

NUYTSIA

Volume 5 • Number 1
1984

WESTERN AUSTRALIAN HERBARIUM
DEPARTMENT OF AGRICULTURE

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DEPARTMENT OF AGRICULTURE,
SOUTH PERTH, WESTERN AUSTRALIA

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Four new names for *Pimelea* species (Thymelaeaceae) represented in the Perth Region

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Abstract

Rye, B. L. Four new names for *Pimelea* species (Thymelaeaceae) represented in the Perth Region. Nuytsia 5(1): 1-11 (1984). Descriptions of three new *Pimelea* species (*P. brevistyla* Rye, *P. calcicola* Rye and *P. ciliata* Rye) are given in preparation for the "Flora of the Perth Region". A further species, which appears to be rare and endemic to the Perth Region, is given the new name *P. rara* Rye, based on *P. lehmanniana* Meissner var. *ligustrinoides* Benth.

Introduction

The Perth Region is defined for the proposed regional flora as the coastal strip of land extending from Gingin to Boyanup and inland to the highest peaks along the Darling Range (Marchant & Perry 1981). It contains 19 of the approximately 45 *Pimelea* species recorded for Western Australia. Three of the species occurring in the Perth Region are undescribed and another has been described only as a variety. These taxa are described here, prior to my projected revision of the genus in Western Australia, so that the names can be used in the proposed "Flora of the Perth Region".

As in other Thymelaeaceae, *Pimelea* species have a floral tube consisting of outer axial tissue and inner tissue derived from the corolla and stamen whorls (Bunniger 1972). Calyx tissue arises at the summit of the axial part of the floral tube; hence the calyx apparently consists only of the so-called 'calyx lobes', which should, therefore, be known as sepals. In *Pimelea*, four sepals and two (very rarely one) free stamen filaments arise at the summit of the floral tube but the corolla lobes have been lost. The floral tube has a swollen basal portion surrounding the ovary or fruit and a more cylindrical, usually much longer, upper portion enclosing much of the style. For convenience, these parts of the floral tube will be referred to here as the ovary and style portions. However, these portions should not be taken as indicating the precise lengths of the ovary and enclosed style respectively.

Species descriptions

Pimelea brevistyla Rye, sp. nov. (Figure 1)

Planta inter *Pimeleam preissii* Meissner et *P. ciliatam* Rye quasi intermedia, a priore differt tubo florali non circumscisso, parte centrali pilis divaricatis obsito; a posteriore differt stylo breviter et staminibus subsessilibus connectivo lato plano.

Typus: Glenburn Rd, Glen Forrest, Western Australia, 6 Oct. 1983, N. Cohen 1002 (holo: PERTH; iso: CANB, K, MEL, NSW).

Somewhat intermediate between *Pimelea preissii* Meissner and *P. ciliata* Rye, differing from the former in the lack of circumscission and the long spreading hairs on the central part of the floral tube; differing from the latter in the short style and the subsessile stamens, with a broad flat connective.

Shrub erect, to 1.5 m tall, glabrous except for the inflorescences. *Stems* apically red-brown, becoming grey with age. *Leaves* opposite, decussate, spreading; *petiole* 0.5-1.5 mm long; *lamina* usually narrowly ovate, 12-28 × 2-3.5 mm, concave or flat, tapering at both ends, often with a conspicuous yellowish midrib; the lateral margins incurved (when dry). *Inflorescence* a head-like condensed raceme, terminal, erect, of numerous flowers. *Involucral bracts* 4 or 6, yellowish, 8-22 mm long, acute or acuminate; *outer bracts* glabrous, often separated by distinct internodes from the inner pair, the outermost pair (if 6 bracts present) often much more leaf-like than the others; *inner bract pair* broadly ovate-elliptic, 7-13 mm broad, much thinner than the leaves, glabrous outside, silky-hairy inside, the lateral margins densely ciliate. *Flowers* bisexual; *pedicel* c. 1 mm long, silky-hairy. *Floral tube* not circumscissile; *ovary portion* brown, ellipsoid, 2-4 mm long, prominently 8-ribbed, appearing glabrous but usually sparsely covered by minute reflexed or widely spreading hairs; *style portion* expanding gradually to c. 1 mm in diameter at the summit, 6-10 mm long, glabrous inside; lower half of the style portion brown, prominently ribbed, with minute hairs similar to those on the ovary portion, mixed (at least in the upper part) with spreading hairs 3-4 mm long; upper half of the style portion white, densely silky-hairy with appressed hairs to 1 mm long. *Sepals* spreading, white, ovate, 3-6 mm long, obtuse, the outside with a similar vestiture to that of the upper part of the floral tube, the inside more sparsely hairy or glabrous. *Stamens* appearing sessile, the filaments c. 0.25 mm long; *anther* oblong, 1-2 × c. 0.7 mm; cells parallel on the inner face of a flat dorsal connective, which extends the full width of the anther. *Ovary* glabrous. *Style* c. as long as the style portion of the floral tube, the *stigma* usually borne in the throat of the tube.

Other specimens examined. WESTERN AUSTRALIA: Muntadgin, E. T. Bailey 686 (PERTH); Wyalkatchem, Oct. 1937, W. E. Blackall s.n. (PERTH); Smith's Mill [Glen Forrest], Sept. 1901, Diels & Pritzel s.n. (PERTH); Karragullen, A. R. Fairall 319A (PERTH); Serpentine Falls, J. W. Green 361 (PERTH); Merredin, M. Koch 2772 (MEL); Merredin, M. Koch 2843 (MEL); Kellerberrin, Sept. 1897, R. B. Leake s.n. (PERTH); 13 mi [c. 21 km] NE Hyden, K. Newbey 1090 (PERTH); Serpentine, Sept. 1922, G. E. Perrin s.n. (MEL); 1 km from Wubin to Brinbro, M. E. Phillips 930 (CBG, PERTH); 1 mi [c. 1.6 km] S Wubin, 2 Oct. 1962, M. E. Phillips, s.n. (CBG); 5.3 mi [c. 8 km] S Wubin, M. E. Phillips 2928 (CBG); Darling Range, Sept. 1901, E. Pritzel s.n. (PERTH); 12 mi [c. 19 km] E Ballidu, R. D. Royce 2132 (PERTH); Helena Valley, J. Seabrook 584, (PERTH); Mt Caroline, 1890, G. Sewell s.n. (MEL); Ca 50 km NNW Merredin, D. J. E. Whibley 4726 (PERTH).

Distribution and habitat. The species occurs both in the Darling Range near Perth and in the wheatbelt, the two areas separated by over 130 km (Figure 3A). The wheatbelt localities extend about 335 km in a north-west to south-east direction from Wubin to Hyden respectively. In the Darling Range, *P. brevistyla* has been recorded in gravelly sand and on granitic slopes. The habitat of the wheatbelt populations is uncertain but two of the known localities are probably granite outcrops.

Flowering period. August-October.

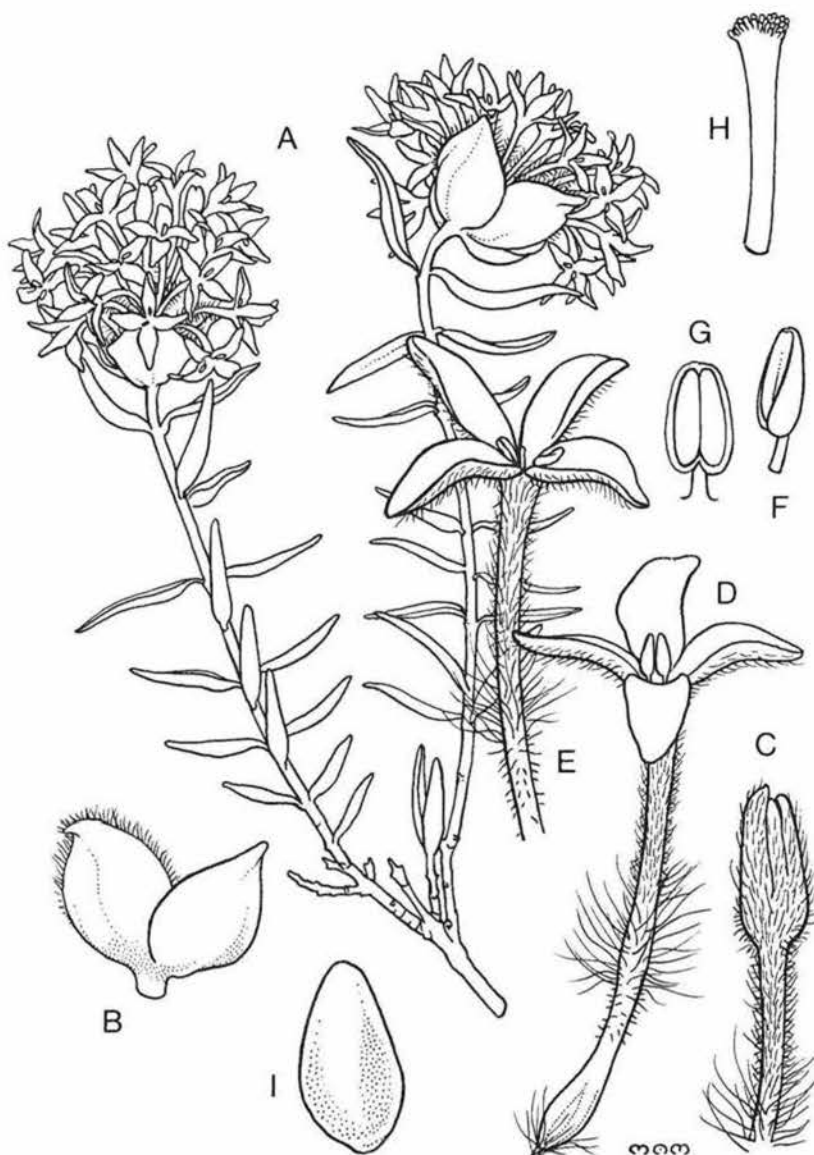


Figure 1. *Pimelea brevistyla*. A—Flowering branch. B—An outer and an inner bract. C—Flower bud. D—Newly opened flower. E—Mature flower. F—Side view of anther. G—Inner face of anther. H—Ovary. I—Upper style and stigma.

Drawn from fresh material collected at the type locality.

Discussion. This species does not appear to have any very close relatives. It bridges the gap between sect. *Heterolaena*, which includes *Pimelea ciliata*, and sect. *Epallage*, which includes *P. preissii*.

In the Darling Range, *Pimelea brevistyla* has leaves 22-28 mm long, involucre bracts 12-22 mm long, sepals 5-6 mm long and the style portion of the floral tube is 8-10 mm long. Wheatbelt specimens have shorter leaves and flowers, not overlapping the range of measurements given for the Darling Range specimens. These differences may result from the difference in rainfall between the two areas, the wheatbelt localities receiving less than 750 mm mean annual rainfall whereas the Darling Range receives over 1 050 mm. There are no obvious topographic or edaphic reasons for the disjunction in the known range of the species. It could possibly be due to inadequate collecting or to a paucity of granite outcrops in the intervening area.

Derivation of name. *Brevis* (L)—short, *stylus* (L)—style.

***Pimelea calcicola* Rye, sp. nov. (Figure 2)**

[*Pimelea graciliflora* auctt. non Hook.: Meissner in Lehm., Pl. Preiss. 1: 605 (1845).]

Pimeleae sylvestri R.Br. affinis a qua differt bracteis fructiferis non reflexis, tubo florali magis cylindraco, antheris late oblongo-ellipsoideis, carneis, connectivo dorso plano, thecis in facie adaxiali connectivi parallelis.

Typus: Cromford Way, Carine, Perth, Western Australia, 10 Oct. 1983, N. Cohen 1007 (holo: PERTH; iso: CANB, K, MEL, NSW).

Related to *Pimelea sylvestris* R.Br. but differs in the unreflexed fruiting bracts, more cylindrical floral tube, deep pink and broadly oblong-elliptic anthers and flat dorsal connective, with the anther cells lying parallel on the inside.

Shrub erect, to 1 m tall, with a single main stem, glabrous. *Stems* apically pale green (sometimes pink-tinged), soon becoming red-brown then grey. *Leaves* opposite, decussate, usually spreading; *petiole* c. 1 mm long; *lamina* pale green (when dry), narrowly elliptic to elliptic, 17-27 x 4-7 mm, flat, with a conspicuous yellowish midrib; the lateral margins slightly incurved. *Inflorescence* a head-like condensed raceme, terminal, erect, of numerous flowers. *Involucre bracts* 6 (rarely 4), leaf-like, ovate, 12-17 mm long, glabrous, not becoming reflexed in the fruit. *Flowers* bisexual, pale to deep pink, the lower part more deeply coloured; *pedicel* to c. 1 mm long, silky-hairy. *Floral tube* circumscissile; *ovary portion* 3.5-4 x c. 1.5 mm, glabrous; *style portion* cylindrical, expanding only slightly throughout its length to a maximum of c. 1.5 mm in diameter at the summit, 9-14 mm long, distinctly 8-veined, glabrous outside, silky-hairy inside in the upper half, the circumscission point distinct 1-1.5 mm above the summit of the ovary portion. *Sepals* somewhat spreading, ovate, 2.5-5 mm long, concave, glabrous, the midrib thickened and incurved at the summit. *Stamens* 2.5-4 mm long; *anther* orange inside at dehiscence, rapidly becoming deep pink throughout, broadly oblong-elliptic, c. 0.8 x 0.5 mm; connective flat, almost as broad as the anther, the cells parallel on the inner face. *Ovary* silky-hairy at the summit. *Style* 15-20 mm long.

Other specimens examined. WESTERN AUSTRALIA: South of Fremantle, Sept. 1902, C. Andrews s.n. (PERTH); Mandurah, Aug. 1961, J. Burbidge s.n. (CANB); 29.6 mi [c. 48 km] S Fremantle, 3 Oct. 1968, E. M. Canning s.n. (CBG); Yanchep National Park, 5 Oct. 1968, E. M. Canning s.n. (CBG); Mandurah, C. F. Davies 138 (PERTH); Burns Beach Rd, H. Demarz 359 (PERTH); Mandurah, Oct. 1964, C. A. Gardner s.n. (PERTH); Madora Beach settlement, B. Haberley 201 (PERTH); North Fremantle, 3 Nov. 1897, R. Helms s.n. (PERTH); Yanchep National Park,

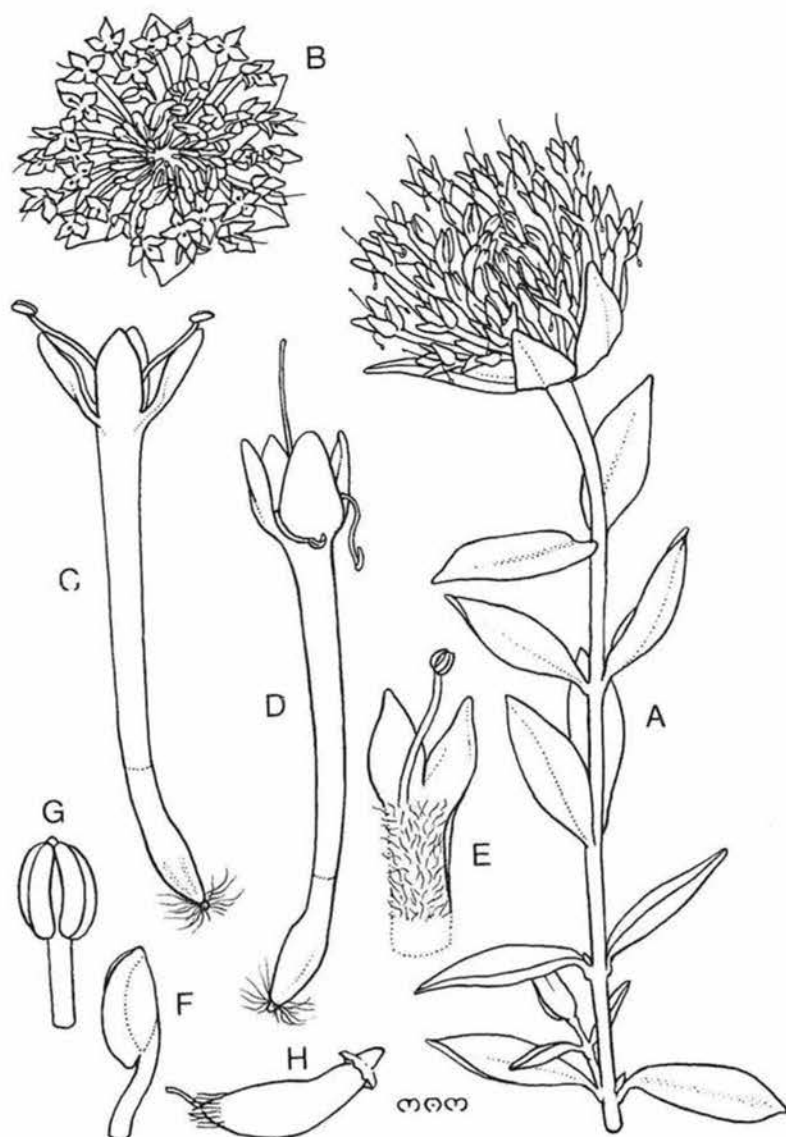


Figure 2. *Pimelea calcicola*. A—Flowering stem. B—Top view of inflorescence. C—Flower with mature anthers but immature style. D—Flower with mature style and finished anthers. E—Inside portion of upper tube. F—Side view of anther. G—Inner face of anther. H—Ovary.

Drawn from fresh material collected at the type locality.

A. M. James 49 (PERTH); 24 mi peg [38 km] on Yanchep Road, F. Lullfitz 3700 (PERTH); The Plains, near Mandurah, V. Mann & A. S. George 32 (PERTH); Near Coogee, s.d., F. Mueller s.n. (MEL); S. loc., F. Mueller 165 (MEL); S. loc., F. Mueller 1274 (MEL); Yalgorup National Park, S. Paust 1341 (PERTH); Yanchep National Park, 27 Oct. 1962, M. E. Phillips s.n. (CBG); North of Wanneroo, F. G. Smith 1584. (PERTH); Victoria Park, J. L. Steedman s.n. (NSW); 24 mi [c. 38 km] Perth to Yanchep, 5 Oct. 1968, J. W. Wrigley s.n. (CBG); S. loc., s. coll. (MEL 102496).

