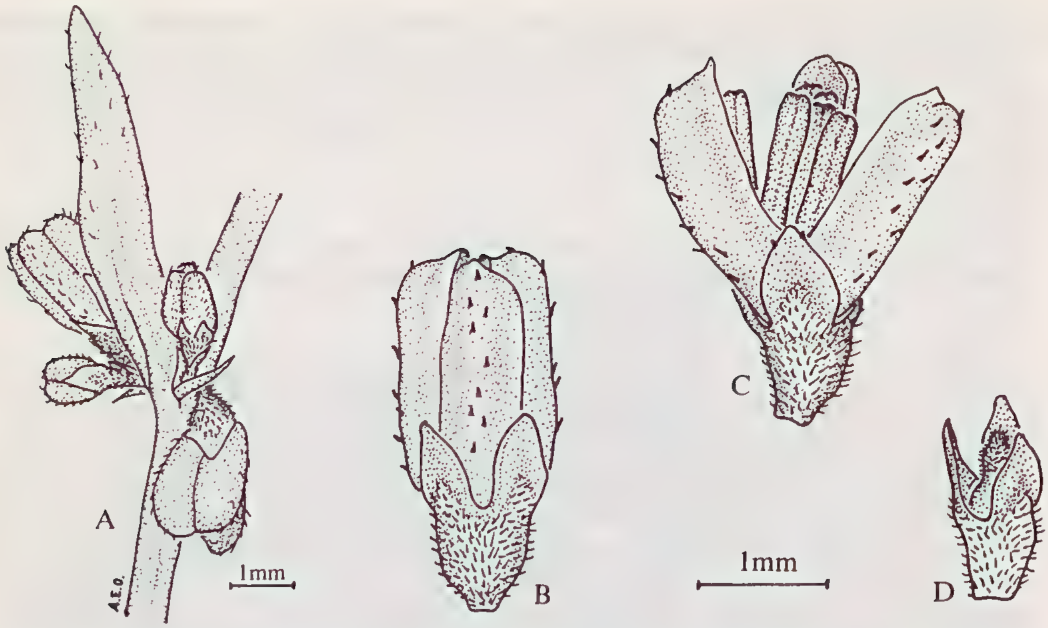

Fig. 2. *Haloragis eyreana*. A, portion of inflorescence, showing flowers in the axil of a primary bract; B, flower just before anthesis; C, flower at anthesis showing fully developed but indehiscent anthers; D, the same with petals and stamens removed to show the single style. (All from *Alcock 2553*).

the anthers are indehiscent. In the 4-merous flowers some of the anthers are vestigial while others grow to more or less normal size, and in some flowers the subtending bracts are fused to the ovary. The filaments on many of the anthers are short and deformed or twisted.

The relationships of this species seem to lie with the *H. aspera* complex, and in habit, leaf form, rootstock and "fruit" shape, *H. eyreana* comes closest to *H. heterophylla* Brongn., but is distinct in indumentum and flower structure. Despite the similarity in the reduction of the flower, the relationship between *H. eyreana* and *H. digyna* is probably not close. The nearest populations of *H. heterophylla* to *H. eyreana* are in the Mt Lofty Ranges, and it is conceivable that *H. eyreana* represents an isolated outlier of *H. heterophylla* which has evolved in isolation over a long period along the path to vegetative reproduction because of a breakdown in meiotic organisation.

The conservation status of this species must be assessed as endangered. No populations are known to occur inside National Parks, and all recorded collections come from areas subject to disturbance. The absence of sexual reproduction precludes the long distance dispersal and establishment of the species in safer localities, except via human agency.

With the description of the South Australian plants of *H. digyna* (*sensu* Orchard, 1975) as *H. eyreana*, the former species (*s.str.*) is now considered to be endemic to southern Western Australia.

Acknowledgements

I acknowledge with thanks the assistance of Dr J.P. Jessop who kindly examined the pollen slide of *Alcock 2553* on my behalf, and also made available to me on loan the AD collections cited in the text. The photograph of the holotype was made by the Photography Section, University of Tasmania.

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

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FIVE NEW SPECIES OF *EREMOPHILA* (MYOPORACEAE) FROM WESTERN AUSTRALIA

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Abstract

Five new species of *Eremophila*, namely *E. falcata*, *E. linearis*, *E. punctata*, *E. spinescens* and *E. undulata* are described from central Western Australia. Each species is illustrated and distribution maps are provided.

Introduction

When I published an account of a number of new species of *Eremophila* from central and Western Australia (Chinnock, 1979) it was partly in preparation for the Myoporaceae treatment in the forthcoming "Flora of Central Australia". At that time I had been aware of five other undescribed species from the central Western Australian region but due to the inadequacies of the available collections I delayed publishing the species until I had visited the region. In most cases information on fruit characters were lacking and in addition *E. falcata* and *E. undulata* were only known from two collections each.

During September-October last year the region where these species occur was visited and existing collections were supplemented by additional collections and field data.

Herbarium abbreviations follow Holmgren and Keuken (1974) except for Kings Park Herbarium, Perth, which is designated KP.

1. **Eremophila falcata** Chinnock sp. nov.

Frutex viscidus glaber glandulifero-punctatus; *foliis* alternis falcatis crassis viscidis; *sepalis* non imbricatis obovatis vel spathulatis obtusis extra glabris interne glandulifero-papillatis; *corolla* alba vel purpurascento-rosea villosa, lobis obtusis; *staminibus* glabris; *ovario* ovoideo glandulifero-pubescenti, pilis longioribus villosi; *stylo* glabro; *fructu* ovoideo lateraliter compresso. (Fig. 1)

Type: *R.J. Chinnock 4807*, 19.3 km SW of Mt Vernon, 24.ix.1979, fl.fr. (holotype: AD; isotypes: CANB, PERTH).

Glabrous glandular-papillate viscid shrub to 2 m. *Branches* whitish-grey, distinctly flattened in young parts but eventually terete, with prominent tubercles restricted to short ribs which extend from the leaf bases down the branch, glabrous. *Leaves* alternate, sessile, thick, falcate or more rarely linear and sigmoid in outline, mucronate, margins entire, (15-) 19-31 (-36) x (1-) 2-5.5 (-6.5) mm, viscid, shiny. *Flowers* 1-2 (-4) in the leaf axils, pedicellate; pedicel 2.5-4.5 mm, slightly compressed. *Sepals* 5, not imbricate, obovate to spathulate, obtuse, enlarging slightly after flowering, 2.2-5.5 x 0.7-2 (-2.6) mm, glabrous outside except for the sparsely ciliate margins, densely glandular-pubescent inside. *Corolla* 10-18 mm, white to pale purplish-pink, the lowermost lobe spotted yellow to brownish-yellow; upper four lobes obtuse, lowermost one dilated and emarginate; villous outside often with numerous shorter glandular hairs; the lowermost lobe densely villous inside extending down the tube to the base of the stamens. *Stamens* 4, included; filaments and anthers glabrous. *Ovary* ovoid, 1.8-2.5 x 0.8-1.5 mm, finely glandular-pubescent with longer villous hairs particularly towards the base; style glabrous. *Fruit* dry, crustaceous, ovoid, beaked, laterally compressed, (3.5-) 4-6 x 2-2.7 mm, viscid, indumentum as for ovary. *Seed* unknown.

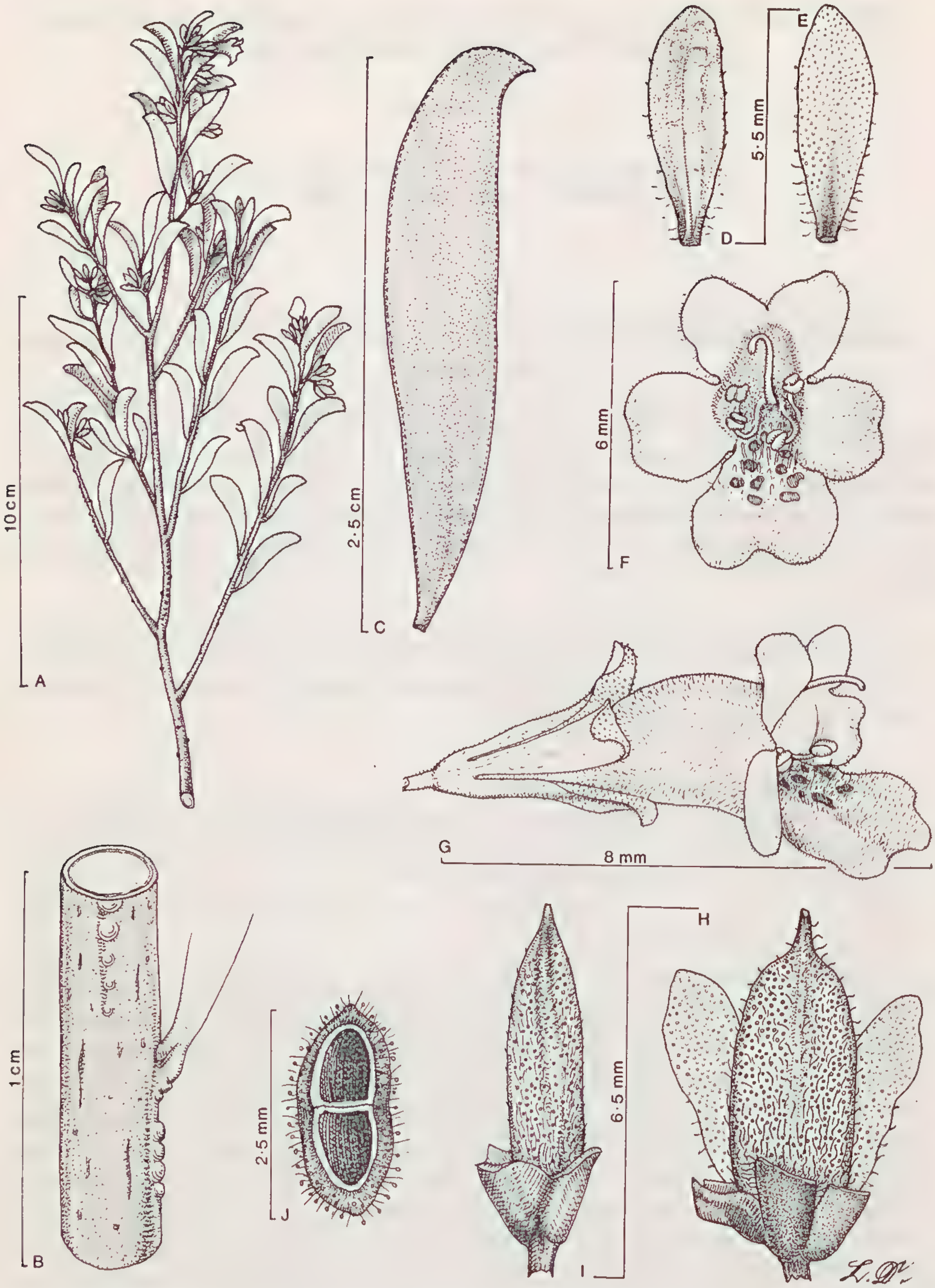

Fig. 1. *E. falcata* Chinnock. A, habit; B, enlargement of stem showing position of tubercles; C, leaf; D, E, outer and inner surface of sepal; F, G, front and side view of corolla; H, I, front and side view of fruit; J, cross-section of fruit showing the two loculi. (A-D, H-J, *Mitchell 223*, E, F, *Chinnock 4807*).

Epithet derivation

The specific epithet is taken from the leaf shape.

Distribution

Extending in a narrow band from south of Neale Junction through the Carnegie Salient to the vicinity of Mt Vernon on the southern side of the Hamersley Range (Map 1).

Specimens examined

WESTERN AUSTRALIA: *R.J. Chinnock 3921*, 30.1 km SE of Mt Vernon HS, 10.ix.1977 (AD); *R.J. Chinnock 4507*, 118 km N of Rawlinna, 5.ix.1979 (AD); *R.J. Chinnock 4509*, 201.5 km N of Rawlinna, 6.ix.1979 (AD); *R.J. Chinnock 4541*, 140 km W of Neale Junction, 8.ix.1979 (AD); *R.J. Chinnock 4547*, Yeo Camp, 167.2 km W of Neale Junction, 8.ix.1979 (AD); *R.J. Chinnock 4629* 2.4 km N of Paddy's Well, 13.ix.1979 (AD); *R.J. Chinnock 4665*, 47.2 km NE of Prenti Downs, 15.ix.1979 (AD); *R.J. Chinnock 4808*, 19.3 km SW of Mt Vernon, 24.ix.1979 (AD); *R.J. Chinnock 4821*, 54.2 km SE of Mt Vernon, 25.ix.1979 (AD); *A.S. George 8464*, c. 145 miles N of Rawlinna, 12.x.1966 (PERTH); *A.A. Mitchell 223*, Mt Vernon Station, Sept. 1976 (PERTH).

Affinities

Eremophila falcata is closely allied to *E. paisleyi* F. Muell. *E. sturtii* R.Br and *E. mitchellii* Benth. of the central and eastern states and these together with a number of other undescribed species in South and Western Australia form a well-defined group of glabrous broom-like shrubs. The most distinctive features of *E. falcata* are the falcate leaves and the whitish-grey branches with prominent tubercles on short ribs, which extend down the branch from the leaf bases.

Ecology

E. falcata is usually associated with open *Acacia aneura* Benth. (mulga) woodland on red-brown clay loams over limestone. Other commonly associated species include *Atriplex vesicaria* Hew.ex Benth., *Maireana sedifolia* (F. Muell.) Wilson, *Cassia* spp. and *Eremophila* spp., especially *E. alternifolia* var. *latifolia* Benth. and *E. latrobei* F. Muell.

In the north-western part of its range in the Mt Vernon region, *E. falcata* is usually the dominant shrub where it occurs. Here it appears restricted to a number of isolated pockets on stony rises in *Eremophila*/*Cassia* shrubland.

2. **Eremophila linearis** Chinnock sp. nov.

Eremophila duttonii auctt: J.S. Beard, West.Austr.Pl.120(1965); B.J. Grieve and W.E. Blackall, West. Austr.Wildfls 4: 652(1975). *E. duttonii* "subspecies parvifolia" Barlow, Aust.J.Bot.19: 296, 299 (1971).

Frutex vel arbor parva viscida glabra; *ramis* maxime viscidis; *foliis* alternis linearibus integris manifeste glandulifero-punctatis; sepalis ovatis acutis; *corolla* rubra extra glabra; *staminibus* gynoecioque glabro; fructu late ovoideo manifeste rostrato. *Chromosomatum numerus*: n = 18. (Fig. 2)

Type: *R.J. Chinnock 4663*, 20.7 km ENE of Prenti Downs, 15.ix.1979, fl.fr. (holotype: AD; isotypes: CANB, K, MEL, PERTH).

Viscid glabrous shrub or small tree 1-4 m. *Branches* fine, 0.5-1 mm diameter, slightly compressed in the younger parts, extremely viscid and usually thickly coated with resin, glabrous, leaf bases persistent. *Leaves* alternate, sessile, densely clustered, linear, acute, entire, prominently glandular-punctate, (16-) 17-23 (-27) x (1.1) 1.2-1.8 (-2.3) mm, glabrous, extremely viscid. *Flowers* solitary, pedicellate; pedicel 9-15 mm, sigmoidly curved, glabrous. *Sepals* 5, imbricate, appressed to corolla, reflexed in fruit, ovate, acute to acuminate, sometimes uncinate, surface ± rugose, enlarging slightly at fruiting stage but not becoming scariose or reticulate, (4-) 5.5-9 (-11) x (3-) 4-6 (-6.5) mm, glandular-papillate, glabrous. *Corolla* 25-30 mm, red above, orange to yellow below, the tube yellow inside, unspotted; upper lobes acute, lowermost lobe broadly acute to obtuse, mucronate; viscid; glabrous outside, the tube inside with long interlacing woolly hairs

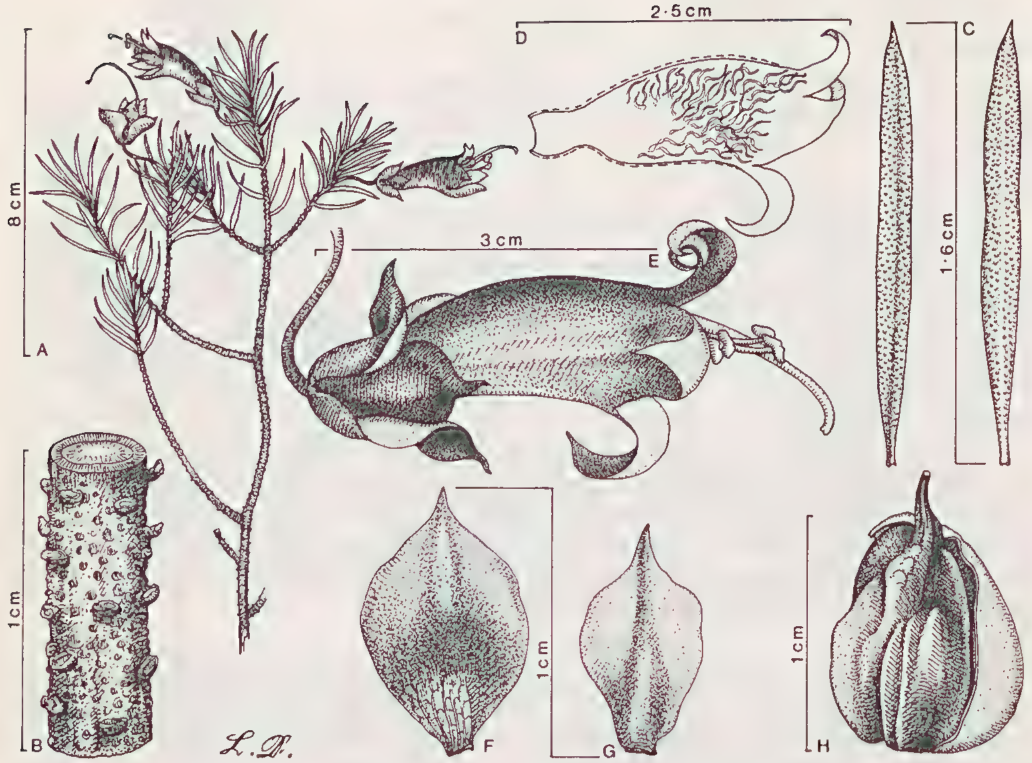

Fig. 2. *E. linearis* Chinnock. A, habit; B, enlargement of branch; C, upper and lower view of leaf surface, respectively; D, longitudinal view of corolla to show hairs on inside of corolla tube; E, side view of flower; F, G, sepals, inner and outer surface respectively; H, side view of fruits with portion of exocarp removed to show the prominently winged endocarp. (A-G, *Chinnock 3972*; H, *Gardner s.n.*, 15 km N of Meekatharra).

extending to the base of the lobes, lobes otherwise glabrous. *Stamens* 4, exserted, glabrous. *Ovary* ovoid, 3-4 x 1.5-2 mm, viscid, glabrous; style glabrous or sparsely hirsute. *Fruit* broadly ovoid, prominently beaked, 8-13 x 8-10 mm, exocarp grey, papery, endocarp prominently 6-winged. *Chromosome number*: n = 18 (Barlow 1971).

Epithet derivation

Taken from the leaf shape which is very uniform in this species.

Distribution

Widespread in central Western Australia, especially in the Meekatharra-Wiluna region (Map 2).

Representative collections (total seen 34)

WESTERN AUSTRALIA: *T.E.H. Aplin 2436*, 29 km W of Wiluna, 22.viii.1963 (PERTH); *W.R. Barker 1928*, 3 km WNW of Paddy Well, Yelma station, 14.viii.1977 (AD); *B.A. Barlow 1642*, 18 km N of Meekatharra, 23.vi.1969 (AD); *J.S. Beard 6552*, 26 miles N of Barwidgee, 13.xi.1973 (PERTH); *R.J. Chinnock 848*, near James Pool, Windidda Station, 6.ix.1973 (AD); *R.J. Chinnock 4686*, 15.3. km NE of Carnegie, 16.ix.1979 (AD); *R.J. Chinnock 4733*, 19.7 km NW of New Springs, 19.ix.1979 (AD); *R.J. Chinnock 4748*, Gascoyne River, middle arm, 65.5. km S of Kumarina, 19.ix.1979 (AD); *A.S. George 5565*, 21 miles W of Carnegie, 27.vii.1963 (PERTH); *J. Morrissey 17*, Wiluna, Dec. 1970 (PERTH); *N.H. Speck 1138*, 38 miles NE of Meekatharra, 5.viii.1958 (CANB, MEL); *H & E Walter 385*, SE of Wiluna, 1.ix.1958 (B); *P.G. Wilson 7445*, 6 km S of Bilgarrie Cutarrie Bore, 28.viii.1968 (PERTH).

Affinities

This species has previously been included within the circumscription of *Eremophila duttonii* F. Muell., a very closely related widespread species in the eastern and central states, which just extends over the border into Western Australia in the Warburton region, where it appears to be very rare.

Eremophila linearis is distinguished from *E. duttonii* by its more dense and finer glabrous leaves and branches and glabrous pedicel and corolla (outside). In addition plants of *E. linearis*, except old tall ones, have a broom-like habit similar to *E. scoparia* (R.Br.) F. Muell. and *E. pantonii* F. Muell., quite unlike *E. duttonii*, which has a more rigid spreading habit.

Ecology

Eremophila linearis favours heavy red-brown clay loams in areas subject to flooding such as clay depressions, river flats or outwash plains.

It is frequently associated with open mulga (*Acacia aneura*) woodland or *Eremophila*/*Cassia* scrubland including *Eremophila fraseri* F. Muell., *E. delisseri* F. Muell., and *E. margarethae* S. Moore.

3. **Eremophila punctata** Chinnock sp. nov.

E. sp. 5 Barlow, Aust.J.Bot.19: 296(1971).

Frutex viscidus; *ramis* glandulifero-pubescentibus; *foliis* oblanceolatis crenatis vel serratis apices versus manifeste glandulifero-punctatis glabris praeter pilos disperso ad bases marginesque: *sepalis* imbricatis lanceolatis vel late depresso-obovatis acutis glandulifero-pubescentibus; *corolla* lilacina et purpurea sparsim pilosa; *staminibus* glabris; *ovario* styloque villoso; fructu late ovoideo reticulatim costato. *Chromosomatum numerus*: n = 18. (Fig. 3)

Type: *R.J. Chinnock 4680*, 57.2 km NE of Carnegie near the Gunbarrel Highway, 16.ix.1979, fl.fr. (holotype: AD; isotypes CANB, K, MEL, NT, PERTH).

Erect, viscid shrub 0.5-1.5 m. *Branches* weakly ribbed, glandular-pubescent, leaf bases persistent ± appressed. *Leaves* alternate, sessile, thick, spreading, oblanceolate with the base cuneate and the apex obtuse; margins irregularly serrate or crenate towards the apex or rarely entire; surfaces prominently glandular-punctate; (5-) 9-16 (-26) x (1.5-) 1.8-3.5 (-5.7) mm, glabrous except for a few glandular hairs towards the base and on the margin.

Flowers solitary or rarely paired, pedicellate; pedicel (3-) 4.2-20 (-25) mm, glandular-pubescent. *Sepals* 5, imbricate, green to purple, lanceolate to ovate to very widely depressed obovate, the inner ones slightly narrower, apex acute, (7.5-) 10-16 (-20) x (2.5-) 3.4-9 (-13) mm, glandular-pubescent on both surfaces. *Corolla* 20-30 mm, pale lilac to purple, the tube inside cream spotted purple; lobes acute; sparsely hairy outside, densely hairy within the tube, the lobes glabrous inside. *Stamens* 4, glabrous. *Ovary* ovoid to oblong, 2.5-3.2 x 101.8 mm, villous; style villous except in the uppermost part. *Fruit* dry, broadly ovoid, splitting towards the apex, reticulately ribbed, 5.5-6.5 x 4.3-5.5 mm, villose. *Chromosome number*: n = 18 (Barlow 1971).

Epithet derivation

The epithet is taken from the prominently punctate nature of the leaves.

Distribution

Eremophila punctata is endemic to Western Australia extending from the Great Victoria and southern Gibson Deserts westwards to near Meekatharra (Map 3).

Fig. 3. *E. punctata* Chinnock. A, habit; B, enlargement of branch; C, upper surface of leaf; D-F, variations in leaf apices; G, side view of flower; H, gynoecium; I, sepal; J, K, side and cross-section of fruit (A-C, G-I, *R.J. Chinnock 782*, D, J-K, *Gardner 7872*, E, *Barlow 1823*, P, *Speck 1190*).

Representative specimens (total seen 23)

WESTERN AUSTRALIA: *B.A. Barlow 1828*, 42 miles W of Wiluna, 29.vi.1970 (AD); *A.C. Beauglehole 60075 and E.G. Erray 3775*, 372 km NE of Laverton on the Warburton road, 17.ix.1978 (AD); *R.J. Chinnock 782*, Beru Pool, Yelma Station, 5.ix.1973 (AD); *R.J. Chinnock 4546*, 137.8 km W of Neale Junction, 8.ix.1979 (AD); *R.J. Chinnock 4651, 4652*, von Truer Tableland, 11.6 km S of Prenti Downs, 15.ix.1979 (AD); *R.J. Chinnock 4676*, hills 87.6 km NE of Carnegie, 16.ix.1979 (AD); *A.R. Fairall 2034*, summit of Mt Everard, 27.vii.1966 (KP, PERTH); *C.A. Gardner 7872*, 36 miles E of Meekatharra, 16.x.1945 (PERTH); *N.H. Speck 1139*, Glengarry Range, 5 miles SE of Mooloogool Homestead, 5.vii.1958 (CANB); *N.H. Speck 1418*, 2 miles S of Lorna Glen Homestead, 10.ix.1958 (CANB, PERTH); *P.G. Wilson 7365*, 56 km NE of Bandya Homestead, 27.viii.1968 (PERTH).

Affinities

Features of the flower including the large imbricate sepals, the corolla structure and the villous ovary and fruit clearly ally this species to *E. granitica* S. Moore. It differs by its flat, oblanceolate, prominently glandular-punctate leaves which are usually crenate or serrate towards the apex and the much smaller ovoid fruit.

Ecology

In the situations in which I have observed this species it has always occurred on skeletal clay loams in rocky situations, especially on breakaways.

4. **Eremophila spinescens** Chinnock sp. nov.

Frutex humilis divaricatus; *ramis* spinescentibus; *foliis* alternis sessilibus oblanceolatis integris vel aliquot dentibus; *sepalis* imbricatis ellipticis vel obovatis glabris, glandulifero-pubescentibus vel hirsutis; *corolla* caerulea vel atropurpurea; vittis duobus prominentis nigro-purpureis secus tubum extensis; *ovario* ovoideo villosis; *stylo* glabro vel hirsuto; *fructu* ovoideo vel subgloboso villoso. (Fig. 4)

Type: *R.J. Chinnock 4683*, 24.4 km NE of Carnegie Homestead, 16.ix.1979, fl.fr. (holotype: AD, lowermost specimen; isotypes: AD, CANB, K, MEL, NT, PERTH, US).

Low divaricate spinescent shrub 0.3-0.5 m tall. *Branches* terete, the tips becoming spinescent, hairy with long, stiff, white hairs interspersed with numerous, shorter, glandular ones. *Leaves* alternate, sessile, green to green-tinged-purple, linear to oblanceolate, entire or sometimes with a few scattered teeth, often fascicled on short lateral branches, deciduous during drought, (2.5-) 3.3-19 (-25) x (0.5-) 0.8-2.6 (-3.8) mm, sparsely hairy. *Flowers* solitary, pedicellate; pedicel hirsute, glandular-pubescent or glabrous. *Sepals* 5, imbricate, green to blackish-purple, unequal, elliptic to obovate, obtuse or acute, (3.5-) 4-8 (-8.7) x (1.8-) 2.1-3.3 (-3.8) mm, hirsute, glandular-pubescent or glabrous outside, glandular-pubescent within. *Corolla* 15-20 mm, pale blue to dark purple, the tube inside cream with two broad blackish-purple bands extending down the tube from the base of the lateral lobes; upper lobes broadly acute, lowermost lobe dilated, obtuse, densely villous, glandular-pubescent to almost glabrous outside, the lobes glabrous within, the tube densely hairy on the upper side and around the base of the stamens. *Stamens* 4, included; filaments sparsely hirsute; anthers glabrous. *Ovary* ovoid, 2.5-4 x 1-2 mm, densely villous; style hirsute or glabrous. *Fruit* subglobular, 4.5-7 mm, villous.

Epithet derivation

The specific epithet alludes to the spinescent habit of the species.

Distribution

Eremophila spinescens is widespread throughout the Carnegie salient and extending to the edge of the Gibson Desert (Map 4).

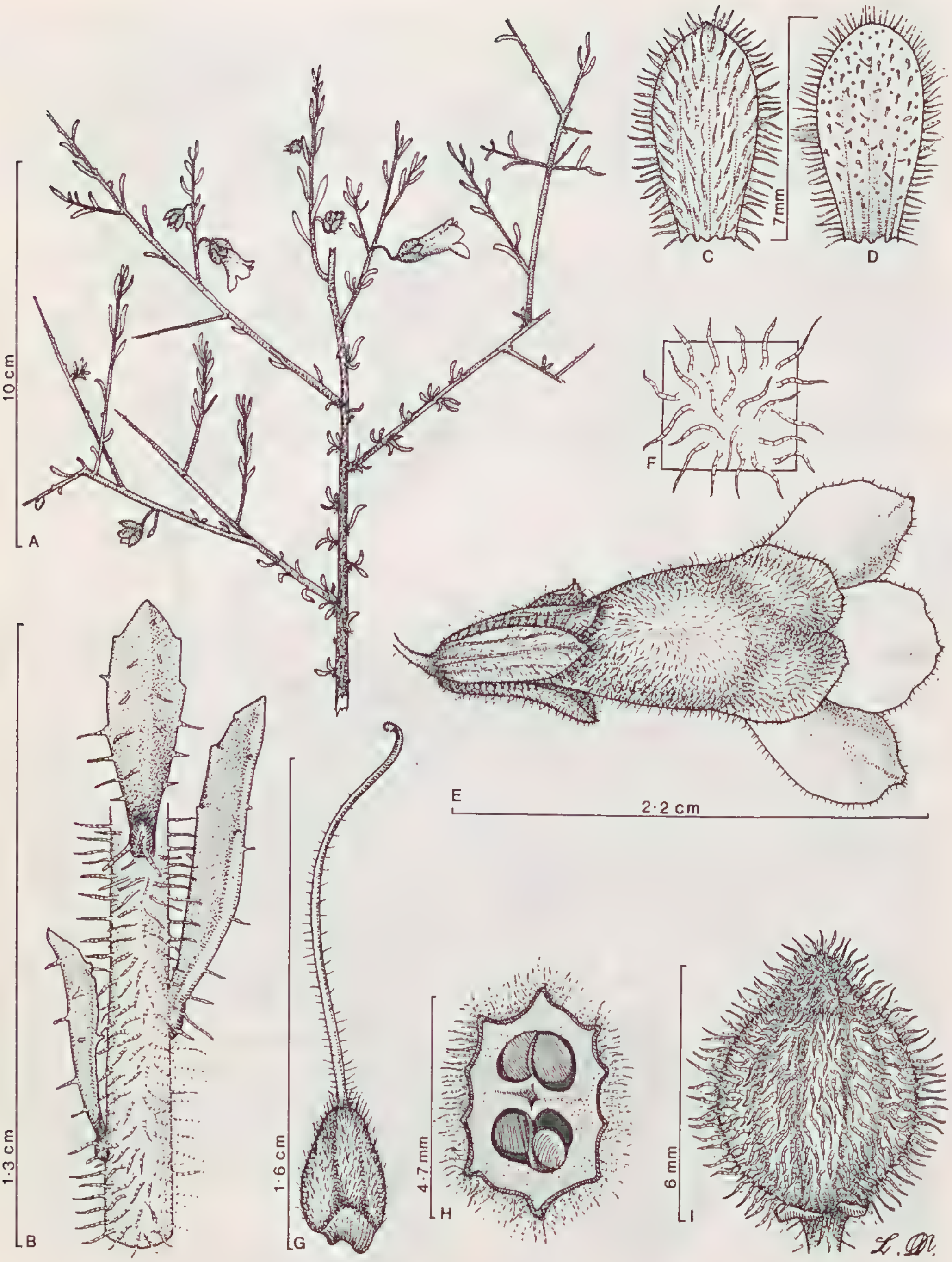

Fig. 4. *E. spinescens* Chinnock. A, habit; B, enlargement of branch with leaves; C, D, outer and inner surface of sepal; E, upper view of flower; F, corolla hairs; G, gynoecium; H, I, cross-section and side view of fruit. (A-I, *George 5520*).

Specimens examined

WESTERN AUSTRALIA: *W.H. Butler s.n.*, Lake Naberu, Aug. 1964 (PERTH); *R.J. Chinnock 760*, Beru Pool, 5.ix.1973 (AD); *R.J. Chinnock 4596*, 16.1 km S of Wiluna, 12.ix.1979 (AD); *R.J. Chinnock 4600*, 74.6 km ESE of Wiluna, 12.ix.1979 (AD); *R.J. Chinnock 4614*, 131 km E of Wiluna, 12.ix.1979 (AD); *R.J. Chinnock 4623*, Beru Pool, 13.ix.1979 (AD); *R.J. Chinnock 4632*, 12 km E of Windidda, 13.ix.1979 (AD); *R.J. Chinnock 4715*, 8.4 km NE of Earaheedy, 17.ix.1979 (AD); *R.J. Chinnock 4716*, 10.3 km NE of Granite Peak, 17.ix.1979 (AD); *R.J. Chinnock 4740*, 27.7 km E of Great Northern Highway on Ned's Creek road, 19.ix.1979 (AD); *A.R. Fairall 1966*, 61.1 miles Wongawal to Carnegie Station, 26.vii.1966 (KP); *C.A. Gardner 7931*, 11 miles S of Wiluna, 17.x.1945 (PERTH); *A.S. George 5520*, 14 miles E of Carnegie Homestead, 27.viii.1963 (PERTH); *N.H. Speck 1348*, Barwidgee road, 7 miles S of Yelma, 1.ix.1958 (CANB, PERTH). *P.G. Wilson 7400*, near Colurabi Hills, c. 195 km N of Laverton, 28.viii.1968 (PERTH).

Affinities

This species is allied to *E. battii* F. Muell. It differs in having spinescent branches, the presence of glandular hairs on the branches, pedicels and sepals and the linear to linear-oblanceolate flattened leaves.

Ecology

Eremophila spinescens is common throughout the Wiluna-Lake Carnegie region in depressions or on the margins of salt lakes on light brown to red-brown clay loams. It is usually associated with *Frankenia* spp., *Hemichroa* sp., *Eremophila pterocarpa* W.V. Fitzg. and chenopodiaceous shrubs including *Rhagodia spinescens* R.Br., *Arthrocnemum* spp., *Maireana* spp. and *Sclerolaena* spp.

5. **Eremophila undulata** Chinnock sp. nov.

Frutex parvus; *ramis* pilis longis albis ramosis vestitis; *foliis* alternis petiolatis, lamina undulata stellato-pubescenti; *sepalis* imbricatis ovatis vel ovato-oblongis, pilis longis simplicibus ramosisque tectis; *corolla* virello-brunnea glandulifero-pubescenti, lobis acutis; *staminibus* exsertis glabris; *ovario* oblongo glabro; *fructu* subgloboso glabro. (Fig 5)

Type: *A.S. George 11939*, 88 km S of Neale Junction, Great Victoria Desert, Western Australia, fl. immature fr. (holotype: PERTH; isotype: CANB).

Small shrub to 0.5 x 1 m. *Branches* terete, densely clothed with long white branched hairs and shorter substellate ones, leaf bases persistent. *Leaves* alternate, distinctly petiolate, petiole 5-11 mm, terete, clothed with long, white, branched hairs; lamina oblong to elliptic, undulate, margins repand, apex obtuse, (20-) 22-30 (-33) x (5-) 6-10 mm, stellate-pubescent. *Flowers* solitary, pedicellate; pedicel terete, sigmoid, 12-17 mm, clothed with long, simple and branched, white hairs. *Sepals* 5, imbricate, ovate to ovate-oblong, enlarging slightly after flowering, 6.5-8.5 x 2.5-4 mm, covered outside with long, simple and branched, white hairs. *Corolla* 15-20 mm, greenish-brown to yellowish-green, lobes acute, the lowermost one reflexed, glandular-pubescent outside and within. *Stamens* exserted, glabrous. *Ovary* oblong, obtuse, glabrous; style glabrous. *Fruit* dry, sub-globular, 6-7 mm long and broad, exocarp papery, endocarp irregularly ribbed ± reticulate, 2 ribs often larger, wing-like.

Epithet derivation

The specific epithet refers to the undulate lamina, a feature of this species.

Distribution

Eremophila undulata is known only from the Great Victoria Desert S of Neale Junction on the Rawlinna road (Map 4).

Specimens examined

WESTERN AUSTRALIA: *R.J. Chinnock 4510*, 249.3 km N of Rawlinna, 6.ix.1979 (AD); *B.C. Crisp 58*, c. 16 km S of Neale Junction, 22.v.1974 (AD).

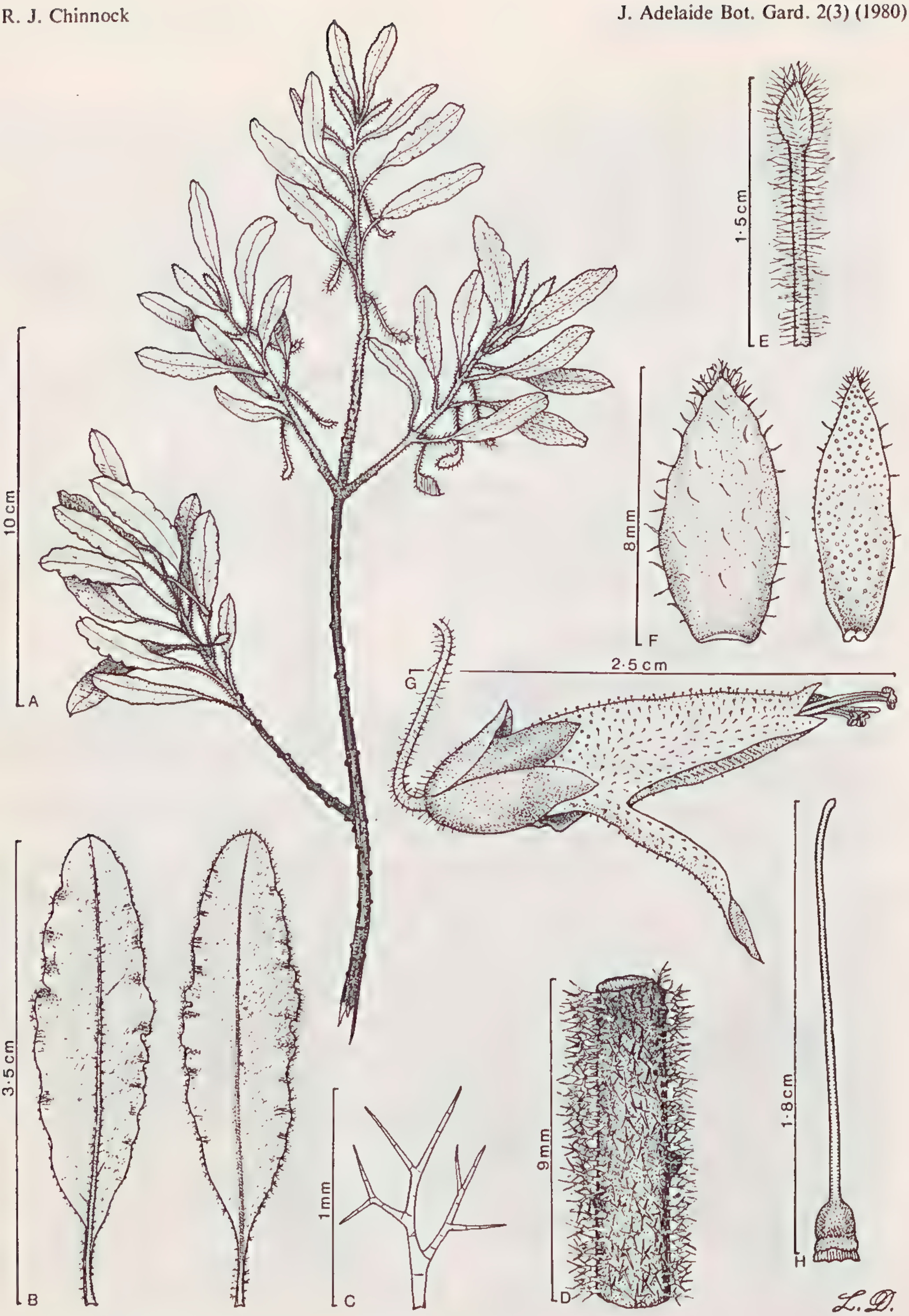

Fig. 5. *E. undulata* Chinnock. A, habit; B, lower and upper surface of leaf respectively; C, branched hair of stem; D, enlargement of branch to show hairs; E, flower bud; F, outer and inner surface of sepals; G, side view of flower; H, gynoecium. (based on type).

Affinities

Eremophila undulata is closely allied to *E. serrulata* (A. Cunn. ex A.DC.) Druce. It differs in its smaller compact habit, the long, white, branched and simple hairs on the branches and sepals and the undulate lamina with prominent stellate hairs.

Ecology

This species is known only to grow on red-brown clay loams in mulga woodland where it is very common under the trees and in open situations amongst spinifex (*Triodia* sp.).

Acknowledgements

I wish to thank Mr Ludwik Dutkiewicz for preparing the illustrations and Dr John Jessop and Dr Bryan Barlow for their interest in the preparation of this paper.

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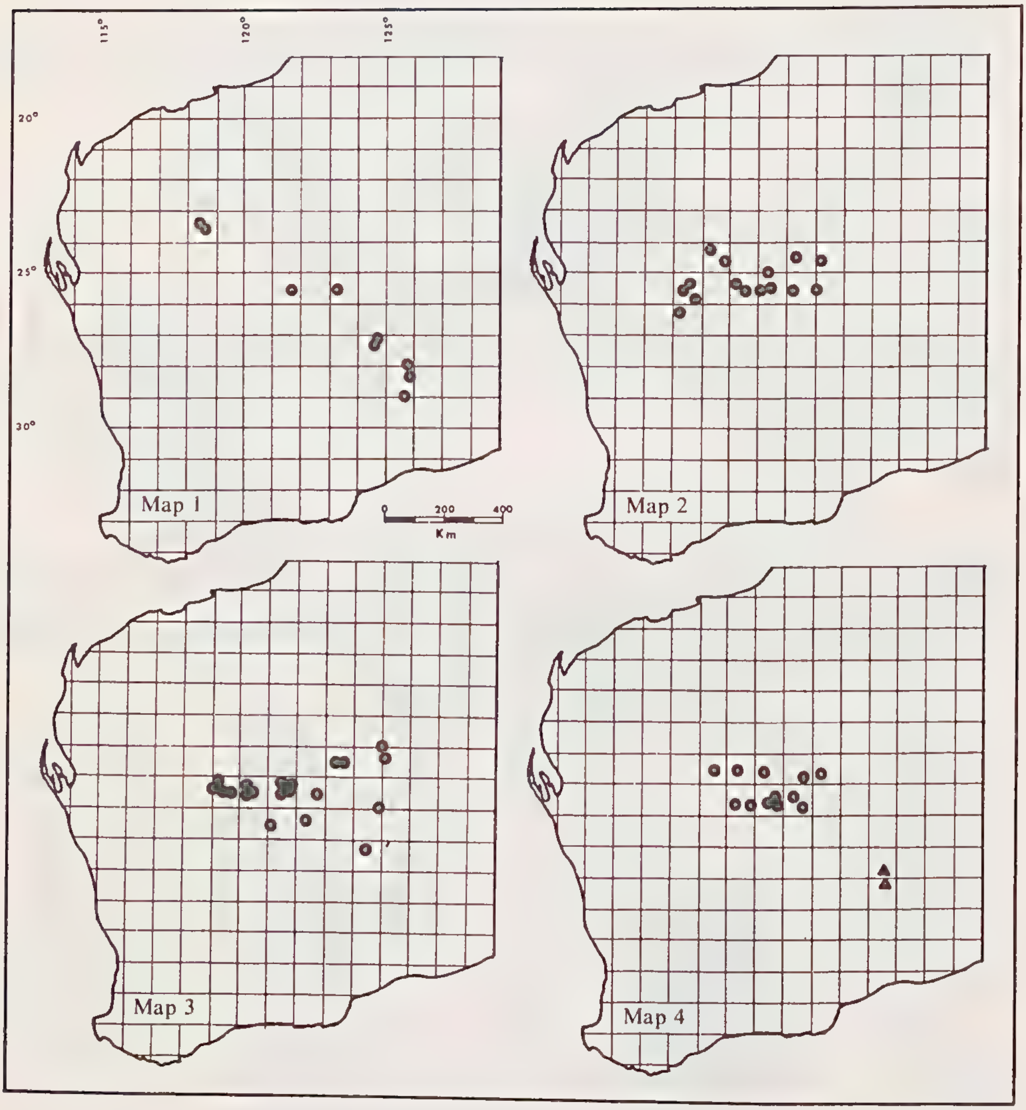

Distributions of *Eremophila* species.
Map 1, *Eremophila falcata*. Map 2, *E. linearis*. Map 3, *E. punctata*. Map 4, *E. spinescens* (spots), *E. undulata* (triangles).

J. Adelaide Bot. Gard. 2(3): 271-276 (1980)

DAVIESIA AND *LEPTOSEMA* (FABACEAE) IN CENTRAL AUSTRALIA : NEW SPECIES AND NAME CHANGES

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Abstract

Two new species, *Daviesia eremaea* and *D. purpurascens*, are described; the names *D. benthamii* Meisn. and *Leptosema chambersii* F. Muell. are reinstated, and *Leptosema anomalum* (Ewart et Morrison) comb. nov. is transferred from *Jacksonia*.

Introduction

This paper is a precursor to the handbook to the Flora of Central Australia, due to be published early in 1981. Its purpose is to formalise new and reinstated names for use in the Flora and is therefore presented ahead of monographs of the genera *Daviesia* and *Leptosema* currently in preparation by the author.

Daviesia Sm.

This is a large but apparently natural genus easily distinguished from its relatives. In earlier literature, e.g. Hutchinson, *Gen. Flower. Plant*. 2(1964)335-9, it was separated from other genera in the tribe *Podalyrieae* Benth. by its simple, xeromorphic leaves, (ob-) triangular pod, 2 ovules and arillate seed. To these the following diagnostic characters should be added:

Stipules greatly reduced or absent; *inflorescence* axillary, a short raceme or modification of one, with several barren bracts crowded towards the base of the peduncle; *flowers* generally < 10 mm long, articulate on the pedicel; *legume* exserted, compressed or turgid, dehiscing elastically into supervolute valves.

1. **Daviesia benthamii** Meisn. in Lehm., Plantae Preissianae 1(1844)48.

D. aphylla F. Muell. ex Benth., Flor. Aust. 2(1864)88, syn. nov.; *D. acanthoclona* F. Muell., Fragm. Phyt. Aust. 10(1876)32, syn. nov.; *D. nudula* J.M. Black, Trans. R. Soc. S. Aust. 71(1947)20, syn. nov.

The correct name for this species lapsed when Bentham, *Flor. Aust*. 2(1864)84, placed it as a synonym of *D. incrassata* Sm., a vegetatively similar but not closely related species. *D. benthamii* is widespread in dry country from Shark Bay in W.A. to Renmark in S.A. It shows geographic variation in leaf and inflorescence which will be analysed in the forthcoming revision. Each of the above synonyms belongs to a distinct geographic form.

2. **Daviesia eremaea** M.D. Crisp sp. nov.

a *D. benthamii* Meisn. ac *D. genistifolia* A. Cunn. ex Benth. foliis erectis longioribus (4—12 cm longis) et pedicellis longioribus (—8 mm longis) differt.

Holotype: Northern Territory, 12 miles [19km] NE of Narwietooma Station, *M. Lazarides 5991*, 15.ix.1956, fl. & photo (CANB). *Isotypes*: AD, BRI, CANB, NT, PERTH.

The specific epithet alludes to its desert habitat.

Glabrous *shrub* with many stems, 0.9—1.8 m tall. *Branchlets* erect, terete, smooth. *Leaves* alternate, erect, articulate with the branchlet, terete, acuminate, more or less

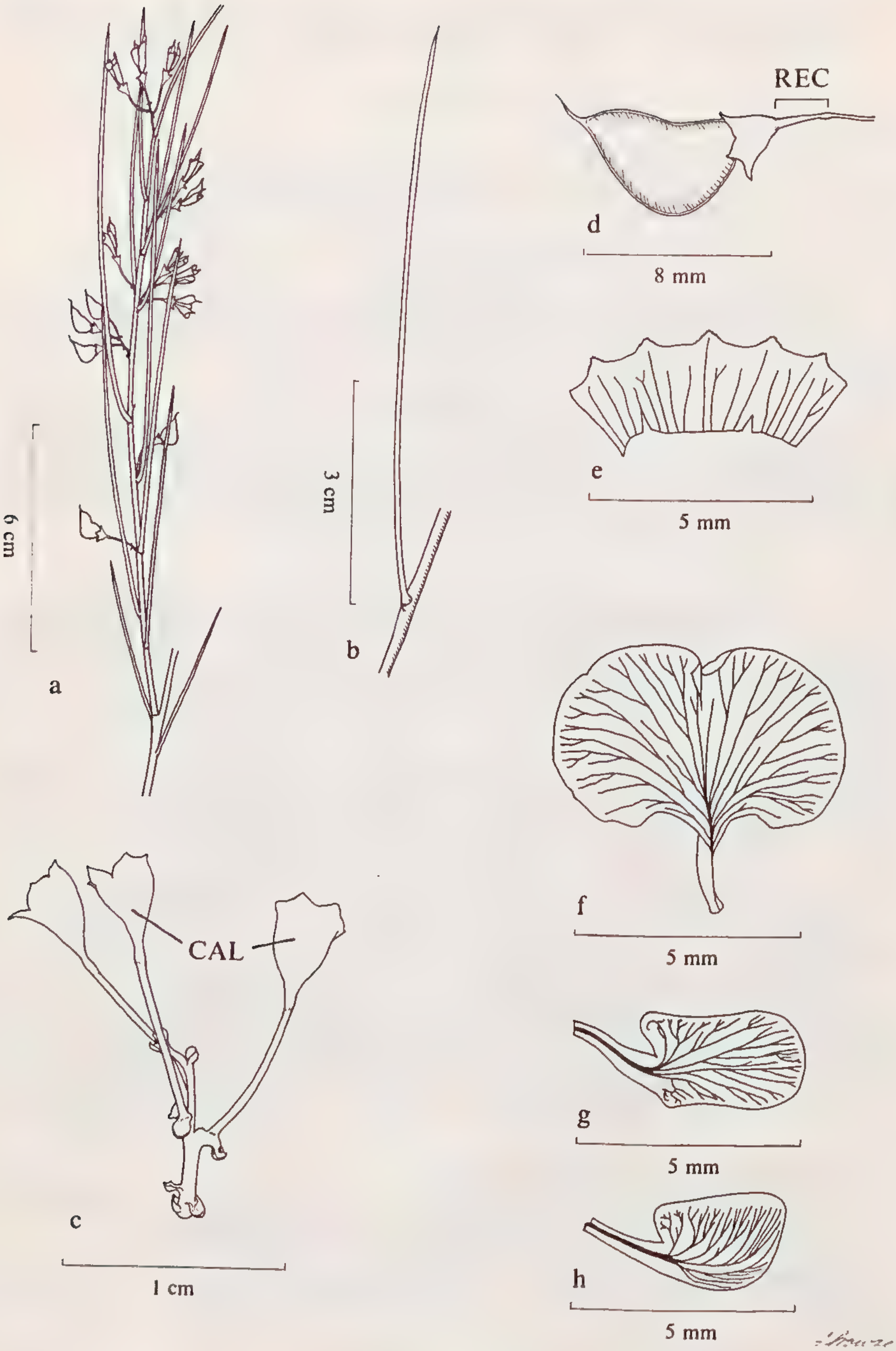


Fig 1. *Daviesia eremaea* M.D. Crisp. a, habit; b, leaf; c, raceme; d, legume; e, calyx, cut open and flattened with upper 2 lobes at right; f, standard (claw twisted); g, wing; h, keel-petal. (a, b, d, from *Nelson 99*; c, e-h, from *Lazarides 5991*). CAL = calyx. REC = receptacle.

pungent, thickened at the base, 4—12 cm long x c. 1 mm diam. *Racemes* 1 or 2 per axil, 3—5 flowered; rhachis 3—7 mm long. *Pedicel* slender, 4—8 mm long. *Calyx* oblique-campanulate, abruptly contracted at the base into the slender, 1.5—2 mm long receptacle; tube 2—2.5 mm long; lobes sub-apiculate, c. 0.5 mm long. *Corolla* papilionaceous; *standard* c. 6 x 7 mm; lamina transverse-elliptic, retuse, slightly cordate, yellow marginally, grading to red at the centre; claw c. 2 mm long; *wings* obovate-oblong, auriculate on the upper and slightly so on the lower margin at the base, c. 5 mm long including the 1.5—2 mm claw, reddish; *keel-petals* half transverse-broad-obovate i.e. truncate on the upper margin, obtuse, auriculate above at the base, c. 4.5 x 2 mm including the 1.5 mm claw, reddish. *Stamens* free, dimorphic i.e. inner row of 5 with flat incurved filaments and anthers sub-dorsifixed, subglobular, without connective; outer row of 5 with longer filaments slightly dilated upwards and anthers basifixed, larger, oblong, with a narrow-triangular connective. *Ovary* subsessile, narrow-elliptic, tapering to the incurved style. *Legume* compressed, asymmetric, transverse-obtriangular, c. 7 x 7 mm, dehiscing elastically; dorsal suture sigmoid; seed not seen. (Fig 1.)

Distribution (Map 1)

Northern Territory: Central Australia—west of Alice Springs, from Stuart Bluff Range south towards the South Australian border.

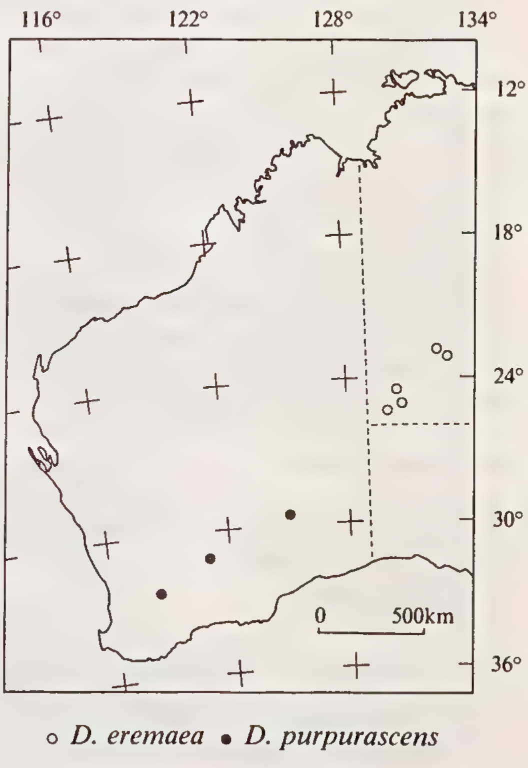
Specimens seen

NORTHERN TERRITORY: c. 76 miles [122 km] NE of Mt Davies Camp, *P.K. Latz 943*, 2.xi.1970, fr. (NT, AD, DNA); 12 km S of Mt Currie, 25°06'S, 130°33'E, *P.K. Latz 5751*, 23.ix.1974, fl. & fr. (NT, AD, CANB, DNA, PERTH); Lake Neale area, 24°28'S, 130°22'E, *J.R. Maconochie 1897*, 28.viii.1973, fl. (NT); Lakes Neale/Amadeus area, 24°28'S, 130°25'E, *J.R. Maconochie 1900*, 28.viii.1973, fl. (NT, DNA); 7 miles [11km] S of Mount Wedge homestead, *D.J. Nelson 99*, 18.x.1961, fr. (NT. CANB).

Affinity

D. eremaea is closely related to *D. genistifolia* A. Cunn. ex Benth. and to *D. benthamii* (q.v.), both of which have leaves which are shorter (< 8 cm long; usually < 5 cm) and widely divergent at 45-90° to the branchlet.

In *D. genistifolia* the leaf is either continuous or articulate with the branchlet, and the pedicel is less than 2 mm long. In *D. benthamii* the leaves are rigid, continuous with the branchlet, often much reduced in number and size, and the pedicel rarely longer than 4 mm.



Map 1. Distribution of *Daviesia eremaea* and *D. purpurascens*.

Ecology

D. eremaea occurs on red sand, often at the bases of dunes. Associated vegetation includes *Triodia* spp. and either *Casuarina decaisneana* F. Muell. or mallee eucalypts e.g. *E. gamophylla* F. Muell.

Although known from five locations, the new species appears to be rare at any given site. Further investigation is needed to determine whether it is threatened with extinction. Possibly, it occurs in the adjacent areas of Western Australia and South Australia.

3. **Daviesia purpurascens** M.D. Crisp sp. nov.

D. benthamii Meisn. characteribus vegetativis similis est sed manifesto ob legumen turgidum nec triangulare, quod inelastice dehiscit, et ob ramulos foliaque glaucescentia saepe purpurascentia differt.

Holotype: Western Australia, 6.3 km N of Bendering on Narembeen road, 32° 20'S, 118° 19'E, *M.I.H. Brooker 6329*, 12.viii.1979, fl., spirit material (CBG). *Isotypes*: AD, CANB, K, NSW, PERTH.

The specific epithet refers to the frequently purplish glaucescence of the leaves and branchlets.

Glabrous *shrub* with many stems, 0.4—0.9 m tall. *Branchlets* numerous, rigid, flexuose, grey-green to purplish-glaucescent. *Leaves* alternate, ascending to divaricate, continuous with the branchlet, terete, gently tapered, rigid, pungent, 5—50 mm long x 0.7—1.5 mm diam., grey-green to purplish-glaucescent. *Racemes* 1—3 per axil, 2—7-flowered; rhachis 0—15 mm long. *Pedicel* 0.5—3 mm long. *Calyx* oblique-campanulate, turgid in fruit, scarcely contracted into the c. 0.75 mm receptacle; tube 1.5—2 mm long; lobes subequal, very broad- to depressed-triangular, subacute to obtuse, c. 0.5 mm long; upper 2 lobes slightly shorter and broader than the others. *Corolla* papilionaceous; *standard* 5.5—6 x 6—7 mm; lamina depressed-ovate, retuse, sub-cordate, yellow marginally, grading to maroon at the centre; claw 1.5 mm long; *wings* oblong to obovate, auriculate on the upper, and sometimes on the lower margin at the base, 5—5.5 mm long including a 2 mm claw, maroon towards the apex; *keel* inflated, saccate; laminae half broad-obovate, more or less obtuse, auriculate like the wings, 3 x 2—2.5 mm, maroon in the upper half, on a 2 mm claw. *Stamens* free, dimorphic i.e. inner row with flat inflexed filaments and anthers basifixed, subglobular, without connective; outer row with similar but longer filaments and anthers larger, oblong, with a narrow-triangular connective. *Ovary* narrow, tapered below to a short stipe and above to the inflexed style. *Legume* turgid, broad-oblique-obovate to obtrullate in outline, 4—6 x 3—4 mm, not dehiscing elastically; immature *seed* arillate. (Fig 2.)

Distribution (Map 1)

Known from three disjunct populations in Western Australia viz. near Kondinin in the wheat belt, Gnarlbine Rocks south of Coolgardie, and near Plumridge Lakes in the Great Victoria Desert.

Specimens seen

WESTERN AUSTRALIA: 33 km from Narembeen along rd to Kondinin, 32° 20'S, 118° 18'E, *M.D. Crisp 5517*, 27.i.1979, fr. (CBG, PERTH); 18 km ENE of Kondinin, 32° 27'S, 118° 28'E, *M.D. Crisp 6168*, 26.ix.1979, fr. (CBG, PERTH, NSW); 30 km SSW of Coolgardie, 3 km NW of Gnarlbine Rock, 31° 08'S, 120° 56'E, *M.D. Crisp 5607-9*, 31.i.1979, fr. & photo (CBG, AD, PERTH); ibid., *M.D. Crisp 5902-3*, 18.ix.1979, fl., photos, spirit material (CBG, L, MEL, PERTH); near Gnarlbine, *R. Helms s.n.*, 12.xi.1891, fr. (AD, MEL, PERTH); Victoria Desert, Camp 54, Elder Exploring Expedition, *R. Helms s.n.*, fr., poor fl. (AD, NSW, MEL).

Affinity

I do not know of any close relatives to *D. purpurascens*. It differs from other species of *Daviesia* by its non-triangular pod. Nevertheless the type of inflorescence, especially the sterile bracts at the base, and the morphology of the floral parts clearly place it in *Daviesia*.

Mueller & Tate in *Trans. R. Soc. S. Aust.* 16(1896) assigned the Helms collections of *D. purpurascens* to the superficially similar *D. acanthoclona* F. Muell. (= *D. benthamii*, q.v.). However, the latter differs by its laterally compressed obtriangular pods which

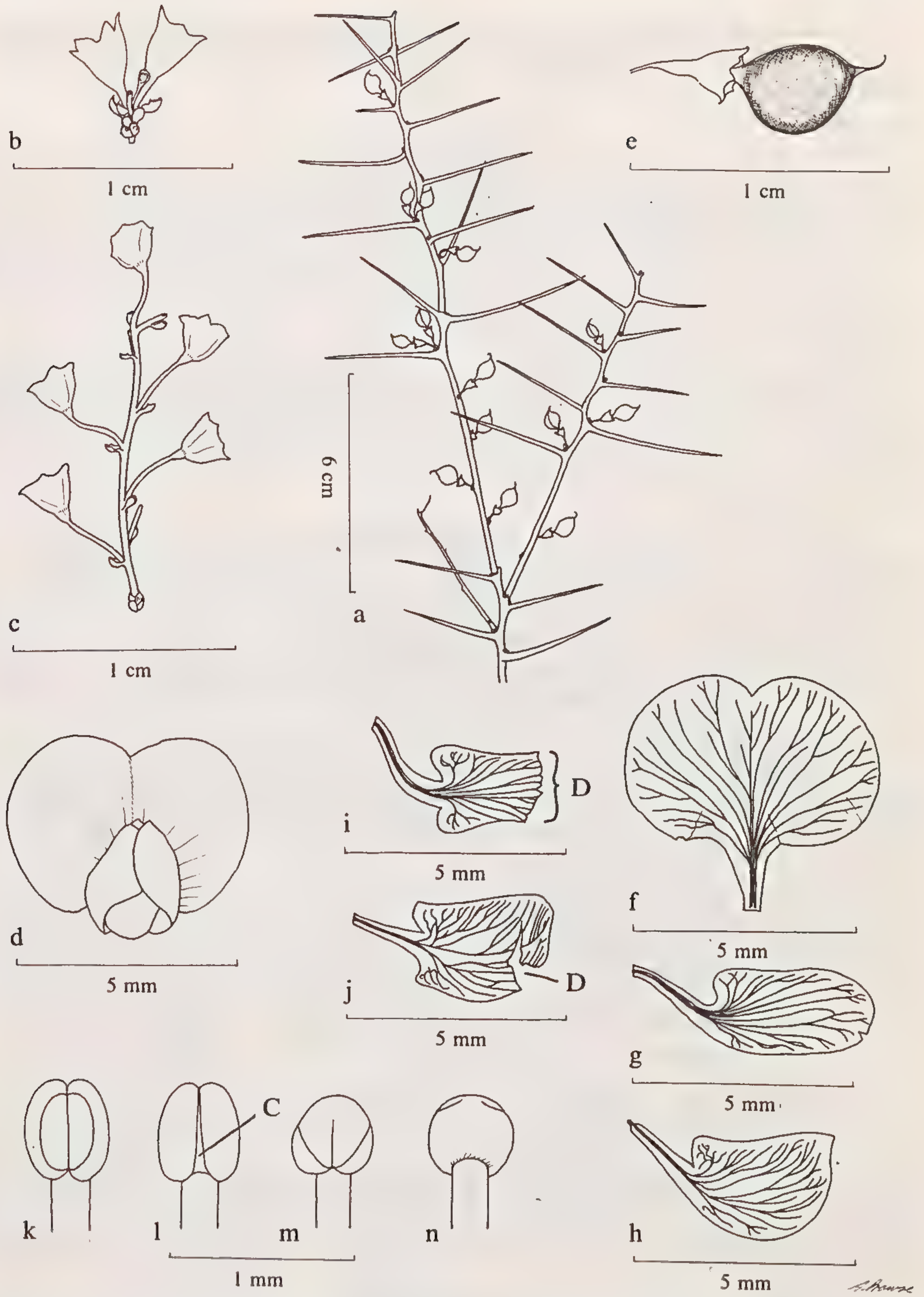


Fig 2. *Daviesia purpurascens* M.D. Crisp. a, habit; b, c, racemes, showing variation; d, flower; e, legume; f, standard; g, i, wings, showing variation; h, j, keel-petals, showing variation. (i, j, insect-damaged). k-n, anthers; k, from outer row, front view; l, outer row, rear view; m, inner row, front view; n, inner row, rear view. (a, e, from *Crisp 6168*; b, d, f-h, k-n, from *Brooker 6329*; c, i, j, from *Helms, 16.ix.1891*). C = connective. D = insect damage.

dehisce elastically, forming supervolute valves, and also by its greenish-yellow branchlets and leaves which are never glaucescent. *D. purpurascens* is always slightly glaucous, although the purple tinge is strongest in summer.

Geographic variation

There is some morphological variation between the populations of the new species. In the Victoria Desert the wing- and keel-petals have auricles on the lower margins which are absent at Kondinin and scarcely developed at Gnarlbine (Fig 2, g-j). Similarly, the raceme is longest with up to seven flowers in the Victoria Desert, and shortest with two flowers at Kondinin (Fig 2, b,c). Other characters vary slightly between populations. This pattern suggests a southwest-northeast cline, but until more extensive collections are made, I am reluctant to propose infraspecific taxa.

Ecology

D. purpurascens is found on red sand-dunes in the Victoria Desert and at Gnarlbine, and on white sand-plains at Kondinin. At Gnarlbine and Kondinin it is in the shrubby understorey of mallee dominated by *Eucalyptus* spp. including *E. eremophila* (Diels) Maiden, *E. foecunda* Schau. and *E. transcontinentalis* Maiden. The vegetation at the Victoria Desert site is unknown.

D. purpurascens is uncommon both at Kondinin and at Gnarlbine, where it is threatened by clearing and sand-mining respectively. I was unable to relocate it in the Victoria Desert, despite an extensive search. Thus, the species must be considered both rare and endangered.

Leptosema Benth.

Leptosema Benth., Comm. legum. gen. (1837)20; Ann. Wiener Mus. 2(1839)84; Hutch., Gen. Flower. Plant. 2(1964)342.

Brachysema R.Br. sect. *Leptosema* (Benth.) Benth., Flor. Aust. 2(1864)9.

The history of the genus *Leptosema* is summarised in the references above. Bentham (1864) gives diagnostic characters to separate it from *Brachysema* s.str. Hutchinson (1964) reinstated *Leptosema* but did not deal with any species except the type. There are two species in Central Australia.

1. **Leptosema chambersii** F. Muell., Essay plant. coll. E. Fitzalan during Lieut. Smith's exped. estuary Burdekin (1860)8.

Brachysema chambersii (F. Muell.) F. Muell. ex Benth., Flor. Aust. 2(1864)13.

2. **Leptosema anomalum** (Ewart et Morrison) M.D. Crisp comb. nov.

Jacksonia anomala Ewart et Morrison, Proc. R. Soc. Vict. n.s. 26(1913)158, *basionym*.

The original authors suggested that this species may belong to *Brachysema* sect. *Leptosema*, but placed it in *Jacksonia* because of the 2 ovules (as opposed to several in other *Leptosema* spp.) and the small size of flowers. However, the number of ovules varies from 2—several in some related genera, and cannot be a critical character at generic level. Furthermore, there are several species of *Leptosema* with flowers of comparable size to those of *L. anomalum*. In other respects, especially the racemose infloresence and peculiar floral morphology, *L. anomalum* is a typical *Leptosema* and clearly distinct from *Jacksonia*.

Acknowledgements

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THE FOOD PLANTS OF AUSTRALIAN BUTTERFLY LARVAE

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Abstract

An examination of the food plants of butterfly larvae of Australia shows that these plants belong mainly to families of tropical origin. Australian or characteristically southern plant families provide food for the larvae of very few species of butterflies. The evidence suggests that the larval/plant relationships were already well established by the time Australia received its butterfly fauna from the north and that few species have been able to transfer freely to food plants in new families.

Introduction

There has been, in recent years, increasing interest in the relationships between butterflies and their food plants. This was described broadly by Ehrlich and Raven (1964) and some aspects of co-evolution by Edgar, Culvenor and Pliske (1974) and Rathcke and Poole (1975). The paper by Ehrlich and Raven (1964) (hereafter E & R (1964)), did not include the insect family Hesperiidae and made very few direct references to Australia.

Two recent books on Australian butterflies, Common and Waterhouse (1972) and Fisher (1978) provide classified lists of the food plants eaten by the caterpillars of these insects. The following analyses are based on this information. So that the data can be presented compactly, both plants and insects are considered at the generic level, although this inevitably obscures some of the specificity of their relationships. The flowers visited by the adult insects are not considered. The term butterfly is as used by Common and Waterhouse (1972) and here includes the superfamilies Hesperioidea and Papilionoidea.

The basic data follow in extended Tables. The arrangement of the butterfly genera follows Common and Waterhouse (1972). The plant genera used as food by butterfly larvae in Australia are extracted from that book, from Fisher (1978), Sankowsky (1978) and from additional data supplied by Dr I.F.B. Common and R.H. Fisher. Alien genera established in Australia are indicated by an asterisk.

Table 1. Superfamily Hesperioidea, Family Hesperiidae, Subfamily Coeliadinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Allora	2	2	—
Hasora	27	4	*Derris*, *Millettia*, *Mucuna*, *Pongamia* (Fab.)
Badamia	2	1	*Terminalia* (Combret.)

This group is too small for any generalisations to be made.

Table 2. Superfamily Hesperioidea, Family Hesperiidae, Subfamily Pyrginae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Euschemon	1	1	*Tetrasynandra*, *Wilkiea* (Monim.); *Tristania* (Myrt.)
Chaetocneme	12	4	*Acmena*, *Tristania* (Myrt.); **Annona* (Annon.); *Cinnamomum* (Laur.)
Netrocoryne	2	1	*Acmena*, *Tristania* (Myrt.); *Alectryon* (Sapin.); *Callicoma* (Cunon.); *Elaeocarpus* (Elaeocarp.); *Endiandra* (Laur.); *Notelaea* (Olea.); *Podocarpus* (Podoc.); *Scolopia* (Flacourt.); *Brachychiton* (Stercul.)
Tagiades	12	2	—
Exometoeca	1	1	—

No particular pattern is evident here and a wide range of tropical and subtropical trees is eaten. The list includes the only record of butterfly larvae on an Australian conifer, *Podocarpus*.

Table 3. Superfamily Hesperioidea, Family Hesperiidae, Subfamily Trapezitinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Rachelia	1	1	—
Trapezites	12	12	*Lomandra* (Xanthor.)
Anisyntoides	1	1	*Acanthocarpus* (Xanthor.)
Anisynta	6	6	**Brachypodium*, *Cynodon*, *Danthonia*, *Poa*, *Stipa* (Poac.)
Dispar	1	1	*Poa* (Poac.); *Lomandra* (Xanthor.)
Pasma	1	1	*Poa*, *Tetrarrhena* (Poac.)
Signeta	2	2	*Poa* (Poac.)
Toxidia	9	8	*Cenchrus*, *Tetrarrhena* (Poac.); *Gahnia* (Cyp.); *Dianella* (Lil.)
Neohesperilla	4	4	—
Hesperilla	14	14	*Baumea*, *Carex*, *Cyperus*, *Gahnia*, *Scleria* (Cyp.)
Oreisplanus	2	2	*Carex*, *Gahnia*, *Scirpus* (Cyp.)
Motasingha	2	2	*Gahnia*, *Lepidosperma* (Cyp.)
Mesodina	2	2	*Patersonia* (Irid.)
Proeidosa	1	1	*Triodia* (Poac.)
Croitana	1	1	—

This is described as a "characteristically Australian subfamily" and most species are confined to Australia. It can be seen that this subfamily feeds exclusively on monocotyledons of several families in which the grasses and sedges are almost equally common. The grass genera *Poa* and *Stipa* could be considered cosmopolitan, *Tetrarrhena* is southern and the sedge genera range into the tropics, e.g. *Gahnia*, or are cosmopolitan (*Carex* and *Cyperus*). The list includes the only larvae in Australia feeding on a member of the Iridaceae.

Table 4. Superfamily Hesperioidea, Family Hesperiidae, Subfamily Hesperiinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Notocrypta	10	1	*Alpinia*, *Hornstedtia* (Zingib.)
Taractrocera	14	5	*Carex* (Cyp.); *Brachiaria*, *Cenchrus*, *Cynodon*, *Danthonia*, *Echinopogon*, *Imperata*, *Microlaena*, *Oryza*, *Pennisetum*, *Paspalum*, *Poa* (Poac.)
Ocybadistes	5	4	**Brachypodium*, *Cynodon*, *Pennisetum* (Poac.); *Thuarea* (Cyp.); *Dianella* (Lil.)
Suniana	3	2	*Imperata*, *Leersia*, *Panicum*, *Paspalum* (Poac.)
Oriens	8	1	—
Arrhenes	7	2	*Imperata*, *Leersia*, **Saccharum* (Poac.)
Telicota	22	9	*Imperata*, *Leptaspis*, *Oryza*, *Sorghum* (Poac.); *Flagellaria* (Flagell.); *Scleria* (Cyp.)
Cephrenes	5	2	*Archontophoenix*, *Cocos*, *Livistona* (Palm.)
Sabera	11	3	*Cordyline* (Lil.)
Mimene	15	1	—
Parnara	4	2	*Bambusa*, *Oryza*, **Saccharum* (Poac.); *Colocasia* (Arac.)
Borbo	18	3	*Oryza*, *Paspalum*, **Saccharum* (Poac.)
Pelopidas	9	2	*Oryza*, *Paspalum*, *Sorghum*, **Saccharum* (Poac.)

This extensive tropical subfamily feeds exclusively on species of monocotyledons of several families, and includes the principal feeder on palms, *Cephrenes*. The grasses are almost all coarse-leaved tropical species. *Taractrocera* includes the more southern *Microlaena*, *Danthonia* and *Echinopogon* in its diet.

Table 5. Superfamily Papilionoidea, Family Papilionidae, Subfamily Papilioninae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Protographium	1	1	*Rauwenhoffia* (Anon.)
Graphium	numerous	6	**Annona*, *Melodorum*, *Mitrephora*, *Polyalthia*, *Rauwenhoffia*, *Saccopetalum*, *Uvaria*, **Xylopia* (Annon.); *Macaranga* (Euphor.); *Cinnamomum*, *Cryptocarya*, *Endiandra*, *Litsea*,, *Neolitsea* (Laur.); **Michelia* (Magnol.); *Atherosperma*, *Daphnandra*, *Doryphora* (Monim.); *Tristania* (Myrt.); *Geijera* (Rut.); *Diploglottis* (Sapind.); *Planchonella* (Sapot.); *Drimys* (Winter.)
Papilio	numerous	7	*Acronychia*, **Choisya*, **Citrus*, *Clausena*, *Eremocitrus*, *Eriostemon*, *Euodia*, *Fagara*, **Feronia*, *Flindersia*, *Geijera*, *Glycosmis*, *Halfordia*, *Melicope*, *Microcitrus*, *Micromelum*, *Murraya*, *Phebalium*, *Zanthoxylum*, *Zieria* (Rutac.); *Psoralea* (Fab.); *Cryptocarya* (Laur.); *Morinda* (Rub.)
Cressida	1	1	*Aristolochia* (Aristo.)
Pachliopta	13	1	*Aristolochia* (Aristo.)
Ornithoptera	12	1	*Aristolochia* (Aristo.)

Three genera are confined to *Aristolochia*; *Papilio* eats plants of no fewer than 20 genera belonging to the Rutaceae, while *Graphium* and *Protographium* consume leaves of a wide variety of tropical trees (23 genera) of which the Annonaceae, Lauraceae and Monimiaceae are prominent. The families listed are similar to those given by E & R (1964). However, the Umbelliferae (Apiaceae) listed by E & R (1964) as extra tropical food plants for some members of the Papilionidae have not been recorded in Australia.

Table 6: Superfamily Papilionoidea, Family Pieridae, Subfamily Coliadinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Catopsilia	numerous	4	*Cassia* (Caesal.)
Eurema	numerous	8	*Acacia, Albizia, *Leucaena, Neptunia* (Mimos.); *Cassia* (Caesal.); *Indigofera, Sesbania* (Fab.); *Breynia, Phyllanthus* (Euph.)

This subfamily, well developed in the tropics, is found mainly in northern Australia and eats shrubby legumes, all with pinnate leaves, and two genera of Euphorbiaceae. This is a somewhat more narrowly based list than that given by E & R (1964) who note that the legumes are the most important food plants of the Coliadinae.

Table 7. Superfamily Papilionoidea, Family Pieridae, Subfamily Pierinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Elodina	5	4	*Capparis* (Capparid.)
Delias	150	8	*Exocarpos, Santalum* (Santal.); *Amyema, Dendrophthoe, Korthalsella, Muellerina* (Loranth.)
Anaphaeis	9	1	*Apophyllum, Capparis* (Capparid.)
Cepora	20	1	*Capparis* (Capparid.)
Appias	30	5	*Drypetes* (Euph.)
Pieris	numerous	1	**Brassica, *Cakile, Lepidium* (Brassic.); *Cleome* (Capparid.); **Reseda* (Resed.); **Tropaeolum* (Tropaeol.)

There is considerable specialisation in this subfamily. The introduced *Pieris* mainly eats members of Brassicaceae (Cruciferae), all introduced with the exception of *Lepidium*. Species of two other genera eaten, *Reseda* and *Cleome* belong to the Resedaceae and Capparidaceae respectively and all these are grouped in the plant order Capparidales; *Tropaeolum* is not closely related. The three genera *Elodina, Anaphaeis*, and *Cepora* eat only species of *Capparis* and *Apophyllum*, the latter also in the Capparidaceae. An exception is *Appias* on *Drypetes* (Euphorbiaceae). The largest genus *Delias* is found on Loranthaceae and Santalaceae, two related families in the order Santalales and not close to Capparidales. The plant genera eaten agree closely with those given by E & R (1964).

Table 8. Superfamily Papilionoidea, Family Nymphalidae, Subfamily Danainae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Danaus	40	6	**Araujia, *Asclepias, *Calotropis, Cynanchum, Leichhardtia, Pentatropis, Secamone* (Asclep.)
Euploea	40	10	**Asclepias, Cryptostegia, Cynanchum, Gymnanthera, Hoya, Leichhardtia, Sarcostemma, Secamone* (Asclep.); *Carissa, *Mandevillea, *Nerium, Parsonsia, *Stephanotis, *Trachelospermum* (Apocyn.); *Ficus, Malaisia* (Morac.)

With the exception of the two plant genera belonging to the Moraceae, the Danainae feed only on species of Asclepiadaceae and Apocynaceae, two closely related families. However, all three families have milky sap and the last two contain many species with tissues toxic to higher animals. The plants eaten in Australia differ in no way from the list given for the subfamily by E & R (1964). There has been considerable study of the relationships of these butterfly genera and their food plants, Edgar, Culvenor and Pliske (1974).

Table 9. Superfamily Papilionoidea, Family Nymphalidae, Subfamily Ithomiinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Tellervo	1	1	*Parsonsia* (Apocyn.)

This subfamily is primarily American and only one species is recorded for Australia from Cape York. In the Americas the subfamily feeds exclusively on many genera of Solanaceae (E & R 1964). The co-evolution there of butterfly and plant is described by Rathcke and Poole (1975). It is of much interest that no butterfly larvae have been recorded from Australian species belonging to the Solanaceae. The genus *Solanum* is widespread and half a dozen other genera belonging to the Solanaceae occur in Australia. The diet of *Tellervo* is exceptional in the subfamily.

Table 10. Superfamily Papilionoidea, Family Nymphalidae, Subfamily Satyrinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Melanitis	13	2	*Imperata*, *Paspalum*, **Saccharum*, **Stenotaphrum* (Poac.)
Elymnias	40	1	—
Mycalesis	numerous	3	*Imperata* (Poac.)
Orsotriaena	2	1	—
Hypocysta	12	6	*Cynodon*, *Imperata* (Poac.)
Argynnina	2	2	**Lolium* (Poac.)
Geitoneura	3	3	**Brachypodium*, *Poa*, *Themeda* (Poac.)
Heteronympha	7	7	**Brachypodium*, *Danthonia*, *Poa*, *Themeda* (Poac.); *Carex* (Cyp.)
Nesoxenica	1	1	*Uncinia* (Cyp.)
Oreixenica	6	6	*Microlaena*, *Poa* (Poac.)
Tisiphone	2	2	*Imperata* (Poac.); *Gahnia* (Cyp.)
Xois	2	1	*Imperata* (Poac.)

This subfamily contains a distinctly Australian element of endemic and southern genera. It feeds exclusively on monocotyledons, which include three sedges, but mainly on coarse-leaved tropical grasses. E & R (1964) record Juncaceae and Restionaceae as occasionally eaten but both are conspicuously absent from Australian food plant lists.