Distribution and habitat. Extends about 150 km from Yanchep National Park in the north to Yalgorup National Park in the south (Figure 3B), occurring close to the coast associated with limestone.

Flowering period. September–November.

Discussion. Several authors (e.g. Diels & Pritzel 1904, Beard 1970) have followed Meissner's misapplication of the name *Pimelea graciliflora* to this species. *Pimelea graciliflora* is conspecific with *P. sylvestris* R.Br., the closest relative of *P. calcicola*. As no type specimen has been located for *P. graciliflora*, the type description and illustration must be relied upon to identify the species. The taxon was reportedly grown from seed collected at King George Sound (Albany). Its flower colour and stamens were typical of *P. sylvestris* but the illustration suggests that the floral tube was more cylindrical than usual. *Pimelea sylvestris* typically has pure white flowers, although a few specimens are pale pink or pink-tinged, and its floral tube shows a more obvious expansion at the summit than in *P. calcicola*. In *P. sylvestris*, the involucre bracts become reflexed after flowering is completed and are often dark purple or black on the undersurface. The anthers are orange, more elongated (rounded oblong) than in *P. calcicola*, with the connective bent so that the cells are divergent rather than introrse. The two species are allopatric, the closest occurrences of *P. sylvestris* to *P. calcicola* being along the Darling Range in the vicinity of Perth (Figure 3B). However, *P. sylvestris* does occur on the coastal plain both north and south of *P. calcicola*'s range and occasionally occurs on limestone. Populations of *P. sylvestris* occurring on limestone in the north are much more similar to *P. calcicola* than those occurring elsewhere.

Derivation of name. *Calcis* (L)—limestone, *cola* (L)—an inhabitant, referring to habitat.

Pimelea ciliata Rye, sp. nov.

Pimelea roseae R. Br. affinis a qua bracteis involucri multiciliatis minus productis, staminibus longioribus, floribus albis vel pallide roseis, tubo florali parte ovarii plerumque pilis longis carentibus differt.

Typus: Glenburn Rd, Glen Forrest, Western Australia, 6 Oct. 1983, N. Cohen 1001 (holo: PERTH; iso: CANB, K, MEL, NSW).

Related to *Pimelea rosea* R. Br. but differs in the more ciliate and less elongated involucre bracts, longer stamens, white or pale pink flower colour and, usually, absence of long hairs on the portion of the floral tube surrounding the ovary.

Shrub erect, to 1 m high, glabrous except for the inflorescences. *Stems* apically red-brown or orange-brown, becoming dark grey with age. *Leaves* opposite, decussate, usually widely spreading; *petiole* to c. 1 mm long; *lamina* darker on the upper surface, narrowly elliptic-ovate, 7–22 × 2–7 mm, tapering to the base, the lateral margins somewhat recurved; *apex* acute or acuminate, recurved. *Inflorescence* a head-like condensed raceme with an almost flat receptacle, erect, of numerous flowers. *Involucre bracts* 4–8, usually pinkish, sessile with a broad base, ovate or broadly ovate, 9–13 mm long, with ciliate lateral margins, otherwise glabrous; *cilia* long, often fairly dense. *Flowers* bisexual, white or pale pink; *pedicel* 1–2 mm long, with erect hairs c. 3 mm long. *Floral tube* 13–15 mm long, not circumscissile, glabrous inside; *ovary portion* strongly 8-ribbed, with numerous very short spreading hairs, very rarely with a few long hairs in the upper part; *style portion* c. 1.5 mm in diameter at

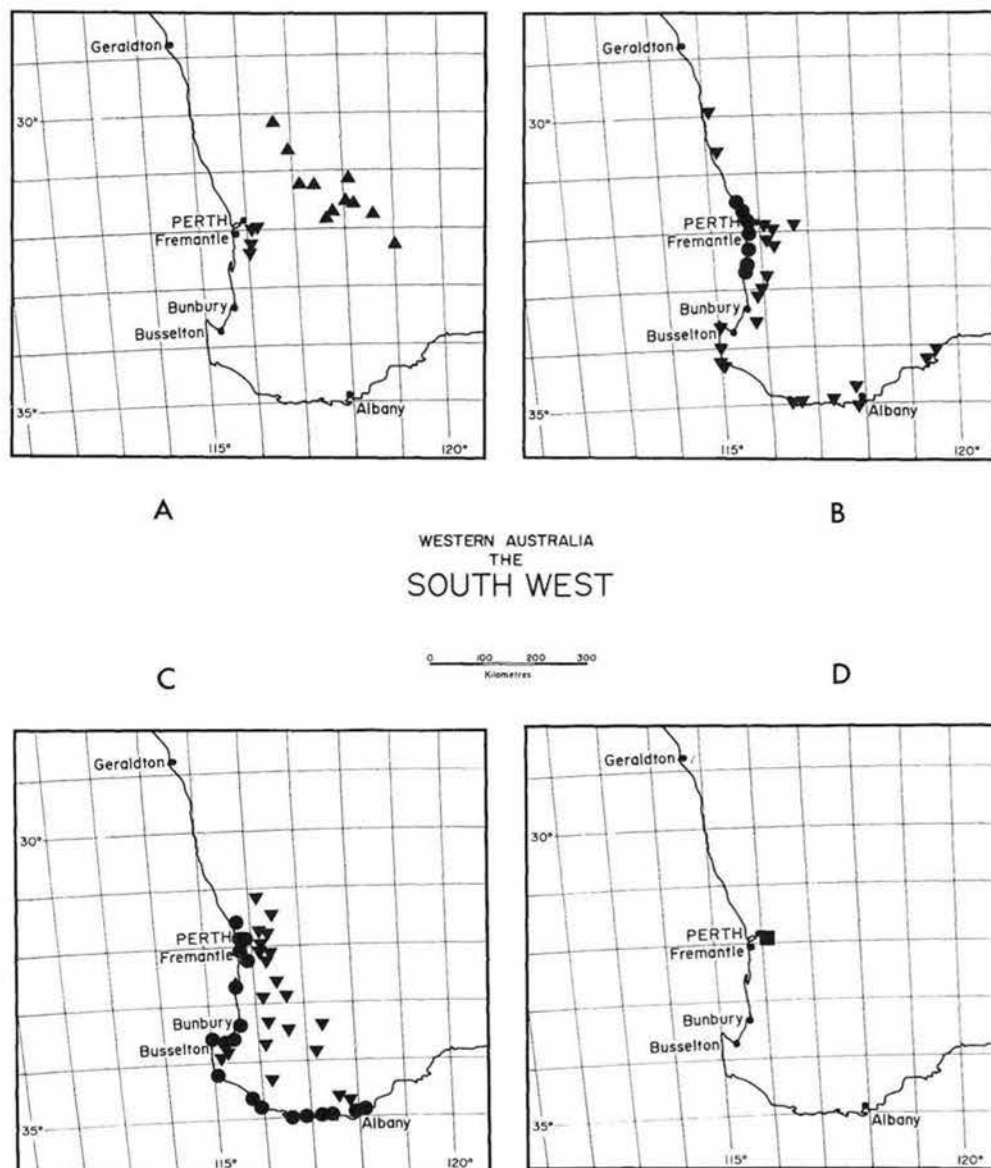


Figure 3. Distribution maps. A—*Pimelea brevistyla*, Darling Range localities ▼ and wheatbelt localities ▲. B—*P. calcicola* ● and *P. sylvestris* ▼. C—*P. ciliata* ▼ and *P. rosea* ●. D—*P. rara* ■.

the summit, 7-9 mm long; lower half of the style portion ribbed, silky-hairy with widely spreading hairs 3-4 mm long mixed with a few tiny hairs similar to those on the ovary portion; upper half of the style portion covered by very fine appressed hairs mostly c. 1 mm long. *Sepals* widely spreading, ovate or narrowly ovate, 3-5.5 mm long, obtuse, the outside with similar hairs to those on the upper part of the floral tube mixed with large erect hairs, glabrous inside. *Stamens* 3.25-5.5 mm long; *anther* 0.75-1.5 x c. 0.3 mm; cells divergent when dehiscent. *Ovary* glabrous. *Style* 11-15 mm long.

Selected specimens examined. WESTERN AUSTRALIA: Manjimup, *H. J. Anderson* 28 (PERTH); Armadale, Sept. 1901, *C. Andrews* s.n. (PERTH); West of Wagin, *J. S. Beard* 2107 (PERTH); 42 mi [c. 68 km] Perth to Toodyay, *E. M. Canning* 2808 (CBG); 71 mi [c. 114 km] Perth to Williams, 30 Sept. 1968, *E. M. Canning* s.n. (AD, CBG); Pickering Brook, 13 Nov. 1928, *E. Dell* s.n. (PERTH); Helena Valley, *H. Demarz* 1724 (CANB); Bickley Reservoir, *H. Demarz* 6199 (PERTH); Wagin, *T. E. George* 191 (MEL); Mount Barker, *T. E. George* 561 (MEL); Wooroloo, *M. Koch* 1424 (MEL); Manjimup, *M. Koch* 2455 (MEL); Lowden, Oct. 1909, *M. Koch* s.n. (AD); York, 1880, *McHard* s.n. (MEL); Kelmscott, 11 Sept. 1897, *A. Morrison* s.n. (BRI, CANB); Darlington, 6 Oct. 1910, *A. Morrison* s.n. (BRI); 2 mi [c. 3 km] E Kojonup, *K. Newbey* 1303 (PERTH); 54 mi [c. 87 km] Perth to Williams, 16 Oct. 1962, *M. E. Phillips* s.n. (CBG); 5 mi [c. 8 km] W Darkin, *M. E. Phillips* 4005 (AD, CBG); Near Bramley, *R. Pullen* 9870 (CANB); Near Lesmurdie, *J. Pulley* 1346 (CBG); Jindong, *R. D. Royce* 2484 (PERTH); Bindoon to Moora, Aug. 1964, *E. J. Salisbury & C. A. Gardner* s.n. (PERTH); Mundaring Weir, 1936, *J. Scott* s.n. (NSW); Rocky Pool, Sept. 1929, *A. Steffanoni* s.n. (ADW); Stirling Range, *F. W. Went* 154 (PERTH); Cowaramup to Margaret River, *D. J. E. Whibley* 5044 (AD, PERTH); Manjimup to Nannup, *D. J. E. Whibley* 3242 (AD, NT); Near Porongurup Range, *P. G. Wilson* 3369 (AD, CBG, PERTH); Collie River, *P. G. Wilson* 3761 (PERTH);

Distribution and habitat. Extends from north of Bindoon (north of Perth) to the extreme south-west of the State and to the Porongurup Range near Albany (Figure 3C). Recorded from heavy soils in lateritic or granitic areas, usually on hills.

Flowering period. August-November.

Discussion. Bentham (1873) and later authors have apparently regarded *Pimelea ciliata* as a white-flowered variant of *P. rosea* R. Br. Photographs of both species, regarded as two variants of *P. rosea*, are given in Erickson et al. (1979: 27, 48). In the Perth Region the two species are quite distinct in their morphology and habitat. Apart from the differences noted in the diagnosis, *Pimelea rosea* has short sepals (2.5-3.5 mm) and occurs along the coast, whereas *P. ciliata* has sepals 4-5.5 mm long and occurs on or near the Darling Scarp and Range. *P. ciliata* usually has white flowers, the few pink-flowered specimens being a much paler pink than in *P. rosea*. However, *P. ciliata* becomes progressively more like *P. rosea* in some of these characters towards the south of its range, where it frequently has pale pink flowers, shorter sepals (3-4 mm) and stamens only just exceeding the sepals. In *P. rosea* the stamens are normally shorter than the sepals, although a few specimens on the south coast, especially near Albany, have stamens slightly exceeding the sepals. Throughout its range, *P. rosea* tends to have softer leaves than *P. ciliata*.

In the extreme south-west corner of Western Australia, *Pimelea ciliata* and *P. rosea* are readily confused. They occur close together and may be sympatric (Figure 3C), although on the whole they appear to be separated by the same habitat difference as in the Perth Region. The south-western specimens of *P. ciliata* can be distinguished by their longer floral tubes, almost invariable lack of long hairs on the ovary portion of the floral tube, slightly longer stamens, which just exceed the sepals, more ciliate bracts and paler flower colour, although a few *P. rosea* specimens in this area are also rather pale. *Pimelea ciliata* can also be confused in the extreme south-west with *P. hispida* R.Br., which differs in having rather dense hairs on the inside of the involucre bracts. Possibly, the three species occasionally hybridize because a few specimens of each possess a character more typical of one of the other species.

Derivation of name. *Cilium* (L), referring to the cilia on the involucre bracts.

Pimelea rara Rye, nom. et stat. nov. (Figure 4)

Pimelea lehmanniana Meissner var. *ligustrinoides* Benth. Fl. Austral. 6: 9 (1873).
Type: Swan River (Western Australia), Drummond, 1st collection (lecto: K; iso: K, NY).

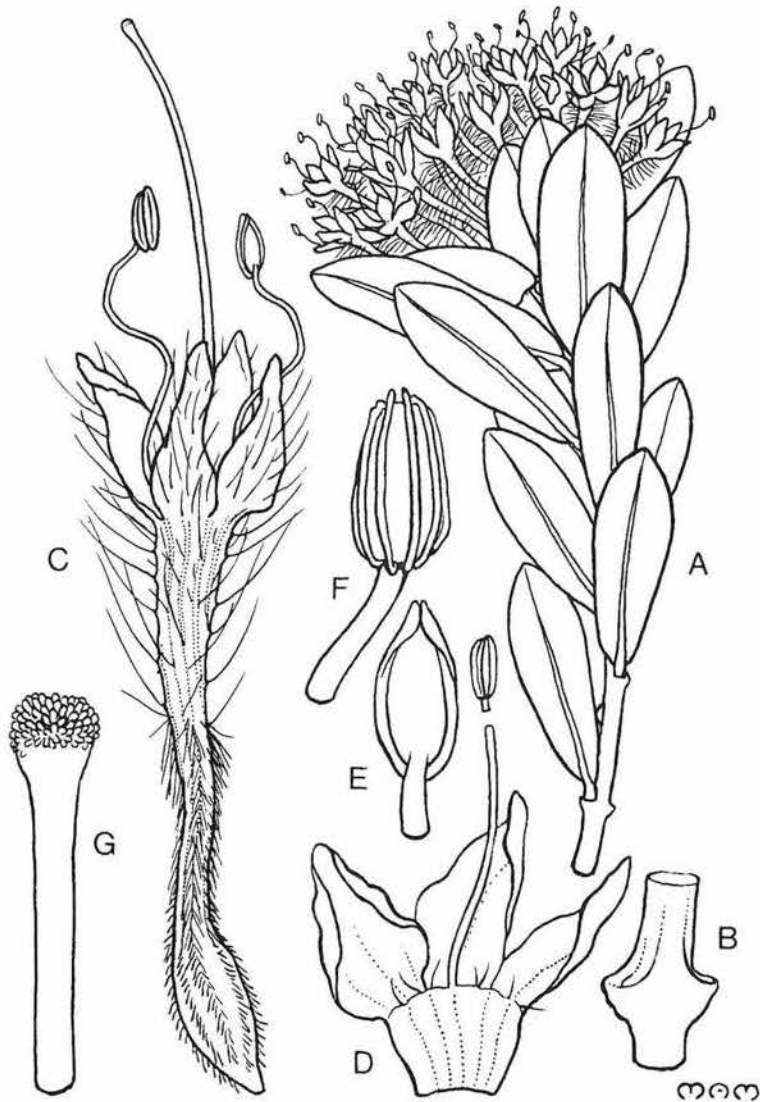


Figure 4. *Pimelea rara*. A—Flowering stem. B—Portion of stem showing leaf bases. C—Flower. D—Portion of flower showing hairs at the throat. E—Outer face of anther. F—Inner face of anther. G—Upper style. Drawn from W.A. Ross 435 and the lectotype.

Shrub, erect, to at least 0.35 m tall, glabrous except for the inflorescences. *Stems* dark brown to black, apically with a reddish tinge. *Leaves* opposite, decussate; *petiole* c. 1 mm long; *lamina* dull bluish green (when dry), elliptic or obovate, c. 30 x 8 mm, flat, with prominent yellowish lateral margins and midrib. *Inflorescence* a head-like condensed raceme, terminal, erect, of numerous flowers. *Involucral bracts* 4 or 6, leaf-like, broadly ovate, 13-16 x c. 10 mm; *outer bracts* glabrous; *inner bract pair* sparsely silky-hairy inside, the margin ciliate except near the apex. *Flowers* bisexual; *pedicel* c. 0.6 mm long, silky-hairy. *Floral tube* probably not circumscissile, c. 11 mm long, entirely glabrous inside or with a circle of hairs c. 0.5 mm long at the throat; *ovary portion* ellipsoid, c. 3 mm long, 8-ribbed, covered by reflexed appressed hairs c. 0.5 mm long; *style portion* expanding to c. 1 mm in diameter at the summit, c. 8 mm long, prominently 8-ribbed, with long spreading hairs 2.5-3 mm long above a basal belt with short hairs similar to those on the ovary portion. *Sepals* spreading, ovate, c. 3 mm long, the outside sparsely covered by rather short silky hairs, glabrous inside. *Stamens* c. 5 mm long; *anther* c. 1.5 x 0.5 mm, broadest near the base; cells divergent when dehiscent. *Ovary* glabrous. *Style* c. 13.5 mm long.

Other specimens examined. WESTERN AUSTRALIA: Between Parkerville and Smith's Mill [Glen Forrest], Jan. 1904, *W. V. Fitzgerald* s.n. (NSW); Parkerville, *W. A. Ross* 435, (PERTH).

Distribution and habitat. Only known from near Parkerville in the Darling Range east of Perth (Figure 3D).

Flowering period. December-January.

Conservation status. The species appears to be either very rare and geographically restricted or extinct. However, its exact status cannot be determined because no recent attempt has been made to collect or survey it. There are only three known collections, two from the vicinity of Parkerville and one of unknown origin, the most recent collection having been made in 1919.

Discussion. The summer flowering time of *Pimelea rara* is unusual as the predominant flowering period for the genus in south-western Australia is July-November. In floral morphology, *P. rara* is closest to *P. lehmanniana*, but there are many differences in the distribution, orientation and size of the hairs on the floral tube. For example, the basal hairs in *P. lehmanniana* (if present) are much thicker and are spreading rather than reflexed.