Table 11. Superfamily Papilionoidea, Family Nymphalidae, Subfamily Morphinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Taenaris	20	2	No record of food plants from Australia is given.

E & R (1964) state that eleven genera feed on monocotyledons and that *Morpho* feeds on dicotyledons.

Table 12. Superfamily Papilionoidea, Family Nymphalidae, Subfamily Charaxinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Polyura	numerous	1	*Abarema, Acacia, Albizia* (Mimos.); *Caesalpinia, Cassia,* **Delonix* (Caesal.); **Robinia* (Fab.); *Guilfoylia* (Simarub.); *Brachychiton* (Stercul.); *Celtis* (Ulm.); *Cinnamomum* (Laur.); **Lagerstroemia* (Lythr.)

A polyphagous species found on woody tropical legumes and on four unrelated genera of tropical trees. Small as this sample is of the subfamily, it does not differ from the food lists given by E & R (1964).

Table 13. Superfamily Papilionoidea, Family Nymphalidae, Subfamily Nymphalinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Phaedyma	1	1	*Mucuna, Pongamia* (Fab.); *Aphananthe, Celtis* (Ulm.); *Ehretia* (Borag.); *Bombax, Brachychiton* (Stercul.)
Neptis	several	1	—
Pantoporia	14	2	*Derris, Lonchocarpus* (Fab.)
Argyreus	1	1	*Viola* (Viol.)
Mynes	6	1	*Dendrocnide, Pipturus* (Urtic.)
Doleschallia	9	1	*Asystasia, Graptophyllum, Pseuderanthemum, Strobilanthes* (Acanth.)
Hypolimnas	numerous	4	*Alternanthera* (Amaran.); *Sida* (Malv.); *Polygonum* (Polygon.); *Richardia* (Rub.); **Synedrella* (Ast.); *Portulaca* (Portul.); *Asystasia, Dipteracanthus, Graptophyllum, Pseuderanthemum* (Acanth.)
Yoma	1	1	—
Vanessa	numerous	3	*Ammobium,* **Arctotheca,* **Artemisia, Gnaphalium, Helichrysum, Helipterum,* **Onopordum* (Ast.); **Helxine, Urtica* (Urtic.)
Junonia	numerous	3	*Asystasia, Hemigraphis, Hygrophila, Pseuderanthemum, Thunbergia* (Acanth.); *Epaltes* (Ast.); *Evolvulus* (Convol.); *Goodenia, Scaevola* (Good.); *Plantago* (Plantag.); *Centaurium* (Gentian.); *Portulaca* (Portul.); **Antirrhinum,* **Angelonia, Buchnera,* **Russelia* (Scroph.); *Verbena* (Verben.)
Cethosia	12	2	*Adenia* (Passifl.)
Vindula	4	1	*Adenia, Passiflora* (Passifl.)
Vagrans	1	1	*Homalium, Xylosma* (Flacourt.)
Phalanta	several	1	*Petalostigma* (Euph.)
Cupha	10	1	*Flacourtia, Scolopia, Xylosma* (Flacourt.)

The species of this subfamily eat very varied food plants. *Cethosia* and *Vindula* on Passifloraceae, *Vagrans* and *Cupha* on Flacourtiaceae, which together with *Viola* are grouped in the Violales and considered close (as orders go) to the Passiflorales. *Vanessa* is one of the few genera feeding on the very large cosmopolitan family Asteraceae (Compositae). The polyphagous *Junonia* feeds on a number of genera grouped in the order Scrophulariales, and in fact *Vanessa* and *Junonia* eat more of the 'advanced' plant genera than any other two butterfly genera in Australia. It can be noted that few legumes and no monocotyledons are eaten.

Table 14. Superfamily Papilionoidea, Family Nymphalidae, Subfamily Acraeinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Acraea	12	1	*Adenia*, *Passiflora*, *Tacsonia* (Passifl.)

This subfamily is closely related to the Nymphalinae and does not differ in food plants eaten. The single species established in Australia is relatively widespread, but its food plants do not include several families listed by E & R (1964).

Table 15. Superfamily Papilionoidea, Family Nymphalidae, Subfamily Libytheidae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Libythea	12	1	No record of food plant from Australia

This genus is restricted in its distribution in Australia to Cape York and the far north coast of W. Australia and the Northern Territory. It's larvae are reported by E & R (1964) to feed almost exclusively on *Celtis* with a few records on *Prunus*.

Table 16. Superfamily Papilionoidea, Family Lycaenidae, Subfamily Lycaeninae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Liphyra	2	1	—
Bindahara	2	1	*Salacia* (Celast.)
Rapala	numerous	1	*Alphitonia*, *Ziziphus* (Rham.); **Litchi* (Sapind.)
Virachola	numerous	2	*Strychnos* (Logan.)
Deudorix	numerous	2	*Caryota* (Palm.); *Macadamia* (Prot.); *Harpullia* (Sapind.)
Hypolycaena	numerous	1	*Vanda*, *Dendrobium* (Orchid.); *Flagellaria* (Flag.); *Cassia* (Caesal.); *Acmena* (Myrt.); *Cupaniopsis* (Sapind.); *Planchonella* (Sapot.); *Clerodendrum*, *Faradaya* (Verben.)
Pseudalmenus	1	1	*Acacia* (Mimos.)
Jalmenus	9	9	*Acacia* (Mimos.); *Cassia* (Caesal.); *Heterodendrum* (Sapind.); *Eucalyptus* (Myrt.)
Narathura	150	4	*Acmena*, *Eucalyptus*, *Melaleuca* (Myrt.) *Cordia* (Borag.); *Cryptocarya* (Laur.); *Cupaniopsis* (Sapind.); *Glochidion* (Euph.); *Faradaya* (Verben.); *Heritiera* (Stercul.); *Hibiscus* (Malv.); *Terminalia* (Combret.)
Ogyris	15	12	*Amyema*, *Amylotheca*, *Dendrophthoe*, *Lysiana*, *Muellerina* (Loranth.); *Choretrum*, *Leptomeria* (Santal.)
Hypochrysops	numerous	17	*Drynaria* (Pterido.-Polypod.); *Cassinia* (Ast.); *Barringtonia* (Barring.); *Casuarina* (Casuar.); *Terminalia* (Combret.); *Elaeocarpus* (Elaeoc.); *Brachyloma* (Epac.); *Jacksonia* (Fab.); *Amyema*, *Dendrophthoe*, *Muellerina* (Loranth.); *Acacia* (Mimos.); *Angophora*, *Eucalyptus* (Myrt.); *Banksia* (Prot.); *Alphitonia*, *Pomaderris* (Rham.); *Bruigiera*, *Ceriops*, *Rhizophora* (Rhizoph.); **Prunus*, *Rubus* (Ros.); *Myrmecodia* (Rub.); *Choretrum*, *Exocarpos* (Santal.); *Cupaniopsis*, *Dodonaea*, *Heterodendrum* (Sapind.); *Smilax* (Smilac.); *Commersonia* (Stercul.); **Camellia* (Thea.); *Triumfetta* (Tilia.); *Avicennia* (Verb.)

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Table 16 (*continued*)

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Pseudodipas	7	6	*Smilax* (Smilac.); *Diospyros* (Eben.); *Clerodendrum*, *Faradaya* (Verben.)
Paralucia	3	3	*Bursaria*, *Citriobatus* (Pittosp.)
Lucia	1	1	*Oxalis* (Oxal.)
Danis	several	3	*Alphitonia* (Rham.); *Entada* (Mimos.)
Petrelaea	1	1	—
Prosotas	18	3	*Acacia* (Mimos.); *Macadamia* (Prot.); *Alectryon*, *Cupaniopsis*, **Litchi* (Sapind.)
Nacaduba	37	4	*Acacia* (Mimos.); *Aegiceras*, *Maesa*, *Rapanea* (Myrsin.); *Alectryon*, *Cupaniopsis*, *Heterodendrum* (Sapind.); *Macadamia* (Prot.)
Ionolyce	2	1	—
Erysichton	3	2	*Alectryon*, *Cupaniopsis* (Sapind.); *Ehretia* (Borag.); *Macadamia* (Prot.); *Dendrophthoe* (Loranth.)
Catopyrops	4	2	*Caesalpinia* (Caesal.); *Trema* (Ulm.)
Jamides	numerous	5	*Canavalia*, **Phaseolus* (Fab.); *Sarcopteryx* (Sapind.)
Syntarucus	several	1	*Plumbago* (Plumb.)
Anthene	several	2	*Caesalpinia*, *Cassia* (Caesal.); *Pongamia* (Fab.); *Clerodendrum*, *Faradaya* (Verben.); *Cupaniopsis*, **Litchi* (Sapind.)
Theclinesthes	7	7	*Cycas*, *Macrozamia* (Cycad.); *Arthrocnemum*, *Atriplex*, *Chenopodium*, *Rhagodia*, *Salicornia* (Chenopod.); *Adriana* (Euph.); *Sesbania* (Fab.); *Acacia* (Mimos.); *Eucalyptus* (Myrt.); *Alectryon*, *Atalaya*, *Cupaniopsis* (Sapind.)
Lampides	1	1	**Chamaecytisus*, *Clianthus*, *Crotalaria*, **Cytisus*, *Dolichos*, *Kennedia*, **Lathyrus*, *Lotus*, **Lupinus*, **Phaseolus*, **Pisum*, *Psoralea*, *Sesbania*, *Swainsona*, **Vicia*, **Virgilia* (Fab.)
Catochrysops	3	2	*Crotalaria* (Fab.)
Euchrysops	numerous	1	*Phaseolus*, *Sesbania*, *Vigna* (Fab.)
Everes	several	1	—
Neolucia	3	3	*Aotus*, *Bossiaea*, *Daviesia*, *Dillwynia*, *Eutaxia*, *Pultenaea* (Fab.); *Epacris*, *Monotoca* (Epacrid.)
Zetona	1	1	—
Zizula	2	1	—
Zizina	3	1	*Desmodium*, *Glycine*, *Indigofera*, *Lotus*, **Medicago*, **Phaseolus*, **Pisum*, *Psoralea*, *Swainsona*, **Trifolium*, *Trigonella*, **Vicia*, **Virgilia* (Fab.)
Zizeeria	2	1	*Glinus* (Aizoac.); *Tribulus* (Zygoph.)
Famegana	1	1	(Fabaceae)
Freyeria	few	1	*Indigofera* (Fab.)
Candalides	numerous	2	*Tieghemopanax* (Aral.); *Cassia* (Caesal.); *Castanospermum*, *Jacksonia*, *Millettia*, **Wisteria* (Fab.); *Flagellaria* (Flagell.); *Westringia* (Lam.); *Cassytha*, *Cryptocarya* (Laur.); *Amyema*, *Amylotheca*, *Benthamina*, *Dendrophthoe*, *Muellerina* (Loranth.); *Eremophila*, *Myoporum* (Myop.); *Plantago* (Plantag.); *Grevillea*, *Macadamia* (Prot.); *Alectryon*, *Cupaniopsis* (Sapind.); *Parahebe* (Scroph.); *Brachychiton* (Stercul.); *Pimelea* (Thymel.)

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Table 16 (*continued*)

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Nesolycaena	1	1	*Boronia* (Rut.)
Adaluma	1	1	*Boronia* (Rut.)
Philiris	numerous	6	*Ficus* (Mor.); *Glochidion* (Euph.)
Lycaenopsis	1	1	—
Megisba	2	1	—
Neopithecops	several	1	*Glycosmis* (Rut.)
Pithecops	4	1	—

This large subfamily includes 44 genera and 119 species in Australia. The larvae eat a variety of plants but there are several specialised genera of note. *Ogyris* species are confined to Loranthaceae and Santalaceae; *Paralucia* is the only genus found on the Pittosporaceae; *Lucia* on *Oxalis*; and *Theclinesthes* the only genus found on Chenopodiaceae; *Neolucia* is one of the few genera the larvae of species of which eat the typically Australian leguminous genera such as *Daviesia*, *Eutaxia*, *Pultenaea*. The genera *Lampides* and *Zizina* comprise species the larvae of which attack a number of the introduced legumes e.g., *Vicia*, *Pisum* and *Trifolium*, as well as native genera. *Theclinesthes* is the only genus the larvae of which eat the primitive gymnosperms *Cycas* and *Macrozamia*. The subfamily also includes the two genera comprising species with the widest larval food ranges recorded in Australia, *Hypochrysops* eating species of 33 genera and *Candalides* 25 genera. These two butterfly genera both contain species the larvae of which eat species of plant genera from the Loranthaceae, legumes and Sapindaceae, in addition to many broad-leaved trees. The occasional records of *Eucalyptus*, *Banksia*, *Grevillea* and *Casuarina* represent members of the southern elements in our Flora. Although not detailed here the Lycaenidae also includes several genera which have specialised relationships with ants; E & R (1964) consider that this might influence the food plants eaten. The butterfly genera in Australia do not include the lichen-eaters known in Africa, but do include some which feed on cycads and on orchids both of which have been recorded as food plants for overseas genera, but not those from southern Africa.

Table 17. Superfamily Papilionoidea, Family Lycaenidae, Subfamily Nemeobiinae.

Butterfly genera	Total no. of species in genus	No. of species in Australia	Food plants in Australia
Praetaxila	10	1	No record of food plants from Australia

Table 18. Condensed summary of food plants of Australian butterfly larvae.

Families and subfamilies	Food plants
Hesperiidae	
Coeliadinae	Varied incl. legumes
Pyrginae	Varied trop. trees
Trapezitinae	Monocotyledons
Hesperiinae	Monocotyledons
Papilionidae	
Papilioninae	Tropical trees, many Rutaceae, *Aristolochia*
Pieridae	
Coliadinae	Woody legumes
Pierinae	Santales, Capparidaceae, Brassicaceae, Tropaeolaceae

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Table 18 (*continued*)

Families and subfamilies	Food plants
Nymphalidae	
Danainae	Asclepiadaceae, Apocynaceae
Ithomiinae	Apocynaceae
Satyrinae	Monocotyledons
Morphinae	—
Charaxinae	Varied incl. legumes
Nymphalinae	Very varied, more herbaceous species, no monocotyledons
Acraeinae	Passifloraceae
Libytheidae	No information from Australia
Lycaenidae	
Lycaeninae	Very varied (very few monocots)
Nemeobiinae	No information

Entomological considerations

It is obvious that within some families, subfamilies or genera of butterflies there is a remarkable degree of canalisation tying the butterfly larvae to particular food plants (Table 18). This is based overwhelmingly on the chemistry of the plants rather than on their morphology. I do not think that there is any evidence that the plants obtain any advantage from being eaten despite Culvenor's (1970) statement that the Poaceae (Gramineae) is the only plant family adapted to being eaten, or at least resistant to being torn up and totally consumed. This is in marked contrast to the relationships between insects and the plants that they pollinate. There are numerous morphological defence responses that protect plants to a varying extent against predation e.g., dense tomentum, glandular hairs, resins and prickles. The development of chemically active secondary substances in the plant that disturb the metabolism of the predator are less obvious defence mechanisms (Culvenor 1970). The following examples are culled from Fraenkel (1969). There may be repellent volatile chemicals from the plants which reduce any stimulation for feeding or egg laying, or the plants may contain a "juvenile hormone activity" which prevents the process of insect metamorphosis. Plants may also contain a "moulting hormone activity" which stimulates the processes which lead to the critical phenomenon of moulting. A combination of one or more of these may protect the plants against susceptible larvae.

What, then, are the nature of the ties which link some butterfly larvae so strongly to particular genera or families of plants in so many cases?

1. Some larvae sequester toxic substances from the food plants which then make the larvae or adult butterflies unpalatable to predators. The well-known examples are the Monarch Butterfly which feeds on genera of the Asclepiadaceae and related butterfly genera which eat plants of the Apocynaceae or Aristolochiaceae. Plants in these families contain cardiac glycosides many of which are toxic to higher animals. The defence agent for the plant becomes the defence agent for the insect. If these larvae eat other plants, (and this can be induced under experimental conditions), they may cease to be toxic to predators and may then be eaten with impunity. Many of these adult butterflies are conspicuous and showy and have many mimics, Edgar, Culvenor, Pliske (1974).

2. Other butterflies are attracted by particular plant odours which stimulate egglaying, or feeding responses of the larvae. A well known example is the stimulating effect of

mustard oil glycosides in the Brassicaceae on *Pieris*. Similar chemicals are found in the Capparidaceae, Apiaceae and Tropaeolaceae which all provide food plants for Pierids. Once canalised by feeding or egglaying responses to particular plants it is obviously difficult for an insect to transfer to another food plant if vital responses are not triggered.

3. It is now well known that mates may be attracted, or reproductive cycles initiated by an array of chemical substances referred to as pheromones released in the air at extreme dilutions. Precursors for the pheromones are obtained from specific plants e.g., pyrrolizin alkaloids from the Boraginaceae and Asteraceae. Some butterflies have become dependent on these hepatotoxic products for the synthesis of their pheromones. It has been shown that butterflies raised in captivity in the absence of appropriate plant sources are unable to produce the ketones needed, Schneider *et al*., (1975).

Much of the work in this field is very recent and the use of plants as sources of pheromone precursors is probably far more widespread than has yet been demonstrated. What factors the monocotyledons have in common and to which the Trapezitinae, Hesperiinae and Satyrinae are tied has not been shown. Culvenor (1970) points out that the Poaceae (Gramineae) are remarkable for the paucity of toxic substances and secondary compounds recorded from them and suggests that they are in fact well adapted to being eaten. This does not explain why three subfamilies of butterflies are confined to monocotyledons and other groups avoid them completely.

Once established it may well be difficult for these butterflies to change their feeding habits. After 3,000 years of domestication the silkworm, a moth not a butterfly, still has a restricted diet of mulberry and it has not been possible to induce the larvae to accept a more 'convenient' diet of cabbage, grass, lucerne, or lettuce on which mortality is high.

Botanical considerations

The plant families that are well represented as larval food plants in Australia (Table 19) include the large monocotyledonous families Poaceae (grasses) and Cyperaceae (sedges), but not Juncaceae, and the genus *Lomandra* in Xanthorrhoeaceae (or Liliaceae), but not *Xanthorrhoea* itself.

The dicotyledonous families well represented include all the legumes, Fabaceae, Mimosaceae, and Caesalpiniaceae, the mistletoes Loranthaceae, closely followed by the Sapindaceae and Lauraceae. These are followed by a fairly long 'tail' with 12 families each feeding 5-8 species of butterfly and 38 families each feeding 1-4 species. The principal families of food plants are of tropical origin.

Table 19. Most favoured food plant families of Australian butterfly larvae.

Plant families	Principal distribution	Butterfly species
Gymnosperms		
Cyadaceae	tropic & subtropic	1
Podocarpaceae	tropic & temperate	1
Monocotyledons		
Poaceae	cosmopolitan	51
Cyperaceae	cosmopolitan	19
Palmae	pantropic	3
Flagellariaceae	tropic old world	3
Smilacaceae	tropic	2
4 other 1 species each		

Continued on page 288

Table 19 (*continued*)

Plant families	Principal distribution	Butterfly species
Dicotyledons		
Fabaceae	pantemperate	22
Mimosaceae	pantropic	20
Caesalpiniaceae	paleotropic	12
Loranthaceae	tropic	22
Sapindaceae	tropic	20
Lauraceae	paleotropic	11
Rutaceae	widespread ?southern	8
Myrtaceae		
(Leptospermoideae)	Australia	8
(Myrtoideae)	tropic (America)	4
Verbenaceae	tropic & subtropic	7
Capparidaceae	paleotropic	6
Sterculiaceae	pantropic	6
Annonaceae	paleotropic	6
Moraceae	pantropic	6
Proteaceae	temperate, southern	6
Acanthaceae	pantropic	5
Asclepiadaceae	pantropic	5
Euphorbiaceae	cosmopolitan	5
Rhamnaceae	cosmopolitan	5
Rubiaceae	pantropic	5
Aristolochiaceae	tropic	4
Asteraceae	cosmopolitan	4
Apocynaceae	pantropic	3
Boraginaceae	cosmopolitan	3
Epacridaceae	Australian	3
Flacourtiaceae	pantropic	3
Monimiaceae	tropic & subtropic	3
Passifloraceae	tropic (America)	3
Portulacaceae	temperate (America)	3
Santalaceae	temperate & tropic	3
Scrophulariaceae	cosmopolitan	3
Ulmaceae	tropic & temperate	3
26 families with 1-2 species each		

Table 20. Southern botanical families and their butterfly fauna*.

	Approx. no. genera in Australia	Wide dist. in Australia	Butterfly species
Monocotyledons			
Centrolepidaceae	7	—	0
Haemodoraceae	7	—	0
Hypoxidaceae	5	—	0
Juncaceae	9	W	0
Juncaginaceae	3	—	0
Philesiaceae	3	—	0
Philydraceae	5	—	0
Restionaceae	17	W	0
Xanthorrhoeaceae	8	W	10
Dicotyledons			
Aizoaceae	12	W	1
Araliaceae	13	—	1
Casuarinaceae	1	W	1
Chenopodiaceae	27	W	2
Cunoniaceae	14	—	1
Droseraceae	3	W	0
Dilleniaceae	5	W	0
Elaeocarpaceae	5	—	2
Epacridaceae	28	W	3
Eucryphiaceae	1	—	0
Goodeniaceae	14	W	1
Haloragaceae	7	W	0
Monimiaceae	11	—	3
Myoporaceae	2	W	1
Myrtaceae			
(Leptospermeae)	47	W	8
(Myrtoideae)	6	—	4
Pittosporaceae	9	W	2
Portulacaceae	6	W	3
Proteaceae	38	W	6
Rutaceae	38	W	8
Solanaceae	8	W	0
Stackhousiaceae	2	W	0
Stylidiaceae	5	W	0
Thymelaeaceae	7	W	2
Tremandraceae	3	W	0
Winteraceae	2	—	1
Zygophyllaceae	4	W	1

*Botanical families from Good (1961) to which have been added Juncaceae, Chenopodiaceae and Solanaceae; genera from Burbidge (1963); Juncaceae and Xanthorrhoeaceae as used by Burbidge are disputed groupings, nine of the ten species of butterflies listed here eat *Lomandra*; eleven of the sixty-one species of butterflies listed belong to the polyphagous genera *Candalides* and *Hypochrysops*.

While the grasses and sedges are well represented, three monocotyledonous families poorly represented are the Orchidaceae, Juncaceae and the Restionaceae. The first is a large and diverse family but in Australia feeds only one butterfly. The second is not usually considered a 'southern' family but both Cronquist (1968) and Takhtajan (1969) note its morphological affinities to Restionaceae and Rendle (1956) to *Xanthorrhoea* and *Calectasia*, two endemic Australian genera. The Restionaceae is a small but distinctly southern family somewhat similar to many sedges but it feeds no butterflies here.

The following dicotyledonous families well represented in Australia are eaten by few or no butterfly larvae (Table 20): (1) Casuarinaceae which are found throughout most of Australia. (2) Proteaceae which, while not confined to Australia, is one of the classical southern families. The only butterfly larvae recorded on *Banksia* is the polyphagous *Hypochrysops*. The only other Proteaceous genera eaten are *Macadamia* and *Grevillea* by the polyphagous *Candalides*. It is remarkable that there are no records from the large and diverse genera *Dryandra* and *Hakea*. (3) Chenopodiaceae which are well developed in drier Australia feed two butterflies. (4) Dilleniaceae feed no butterfly larvae, the Zygophyllaceae feed one. (5) Considering their occurrence through the warmer parts of Australia, the Malvaceae feed few. (6) Myrtaceae, abundantly and variously developed in Australia and containing one of the largest and most widespread genera in *Eucalyptus*, are eaten by very few butterfly larvae. (7) Haloragaceae, though not a large family, are widespread and *Haloragis* is not represented as a food plant. (8) Epacridaceae, well developed in Australia, feeds only two species of *Neolucia*. (9) Goodeniaceae widespread in Australia are eaten by the larvae of *Junonia* only.

A number of families in the Sympetalae, particularly the Tubiflorae, and including such families as Boraginaceae, Verbenaceae, Labiatae, Scrophulariaceae, Acanthaceae, Myoporaceae, Plantaginaceae, Rubiaceae and Asteraceae (Compositae) feed remarkably few butterfly larvae in Australia. The last is one of the largest and most widespread of all plant families, but includes only 10 genera that are eaten, of which four are introduced, and seven are eaten by a single species *Vanessa kershawi*. Except for the Myoporaceae none of these families is usually considered to be of southern origin or to have been especially elaborated in Australia. In general terms they are considered to be of northern temperate or tropical origin. Strikingly absent from the food plants in this order are those families of southern origin or elaboration, for example Solanaceae, Goodeniaceae, Stylidiaceae.

It is of interest that the two subfamilies of butterflies considered to be well developed in Australia, the Trapezitinae and to a lesser extent the Satyrinae, feed exclusively on monocotyledons, and in the period of their evolution have not spread on to typically Australian or indeed southern families. The principal families involved, the cosmopolitan Poaceae and Cyperaceae, and pantropic Palmae, are in no way especially or singularly Australian. The absence of larval food plants in the Restionaceae, the most distinctly southern family, and in the Juncaceae is intriguing.

Food plants in relation to the origin or centres of diversity of the butterfly genera.

Most of the genera of butterflies in Australia extend through Papua New Guinea to the South-east Asian land mass, or to the South-west Pacific. A few are well developed in or extend to Africa, Eurasia or the Americas. One of these is *Tagiades* (Hesperiidae), a genus of a dozen species widespread in Asia and extending to Africa and Madagascar. Beyond Australia the larvae feed on Dioscoreaceae (yams) and Roxburghiaceae, but especially on Convolvulaceae. All three families are widespread in the tropics and, though not closely related botanically, all three contain many climbing species.

Three genera of the Hesperiinae, *Parnara*, *Borbo* and *Pelopidas*, also extend to Africa and Madagascar but their recorded food plants in Australia differ in no way from those of other genera in the subfamily. In the family Pieridae the subfamily Coliadinae is well developed in the tropics of both the Old and the New World. Both genera *Catopsilia* and *Eurema* feed on *Cassia* and other woody legumes. While the legumes are widespread in both Old and New World tropics the genus *Cassia* is particularly well developed in the American tropics.

The subfamily Pierinae contains the genus *Pieris* which is well developed in the northern hemisphere and in north and central America. Its prediliction for Brassicaceae (Cruciferae) is well known and this plant family is distributed primarily in the northern hemisphere, particularly in the cooler regions with fewer species elsewhere. As an alien in the Australian fauna *Pieris* has retained its original food plants and the only native plant recorded as a food plant is *Lepidium hyssopifolium* Desv. which belongs to a cosmopolitan genus.

In the family Nymphalidae, subfamily Danaiinae, the genera *Danaus* and *Euploea* feed mainly on Asclepiadaceae and Apocynaceae—both are pantropical and the Asclepiadaceae are well developed in South America. Both families contain many climbers.

The subfamily Ithomiinae is well developed in Central and South America but is only represented here by a single species feeding on *Parsonsia*. In the Americas members of the subfamily feed on species of the Solanaceae.

In the subfamily Nymphalinae, the genus *Argyreus* which belongs to a group of genera well developed in the Palearctic and Nearctic regions with few species in the southern hemisphere, feeds on *Viola*, a genus best developed in the temperate regions of the northern hemisphere. It has not moved from Australian representatives of that genus. The genus *Vanessa*, world wide and best developed in Palearctic and Nearctic areas, feeds in Australia on Asteraceae (Compositae) and the nettle, *Urtica*. The latter belongs to a primarily tropical family, while the former, though cosmopolitan, is not conspicuous in tropical regions and is best developed in temperate areas. The genus *Acraea* (subfamily Acraeinae), is well developed in Africa and here feeds on*Adenia* and *Passiflora* and while the Passifloraceae, to which both genera belong, is well developed in the Americas, *Adenia* is best developed in Africa.

If any generalisation can be drawn from these examples it is that butterfly species in Australia which might be considered outliers of genera well developed elsewhere, remain feeding on plants no different from those found in the main centres of distribution of the genus and they have not moved on to distinctively Australian plants. However, some geographical differences in food preferences are known. *Papilio demoleus* in Australia and New Guinea, for example feeds mostly on *Psoralea* but sometimes on *Citrus* and *Microcitrus*. In India *Citrus* and other Rutaceae are the usual food plants (Common & Waterhouse, 1972).

It could perhaps be expected that the number of plant genera eaten would be related to the number of butterfly species in the genus. If the number of butterfly species is plotted against the number of plant genera eaten the spread is very wide and what little correlation there may be is provided by the few large polyphagous genera *Papilio*, *Euploea*, *Hypochrysops* and *Candalides*. The correlation coefficient between the number of species in the genus and the number of food plant genera eaten is $r = 0.53$ and that between the number of species in the genus and the number of plant families eaten is $r = 0.42$. These can be considered only moderate correlations and so indicate that there is a tendency for the species in a genus of butterflies to be restricted to a limited range of food plants.

Conclusion

The Australian land mass collided with the east Asian land mass no earlier than late Cainozoic (Veevers and McElhinney 1976), about 25-35 million years ago (Oligocene), and began to receive Laurasian tropical elements of its flora and fauna. Butterflies, often considered to be of tropical origin, moved into Australia with their food plants, for by this time the close relationships between butterfly larvae and food plants had become well established. In some cases butterflies followed their preferred food plants into now extremely arid sites, e.g., *Eurema* on *Cassia*, *Jalmenus* on *Acacia*, or *Ogyris* on *Loranthaceae*, and rarely transferred to other elements of the arid flora e.g., Chenopodiaceae, Myoporaceae or Myrtaceae (Leptospermeae).

Those subfamiles of butterflies with many endemic genera and species in Australia are confined to groups of monocotyledons of tropical origin and few have been able to transfer to typically Australian plant families or genera. Butterfly larvae are conspicuously absent from the recognised southern plant families.

Acknowledgements

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ONE NEW SPECIES AND TWO NEW SUBSPECIES OF *EUCALYPTUS* FROM SOUTHERN AUSTRALIA

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Abstract

A new species *Eucalyptus flindersii*, the grey mallee or mallee red gum, previously referred to *E. morrisii* R.T.Bak. in error, and two new subspecies, *E. viminalis* subsp. *cygnetensis* for the rough-barked manna gum incorrectly referred to *E. huberana* Naud., and *E. yumbarrana* subsp. *striata* from south of Lake Wyola in the Far West Zone of South Australia, are described.

Eucalyptus flindersii C.D. Boomsma, sp. nov.

E. morrisii auct. non R.T. Bak.: Blakely, A Key to the Eucalypts (1st ed.) 129 (1934) ? p.p.; Burbidge, Trans. Roy. Soc. S.Aust. 71: 145 (1947)? p.p.; Black, Flora of South Australia (2nd ed.) 631 (1952)? p.p.

Ab *E. morrisii* R.T. Baker differt trunco laevi griseo, raro cortice aspero ad basem, et foliis plantularum latioribus.

From *E. morrisii* R.T. Baker it differs by its smooth, grey trunk rarely with rough bark at the base and the broader seedling leaves.

Holotypus: South Australia, Mount Hack, Flinders Range (40 km SSE Leigh Creek) 10.ix.1969, *R. Callen 38* (AD).

Isotypus: Woods and Forests Department.

Mallee or small tree to 5 m, smooth grey-barked trunk; *seedling leaves* opposite for 5-8 prs, broadly ovate to broadly ovate-lanceolate; *adult leaves* alternate, petiolate, lanceolate, grey-green, dull; *buds* in axillary clusters, rarely opposite, subsessile, 3-7 per cluster; *peduncle* robust, 5-7 mm long; *operculum* broadly conical, much longer than the cupular torus; *fruit* sessile or occasionally subsessile, obovoid, globose, rim narrow, disc broad and raised, valves 3-4, broad, exsert; *seeds* dark grey-brown to dark grey, with about 20 rows of shallow areolae and a bristle-like fringe. (Fig. 1.)

Distribution

It is apparently restricted to South Australia, being mainly distributed on slopes, and the summits of peaks in the North Flinders Range with rare outliers extending to the South Flinders Range as at Devil Peak, but more frequently at Spring Dam south of Yunta and Pualco Gorge. A related mallee which occurs in a similar rocky habitat at Mootwingie, western New South Wales, can scarcely prove acceptable as this species because it differs in having brown, not grey, seeds and lanceolate, not ovate (orbicular), advanced seedling leaves.

Discussion

This new species has for long been assigned to the related *E. morrisii* R.T.Bak. until it was pointed out by M.I.H. Brooker (pers. com 1973) and later by Hall and Brooker (1975), that the seedling leaves of *E. morrisii* are narrow-lanceolate in contrast with ovate-lanceolate in the grey mallee from the Flinders Ranges.

There are three other related taxa which grow in isolated rocky ranges in arid areas exhibiting divergence in seedling characters but similarities in adult material. These are *E. incurva* C. Boomsma from Mount Lindsay, Birksgate Range, *E. gillenii* A.J. Ewart from Mount Gillen near Alice Springs and *E. morrisii* from the Cobar-Bourke area,


a
b
c
d
e
f
g

western New South Wales. Even though the taxa may ultimately be better treated as subspecies, it is considered that there will be less confusion in current nomenclature if the new taxon is treated similarly to the other three related taxa.

The name commemorates Captain Matthew Flinders, the navigator who observed a mountain range in the vicinity of Quorn in 1803 which has been subsequently named the Flinders Ranges.

Specimens examined

SOUTH AUSTRALIA: Flinders Ranges. Yankaninna Stn, *J. Johnson s.n.*, 21.ix.1966 (AD, Woods and Forests Department); Mount Serle, *D. Symon 3998*, 4.iii.1966 (ADW, K, NSW, Woods and Forests Department); Mount Serle, *D. Symon 3991*, 4.iii.1966 (ADW, NSW, Woods and Forests Department); Mount Serle, *D. Symon 3989*, 4.iii.1966 (ADW, NSW, Woods and Forests Department); Mount Serle, *D. Symon 3994*, 4.iii.1966 (ADW, K, NSW, Woods and Forests Department); Mount McKinley, *D. Symon 4019*, 4.iii.1966 (ADW, NSW, Woods and Forests Department); Mount Falkland, *P. Shooter s.n.*, 9.v.1976, (Woods and Forests Department); Wilpena Pound, *L.D. Williams 9309*, 1.v.1977 (AD); Mount Hack, *T.R.N. Lothian 5295*, 19.ix.1973 (AD); Mount Aleck, *G.R. Gross s.n.*, Dec. 1972 (AD); Illinawortina Pound, *R. Callen s.n.*, 8.x.1969 (AD); Arkapena, 6.5 km S.E. of H.S., *M.D. Crisp 859*, 1.ix.1974 (AD, FRI); Arcoona Creek near foot of North Tusk, *Hj. Eichler and G.F. Gross s.n.*, 20.ix.1956 (AD); Mount Patawurta, *E.H. Ising 536*, 3.x.1918 (AD); Mount McKinlay, *T.R.N. Lothian 3603*, 17.ix.1965 (AD, NSW); Bibliando Stn, West Bore paddock, *M.D. Crisp 756*, 14.iv.1974 (AD); Pualco Gorge, *B.J. Warren 58*, 31.v.1969 (AD); Spring Dam, Yunta, *M.I.H. Brooker 3899*, 12.xii.1972 (AD, FRI); Mount Rowe, *J.B. Cleland s.n.*, 5.ix.1941 (AD); Gammon Hill, *K.D. Rohrlach 669*, 11.x.1959 (AD, K, P, L, BH, UC); Malkia Springs, *J.B. Cleland s.n.*, 27.v.1937 (AD).

Eucalyptus viminalis Labillardière subsp. **cygnetensis** C.D. Boomsma, subsp. nov.

E. huberana auctt. non Naudin: Blakely, A Key to the Eucalypts (1st ed.) 163 (1934); *E. viminalis* var *huberana*: Burbidge, Trans. Roy. Soc. S.Aust. 71: 147 (1947); Black, Flora of South Australia (2nd ed.) 627 (1952).

Arbor patens sylvatica, usque ad c. 20 m alta, *E. viminali* subsp. *viminali* differt umbellis alabastra tres plusve ferentibus et cortice aspero, in dimidio inferiore trunci persistenti, interdum in ramos maiores extenso.

Holotypus: South Australia, Kangaroo Island, Cygnet River, Hundred MacGillivray, Sec. 40; *R.C. Hagerstrom and C.D. Boomsma*, 10.xii.1979 (AD 98003287). (Fig. 2.)

Spreading tree to about 20 m high; rough bark persistent on the lower half of the trunk, sometimes extending onto the major branches. Umbels of seven buds, infrequently less, to as few as three.

Distribution

In South Australia it commonly occupies well-drained sites of friable soils mostly in cool regions receiving an annual rainfall ranging from 450-900 mm. It occurs in the Lower and Upper South East Zones, Mount Lofty Range, Eyre Peninsula at Mickera and Coffin Bay, and in valleys of alluvial soils on Kangaroo Island. Also occurs in SW Victoria.

At the lower limits of rainfall, it occurs as small inliers within open scrub or low woodland from near Bordertown, northwards to near Pinnaroo and Parrakie. Also occurs in similar adjacent areas in Victoria.

Fig. 1. *Eucalyptus flindersii* C.D. Boomsma. a, capsule, upper size range; b, branchlet; c, seed X 30; d, seedling at 90 days X $^1/_2$; e, mature bud; f, anther X 30; g, portion of lamina X 3. (a, Mt Patawurta, Flinders Ra., *E.H. Ising 576*; b,c,e,f,g, holotype, *R.A. Callen 38*; d, Wilpena Pound, ex cult. Adelaide Bot. Gard. S/R 1761.)

Fig. 2. *Eucalyptus viminalis* subsp. *cygnetensis* C.D. Boomsma. Photograph of holotype, *R. Hagerstrom and C.D. Boomsma s.n.*, 11.xii.1979 (AD 98003287).

Discussion

The rough-barked manna gum in South Australia and SW Victoria has long been associated with favourable sites for afforestation and intensive grazing so that considerable clearance of areas once occupied by it has proceeded to almost eliminate it from some districts. The selection of the Cygnet Valley as the type locality eliminates the possibility of contemporary hybridisation with species which have subglaucous or glaucous seedling or reversionary leaves. Further, the population is substantial and in surviving settlement operations to date, has demonstrated a reasonable likelihood of continued survival.

The conclusion of Banks (1972, p.20) on the identity of the type material of *E. huberana* Naud. as *E. benthamii* Maid. & Cambage or *E. benthamii* var. *dorrigoensis* Blakely or a hybrid was largely influenced by the ovate seedling leaves being described as "légèrement glaucescentes" [slightly glaucescent] in the type description (1891). Later, in 1956, an independent observation by A. Metro of contemporary collected material from the same tree and recorded by Banks (1972, p.18) noted "immature fruits slightly glaucous".

The absence of glaucous individuals in isolated occurrences in South Australia such as Kangaroo Island support Pryor's (1955) and Banks' (1972) assertions that *E. huberana* does not refer to the rough-barked manna gum. Additionally, the type description, Naudin (1891), refers to much broader seedling leaves of oval to oval-oblong shape compared with the usual narrowly elliptical to narrowly elliptical-lanceolate of *E. viminalis* subsp. *cygnetensis*. Therefore a new subspecies of *E. viminalis* is proposed and described.

It is well known, Boomsma (1948), that intergrades between the rough-barked manna gum and glaucescent or glaucous species, with broader seedling leaves, can occur. In the event that such an explanation is applicable to *E. huberana*, even further support is provided for the separate recognition of the non-glaucous, rough-barked manna gum. In conclusion, if *E. huberana* is synonomous with *E. benthamii* Maid. & Cambage (1914) or its var. *dorrigoensis* Blakely (1934), as suggested by Banks (1972, p. 19), it would be the earliest name and should be taken up.

Specimens examined

SOUTH AUSTRALIA: Upper and Lower South East Zones. Hd Penola, *D. Hunt 705*, 4.iii.1962 (AD); Marsh's Swamp, Hd Riddoch, *I.B. Wilson 445*, 19.ii.1966 (AD); Lake Hawdon Station, *R.M. Welbourn 46*, 13.vii.1963 (AD); Big Heath Conservation Park, *C.R. Alcock 3042*, 7.xi.1969 (AD); Fair View Conservation Park, *J.B. Cleland s.n.*, 2.v.1966 (AD); 3 km east of Struan, *I.B. Wilson 562*, 8.x.1966 (AD, NSW, CANB); 45 km south-west of Naracoorte, *D. Hunt 673*, 2.ii.1966 (AD); Tintinara, *T.R.N. Lothian s.n.*, 28.iii.1963 (AD); West of Bunn's Bore, *S. Barker s.n.*, 10.viii.1974 (Woods and Forests Department 1532); 26 km south of Geranium, *R. Isaacson 5301*, 24.vii.1975 (AD, FRI).

Mount Lofty Range. Devil's Elbow, *E.S. Booth 3057*, 15.v.1947 (AD); Mount Crawford, *R.L. Specht 2207*, 18.vi.1960 (AD); Mount Kitchener, *E.N.S. Jackson 346*, 30.vii.1961 (AD); Cox's Scrub, *B.C. Crisp 55*, 13.xii.1970 (AD); McLaren Vale, *R.F. Parsons 106*, 17.xii.1961 (AD).

Eyre Peninsula. Mickera Station, *J. Thomas s.n.*, 20.ii.1951 (Woods and Forest Department 1163); Mickera Station, *R. French s.n.*, 17.ii.1958 (Woods and Forests Department 1167); Mickera Station,*C. Boomsma s.n.*, 29.ix.1958 (Woods and Forests Department 1166); Mickera Station, *C. Boomsma s.n.*, 21.ix.1958 (Woods and Forests Department 1162); Kellidie Bay, *C. Boomsma s.n.*, 25.x.1973 (Woods and Forests Department 11712).

Kangaroo Island. Cygnet River, *C. Boomsma s.n.*, 19.iv.1948 (Woods and Forests Department 1160); Cygnet River, *C. Boomsma s.n.*, 22.xii.1963 (Woods and Forests Department 1161).

VICTORIA: 25 km south of Kiata, Little Desert, *G.C. Cornwall 323*, 24.v.1979 (Woods and Forests Department).

Fig. 3. *Eucalyptus yumbarrana* subsp. *striata* C.D. Boomsma. a, mature bud with operculum removed; b. branchlet; c, fruits; d, anther X 30. (Holotype, *T. Dennis 182*.)

Eucalyptus yumbarrana subsp. **striata** C.D. Boomsma, subsp. nov.

Ab *E. yumbarrana* subsp. *yumbarrana* differt alabastris ramulisque glaucis et operculis alabastrorum non-deformium costatis usque leviter striatis, toris non-profunde sculptis.

Holotypus: South Australia, 50 km south-west of Lake Wyola, *T. Dennis 182*, 16.viii.1979 (AD).

Isotypus: Woods and Forests Department.

It differs from subsp. *yumbarrana* in having strongly glaucous buds and branchlets; opercula faintly striated to distinctly costate, the torus less so. (Fig. 3.)

Distribution

So far it has been observed only in the Far West Zone of South Australia, in a single region south of Lake Wyola, where it is not uncommon in swales of deep, red-brown loamy sand in open scrub in association with *Eucalyptus socialis* F. Muell. ex Miq. (NW form), *Eucalyptus striaticalyx* W.V. Fitz. and the ubiquitious mulga, *Acacia aneura* Benth.

Discussion

This subspecies appears to be the second observed taxon in the *Oleosae* with surface ornamentation to the buds. So far it has been collected sparingly, but field observation by T. Dennis (pers. com.) suggests that it is not uncommon in the region south-west of Lake Wyola.

Specimens examined

SOUTH AUSTRALIA: Far West Zone. 75 km S.W. Lake Wyola, *T. Dennis 183*, 16.viii.1979 (AD, Woods and Forests Department); 78 km S.W. Lake Wyola, *T. Dennis 184*, 16.viii.1979 (AD); James (SW of Lake Wyola), *J. Johnson and S. Reid 1*, 8.vi.1970 (AD, Woods and Forests Department).

Acknowledgements

I appreciate the assistance given to me by Dr W. Barker during the preparation of the manuscript and for the Latin diagnoses; to the Director, Mr P.M. South, of the Woods and Forests Department, I am indebted for permission to offer this paper for publication; Mr J. Banks kindly provided a copy of his thesis and the illustrations were made by Mr L. Dutkiewicz by kind permission of the Chief Botanist, Dr J. Jessop of the State Herbarium. The careful collection of specimens by R. Hagerstrom and T. Dennis was appreciated.

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J. Adelaide Bot. Gard. 2(3): 299-300 (1980)

BOOK REVIEW

The student's flora of Tasmania
Part 4A, Orchidaceae

Curtis, Winifred M. 'The Student's Flora of Tasmania, Part 4A, Angiospermae: Orchidaceae', 1980, Government Printer, Hobart.

A constant source of frustration to those working with Tasmanian plants is the lack of a complete up-to-date Flora for the region. The last complete account of the State's vascular flora was that of Rodway (1903), which has long been outdated, overtaken by new discoveries and numerous changes of name. For the Dicotyledons the gap has been filled by parts 1-3 of Dr. Curtis', 'Student's Flora', published between 1956 and 1967, but the march of progress overtook this work too, necessitating a new edition of part 1 in 1975 (jointly authored with Dennis Morris). Just as some people were wondering whether we would ever see the Monocotyledon volume, Part 4A dealing with the Orchidaceae has appeared, and the wait has been well worthwhile.

At first sight, it appears to be the formula as before, the book being bound (in the economy version) with the familiar brown utilitarian cardboard covers. Inside, however, there are a number of changes. This volume is printed in slightly larger type, making a significant difference in the ease with which it can be read, and for the first time there are coloured illustrations, in the form of photographs illustrating at least one species of each genus.

The amount of work that has gone into this volume, and its consequent value to Tasmanian botany is perhaps most graphically illustrated by the fact that it deals with 145 species in 24 genera, compared with the 79 species in 23 genera listed by Rodway. The only other recent account of Tasmanian orchids, Firth's 'Native Orchids of Tasmania' (1965) included 128 species, illustrating, if such were needed, the continuing high rate of discovery of novelties in the Tasmanian flora, and pointing out the potential for new finds if the necessary effort and resources can be found.

The keys, synonymies, distribution and comments about the taxa follow the same pattern as previous volumes, but the descriptions are slightly longer as a concession to the greater intricacy of the flowers. The descriptions, as in the earlier parts, are drawn up from living plants, making them particularly useful in the field. Pat Palmer's photographs are excellent, and almost make the generic key superfluous. They are supported by Dennis Morris' line drawings, again usually one per genus, and these show in most cases the habit at life size and a magnified detailed view of a single flower. It would have been desirable to have included more of these drawings, and perhaps more dissections and comparative charts (as is given on p. 41, where the columns of most *Thelymitra* species are illustrated) but presumably costs prevented this. The taxa are fully indexed, and arranged with regard to their similarities and relationships.

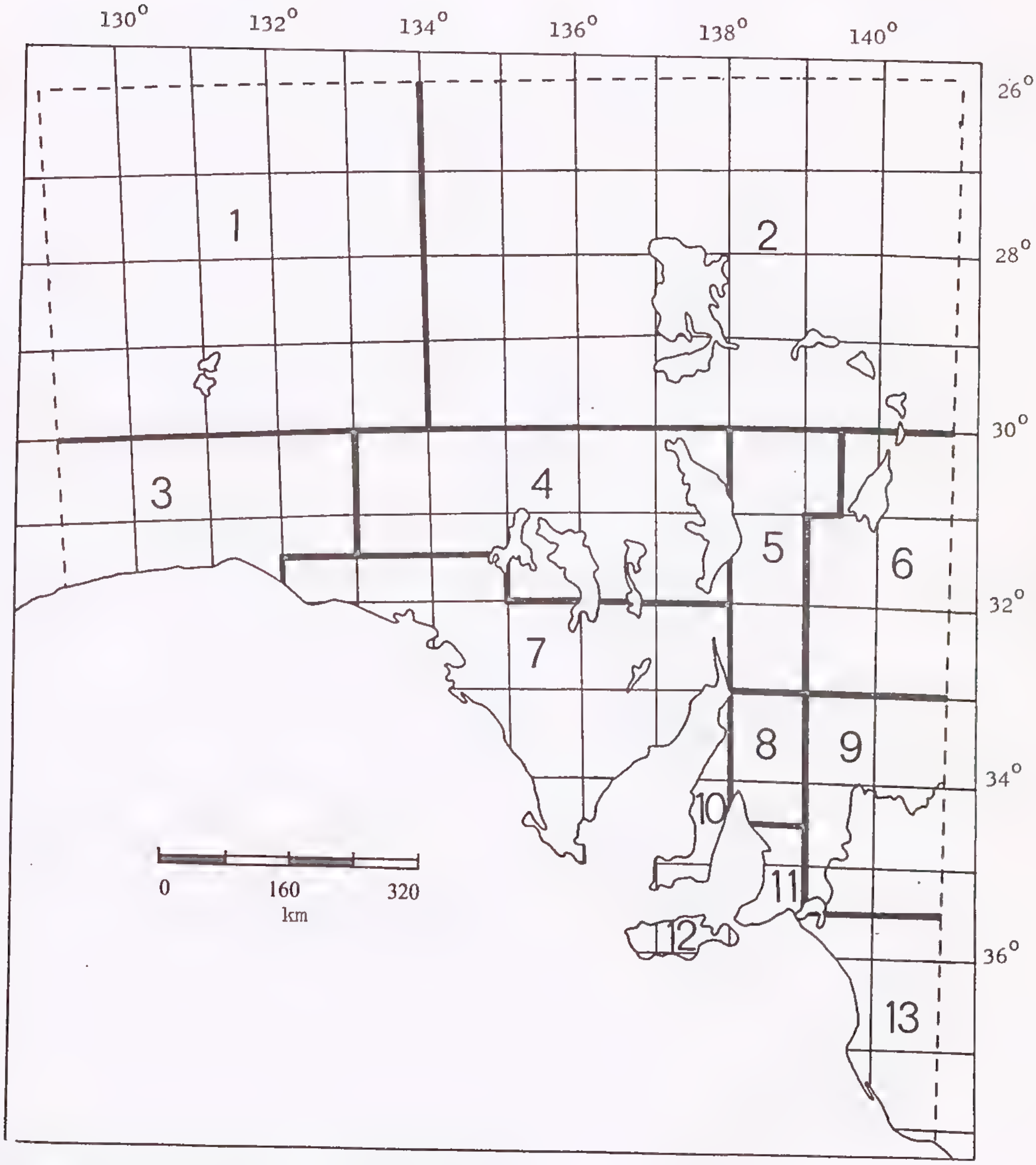
Inevitably a few minor typographic errors slipped in (e.g. misspelling of Abbreviations on p.ii, *Caladenia* instead of *Caladeniae* on p. 133; inconsistencies as in mycorrhiza and mycorhyzic on p.ii) but these are rare. Notes on nomenclature (3 new combinations, 1 new species name) appear at the end of the work, following the tradition established in earlier parts, but one might ask why the opportunity was not taken to describe formally the "interesting and spectacular" *Thelymitra* informally described on p. 45. Species delimitations in general seem to follow other recent treatments, with one notable exception. Dr. Curtis maintains *Pterostylis aphylla* as distinct from *P. parviflora* and gives for both a distribution of (Tas.), S.A., Vic., N.S.W., Qld. *P. aphylla* is not listed, even as a synonym, in most mainland Floras (the exception is Willis, 1962) and I wonder on what evidence it is ascribed to those other States?

However these criticisms are of a very minor nature, and detract not at all from Dr Curtis' achievement. I am sure that botanists throughout Australia will wish "all speed to her pen", that we may soon be presented with Part 4B.

A. E. Orchard
Tasmanian Herbarium

REGIONS OF SOUTH AUSTRALIA ADOPTED BY THE STATE HERBARIUM — ADELAIDE

1. North-western
2. Lake Eyre Basin
3. Nullarbor
4. Gairdner-Torrens Basin
5. Flinders Ranges
6. Eastern
7. Eyre Peninsula
8. Northern Lofty
9. Murray
10. Yorke Peninsula
11. Southern Lofty
12. Kangaroo Island
13. South-eastern



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JOURNAL of the ADELAIDE BOTANIC GARDENS

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JOURNAL of the ADELAIDE BOTANIC GARDENS

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Instructions to Authors

Topics

Papers will be accepted in the following categories:

(a) Plant systematics (Australian and horticultural groups); (b) Descriptive plant morphology, anatomy and ecology; (c) Obituaries, biography and history; (d) Bibliographic studies, book reviews; (e) Botanical illustrations; (f) Noteworthy horticultural contributions.

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Manuscripts must be typed, with double spacing and margins at least 3 cm wide, on one side of the paper only. Three copies must be submitted. Captions must not be italicized, underlined or typed in capitals. All scientific names of generic or lower rank must be underlined.

The print area for illustrations is 20 x 13 cm (including captions). Half-tone material should be submitted this size if possible, but will be reduced by the printers, if necessary.

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50 copies of reprints will be provided for each paper. Additional reprints may be purchased at cost.

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The pattern of the paper should generally be:

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Text references to publications should be indicated as follows: (Smith, 1959), (Smith, 1959, p. 127), Smith (1959) or Smith (1959, pp. 125-208). The final section of the paper, headed 'References', should include only those titles referred to in this way. It should be laid out as follows:

Smith, L. L. (1879). The species of *Danthonia* found in pastures in Victoria. *Austral. J. Bot.* 65: 28-53.

Bentham, G. (1868). "Flora Australiensis", Vol. 4. (London: L. Reeve.)

Baker, J. G. (1898). Liliaceae. In Thiselton-Dyer, W. T. (ed.), "Flora of Tropical Africa", Vol. 7 (Ashford: L. Reeve).

Journal abbreviations must be consistent within a paper and authors are recommended to follow "Botanico-Periodicum-Huntianum". Journals not cited in B-P-H should be abbreviated to conform with this general pattern. The following abbreviations for Australian states should be used: WA, NT, SA, Qld, NSW, ACT, Vic., Tas.

Text references to specimens should be italicized, for example *Kock 276*.

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When required, follow the pattern on, for example, p. 106 of vol. 1, pt. 2.

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References may be cited as:

Benth., *Fl. Austral.* 4: 111 (1868) OR
Benth., *Fl. Austral.* 4: (1868) 111.

Citation of specimens

10-30 specimens should be cited for each species (or subspecific taxon), although this may be varied under certain circumstances. The author may decide whether or not to include dates of collections and the sequence, provided a constant pattern is adhered to throughout a paper.

Authors wishing to cite all specimens seen may list them all in an index to collectors after the style of the "Flora Malesiana" identification lists. Collections not identifiable by a collection number (assigned by either the collector or herbarium) should cite dates.

Correspondence

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ACACIA (LEGUMINOSAE-MIMOSOIDEAE): A CONTRIBUTION TO THE FLORA OF CENTRAL AUSTRALIA

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Abstract

The taxonomy of fifteen *Acacia* species from Central Australia is discussed. Seven new species are described, namely *A. abbreviata* (N.T.—a possible hybrid origin for this species is considered), *A auricoma* (W.A. and N.T.—a very unusual species due to its possession of stellate hairs), *A. dolichophylla* (N.T.), *A. jamesiana* (W.A.), *A. latzii* (N.T.), *A. nelsonii* (N.T.) and *A. rhodophloia* (W.A. and N.T.—this name replaces *A. sibirica* auct. non S. Moore). The following names are here relegated to synonymy for the first time: *A. coronalis* J.M. Black (under *A. victoriae* Benth.), *A. dentifera* var. *intermedia* S. Moore and *A. graffiana* F. Muell (under *A. hemiteles* Benth.), *A. dentifera* var. *parvifolia* S. Moore (under *A. prainii* Maiden) and *A. genistoides* A. Cunn. ex Benth. (under *A. tetragonophylla* F. Muell.). Notes are provided regarding J.M. Black's synonymy of *A. prolifera* J.M. Black (under *A. prainii* Maiden) and D.J. Whibley's synonymy of *A. sowdenii* Maiden (under *A. papyrocarpa* Benth.). A brief discussion of the *A. brachystachya* group is given (including the species *A. brachystachya* Benth., *A. linophylla* W.V. Fitzg. and *A. ramulosa* W.V. Fitzg.) and also notes as to why *A. melleodora* Pedley is not treated separately from *A. dictyophleba* F. Muell. Lectotypification is effected for seven taxa, namely *A. dentifera* var. *parvifolia* S. Moore, *A. genistoides* A. Cunn. ex Benth., *A. graffiana* F. Muell., *A. hemiteles* Benth., *A. papyrocarpa* Benth., *A. prainii* Maiden and *A. tetragonophylla* F. Muell.

Introduction

The main purpose of this paper is to validate new names used in my account of *Acacia* in the 'Flora of Central Australia' (in press), to effect the synonymy of a number of species within the region and to comment on the taxonomic status of others occurring there. A phytogeographical analysis of the 116 taxa in Central Australia will be published elsewhere (Maslin and Hopper, in preparation). The taxa are presented alphabetically by specific name and a list is given at the end of the paper of the numbered specimens seen for the new species described.

1. **Acacia abbreviata** Maslin sp. nov. (Fig. 1.)

Frutex expansus ad 60 cm altus et 2 m diam.; *ramuli* glabri vel glabrescentes. *Stipulae* 1-1.5 mm longae. *Phyllodia* fasciculata (in surculis novellis solitaria), linearia ad anguste oblonga, 4.5-10 (25) x 0.8-1.2 mm, glabra, lateraliter mucronulata. *Inflorescentia* axillaria; *spicae* 8-15 mm longae; *pedunculi* 8-18 mm longi. *Flores* 5-meri. *Legumina* linearia sed ad basim angusta, ad 6.5 x 0.5 cm, sublignosa, plana, resinosa, glabra. *Semina* in legumine obliqua; *funiculus-arillus* strictus, anguste turbinatus.

Type: Tanami, 20°00'S, 129°40'E, Northern Territory. "Small bushy shrub to 2 ft. high, stems and branches spreading. Localized to drainage areas on stony spinifex plain." 25 May 1970, *J.R. Maconochie 1026*. Distributed as *Acacia amentifera* F. Muell. (holo: PERTH; iso: K, MEL, NT, PERTH).

Bushy, spreading, infundibular *shrubs* to 60 cm tall and 2 m diam.; *bark* smooth and grey; *branchlets* resinous, terete, very obscurely nerved, apically yellow but becoming (reddish-) brown with age, glabrous or glabrescent. *Stipules* persistent, narrow-triangular, 1-1.5 mm long, ascending, scarious, brown. *Phyllodes* at first solitary (on new shoots) but soon developing clusters of up to 6 per node, linear to narrow-oblong but often slightly tapered towards the base, 4.5-10 mm long (one sample with new shoots the phyllodes to 25 mm), 0.8-1.2 mm wide, L/W = 3.5-14 (30-new shoots), rather spreading, straight to slightly curved or very shallowly sigmoid, resinous (at least when young), glabrous, compressed yet thick or sometimes almost terete, longitudinally wrinkled when dry, very obscurely longitudinally multistriate; *apices* distinctly yet minutely mucronulate (mucro laterally positioned, acute and slightly sharp); *pulvinus* obscure; *gland* very obscure, situated on upper margin of phyllode 2-3 mm above the pulvinus, often comprising a tiny orifice with no associated yellow rim. *Inflorescences* simple (not racemose) and axillary, 1 per node; *spikes* short (8-15 mm long), sometimes obloid when in bud; *peduncles* 8-18 mm long, as long as or longer than spikes, glabrous. *Bracteoles* c. 1 mm long, claws ± linear and expanded into inflexed, thickened, ovate, acute laminae. *Flowers* 5-merous, 2-2.5 mm long, buds subacute; *calyx* c. $^1/_2$ length of corolla, glabrous, obscurely 5-nerved, dissected $^1/_3$ - $^1/_2$ its length into oblong, subacute lobes with distinctly concave sinus between them; *petals* connate for c. $^1/_2$ their length, glabrous, 1-nerved. *Legumes* erect, linear but narrowed towards their bases, to 6.5 cm long and 5 mm wide, splitting elastically from apex, straight but valves curved following dehiscence, subwoody, flat, resinous, glabrous, dark brown, obliquely longitudinally nerved (nerves yellowish), apices thick and uncinate; *margins* thick, yellow and not constricted between seeds. *Seeds* (slightly immature) oblique to longitudinal in legume, obloid, c. 3.5 x 1 mm, medium brown; *pleurogram* obscure, situated near periphery of seed; *funicle-aril* narrow-turbinate, straight.

Distribution (Fig. 8)

Known only from Northern Territory in the vicinity of Tanami (19° 59′S, 129° 43′E) near the Western Australian border. Although *A. abbreviata* has not been collected within the Central Australia region it occurs close to its northern border (i.e. 20° S) and future sampling may well record it for the area as well as for W.A.

Habitat

Laterite or clay-loam over laterite with Spinifex (*Triodia basedowii, T. spicata*) and *Eucalyptus brevifolia*. The species is sometimes localized in drainage areas.

Flowering and fruiting period

Flowers from May to July and legumes with near-mature seeds have been collected between August and October.

*Specimens examined**

NORTHERN TERRITORY: Tanami, 2 mi. (3.4 km) W of old mine, 19°58′S, 129°43′E, *C.R. Dunlop 2342* (BRI, CANB, NSW, NT); 6 km from Tanami towards Western Australian border, *C.H. Gittins 2303* (BRI); About 2 mi (3.4 km) N.W. of Tanami Bore, *N.M. Henry 500* (NT, PERTH); Tanami Mining Camp, 19°57′S, 129°50′E, *J.R. Maconochie 1099* (AD, BRI, MEL, NSW, NT, PERTH) and *1100* (DNA, NSW, NT); 3 km S.W. of Tanami Mine, 19°58′S, 129°40′E, *J.R. Maconochie 1632* (BRI, CANB, DNA, NSW, NT, PERTH); Tanami, 29°58′S, 129°43′E, *J.R. Maconochie 1726* (NSW, NT, PERTH).

Judging from morphological evidence it is quite possible that *A. abbreviata* represents a natural hybrid between *A. hilliana* Maiden (sect. *Juliflorae*) and *A. minutifolia* (sect. *Plurinerves*). All three species are low, spreading shrubs with resinous branchlets, have persistent stipules, glabrous, obscurely nerved, mucronulate phyllodes, 5-merous flowers and all possess the same basic carpological features. Some of the characters suggesting hybrid origin for *A. abbreviata* are given in Table 1. All three species are known to grow in the region of Tanami which is the only locality known for *A. abbreviata*. Detailed field studies are required to examine the possible hybrid population(s) but these studies have not as yet been carried out due to the remoteness of the locality. The close relationship between sect. *Juliflorae* and sect. *Plurinerves* has been reported in recent literature viz. Pedley (1978), Pettigrew and Watson (1975) and Vassal (1972). Therefore it would not be too surprising if *A. abbreviata* is subsequently shown to be a natural hybrid between species from these two sections although it is noted that natural hybridity within *Acacia* is not a commonly reported event.

* I have seen only those specimens lodged at AD, BRI, PERTH and NT; the other herbaria listed are noted on the original NT labels as having been donated duplicates.

Table 1. Some of the morphological features showing *A. abbreviata* intermediate between *A. hilliana* (sect. *Juliflorae*) and *A. minutifolia* (sect. *Plurinerves*).

Character	A. hilliana	A. abbreviata	A. minutifolia
Branchlets	Glabrous	Glabrous or glabrescent	Puberulous
Phyllodes	Solitary (rarely tardily fasciculated) 20-60 mm long terete (rarely flat)	Fasciculate 4.5-10 (25) mm long flat (yet thick), sometimes ± terete	Fasiculate c. 2 mm long flat (yet thick)
Flower-heads	Distinctly cylindrical (1) 2-4 cm long	Short cylindrical 0.8-1.5 cm long	Globular, c. 0.6 cm diam.
Flower-buds	Not attenuate	Somewhat attenuate	Distinctly attenuate
Calyx	Deeply dissected, sinus distinct between lobes	Deeply dissected, sinus distinct between lobes	Shallowly dissected, sinus indistinct

Acacia amentifera F. Muell. and *A. conjunctifolia* F. Muell. are also resinous shrubs with small, fasciculate phyllodes but *A. abbreviata* is readily distinguished from these species by its less prominently ribbed branchlets, its narrower, thicker, less flattened phyllodes, its longer peduncles and its sepals which are united for about half their length. The types of both *A. amentifera* and *A. conjunctifolia* were collected from the Victoria River area about 300 km north of Tanami.

The specific epithet refers to the very short phyllodes.

2. **Acacia auricoma** Maslin sp. nov. (Fig. 2.)

Frutex 2.5 m altus; *rami* phyllodia et legumina modice ad dense minute stellato-pilosa. *Stipulae* transverse triangulares, 1-1.5 x 1.2-2 mm. *Phyllodia* oblique elliptica ad late-elliptica, 3-10 x 1.5-4 cm, L/B = 1.5-2.5, coriacea, obtusa, (3)4(5)-nervata, nervis aliquot ad basim cum margine confluentibus, reticulata. *Inflorescentiae* axillares, ad apices ramulorum vel recemosae vel paniculatae ob phyllodia reducta; *pedunculi* ad anthesin 2-3 cm longi et pilis aureis stellata; *capitula* globulosa, c. 130-floribus. *Florae* 5-merae; *calyx* et *corolla* apicem versus aurea puberula. *Legumina* anguste-oblonga, ad 8 cm x 1.5-2 cm, plana, reticulata. *Semina* in legumine transversa, obloidea, 6-6.5 x 3-3.5 x 2 mm.

Type: Bloods Range, 24°43'S, 129°01'E, Northern Territory. "Erect shrub to 2 m, inflorescence golden brown, falling rapidly when dry; bark smooth. Growing on scree slopes with Spinifex and occasional bloodwood, mulga, solanum; Plect. melvillei, multi-stemmed." 10 April 1972, *J.R. Maconochie 1395*. Distributed as *Acacia* sp. nov. affinity *A. retivenia* (holo: PERTH; iso: AD, B, BRI, CANB, DNA, K, MEL, NSW, NT. I have seen only the K, NT and PERTH sheets).

Erect, rather scraggly, sparsely branched, multi-stemmed *shrubs* to 2.5 m tall; *bark* smooth; branches terete, very finely nerved (apically somewhat coarsely nerved), reddish-brown, moderately to densely minutely stellate hairy (hairs white but often golden towards branch apices); *new shoots* golden. *Stipules* sub-persistent, shallow-triangular, 1-1.5 mm long, 1.2-2 mm wide, dark brown, densely stellate-hairy abaxially, glabrous adaxially. *Phyllodes* asymmetrically elliptic to broad-elliptic, 3-10 cm long, 1.5-4 cm wide, L/B = 1.5-2.5, coriaceous, minutely stellate-hairy, subglaucous, drying greyish-green, obtuse; longitudinal *nerves* (3)4(5), yellowish, raised when dry, some confluent with lower margin for up to c. 1 cm above the pulvinus, the 2 lower nerves ending at the apex, the remainder frequently intersecting the upper margin at indentations which are usually gland-bearing, lateral nerves transversely anastomosing and forming a prominent reticulum; *pulvinus* 3 mm long, transversely rugose; *gland*

Fig. 1. *Acacia abbreviata* sp. nov.
(*J.R. Maconochie 1026*, holotype— PERTH).

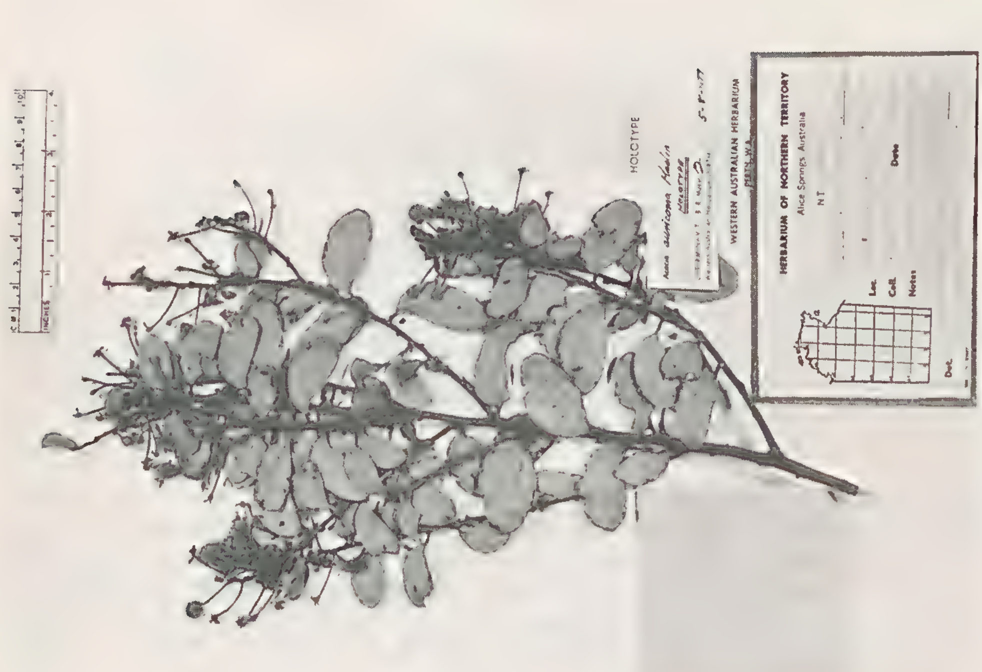

Fig. 2. *Acacia auricoma* sp. nov.
(*J.R. Maconochie 1395*, holotype— PERTH).

prominent on upper margin of phyllode at distal end of pulvinus, elliptic, 1-1.5 mm long, lip yellow, orifice slit-like, 2-4 smaller glands along the upper margin of the phyllode which is indented about these structures. *Inflorescences* simple and axillary but terminally racemose or paniculate due to phyllode reduction; *peduncles* 2-3 cm long, to 4.5 cm when in fruit, thick, longitudinally nerved, golden stellate-hairy at anthesis, indumentum white on fruiting specimens; *receptacles* capitate; *flower-heads* globular, large, dense, c. 130-flowered, brownish-golden. *Bracteoles* linear-spathulate, 2.5 mm long; *laminae* slightly inflexed, thickened, dark brown, densely puberulous abaxially, glabrous adaxially. *Flowers* 5-merous, to 2.5 mm long; *calyx* $^3/_5$ length of corolla, dissected $^1/_4$-$^1/_2$ its length into narrow-oblong lobes often with hyaline margins, lobe apices slightly dilated concave and densely golden puberulous, calyx tube light brown and glabrescent; *corolla* gamopetalous, connate for $^2/_3$ its length with the free portions densely golden puberulous, the tube glabrous and brown but petals separated by membranous hyaline tissue. *Legumes* narrow-oblong, to 8 cm long, 1.5-2 cm wide, ± straight, flat, firmly chartaceous, transversely reticulate, minutely stellate hairy, not or rarely slightly constricted between seeds, narrowly winged (wing more evident along one margin). *Seeds* transverse in legume, obloid, somewhat compressed, 6-6.5 mm long, 3-3.5 mm wide, 2 mm thick, dark brown; *pleurogram* fine, open towards the hilum; *areole* c. 4 x 1.5 mm; *funicle* thickly filiform, 1.5 mm long, brownish, abruptly expanded into a thick, white, non-folded, conic *aril*.

Distribution (Fig. 8)

Restricted to the Western Australia-Northern Territory border area in the region of Docker River where it extends from Anne Range, W.A. (c. 24°47'S, 128°47'E) east to Bloods Range, N.T. (c. 24°43'S, 129°01'E) and Petermann Ranges, N.T. (c. 25°S, 129°30'E).

Habitat

Grows in skeletal soil on quartzite scree slopes with "spinifex" (*Plectrachne melvillei*, *Triodia spicata* and *T. pungens*) and occasional shrubs or trees (*Acacia aneura*, *Eucalyptus brevifolia*, *E. odontocarpa* and *Solanum* sp.).

Flowering and fruiting period

Flowering specimens have been collected in April and August. Young legumes are present on the plants in July-August and reach maturity in October.

Specimens examined

WESTERN AUSTRALIA: Near E. end of Anne Range, ± 24°47'S, 128°47'E, *A.S. George 12094*, per *S. Carlquist* (PERTH).

NORTHERN TERRITORY: Shaw River, East Petermann Range, *W.H. Butler 7* (PERTH); About 18 km N of Docker Aboriginal Mission, 24°43'S, 129°03'E, *N.N. Donner 4455* (NT); Hull River, 12 mi (19 km) E of Docker River Settlement, *P.K. Latz 863* (NT); Lassiter's Cave, 25°02'S, 129°24'E, *P.K. Latz 4159* (CANB, DNA, NT, PERTH); Churnside Creek area, 107 mi (171 km) W of Ayers Rock, *J.R. Maconochie 661* (NT).

Acacia auricoma is a member of Bentham's (1864) series *Plurinerves-Dimidiatae*. It appears to be most closely related to the desert-subtropical species *A. retivenia* F. Muell. which normally also occupies rocky habitats and has the same basic phyllode nervature (except that its principal longitudinal nerves are not basally confluent and its reticulum is more pronounced), inflorescence structure and carpological features. *Acacia auricoma*, however, is readily distinguished by its minutely stellate branch, phyllode, peduncle and legume indumentum (softly tomentose and comprising simply hairs in *A. retivenia* except the legume which is glabrous), its golden (not white) calyx and corolla indumentum and its non-aculeolate bracteoles. Stellate hairs are known from three other members of the *Plurinerves-Dimidiatae* viz. *A. flavescens* A. Cunn. ex Benth., *A. leptoloba* Pedley (both Queensland species) and *A. sericata* A. Cunn. ex Benth. (NW Kimberleys, W.A.) but

A. auricoma differs from all these species in its simple, axillary (not racemose) inflorescences and its phyllodes which are proportionately shorter.

The specific epithet refers to the conspicuous golden indumentum of the new shoots, flowering peduncles and sepal and petal apices.

3. **Acacia basedowii** Maiden, J. Roy. Soc. N.S.W. 53: 197 t.13 ff. 1-6 (1920).

Holotype: Musgrave Ranges, 1903, *H. Basedow 70* (NSW).

Acacia basedowii var. *viridis* Blakely, Austral. Nat. 11: 9 (1944), synon. nov.

Holotype: Stanley Chasm, 40 mi W of Alice Springs, 17.7.1939, *Mrs. B.A. Dale*, per *Jean Buckingham* (NSW).

Through the courtesy of the National Herbarium, Sydney (NSW), I have compared the holotypes of these taxa. Although the type of var. *viridis* does show some differences from that of the typical variety (as noted by Blakely l.c.) when a large range of material is examined it is evident that these differences can be accommodated within the natural range of variation for the species and that varietal segregation is not justified.

4. **Acacia brachystachya** group

These notes are presented in order to explain the approach I have adopted regarding this very complex species-group in my Flora of Central Australia account. As noted by both Pedley (1973, 1978) and Whibley (1980) the *A. brachystachya* group has affinities with *A aneura* F. Muell. ex Benth. (Mulga), a species distinguished principally by its flat, winged, ± glabrescent, non-striate legumes.

Species of the *A. brachystachya* group* are woody shrubs or trees characterized by longitudinally multistriate phyllodes, normally spicate inflorescences and cylindrical or somewhat flattened legumes which are characteristically longitudinally brown-striate with a dense, appressed, silvery indumentum between the nerves. Generally speaking members of this group have been distinguished from one another by the width and transverse sectional shape (± flat vs. terete) of their phyllodes and legumes. Following an examination of a wide range of herbarium material, from limited field observations in both Western Australia and Northern Territory and from a consideration of the literature it is evident that there is much variation in these "diagnostic" characters. Certainly further critical studies are required in order to gain a clearer understanding of this variation but the following suggestion is offered as a possible explanation of the existing taxonomic complexities in the group: as a consequence of apparently uncorrelated, continuous variation in two principal characters, viz. phyllode and legume transverse sectional shape and size, the existing species appear to represent no more than arbitrary points at some intersections of non-parallel clines for these characters.

In the Flora of Central Australia a description is provided which includes the variational ranges of *A. brachystachya*, *A. linophylla* and *A. ramulosa*. The species are not treated separately but are referred to collectively as the *A. brachystachya* group. Brief notes regarding these three species are now presented.

(a) *A. brachystachya* Benth. and *A. ramulosa* W.V. Fitzg. In the two recent accounts of *Acacia* already referred to, both Pedley and Whibley recognized *A. brachystachya* and *A. ramulosa* as distinct species—the former species having short (3-6 cm), rather flat legumes and flat or nearly terete phyllodes and the latter species having long (7-13 cm), terete legumes and flat or terete phyllodes. Considering the range of variation of material

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*This group comprises *A. brachystachya* Benth. (syn. *A. cibaria* F. Muell.), *A. linophylla* W.V. Fitzg. and *A. ramulosa* W.V. Fitzg. *Acacia subtessarogona* Tindale et Maslin has affinities here also but because it occurs outside Central Australia and because it is readily recognized by its subtetragonous legumes it is not included in the present discussion.

under these two names at PERTH and also taking into account my comments under *A. linophylla* below, it seems that the distinction between *A. brachystachya* and *A. ramulosa* is rather indefinite.

Pedley (1978, p. 131) discussed the typification of *A. cibaria* F. Muell. and by selecting Beckler's "Yayinya Mountains" specimen as lectotype has rendered this name synonymous with *A. brachystachya*. I agree with Pedley's typification and general treatment of *A. cibaria* except for his comments regarding the syntype, Gascoyne River, Oliver Jones. I have examined this material (legumes and seeds only) at MEL and found it agreeing with other W.A. material referable to the *A. brachystachya* group (legumes flatter and a little broader than normal though—see *A. linophylla* below). This syntype is definitely not *A. wanyu* Tindale as suggested by Pedley.

(b) *A. linophylla* W.V. Fitzg. This species was described in the same publication as *A. ramulosa* and even though the types of both taxa are in fruit Fitzgerald did not allude to their obvious similarity. Apparently *A. linophylla* is a terete phyllode member of the *A. brachystachya* group but there appears to be continuous gradation to distinctly flat phyllode forms (these flat forms are generally called *A. brachystachya* or *A. ramulosa*, depending on their legume morphology). All terete phyllode individuals that I have seen possess either cylindrical or somewhat compressed legumes which are often broader (to 15 mm) than those found in other members of the group. Quite possibly the Oliver Jones syntype of *A. cibaria* referred to above fits here. In W.A. the terete phyllode individuals occupy much the same geographical range as those with flat phyllodes; they are common in the Murchison and Ashburton districts but have been recorded as far east as the Warburton Range. In South Australia and Queensland both Whibley (1980) and Pedley (1978) refer to terete phyllodes under *A. ramulosa*. It is therefore possible that future work will reveal that *A. linophylla* should not be maintained as a distinct species.

5. **Acacia dictyophleba** F. Muell.

Pedley (1978) described *A. melleodora* and distinguished it from *A. dictyophleba* on the basis of smaller, less coarsely veined phyllodes and smaller flowers and flower-heads. The name *A. dictyophleba* was applied to plants from the Simpson Desert while *A. melleodora* was applied to the more widely distributed element extending from Queensland to Western Australia. From an examination of a large range of W.A. material it appears that at least in this State (and probably also in western Northern Territory) these supposed distinguishing characters for *A. melleodora* do not hold. In the absence of any significant additional characters it seems prudent, for the purpose of the Flora of Central Australia at least, to use the well known name *A. dictyophleba* and to treat the taxon as a single variable species. It is recognized, however, that future work may well invalidate this decision.

6. **Acacia dolichophylla** Maslin sp. nov. (Fig. 3.)

Frutex ad 3.5 m altus; *rami* apicem versus minute appresso-puberuli. Stipulae caducae. *Phyllodia* linearia, acuminata, 12-19 cm x 1-2 mm, plana, stricta, glabrescentia, 3-nervata, nervis discretis, non-anastomosantibus. *Inflorescentia*: racemus brevissimus 2-5-ramosus; *pedunculi* 10-13 mm longi; *capitula* globulosa. *Flores* 5-meri; *sepala* libera. *Legumina* late-linearia, ad 10 cm longa, 6-7 mm lata, ± chartacea. *Semina* in legumine longitudinalia, ellipsoidea, 4.5 x 3 mm.

Type: Mount Giles, 23° 39′S, 132° 55′E, Northern Territory. "Shrub to 3 m with smooth bark. Infrequent in skeletal soil, on slopes of gully in schistoze hill." 19 Sept. 1976, *P.K. Latz 6606* (holo: PERTH; iso: CANB, K, NT—I have seen only the NT and PERTH specimens).

Dense, bushy, rounded *shrubs* to 3.5 m tall; *bark* smooth, greyish; *branches* straight, spreading-erect and sparsely divided, terete, finely ribbed (ribs yellowish and most obvious immediately below insertion of phyllodes), red-brown to grey-brown, apically minutely appressed white puberulous, bronze resin hairs present on young growth. Stipules caducous. *Phyllodes* linear but narrowed at apices into delicate straight or curved innocuous points, 12-19 cm long, 1-2 mm wide, flat, straight, not rigid, olive green, glabrescent, with 3 longitudinal nerves on each face (nerves raised and distant), not anastomosing; *pulvinus* cylindrical but grooved adaxially, 1-2 mm long, transversely wrinkled, yellowish; *gland* obscure, situated on adaxial margin of phyllode 1-3 mm above the pulvinus. *Inflorescences* very condensed 2-5-branched racemes with puberulous axes 0.5-2 mm long; *peduncles* 10-13 mm long, sparsely to moderately appressed white puberulous, some bronze resin hairs also normally present; *flower-heads* globular, pale yellow. *Bracteoles* 1.3 mm long, puberulous; *claws* linear; *laminae* ovate, inflexed, concave and slightly thickened. *Flowers* 5-merous, 2-3 mm long; *calyx* c. $^1/_2$ length of corolla, sepals free, linear-spathulate and apically ciliolate; *petals* connate for $^2/_3$ their length, glabrous, obscurely 1-nerved; *ovary* densely tomentose. *Legumes* broad-linear, to 10 cm long, 6-7 mm wide, ± chartaceous but slightly cartilaginous when young, slightly undulate, nerveless, flat but raised over and normally only slightly constricted between the seeds, glabrescent and slightly shiny at maturity (antrorsely puberulous when young with an admixture of white and bronze resinous hairs), dark brown but greyish-brown when young, rather abruptly narrowed at both ends; *margins* thickened, narrow and yellowish. *Seeds* (slightly immature) longitudinal in legume, ellipsoid, 4.5 mm long, 3 mm wide, greyish-brown; *pleurogram* yellowish, open towards the hilum; *areole* 2.5.x 1.2 mm; *funicle* filiform, folded below and gradually expanded into a slightly thickened *aril*.