The leaves of *Pimelea rara* are similar in gross morphology to an eastern Australian species, *P. macrostegia* (Benth.) J. M. Black. The latter was once considered to be just a variant of *P. ligustrina* Labill., hence Bentham's choice of the epithet *ligustrinoides* for *P. rara*. However, *P. ligustrina* is quite different in both floral and leaf morphology from *P. rara*. As Bentham's epithet is inappropriate for the new species, I have chosen a new epithet rather than making a new combination.

Acknowledgements

I thank Professor K. H. Rechinger and Mr P. G. Wilson for providing the Latin diagnoses, Ms M. A. Menadue for the illustrations and my colleagues at the Western Australian Herbarium for general advice. I am also grateful to the Directors of the following herbaria for the loan of specimens: AD, ADW, BRI, CANB, CBG, K, MEL, NSW and NT.

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Taxonomic clarification of the *Lomandra odora* group (Xanthorrhoeaceae or Dasypogonaceae)

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Abstract

Macfarlane, T. D. Taxonomic clarification of the *Lomandra odora* group (Xanthorrhoeaceae or Dasypogonaceae). Nuytsia 5(1): 13-24 (1984). Three species are recognised in the *Lomandra odora* group, two of them new: *L. odora* (Endl.) Ewart, *L. nigricans* T. D. Macfarlane and *L. integra* T. D. Macfarlane. The name *L. endlicheri* (F. Muell.) Ewart is illegitimate; it has often been applied to each of the three species recognised here. Descriptions, photographs of specimens, distribution maps and a key to the three species are provided.

Introduction

This study arose from the preparation of the account of *Lomandra* for the "Flora of the Perth Region". An illegitimate name, *L. endlicheri* (F. Muell.) Ewart has long been in use, but simple substitution of a legitimate name is an insufficient remedy in view of the observed taxonomic heterogeneity. The group of closely related species dealt with here is restricted to south-western Australia and is referred to as the *L. odora* group.

Taxonomic studies of the *L. odora* group commenced when Endlicher (1846) assigned one specimen collected by Ludwig Preiss to *Xerotes tenuifolia* R. Br. and another Preiss specimen to the new species *X. odora*. Mueller (1874) recognised that the Preiss specimen identified by Endlicher as *X. tenuifolia* did not in fact belong to that species. Mueller further considered the Preiss specimens cited by Endlicher under these two names and some later collections to represent a single species, to which he gave the name *X. endlicheri* F. Muell., an illegitimate name because *X. odora* was cited as a synonym. Mueller thought that *X. rupestris* Endl. might possibly be a variety of *X. endlicheri*, but it has been excluded from the present study on the basis of a statement by Choo (1969) who, having examined the type, considered it a synonym of *L. collina* (R. Br.) Ewart (= *L. glauca* (R. Br.) Ewart subsp. *collina* (R. Br.) A. T. Lee).

Bentham (1878) recognised Endlicher's two taxa, *X. odora* (under which he cited the type and a specimen from Drummond's first collection not seen by me) and *X. endlicheri* (where the specimen identified by Endlicher as *X. tenuifolia* was cited along with several other specimens, most of them seen by me). The epithets of *X. odora* and *X. endlicheri* were also used (in the genus *Lomandra*) in the censuses and catalogues of Gardner (1930), Beard (1970) and Green (1981). Bentham, misled by the immature state of the type specimen of *L. odora*, described the species as having sessile male flowers, as did Blackall and Grieve (1954). Consequently specimens of the *L. odora* group, which have distinctly pedicellate male flowers when mature, have

usually been identified as *L. endlicheri* (described by Bentham as having pedicellate flowers). Choo (1969) recognised one species in the *L. odora* group as treated here, and applied to it the legitimate name *L. odora* with *L. endlicheri* consigned to its synonymy.

This study of the *L. odora* group has led to the conclusion that there exist three species, each represented among the specimens assigned to one species by Mueller (1874) and Choo (1969) while at least two of the species are represented among the specimens assigned by Bentham (1878) to *X. endlicheri*. The three species are *L. odora* (Endl.) Ewart, *L. nigricans* sp. nov. equivalent to Endlicher's '*X. tenuifolia* R. Br.', and *L. integra* sp. nov., a hitherto unrecognised species. They share the following unique combination of features: flowers white or greenish yellow and usually marked with purple or green toward the tip of at least the outer perianth segments, flowers strongly and pleasantly scented, arranged in verticillate clusters on a simple or branched inflorescence, pedicellate in the male and sessile in the female, leaves glabrous, capsules (where known) smooth, and a chromosome number of $2n = 16$. There are three other species which share several of these features and in particular a similar inflorescence structure, but which lack perianth markings and strong flower scent and differ further in the features detailed below. *Lomandra multiflora* (R. Br.) J. Britten has 8-10 mm long pedicels compared with 2-7.5 mm pedicels in the *L. odora* group, the base of the flowers form a distinctive collar around the top of the narrower pedicel compared with the smooth transition of pedicel to flower in the *L. odora* group, and the arrangement of flower-subtending bracts is different in *L. multiflora* compared with the *L. odora* group (Stevens 1978). *Lomandra patens* Lee, much more robust than the *L. odora* group, has a male panicle which usually has more branch-bearing nodes with branches often secondarily branched (never seen in the *L. odora* group), male pedicels 0.3-1 mm long and a consistently paniculate female inflorescence (female inflorescences are never paniculate in *L. odora* and only sometimes so in *L. nigricans* and *L. integra*). Plants of *L. ordii* F. Muell. are very much larger than any in the *L. odora* group, with wider leaves (10-20 mm wide), they possess a very large peduncle 60-100 cm long and 4-10 mm diameter, the stamens of the inner whorl are inserted higher on the perianth than those of the outer whorl, and female flowers are shortly pedicellate. The species of the *L. odora* group differ from each other in features of the leaf bases, leaf dimensions, inflorescence dimensions, flower colour, flowering time and to some extent in soil preferences. All occur near Perth and extend varying distances southward, one species growing along the south coast as far east as Israelite Bay (Figure 5).

Herbarium specimens from herb. PERTH, MEL and UWA were employed in this study, including the relevant types and the majority of the specimens used by Mueller, Bentham and Choo. All three species were seen in the field. Detailed examination including measurements were made on at least 15 specimens of each species except that flower measurements are based on four specimens per species, these being sufficient to show lack of discriminatory value in flower dimensions. Chromosome numbers are based on unpublished information from G. J. Keighery. Voucher specimens for the chromosome counts, marked in the specimen citation lists by an asterisk (*), are lodged at PERTH.

Key to the species of the *Lomandra odora* group

1. Leaf bases shredding into fine fibres at least with age
2. Leaf bases remaining white or pale (becoming grey in old leaves but not blackening), inflorescence less than half as long as leaves (of ungrazed and unburnt plants), usually 1/4-1/3 as long as

- leaves; longest internode between flower clusters or branches of male inflorescences usually less than 1 cm long (range 0.4-1.8 cm); female inflorescence with 1-4 flower-bearing nodes; flowers greenish yellow to cream, sometimes with purple markings1. *L. odora*
2. Leaf bases blackening or turning dark brown except for a white zone occupying about 1-2 cm at bottom and sometimes the uppermost 1 cm of leaf base; inflorescence from about half to as long as leaves (of ungrazed and unburnt plants), longest internode between flower clusters or branches of male inflorescences usually more than 2 cm long (range 0.9-7 cm); female inflorescence with 4-12 flower-bearing nodes; flowers white with purple markings2. *L. nigricans*
1. Leaf bases membranous, intact or with very few longitudinal splits3. *L. integra*

1. ***Lomandra odora*** (Endl.) Ewart, Proc. Roy. Soc. Vict. 28: 219 (1916). (Figure 1)

Xerotes odora Endl. in Lehm., Pl. Preiss. 2: 50 (1846). Type: In turfoso-arenosis umbrosissimis inter gramina alta supra urbeculam Perth, Preiss 1529, 1 Sept. 1839 (iso: MEL 21078).

Xerotes endlicheri F. Muell., Fragm. 8: 205-206 (1874) nom. illeg., pro parte, as to the name *X. odora* Endl. cited in synonymy.

Plants consisting of 1-several tufts arising from a compact segmented horizontal rhizome, new tufts arising near the leaf bases by short (6-15 mm) horizontal extensions of rhizome, roots arising from rhizome at base of each tuft, new leaves often growing out from among previous season's leaves so that old leaf bases surround the tuft. Leaves fine, crowded on a short erect concealed stem, 10-54 cm long and 0.5-1.2 mm wide, all of similar length and width on each plant, semi-terete or plano-convex, occasionally very shallowly channelled on top, not ribbed, glabrous; leaf bases with margins at first membranous or scarious but at length breaking up into fine fibres which remain whitish; leaf apex obtuse. Male inflorescence a raceme or panicle of verticillate clusters of flowers, branches when present occurring only at lowest 1-2 nodes and accompanied by pedicellate flowers attached to same node, the branches inconspicuous, the longest usually 1 cm long, occasionally up to 2.5 cm, the inflorescence of fully grown plants (i.e. excluding plants regenerating after fire or grazing) less than half as long as leaves, usually 1/4-1/3 as long, the flower and branch clusters mostly closely spaced giving the whole inflorescence a compact cylindrical shape, sometimes the nodes more widely spaced, longest internode 0.4-1.8 cm long, usually 1 cm or less; cluster bracts conspicuous, rather herbaceous in texture, with broad base and long attenuated upper half, greenish, a little shorter to a little longer than pedicels of mature flowers. Female inflorescence a compact spike of 1-several verticillate clusters of flowers, of similar length to male inflorescence. Flowers scented, greenish-yellow to cream, sometimes with purple markings toward tip of outer perianth segments. Male flowers on spreading or erect 2-5 mm long pedicels, perianth spreading at anthesis and usually remaining open afterwards, 2.8-3.2 mm long, segments free or joined at base, the outer 3 segments markedly shorter or about equal to inner 3, slightly narrower and thinner, all segments thin and flexible in texture (not thick, fleshy and inflexible); stamens about equal in length, filaments shortly adnate to perianth, those opposite inner segments inserted slightly higher than other 3.

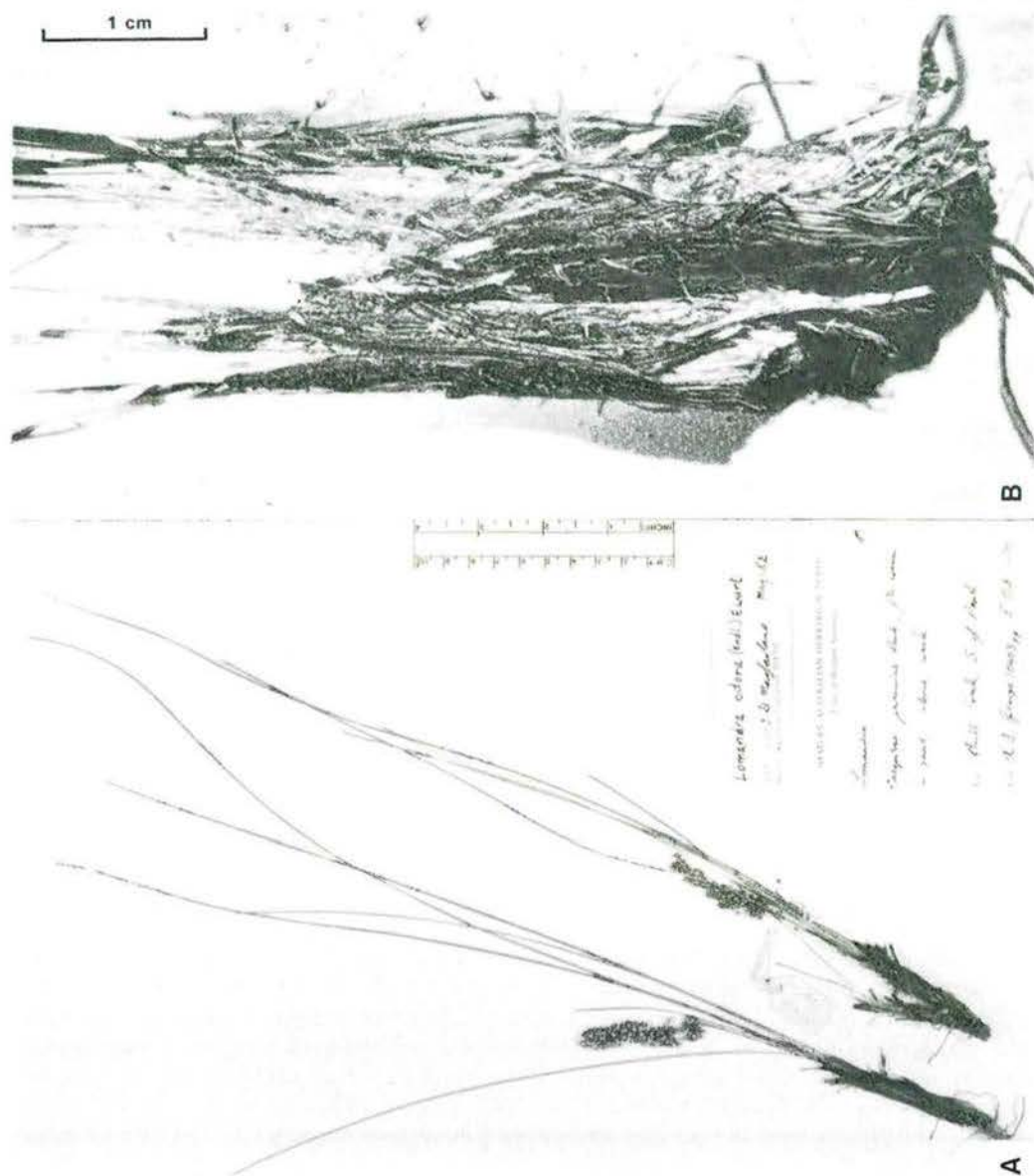


Figure 1. *Lomandra odora*. A—Whole plant. B— Leaf bases.

A from A. S. George 10403 (male); B from R. Coveny 8203.

Female flowers sessile; staminodes very small, inserted like stamens of male flowers; stigmas borne on a short but distinct style. Only young capsules seen, approximately spherical, green with pale vertical stripes along middle of valves. Chromosome number $2n = 16$.

Additional specimens examined. WESTERN AUSTRALIA: Guildford, 31 July 1896, H. W. Alcock (PERTH); Canning Plain, Perth, Aug. 1902, C. Andrews (PERTH); Guildford, Aug. 1902, C. Andrews (PERTH); Gooseberry Hill, F. M. Bennett (UWA)

3197); Canning Vale near Perth, 25 Sep. 1982, A. Brown (PERTH); Kewdale, R. Coveny 8203 (PERTH, NSW n.v.); Red Hill Road, Upper Swan, 30 Aug. 1978, R. J. Cranfield (PERTH); Palm Terrace, Forrestfield, 5 Oct. 1978, R. J. Cranfield (PERTH); Greenbushes, Aug. 1901, Diels (PERTH); Without precise locality, Drummond 816 (MEL 20535); Canning Plains, 28 Aug. 1902, W. V. Fitzgerald (PERTH); Gnangara, C. A. Gardner 7685 (PERTH); Bull Creek, S of Perth, A. S. George 10403 (PERTH, NSW, CANB); 11 mi [17.7 km] S of Mandurah, G. J. Keighery 168 (PERTH*); Wooroloo, M. Koch (MEL 20524); Mundaring, Aug. 1901, Lambert (PERTH); Bayswater, A. Morrison 16177 (MEL); W. Australia, Oldfield (MEL 20515); Benger, R. D. Royce 4833 (PERTH); Mandurah, R. D. Royce 5737 (PERTH); Elgin, R. D. Royce 5746 (PERTH); Cannington, Sep. 1916, F.W. Wakefield (PERTH).

Flowering period. Late August to early October.

Habitat. Grows in sandy soil in woodland of *Banksia* or Tuart (*Eucalyptus gomphocephala*) or at edges of swamps on the Coastal Plain, and found occasionally on the Darling Range where the habitat has not been recorded.

Distribution. (Figure 4) Western Australia, Perth south to Greenbushes (70 km SE of Busselton).

Notes. There is an additional specimen (MEL 20516) of *L. odora* (with a fragment of *L. caespitosa* (Benth.) Ewart) which is not accounted for in the above distribution summary and specimen list. It bears two labels, (1) W. Australia, Oldf. [Oldfield] and (2) Port Gregory, W. Australia, Oldf. For both *L. odora* and *L. caespitosa* Port Gregory, near Geraldton, would be a considerable northward range extension on the evidence of all other specimens. Unfortunately Oldfield's precise itineraries are unknown although he is known to have collected in the Geraldton area and further south. In view of the mixed taxa, the presence of two labels and the anomalous geographical location, I have decided to treat this Oldfield specimen as a doubtful record pending further collections of either *L. odora* or *L. caespitosa* from the Geraldton area.

2. *Lomandra nigricans* T. D. Macfarlane, sp. nov. (Figure 2)

Xerotes endlicheri F. Muell., Fragm. 8: 205-206 (1874), nom. illeg. pro parte, as to "Hay-River (Warburton)".

[*Xerotes tenuifolia* auct. non R. Br.: Endl. in Lehm., Pl. Preiss. 2: 49 (1846).]

Caespites rhizomate compacto segmentato exorientes; radices prope bases foliorum exorientes. Bases foliorum laceratae, nigrescentes praeter infimus 1-2 cm. Folia 23-68 cm longa, semper angusta. Inflorescentia mascula in paniculam vel racemum disposita, foliis aequantia vel dimidio breviora; fasciculi florum inferi plerumque distantes (internodio longissimo plerumque 2-7 cm longo), floribus verticillatis. Flores albi maculis purpureis ornati, odorati, pedicellati.

Typus: 11 mi NW of Northcliffe, A. S. George 2633 (holo: PERTH (male and female together)).

ribbed, glabrous; leaf bases with margins membranous and white when young but soon shredding finely and turning dark brown, purple-black or black, the lowest 1-2 cm and sometimes the uppermost 1 cm remaining white; leaf apex obtuse. Male inflorescence a panicle or raceme of verticillate clusters of flowers, branches often at the lower 1-several nodes and usually accompanied by pedicellate flowers attached to same node, the longest branch measuring 1-9 cm (often more than 3 cm) long, the inflorescence about half to as long as the leaves, the flower and branch clusters (at least the lower few) usually well spaced, longest internode 0.9-7 cm long, usually more than 2 cm. Cluster bracts (except at lowest 1-2 nodes) thin in texture and inconspicuous, broad-based with short obtuse or erose apex, purplish, shorter than the pedicels of mature flowers. Female inflorescence a spike or paniculate spike of verticillate clusters of flowers, of similar length to male inflorescence. Flowers scented, white with purple markings on upper part of perianth segments, especially the outer 3. Male flowers on pedicels 2-7.5 mm long, perianth spreading at anthesis, otherwise more or less campanulate and often appearing rather pendulous after anthesis, 2.6-4.2 mm long, segments free or joined at the base, outer 3 segments slightly shorter (occasionally as long), narrower and thinner, all segments thin and flexible in texture (i.e. not thick, fleshy and inflexible); stamens about equal in length, filaments shortly adnate to perianth, those opposite inner segments inserted slightly higher than other 3. Female flowers sessile; staminodes very small, inserted like stamens of male flowers; stigmas borne on a short but distinct style. Capsules green or purplish green with pale vertical stripes along septa and in middle of valves, ovoid to depressed spherical, up to 8 mm long, not wrinkled. Chromosome number $2n=16$.

Selected specimens examined. WESTERN AUSTRALIA: Muresk, *E. T. Bailey* 191 (PERTH); Jandakot, Aug. 1939, *W. E. Blackall* (PERTH); Stirling Range, below Bluff Knoll, *J. Chessell & A. McComb*, McC. 90 (UWA); Station Gully near the creek, on road to Yallingup, *Choo Ten Soo* 6655 (UWA); Jarrah Road, South Perth, *R. J. Cranfield* R62, R231 (PERTH); Canning Mills Road, Roleystone, *R. J. Cranfield* 295 (MEL, PERTH); Without precise locality, *Drummond* 815 (MEL 20532); Gingin, Sep. 1920, *C. A. Gardner* (PERTH); 26 mi [41.8 km] E of Jerramungup, *A. S. George* 4401 (PERTH); Near edge of Lough McNess, Yanchep National Park, *A. M. James* 312 (PERTH); East Mount Barren, July 1924, *A. Johnson* (PERTH); 20 km E of West Mount Barren, *G. J. Keighery* 158 (PERTH*); 7 km S of Collie on Mumballup Road, *G. J. Keighery* 197 (PERTH*); Lucky Bay, *G. J. Keighery* 216 (PERTH*); 30 km E of Israelite Bay on edge of scarp, *G. J. Keighery* 221 (PERTH*); 30 km W of Israelite Bay on edge of Wylie Scarp, *G. J. Keighery* 617 (PERTH*); Ruabon, *G. J. Keighery* 2361 (PERTH); 4.2 km along Hassell Highway from Albany-Borden Road, c. 16 km by road NE of Albany, *T. D. Macfarlane* 1166 (AD, BRI, CANB, NSW, PERTH); 3 mi [4.8 km] S of Mt Barker on Albany road, *R. Melville & R. D. Royce* sub Melville 4381 (K n.v., MEL); Subiaco, *A. Morrison* 10238 (MEL); About 7 mi [11.3 km] N of Albany, *K. Newbey* 2811 (PERTH); W. Australia, *Oldfield* (MEL 20527, 20528); Peaceful Bay, *S. Paust* 383 (PERTH); In arenosis circa urbeculam Perth, 15 Maji 1839, *Preiss* 1530 (MEL 20523, 20498); Cape Naturaliste, 11 June 1980, *M. H. Robinson* (PERTH); Darlington, *R. D. Royce* 3058 (PERTH); Upper Hay River, *M. Warburton* (MEL 20507, 20549); Bremer River, *Webb* (MEL 20506, 20514); Near Yarloop, *F. W. Went* 239 (PERTH); Walpole, *J. H. Willis* (MEL 20554).

Flowering period. Late May to August.

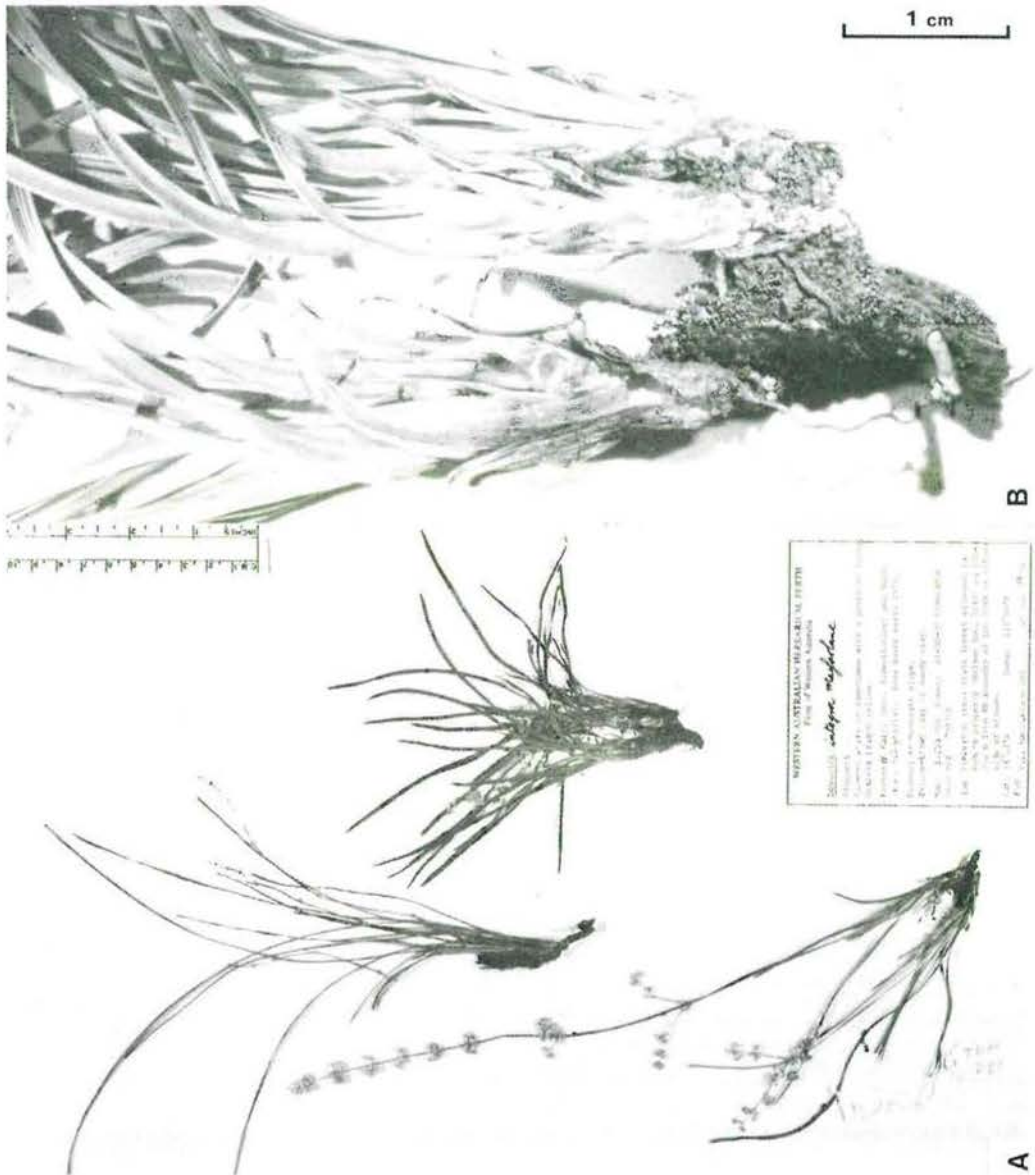


Figure 3. *Lomandra integra*. A—Whole plant. B—Leaf bases.

Both from T. D. Macfarlane 281.

Habitat. Grows on grey or yellow sand in Jarrah (*Eucalyptus marginata*) and *Banksia* woodland on the Swan Coastal Plain, on lateritic soil in Jarrah forest on the Darling Range, and in moist black sand in swampy areas and in lateritic or sandy soils covered by shrubland along the south coast.

Distribution. (Figure 5) Western Australia, Gingin (70 km N of Perth) SE to Israelite Bay (185 km E of Esperance).

Notes. This species is sometimes to be found growing sympatrically with *L. odora* on the Swan Coastal Plain near Perth but flowers earlier.

The specific epithet *nigricans* refers to the blackening of the leaf bases.

3. *Lomandra integra* T. D. Macfarlane, sp. nov. (Figure 3)

Xerotes endlicheri F. Muell., Fragm. 8: 205-206 (1874), nom. illeg., pro parte, as to "Lake Muir (Muir), Blackwood-River (McHard)."

Caespites rhizomati elongato insidens, radicibus rhizomate basibus foliorum remotis exorientibus. Bases foliorum intactae vel parum fissae, scariosae, albae, flavidae vel pallido brunneae. Folia 7-58 cm longa, interdum brevia lataque, interdum longa angustaque. Inflorescentia mascula in paniculam vel racemum disposita, foliis brevioribus vel longioribus sed plerumque quam dimidio folia multo longiora; fasciculi florum inferi distantes (internodio longissimo plerumque 2-8 cm longo); floribus verticillatis. Flores albi, saepe maculis purpureis ornati, odorati, pedicellati.

Typus: About 5 km N along South Western Highway from Palgarup, 34°09'S, 116°12'E, T. D. Macfarlane 963 (holo: PERTH (male and female together); iso: CANB (male), NSW (male)).

Plants consisting of 1-several tufts arising from an elongated straight or somewhat knarled ascending rhizome which extends deep into soil below leaf bases, roots mostly arising from lower parts of rhizome distant from leaf bases, new leaves arising in new tufts from upper parts of rhizome and not surrounded by bases of old leaves. Leaves rather coarse, crowded on a short erect concealed stem, 7-58 cm long and 0.7-3 mm wide, some plants with all leaves short (7-c.15 cm) and broad or rarely narrow, some plants with all leaves long (more than 25 cm) and narrow, other plants with both short-broad and long-narrow leaves, shorter leaves usually flat, longer leaves flat, concave-convex or shallowly channelled on top and convex beneath, often strongly ridged especially when flat, glabrous; leaf base with membranous or scarios margins that remain intact or occasionally exhibit 1 or a few longitudinal splits but not shredding, remaining white or at most turning yellowish or pale brown; leaf apex obtuse. Male inflorescence a panicle or raceme of verticillate clusters of flowers, branches usually present at lower 1-several nodes and usually accompanied by pedicellate flowers attached to the same node, the longest branch measuring 0.5-12 cm (often more than 3 cm) long, the inflorescence shorter or longer than leaves but almost always more than half as long, the flower or branch clusters usually well spaced, longest internode 1-8 cm long, usually more than 2 cm; cluster bracts (except at lowest 1-2 nodes) thin in texture and inconspicuous, deltate or broadly triangular with an acute apex, green in the centre with whitish margins, shorter than to as long as pedicels of mature flowers. Female inflorescence a spike of verticillate clusters of flowers or a paniculate spike with one or more branches occurring at lower nodes, similar in length to male inflorescence. Flowers scented, white often with purple markings on upper part of perianth segments, especially the outer 3. Male flowers on pedicels 2-4 mm long, perianth spreading at anthesis, 2.7-3 mm long, all segments free or joined at base, outer 3 segments slightly shorter, narrower and thinner, all segments thin and flexible in texture (i.e. not thick, fleshy and inflexible); stamens about equal in length, filaments adnate to perianth for a small part of their length,

those opposite inner segments inserted slightly higher than other 3. Female flowers sessile; staminodes very small, inserted like stamens of male flowers; stigmas borne on a short but distinct style. Capsules not seen. Chromosome number $2n=16$.

Additional specimens examined. WESTERN AUSTRALIA: Pemberton, 21 Oct. 1968, A. M. Ashby (PERTH); Augusta, A.M.B. [Baird], (UWA 3186); Port Augusta near Geographe Bay, 1881, Miss Bunbury (MEL 20511); Augusta, on road to lighthouse, Choo Ten Soo 6657, (UWA); Blackwood River, McHard (MEL 20508, 20509, 20510); Carey Block, Sandy Hill Rd Area [c. 21 km W of Pemberton], 17 Sep. 1962, A. J. Hart (PERTH); Blackwood River, Hester (MEL 20512); Dwellingup, G. Hos 16A/2 (PERTH); Bow River, Nov. 1912, S. W. Jackson (PERTH); Jarrahdale, G. J. Keighery 26 (PERTH*); Pemberton area, $34^{\circ}23'S$, $115^{\circ}59'E$, T. D. Macfarlane 281 (PERTH, NSW); Type locality, burnt area, T. D. Macfarlane 964 (PERTH); Lake Muir, Muir (MEL 20522); Mouth of Ellen Brook on Caves Rd W of Gracetown, S. Paust 157 (PERTH); Karri Dale, W.R. (= and Warren River? Collected by Walcott? See Mueller, 1874 p. 205) (MEL 20536); Manjimup, R. D. Royce 2733 (PERTH); West bank of Walpole River on South Western Highway, E. M. Scrymgeour 1194 (PERTH); Mt William near Wagerup, P. Vandermoezel 19 (PERTH); Mornington Mills, R.F.W. [Williams] 47, 79 (UWA); Karri Dale, Walcott (MEL 20525, 20529); Mt Lindsay [Lindesay], Webb (MEL 20502); Canning Dam, F. W. Went 25 (PERTH); Parryville, 12 mi [19.3 km] W of Denmark, J. H. Willis (MEL 20552).

Flowering period. August to November.

Habitat. Occurs on lateritic soils in Jarrah (*Eucalyptus marginata*) forest and on sandy clay soils in Karri (*E. diversicolor*) forest.

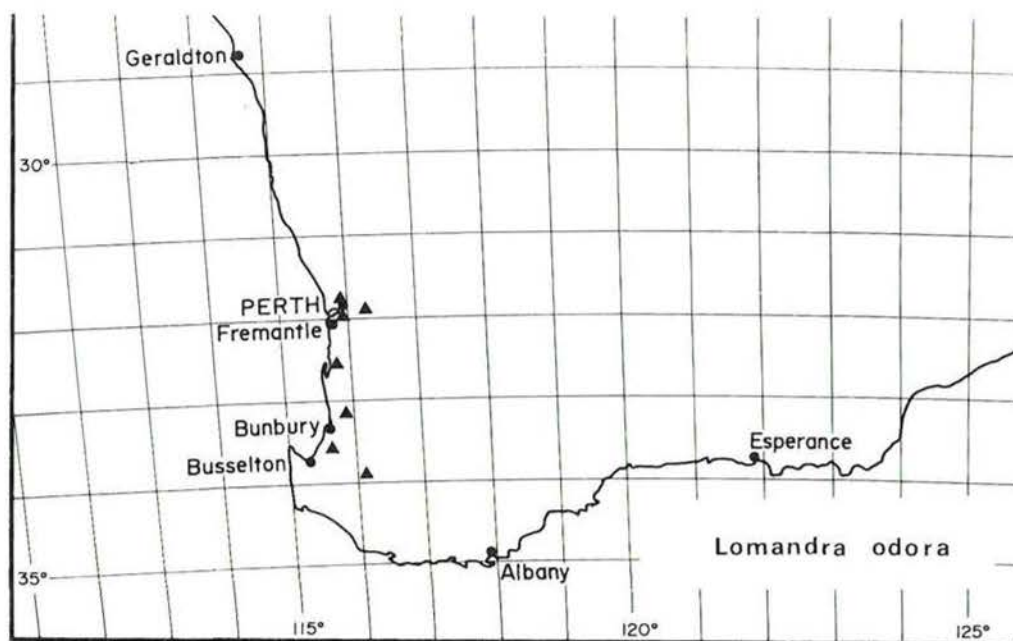


Figure 4. Distribution of *Lomandra odora*.

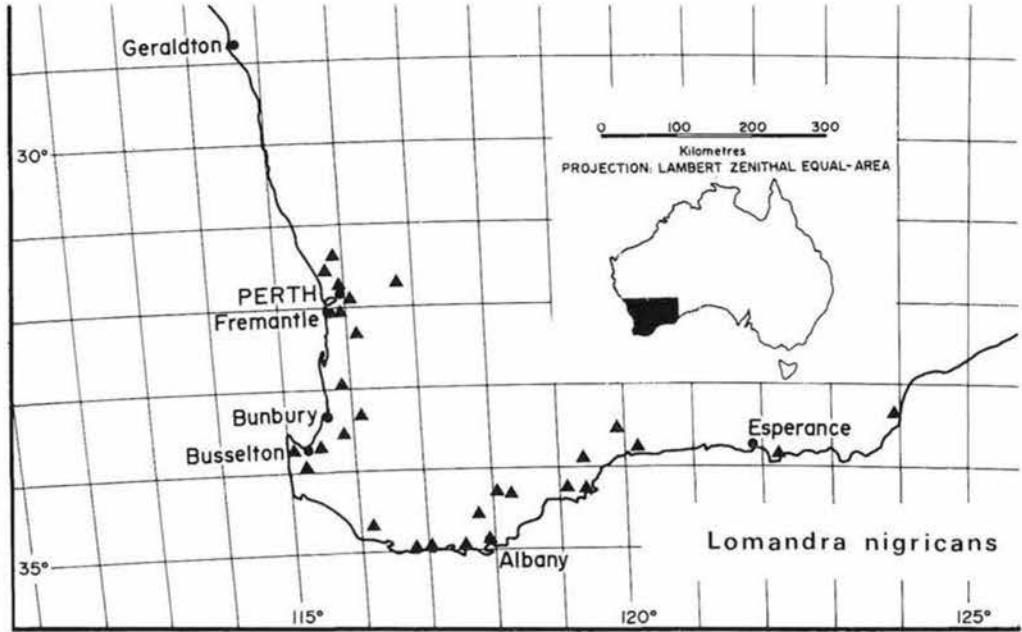


Figure 5. Distribution of *Lomandra nigricans*.