Distribution (Fig. 8)

Known only from the Chewings Range, Northern Territory, in the vicinity of Mount Giles (23° 39′S, 132° 55′E).

Habitat

Appears to be restricted to steep, sheltered gullies in relatively nutritious (although skeletal) soils around Mt Giles. The rocks in this area are meta-quartzite and quartz-sericite schists unlike most of the other mountain ranges in the area which consist predominantly of quartzites (P.K. Latz, pers. comm.)

Flowering and fruiting period

Because of the paucity of collections it is difficult to accurately establish flowering and fruiting times. However, from specimens to hand, flowering occurs in July and near-mature fruits occur in late September.

Specimens examined

NORTHERN TERRITORY: Chewings Range, 23° 39′S, 132° 58′E, *P.K. Latz 6642* (CANB, BRI, NT, PERTH); Mt Giles area, 23° 42′S, 132° 54′E, 14 July 1975, *J. Wauchope s.n.* (NT).

Using Bentham's (1864) classification this new species should be placed in series *Plurinerves-Oligoneurae*. In its long, linear phyllodes with 3 nerves on each face, its globular flower-heads and its free sepals *A. dolichophylla* has affinities with the tropical species *A. praelongata* F. Muell. but differs in its hairy branchlets, its acuminate phyllodes and its very condensed racemes. Judging from Mueller's (1887) illustration of *A. praelongata*, carpological features of the two species are not dissimilar. However, the legumes of *A. dolichophylla* are narrower, the funicle thicker and more folded and the areole larger. In its 3-nerved phyllodes and inflorescence characters *A. dolichophylla* is allied to the desert species *A. estrophiolata* (both species grow in the Chewings Range area, the only locality known for the new species) but differs in its longer, narrower phyllodes and its carpological features, i.e. legumes not reticulate or narrowly winged or breaking easily at constrictions between the seeds; the seeds are also slightly arillate. Additionally *A. dolichophylla* is a shrub, not a tree, and does not have the same graceful

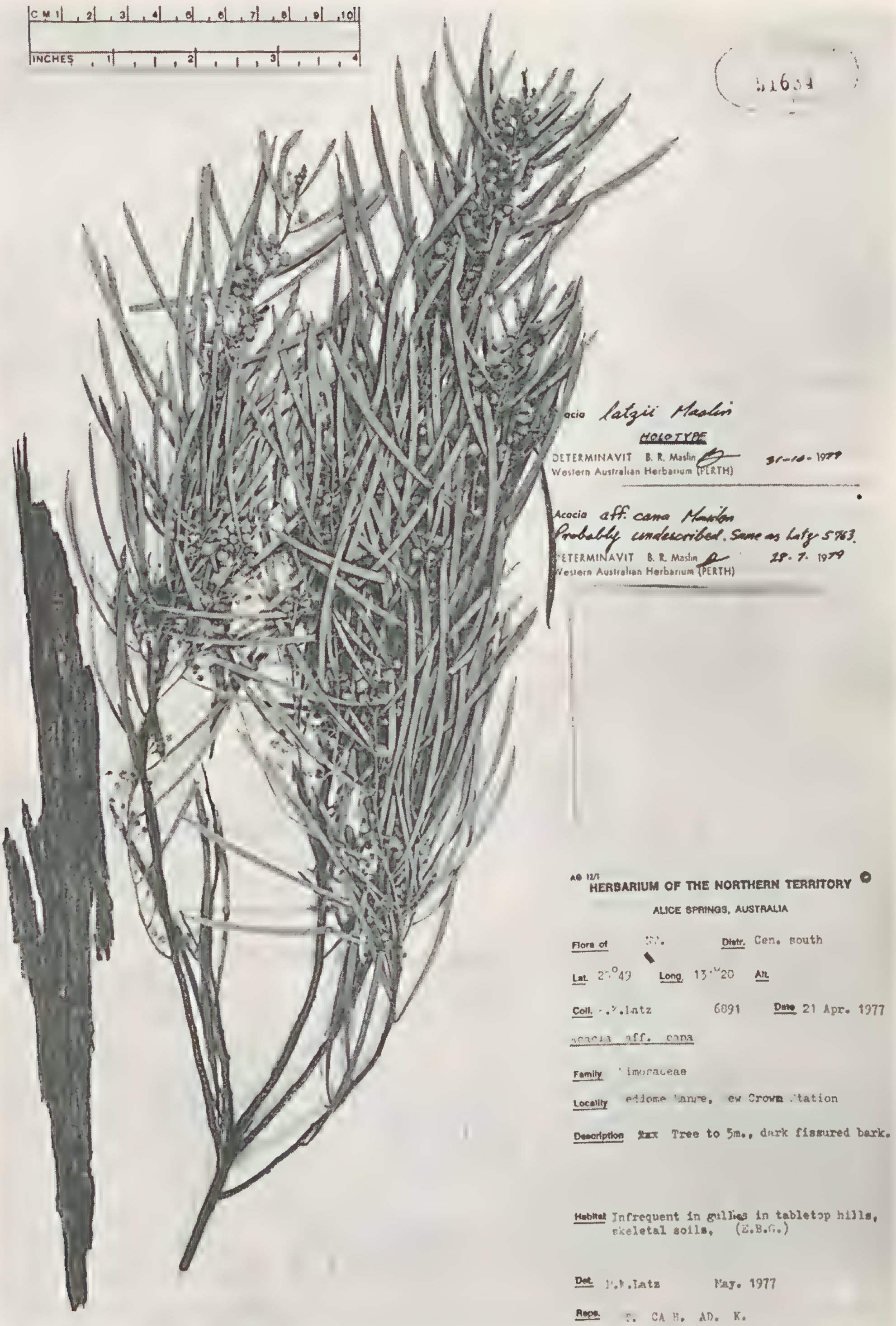

Fig. 5. *Acacia latzii* sp. nov. (*P.K. Latz 6891*, holotype—NT).

drooping habit of *A. estrophiolata*. Another species bearing some relationship with the new species is *A. tenuior* Maiden. This species is known only from the type which was collected by Herbert Basedow in the Musgrave Ranges (about 300 km south of Chewings Range). Both species have long, 8-nerved phyllodes, globular flower-heads and free sepals but unlike *A. dolichophylla* the phyllodes of *A. tenuior* are terete. Legumes are unknown for *A. tenuior*.

The specific epithet refers to the very long phyllodes.

7. **Acacia hemiteles** Benth., Linnaea 26: 619 (1855).

Lectotype: Swan River, *Drummond 47* (K, right hand specimen on sheet stamped Herbarium Hookerianum, 1867; iso-lectotype—K), *lecto. nov.*

A. graffiana F. Muell., Chem. and Druggist of Australas. 2(5): 118 (1887), *synon. nov.*

Lectotype: "*Acacia graffiana* F.v.M. W.A. *J. Dr.*" (MEL, flowering specimen annotated by Mueller; *iso-lectotype*—PERTH), *lecto. nov. Lectoparatype*: "*Acacia graffiana* F.v.M. West Australia, *James Drummond*" (K and MEL, fruiting specimens annotated by Mueller).

Acacia dentifera Benth. var. *intermedia* S. Moore, J. Proc. Linn. Soc. Bot. 45: 174 (1920), *synon. nov.*

Holotype: Nungarin, Western Australia, 1916, *F. Stoward 302* (BM; isotype—PERTH).

Having inspected the type collections of all three names given above I have no hesitation in regarding them as synonymous. The confusion surrounding the name *A. hemiteles* seems to have arisen as a consequence of Bentham (1864, p. 369) erroneously synonymizing this taxon under *A. subcaerulea* Lindl. (1827). Subsequently Mueller described the true *A. hemiteles* as *A. graffiana* under which name it became well known in Western Australia.

Although *A. hemiteles* has not been recorded for Central Australia it is included in my key to species for the Flora because it does occur around Queen Victoria Spring (30° 26′S, 123° 34′E) and future collecting may well extend its range into the region.

8. **Acacia jamesiana** Maslin sp. nov. (Fig. 4.)

Frutex vel arbor 3-5 m alta; *ramuli* sparsim appresso-puberuli. *Phyllodia* linearia-tetragona (in sectione transversali rhombea), raro plana, (8)10-22 cm x 1-2(3) mm, aliquanto rigida, subulata, aliquanto pungentia. *Inflorescentia* axillaria, solitaria; *pedunculi* 2-6 mm longi, interdum ad 15 mm in fructu; *capitula* densa, obloidea, ante anthesin 6-8 x 4-5 mm, L/B = 1.5. *Flores* 5-meri; *calyx* irregulariter lobatus; *petala* obscure 1-nervata. *Legumina* linearia, ad c. 12 cm x 4 mm, cartilaginea ad sublignosa. *Semina* in legumine longitudinalia, obloidea-ellipsoidea, 5-6 x c. 2.5 x 2 mm, niger.

Type: 13 miles (21 km) NE of Wiluna, Western Australia. "Spreading shrub 3 m. On sand dune." 28 July 1963, *A.S. George 5610* (holo: PERTH; iso: PERTH).

Spreading, bushy *trees* or *shrubs* 3-5 m tall; *branches* terete, finely nerved, reddish-brown but with a light grey longitudinally cracking epidermis; *branchlets* ± resinous, rather sparsely appressed silvery puberulous but hairs normally dense around phyllode bases; *new shoots* resinous, indumentum dense and comprising a mixture of bronze and silvery appressed hairs, the bronze hairs soon disappearing. *Stipules* caducous. *Phyllodes* linear-tetragonous (rhombic in cross section) or rarely flattened but then with a raised central nerve, nerves at apices of angles rather broad (to 3 mm) and yellowish-green while those on the intervening faces are very indistinct and range from 3-6 in number, (8) 10-22 cm long, 1-2(3) mm wide, slightly curved, rather rigid, slightly resinous, glabrous or silvery appressed puberulous between nerves at maturity, drying yellowish-green, greyish-green or light olive green; *apices* subulate, straight and coarsely pungent; *pulvinus* c. 2mm long, obscurely transversely wrinkled, densely tomentose adaxially; *gland* on adaxial side of phyllode at distal end of pulvinus or to 2 mm above it, lamina slightly swollen about the gland, lip indistinct, orifice sometimes well developed. *Inflorescences* axillary and solitary, often borne at the base of rudimentary shoots which grow out;

peduncles 2-6 mm long, sometimes to 15 mm when in fruit, longitudinally sulcate when dry, rather sparsely appressed silvery puberulous, basal bracts solitary and caducous; *flower-heads* dense, obloid, 6-8 x 4-5 mm just prior to anthesis, L/B=1.5, c. 40-flowered; *receptacles* thicker than peduncles, longitudinally ridged and with rather obvious flower scars when in fruit. *Bracteoles* 1.5 mm long, ± sparsely puberulous; *claws* linear; *laminae* ovate, apically acute, inflexed, somewhat thickened, brown. *Flowers* 5-merous, 2.5 mm long; *calyx* c. $^1/_2$ length of corolla, variably dissected $^1/_4$–$^3/_4$ its length into oblong lobes which are distally inflexed thickened brownish and puberulous, tube nerveless and sparsely puberulous; *petals* connate for c. $^3/_4$ their length, obscurely 1-nerved, moderately puberulous abaxially. *Legumes* linear, to c. 12 cm long, 4 mm wide, cartilaginous to subwoody, brownish, slightly resinous, sparsely appressed puberulous, longitudinally wrinkled when dry, flat but raised over and very slightly constricted between seeds, somewhat twisted when young; *margins* thickened and laterally broad. *Seeds* longitudinal in legume, obloid-ellipsoid, ± narrowed towards margins, 5-6 x c. 2.5 x 2 mm, blackish, shiny; *pleurogram* open towards the hilum, bordered by a diffuse band of yellowish tissue; *areole* c. 1 x 0.7 mm; *funicle* flattened, folded below a thickened pale yellow *aril* which extends c. $^1/_3$ down one side of the seed.

Distribution (Fig. 8)

Relatively common in the arid Austin Botanical District, Western Australia, from the vicinity of Mount Magnet east to Leinster Downs station and northeast to Wiluna. The species also extends north to the southern tip of the Little Sandy Desert in the region of the Carnarvon Range and also east to the Gibson Desert about 120 km west of Giles.

Habitat

Seems to be restricted to sand dune country.

Flowering and fruiting period

Judging from herbarium material flowering seems sporadic and probably extends throughout much of the year. Flowering specimens to hand (mostly bearing buds, flowers at anthesis and frequently also developing legumes) were gathered between July and November. I have not seen any specimens gathered between December and June. Legumes with mature seeds have been collected in late October, this specimen also possessed flowers at anthesis.

Selected specimens

WESTERN AUSTRALIA: Iona Station near Mount Magnet, *J.S. Beard 6665* (PERTH); Leinster Downs, near Perserverence Well, *M. Blackwell 19* and *20* (PERTH); Gibson Desert, 118 km W of Giles, 24°51'S, 127°16'E, *R. Buckley s.n.* (NT 59902); Carnarvon Range and vicinity, *A.A. Burbidge 11* (PERTH); 70 mi (112 km) N of Sandstone towards Wiluna, *R.D. Royce 10368* (MEL, PERTH).

Using Bentham's (1864) classification *A. jamesiana* should be placed in series *Juliflorae-Stenophyllae* close to *A. resinomarginea* W.V. Fitzg. Both species possess long, striate phyllodes which are normally rhombic in cross section (rarely flat) and dense, non-globular flower-heads. *Acacia jamesiana*, however, is distinguished by its branchlets and phyllodes which lack resin-ribs, its coarser, more rigid phyllodes without delicately curved apices, its more deeply dissected calyx, its slightly shorter and broader spikes, its larger legumes and its larger, blackish seeds. The uncommon flat phyllode forms of *A. jamesiana* superficially resemble *A. heteroneura* Meisn. but are distinguished by their denser flower-heads and larger legumes and seeds.

This species is named in honour of my good friend and colleague Dr James Hamlyn Willis whose contribution to Australian botany has been immense (see *Muelleria* 3(2): 69-88, 1975).

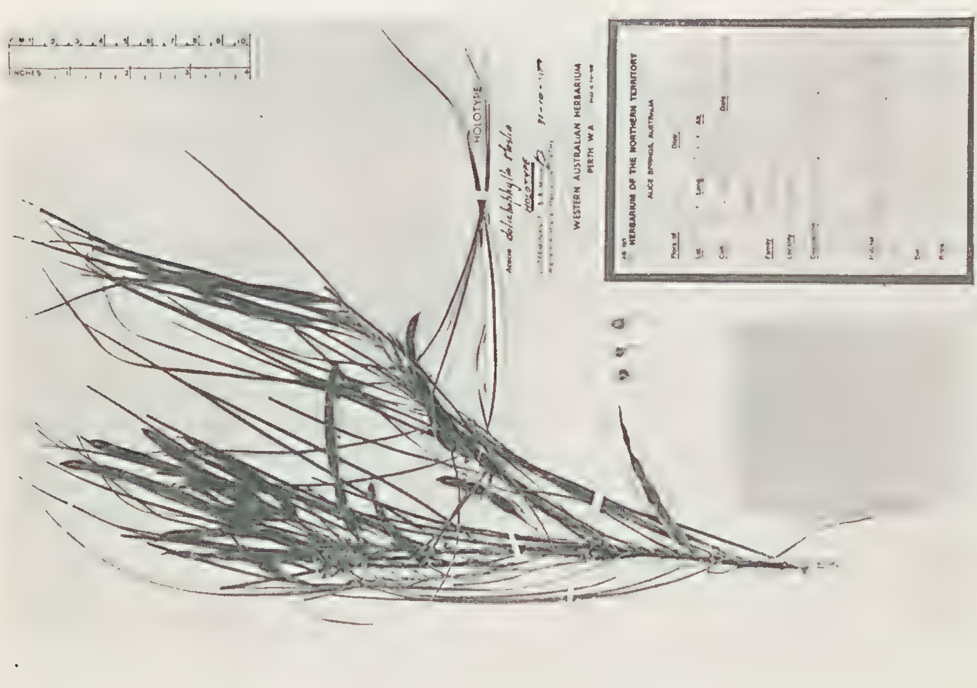

Fig. 3. *Acacia dolichophylla* sp. nov.
(*P.K. Latz 6606*, holotype—PERTH).

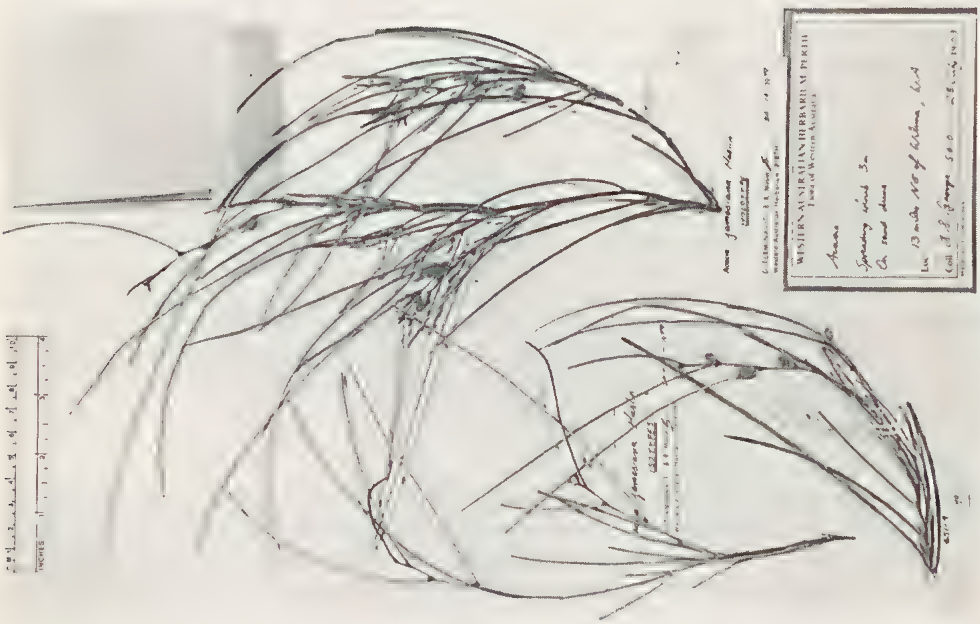

Fig. 4. *Acacia jamesiana* sp. nov.
(*A.S. George 5610*, holotype and isotypes—PERTH).

9. **Acacia latzii** Maslin sp. nov. (Fig. 5.)

Arbor ad 5 m alta; *ramuli* apicem versus sparsim appresso-puberuli. *Phyllodia* late linearia ad angustissime oblanceolata, 5-10 cm x 2-4 mm, L/B = 20-33, plana. *Inflorescentia*: racemus brevis 2-5-ramosus; *pedunculi* 5-9 mm longi; *capitula* parva, 13-18-floribus, resinacea. *Florae* 5-merae. *Legumina* (immatura) late-linearia, ad 15 cm x 5 mm, coriacea, plana, reticulata.

Type: Beddome Range, New Crown Station, 25° 49′S, 134° 20′E, Northern Territory. "Tree to 5 m, dark fissured bark. Infrequent in gullies in tabletop hills, skeletal soils, (E.B.G.)." 21 April 1977, *P.K. Latz 6891* (holo: NT; iso: AD, CANB, K—I have seen only the AD and NT specimens).

Bushy *trees* to 5 m tall; *bark* dark grey and fissured; *branchlets* terete, very finely nerved, very slightly resinous, dark reddish to grey but apically yellowish, sparsely appressed white puberulous. *Stipules* caducous. *Phyllodes* broad-linear to very narrow-oblanceolate, 5-10 cm long, 2-4 mm wide, L/B = 20-33, flat, not particularly rigid, slightly curved and sometimes very shallowly sigmoid due to recurved apices, drying grey to greyish-green, hoary (hairs appressed and often very indistinct), longitudinally multistriate, nerves very indistinct but the central one sometimes slightly more evident than the rest; *apices* rather abruptly narrowed into slightly recurved, acute, brown points which are sometimes coarsely pungent; *pulvinus* 1-2.5 mm long, transversely wrinkled, often indistinct; *gland* obscure, situated on adaxial margin of phyllode 1-4 mm above the pulvinus, lamina slightly swollen about the gland. *Inflorescences* condensed 2-5-branched recemes, axes 1.5-5 mm long and densely white tomentose; *peduncles* 5-9 mm long, sparsely antrorsely puberulous, basal bract caducous and seminavicular; *flower-heads* small, c. 4 mm diam. at anthesis, 13-18-flowered, resinous. *Bracteoles* 0.5 mm long, ± spathulate, laminae moderately puberulous abaxially. *Flowers* 5-merous, 1.2 mm long; *calyx* $^1/_3$-$^1/_2$ length of corolla, dissected ± to base into oblong sparsely puberulous sepals; *petals* glabrous, obscurely 1-nerved. *Legumes* (immature) broad-linear, to 15 cm long, 5 mm wide, coriaceous, curved, flat, glabrous, slightly resinous, reticulate, acute at both ends; *margins* thickened yet narrow, yellowish, slightly or sometimes prominently constricted between seeds. *Seeds* immature.

Distribution (Fig. 8)

Known only from two Northern Territory localities, viz. Beddome Range on New Crown Station (25° 49′S, 134° 20′E) and Tempe Downs Station (24° 36′S, 132° 54′E).

Habitat

Low, hilly country where it favours skeletal soils in steep gullies. These hills often form mesas or buttes and have a hard rock capping underlain by clay, siltstone and shale (P.K. Latz, pers. comm.).

Flowering and fruiting period

Judging from the few specimens at hand flowering occurs in April-May while fruits with immature seeds occur in late September.

Specimens seen

NORTHERN TERRITORY: Beddome Range, 25° 48′S, 134° 20′E, *P.K. Latz 5238* (BRI, CANB, NT, PERTH); Tempe Downs Station, 24° 36′S, 132° 54′E, *P.K. Latz 5763* (BRI, DNA, NSW, NT, PERTH).

The new species occurs in Bentham's (1864) series *Plurinerves-Microneurae* and seems most closely allied to *A. calcicola* Ford et Ising with which it had sometimes been confused in the past. *Acacia latzii*, however, is distinguished by its smaller flower-heads bearing fewer flowers (13-18 compared with 30-60) and its flat, coriaceous, glabrous, reticulate legumes (± moniliform, woody, hoary and not reticulate in *A. calcicola*). Additionally the branchlet and phyllode indumentum on *A. latzii* tends to be less dense than that of *A. calcicola* and also its peduncles at anthesis are not golden coloured. *Acacia* *calcicola*, unlike *A. latzii*, is common in Central Australia and grows on limestone or sand over limestone (P.K. Latz, pers. comm.).

The new species is named in honour of Mr Peter Latz, Arid Zone Research Institute, Alice Springs, upon whose fine collections the above description is based.

10. **Acacia nelsonii** Maslin sp. nov. (Fig. 6.)

Arbor fruticulosa 3-4 m alta; *cortex* in ramulis lateralibus "Minni Ritchi". *Phyllodia* linearia, acuminata, 12-18 cm x 1.5.-2 mm, plana, glabra, tenuissime multistriata. *Inflorescentia* racemus brevissimus 1-2-ramosus; *pedunculi* 2-10 mm longi; *capitula* cylindrica, ad anthesin 2 cm longa. *Flores* 5-meri; *calyx* breviter lobatus. *Legumina* submoniliformia, ad 9 cm x 4 mm, glabra. *Semina* in legumine longitudinalia, 4-4.5 x 2.5-3 mm, nigra.

Type: Atherrita Bore, Todd River Station, 24° 26'S, 134° 52'E, Northern Territory. "Tree to 4 m, flowering almost finished, red peeling bark, phyllodes erect. Flowering sparse on all trees." 21 Aug. 1979, *J.R. Maconochie 2507* (holo: PERTH, iso: NT, PERTH).

Shrubby *trees* 3-4 m tall; *bark* grey and fibrous on main trunk to c. 2 m above ground level but then becoming typical "Minni Ritchi" (i.e. red and exfoliating in narrow curly strips) on lateral branches but not on branchlets; *branchlets* terete, very obscurely nerved, glabrous. *Stipules* caducous. *Phyllodes* linear but acuminate with slightly curved apices, 12-18 cm long, 1.5-2 mm wide, flat, not rigid, straight to slightly curved, glabrous, bright green when young but becoming subglaucous with age due to a light grey flaking epidermis, very finely longitudinally multistriate, central nerve barely more evident than the remaining nerves; *pulvinus* 2-3 mm long, transversely wrinkled, yellow to brown; *gland* very indistinct, situated on upper margin of phyllode at distal end of the pulvinus. *Inflorescences* 1-2-branched condensed axillary racemes, axes 1-3 mm long and sometimes growing out at their apices; *peduncles* 2-10 mm long, resinous-papillose but becoming glabrous; *spikes* light golden, not particularly dense, c. 2 cm long at anthesis, to 3.5 cm when in fruit; *receptacles* glabrous. *Bracteoles* linear-spathulate, c. 1 mm long, somewhat caducous, puberulous abaxially. *Flowers* 5-merous, c. 1.5 mm long; *calyx* c. $^1/_2$ length of corolla, dissected for c. $^1/_6$ its length into broad-triangular, scarcely thickened, slightly inflexed lobes, tube rather broad, nerveless and moderately puberulous, commonly light brown; *petals* ± nerveless, glabrous. *Legumes* submoniliform, to 9 cm long, 4 mm wide, firmly chartaceous to slightly brittle, glabrous, longitudinally wrinkled, yellowish-brown, margins not thickened. *Seeds* longitudinal in legume, obloid-ellipsoid, 4-4.5 x 2.5-3 mm, black, not mottled, shiny; *pleurogram* very fine, open towards the hilum, bordered by a narrow band of yellowish tissue; *areole* u-shaped, c. 0.7 x 0.5 mm; *funicle* flattened and folded below a moderately thickened white *aril*.

Distribution (Fig. 8)

Known only from Atherrita Bore, Rodinga Range, and several dry water courses at the base of Trains Hills on Todd River Station, Northern Territory (24° 26'S, 134° 52'E).

Habitat

Beds of rocky water courses draining from Atherrita Range.

Flowering and fruiting period

It is not known when anthesis commences, but specimens just finishing flowering have been collected in August and September. Legumes with mature seeds have been collected in mid-October.

Specimens seen

NORTHERN TERRITORY: Atherrita Bore, Todd River Station, 24° 26'S, 134° 52'E, *J.R. Macononchie 466* (NT, PERTH), *2505* (NT, PERTH), *2506* (NT, PERTH), *2508* (NT) and *D.J. Nelson 1305* (AD, NT) and *2481* (NT, PERTH).

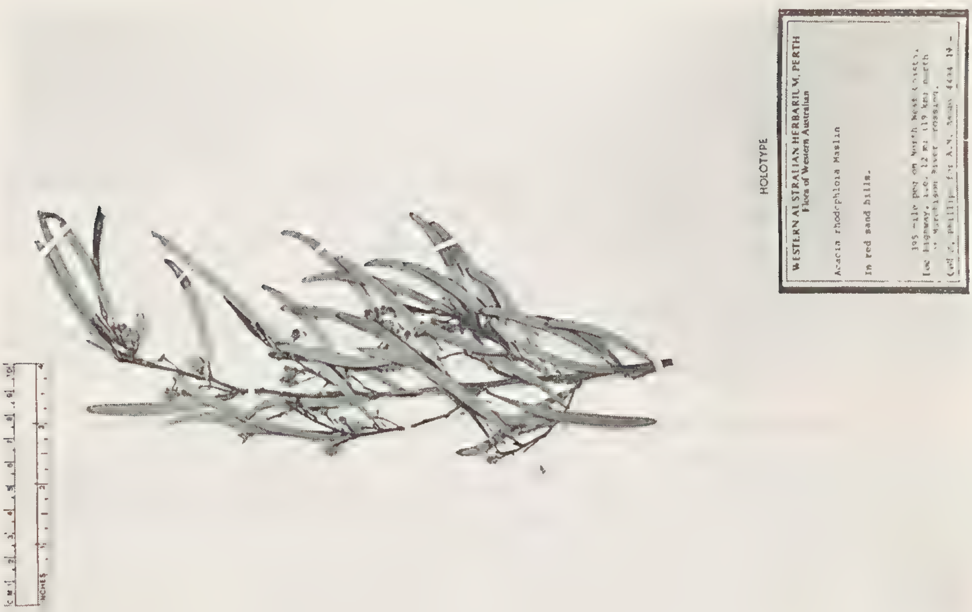

Fig. 7. *Acacia rhodophloia* sp. nov.
(*G. Phillips* for *A.M. Ashby 4494*, holotype—PERTH).

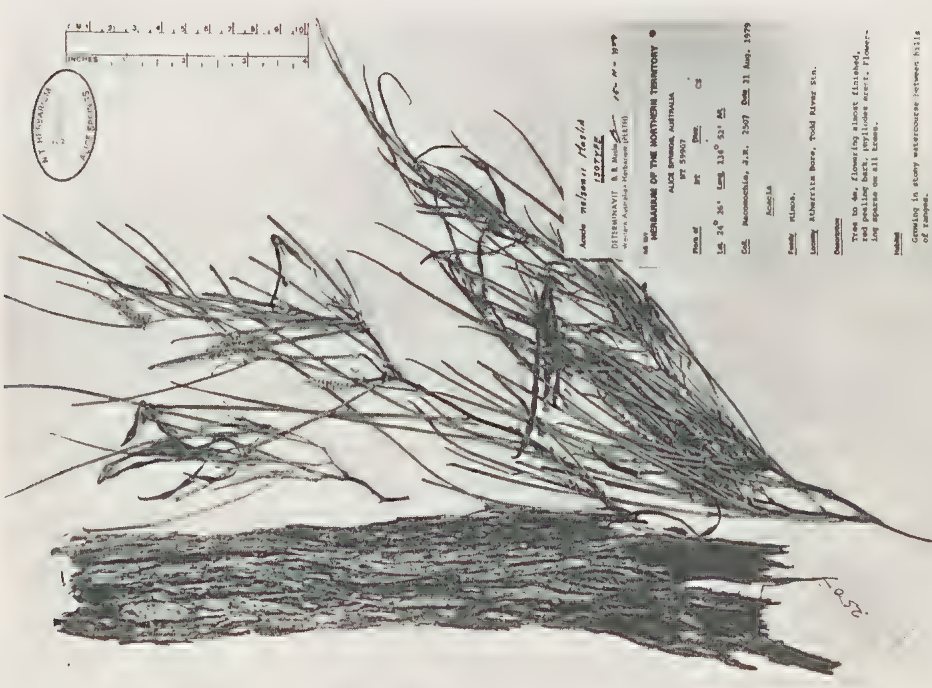

Fig. 6. *Acacia nelsonii* sp. nov.
(*J.R. Maconochie 2507*, isotype—NT).

Using Bentham's (1864) classification *A. nelsonii* should be placed in series *Juliflorae-Stenophyllae* and is most closely allied to *A. rhodophloia* Maslin (sp. 13 below) on account of its bark and general phyllode, inflorescence and seed characters. However, sufficient differences exist to warrant specific rank for this restricted, endemic Northern Territory plant. Both species have "Minni Ritchi" bark on their lateral branches but *A. nelsonii* differs in that towards the base of its main trunks (to 2 m above ground level) this red bark is replaced by a dark grey, fibrous layer which does not exfoliate in narrow curly strips. Other characters distinguishing *A. nelsonii* from the more widely distributed *A. rhodophloia* include its acuminate phyllodes which are longer, narrower, less rigid and possessing a light grey flaking epidermis, its short racemose inflorescences, its less dense spikes which are never reduced to globular heads, its submoniliform legumes and its glossy black seeds which are never mottled.

The species is named in honour of Mr D.J. Nelson, Division of Land Resources Management, CSIRO, Alice Springs, in recognition of his contribution to botanical exploration in Northern Territory.

11. **Acacia papyrocarpa** Benth., Flora Austral. 2: 338 (1864); Whibley D.J. (1980), Acacias of South Australia, p.172.

Lectotype: Inlet XII South Coast, *R. Brown*, Iter Australiense, 1802-5, upper left hand specimen on sheet bearing Bennett(?) distribution number 4343 (BM; iso-lectotypes -BM, the remaining specimens on the same sheet), *lecto. nov.*

Acacia sowdenii Maiden, J. Roy. Soc. N.S.W. 53: 180 t.11 (1919).

Holotype: Port Augusta, South Australia, Jan. 1907, *J.H. Maiden s.n.* (NSW; iso: K. PERTH).

It is unfortunate that the well known name (*A. sowdenii*) for "Western Myall" must be changed. However, having inspected the type collection of both *A. papyrocarpa* and *A. sowdenii* it is apparent that the taxa are conspecific and following my suggestion Whibley (1980) first effected the synonymy. Both types are in fruit and share the following significant characters: phyllodes flat, finely longitudinally multistriate, silvery appressed puberulous (at least when young), apices attenuate and delicately curved; legumes chartaceous, flat, c. 1 cm wide, reticulate; seeds compressed. The collections exhibit slight differences e.g. branchlet indumentum, phyllode width and seed length, but these are not considered significant. The type of *A. papyrocarpa* was collected by Robert Brown from "Inlet XII" which is in the vicinity of Mount Brown at the head of Spencer Gulf, S.A. The type of *A. sowdenii* was collected by J.H. Maiden from Port Augusta, S.A., which is very close to Brown's locality. Maiden (1920, p. 182) misinterpreted *A. papyrocarpa* resulting in his describing this species as *A. sowdenii*. The plant which Maiden thought to be *A. papyrocarpa* was probably one collected by Max Koch from Mt Lyndhurst, S.A., a plant possibly representing an undescribed species—(see species no. 73 in the forthcoming account of *Acacia* in the 'Flora of Central Australia'). Black (1924, 1948) seems to have followed Maiden's interpretation although his 1924 description of "*A. ? papyrocarpa*" is evidently based on mixed gatherings (including elements of *A. havilandii* Maiden, *A. papyrocarpa* and the M. Koch, Mount Lyndhurst material—D.J. Whibley, pers. comm.).

12. **Acacia prainii** Maiden, J. Roy. Soc. N.S.W. 51: 238 (1917); Whibley, D.J. (1980), Acacias of South Australia, p.96.

Lectotype: Southern Cross, Western Australia, October 1909, *J.H. Maiden s.n.*, (NSW—the longer of the two specimens on the sheet; iso-lectotype—K, NSW), *lecto. nov.*

A. prolifera J.M. Black, Trans. Roy. Soc. S. Austral. 44: 375 t.22 (1920).

Holotype: Barton or Wynbring, South Australia, 22 Sept. 1920, *J.M. Black s.n.* (AD; isotype—K, NSW).

A. dentifera var. *parvifolia* S. Moore, J. Proc. Linn. Soc. Bot. 45: 174 (1920), *synon. nov.*

Lectotype: Bruce Rock, Western Australia, 1916, *F. Stoward 333* (BM; iso-lectotype at PERTH), *lecto. nov.*

Lectoparatype: Mount Marshall, Western Australia, 1916, *F. Stoward 451* (BM).

Having examined the type collection of both *A. prainii* and *A. prolifera* I consider that these two names should be regarded as synonymous. Both types are in flower and share the following diagnostic features: branches glabrous, nerves yellowish and resinous; phyllodes glabrous, ± pungent, midribs and marginal nerves yellowish and resinous, glands 2 along adaxial margin; inflorescences glabrous racemes; sepals free. The only real differences between the two types is that *A. prainii* has shorter phyllodes (c. 3 cm compared with 5-9 cm) and younger inflorescences which have not grown out as leafy shoots. Neither difference is considered significant. Black (1924) treated *A. prolifera* as a synonym of *A. prainii*. However, in 1948 he accepted the name *A. prolifera* but noted that legumes were required to establish its relationship with *A. prainii*. I have not found any carpological characters that warrant the recognition of two taxa.

13. **Acacia rhodophloia** Maslin sp. nov. (Fig. 7.)

Frutex vel *arbor* ad 4 m alta; *cortex* "Minni Ritchi". *Phyllodia* linearia ad anguste-elliptica vel anguste-oblanceolata, (1.5)2.5-10 cm x 2-8(13) mm, L/B = (3)5-50, plana, subtiliter multistriata. *Pedunculi* (5)8-20 mm; *capitula* ± globosa ad cylindrica, aliquantum densa. Flores plerumque 5-meri; *calyx* longitudine $^3/_5$-$^3/_4$ petalarum partes aequans. *Legumina* linearia, ad 9 cm x 2-6 mm, plana. *Semina* saepe maculata.

Type: 395 mile peg on North West Coastal Highway, i.e. 12 mi (19 km) north of Murchison River crossing, Western Australia. "In red sand hills." No date given, *G. Phillips* for *A.M. Ashby 4494* (holo: PERTH; iso: BM, CANB, K, NY, PERTH).

Normally rounded *shrubs* or small *trees* to 4 m tall and with a number of stems spreading from ground level; *bark* bright red and exfoliating in narrow curly strips i.e. "Minni Ritchi"; *branches* terete, very obscurely nerved, glabrous or apically appressed puberulous, apically resinous (resin sometimes forming a thickish, translucent layer), "Minni Ritchi" bark rarely extending to branch apices; *new shoots* dark brown and resinous or sometimes mealy-canescent. *Stipules* caducous. *Phyllodes* variable, linear to narrow-elliptic or narrow-oblanceolate, (1.5)2.5-10 cm long, 2-8(13) mm wide, L/B = (3)5-50, flat, slightly thickened, rather rigid, normally slightly curved, dull green to subglaucous, sometimes glabrous but normally with inconspicuous appressed hairs restricted to intercostal regions, indumentum often more dense on young phyllodes, resinous (resin sometimes forming a thickish, translucent layer), finely longitudinally multistriate, nerves uniform or some slightly more evident than the rest, ± abruptly contracted at apices into short acute straight or slightly uncinate hard brown points; *pulvinus* terete, yellowish, 1-3 mm long; *glands* very indistinct, situated on upper margin of phyllode at distal end of the pulvinus. *Inflorescences* axillary, 1 or 2 arising at extreme base of a rudimentary shoot which often grows out; *peduncles* (5)8-20 mm long, often as long as or longer than flower-heads; *flower-heads* ± globular to distinctly cylindrical, 6-25 mm long, rather dense. *Bracteoles* c. 1.5.mm long, linear-spathulate; *claws* puberulous abaxially especially near their summit, hairs often sparse; *laminae* thickened, ± inflexed and concave, resinous-papillose and sometimes also puberulous. *Flowers* predominantly 5-merous but occasionally petals or sepals 6, 2-2.5 mm long; *calyx* stout, $^3/_5$-$^3/_4$ length of petals, shortly dissected into broad-triangular or occasionally oblong, slightly thickened and inflexed, often sparsely resinous-papillose lobes, 5-nerved (nerves often obscure), tube normally basally tomentellose (hairs pale yellow or white, sometimes sparse); *petals* connate for $^2/_3$ their length, ± obscurely 1-nerved (nerves a little thickened at petal apices), glabrous. *Legumes* linear, slightly curved, to 9 cm long, 2-6 mm wide, ± cartilaginous to slightly hard and brittle, light grey-brown, minutely resinous-papillose, flat, barely raised over seeds, obscurely longitudinally nerved; *margins* hardly thickened, not constricted between seeds, slightly broad laterally. *Seeds* longitudinal in legumes, obloid-ellipsoid, 2-4.5 x 1-2.5 mm, black or brown, often mottled, shiny; *pleurogram* very fine, open towards the hilum; *areole* u-shaped, c. 0.2 x 0.3 mm, often yellowish; *funicle* flattened, expanded into a thickened convoluted creamy white *aril*.

Distribution (Fig. 8)

Widespread in the drier areas of Western Australia from the Pilbara-Murchison regions east through the southern parts of the Little Sandy Desert and the Gibson Desert and the northern part of the Great Victoria Desert to the Northern Territory as far as the Ehrenberg Range (23° 20'S, 130° 22'E).

Habitat

Grows in sand or on rocky ground and is frequently associated with "spinifex" (*Triodia* sp.).

Flowering and fruiting period

Flowering is somewhat sporadic but the main period seems to be from June to October. Like many other arid zone species, the incidence of flowering is probably dependent on moisture availability. Legumes with mature seeds have been collected from late September to November.