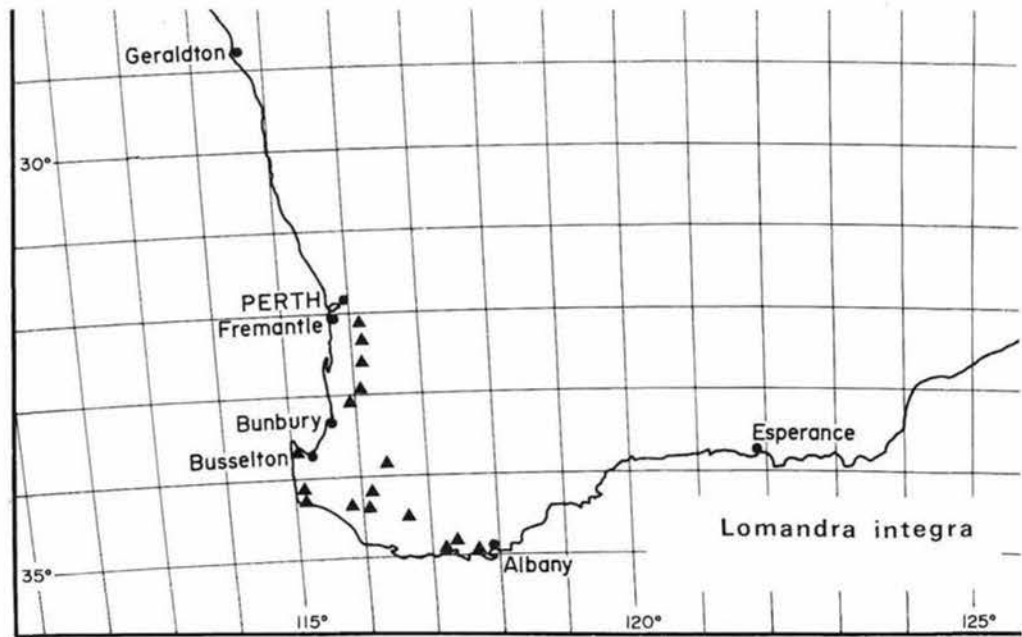


Figure 6. Distribution of *Lomandra integra*.

Distribution. (Figure 6) Western Australia, near Perth south to Albany, inland from the Swan Coastal Plain or on near coastal hills (e.g. in the Cape Leeuwin-Cape Naturaliste area and near Walpole).

Notes. The leaves of this species vary considerably in relative length and width, sometimes in the one collection (Figure 3). Shorter leaves, which are usually broader than long leaves, are evidently formed in the first season of regeneration after fire but perhaps also under certain other conditions as they are not found only on recently burnt plants.

There are very few female plants of *L. integra* to be found among the herbarium collections. Field observations indicate that in this species there is an excess of male plants in natural populations. This contrasts with the situation for most species of *Lomandra* where the females are less common than males in herbarium collections owing to their being different in form or otherwise less conspicuous to collectors but actually occurring with similar frequency to the males in nature.

Lomandra integra can be found growing sympatrically with *L. nigricans* on the Darling Range, but *L. integra* flowers later.

The specific epithet *integra* refers to the entire leaf bases.

Acknowledgements

I would like to thank the following: the heads of the herbaria MEL and UWA for loans of specimens, C. L. Lynch and P. J. Poli for technical assistance and map preparation, Paul G. Wilson for critical comments on the draft manuscript and checking my Latin diagnoses and G. J. Keighery, Kings Park and Botanic Garden, for permission to use his unpublished chromosome number information.

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A new species and a new combination among the Proteaceae represented in the Perth Region

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Abstract

Rye, B. L. A new species and a new combination among the Proteaceae represented in the Perth Region. *Nuytsia* 5(1): 25-30 (1984). In preparation for the "Flora of the Perth Region", the new combination *Banksia seminuda* (A. S. George) Rye (syn. *B. littoralis* R. Br. var. *seminuda* A. S. George) is made and the new species *Hakea lasianthoides* Rye (syn. *H. lasiantha* R. Br. var. *angustifolia* Benth.) is described. *Hakea lasianthoides* differs from its closest relative, *H. lasiantha*, in the shorter appressed indumentum on the young growth, the similar rather than differential colour of the hairs on the pedicel and calyx and the more elongated thinner leaves. It also differs in its flowering period, geographical distribution and, apparently, in habitat.

Introduction

This paper provides a new combination, *Banksia seminuda*, and describes a new species, *Hakea lasianthoides*, so that the names can be used in the proposed "Flora of the Perth Region". Both species occur in, but are not confined to, the Perth Region, the boundaries of which are shown in Marchant & Perry (1981).

Following Cronquist (1981: 608), the conspicuous outermost floral whorl of the Proteaceae is referred to here as the calyx; the corolla is considered to be reduced to the nectary gland(s). In *Hakea*, the typical indumentum consists of three-celled T-shaped or Y-shaped hairs, the basal cell immersed in the epidermis, the second cell forming a short stalk, while the terminal cell is elongated and attached at or near the centre (Johnson & Briggs 1975). Hence the hairs appear bifid or like a pair of hairs. The measurements given here for hairs refer to the total length of the terminal cell only if the hairs are appressed and straight, that is T-shaped. Where the cells are Y-shaped, the length of the arms of the terminal cell are stipulated.

Species treatments

Banksia seminuda (A. S. George) Rye, comb. et stat. nov.

Banksia littoralis R. Br. var. *seminuda* A. S. George, *Nuytsia* 3: 408-410 (1981).

Type: Nanga Brook, south of Dwellingup, Western Australia (32°49'S, 116°04'E), 15 May 1973, A. S. George 11655 (holo: PERTH; iso CANB, K, MEL, NSW, PERTH).

Discussion. This taxon is adequately described and illustrated by George (1981) in his recent revision of *Banksia*. George (pers. comm.) treated *B. seminuda* as a variety of *B. littoralis*, because he was unable to separate them by fruit characters and the floral differences were less than are usually found between pairs of closely related *Banksia* species. However, he now considers them to be distinct species. Floral characters alone are quite sufficient to distinguish *B. seminuda* from *B. littoralis* and leaf dimensions are also usually sufficient for identification. In the field the two species are readily distinguished by their bark. They are also distinct in their habit,

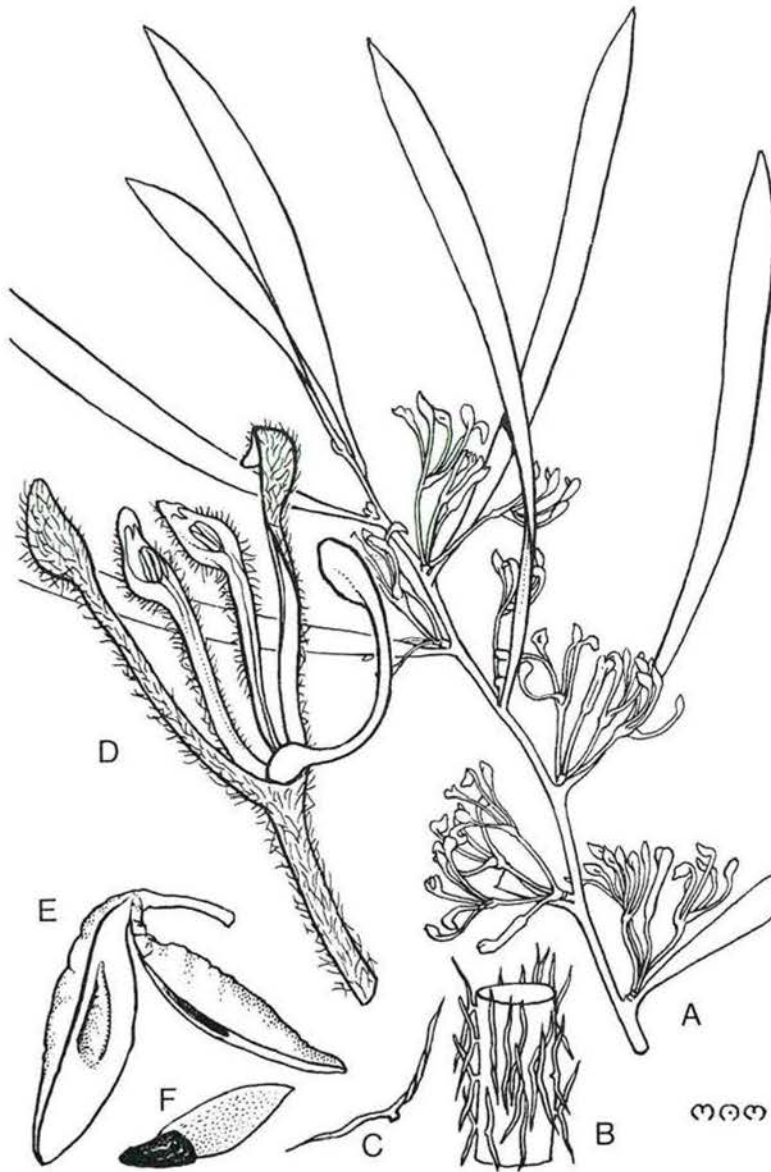


Figure 1. *Hakea lasianthoides*. A—Flowering branch (x1.5). B—Portion of young stem (x20). C—Stem hair (x30). D—Flower (x7). E—Dehiscent follicle (x1.5). F—Seed (x1.5).

Drawn from several PERTH specimens.

although in exposed coastal locations the normally tall, straight-trunked *B. seminuda* has a more stunted habit, which is less readily distinguished from that of *B. littoralis*. The bark and habit differences are illustrated by photographs in George (1981: 406).

Further evidence that the two *Banksia* taxa are distinct species, rather than just variants of a single species, is their failure to hybridize in mixed stands. S. D. Hopper (pers. comm.) conducted a thorough survey of two mixed populations in the Two Peoples Bay area but found no hybrids. A number of other mixed populations are known, although the species generally occupy different habitats. *B. littoralis*, commonly known as Swamp Banksia, typically occurs in winter-wet depressions whereas *B. seminuda*, known as River Banksia, occurs along watercourses.

Both species have long flowering seasons, which overlap considerably. George (1981: 410) suggested that a difference between the two taxa in the orientation of the calyx limb may relate to their having different pollinators. However, it is more likely that the pollen is deposited on different positions on the same pollinators. Either way, the floral difference might provide an effective barrier to cross-pollination.

***Hakea lasianthoides* Rye, sp. nov. (Figure 1)**

Hakea lasiantha R. Br. var. *angustifolia* Benth. Fl. Austral. 5: 502 (1870). Type: Drummond 21 (holo: presumably K-n.v.; iso: MEL-n.v., probable isotype also at PERTH).

Hakeae lasianthae R. Br. affinis a qua surculis juvenilibus indumento brevior appressoque, colore pilorum pedicellorum colori pilorum calycis simili, foliis tenuioribus magis elongatis, anthesi serotina differt.

Typus: Bow River, Western Australia, "Shrub several feet high on damp ground", November 1912, S. W. Jackson s.n. (holo: PERTH; iso (n.v.): K, CANB).

Related to *Hakea lasiantha* R. Br. but differs in the shorter and appressed indumentum on the young shoots, the similar rather than differential colour of the hairs on the pedicels and calyx, the thinner more elongated leaves and the later flowering time.

Erect shrub or small tree to 5 m tall. Young shoots ferruginous, covered by a mixture of ferruginous and colourless hairs; hairs closely appressed, straight, to c. 1 mm long. Leaves usually lacking a well defined petiole, often bluish green (in dried material), linear to narrowly obovate (rarely almost elliptic), often curved, 40-120 x 3.5-13 mm, thinly coriaceous, often retaining sparse hairs on the upper surface, 2 or more main veins arising in the lower half of the leaf and converging with the midrib at the apex; mucro usually 1-2 mm long, broad, black in the upper part, innocuous. Flowers several, in condensed racemes in the upper leaf axils; peduncle c. 1 mm long; involucre bracts early deciduous, golden brown, hairy near the apex or ciliate on the upper margin; rachis c. 2 mm long. Pedicels 4-10 mm long; hairs of the same shape and colour as those on the calyx but less dense and shorter. Receptacle fairly straight. Calyx white (rarely cream or ferruginous in the upper part), 6-10 mm long, densely hairy on the outside, glabrous inside; claw 5.5-8 mm long, each sepal c. 0.3 mm broad; limb with a recurved apex in the bud, 2-3 x c. 1 mm, the subterminal concavities 1.1-1.4 mm long; hairs Y-shaped, colourless (very rarely mixed with ferruginous hairs), the spreading arms 0.5-1 mm long. Anthers 0.5-0.7 mm long. Nectary horseshoe-shaped. Ovary c. 1 mm long, distinctly stipitate. Style 5-7 mm long; stigmatic disk lateral, 1-1.5 x 0.6-1 mm. Follicle 25-33 x 7-9 mm, almost straight; outer surface somewhat chartaceous and wrinkled, sometimes shed. Seed body black, c. 8 x 4 mm; wing up to 15 mm long (including the decurrent portion), c. 5 mm broad, acute, narrowly decurrent at least part way along the shorter side of the seed body.

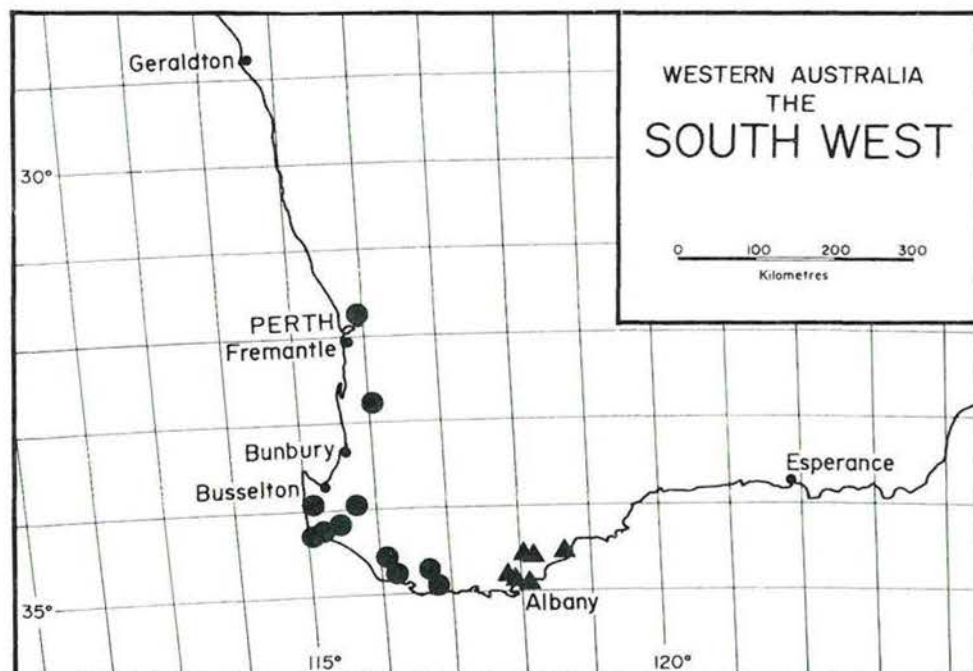


Figure 2. Distributions of *Hakea lasianthoides* ● and *H. lasiantha* ▲.

Other PERTH specimens examined. WESTERN AUSTRALIA: Near Augusta, A. M. Ashby 2373; Forest Grove—Alexandra Bridge, R. J. Cranfield 938; West of Nannup, A. R. Fairall 829; Northcliffe, A. R. Fairall 862; Pemberton, Jan. 1936, C. A. Gardner s.n.; Bow River, Nov. 1912, S. W. Jackson s.n.; Bow River, Dec. 1912, S. W. Jackson s.n.; Coronation Rd, Warren district, M. Page 15; East of Bullsbrook, 24 Aug. 1981, F. Phillips s.n.; Nannup—Busselton, R. D. Royce 2395; Cowaramup, R. D. Royce 5782; Pemberton district, F. M. C. Schock 45; Brockman Hwy, E. M. Scrymgeour 1224; Nannup, Sept. 1926, A. C. Shedley s.n.; Nannup, 20 Aug. 1951, J. B. Sobott s.n.; Pemberton, Nov. 1934, T. N. Stoate s.n.; Dwellingup, Sept. 1935, T. N. Stoate s.n.; Near Cranbrake Pool (sic.), A. Strid 21768; Near Walpole, F. W. Went 131; West of Manjimup, D. J. E. Whibley 5108; North of Walpole, P. G. Wilson 6352.

Distribution and habitat. Extends from Bullsbrook (near Perth) to Bow River on the south coast (Figure 2), usually recorded from damp habitats in forests or woodlands.

Flowering time. Late August to January.

Discussion. Both the isotype of *Hakea lasiantha* var. *angustifolia* at MEL (Marchant pers. comm.) and the probable isotype at PERTH lack flowers but match *H. lasianthoides* in their stems and leaves. A new name was chosen for the taxon rather than a new combination because the specific epithet *angustifolia* had already been used.

Hakea lasiantha and *H. lasianthoides* appear to be allopatric (Figure 1), the former extending from Albany north to the Stirling Range and east to Cheyne Beach. The separation between the known ranges of the two species is c. 85 kilometres. Although both species have long flowering periods lasting about 5 months, they show little or no overlap, *H. lasiantha* flowering from early April to August and *H. lasianthoides* from late August to January. In any given year there is probably no overlap in flowering time. As far as can be determined from the available details on herbarium specimens and limited field observations by A. Strid (pers. comm.), the species also occupy distinct habitats. *Hakea lasianthoides* occurs in wooded areas in winter-wet depressions or along watercourses whereas *H. lasiantha* occupies drier more exposed sites, generally in heathlands.

The most reliable morphological differences between the two *Hakea* species are in the indumentum. In *H. lasiantha*, the young shoots are very densely covered by Y-shaped hairs with arms 0.5-2 mm long. The stems usually retain the dense indumentum in the flowering region, appearing ferruginous and furry. In *H. lasianthoides*, the stems in the flowering region are grey and not conspicuously hairy, the hairs differing from those of *H. lasiantha* in being appressed, smaller and less dense. The pedicels of *H. lasiantha* have a mixture of ferruginous and colourless hairs and are noticeably darker than the calyx, which has only colourless hairs or very few ferruginous hairs. In *H. lasianthoides*, all pedicel and calyx hairs are colourless, except in the northernmost population at Bullsbrook, where a mixture of ferruginous and colourless hairs occurs on both the pedicel and calyx. The Bullsbrook specimen is unique in that the calyx is two-coloured, the ferruginous hairs mainly on the limb and the colourless hairs mainly on the claw.

Hakea lasianthoides almost always has more elongated leaves than *H. lasiantha*, as can be seen from the measurements made of the longest leaf on 18 specimens of each species (Table 1). The ratio of leaf length to breadth was useful in separating the two species, with most *H. lasiantha* specimens having ratios of 3.6-5.8 whereas most *H. lasianthoides* specimens had ratios of 6.5-24.5. Only one specimen of each species fell within the range (as given above) of the other species. The leaves of *H. lasiantha* also tend to be much thicker than those of *H. lasianthoides* but this difference is not easy to quantify.

Table 1. Ranges of measurements of the longest leaf from each PERTH specimen of *Hakea lasiantha* and *H. lasianthoides*.

	<i>Hakea lasiantha</i>		<i>Hakea lasianthoides</i>	
	Total	Excluding extremes*	Total	Excluding extremes*
Length (mm)	36-84	41-69	42-120	50-116
Breadth (mm)	7-19.5	7.5-16.5	3.5-10	4-9
Length/breadth	2.7-9.2	3.6-5.8	5.6-29.4	6.5-24.5

* Range excluding the highest measurement and the lowest measurement.

Although *Hakea lasiantha* and *H. lasianthoides* show differences in several other characters, their ranges of variation overlap. The flowers of *H. lasiantha* tend to be slightly longer and usually appear much thicker and more furry (mainly because of the thicker longer indumentum) than in *H. lasianthoides*. The fruits also tend to be shorter and thicker in *H. lasiantha*.

Hakea lasianthoides and *H. lasiantha* show obvious morphological similarities and are not as readily distinguished as most pairs of related *Hakea* species. Nevertheless, they are treated here as distinct species, rather than just as subspecies of *H. lasiantha*, because they can be reliably distinguished on morphological criteria and because they appear to be good biological species. Even if they were not geographically separated, their flowering time difference would presumably prevent hybridization.

Acknowledgements

I am grateful to Dr N. G. Marchant for checking material of the new *Hakea* against type specimens in MEL, Professor K. H. Rechinger for writing the Latin diagnosis and Ms M. A. Menadue for the illustration.

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Taxonomic notes on some Western Australian species of *Hibbertia* (Dilleniaceae)

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Abstract

Wheeler, J. R. Taxonomic notes on some Western Australian species of *Hibbertia* (Dilleniaceae). *Nuytsia* 5(1): 31-42 (1984). One new species, *H. ferruginea* and one new subspecies, *H. spicata* subsp. *leptothea*, are described and illustrated. Taxonomic notes are provided on *H. montana* Steudel and its allies. *Hibbertia commutata* Steudel and *H. ovata* Steudel are reinstated as distinct species.

Introduction

The genus *Hibbertia* Andr. has between 60 and 70 species in Western Australia, most of which are endemic to the south west of the State. The purpose of this paper is to validate two new names so that they may be included in a treatment of the genus for the forthcoming "Flora of the Perth Region" and also to explain the reinstatement of two names which have been relegated to synonymy since Bentham's treatment (1863). The Perth Region as defined by Marchant & Perry (1981), contains 30 species of *Hibbertia*. Firstly the new taxa are described and secondly notes are provided on *H. montana* and its allies. This paper highlights the need for further research in the genus *Hibbertia*. Throughout the paper the sectional classification which I have followed is that of Gilg and Werdermann (1925). However further studies are necessary on the sectional and subsectional boundaries to establish their accuracy.

1. *Hibbertia ferruginea* J. R. Wheeler, sp. nov. (Figure 1)

Frutex tenuis, 0.2-0.5 m altus. Folia linearia, alterna vel subfasciculata. Flores sessiles, solitarii vel glomerati, flos quisque bracteis 3-7, latis, rigidis, ciliatis, 4-6.5 mm longis suffultus. Sepala quam bractee paulo longiora, pilis ferrugineis dense sericea. Stamina in fasciculos 5 tristaminatos disposita; filamenta connata. Ovarium carpellis 5 glabris compositum.

Typus: Yoongarillup, near Busselton, Western Australia. "Sandy soil." 17 October 1952, R. D. Royce 3891 (holo: PERTH; iso: CANB, MEL).

Erect shrubs 0.2-0.5 m high. Stems slender with long internodes. Leaves alternate or in few-leaved fascicles, sessile, linear, (7)15-30(50) × 1-1.5 mm, bluntly mucronate, glabrous to sparsely hairy with fine, often curled hairs, more densely hairy at the slightly dilated and ciliate base, margins closely revolute. Flowers terminal and axillary, sessile, solitary or several together, mostly 10-15 mm in diameter, surrounded by 3-7 bracts. Bracts broad, imbricate, concave, rigid, oblong to circular or broadly obovate, sometimes almost as long as and partly concealing the sepals, 4-6.5 × 3-7 mm, obtuse or minutely apiculate, the outermost bracts somewhat smaller and terminating in a small leaf-like projection; inner surface glabrous; outer surface



Figure 1. *Hibbertia ferruginea* A—Habit. B—Leaf. C—Flower. D—Flower with sepals and petals removed, showing the arrangement of stamens and carpels. E—Staminal bundle. F—Anther. G—Carpels.

From A. T. Hotchkiss, Ludlow, 4 Sept. 1953.

glabrous at the base but sparsely to densely sericeous towards the centre and apex with white or ferruginous hairs; margins membranous and ciliate with white curled hairs. *Sepals* 5, shortly united at the base, narrowly ovate or narrowly oblong to ovate or oblong, 5-7.5 x 2-3.5 mm, acute or subacute; the inner surface sparsely hairy towards the apex, otherwise glabrous; the outer surface densely sericeous with ferruginous hairs; margins becoming glabrous, entire or minutely ciliate. *Petals* 5, free, obovate, emarginate to obcordate, sometimes rather obliquely so, 6-10 x 3-

6.5 mm. *Stamens* 15, in 5 fascicles, each of 3 stamens with fused filaments, 2 of the 3 anthers of each fascicle sessile, the filament of the third innermost stamen is continued and swollen just below the anther; *anthers* 2-celled, oblong to elliptic, 1-1.75 mm long, opening by longitudinal slits; *staminodes* absent. *Carpels* 5, glabrous; *styles* arising from the adaxial side of the carpel and radiating; *ovules* 1 per carpel.

Other specimens examined (all PERTH): Ludlow, 4 Sept. 1953, A. T. Hotchkiss s.n.; Collie Basin, J. M. Koch CJK592; Sabina Road, 0.8 km west of Nannup to Busselton Road, B. R. Maslin 2819; 8 miles [12.9 km] from Nannup, towards Northcliffe, M. E. Phillips 2557; Capel-Donnybrook Road, R. D. Royce 2307; Yoongarillup, R. D. Royce 3163; Yoongarillup, R. D. Royce 3891; Capel, R. D. Royce 4375; Yoongarillup, Busselton District, R. D. Royce 4544; Hithergreen, Busselton district, R. D. Royce 5752; Yoongarillup, R. D. Royce 5760; Wilcock Forestry Plantation, near Curtis Siding, 150 miles [241 km] S of Perth, C. L. Wilson 861.

Habitat. Sandy soils, in Jarrah or *Banksia* woodland, or on sandy heathlands.

Distribution. (Figure 3) South-west of Western Australia, from near Capel (c. 26 km S of Bunbury) and Collie (c. 55 km E of Bunbury) southwards to near Busselton and Nannup.

Flowering period. August to November.

Etymology. The specific epithet refers to the colour of the hairs on the sepals.

Hibbertia ferruginea belongs to section *Candollea* (Labill.) Gilg. and is part of a species aggregate, which includes *H. depressa* Steudel, *H. desmophylla* (Benth.) F. Muell. and *H. helianthemoides* (Turcz.) F. Muell., in which species boundaries are unclear. Bentham (1863) and later workers have placed much emphasis on the number of carpels as a character for discriminating species. This character is variable in some species; however, it appears to be a reliable diagnostic character when distinguishing between the species in this particular complex.

Table 1. The critical differences between *Hibbertia ferruginea*, *Hibbertia depressa*, *Hibbertia helianthemoides* and *Hibbertia desmophylla*

	<i>H. ferruginea</i>	<i>H. depressa</i>	<i>H. helianthemoides</i>	<i>H. desmophylla</i>
Carpel Number	5	5	3	3
Staminal Arrangement	5 x 3	5 x 3	3 x (3-4) + 2 x (1-2)	3 x (3-4) + 2 x (1-2)
Bracts	Rigid, broad, conspicuous	Membranous, inconspicuous	Membranous or rigid and narrow, mostly inconspicuous	Membranous, inconspicuous
Sepals	Subacute, densely hairy	Subacute, mostly sparsely hairy	Subacute to acute, glabrous or sparsely hairy	Obtuse, glabrous
Leaves	Few, alternate or clustered. Almost glabrous to sparsely hairy	In dense clusters. Densely hairy	In dense clusters. Sparsely to densely hairy	In dense clusters. Sparsely to densely hairy
Leaf length	Mostly 15-30 mm	Mostly 6-15 mm	Mostly 8-15 mm	Mostly 8-20 mm

Hibbertia ferruginea is similar to *H. depressa* in the number and arrangement of carpels and stamens. Both have 5 carpels and have their stamens in 5 fascicles of three stamens with none free. *Hibbertia ferruginea* is also close to *H. desmophylla* and *H. helianthemoides* but the latter two species have only 3 carpels with stamens arranged in 5 fascicles of which 3 have three or four stamens and 2 have either two or one stamen.

The principal diagnostic characteristics of *H. ferruginea* and its allies are shown in Table 1. *Hibbertia ferruginea* differs from the other species in this complex in the presence of conspicuous, broad, rigid bracts closely surrounding the flowers and densely ferruginous appressed hairs on the sepals. It also differs in its more slender habit with narrower, less hairy and less clustered leaves. Although *H. depressa*, *H. helianthemoides* and *H. desmophylla* may each show some variation in shape and texture of both bracts and sepals, none of their variants come close to *H. ferruginea*, which itself shows very little variation.

2. *Hibbertia spicata* F. Muell., Fragm. Phyt. Austral. 2:1-2(1860). Type citation: "Ad portum Gregorii. Walcott et Oldfield" (holo: K; iso: MEL).

Hemistephus linearis J. Drumm. ex Harvey, Hooker's J. Bot. Kew Gard. Misc. 7:52(1855). Type citation: "Northern districts. J. Drummond", s.n. (type not located at K). Non *Hibbertia linearis* R. Br. (1817).

A low, erect or spreading *shrub*, 0.2-0.5 m high, rarely to 0.7 m. *Leaves* linear, rarely very narrowly oblong, (7)9-30(39) mm long, obtuse to shortly mucronate; upper surface glabrous, tuberculate or smooth, rarely sparsely scabrous; lower surface densely and minutely stellate; margins revolute. *Inflorescence* a 2-5(9)-flowered pedunculate spike. *Flowers* 5-15(20) mm in diameter, all but the lowest subtended by 2, often dimorphic, bracts; *bracts* narrowly elliptic to narrowly ovate, rarely broadly ovate, 2-5(8) mm long, margins sometimes ciliate. *Sepals* 5, 3.5-8 mm long; the outer 2 sepals narrowly ovate to narrowly elliptic, rarely narrowly obovate or ovate, mostly acute with a prominent midrib, glabrous or with minute stellate hairs, usually also with a few simple, uncinata hairs and rarely a few straight hairs, margins sometimes ciliate; the inner 3 sepals scarious, broadly elliptic, obtuse, with a less prominent or scarcely any midrib, minutely stellate hairy and also sometimes with a few simple, uncinata hairs towards the base, margins minutely ciliolate. *Stamens* 6-12(15), all on one side of the carpels; *filaments* sometimes united towards the base; *anthers* narrowly oblong and 1-1.5 mm long, or linear and 1.5-3 mm long; *staminodes* variable, either on both sides of the stamens only, or on both sides and opposite the stamens, or continued around to form a complete ring with the stamens, or forming a complete ring outside the stamens, or behind the stamens only, or absent. *Carpels* 2, densely hairy; *ovules* 2 per carpel.

Both *H. spicata* F. Muell. and *H. polystachya* Benth. (1863) belong to section *Hemipleurandra* Benth. subsection *Spicatae* Gilg, in which the stamens are all on one side of the carpels and in which staminodia are usually present. Their inflorescence is a one-sided spike of 2 or more flowers.

Hibbertia spicata is characterised by an almost glabrous upper leaf surface and sepals which mostly have only uncinata and/or minute stellate hairs. *H. polystachya* is characterised by long, simple, spreading hairs on the upper leaf surface and sepals which are densely hairy with long straight simple and minutely stellate hairs. However some specimens are intermediate in respect to these characters. Bentham (1863)

also used differences in staminodes to separate the two species, but these differences have been found to be unreliable. Specimens considered to be *H. polystachya* on the basis of leaf and sepal characters were found to have staminodes which were similar in both number and arrangement to specimens considered, on the basis of leaf and sepal characters, to be *H. spicata*. Therefore it seems that the status of *H. polystachya* is uncertain. Further studies are necessary to clarify the position. *Hibbertia polystachya* and *H. spicata* are extremely closely related and may even be conspecific.

Key to subspecies

1. Anthers narrowly oblong, 1-1.5 mm long, staminodes several. Outer 2 sepals hairy with simple, uncinata and/or minute stellate hairssubsp. *spicata*
1. Anthers linear, 1.5-3 mm long, staminodes few or absent. Outer 2 sepals glabrous, or almost sosubsp. *leptotheca*

2a. subsp. *spicata*

Low erect or spreading *shrub*, 0.2-0.7 m high. *Leaves* 7-39 mm long, obtuse to shortly mucronate; upper surface glabrous, smooth or tuberculate, rarely minutely scabrous. *Flowers* 8-15(20) mm in diameter. *Outer sepals* mostly narrowly ovate or narrowly elliptic, 4-7 mm long, acute with simple, uncinata and/or minute stellate hairs, rarely narrowly obovate, obtuse, with straight uncinata and stellate hairs, or rarely ovate, ciliate and with only a few straight and uncinata hairs. *Inner sepals* 5-6 mm long, minutely stellate with often a few simple, uncinata hairs towards the base. *Stamens* 6-12; *anthers* narrowly oblong, 1-1.5 x 0.2-0.4 mm; *staminodes* variable in number and position, always present.

Selected specimens examined (all PERTH): Wagin, C. A. Gardner 1003; Cockleshell Gully, C. A. Gardner 8430; 9 km S of Eneabba, E. A. Griffin 1006; Avondale Research Station, 6 km W of Beverley, R. Hnatiuk 790181; Vearnlea, 11 km N of Cockleshell Gully, R. D. Hoogland 11962; near the turnoff from the Geraldton to Mullewa road to the Casuarinas, c. 36 miles [57.9 km] E of Geraldton, R. D. Hoogland 11978; Great Northern Highway, N of Pearce at 32 mile peg [51.5 km] from Perth, R. D. Hoogland 12014; 31.7 miles [51 km] E of Geraldton airport towards Mullewa, F. Lullfitz 5701; Glen Forrest, 18 Nov. 1899. A Morrison s.n.; Red Hill, 22 Sept. 1944, R. D. Royce s.n.

Distribution. (Figure 3) Widespread in Western Australia. Occurs in the Eremaean Botanical Province, in the area of North West Cape, and in the Irwin, Avon and Darling Botanical Districts from Kalbarri southwards to Wagin and just north of Katanning.

Habitat. Found on a variety of soils including limestone soils of North West Cape, sands of the northern heathlands and lateritic soils of the Darling Range.

Flowering period. July to November.

Variants of subsp. *spicata* from North West Cape and from Tammin have slightly larger flowers 15-20 mm across, lack uncinata hairs and have very dense stellate hairs on the slightly broader and darker coloured sepals.

2b. subsp. *leptotheca* J. R. Wheeler, subsp. nov. (Figure 2)

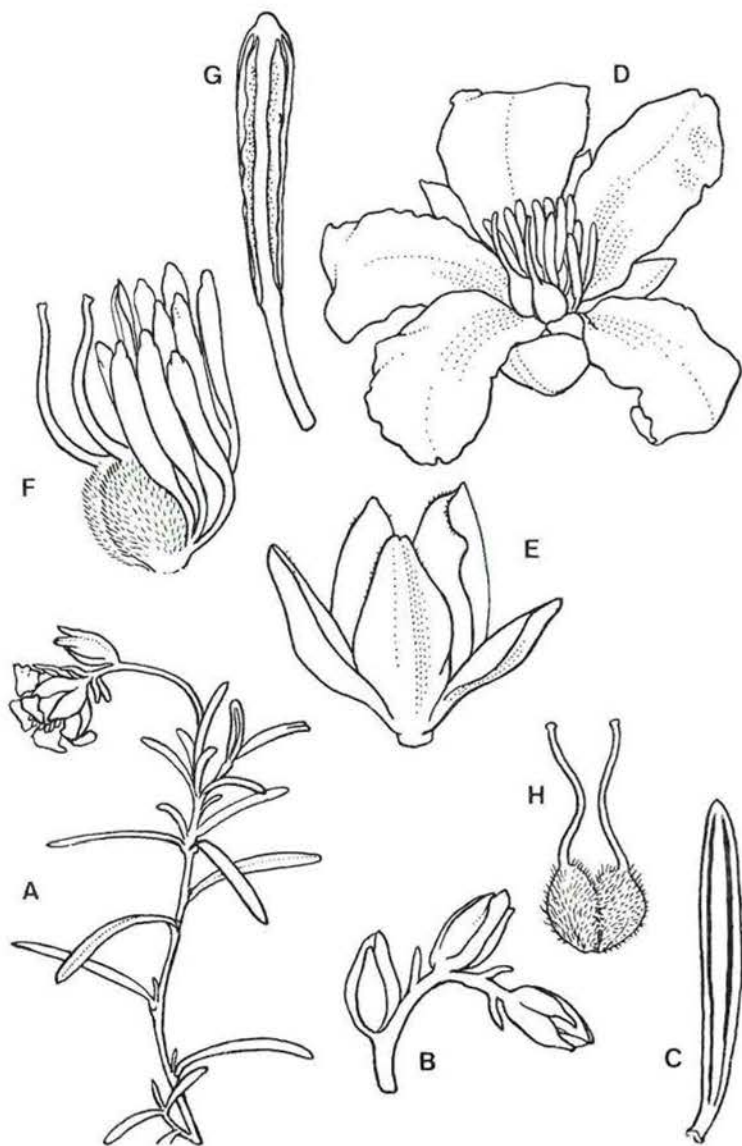


Figure 2. *Hibbertia spicata* subsp. *leptotheca* A—Habit. B—Buds. C—Leaf. D—Flower. E—Sepals. F—Flower with sepals and petals removed, showing the arrangement of stamens and carpels. G—Stamen. H—Carpels.