Selected specimens

WESTERN AUSTRALIA: East Yuna Reserve NE of Geraldton, 13 Aug. 1967. *A.C. Burns 37* (PERTH); 25.6 km WSW of Warburton Mission, *R.J. Chinnock 632* (AD, PERTH); 11.5 km N of Roy Hill, *H. Demarz 7014* (PERTH, TLF); 65 km W of Millstream, *H. Demarz 7084* (PERTH, TLF); Meekatharra, *C.A. Gardner 2353* (PERTH); 53 mi (85 km) S of Giles Meteorological Station, *J.R. Maconochie 813* (NT, PERTH); About 43 km N of Murchison River on North West Coastal Highway, *B.R. Maslin 3152* (AD, B, BH, BM, BRI, K, PERTH, RH); Between wells 6 and 7, Canning Stock Route, *H.M. Wilson 28* (PERTH).

NORTHERN TERRITORY: Ehrenberg Range, 23° 20'S, 130° 22'E, *J.R. Maconochie 1373* (NT, PERTH); Rowley Range, 24° 39'S, 129° 45'E, *J.R. Maconochie 1926* (AD, BRI, CANB, NT, PERTH).

Specimens of *A. rhodophloia* were formerly referred to as *A. sibirica* S. Moore but as was shown by Pedley (1978, p. 154) the latter species is a taxonomic synonym of *A. kempeana*. Using Bentham's (1864) classification the new species should be placed in series *Juliflorae-Stenophyllae* and is most closely allied to *A. nelsonii* Maslin—see sp. 10 above for distinguishing features. In its general phyllode and inflorescence morphology *A. rhodophloia* often resembles some forms of *A. stowardii* Maiden (syn. *A. clivicola* Pedley) but is distinguished by its "Minni Ritchi" bark, its normally appressed puberulous phyllodes and branchlet apices and its often longer and narrow, ± cartilaginous to slightly hard and brittle (not chartaceous) legumes. Another desert species having affinities to *A. rhodophloia* is *A. adsurgens* Maiden et Blakely. Both these taxa have elongate, multistriate phyllodes, dense spicate inflorescences, and similar calyx and legume characters. *Acacia rhodophloia*, however, is readily recognized by its "Minni Ritchi" bark and its shorter phyllodes (9-20 cm in *A. adsurgens*).

There is considerable variation in the material I have here referred to *A. rhodophloia* and future work may well indicate that more than one species should be recognized. Specimens from the type locality (i.e. Murchison River area of W.A.) have broad phyllodes (3-8 mm, $L/B = 8\text{-}20$), short, obloid or even ± globular flower-heads and narrow legumes (2 mm). Further east in the Central Australian desert areas the phyllodes tend to be narrower (2-4 mm, $L/B = 8\text{-}50$), the spikes distinctly cylindrical and the legumes slightly broader (3-4 mm).

In the Pilbara region of Western Australia there exists a variant allied to *A. rhodophloia* on account of its "Minni Ritchi" bark, general phyllode morphology, and spicate inflorescences. It differs, however, in its taller stature (to 8 m), interrupted spikes and nerveless, white-fimbriate, smaller calyces. Until legumes are known and further field studies made, this variant will not be formally described. The specimens seen and referable to this variant are: Spear Hill, 21° 31′S, 119° 25′E, *J.S. Beard 4627* (PERTH); Maroonah, 23° 29′S, 115° 33′E, *J.S. Beard 6178* (PERTH); 10 km S of Minnie Creek homestead, 24° 04′S, 115° 42′E, *A.A. Mitchell 76/3* (PERTH); Pingandie Station, c. 24° S, 117° 50′E, 1972, *M. Scott s.n.* (PERTH).

The specific epithet refers to the characteristic bright red ("Minni Ritchi") bark which exfoliates in narrow curly strips rendering this species one of the most attractive in the genus.

14. **Acacia tetragonophylla** F. Muell., Fragm. Phyt. Austral. 4: 3 (1863); J. Linn. Soc. Bot. 3: 121 (1859), pro syn.

Lectotype: Darling River, *Dallachy* and *Goodwin* (MEL—right hand specimen on sheet; iso-lectotype: BM, K, MEL), *lecto. nov.*

Lectoparatypes: Cooper's Creek, *J. Murray* (K, MEL); Top of Mount Murchison (presumably *Dallachy* and *Goodwin*, label torn obliterating collectors names-MEL); Yaginga Mountains, *Beckler* (K, MEL).

Acacia genistoides A. Cunn. ex Benth., Flora Austral. 2: 330 (1864), *synon. nov.*

Lectotype: Dirk Hartog Island, 7 Jan. 1822, *A. Cunningham 324* (K—right hand specimen on sheet; iso-lectotype: K., left hand specimen on the same sheet), *lecto. nov.*

Lectoparatypes: Shark Bay, *Milne* (K); South Hutt River, *Oldfield* (K); Near Mt. Curious, *Oldfield* (K, MEL).

Both *Acacia tetragonophylla* and *A. genistoides* were described from more than one gathering but having examined most of these at both Kew (K) and Melbourne (MEL) I have no hesitation in regarding the taxa conspecific. The species is at once recognized by its pungent, fasciculate mature phyllodes. However, on new shoots the phyllodes are solitary (not clustered) while on mature branches they are frequently lost during the drying process. These factors probably contributed to Bentham describing *A. genistoides* as a distinct species. The legume and phyllode differences between *A. tetragonophylla* and *A. genistoides* noted by Bentham (1864, p. 331) are not considered by me significant enough to warrant the recognition of two species. I have collected from Cape Inscription, Dirk Hartog Island, the locality where Alan Cunningham collected the plant here designated the lectotype of *A. genistoides*. The plants at this locality are typical *A. tetragonophylla* in all respects except that they are lower and more spreading than normal, probably due to the effect of wind-pruning.

15. **Acacia victoriae** Benth. in Mitch., J. Trop. Austral. 333 (1848).

Acacia sentis F. Muell., Plant. Indig. Colon. Vict. 2: 18 (1863); J.M. Black, Flora S. Austral. Part 2: 277 (1924).

Acacia sentis var. *victoriae* (Benth.) Domin, Biblioth. Bot. 89: 254 (1926), nom. illeg.; Pedley, Austrobaileya 1(3): 271 (1980).

Acacia hanniana Domin, Biblioth. Bot. 89: 253 (1926); Pedley op. cit.

Acacia coronalis J.M. Black, Trans. Roy. Soc. S. Austral. 71(1): 20 (1947), *synon. nov.*

Type citation: "Crown Point, River Finke, Central Australia" (n.v.).

Mr John Maconochie, Arid Zone Research Institute, Alice Springs, first suggested to me that *A. coronalis* may be conspecific with *A. victoriae*. It is regrettable that Black's type is not available for examination having been misplaced whilst on loan to another institution from AD. Nevertheless from an examination of Black's protologue I am convinced that *A. coronalis* should be reduced to synonymy under *A. victoriae*. The salient parts of the description bringing me to this conclusion are: small, flat, 1-nerved, pinnately veined phyllodes, normally spiny stipules, small flower-heads (20-25 flowered) on slender peduncles which are solitary, twin or in 3's, racemose inflorescences, 5-merous flowers and linear-spathulate sepals. Legumes from the type locality were unknown to Black.

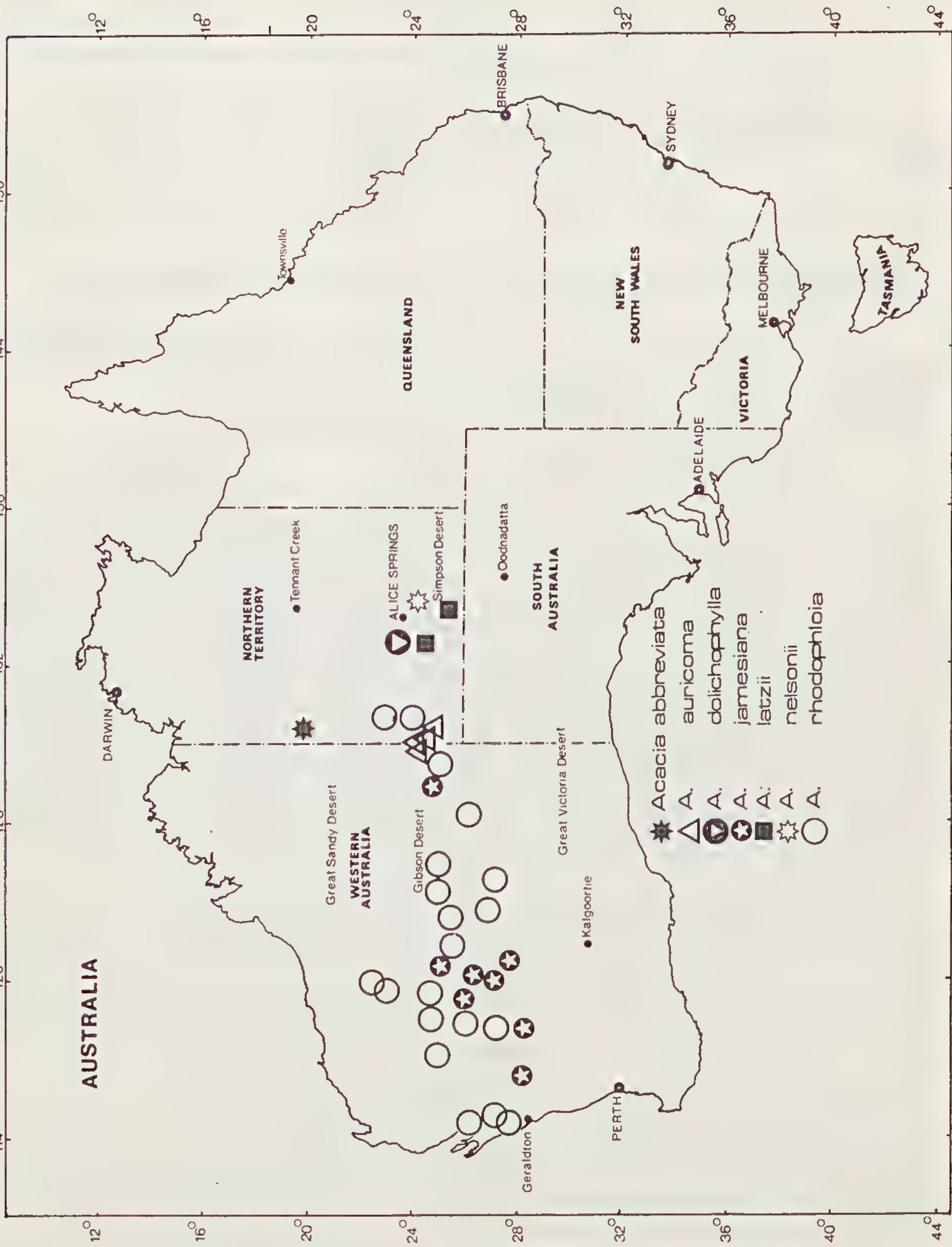

Fig. 8. Distribution map of *Acacia abbreviata*, *A. auricoma*, *A. dolichophylla*, *A. jamesiana*, *A. latzii*, *A. nelsonii* and *A. rhodophloia*.

Acknowledgements

I am indebted to the following people for assistance rendered with the present work. Mr Alex George for checking my Latin descriptions; Mr John Maconochie (NT) for many useful comments on the Northern Territory plants described here and for bringing to my attention the fact that *A. coronalis* may be conspecific with *A. victoriae*; Mr Peter Latz (NT) for valuable field information on *A. dolichophylla* and *A. latzii*; Mr Les Pedley (BRI) for fruitful discussion on the taxonomic problems surrounding *A. dictyophleba* and the *A. brachystachya* group; Mr David Whibley (AD) for discussions concerning *A. papyrocarpa* and *A. prainii*; Mr Garry Marney (PERTH), employed under an ABRS grant, for preparing Fig. 8; and finally, to the Directors of both Australian and European herbaria for allowing me access to specimens cited in this work.

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Index to numbered specimens

Index to numbered specimens seen in the compilation of new species descriptions given herein. The numbers in brackets refer to species numbers in the text.

Ashby, A.M.—see *Phillips, G.* below; *Bailey, E.L.* 1-28 (13); *Beard, J.S.* 4784 (8), 6665 (8), 6674 (8), 6727 (13), 7095 (13); *Blackwell, M.* 19 (8), 20 (8), 21 (8), 166 (8); *Buckley, R.* NT 59902 (8); *Burbidge, A.A.* 11 (8); *Burns, A.C.* 37, 13 Aug. 1967 (13) and 86, 1 Oct. 1967 (13); *Chinnock, R.J.* 632 (13), 860 (13); *Demarz, H.* 4396 (13), 4717 (13), D5681 (13), 7014 (13), D7084 (13); *Dunlop, C.R.* 2342 (1); *Edmiston, R.* 278 (13); *Fairall, A.* 1927 (13), 2043 (13); *Gardner, C.A.* 2317 (13), 2353 (13); *George, A.S.* 4661 (13), 5455 (13), 5466 (13), 5610 (8—Type), 12001 (13), 12094 (2); *Gillett, M.* 42 (13); *Gordon, D.M.* 3833 (13); *Hill, R.* and *Lothian, T.R.N.* 838 (13); *Latz, P.K.* 5238 (9), 5763 (9), 6606 (6—Type), 6642 (6), 6891 (9—Type); *Lay, B.* 909 (13); *Lullfitz, F.* 3184 (8), L4322 (13); *Maconochie, J.R.* 466 (10), 813 (13), 1026 (1—Type), 1099 (1), 1373 (13), 1395 (2—Type), 1400 (13), 1726 (1), 1632 (1), 1850 (13), 1926 (13), 2505 (10), 2506 (10), 2507 (10—Type), 2508 (10); *Maslin, B.R.* 2788 (13), 3152 (13), 3339 (13), 3609 (13); *Mitchell, A.A.* 218 (13); *Nelson, D.J.* 2481 (10), 1305 (10); *Phillips, G.* for *Ashby, A.M.* 4494 (13—Type), 4830 (13); *Royce, R.D.* 10362 (8), 10368 (8); *Speck, N.H.* 984 (13), 1140 (8); *Tindale, M.D.* 1323 (13); *Wauchope, J.* NT46725 (6); *Wilson, H.M.* 28 (13); *Wilson, P.G.* 7440 (13).

J. Adelaide Bot. Gard. 2(4): 323-328 (1980)

THREE NEW SPECIES OF FABACEAE FOR THE FLORA OF CENTRAL AUSTRALIA

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Abstract

Three new species of Fabaceae, namely, *Isotropis centralis* J.R. Maconochie, *Indigofera ammobia* J.R. Maconochie and *Tephrosia arenicola* J.R. Maconochie are described for the 'Flora of Central Australia'.

Descriptions

1. **Isotropis centralis** J.R. Maconochie sp. nov.

Frutex parvus erectus sericeus pluri-caulis usque 50 cm altum. Caules teretes, leviter striati. Folia unifoliolata sericea obovata usque suborbiculata petiolo articulata, margine recto usque leviter undulato, apice obtuso vel retuso, basi truncata usque attenuata, nervo medio subtus prominenti, nervis lateralibus in utroque latere 2-3. Lamina 5-13 mm longa, 4-9 mm lata; petiolus 1-2 mm. Inflorescentia racemosa, floribus laxe dispositus, flores 6-8 mm longi, pedicellis 4-7 mm longis. Calyx 5-6 mm longus, lobis lanceolatis 4 x 1 mm, extra sericeis intus glabris striis 3 notatis. Ovarium sessile sericeum, stylus filiformis glaber, stigma glabrum erectum vel leviter capitatum. Vexillum orbiculatum, emarginatum, supra unguem verticaliter incrassatum, 9 mm longum, 10 mm latum; alae obtuse obovatae, 8 mm longae, 3 mm latae; carina incurvata obtuse obovata, 8 mm x 3 mm. Legumen oblongum, sericeum, turgidum, 10-16 mm x 6 mm diam., seminibus cá 12. Semen reniforme, valde reticulatum, 2.5-3 mm x 2 mm.

Holotype: *J.R. Maconochie 1851*, 16 km E. of Docker River Settlement, N.T. 26.viii.1973 (NT). (Fig. 1.)

Isotypes: AD, CANB, DNA, K, NSW, PERTH.

Description

A small, erect, many stemmed *shrub* to 50 cm high. *Stems* terete, weakly striate, with densely sericeous-tomentose indumentum. *Leaves* unifoliolate, articulate on petiole, obovate to suborbicular, margin straight to slightly undulate, apex obtuse to retuse, base truncate to attenuate, with densely appressed sericeous indumentum, with prominent midvein below and 2-3 lateral veins on each side, 5-13 x 4-9 mm; petiole 1-2 mm. *Inflorescence* a raceme of widely spaced (15-20 mm) single flowers; flowers 6-9 mm long; pedicels 4-7 mm long. *Calyx* 5-6 mm long, lobes lanceolate 4 x 1 mm, densely appressed pubescence, glabrous but tri-striate on inner surface. *Standard* orbicular, incised at apex with vertical thickening above the claw, 9 mm long, 10 mm wide; wings obtuse-obovate 8 x 3 mm; keel incurved, obtuse-obovate 8 x 3 mm. *Ovary* sessile, densely pubescent, style filiform, glabrous; stigma weakly capitate, glabrous. *Pod* oblong, 10-16 mm long and 6 mm diam., appressed pubescence, ca 12 seeds. *Seed* reniform, strongly reticulate 2.5-3 mm x 2 mm.

This species is allied to *Isotropis atropurpurea* F. Muell. but differs in having a smaller calyx, corolla, petiole and lamina. The lamina has a undulate margin.

Specimens examined

WESTERN AUSTRALIA: *A.S. George 8183*, Mt Talbot, Warburton Range, 30.ix.1966 (PERTH).

NORTHERN TERRITORY: *W.H. Butler 60*, Shaw River, E. Petermann Range, iv.1967 (PERTH); *ibid 160*, E. of Bonython Range; *G. Chippendale NT 2753* near Ulambara Spring, Haasts Bluff, 23.viii.1956 (MEL, NT); *ibid (NT 2882)* Mt Olga, 13.ix.1956 (NT); *N.N. Donner 4414*, Felix Spring, Mt Olga, 24.vii.1973 (AD, NT): *E. Giles (MEL 78154)*, Glen of Palms, ([MEL]): *R. Hill, & T.R.N. Lothian 772*, Chasm & flood plain on western side of Mt Olga, 3.vii.1958 (AD, NT): *Kempe 298a*, Finke River, 1880 (MEL); *P.K. Latz 865*, 45 km N.E. Docker River Settlement, 28.x.1970 (NT): *J.R. Maconochie 789*, Learmonth Park, Petermann Ranges,

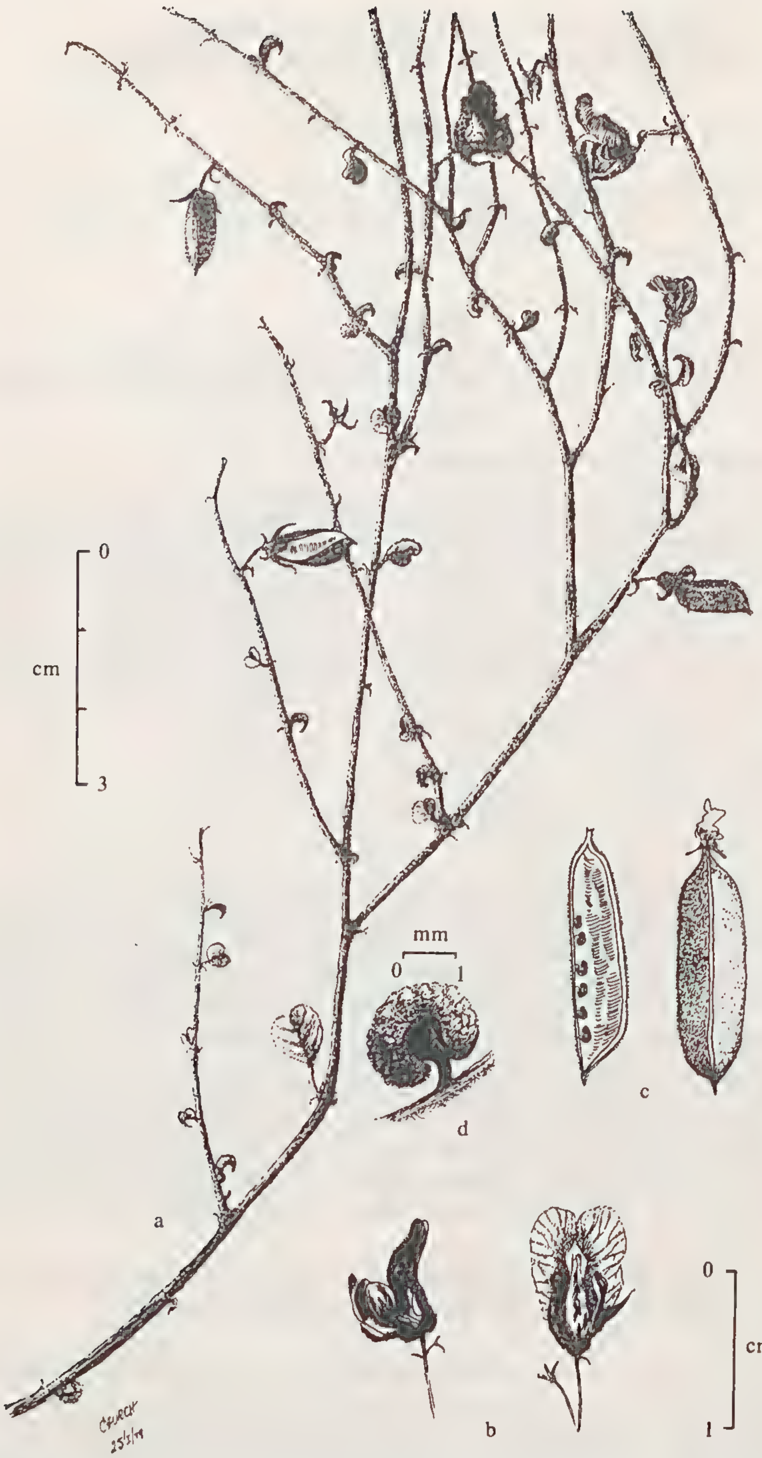

Fig. 1. *Isotropis centralis* J.R. Maconochie, from holotype, *Maconochie 1851* (NT). a, twig; b, flower; c, pod; d, seed. (Del. J. Church.)

20.ix.1969 (AD, NT); *ibid 1643*, Olga Gorge, Ayers Rock-Mt Olga National Park, 31.viii.1972 (NT); *ibid 1851* (type): *ibid 1871*, 72 km N.E. Docker River Settlement, 27.viii.1973 (CANB, DNA, NT); *W. Tietkins s.n.*, Mt Olga, 1889 (MEL).

2. **Indigofera ammobia** J.R. Maconochie sp. nov.

Fruticulus ad 50 cm altus ramis pilis medifixis appressis c. 0.2 mm longis. Folia unifoliolata, articulata ad caulem, linearia, supra canaliculata, 20-40 mm longa, 0.3-0.5 mm lata, pilis medifixis appressis. Inflorescentia racemosa axillaris 10-20 mm longa, floribus 5-7 viridibus. Vexillum viride orbiculatum 3 x 3 mm; ala purpurea obovata 3 x 1 mm; carina viridis obovata 2.5 x 1 mm; legumen rectum lineare, glabrum 20-30 x 1.5-2 mm.

Holotype: *A.S. George 15644*, just south of Tobin Lake, Great Sandy Desert, W.A. 6.v.1979 (PERTH). (Fig. 2.)

Isotypes: CANB, NT.

Description

A many stemmed *subshrub* with sparse pubescence of appressed, biramous papillate hairs, to 50 cm high. *Leaves* unifoliolate, articulate on stem, linear, channelled above, 20-40 x 0.3-0.5 mm, apex subulate, with sparse, appressed, biramous pubescence. Stipules small, scarious. *Inflorescence* an axillary raceme of 5-7 flowers, 10-20 mm long; flowers green not conspicuous. *Calyx* 2 mm long, appressed pubescent, lobes acuminate, 1 mm long, pedicel 1 mm; *standard* green, purple line centred, hairy on back, orbicular, truncated at base 3 x 3 mm; wing purple obovate 3 x 1 mm; keel green, obovate 2.5 x 1 mm; anthers 9 + 1, gland tipped; *ovary* glabrous, stigma capitate. *Pod* linear, glabrous with raised suture 20-30 x 1.5-2 mm, apex truncated, acuminate. *Seeds* cuboid, rugulose 1-1.5 mm, about 8-10 per pod.

I. ammobia appears to be anomalous in having no clear affinity with the majority of other Australian species. It is allied to *I. linifolia* (L.f.) Retz. in foliage but differs in having linear pods and to *I. haplophylla* F. Muell. which has linear oblong leaves.

Specimens examined

WESTERN AUSTRALIA: *A.S. George 14769*, North of Dragon Tree Soak, Great Sandy Desert, 19° 40′ S, 123° 21′ E, 10.viii.1977; *ibid 15292*, just N.W. of Wolf Creek Crater, 19° 10′S, 127° 48′E, 21.vi.1979 (NT, PERTH).

NORTHERN TERRITORY: *T.S. Henshall 1253*, Tanami Sanctuary, 20° 52′ S, 130° 22′ E, 28.v.1976 (AD, BRI, CANB, K, MEL, NSW, NT, PERTH).

3. **Tephrosia arenicola** J.R. Maconochie sp. nov.

Fruticulus ad 50 cm altus ramis pilis tomentosis. Folia unifoliolata articulata, elliptica vel ovata, integra, tomentosa 12-22 mm longa 10-12 mm lata. Flos solitarius sessilis axillaris. Vexillum aurantiacum orbiculatum 5 x 6 mm; ala et carina aurantiaca obovata 4 x 1.5 mm; legumen subglobulare villosum c. 4 mm diametro.

Holotype: *A.S. George 15705*, Great Sandy Desert, ± 20° 56′ S, 123° 15′ E, W.A. 11.v.1979 (PERTH). (Fig. 3).

Isotypes: BRI, CANB, K, L, NSW.

Description

A tomentose *subshrub* with several stems arising from base to 50 cm high. *Leaves* unifoliolate, articulate, elliptical to ovate, entire with dense tomentum of curved unicellular hairs about 0.3-0.5 mm long, with 6 to 8 lateral but reticulate veins below, 12-22 x 10-12 mm, shortly petiolate. Stipules inconspicuous or absent. *Flowers* axillary, sessile, solitary, c. 5-6 mm long. *Calyx* densely tomentose, lobes subulate c. 4 mm long. *Standard* orbicular 5 x 6 mm, densely pubescent on back, orange with yellow "eye" at base; wings orange, obovate 4 x 1.5 mm; keel dark orange, obovate 4 x 1.5 mm; stamens 9 + 1; *ovary* pubescent, uniovulate; style flattened with brush-like beard along the adaxial side; stigma with a bearded tip. *Pod* subglobular, villous c. 4 mm across, *seed* sub-spherical, smooth, attached at base.

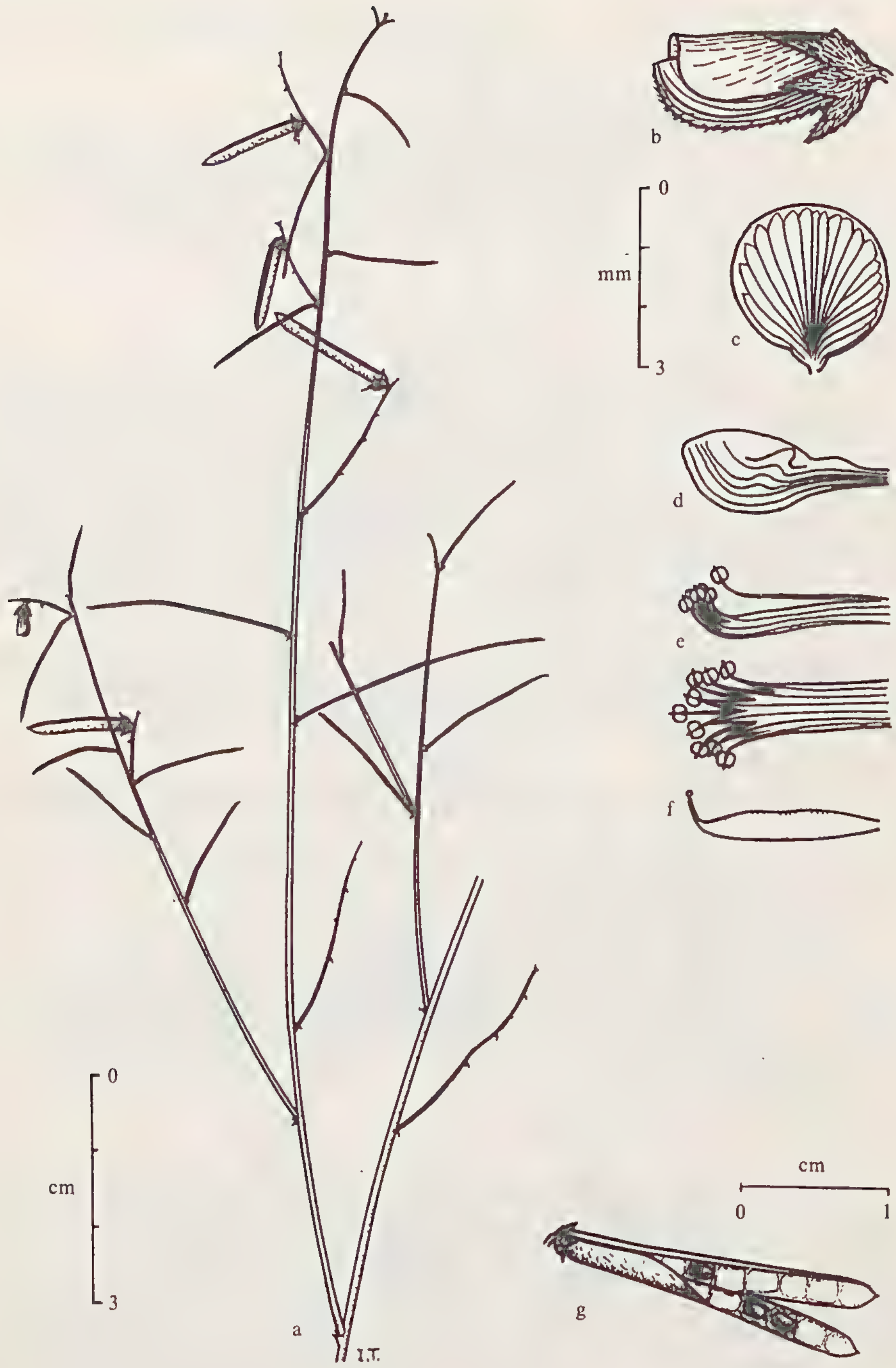

Fig. 2. *Indigofera ammobia* J.R. Maconochie, from holotype, *George 15644* (PERTH). a, twig; b, flower bud; c, standard; d, keel; e, anthers; f, ovary; g, legume. (Del. I. Telford.)

Fig. 3. *Tephrosia arenicola* J.R. Maconochie, from holotype, *George 15705* (PERTH). a, habit; b, flower; c, standard; d, wing; e, keel; f, stamens; g, ovary. (Del. I. Telford.)

T. arenicola is a member of the uniovulate species and is allied to *T. uniovulata* F. Muell. and *T. forrestiana* F. Muell. and the three species can be separated by the following key.

1. Leaves unifoliate only 2
    2. Lamina elliptical to ovate, 12-22 x 10-12 mm; petiole 2-4 x 1 mm; indumentum villous, hairs 0.3-0.5 mm long; flowers 5-6 mm long .... *T. arenicola*
    2. Lamina broad ovate 20-28 x 12-22 mm; petiole 4-5 x 2-2.5 mm; indumentum velutinous hairs c. 1 mm long; flowers 6-7 mm long .... *T. forrestiana*
1. Leaves trifoliolate, both uni- & tri- on same plant, indumentum ferruginous tomentose, lamina obovate 10-13 x 7-10 mm; flowers 4-5 mm long .... *T. uniovulata*

This group of species is also related to the monospecific genus *Paratephrosia lanata* (Benth.) Domin which is uniovulate, has few leaflets and a sericeous tomentum. Thus the generic limits of *Tephrosia* are in need of critical evaluation.

Specimens examined

WESTERN AUSTRALIA: *A.S. George 15705* (type); *A.S. Mitchell 577*, Little Sandy Desert 22° 53′ S, 121° 56′ E, 23.iv.1979 (NT); *ibid 578* loc. cit. (NT); *ibid 1112*, Anketell Ridge, Great Sandy Desert 20° 25′ S, 122° 08′ E, 14.v.1979 (NT); *ibid 1212* loc. cit. (NT).

Acknowledgements

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THE VEGETATION AND FLORA OF REDCLIFF POINT AND SURROUNDING AREAS, SOUTH AUSTRALIA

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Abstract

An account of the vegetation and flora is given for the Redcliff survey area and eleven vegetation associations are recognized. A total of 303 species is recorded consisting of 278 angiosperms, 13 bryophytes and 12 lichens. A brief comparison of the Redcliff flora was made with coastal areas to the north and south and it was found that these were much poorer floristically and had less diversity in the vegetation. A number of rare or undescribed species in the Redcliff area are discussed.

Introduction

The Redcliff survey area (Map 1) is situated near Chinaman Creek, west of Nectar Brook, approximately 25 km SSE of Port Augusta. During the latter part of 1974 and early 1975 the State Herbarium of South Australia carried out a vegetation survey of the proposed Redcliff Petrochemical site and the surrounding area for the Petrochemical Consortium of South Australia.

This account of the vegetation and flora is an expanded, updated, version of my unpublished report (Chinnock, 1975) prepared for the Petrochemical Consortium. It should be pointed out that the survey was carried out in years during which the area experienced more than double the mean annual precipitation and thus the photographs and accounts of the vegetation should be considered to represent the ecosystems following that period of exceptional rainfall. However, I believe that, with regard at least to the perennial species, these descriptions remain largely accurate at all seasons and in all years.

Landform and Soils

The survey area borders Spencers Gulf and gradually rises towards the Flinders Ranges. Along the coast is a series of shell ridges (stranded beach terraces) and sand dunes which stand above the surrounding mud flats. A low residual Pleistocene promontory extends inwards from the Gulf and is surrounded by mud flats and dunes. Mt Grainger (50 m), the northernmost and largest of a series of monadnocks rises at the southern edge of the survey area.

A summary of the vegetation, landforms and soils are given in Table 1 (landform and soil data from Chittleborough et al., 1974).

Climate

The area experiences a semi-arid climate with no definite season of precipitation. During 1973 and 1974 exceptionally high rainfalls were recorded which were over double the mean annual rainfall for the area. Although there are no data available for Chinaman Creek itself the nearest climatic stations at Port Augusta Power Station (20 km N) and Port Germein (35 km SSE) give a good indication of the rainfall received in the area. The figures for Port Augusta Power Station are most probably the closest. Rainfall data (mean monthly and monthly falls for the years 1973, 1974, 1976 and 1977 are given in Table 2, (data provided by the Bureau of Meteorology).

Table 1. Vegetation, landform and soil correlations. (Landform and soil data after Chittleborough et al., 1974.)

Formation	Association	Land Form	Soil
Low Woodland	*Avicennia marina*	Low mud flats	Light brown silty clay with scattered shell fragments.
Low Open Woodland	*Myoporum platycarpum*	Promontory-Low Pleistocene remnant 4-12m above sea level overlain by recent aeolian sands.	Red Fulham sand overlying stiff sandy/clays with gypseous layers (Hindmarsh clays).
Open scrub	*Eucalyptus socialis —E. oleosa*	(a) Coastal monadnock	Skeletal clay-loams over quartzite.
		(b) Sand dunes (recent aeolian dunes)	Fulham sand overlying red calcareous clays.
		(c) Alluvial plain	Red brown sandy loams and clay-loams overlying red calcareous sands and clays.
	Heterodendrum/ Pittosporum / Geijera	Shell ridges	Ridges of shell fragments becoming coarser near coast, overlain by white sands further inland.
	Acacia ligulata	Low sand dune	White sand over light brown silty clays with scattered shell fragments.
Low shrubland	*Maireana pyramidata*	(a) Alluvial plain	Alluvial plain soils (see above)
		(b) Flat marshland—transitional between alluvial plain and tidal flats	Thin highly saline gypseous "flower" over red alluvial clays.
	Sclerostegia (Pachycornia) tenuis—Halosarcia (Arthrocnemum) spp.	(a) Flat marshland	Thin highly saline gypseous "flower" over red alluvial clays.
		(b) Upper mud flats	Thin grey gypseous clay over a grey calcareous clay.
	Atriplex vesicaria	Upper mud flats	Thin grey gypseous clay over a grey calcareous clay.
	Atriplex paludosa (incl. *Nitraria billardieri* zone).	Upper mud flats	Thin grey gypseous clay over a grey calcareous clay.
	Halosarcia (Arthrocnemum) halocnemoides— H. pruinosum	Low mud flats to lower upper mud flats.	Mud flat soils (see above)
Closed grassland	*Stipa nitida* with some *Hordeum leporinum* and other weeds.	Alluvial plain	Alluvial plain soils (see above).
	Zostera/Posidonia	Sand flats exposed only at low tide	Rippled white beach sand overlying gypseous sandy clays.

Methods

Vegetation mapping was done by examination of aerial photographs and ground transects. The map was produced by the combination of field and aerial photograph observations. Voucher specimens were collected of all species and are now housed in the State Herbarium, (AD). The vegetation was classified according to Specht (1972).

Table 2. Rainfall data for Port Augusta Power Station and Port Germein

Location	Years	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Mean Monthly Rainfall														
Port Augusta Power Station	102	15	17	17	19	26	27	19	23	22	23	18	16	242
Port Germein	92	18	19	17	28	39	37	31	35	32	30	22	21	328
Monthly Rainfalls														
Port Augusta Power Station	1973	28	93	8	36	25	39	29	64	31	70	52	38	513
	1974	99	59	2	48	123	20	26	28	43	79	12	<0.4	539
	1976	7	13	9	5	4	10	2	2	7	91	9	6	165
	1977	5	2	2	1	30	21	2	5	20	6	64	9	167
Port Germein	1973	25	130	8	35	48	53	29	67	30	132	30	24	611
	1974	86	46	1	88	123	19	79	32	56	88	5	10	627
	1976	8	10	15	5	17	26	6	14	26	119	32	5	283
	1977	12	<0.4	8	7	38	42	9	9	37	27	50	14	253

Vegetation and Flora

General

The vegetation of the Redcliff area displayed a considerable range of variation over short distances and eleven plant associations were recognized within the area.

Ephemerals were very prominent in all areas and provided an 80%-100% cover between the shrubs. Even in the very saline samphire zones numerous ephemerals occurred, especially on the raised mounds around the bases of shrubs.

A number of species were only observed once as individual plants, e.g. *Senecio magnificus*, *Myriocephalus stuartii*, *Helichrysum apiculatum*, *Alyxia buxifolia*, *Cratystylis conocephala*. Many species were found to be rare and restricted to one site, e.g. *Orobanche australiana*, *Malacocera gracilis*, *Hypoxis hookeri*, *Ranunculus pentandrus* and *Babbagia dipterocarpa*.

Adventive weeds were largely concentrated around the settlement at Chinaman Creek or along roadsides. A number of species were restricted to the settlement area including *Rumex vesicarius*, *Polycarpon tetraphyllum*, *Asphodelus fistulosus*, *Gynandriris setifolia* and *Centaurea melitensis*.

Brassica tournefortii and *Carrichtera annua* were common in most areas near the coast and the latter was the characteristic species in over-grazed areas near Highway 1.

Vegetation Associations

1. *Zostera—Posidonia (Sea-grass) Association*

Extending out into the Gulf were extensive beds of *Zostera* and *Posidonia*. This association was not mapped except for areas to the north of Chinaman Creek. These marine grasses were found to extend up the major creeks for a short distance.

2. *Avicennia marina (Mangrove) Association*

From near Redcliff Point northwards was an extensive area of mangrove covering the outer portions of the lower mudflats (Fig. 1.). These mudflats were dissected by a network of major and minor tidal creeks. On the fringes of the mangroves and in the higher areas within the system *Sarcocornia quinqueflora* formed extensive carpets on the mud. *Suaeda australis* and *Sarcocornia blackiana* were common on the margins.

Fig. 1. *Avicennia marina* association, lower Chinaman Creek. Note ground layer of *Sarcocornia quinqueflora* in foreground. (Photo: D. Reilly)

Fig. 2. *Halosarcia* association near Redcliff Point. Note low shell ridge "island" in background.

3. *Halosarcia (Samphire) Association*

The lower mudflats were extensively covered by a low open shrubland of samphire. (Fig. 2.). Flooding occurred in the lowermost parts twice daily but over most of the mudflats they were not subject to regular flooding but only to occasional high spring tides. *Halosarcia halocnemoides*, *Sarcocornia quinqueflora*, *S. blackiana*, *Suaeda australis*, *Wilsonia humilus* and *Frankenia sessilis* were particularly common on the lower mudflats.