From *J. R. Wheeler* 2040.

Differt a *H. spicata* subsp. *spicata* antheris longioribus linearibus, staminodiis paucis vel nullis, sepalis exterioribus subglabris, interioribus minute tantum stellatis.

Typus: Yalgorup National Park, between the N end of Lake Preston and Martin's Tank Lake, Western Australia, 31°51'30"S, 114°40'20"E. "Diffuse shrub to 45 cm tall. Abundant in *Dryandra sessilis* and *Hakea undulata* and low closed shrubland on limestone soils." 17 September 1981, *N. G. Marchant* 81/76 (holo: PERTH; iso: CANB, MEL).

Low erect or spreading *shrub*, 0.2-0.3 m high with slender *stems*, glabrous or almost so, often viscid. *Leaves* (8)12-25(30) mm long, acute; upper surface smooth or sparsely tuberculate, glabrous with rarely a few minute scabrous hairs towards the base. *Flowers* 5-10 mm in diameter. *Outer sepals* narrowly ovate to narrowly elliptic, 3.5-5 mm long, acute, glabrous or almost so. *Inner sepals* 4.5-6.5 mm long, hairy with minute stellate hairs. *Stamens* 8-15; *filaments* relatively short, free to the base; *anthers* linear, 1.5-3 × 0.25-0.65 mm, the connective dark when dry; *staminodes* absent or rarely 1-2 present, either side of, or behind the stamens.

Other specimens examined (all PERTH): Perry's Lime-kilns, Subiaco, Aug. 1919, W. B. Alexander s.n.; Blackwall Reach, Applecross, along Swan River, Sept. 1904, C. Andrews s.n.; Swan River below Perth, C. Andrews 2nd Coll. no. 2, Sept. 1904; 10 km N of Lancelin, S. R. Chambers & T. Tapper 8; Reservoir Hill, H. Demarz D.5661; Fremantle, Sept. 1897, R. Helms s.n.; Mouth of the Swan River, 1 Sept. 1897, R. Helms s.n.; Fremantle, 1 Sept. 1897, R. Helms s.n.; Cottesloe, mouth of Swan River, 3 Oct. 1900, A. Morrison s.n.; Yalgorup National Park, S. Paust 1354; Lancelin, F. G. Smith 1936; Bold Park, Perth, J. R. Wheeler 2040; 10 miles [16.1 km] from Yanchep turnoff on way to mouth of Moore River, C. L. Wilson 870.

Distribution. (Figure 3) Western Australia, the coastal plain from Lancelin to Yalgorup National Park.

Habitat. Near-coastal limestone.

Flowering period. June to October.

Etymology. The specific epithet refers to the narrow anthers.

Hibbertia spicata subsp. *leptotheca* is geographically separated from subsp. *spicata*; subsp. *leptotheca* occurs only on the coastal plain between Lancelin and Yalgorup National Park, whereas subsp. *spicata* ranges from North West Cape south to Wagin and near Katanning, but is absent from the coastal plain in the Perth Region. Also subsp. *leptotheca* has a different habitat preference from most populations of subsp. *spicata*, occurring on near-coastal limestone.

Notes on *Hibbertia montana* Steudel and its allies.

3. *Hibbertia montana* Steudel, in Lehm., Pl. Preiss. 1:270 (1845). Type citation: "In limosis lapidosis cacuminis montis Bakewell, ditionis York, 5. Febr. 1839. Herb. Preiss. No. 2135." (iso: MEL).

Hibbertia sargentii S. Moore, J. Bot. 47:338 (1909). Type citation: "Foot of Mount Bakewell, in black humus with granite and quartz subsoil; O. H. Sargent, 517" (holo: BM).

There has been much confusion surrounding *H. montana* Steudel. Bentham (1863) misapplied the name *H. montana*, placing *H. commutata* Steudel and *H. discolor* Steudel in synonymy, at the same time relegating *H. confertifolia* Steudel to a variety of *H. montana*. Later workers have all followed Bentham's misapplication of the name *H. montana*. The description of *H. montana* given by Bentham (1863) relates to *H. commutata* and *H. discolor*, both of which have 3 glabrous carpels. *Hibbertia montana*, however, is a species with velutinous carpels. *H. montana* occurs near York, where it still flourishes at the type locality, Mt Bakewell, and may extend as far south as Boyagin.

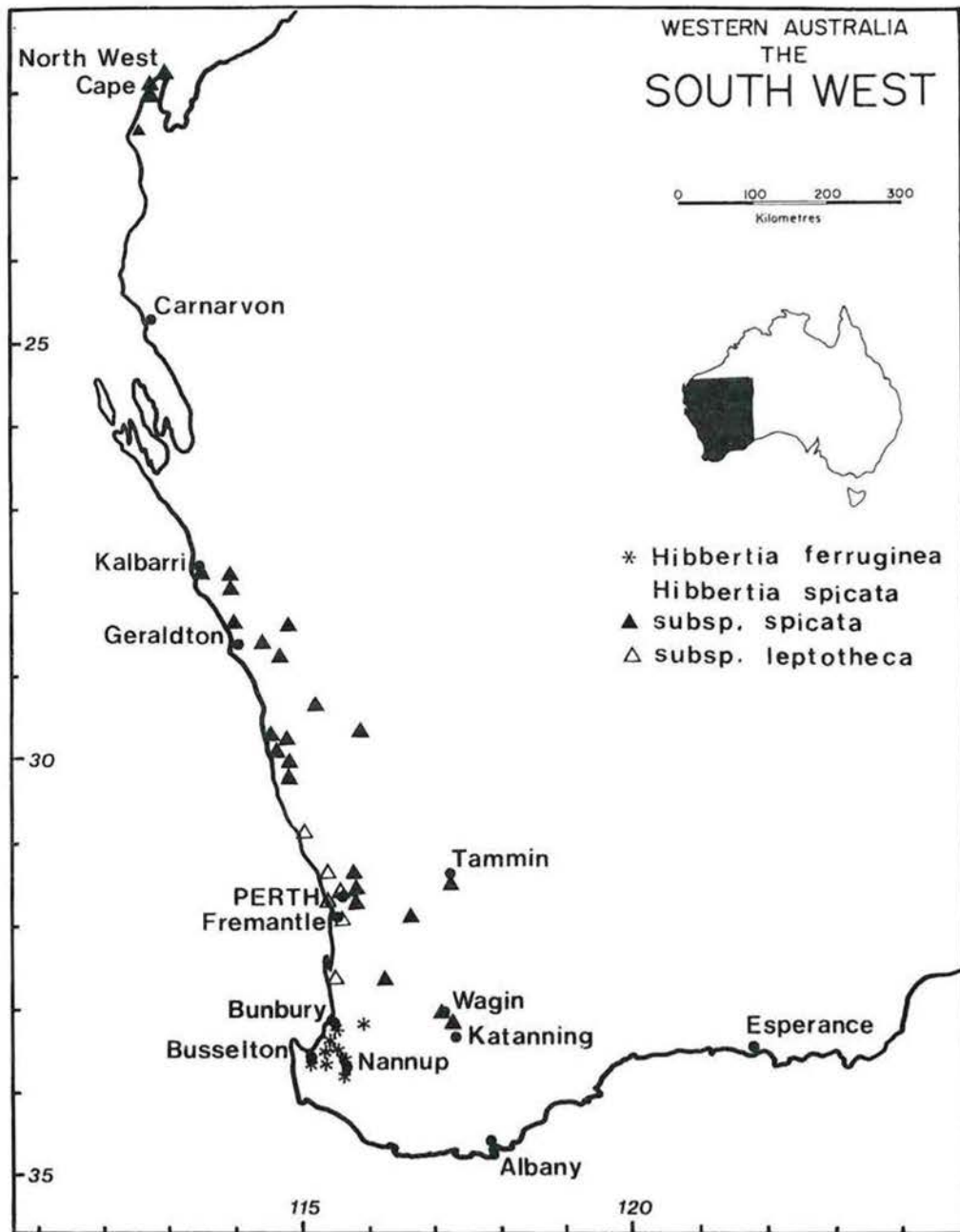


Figure 3. Distribution of *Hibbertia ferruginea*, *H. spicata* subsp. *spicata* and *H. spicata* subsp. *leptotheca*.

Hibbertia sargentii S. Moore, from the description, I consider to be a synonym of *H. montana* Steudel. As may be seen from the following quotation, S. Moore (1909) followed Bentham's misapplication of *H. montana*, when he says of *H. sargentii* "On first view it might be mistaken for *H. montana*, to which Mr Sargent tells me, some

authorities whom he has consulted would refer it; but I cannot accept this opinion, for *H. montana*, besides having glabrous carpels, a matter of some systematic importance in this genus, belongs to another subsection of *Euhibbertia*, of which one of the features is the absence of staminodes.”

The diagnostic characters of *H. montana* are given in Table 2. *Hibbertia montana* is closely related to both *H. ovata* Steudel and *H. lasiopus* Benth., all having 3-5 hairy carpels. The close relationship of *H. montana*, *H. ovata* and *H. lasiopus* is also evident on examination of their stamens. The stamens of *H. montana*, *H. ovata* and *H. lasiopus* are very similar, numerous and arranged all around the carpels. The filaments in the young flowers curve, closely hugging the carpels at the base and spreading only in the upper half. Several staminodes are present amongst the outer stamens. *Hibbertia lasiopus*, with its much larger flowers has many more stamens than *H. ovata* and *H. montana*.

4. ***Hibbertia commutata*** Steudel, in Lehm., Pl. Preiss. 1:267 (1845). Type citation: “In saxosis vallis cataractae ad caput fluvii Cygnorum, 26. Jul. 1839. Herb. Preiss. No. 2136” (iso: MEL).

Hibbertia discolor Steudel, in Lehm., Pl. Preiss. 1:267 (1845). Type citation: “In limosis ad fluvium Canning, 22. Jul. 1839. Herb. Preiss. No. 2137” (iso: MEL).

Hibbertia confertifolia Steudel, in Lehm. Pl. Preiss. 1:267 (1845). Type citation: “In subarenosis districtus Plantagenet, Nov. 1840. Herb. Preiss. 2143” (iso: MEL).

The confusion between this species and *H. montana*, which arose from Bentham's treatment (1863) is discussed above. After examining isotypes (MEL) of both *H. commutata* and *H. discolor* and visiting the type locality of *H. commutata*, the waterfalls of the Susannah Brook, a tributary of the Swan River, I have no hesitation in reinstating *H. commutata* Steudel and placing *H. discolor* Steudel as a synonym. The diagnostic characters of *H. commutata* are shown in Table 2. *Hibbertia commutata* is a widespread species in the Darling Range, from New Norcia southwards to the Stirling Range.

H. confertifolia Steudel I consider to be a small-leaved variant of the variable *H. commutata*.

Hibbertia commutata is closely related to *H. serrata* Hotchkiss, both having 3 glabrous carpels. The stamens of *H. commutata* and *H. serrata* are fewer than those of *H. montana*, *H. ovata* and *H. lasiopus*. They tend to alternate with the carpels rather than evenly surround them. The filaments are almost straight, spreading from the base. Staminodes are absent in *H. commutata* and rare to frequent in *H. serrata*. The larger flowers of *H. serrata* from the Darling Scarp have many more stamens than either *H. commutata* or the *H. serrata* from the karri forest.

5. ***Hibbertia pilosa*** Steudel, in Lehm., Pl. Preiss. 1:272 (1845). Type citation: “In densis umbrosis montis Darling's-range, ditionis Perth, Sept. 1841. Herb. Preiss. No. 2130.” (iso: MEL).

I have been unable to match any material with the original description of *H. pilosa*. According to the original description the leaves of this species are sparsely pilose and the carpels 1-2 with dense, long, pilose hairs. The status of *H. pilosa* therefore is uncertain.

Table 2. Diagnostic characters of *Hibbertia montana* Steudel and its allies

	<i>Hibbertia lasiopus</i>	<i>Hibbertia montana</i>	<i>Hibbertia ovata</i>	<i>Hibbertia commutata</i>	<i>Hibbertia serrata</i> (Darling Range variant)	<i>Hibbertia serrata</i> (sensu stricto)
Habit	Prostrate, rarely erect hairy shrub	Prostrate to erect densely hairy shrub	Low, erect many-stemmed, hairy shrub	Low, erect many-stemmed, sparsely hairy shrub	Tall, erect, single-stemmed, sparsely hairy shrub	Tall, erect, single-stemmed, sparsely hairy to glabrous shrub
Leaves	Obovate to elliptic, 20-60 x 10-30 mm, hairy with very short and longer spreading hairs	Narrowly oblong, 15-23 x 4-7 mm, very densely hairy with spreading hairs	Narrowly elliptic to elliptic or narrowly obovate to obovate, 8-32 x 3.5-12 mm, hairy with very short and longer spreading hairs	Narrowly oblong to narrowly obovate, 6-40 x 2-11 mm, hairy with simple hairs	Narrowly elliptic to elliptic or narrowly obovate to obovate, 30-75 x 8-30 mm, softly hairy with simple hairs	Narrowly elliptic 50-90 x 12-27 mm glabrous or sparsely hairy with simple hairs.
Leaf margin	Crenate	Sparsely crenate	Sparsely crenate	Entire or sometimes sparsely crenate	Crenate	Serrate
Flowers	Pedunculate, up to 65 mm across	Most pedunculate, 20-35 mm across	Sessile, 15-25 mm across	Sessile, 10-20 mm across	Sessile, 25-40 mm across	Sessile, 10-20 mm across
Sepals	Densely silky hairy	Densely silky hairy	Closely appressed hairy, but long ciliate on margins towards the base	Silky hairy	Silky hairy	Sparsely silky hairy
Stamens	Numerous, over 50, all around the carpels, staminodes always present	Numerous, 30-60, all around the carpels, staminodes always present	Numerous, 30-55, all around the carpels, staminodes always present	Fewer, 15-30, staminodes absent	Numerous, 40-50, staminodes rare	Fewer, c. 20, staminodes frequently present
Carpels	5, villous	4-5, velutinous	3-4, velutinous	3, glabrous	3, glabrous	2-3, glabrous

6. ***Hibbertia ovata*** Steudel, in Lehm., Pl. Preiss. 1:270 (1845). Type citation: "In limoso-calculosis fruticosis prope Mahogany-creek, ditionis Darling's-range, 12. Sept. 1839. Herb. Preiss. No. 2134." (iso: MEL).

Hibbertia montana var. *major* Benth., Fl. Austral. 1:35 (1863). p. pte as to the Preiss syntype. Type citation: "Swan River, *Drummond*" s.n. (holo: K not found); "Darling Range, Preiss n. 2134." (iso: MEL).

Bentham included *H. ovata* as a synonym of *H. montana* var. *major*. *Hibbertia ovata*, however, is a species with velutinous carpels, sessile flowers and distinctive sepals. The diagnostic characters of *H. ovata* are shown in Table 2, and on the basis of the differences between it and its allies, shown in Table 2, I reinstate *H. ovata* Steudel as a species quite distinct from both *H. serrata* and *H. montana*. *Hibbertia ovata* is most closely related to *H. montana* and *H. lasiopus* (see above under 3. *Hibbertia montana*).

Hibbertia montana var. *major* Benth. was possibly based on mixed material since Bentham's description does not entirely agree with the Preiss syntype, which is also the type of *H. ovata*. Domin (1923) recognised that two taxa were involved as he appears to have excluded the Preiss syntype from his concept of the variety, lectotypifying, by implication, *H. montana* var. *major* by the Drummond collection. However, since he does not cite either collection, there is no evidence that he saw the Drummond specimen. An attempt by R. Filson to locate the Drummond specimen at Kew has been unsuccessful. Thus the application of the name *H. montana* var. *major*, in the sense of the presumed lectotype, is still in doubt. This name was applied by the W.A. Herbarium and by Blackall and Grieve (1956) to the plant I recognise as *H. serrata* Hotchkiss sensu lato.

7. ***Hibbertia serrata*** Hotchkiss, Proc. Linn. Soc. N.S.Wales 79:29-33 (1954). Type citation: "Pemberton, W.A., A.T. Hotchkiss, September 2, 1953" (holo: NSW)

? *Hibbertia montana* var. *major* Benth., Fl. Austral. 1:35 (1863) p. pte as to the Drummond syntype. Type citation: "Swan River, *Drummond*" s.n. (holo: K not found).

Hibbertia serrata sensu lato includes the Darling Range variant, previously recognised as *H. montana* var. *major*. Further fieldwork is necessary to see if this variant is sufficiently distinct to be recognised at the varietal or subspecific level, or whether indeed *H. serrata* is one variable taxon. The diagnostic characters of *H. serrata* are shown in Table 2 under *H. serrata* (sensu stricto) and *H. serrata* (Darling Range variant). *Hibbertia serrata* is most closely related to *H. commutata* (see above under 4. *Hibbertia commutata*).

The relationships of H. montana and its allies. It has become evident that *H. montana* and *H. ovata* are more closely related in many ways to *H. lasiopus* than to *H. commutata* and *H. serrata*. *Hibbertia commutata* and *H. serrata* belong in section *Hibbertia* subsection *Bracteatae* Benth., whereas I would place *H. montana* and *H. ovata* with *H. lasiopus* in section *Hibbertia* subsection *Hemihibbertiae* Benth., despite the sessile flowers of *H. ovata* which are not characteristic of that subsection. The boundaries of the subsections within section *Hibbertia* perhaps need re-examination in the light of the occasional staminodes found in *H. serrata* and the sessile flowers of *H. ovata*.

Acknowledgements

I wish to thank Dr Neville Marchant for his help and encouragement, for examining types at Melbourne, and for commenting on the manuscript. I am grateful to Dr John Green and Mr Paul Wilson for critically reading the manuscript and making suggestions for improvement. I would also like to thank Margaret A. Menadue for preparing the illustrations, Cheryl Lynch for preparing Figure 3, Professor K. H. Rechinger for preparing the Latin diagnoses, Dr R. D. Hoogland for his helpful comments and Mr R. Filson for searching for types at Kew.