In the upper parts of the lower mudflats and in areas not subject to daily flooding, *Halosarcia pruinosa*, *H.pergranulata*, *Sclerostegia arbuscula* and *Disphyma clavellatum* dominated. Numerous other shrubs and ephemerals occurred in this zone including *Hemichroa diandra*, *Lawrencia glomerata*, *Spergularia diandra*, *Sclerostegia tenuis*, *Mesembryanthemum nodiflorum*, *Angianthus* sp., *A. strictus*, *Dissocarpus biflorus* and *Atriplex spongiosa*.

4. *Sclerostegia tenuis—Halosarcia* spp. *(Samphire) Association*

On the transitional soils between the upper mudflats and the alluvial plain there was a somewhat variable low shrubland dominated by *Sclerostegia tenuis* 40-80 cm high (Fig. 3.). A rich ground layer of ephemerals and chenopods, a reflection of the high precipitation, carpeted the ground dominated by *Disphyma clavellatum*. Numerous low shrubs occurred in this zone. In the areas to the southern side of Chinaman Creek Road *Atriplex vesicaria* and *Halosarcia pruinosa* were common and scattered shrubs or pockets of *Maireana pyramidata*, *Lycium australe* and *L. ferocissimum* also occurred. The ground layer varied over short distances but *Atriplex lindleyi*, *A. angulata*, *Mesembryanthemum nodiflorum*, *Disphyma clavellatum*, *Parapholis incurva*, and *Medicago minima* were prominent.

A number of gypseous mounds occurred in this area immediately to the north and south of Chinaman Creek Road and a number of species were restricted to these mounds, namely *Malacocera gracilis*, *Gnephosis skirrophora*, *Babbagia dipterocarpa* var. and *Angianthus* sp. *Sclerolaena divaricata* and *Zygophyllum compressum* were common on the mounds but rare elsewhere.

The area to the north of Chinaman Creek Road was much more varied in its shrub composition than in the area to the south of the road. Here, *Lycium australe*, *Rhagodia spinescens*, *Maireana cannonii*, *M. pyramidata* and *Atriplex vesicaria* co-dominated with *Sclerostegia tenuis* to form an extensive mosaic of species. Ground layer species included *Disphyma clavellatum*, *Sclerolaena diacantha*, *S. uniflora*, *Babbagia acroptera*, *Thelkeldia salsuginosa* and numerous ephemerals, especially *Lepidium papillosum*, *Medicago* spp., *Senecio glossanthus*, *Crassula sieberana*, *Lamarckia aurea* and *Lophochloa pumila*.

5. *Atriplex paludosa (Marsh saltbush) Association*

In this association I have included for convenience the narrow band of *Nitraria billardieri* which extended from Redcliff Point southwards along the coast to the base of Mt Grainger.

Atriplex paludosa (30-40 cm tall) was the characteristic species (Fig. 4) although in depressions *Halosarcia* species predominate. The ground layer consisted of *Disphyma clavellatum*, *Frankenia* spp. and numerous ephemerals, including *Bromus rubens*, *Crassula* spp., *Helipterum pygmaeum*, *Senecio glossanthus*, *Schismus barbatus* and *Senecio* aff. *lautus*.

Along the base of the cliffs, *Atriplex paludosa* was completely replaced by *Nitraria billardieri* but then continued southwards to the base of Mt Grainger. The south-eastern section was, however, complex as tidal streams have dissected the area and enabled large

Fig. 3. *Sclerostegia tenuis—Halosarcia* association on the transitional mudflat—alluvial soils with rich ground layer dominated by *Disphyma clavellatum*. Note the scattered trees of *Myoporum platycarpum* and the mallee in the background.

Fig. 4. *Atriplex paludosa* association near Redcliff Point with *Senecio* aff. *lautus* prominent in the foreground.

pockets of samphire to establish. *Nitraria billardieri* formed mounds along the streams. Low fragments of shell ridges also interspersed this zone and on these *Acacia ligulata* and *Myoporum insulare* dominated. *Eremophila glabra*, *Lycium ferocissimum*, *Olearia axillaris*, *Disphyma clavellatum*, *Sarcozona praecox* and *Threlkeldia diffusa* were common associated species.

6. *Heterodendrum—Geijera—Acacia ligulata Association*

The vegetation on the shell ridges and sand dunes to the north-west and south-east of the promontory were predominantly *Heterodendrum oleaefolium*, *Pittosporum phylliraeoides*, *Geijera linearifolia* and *Olearia pimeleoides*, although the composition of the larger shrubs varied considerably.

The large area to the south-east consisted of a number of ridges which fanned out into the mudflats. Along the tops of these ridges *Heterodendrum* and *Pittosporum* formed dense thickets while the areas between the ridges were dominated by *Geijera*.

The area to the north-west of the promontory was characterized by *Heterodendrum* (Fig. 5) with only scattered plants of *Pittosporum*. *Geijera linearifolia* was common in the subcanopy layer and *Myoporum deserti*, *Acacia ligulata* and *Santalum acuminatum* occasionally occurred. The understorey in this area and the area to the south consisted of *Atriplex vesicaria* and *Olearia pimeleoides* with scattered shrubs of *Lycium australe*, *Enchylaena tomentosa*, *Threlkeldia diffusa* and *Rhagodia parabolica*.

Stipa elegantissima, *S. platychaeta*, and *Zygophyllum* sp. were common and *Tetragonia amplexicoma* grew over and up through shrubs.

The ground cover consisted of a large variety of ephemerals and perennials the most prominent being *Schismus barbatus*, *Lophochloa pumila*, *Vulpia myuros*, *Stipa nitida*, *Nicotiana goodspeedii*, *Wahlenbergia gracilenta*, *Crassula* spp., *Calandrinia eremaea*, *Medicago minima*, *Brassica tournefortii* and *Carrichtera annua*.

A small, but well defined band of *Acacia ligulata* occurred on a low sand dune running SSE from the settlement of Chinaman Creek to near the cliffs on the edge of the promontory. It was bordered on either side by marsh saltbush and samphire communities. *Acacia ligulata* shrubs 2-3 m tall were the characteristic species with scattered *Heterodendrum oleaefolium* and *Pittosporum phylliraeoides* shrubs. Shrubs of *Eremophila glabra*, *Scaevola spinescens* and *Myoporum insulare* were common and amongst these *Carpobrotus rossii*, *Disphyma clavellatum*, *Sarcozona praecox*, *Senecio* aff. *lautus* and the weed *Brassica tournefortii* were particularly common.

7. *Atriplex vesicaria (Saltbush) Association*

The upper mudflats surrounding the promontory and the areas in the north-east of the survey area were covered by a low dense shrubland dominated by *Atriplex vesicaria* (Fig. 6.). Few other large shrubs were found in this community except for *Sclerostegia tenuis* and *Halosarcia* spp. *Medicago minima* formed an extensive ground cover in more open situations and *Disphyma clavellatum* was also very prominent. *Stipa eremophila* was locally common and a large number of ephemerals occurred on the damp soil amongst and under shrubs. These included *Erodium cygnorum*, *Angianthus strictus*, *Brachyscome lineariloba*, *Gnaphalium involucratum*, *Helipterum corymbiflorum*, *H. pygmaeum*, *Schismus barbatus*, *Lophochloa* spp., *Daucus glochidiatus*, *Thysanotus baueri* and *Calandrinia* spp. The lichens, *Chondropsis semiviridis* and *Parmelia convoluta* were locally common as were various bryophyte species.

8. *Myoporum platycarpum (Sugarwood) Association*

The promontory south-east of Redcliff Point was covered with a low open woodland dominated by *Myoporum platycarpum* (Fig. 7.). *Acacia papyrocarpa* (*A. sowdenii*) was common in the understorey towards the north-eastern end, while *Casuarina cristata* was common along the coast.

Fig. 5. *Heterodendrum—Geijera—Pittosporum* association with *Olearia pimeleoides* in the foreground.

Fig. 6. *Atriplex vesicaria* association with Mt Grainger in the background.

The lower understorey was dominated by *Atriplex vesicaria* with scattered larger shrubs of *Maireana georgei*, *M. pyramidata* and *Geijera linearifolia*. Numerous other shrubs occurred around the bases of trees including *Enchylaena tomentosa*, *Lycium australe*, *Rhagodia* spp. and *Zygophyllum apiculatum*.

The ground cover consisted largely of *Sclerolaena obliquicuspis*, *Crassula sieberana*, *Riccia* sp., *Schismus barbatus*, *Lophochloa pumila* and extensive areas of *Medicago minima*.

The coastal side of the promontory ended in a low red cliff 10 m high and along this the trees were replaced by a narrow band of low shrubland consisting of *Atriplex vesicaria*, *Maireana pyramidata*, *Maireana sedifolia* and *Lycium australe*.

Along the cliff face scattered shrubs of *Geijera linearifolia* and *Casuarina cristata* grew and scattered pockets of *Santalum acuminatum* occurred along the base of the cliff. A number of species not found elsewhere occurred on the cliff face or in seeps at its base, namely *Cratystylis conocephala*, *Alyxia buxifolia*, *Ranunculus pentandrus*, *Hypoxis hookeri*, *Ixiolaena leptolepis* and *Funaria gracilis*.

9. *Maireana pyramidata (Black Bluebush) Association*

A narrow irregular band of low shrubland characterized by *Maireana pyramidata* bordered the mallee woodland and it was best developed on the eastern side north of Chinaman Creek Road (Fig. 8). Scattered trees of *Myoporum platycarpum* occur in this zone as well as shrubs of *Lycium australe*, *L. ferocissimum* and *Templetonia egena*. *Disphyma clavellatum* and *Medicago* spp. were prominent in the ground cover.

10. *Eucalyptus (Mallee) Low Woodland*

A low woodland of the mallees *Eucalyptus socialis—E. oleosa* (Fig. 9), extended northwards from Mt Grainger across the sand dunes onto the alluvial plain. North of the Chinaman Creek Road it was represented by a number of small pockets.

On the dunes, Mt Grainger, and to the areas north, the shrub understorey was largely composed of succulent elements, in particular *Lycium australe*, *Maireana pyramidata*, *Rhagodia spinescens*, *R. gaudichaudiana*, *Enchylaena tomentosa* and *Zygophyllum apiculatum*. Scattered individuals or small pockets of *Myoporum platycarpum*, *Heterodendrum oleaefolium*, *Melaleuca lanceolata*, *Acacia oswaldii* and *Santalum acuminatum* occurred throughout the association. *Disphyma clavellatum* and numerous ephemerals were common in open places.

The composition of the understorey shrubs on the slopes and summit of Mt Grainger was much more varied than in the areas to the north. On the lower slopes *Maireana pyramidata*, *Cassia nemophila* vars, *Eremophila scoparia*, *Ptilotus obovatus*, *Chenopodium ulicinum* and *Maireana radiata* were the common components. *Sclerolaena obliquicuspis* and *Maireana sclerolaenoides* were frequent in open rocky places.

The upper slopes, particularly on the western side, were rocky and the mallee was replaced by shrubs of *Dodonaea lobulata*, *Eremophila alternifolia*, *Solanum petrophilum* and *Sida petrophila*. The ground cover consisted of *Pimelia micrantha*, *P. simplex*, *Arabidella trisecta*, *Vittadinia megacephala*, *Schismus barbatus*, *Danthonia caespitosa* and *Medicago minima*. The lower rocky slopes on the western side just above the limit of the mallee had a sparse cover of *Atriplex vesicaria*, *Maireana sedifolia* and *Chenopodium ulicinum*.

On the summit of Mt Grainger the mallee understorey consisted of *Rhagodia crassifolia*, *Maireana erioclada*, *M. sedifolia*, *Chenopodium ulicinum*, *Atriplex vesicaria*, *Enchylaena tomentosa* and *Threlkeldia diffusa*.

Fig. 7. *Myoporum platycarpum* association with *Atriplex vesicaria* forming a low shrub layer.

Fig. 8. *Maireana pyramidata* association on the eastern side of the mallee.

11. *Stipa (Speargrass) Grassland*

The narrow corridor which extends to Highway 1 on the eastern side of the survey area was farmed with sheep, (Fig. 11.) and consisted largely of grassland dominated by *Stipa variabilis* with a few patches of barley grass (*Hordeum leporinum*). Towards the eastern end weedy species including *Carrichtera annua* (Wards weed), *Medicago* spp., *Dissocarpus paradoxa* and *Sclerolaena obliquicuspis* were prominent (Fig. 10, foreground).

Along the ephemeral drainage channels numerous shrubs of *Acacia victoriae* and *Lycium ferocissimum* occurred and scattered trees of *Eremophila longfolia* and *Acacia oswaldii* were found throughout this area.

Rare and Undescribed Species

A number of rare and undescribed species were found within the survey area and some comments on their rarity and distribution seems desirable.

1. *Malacocera gracilis* Chinnock

This species has only recently been described (Chinnock, 1980) and it is only known to occur at Port Augusta, Lake Callabonna and along the road to Chinaman Creek and near Point Paterson on the northern edge of the survey area.

It is common on the gypseous mounds along the road near the small salt lake in the low samphire shrubland. The species was typified by material collected at this site. Although the recently located population at Lake Callabonna is not considered at risk, no specimens of this species have been collected recently at Port Augusta and it is possible that the species no longer exists at this locality.

2. *Angianthus* sp.

This undescribed species which has affinities with *A. tomentosus* and *A. brachypappus* (Short, pers. comm.), extends from the Redcliff-Port Augusta coast across Eyre Peninsula.

3. *Calandrinia volubilis* Benth.

Black (1924, 1948) misapplied this name to another species now known as *C. eremaea* Ewart and the Redcliff collections of true *C. volubilis* were the first made in this State for over 100 years. The only other South Australian material was supposedly collected by Wilhelm at Port Lincoln (see Bentham, 1863). *Calandrinia volubilis* was common at the base of *Atriplex vesicaria* plants with the flowering stems twining up through the branches of the bushes. Todd (1976) suggested that wet winters may be necessary to induce flowering. However, it seems more likely that a higher continued rainfall is required to trigger good germination and to sustain growth to the flowering stage. Vegetative plants resemble *Disphyma clavellatum* so they could easily be overlooked in dry years. Although I searched for this species in 1976 at sites where it had previously been common in 1974, I could not locate it.

This species apart from the Port Lincoln record is known only from the Redcliff area in South Australia.

4. *Babbagia dipterocarpa* F. Muell.

A small population of this species was found on the samphire flats near the northernmost edge of the promontory. Although this species is widespread in north-east South Australia, it was not known previously further south than Lake Frome. In addition, what appears to be a distinct variety of *B. dipterocarpa*, or possibly a new species, was found growing on the gypseous mounds near the salt lake on the north side of Chinaman Creek Road. It differed from *B. dipterocarpa* in its dense compact habit, larger leaves and fruits which were consistently four-winged.

Fig. 9. *Eucalyptus* woodland on the northern flank of Mt Grainger. *Olearia pimeleoides* and *Maireana pyramidata* in foreground with extensive patches of lichen on sand. Scale units 10 cm.

Fig. 10. *Stipa* grassland near highway. Note the replacement of *Stipa* by *Carrichtera annua* (Wards weed) in the foreground.

Comparison of the survey area with the adjacent coastal areas

The coastal areas, north to Port Augusta and south to Mt Mambray, and bounded on the eastern side by Highway 1, were examined for the purpose of comparison with the survey area.

To the north the vegetation was very similar. The mangrove and samphire associations extend northwards in a broad band although the mangroves gradually contract and form only small pockets from Point Paterson northwards. *Atriplex vesicaria* and *Maireana pyramidata* associations became more extensive northwards. They also formed a buffer between the mallee and samphire zones and essentially replaced the *Sclerostegia tenuis* association in this buffer zone further south. The red mallee also becomes more extensive northwards, extending inland a considerable distance. Associated sub-canopy trees were more common than in the survey area and included *Myoporum platycarpum*, *Melaleuca lanceolata*, *Heterodendrum oleaefolium*, *Acacia oswaldii* and *Acacia papyrocarpa*. *Acacia papyrocarpa* was not observed in the mallee association within the survey area. The general composition of the shrub layer in the mallee association was very similar to the survey area with species of *Atriplex*, *Chenopodium*, *Enchylaena* and *Rhagodia* predominating.

Although the general composition of the vegetation on Mt Gullet was similar to that on Mt Grainger, the floristic diversity was poorer. Many species common on Mt Grainger to the north were absent, e.g. *Eremophila alternifolia*, *Olearia calcarea*, *Dodonaea lobulata*, *Cassia nemophila* var. *coriacea*, and others were only represented by a few individuals, e.g. *Sida petrophila*, *Eremophila scoparia*, *Geijera linearifolia*. Only one species was recorded on Mt Gullett that was not on Mt Grainger, namely *Cassytha melantha*.

The areas to the south of the survey area were predominantly covered by a low shrubland of *Atriplex vesicaria* and *Maireana brevifolia*. Extensive grazing occurred along the coast to the south and *Maireana brevifolia* appeared to come in where reversion to natural scrub proceeded. Red mallee extended slightly south to Mt Grainger, but it was replaced by samphire communities on the more saline soils surrounding Yatala Harbour. Further south it only occurred on Mt Gullet. The sandy shell ridges around Yatala Harbour were covered in *Melaleuca lanceolata*, a feature absent further north. Associated shrubs were those found on the shell ridges within the survey area, e.g. *Heterodendrum oleaefolium*, *Pittosporum phylliraeoides* and *Geijera linearifolia*. *Nitraria billardieri* and *Myoporum insulare* formed a narrow band immediately behind the beach. South of Yatala Harbour the samphire zone was reduced to small pockets along the coast.

Considerable interest was taken in the coastal monadnocks south of Mt Grainger so that their vegetation could be compared; Mt Grainger was considered to be the best preserved and least disturbed of the three.

Mt. Mambray, the southernmost one, was much smaller than Mt Gullet and Mt Grainger. The predominant vegetation was *Atriplex vesicaria*/*Maireana pyramidata* with associated shrubs of *Enchylaena tomentosa*, *Rhagodia parabolica* and *R. spinescens*. A few *Heterodendrum oleaefolium* and *Exocarpos aphyllus* shrubs occurred on the upper slopes and a small group of trees of *Myoporum platycarpum* occurred on the eastern flank.

Mt Gullet, like Mt Grainger is covered by red mallee although here *Eucalyptus oleosa* was the predominant species. *Atriplex vesicaria* formed the predominant understorey layer except in the southern part where overgrazing had resulted in replacement by *Chenopodium ulicinum*. The cross-fence change was quite marked (Fig. 11).

Fig. 11. Cross fence difference at Mt Gullet, *Atriplex vesicaria* (LHS) and *Chenopodium ulicinum* (RHS).

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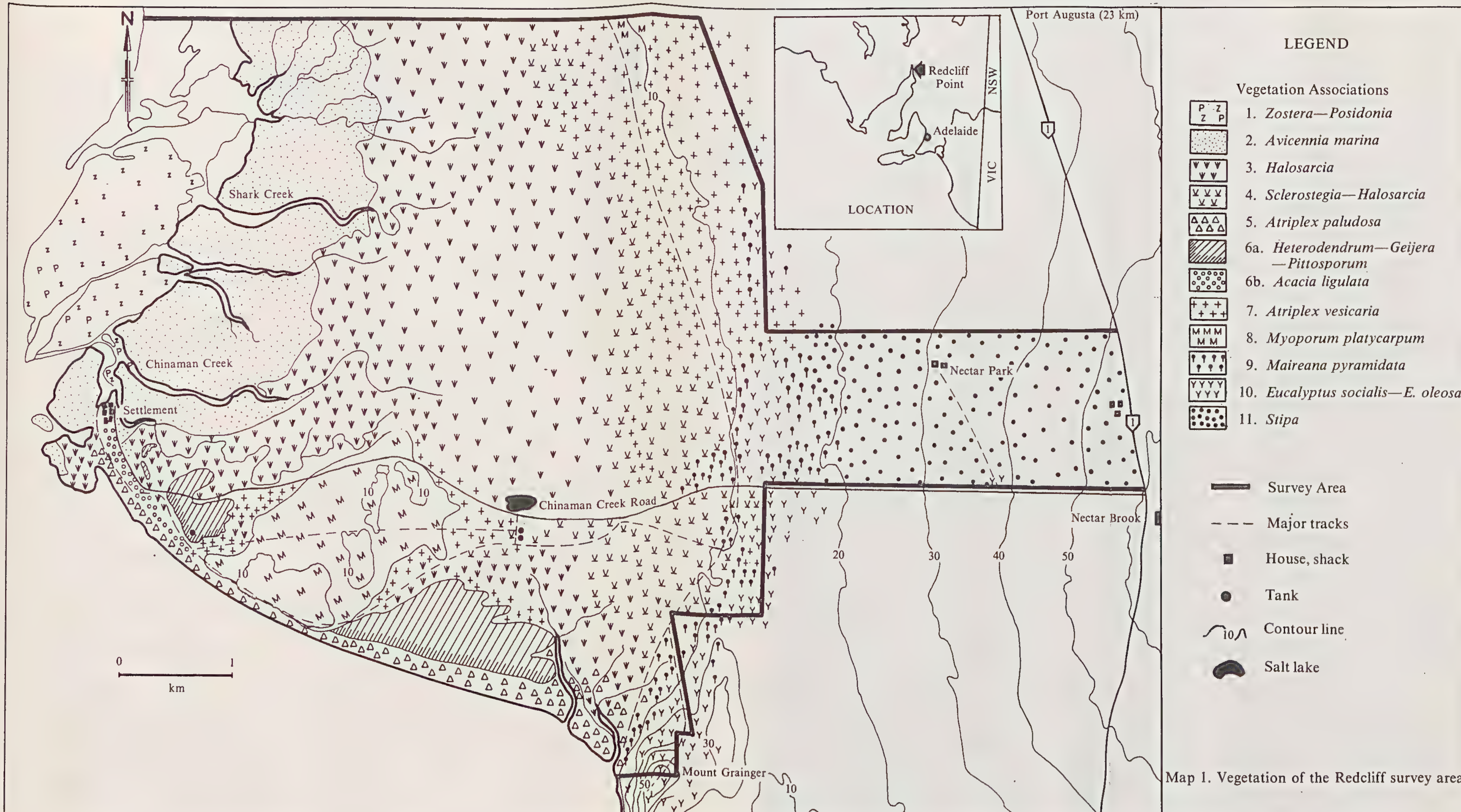

Map 1. Vegetation of the Redcliff survey area.

APPENDIX I

LIST OF PLANT SPECIES

This list includes angiosperms, bryophytes and lichens. Angiosperms are listed alphabetically in families and genera, the bryophytes and lichens alphabetically in genera. The distribution of each species is recorded within the Redcliff area and numbers refer to the plant associations. Location 12 refers to the settlement area at Chinaman Creek and lists only those plants restricted to the area. The symbol * denotes an adventive species.

	LOCATION											
	1	2	3	4	5	6	7	8	9	10	11	12
Aizoaceae												
**Carpobrotus aequilaterus* (Haw.) N.E.Br.	—	—	—	—	+	+	—	—	—	—	—	—
C. rossii (Haw.) Schwantes	—	—	—	—	+	+	—	—	—	—	—	—
Disphyma clavellatum (Haw.) Chinnock	—	—	+	+	+	+	+	+	+	+	—	—
**Galenia secunda* (L.f.) Sond.	—	—	—	—	—	—	—	—	—	—	—	+
**G. pubescens* (Eckl. & Zeyh.) Druce	—	—	—	—	—	+	—	—	—	—	—	—
**Mesembryanthemum aitonis* Jacquin	—	—	—	—	+	+	—	—	—	+	—	—
**M. crystallinum* L.	—	—	—	—	+	+	—	—	—	—	—	—
**M. nodiflorum* L.	—	—	+	+	+	+	+	—	—	—	—	—
Sarcozona bicarinata Blake	—	—	—	—	—	+	—	—	—	—	—	—
S. praecox (F. Muell.) Blake	—	—	—	—	+	+	—	—	—	—	—	—
Tetragonia amplexicoma (Miq.) Hook.f.	—	—	—	—	+	+	—	—	—	+	—	—
T. eremaea Ostenf.	—	—	—	—	+	+	—	+	—	—	—	—
Amarantaceae												
Hemichroa diandra R.Br.	—	—	+	—	—	+	—	+	—	—	—	—
Ptilotus obovatus (Gaudich.) F. Muell.	—	—	—	—	—	—	—	—	+	+	—	—
Apocynaceae												
Alyxia buxifolia R.Br.	—	—	—	—	—	—	—	+	—	—	—	—
Boraginaceae												
**Echium plantagineum* L.	—	—	—	—	—	—	+	—	—	—	+	—
Omphalolappula concava (F. Muell.) Brand	—	—	—	—	—	—	+	—	—	—	+	—
Campanulaceae												
Wahlenbergia gracilenta Lothian	—	—	—	—	—	+	—	—	—	—	—	—
W. stricta Sweet	—	—	—	—	—	—	—	—	—	—	—	+
Caryophyllaceae												
**Gypsophila australis* (Schldl.) A. Gray	—	—	—	—	—	+	—	—	—	—	—	—
**Herniaria hirsuta* L.	—	—	+	—	—	—	—	—	—	—	—	—
**Polycarpon tetraphyllum* var. *diphyllum* (Cav.) DC.	—	—	—	—	—	—	—	—	—	—	—	+
Spergularia diandra (Guss.) Heldr. & Sartar ex Heldr.	—	—	+	—	+	+	—	—	—	—	—	—
**S.* aff. *media* (L.) Presl	—	—	—	—	—	+	—	—	—	—	—	—

Continued on page 344

	LOCATION											
	1	2	3	4	5	6	7	8	9	10	11	12
Casuarinaceae												
Casuarina cristata Miq.	—	—	—	—	—	—	—	+	—	—	—	—
Caesalpiniaceae												
Cassia artemisioides Gaudich. ex DC.	—	—	—	—	—	—	—	—	—	+	—	—
C. nemophila var. *coriacea* (Benth.) Symon	—	—	—	—	—	—	—	—	—	+	—	—
C. nemophila var. *platypoda* (R.Br.) Benth.	—	—	—	—	—	—	—	—	—	+	—	—
C. nemophila var. *zygophylla* (Benth.) Benth.	—	—	—	—	—	—	—	—	—	+	—	—
Chenopodiaceae												
Atriplex acutibracta Anderson	—	—	—	—	—	—	—	—	—	+	—	—
A. angulata Benth.	—	—	—	+	—	—	—	—	—	—	—	—
A. cinerea Poir.	—	—	—	—	+	—	—	—	—	—	—	—
A. holocarpa F. Muell.	—	—	+	—	—	—	—	—	—	—	—	—
A. lindleyi Moq.	—	—	—	+	—	—	—	—	—	—	—	—
A. paludosa R.Br.	—	—	+	—	+	—	—	—	—	—	—	—
A. spongiosa F. Muell.	—	—	+	—	—	—	—	—	—	—	—	—
A. vesicaria Hew. ex Benth.	—	—	—	+	—	+	+	+	—	+	—	—
Babbagia acroptera F. Muell. & Tate	—	—	—	+	—	—	—	—	—	+	—	—
B. dipterocarpa F. Muell.	—	—	+	—	—	—	—	—	—	—	—	—
B. aff. *dipterocarpa* F. Muell.	—	—	+	+	—	—	—	—	—	—	—	—
Chenopodium cristatum (F. Muell.) F. Muell.	—	—	—	—	—	+	—	—	+	—	—	—
C. desertorum (J.M. Black) J.M. Black	—	—	—	—	—	—	—	—	+	+	—	—
**C. murale* L.	—	—	—	—	—	+	—	—	—	—	—	—
C. ulicinum Gandoger	—	—	—	—	—	—	—	—	—	+	—	—
Dissocarpus biflorus (R.Br.) F. Muell.	—	—	+	—	—	+	+	—	—	—	—	—
D. paradoxa R.Br.	—	—	—	—	—	—	—	—	—	+	+	—
Enchylaena tomentosa R.Br.	—	—	—	—	—	+	—	+	+	+	—	—
Halosarcia halocnemoides (Nees) P.G. Wilson	—	—	+	+	—	—	—	—	—	—	—	—
H. pergranulata (J.M. Black) P.G. Wilson	—	—	+	—	—	—	+	—	—	—	—	—
H. pruinosa (Paulsen) P.G. Wilson	—	—	+	+	—	—	+	—	—	—	—	—
Maireana brevifolia (R.Br.) P.G. Wilson	—	—	—	—	—	+	—	—	+	—	+	—
M. cannonii (J.M. Black) P.G. Wilson	—	—	+	+	—	—	—	—	—	—	—	—
M. erioclada (Benth.) P.G. Wilson	—	—	—	—	—	—	+	+	—	+	—	—
M. georgei (Diels) P.G. Wilson	—	—	—	—	—	—	—	+	—	—	—	—
M. oppositifolia (F. Muell.) P.G. Wilson	—	—	+	—	—	—	—	—	—	—	—	—
M. pyramidata (Benth.) P.G. Wilson	—	—	—	+	—	—	—	+	+	+	—	—
M. radiata (P.G. Wilson) P.G. Wilson	—	—	—	—	—	—	—	—	—	+	—	—
M. sclerolaenoides (F. Muell.) P.G. Wilson	—	—	—	—	—	—	—	—	—	+	—	—
M. sedifolia (F. Muell.) P.G. Wilson	—	—	—	—	—	—	+	+	—	+	—	—
M. tomentosa ssp. *urceolata* P.G. Wilson	—	—	+	—	—	+	—	—	+	—	—	—
M. trichoptera (J.M. Black) P.G. Wilson	—	—	—	—	—	—	—	—	—	+	—	—
M. turbinata P.G. Wilson	—	—	—	—	—	—	—	—	—	+	—	—
Malacocera gracilis Chinnock	—	—	+	+	—	—	—	—	—	—	—	—
M. tricornis (Benth.) Anderson	—	—	—	—	—	—	—	—	+	—	—	—

Continued on page 345

Chenopodiaceae *(continued)*

	LOCATION											
	1	2	3	4	5	6	7	8	9	10	11	12
Rhagodia crassifolia R.Br.	—	—	—	—	—	—	—	—	—	+	—	—
R. gaudichaudiana Moq.	—	—	—	—	—	+	—	+	—	+	+	—
R. nutans R.Br.	—	—	—	—	—	+	—	+	—	—	—	—
R. parabolica R.Br.	—	—	—	—	—	+	—	—	—	—	+	—
R. spinescens R.Br.	—	—	—	+	—	—	—	+	—	+	—	—
Sarcocornia blackiana (Ulbrich) Scott	—	—	+	—	+	—	—	—	—	—	—	—
S. quinqueflora (Bunge ex Ung.-Sternb.) Scott	—	+	+	—	+	—	—	—	—	—	—	—
Salsola kali L.	—	—	—	—	—	+	—	—	—	+	—	—
Sclerochlamys brachyptera F. Muell.	—	—	—	+	—	—	—	—	—	—	+	—
Sclerolaena diacantha (Nees) Benth.	—	—	—	+	—	—	+	+	+	+	—	—
S. divaricata (R.Br.) Domin	—	—	—	+	—	—	—	—	—	+	—	—
S. obliquicuspis (Anderson) Ulbrich	—	—	—	—	—	—	—	+	—	+	+	—
S. uniflora R.Br.	—	—	—	+	—	+	+	—	—	—	—	—
S. ventricosa (J.M. Black) Scott	—	—	—	—	—	—	—	—	—	+	—	—
Sclerostegia arbuscula (Moq.) P.G. Wilson	—	—	+	—	—	—	—	—	—	—	—	—
S. tenuis (Benth.) P.G. Wilson	—	—	+	+	—	—	+	—	+	+	—	—
Suaeda australis (R.Br.) Moq.	—	+	+	—	—	—	—	—	—	—	—	—
Threlkeldia diffusa R.Br.	—	—	—	+	+	+	—	—	—	+	—	—
T. salsuginosa (F. Muell.) Benth.	—	—	—	+	—	—	—	—	—	—	—	—
Compositae												
Actinobole uliginosum (A. Gray) Eichler	—	—	—	—	—	+	—	—	—	—	—	—
Angianthus sp.	—	—	+	+	—	—	—	—	—	—	—	—
A. strictus (Steetz) Benth.	—	—	+	+	—	—	+	—	—	—	—	—
**Arctotheca calendula* (L.) Levyns	—	—	—	—	—	—	—	—	—	—	—	+
Brachyscome ciliaris (Labill.) Less.	—	—	—	—	—	+	+	+	—	—	—	—
B. ciliaris var. *lanuginosa* (Steetz) Benth.	—	—	—	—	—	—	+	—	—	—	—	—
B. leptocarpa F. Muell.	—	—	—	—	—	+	—	—	—	—	—	—
B. lineariloba (DC.) Druce	—	—	—	—	—	+	+	—	—	—	—	—
B. trachycarpa F. Muell.	—	—	—	—	—	—	—	—	—	+	—	—
Calotis hispidula F. Muell.	—	—	—	—	—	—	—	—	+	—	—	—
**Carthamus lanatus* L.	—	—	—	—	—	—	—	—	—	—	+	—
Cassinia laevis R.Br.	—	—	—	—	—	+	—	—	—	—	—	—
**Centaurea melitensis* L.	—	—	—	—	—	—	—	—	—	—	—	+
**Cirsium vulgare* (Savi) Ten.	—	—	—	—	—	+	—	—	—	—	—	—
Cratystylis conocephala (F. Muell.) S. Moore	—	—	—	—	—	—	—	+	—	—	—	—
**Dittrichia graveolens* (L.) W. Greuter	—	—	—	—	+	—	—	—	—	—	—	+
Elachanthus pusillus F. Muell.	—	—	+	—	—	+	—	—	—	—	—	—
Gnaphalium indutum Hook.f.	—	—	—	—	—	—	—	+	—	—	—	—
G. involucratum Forst.f.	—	—	—	—	—	+	+	—	—	—	—	—
G. luteoalbum L.	—	—	—	—	—	—	—	—	—	—	—	+
Gnephosis skirrophora (Sond. & F. Muell.) Benth.	—	—	—	+	—	—	—	—	—	—	—	—

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Compositae *(continued)*

	LOCATION											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
* *Hedypnois rhagadioloides* (L.) Willd.	—	—	—	—	—	—	—	—	—	—	+	—
Helichrysum apiculatum (Labill.) D. Don	—	—	—	—	—	—	—	—	—	—	—	+
Helipterum corymbiflorum Schldl.	—	—	+	—	—	—	+	—	—	—	—	—
H. microglossum (F. Muell. ex Benth.) Maiden & Betche	—	—	—	—	—	—	+	—	—	—	—	—
H. polygalifolium DC.	—	—	—	—	+	—	—	—	—	+	—	—
H. pygmaeum (DC.) Benth.	—	—	+	—	+	+	+	—	—	—	—	—
H. strictum (Lindl.) Benth.	—	—	—	—	—	+	—	—	—	—	—	—
* *Hypochoeris glabra* L.	—	—	—	—	—	+	—	—	—	—	—	—
* *H. radicata* var. *heterocarpa* Moris.	—	—	—	—	—	+	—	—	—	—	—	—
Isoetopsis graminifolia Turcz.	—	—	+	—	—	—	—	+	—	—	—	—
Ixiolaena leptolepis (DC.) Benth.	—	—	—	—	—	—	—	+	—	—	—	—
* *Lactuca* sp.	—	—	—	+	—	—	—	—	—	—	—	—
Microseris scapigera (Sol.ex A.Cunn.) Schultz-Bip.	—	—	—	—	—	—	—	+	—	—	—	—
Millotia myosotidifolia (Benth.) Steetz	—	—	—	—	—	—	+	—	—	—	—	—
Minuria cunninghamii (DC.) Benth.	—	—	—	—	—	+	—	+	+	—	—	—
Myriocephalus stuartii (F. Muell. & Sond. ex Sond.) Benth.	—	—	—	—	—	—	+	—	—	—	—	—
Olearia axillaris (DC.) F. Muell. ex Benth.	—	—	—	—	+	+	—	—	—	—	—	—
O. calcarea F. Muell. ex Benth.	—	—	—	—	—	—	—	—	—	+	—	—
O. pimeleoides (DC.) Benth.	—	—	—	—	—	+	—	—	+	+	—	—
* *Onopordum acaulon* L.	—	—	—	—	—	—	—	—	—	—	+	—
Senecio glossanthus (Sond.) Belcher	—	—	—	+	+	+	—	—	+	—	—	—
S. aff. *lautus* Forst.f. ex Willd.	—	—	—	—	+	+	—	+	—	+	—	—
S. magnificus F. Muell.	—	—	—	—	—	+	—	—	—	—	—	—
S. quadridentatus Labill.	—	—	—	—	—	+	—	—	—	—	—	—
* *Sonchus oleraceus* L.	—	—	—	—	—	+	—	—	—	—	—	—
* *S. tenerrimus* L.	—	—	—	—	—	—	—	—	+	—	—	—
Stuartina muelleri Sond.	—	—	—	—	—	—	—	+	—	—	—	—
Vittadinia megacephala (F. Muell. ex Benth.) Black	—	—	—	—	—	—	—	—	—	+	—	—
V. triloba (Gaudich.) DC.	—	—	—	—	—	—	—	—	—	—	—	+
V. aff. *triloba* (Gaudich.) DC.	—	—	—	—	—	+	—	—	—	—	—	—
* *Urospermum picroides* (L.) F.W. Schmidt	—	—	—	—	—	+	—	—	—	—	—	—
* *Xanthium spinosa* L.	—	—	—	—	—	—	—	—	+	—	—	—
Convolvulaceae												
Convolvulus erubescens Sims	—	—	—	—	—	—	—	—	—	+	+	—
* *Ipomoea palmata* Forsk.	—	—	—	—	—	—	—	—	—	—	—	+
Wilsonia humilis R.Br.	—	—	+	—	—	—	—	—	—	—	—	—
Crassulaceae												
Crassula colorata (Nees) Ostenf.	—	—	—	—	+	+	+	+	—	+	—	—
C. sieberana (Schultes) Druce	—	—	—	+	+	+	+	+	—	+	—	—

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	LOCATION											
	1	2	3	4	5	6	7	8	9	10	11	12
Cruciferae												
Arabidella trisecta (F. Muell.) Schultz	—	—	—	—	—	—	—	—	—	+	—	—
**Brassica tournefortii* Gouan	—	—	—	—	—	+	—	—	—	—	—	—
Cakile maritima Scop.	—	—	—	—	+	—	—	—	—	—	—	—
**Carrichtera annua* (L.) DC.	—	—	—	—	—	+	—	—	—	—	+	—
Geococcus pusillus Drumm.ex Harv.	—	—	—	—	—	+	—	—	—	—	—	—
Hymenolobus procumbens (L.) Nuttall ex Schinz & Thell.	—	—	—	—	—	+	—	—	—	—	—	—
Lepidium papillosum F. Muell.	—	—	—	+	—	—	—	—	—	+	—	—
L. rotundum (Desv.) DC.	—	—	+	+	—	—	—	—	—	—	—	—
**Rapistrum rugosum* (L.) All.	—	—	—	+	—	—	—	—	—	—	—	—
**Sisymbrium erysimoides* Desf.	—	—	—	—	—	+	—	—	—	—	—	—
**S. irio* L.	—	—	—	—	—	+	—	—	—	—	—	—
**S. orientale* L.	—	—	—	—	—	—	—	—	—	—	—	+
Stenopetalum lineare R.Br. ex DC.	—	—	+	—	—	+	—	—	—	—	—	—
Cucurbitaceae												
**Citrullus lanatus* (Thunb.) Mansf.	—	—	—	—	—	—	—	—	—	—	+	—
**Cucumus myriocarpus* Naud.	—	—	—	—	—	+	—	—	—	—	—	—
Euphorbiaceae												
Euphorbia drummondii Boiss.	—	—	—	—	—	+	—	—	—	—	—	—
E. eremophila A. Cunn. ex Hook.	—	—	—	—	—	+	—	+	—	—	—	—
**E. paralias* L.	—	—	—	—	—	+	—	—	—	—	—	—
Frankeniaceae												
Frankenia eremophila Summerh.	—	—	—	—	—	+	—	—	—	—	—	—
F. sessilis Summerh.	—	—	+	—	+	+	—	—	—	—	—	—
F. gracilis Summerh.	—	—	—	—	+	+	—	—	—	—	—	—
F. uncinata Sprague & Summerh. ex Summerh.	—	—	—	—	—	—	—	—	—	+	—	—
Geraniaceae												
**Erodium cicutarium* (L.) L'Hér. ex Ait.	—	—	—	—	—	+	—	—	—	—	—	—
E. cygnorum Nees	—	—	—	—	+	+	+	—	—	—	—	—
**E. moschatum* (L.) L'Hér. ex Ait.	—	—	—	—	+	—	—	—	—	—	—	—
Goodeniaceae												
Goodenia pusilliflora F. Muell.	—	—	—	—	+	+	—	—	—	—	—	—
Scaevola spinescens R.Br.	—	—	—	—	+	+	+	—	—	+	—	—
Gramineae												
**Avena barbata* Pott ex Link	—	—	—	—	—	—	—	—	—	—	+	—
**Bromus arenarius* Labill.	—	—	—	—	—	—	+	—	—	+	—	—
**B. diandrus* Roth	—	—	—	—	—	—	—	—	—	—	+	—
**B. rubens* L.	—	—	—	—	+	+	—	—	—	—	—	—
Cymbopogon ambiguus (Steud.) A. Camus	—	—	—	—	—	+	—	—	—	—	—	—
Danthonia caespitosa Gaudich.	—	—	—	—	—	+	+	+	—	+	+	—

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Gramineae *(continued)*

	LOCATION											
	1	2	3	4	5	6	7	8	9	10	11	12
D. aff. *caespitosa* Gaudich.	—	—	+	—	—	—	—	—	—	+	—	—
Distichlis distichophylla (Labill.) Fassett	—	—	—	—	—	+	—	—	—	—	—	—
Enteropogon acicularis (Lindl.) Lazar.	—	—	—	—	—	—	—	—	—	—	+	—
Eragrostis dielsii Pilger	—	—	—	—	—	+	—	—	—	—	—	—
* *Hordeum leporinum* Link	—	—	—	—	+	+	—	—	+	—	+	—
* *Lamarckia aurea* (L.) Moench	—	—	—	+	—	+	+	—	+	+	—	—
* *Lolium* sp.	—	—	—	—	—	+	—	—	—	—	—	—
* *Lophochloa cristata* (L.) Hyl.	—	—	—	—	+	+	+	—	—	—	—	—
* *L. pumila* (Desf.) N.L. Bor	—	—	—	—	—	+	+	+	+	+	—	—
* *Parapholis incurva* (L.) Hubbard	—	—	—	+	—	+	—	—	—	—	—	—
* *Phalaris minor* Retz.	—	—	—	—	—	+	—	—	—	—	—	—
Poa aff. *crassicaudex* Vickery	—	—	—	—	—	—	+	—	—	—	—	—
* *Schismus barbatus* (L.) Thell.	—	—	—	—	+	+	+	+	—	+	—	—
Stipa elegantissima Labill.	—	—	—	—	—	+	—	—	+	—	—	—
S. eremophila Reader	—	—	+	—	—	—	+	+	—	—	—	—
S. nitida Summerh. & Hubbard	—	—	—	—	—	+	—	—	—	—	—	—
S. aff. *nitida* Summerh. & Hubbard	—	—	—	—	—	—	—	—	—	—	+	—
S. platychaeta Hughes	—	—	—	—	—	+	—	—	—	+	—	—
S. variabilis Hughes	—	—	—	—	—	—	—	—	—	—	+	—
* *Vulpia myuros* (L.) Gmel.	—	—	—	—	—	+	—	—	—	—	—	—
Hypoxidaceae												
Hypoxis hookeri Geerinck	—	—	—	—	—	—	—	+	—	—	—	—
Iridaceae												
* *Gynandriris setifolia* (L.f.) Foster	—	—	—	—	—	—	—	—	—	—	—	+
Juncaginaceae												
Triglochin calcitrapum Hook.	—	—	—	—	—	+	—	—	—	—	—	—
T. centrocarpum Hook.	—	—	—	—	—	+	—	—	—	—	—	—
Labiatae												
* *Marrubium vulgare* L.	—	—	—	—	—	—	—	—	—	—	+	—
* *Salvia verbenaca* L.	—	—	—	—	—	—	—	—	—	—	+	—
Westringia rigida R.Br.	—	—	—	—	—	—	—	—	—	+	—	—
Liliaceae												
* *Asphodelus fistulosus* L.	—	—	—	—	—	—	—	—	—	—	—	+
Bulbine semibarbata (R.Br.) Haw.	—	—	—	—	—	—	+	+	—	—	—	—
Thysanotus baueri R.Br.	—	—	—	—	—	—	+	+	—	—	—	—
Loranthaceae												
Amyema melaleucae (Lehm. ex Miq.) Tiegh.	—	—	—	—	—	—	—	+	—	+	—	—
Lysiana exocarpi (Behr) Tiegh.	—	—	—	—	—	—	—	—	—	—	+	—
Malvaceae												
Radyera farragei F. Muell.	—	—	—	—	—	—	—	—	—	+	—	—
Lawrencia glomerata Hook.	—	—	+	—	—	—	—	—	—	—	—	—

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Malvaceae *(continued)*

	LOCATION											
	1	2	3	4	5	6	7	8	9	10	11	12
* *Malva parviflora* L.	—	—	—	—	—	—	—	—	—	—	+	—
Selenothamnus squamatus (Nees) Melville	—	—	—	—	—	+	—	—	—	—	—	—
Sida intricata F. Muell.	—	—	—	—	—	—	—	+	—	—	—	—
S. petrophila F. Muell.	—	—	—	—	—	—	—	—	—	+	—	—
Mimosaceae												
Acacia ligulata A.Cunn. ex Benth.	—	—	—	—	+	+	—	—	—	—	—	—
A. oswaldii F. Muell.	—	—	—	—	—	—	—	—	—	+	+	—
A. papyrocarpa Benth. (=A. sowdenii)	—	—	—	—	—	—	—	+	—	—	—	—
A. victoriae Benth.	—	—	—	—	—	—	—	—	—	—	+	—
Myoporaceae												
Eremophila alternifolia R.Br.	—	—	—	—	—	—	—	—	—	+	—	—
E. glabra (R.Br.) Ostenf.	—	—	—	—	+	+	—	—	—	—	—	—
E. longifolia (R.Br.) F. Muell.	—	—	—	—	—	—	—	—	—	—	+	—
E. oppositifolia R.Br.	—	—	—	—	—	—	—	—	—	+	—	—
E. scoparia (R.Br.) F. Muell.	—	—	—	—	—	—	—	—	—	+	—	—
Myoporum deserti A.Cunn. ex Benth.	—	—	—	—	—	+	+	—	—	—	—	—
M. insulare R.Br.	—	—	—	—	+	+	—	—	—	—	—	—
M. platycarpum R.Br.	—	—	—	—	—	—	—	+	+	+	—	—
Myrtaceae												
Eucalyptus oleosa F. Muell. ex Miq.	—	—	—	—	—	—	—	—	—	+	—	—
E. socialis F. Muell. ex Miq.	—	—	—	—	—	—	—	—	—	+	—	—
Melaleuca lanceolata Otto	—	—	—	—	—	—	—	—	—	+	—	—
Orobanchaceae												
Orobanche australiana F. Muell. ex Tate	—	—	—	—	+	—	—	—	—	—	—	—
Oxalidaceae												
Oxalis corniculata L.	—	—	—	—	—	—	+	—	—	—	—	—
* *O. pes-caprae* L.	—	—	—	—	—	—	—	—	—	—	—	+
Papilionaceae												
* *Lotus cruentus* Court	—	—	—	—	—	—	—	—	—	—	+	—
* *Medicago minima* var. *brevispina* Benth.	—	—	—	+	+	+	+	+	+	+	+	—
* *M. polymorpha* var. *vulgaris* (Benth.) Shinners	—	—	—	+	—	—	+	+	+	+	+	—
* *M. truncatula* Gaertn.	—	—	—	—	+	—	—	—	—	—	—	—
* *Melilotus indica* (L.) All.	—	—	—	—	—	—	—	—	—	—	+	—
Templetonia egena (F. Muell.) Benth.	—	—	—	—	—	—	—	—	+	+	+	—
Pittosporaceae												
Pittosporum phylliraeoides DC.	—	—	—	—	—	+	—	+	—	—	—	—
Plantaginaceae												
Plantago drummondii Dcne.	—	—	—	—	—	—	—	—	—	—	—	+
Plumbaginaceae												
* *Limonium thouinii* (Viv.) O. Kuntze	—	—	+	—	—	—	—	—	—	—	—	—

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	LOCATION											
	1	2	3	4	5	6	7	8	9	10	11	12
Polygonaceae												
******Emex australis* Steinh.	—	—	—	—	—	—	—	—	—	—	—	+
******E. spinosa* (L.) Campd.	—	—	—	—	—	—	—	—	—	—	+	—
******Polygonum aviculare* L.	—	—	—	—	—	—	—	—	—	—	—	—
******Rumex vesicarius* L.	—	—	—	—	—	—	—	—	—	—	—	+
Portulacaceae												
Calandrinia eremaea Ewart	—	—	—	—	—	+	+	+	—	—	—	—
C. volubilis Benth.	—	—	—	—	—	—	+	+	—	—	—	—
Posidoniaceae												
Posidonia australis Hook.f.	+	—	—	—	—	—	—	—	—	—	—	—
Primulaceae												
******Anagallis arvensis* var. *caerulea* Gouan	—	—	—	—	—	—	—	—	—	—	—	+
Ranunculaceae												
Ranunculus pentandrus var. *platycarpus* (F. Muell.) Eichler	—	—	—	—	—	—	—	+	—	—	—	—
Ruppiaceae												
Ruppia sp.	—	+	—	—	—	—	—	—	—	—	—	—
Rutaceae												
Geijera linearifolia (DC.) J.M. Black	—	—	—	—	—	+	—	+	—	—	—	—
Santalaceae												
Exocarpos aphyllus R.Br.	—	—	—	—	—	—	—	—	—	+	—	—
Santalum acuminatum (R.Br.) A.DC.	—	—	—	—	—	+	—	+	—	+	—	—
Sapindaceae												
Dodonaea attenuata A.Cunn.	—	—	—	—	—	+	—	—	—	—	—	—
D. lobulata F. Muell.	—	—	—	—	—	—	—	—	—	+	—	—
D. stenozyga F. Muell.	—	—	—	—	—	—	—	—	—	+	—	—
Heterodendrum oleaefolium Desf.	—	—	—	—	—	+	—	+	—	+	—	—
Solanaceae												
Lycium australe R.Br.	—	—	—	+	+	+	+	+	+	+	—	—
******L. ferocissimum* Miers	—	—	—	+	+	—	—	—	+	—	+	—
******Nicotiana glauca* Grah.	—	—	—	—	—	+	—	—	—	—	—	—
N. goodspeedii Wheeler	—	—	—	—	—	+	—	—	—	+	—	—
N. velutina Wheeler	—	—	—	—	—	+	—	—	—	—	—	—
Solanum coactiliferum J.M. Black	—	—	—	—	—	+	—	—	—	—	—	—
******S. nigrum* L.	—	—	—	—	—	+	—	—	—	—	—	—
S. petrophilum F. Muell.	—	—	—	—	—	—	—	—	—	+	—	—
Thymelaeaceae												
Pimelea micrantha F. Muell.	—	—	—	—	—	—	—	—	—	+	—	—
P. microcephala R.Br.	—	—	—	—	—	+	—	—	—	+	—	—
P. simplex F. Muell.	—	—	—	—	—	—	—	+	—	+	—	—
Umbelliferae												
******Bupleurum semicompositum* L.	—	—	—	—	—	—	—	+	—	—	—	—
Daucus glochidiatus (Labill.) Fisch. Mey & Ave-Lal.	—	—	—	+	—	+	+	—	—	+	—	—

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	LOCATION											
	1	2	3	4	5	6	7	8	9	10	11	12
Urticaceae												
Parietaria debilis Forst.f.	—	—	—	—	—	+	—	—	—	—	—	—
Verbenaceae												
Avicennia marina var. *resinifera* (Forst.f.) Bakh.v.d. Brink	—	+	—	—	—	—	—	—	—	—	—	—
Zannichelliaceae												
Amphibolis antartica (Labill.) Sond. & Aschers. ex Aschers.	+	—	—	—	—	—	—	—	—	—	—	—
Zosteraceae												
Zostera muelleri Irmisch ex Aschers.	+	—	—	—	—	—	—	—	—	—	—	—
Zygophyllaceae												
Nitraria billardieri DC.	—	—	—	—	+	+	—	—	—	—	—	—
Zygophyllum apiculatum F. Muell.	—	—	—	—	—	—	—	+	—	+	—	—
Z. aff *ammophilum* F. Muell.	—	—	+	+	—	—	+	+	—	—	—	—
Z. aurantiacum Lindl.	—	—	—	—	—	—	—	—	—	+	—	—
Z. billardieri DC.	—	—	—	—	—	—	—	—	—	+	—	—
Z. compressum J.M. Black	—	—	—	+	—	—	—	—	—	—	—	—
Z. eremaeum (Diels) Ostenf.	—	—	—	—	—	+	—	—	—	—	—	—
Zygophyllum sp.	—	—	—	—	—	+	—	—	—	—	—	—
Bryophytes												
Hepaticae												
Riccia sp. 1.	—	—	+	—	—	—	+	+	—	—	—	—
Riccia sp. 2.	—	—	+	—	—	—	+	—	—	—	—	—
Musci												
Barbula australasiae (Hook. & Grev.) Brid.	—	—	—	—	—	+	—	—	—	—	—	—
Barbula crinita Schultz	—	—	—	—	—	—	—	—	—	+	—	—
B. torquata Tayl.	—	—	+	—	—	—	—	—	—	—	—	—
Bryum pachytheca C. Muell.	—	—	—	—	—	+	+	—	—	—	—	—
B. sp. C.	—	—	—	—	—	—	—	—	—	+	—	—
Desmatodon convolutus (Brid.) Grout	—	—	+	—	—	—	+	—	—	+	—	—
Funaria gracilis (Hook.f. & Wils.) Broth.	—	—	—	—	—	—	—	+	—	—	—	—
F. hygrometrica Hedw.	—	—	—	—	—	+	—	—	—	—	—	—
Funaria sp.	—	—	—	—	+	—	—	—	—	—	—	—
Gigaspermum repens (Hook.) Lindb.	—	—	—	—	—	+	—	—	—	—	—	—
Goniomitrium enerve Hook. f. & Wils.	—	—	—	—	—	—	—	—	—	+	—	—
Lichens												
Buellia subalbula (Nyl.) Mull.Arg.	—	—	—	—	—	—	—	—	—	+	—	—
Chondropsis semiviridis F. Muell. ex Nyl.	—	—	+	+	+	+	+	+	+	—	—	—
Diploschistes scruposus (Schreb.) Norm.	—	—	—	—	—	+	+	—	—	+	—	—
Endocarpon pusillum Hedw.	—	—	+	+	+	+	—	—	—	—	—	—
Fulgensia subbracteata (Nyl.) Poelt	—	—	+	—	—	+	—	—	—	—	—	—
Lecidia coarctata (J.E. Smith) Nyl.	—	—	—	—	—	+	+	—	—	—	—	—
L. decipiens (Hoffm.) Ach.	—	—	—	—	—	+	+	—	—	—	—	—
Parmelia adhaerens Nyl.	—	—	—	—	—	—	—	—	—	+	—	—
P. convoluta Kremph.	—	—	—	—	—	+	+	+	+	—	—	—
Parmelia sp.	—	—	—	—	—	—	—	—	—	+	—	—
Toninia caeruleonigricans (Lightf.) Th.Fr.	—	—	—	—	—	+	+	+	+	—	—	—
Xanthoria ectanea (Ach.) Räs.ex R. Filson	—	—	—	—	+	+	+	+	+	—	—	—

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THE GLORY VINE IN SOUTH AUSTRALIA

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Abstract

The name 'Ganzin Glory' is proposed for the ornamental vine derived from the cross *Vitis vinifera* L. x *V. rupestris* Scheele and grown widely in southern Australia under a number of invalid or illegitimate names. This cultivar was produced by Victor Ganzin in France and released by him in 1900 as a rootstock under the code 'ARG 9'.

Introduction

A hardy, essentially non-fruiting grape vine has become popular as an ornamental in South Australia over the last half century. This cultivar is also common around Mildura and is grown elsewhere in Victoria and New South Wales. It is often called simply the 'Glory Vine', but is sold by nurserymen under a number of names, such as 'Crimson Glory', 'Alicante Bouschet', 'Teinturier' or 'Teinturier Male', none of which is satisfactory. 'Crimson Glory' is used for *Vitis coignetiae* Pulliat (Bailey, 1947) but the cultivar in question does not belong to this species. 'Alicante Bouschet' is a cultivar of *Vitis vinifera* L. which carries the gene for red juice in the fruit and red colouration of the leaves in autumn. The term "teinturier" is now used as a general name for cultivars carrying this gene and any with male flowers could perhaps be described as male teinturiers. However both 'Teinturier' and 'Teinturier Male' have been used as synonyms for the cultivar more particularly known as 'Teinturier du Cher', which was used in breeding 'Alicante Bouschet' (Galet, 1962).

History

The glory vine is in the vine variety collection of the CSIRO at Merbein, having been imported from the Viticultural Research Station at Nuriootpa in 1963 under the name of 'Tinto' (syn. 'Teinturier Male'). Records of the Department of Agriculture, South Australia, show the origin of the cultivar as Fullarton, 1942, *i.e.* from the former Fullarton vine variety collection maintained by the Department at Urrbrae Agricultural High School. De Castella (1942) lists the 93 cultivars in this collection, 'Tinto' being No. 34, and traces the Fullarton collection to an earlier collection maintained by the Department at Hackney.

The leaf and shoot characters of 'Tinto' are typical of hybrids between *Vitis vinifera* and *Vitis rupestris* Scheele and the cultivar is very similar to the rootstock 'Aramon' x 'Rupestris Ganzin' No. 1 ('ARG 1') used in vineyards in California and north-east Victoria. It differs mainly in having a narrower and V- rather than U-shaped petiolar sinus and less bronzing of the young leaves. This suggests another hybrid of the same series, 'ARG 9', and a check in February 1979 in the vine variety collection of the Victorian Department of Agriculture at Rutherglen, where both are present under those names, indicated that the glory vine is 'ARG 9'.

The Ganzin hybrids were produced by Victor Ganzin (*fl.* 1838-1900), a doctor in law at Le Pradet near Toulon in France. He was the first person in Europe to make the cross of *V. vinifera* and *V. rupestris* and he hoped to combine the fruit characteristics of *V. vinifera* with the resistance of *V. rupestris* to root damage by phylloxera (Ganzin, 1882). This hope was not realised and he later released 'ARG 1' and 'ARG 2' (Ganzin, 1887) and 'ARG 9' (Ganzin, 1900) for use as rootstocks for traditional *V. vinifera* cultivars. It might be thought that 'ARG 9' was released too late to have entered South Australia before the embargo on the importation of vines was imposed but Ganzin (1900) acknowledges that some 'ARG 9' was mixed with the other two hybrids released earlier. In time it was found that the *V. vinifera* x *V. rupestris* hybrids did not have enough resistance to phylloxera for most situations and, apart from the use of 'ARG 1' mentioned earlier, Ganzin's hybrids are now rarely used for this purpose. By back-crossing to cultivars of *V. vinifera* he produced 'Alicante Ganzin' and 'Clairette dorée Ganzin' which, along with the original hybrids, have been used by other breeders and form part of the ancestry of such successful hybrids as 'Villard blanc' and 'Villard noir' (Galet, 1971).

'ARG 9' is reported as somewhat susceptible to leaf galling by phylloxera (Galet, 1956) which might suggest caution in growing it in areas where phylloxera is present. However Swan found no leaf galls on it in 1956 at Rutherglen when other stocks were severely infested (Buchanan & Hardie, 1978) and no galls were observed on my inspection in 1979. It has enough resistance to the common fungus diseases of the vine to require no protective spraying, making it very suitable for an ornamental subject.

Description (Taxonomy)

The name 'Ganzin Glory' is here proposed as the cultivar name for the ornamental vine derived from the cross *Vitis vinifera* x *V. rupestris* and grown widely in southern Australia under a number of invalid or illegitimate names. The cultivar is vigorous with rather glossy, glabrous leaves showing a coppery tint when young, maturing to a somewhat greyish green and colouring to a deep red in autumn. Leaves are usually entire to slightly (occasionally more deeply) 3-lobed, with a narrow V-shaped petiolar sinus. The vine produces numerous inflorescences of male flowers with copious pollen and a strong scent at flowering. The inflorescences then absciss unless, as occasionally happens as the vines age, a few flowers produce functional ovaries and set fruit. This cultivar, produced by V. Ganzin in France and released by him as a rootstock under the code 'ARG 9', is described briefly by Galet (1956) and more fully by Ganzin (1900). Representative specimens (*Symon 11957*) based on material cultivated in the orchard at the Waite Institute have been deposited in herbaria AD, ADW, MEL, CANB.

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J. Adelaide Bot. Gard. 2(4): 355 (1980)

A NEW COMBINATION IN *OPERCULINA* (CONVOLVULACEAE)

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Abstract

Ipomoea aequisepala Domin, a northern Australian species previously confused with *Operculina turpethum* (L.) S.Manso, is transferred to *Operculina* and the necessary recombination effected.

The forthcoming publication of the 'Flora of Central Australia' necessitates the publication of a new combination for a species of *Operculina* (Convolvulaceae) recognised by the present author.

Operculina aequisepala (Domin) R.W. Johnson, comb. nov.

Basionym: *Ipomoea aequisepala* Domin, Biblioth. Bot. 89:535 (1928).

Type: Nordwest-Queensland: Grasflächen der Rolling Downs zwischen Richmond und Cloncurry (Domin II.1910) (holotype: not found).

The holotype of this species has not been located following searches in a number of likely European herbaria. Most of the holotypes of species of Convolvulaceae designated by Domin in 'Bibliotheca Botanica' are held in the National Museum of Prague.

The original description is very detailed and adequately and fairly precisely describes this widespread endemic taxon from semi-arid northern Australia, previously included under *Operculina turpethum* (L.) S. Manso in most herbaria. The latter species is restricted to coastal areas of far northern and eastern Australia. The only point of dispute in Domin's description is his statement that it is a perennial with a tuberous root. From a study of herbarium specimens and living plants it is almost certainly an annual with a tap root.

Because it possesses smooth pollen and its capsule has an operculum it belongs to the genus *Operculina*. The operculum is quite small, 6-9 mm in diameter, compared with other members of the genus in Australia. It can be distinguished from *O. turpethum* in having a smaller corolla, less than 3 cm long, and ± glabrous sepals.

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A NEW SPECIES IN *HELIOTROPIUM* (BORAGINACEAE) AND A NEW COMBINATION IN *ABUTILON* (MALVACEAE)

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Abstract

A new species, *Heliotropium flintii* F. Muell. ex A.S. Mitchell is described and illustrated and a new combination in *Abutilon* (*A. lepidum*) based on *Sida lepida* F. Muell. is made for the Flora of Central Australia.

Heliotropium flintii F. Muell. ex A.S. Mitchell sp. nov.

Suffrutex indumento adpresso argenteo-cano. Folia alterna linearia vel angusto-lanceolata recurvata 8-20 mm longa. Flora 2-seriales, cyman foliaceam secundam scorpioideam facientes. Calyx 4-5 mm longus 5 lobis lineari- lanceolatis. Corolla 6-8 mm longa, extus pilosa intus glabra, alba fragrans. Antherae 3-5 inclusae, ad apicem cohaerentes. Fructus plerumque abortu uno mericarpio, adpressis antrorsis pilis.

Erect *subshrub* to 25 cm tall, densely tomentose with appressed silvery-grey hairs, the outer covering of the stem often peeling away like bark. *Leaves* alternate, linear or narrow-lanceolate, recurved, 8-20 mm long. *Flowers* in 2 rows, forming a loose or dense leafy one-sided scorpoid cyme. *Calyx* 4-5 mm long, deeply divided into 5 linear-lanceolate lobes, the outer ones broader. *Corolla* 6-8 mm long; the tube densely hairy with tangled simple hairs except at the base, constricted above the ovary and slightly swollen about the middle, glabrous inside; the limb spreading, lobes ovate to rhomboid; white, fragrant. *Anthers* 3-5, on short filaments, included in the throat, acuminate, cohering at their minutely hairy apices. *Stigma* a fleshy ring at the base of a central cone, shorter than the style. *Fruit* more often reduced to one mericarp by abortion, covered with simple appressed upward pointing hairs.

Holotype: "Between McDonnel's Range and the boundary of Qld." E. Flint, 1882. MEL 90932.

Distribution and habitat

In the southern Northern Territory from Alice Springs ENE along the Plenty Highway to the Queensland border, with isolated collections north-west of Alice Springs as far as the Tanami. Found on the rocky slopes of hills.

Notes

This species is probably best placed in Bentham's section *Euheliotropium* (Fl. Aust. 4 (1869) 392-3), though it does not exactly agree with the diagnostic characters given in that it has acuminate anthers cohering at their apices. One interesting point is that the fruit is often reduced to one mericarp by abortion, whereas other species either have four 1-seeded nuts, or less commonly two 2-seeded nuts.

Specimens examined

NORTHERN TERRITORY: 10 km N Alice Springs 23°35′ 133°53′, *G. Chippendale 484*, 10.xi.1954 (NT); 6 km N Alice Springs 23°38′ 133°53′, *G. Chippendale 1665*, 14.ix.1955 (NT, NSW, MEL); White Range, 5 km NE Arltunga 23°27′ 134°43′, *G. Chippendale 4101*, 26.iii.1958 (NT, BRI, NSW, CANB, MEL); 1 km N Mirror Finish Mine, Huckitta 23°07′ 135°25′, *P.K. Latz 1127*, 7.i.1971 (NT); Christmas Dam, Marqua 22°53′ 137°35′, *P.K. Latz 2616*, 24.v.1972 (NT, BRI, PERTH); 11 km SW Indiana Station 23°24′ 135°22′, *M. Lazarides 5969*, 11.ix.1956 (NT, CANB); 6 km N Sangsters Bore, Tanami 20°47′ 130°22′, *J.R. Maconochie 998*, 21.iv.1971 (NT, BRI, CANB); Wiggleys Waterhole, 10 km N Alice Springs 23°38′ 133°53′, *A.S. Mitchell 216*, 24.ii.1975 (NT, PERTH); 16 km N Alice Springs 23°33′ 133°50′, *D.J. Nelson 1371*, 19.x.1964 (NT, MEL); 5 km S Greentree Dam, Hamilton Downs 23°35′ 133°32′, *D.J. Nelson 2294*, 1.viii.1973 (NT, CANB).

Abutilon lepidum (F. Muell.) A.S. Mitchell comb. nov.

Basionym: Sida lepida F. Muell., Fragm. 6 (1868) 168.

Lectotype: (? Dr. Martin) s.n., Camden Harbour. MEL 53621.

Typification

Mueller described this species from two syntypes—"In vicinia portus Walcotti; C. Harper. Ad Camden Harbour; Dr. Martin." The Camden Harbour sheet (MEL 53621) unfortunately, does not list the collector. However, it was not unusual for Mueller's label annotations to appear somewhat differently in print to how they actually did on the label. The entire holdings of *S. lepida* in MEL were examined, and there is nothing to suggest that MEL 53621 was not collected by Dr. Martin. It is a much more complete specimen than that from Port Walcott (MEL 53624), and so is proposed as the lectotype.

Distribution and habitat

Found on sandy, alluvial or gravelly soils in the north-west of Western Australia (Hamersley Ranges) with scattered occurrences through the Great Sandy Desert and as far east as Hermannsburg (SW of Alice Springs, N.T.), though rare there.

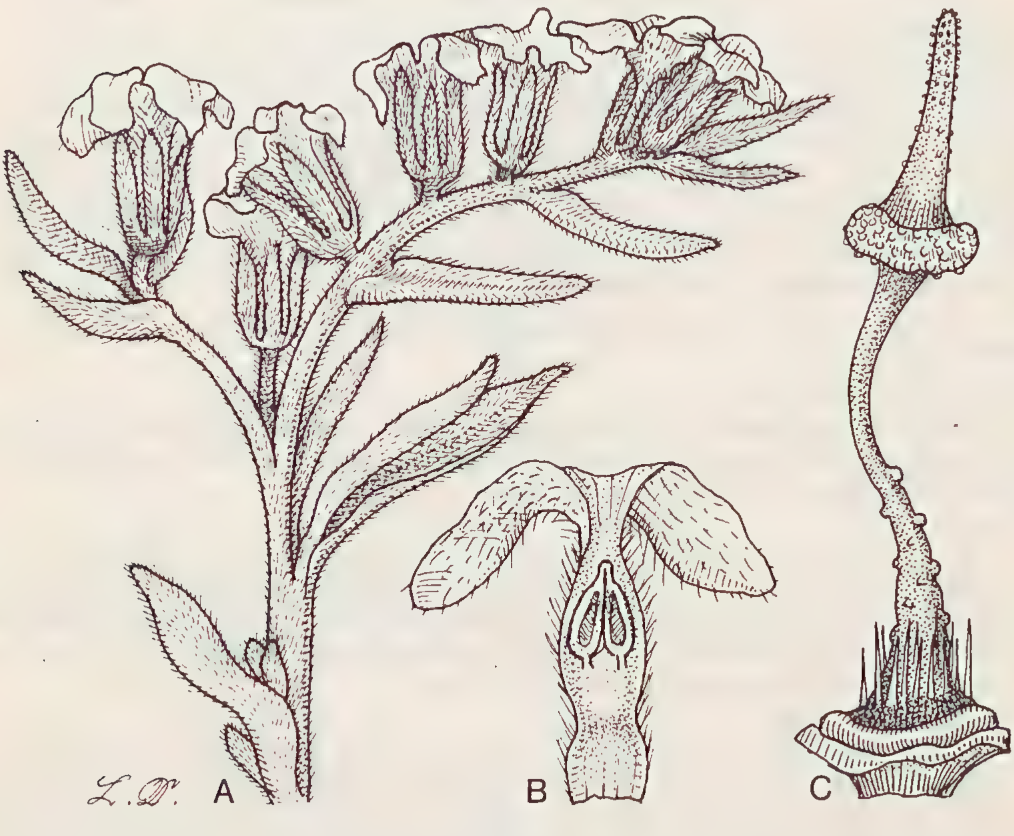

Fig. 1. *H. flintii* F. Muell. ex A.S. Mitchell. A, inflorescence, x 5; B, cross-section of corolla showing coherent anthers, x 10; C, gynoecium showing prominent fleshy ringed stigma at the base of the central column, x 45. (A-C, *Latz 1127*).

Notes

The fruits of this taxon are narrow, chartaceous and dehiscent and, apart from the fact that they are one-seeded, rather than the normal two, fit the genus *Abutilon* much better than they do *Sida*. One interesting point is the fact that the yellow-orange flowers usually dry blue or purple, a characteristic apparently restricted to this species in the genus.

Specimens examined

WESTERN AUSTRALIA: Yampire Gorge 22° 24′ 118° 28′, *A.C. Beauglehole 48533*, 7.viii.1974 (NT); Dales Gorge 22° 30′ 118° 36′, *A.C. Beauglehole 48612*, 8.viii.1974 (NT); 18 km NE Mary River Crossing, Great Northern Highway, *A.C. Beauglehole 53284*, 19.vi.1976 (NT); 5 km from Learmouth Camp, Cape Range 22° 20′ 113° 56′, *Y. Chadwick 1462*, 7.ix.1964 (PERTH); Nichol Bay, *W.K. Cussack s.n.*, 1897 (MEL); Sherlock River, *J. Forrest s.n.*, n.d. (MEL); between the Sherlock and Yule River, *J. Forrest s.n.*, 1878 (MEL); Menilyalya River, *J. Forrest s.n.*, 1882 (MEL); Gascoyne River, *J. Forrest s.n.*, 1882 (MEL); 40 km E Bullara Homestead 22° 41′ 114° 27′, *A.S. George 1203*, 29.viii.1960 (PERTH); 22 km E Bullara Homestead 22° 41′ 114° 16′, *A.S. George 1246*, 29.viii.1960 (PERTH); Peeawal Station, *A.S. George 3407*, 25.ii.1967 (PERTH); Yardie Sation 21° 53′ 114° 01′, *A.S. George 6654*, 27.v.1965 (PERTH); Dovers Hills 23° 08′ 128° 40′, *A.S. George 8997*, 27.vii.1967 (PERTH); Anketell Ridge 20° 24′ 122° 07′, *A.S. Mitchell 1206*, 14.v.1979 (NT); 90 km N Nullagine 21° 03′ 120° 07′, *A.S. Mitchell 1240*, 17.v.1979 (NT).

NORTHERN TERRITORY: Mt Liebig 23° 18′ 131° 22′, *A.C. Beauglehole 46062*, 28.vi.1974 (NT); Hermannsburg 23° 55′ 132° 45′, *G. Griffin 4*, ix.1972 (NT); Finke River 23° 55′ 132° 45′, *H. Kempe 509*, 1882 (MEL).

Acknowledgements

I would like to thank Dr Jim Ross (MEL) and Mr John Maconochie (NT) for their assistance in the preparation of this paper and Mr L. Dutkiewicz for providing the illustration of *Heliotropium flintii*.

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BOOK REVIEW

South Australian Wattles

Whibley, D.J.E. with assistance from Donner, N.N. Illustrated by L. Dutkiewicz. 'Acacias of South Australia', 1980, Government Printer, South Australia.

This "Handbook of the Flora and Fauna of South Australia" maintains the high standard of the series. It is an attractive publication with a colourful, flexible but durable cover, good quality paper, clear type and plenty of illustrations.

The scope of the book is explained in the "Introduction" and "Explanation of the Text". Following these sections there are two keys to the species of *Acacia* in South Australia, an illustrated one and a conventional dichotomous indented one. The former is useful but distinctions between some species in Group 3 are not at all obvious, largely because of the small size of the illustrations. I tested the conventional key on a number of specimens and found that it worked well.

Ninety-seven species are treated individually, the text covering description, flowering time, occurrence, cultivation and, in some cases, related species. Each species is illustrated by drawings and a habit photograph and there is a distribution map (approx. 1:24,000,000) for each. All information is placed on two facing pages, a great convenience for the user.

The scientific and common name (when there is one) is followed by a reference to the author, place of publication of the name, derivation of the name and synonyms. The descriptions are brief but accurate and adequate for most purposes. Details of flowers are not given but, except for size in a few species such as *Acacia myrtifolia*, unless highly magnified they are of little value in identification. The section on occurrence gives detailed information on the range of the species in South Australia, information which is also given on the distribution map, ecological data, and its occurrence in other states. I found that the notes on related species of great interest. Problems abound in *Acacia* and some of them involving South Australian species are discussed briefly by the author in these notes. For example, notes to *A. aneura*, *A. brachystachya* and *A. ramulosa* draw attention to the difficulty in distinguishing these species from each other and from *A. linophylla*, which may or may not be distinct from *A. ramulosa*.

The author adopts some solutions and refers to literature pertinent to the problem. There are a few species which are in some way doubtful and are mentioned only in notes, but they are indexed.

The book is remarkably free from misprints or other errors. I found only one misprint, a date so obviously wrong that there is no possibility of its misleading anyone, and some mistakes in the occurrence of species. *A. baileyana* is naturalised in Queensland and *A. flexifolia* occurs naturally there, whereas *A. mearnsii* does not occur at all. But none of this information was available to the author and he cannot be blamed for such minor blemishes.

The line drawings complement the text. At first sight they may seem somewhat stiff and stylised, but acacias are harsh plants and deserve bold treatment. With the conventional key and the drawings it is possible, in fact, to identify a species without referring to the description. The low, densely branched species with small uninerved phyllodes are often difficult to distinguish but the drawings to species No.'s 8, 9 and 10 would leave the user in little doubt as to which he had. Again floral details are omitted without detracting from the usefulness of the drawings.

The habit photographs are not up to the high standard of the rest of the book. Some, for example that of *A. calcicola*, are very good indeed, but about half of them are not particularly informative. The colour ones are significantly better than the monochrome ones though only two-thirds are really satisfactory. In many cases this is not the fault of the author, photographer, artist or printer but rather of the subject matter. Many acacias are low dense shrubs with small phyllodes and yellow inflorescences and look very much alike in photographs, even in colour. The use of colour for all photographs would certainly increase their value and would also greatly increase the price of the book. Such a move cannot be justified when the book already contains such useful drawings.

The treatment of individual species is followed by a distribution chart of species, references to works cited in the text, a glossary, and an index. The distribution chart is useful for comparing areas inside and outside of South Australia. It is surprising for example, that 11 of the 25 species recorded from the Lake Eyre region do not occur in Queensland whereas 6 of the 23 species of the contiguous Gregory South District of Queensland do not occur in South Australia. The references, besides being necessary to an understanding of the notes, give the general reader a lead into the literature of *Acacia* in South Australia. The glossary is easy to use and seems to cover all technical terms used, while the index is comprehensive and accurate.

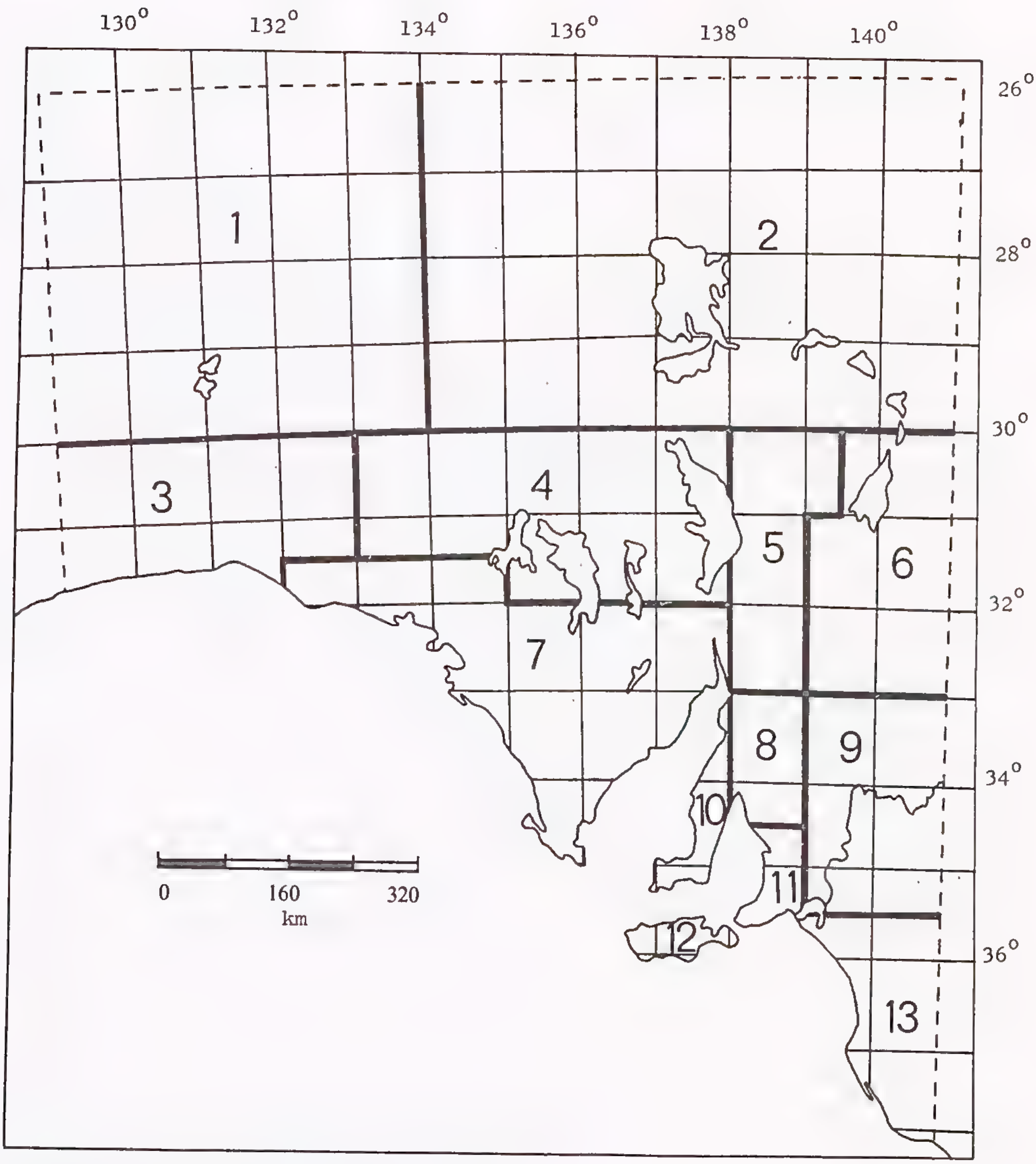
The book is highly recommended to the professional worker, the amateur enthusiast and the layman. South Australians are fortunate to have such a practical and attractive guide to the acacias of their state, and everyone involved in its production is to be congratulated.

Whibley, D.J.E. with assistance from Donner, N.N. 1980 (February 29) 'Acacias of South Australia', pp. 240, 37 coloured plates, 60 monochrome plates, 104 line drawings, 1 map. (Published by Handbooks Committee, printed by Government Printer, South Australia). Paperbound $7.90.

L. Pedley
Queensland Herbarium

REGIONS OF SOUTH AUSTRALIA ADOPTED BY THE STATE HERBARIUM — ADELAIDE

1. North-western
2. Lake Eyre Basin
3. Nullarbor
4. Gairdner-Torrens Basin
5. Flinders Ranges
6. Eastern
7. Eyre Peninsula
8. Northern Lofty
9. Murray
10. Yorke Peninsula
11. Southern Lofty
12. Kangaroo Island
13. South-eastern



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JOURNAL of the ADELAIDE BOTANIC GARDENS

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