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Two new Western Australian species of *Lomandra* Labill. (Xanthorrhoeaceae)

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Abstract

Choo, T. S. (Roland). Two new Western Australian species of *Lomandra* Labill. (Xanthorrhoeaceae). *Nuytsia* 5(1): 43-48 (1984). Two new species of *Lomandra*, *L. brittanii* and *L. maritima*, are described and figured. They are both restricted to the south-west of Western Australia. *Lomandra brittanii* occurs east and up to 100 km south-east of Perth and *L. maritima* occupies coastal habitats over a range from c. 200 km north to c. 70 km south of Perth.

Introduction

This paper is presented to validate names for the forthcoming "Flora of the Perth Region". It is based on work conducted at the University of Western Australia during 1967 and 1968 and embodied in a Master's thesis (Choo 1969). Species studied included all the then recognized Western Australian species of *Lomandra*.

Lomandra brittanii Choo, sp. nov. (Figure 1)

Differt a *L. pauciflora* (R.Br.) Ewart: inflorescentiiis femineis racemosis paucifloris, inflorescentiiis masculis spicatis; bracteis florum femineorum pro genere longissimis (10-25 mm longis); caulibus rectis brevissimis (0.5-1 cm).

Typus: 28 mile peg on Albany Highway, south-east of Perth, Western Australia. 9 Nov. 1967. Choo, T. S. 67104 (male) (holo: PERTH).

Perennial, rhizomatous, dioecious herbs. *Leafy stems* erect and short, very densely tufted. *Leaves* basal, soft, narrow-linear, flat or concave, 5-20 cm long, 0.5-1 mm broad, apex rounded; *sheathing bases* white or yellowish, margins scarious and sometimes splitting into fibres. *Male inflorescences* small and inconspicuous, spicate, 3-8 cm long, bearing 6-20 flowers in groups of two or three. Each *male flower* subtended by a bract and bracteole; *bract* scarious, lanceolate to ovate, 1.5-10 mm long, 0.7-1.5 mm broad; *bracteole* scarious, ovate to very broadly ovate, 0.5-2 mm long, 0.5-1 mm broad. *Female inflorescences* very much reduced racemes, 1-3 mm long, hidden among the leaves, bearing a single terminal cluster of 1-5 flowers. Each *female flower* subtended by a conspicuous bract and bracteole; *bract* larger, scarious, narrowly lanceolate to lanceolate, 10-25 mm long, 1-2 mm broad; *bracteole* similar but smaller, 3-10 mm long, 1-1.5 mm broad. *Male flowers* purple or yellowish-purple, globular, 2.5-3.5 mm long, sessile, rarely lower flowers on very short pedicels, 0.5-1 mm long. *Tepals* free, 3-, 5- or 7-nerved, incurved, differentiated into an outer sepaloid whorl and an inner petaloid whorl; *outer tepals* shorter and narrower, purple, membranous, narrowly ovate to broadly elliptic, 1.5-2 mm long, 1-1.5 mm broad; *inner tepals* longer and broader, purple or yellowish-purple, thick and fleshy with membranous

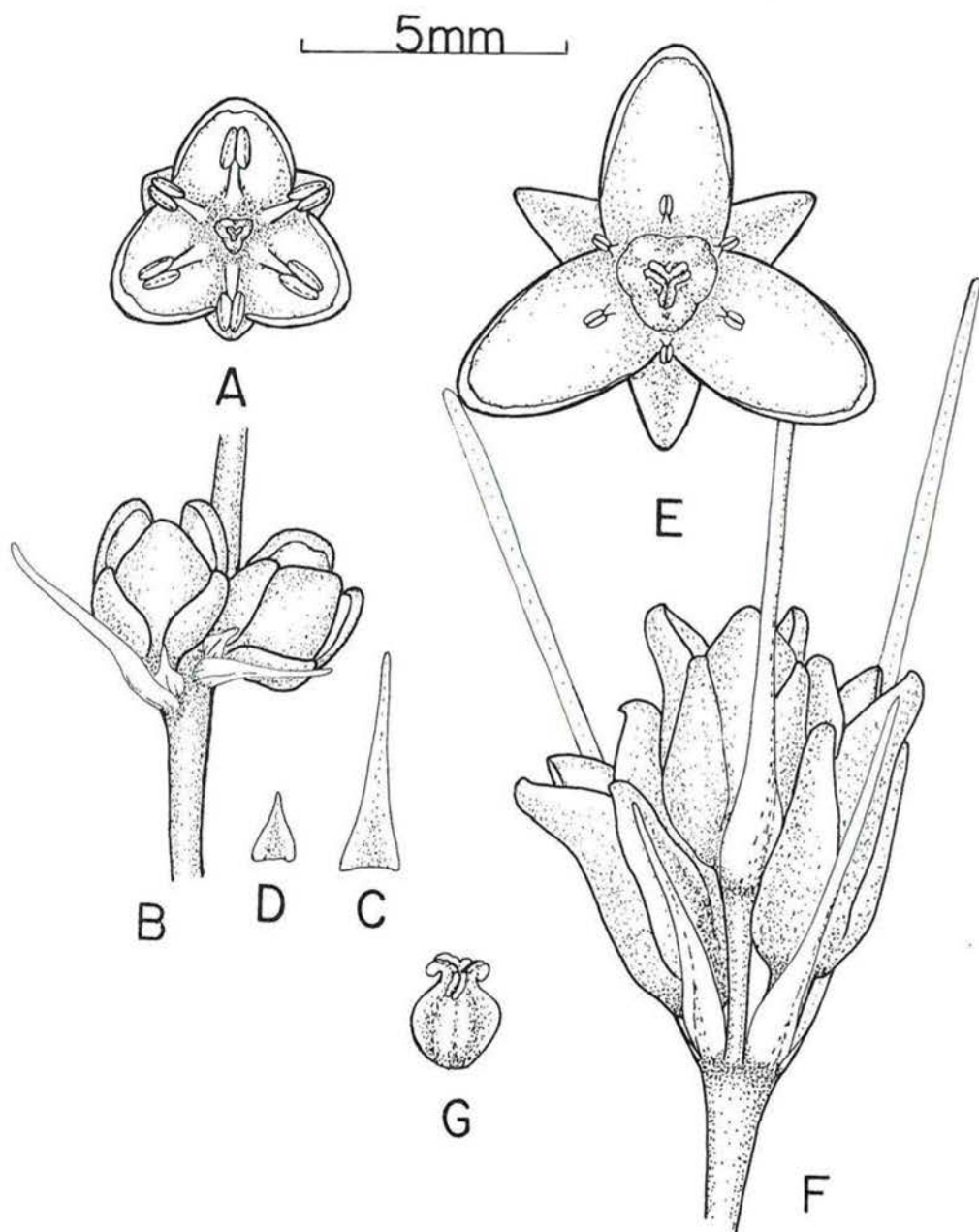


Figure 1. *Lomandra brittanii*. A and B—Male flowers; C—Bract of male flower; D—Bracteole of male flower; E—Female flower; F—Female inflorescence bearing three flowers with long bracts; G—Ovary.

incurved margins, rotund to orbicular, 2-2.5 mm long, 2-2.5 mm broad. *Stamens* equal in length, 1-1.5 mm long, inserted at the base of the tepals. *Rudimentary ovary* 0.3-0.7 mm long, 0.3-0.7 mm in diameter. *Female flowers* larger, purple, campanulate, 4-6 mm long on pedicels 0.5-3 mm long. *Tepals* free, 3-, 5- or 7-veined, differentiated as in male flowers; *outer tepals* shorter and narrower, membranous, lanceolate to narrowly ovate, 3-4 mm long, 1.5-2 mm broad; *inner tepals* longer and broader, thick

and fleshy with membranous incurved margins, elliptic to rotund, 4-5 mm long, 2-3 mm broad. *Staminodes* c. 0.5 mm long, insertion on tepals similar to stamens in male flowers. *Ovary* triquetrous, 1.5-2 mm long, 1.5-2 mm broad. *Stigmas* sessile on ovary.

Additional specimens examined. Type locality, T. S. Choo 67101 (male) and 67109 (female) (CANB), 67102 (male) and 67110 (female) (K), 67103 (male) and 67112 (female) (NSW), 67111 (female) (PERTH), 67105, -106, -107 (all male) and 67113, -114, -115 (all female) (UWA); Parkerville, T. S. Choo 6721 (UWA—spirit collection); 60 mile peg, Albany Highway, T. S. Choo 6741a (UWA—spirit collection); Western Australia, *Oldfield*, MEL 20707 (n.v.)

Distribution and ecology. Restricted to an area east and south-east of Perth (c. 40-100 km) in Jarrah (*Eucalyptus marginata*) forest in sandy or lateritic soils (Figure 3).

Flowering period. October-November.

On account of its perianth structure this species is seemingly closely related to *L. pauciflora*, but the two species differ as follows.

(a) The staminate inflorescence of *L. brittanii* is a spike, whereas that of *L. pauciflora* is a raceme. The pistillate inflorescence of the former species is very different from its staminate inflorescence and is a very reduced raceme bearing a terminal cluster of 1-5 flowers, whereas that of the latter species is very similar to its staminate inflorescence and bears 10-20 flowers in groups of two or three.

(b) The bracts, especially those of the pistillate flowers, of *L. brittanii* are very conspicuous and longer than the flowers, whereas those of *L. pauciflora* are shorter than the flowers.

(c) The leafy stems are erect and short, 0.5-1 cm long, and the leaves are basal in *L. brittanii*, whereas in *L. pauciflora* the stems are procumbent and elongated, 10-50 cm long, and the leaves are cauline.

The Oldfield specimen cited above, was originally identified as *Xerotes caespitosa* Benth. and later (Lee 1962: 162, 1966) identified as *L. sororia* (F. Muell. ex Benth.) Ewart (T. D. Macfarlane, pers. comm.), the sole record of that species from Western Australia.

The specific epithet commemorates Dr N. H. Brittan who supervised the author's postgraduate degree.

Lomandra maritima Choo, sp. nov. (Figure 2)

Differt a *L. hermaphrodita* (C. Andrews) C. A. Gardner: foliis longioribus (30-50 cm), latioribus (2-5 mm), nec tortilibus, nec torsilibus; rachillis inflorescentianum alternis; floribus solitaribus raro 2-3 simul praesentibus; florescentia Aug-Oct.

Typus: On hillslope near Challenger Drive, City Beach, near Perth, Western Australia. 29 Sept. 1966. T. S. Choo 6698 (male) (holo: PERTH).

Perennial, rhizomatous dioecious herbs. *Leafy stems* erect and short, densely tufted. *Leaves* basal, soft, narrow-linear, flat 30-60 cm long, 2-5 mm broad, apex rounded; *sheathing bases* brown or purplish, with scarious margins splitting into

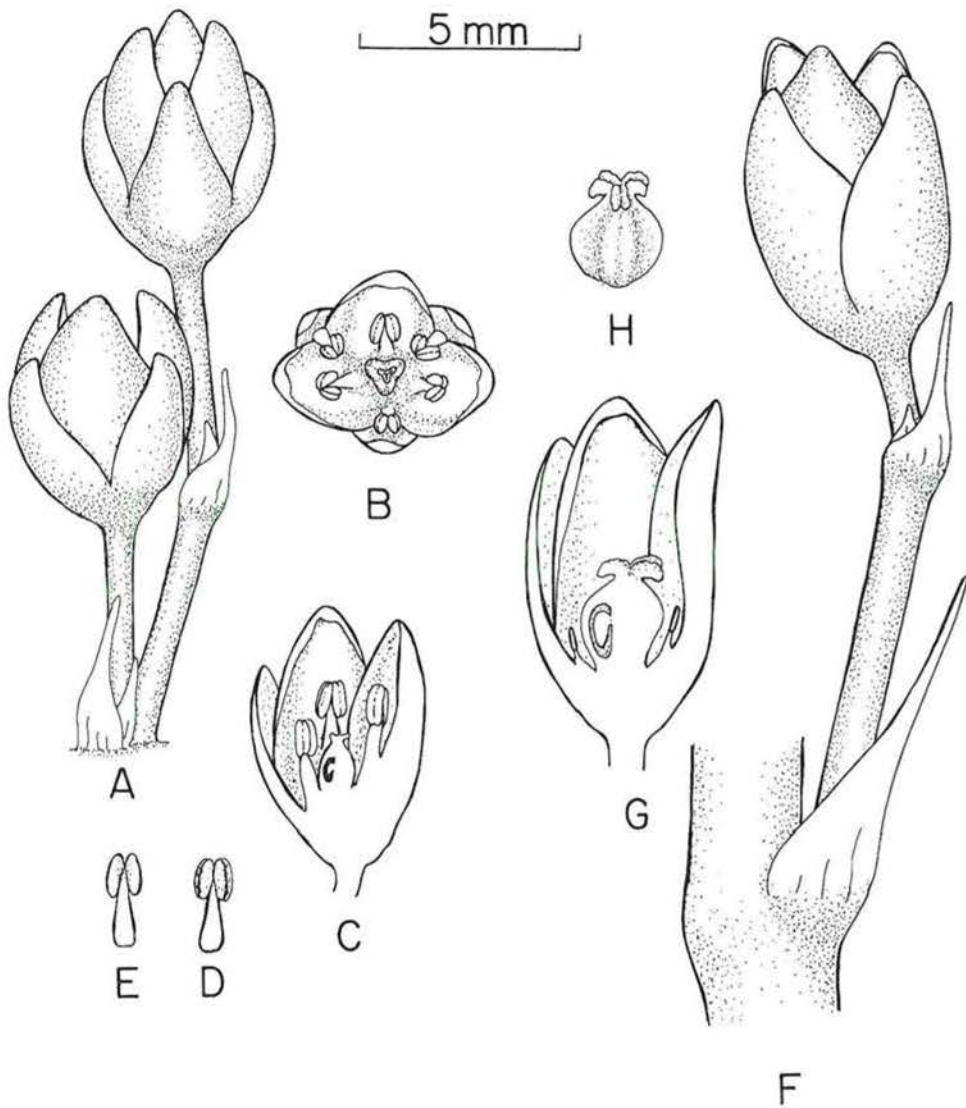


Figure 2. *Lomandra maritima*. A and B—Male flowers; C—Longitudinal section of male flower; D—Front view of stamen; E—Back view of stamen; F—Female flower; G—Longitudinal section of female flower; H—Ovary.

fibres. *Male and female inflorescences* similar, a panicle 5-10 cm long, with alternate rachillae bearing solitary scattered flowers, occasionally two or three together. Each *flower* subtended by a bract and a bracteole; *bract* membranous, lanceolate to ovate, 2-6 mm long, 1-2.5 mm broad; *bracteole* similar but smaller, 1-4 mm long, 0.5-1 mm broad. *Male flowers* purple and yellow, globular, 3.5-6 mm long, on pedicels 2-10 mm long. *Tepals* free, 3-, 5- or 7-veined, incurved, differentiated into an outer sepaloid whorl and an inner petaloid whorl; *outer tepals* purple, membranous, narrowly ovate to rotund, 3-4 mm long, 2-2.5 mm broad; *inner tepals* yellow, thick and fleshy with membranous incurved margins, broadly ovate to rotund 4-5 mm long, 2.5-3.5 mm broad. *Stamens* 1.5-2 mm long, inserted near the base of the tepals. *Rudimentary*

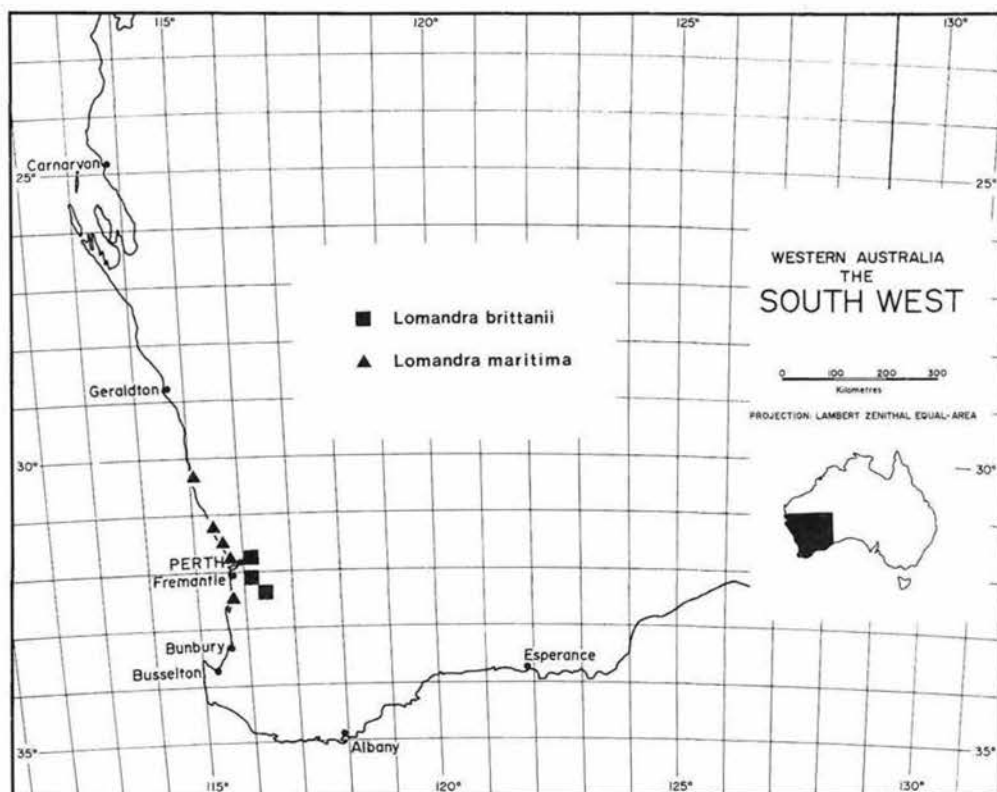


Figure 3. Distribution map for *L. brittania* and *L. maritima*.

ovary 0.5-1 mm long, 0.5-1 mm in diameter. Female flowers purple and yellow, ellipsoid, 5-8 mm long on pedicels 1-5 mm long. Tepals as in staminate flowers but larger; outer tepals broadly to very broadly ovate; 3-5 mm long, 2.5-4 mm broad; inner tepals broadly ovate to rotund, 4-6 mm long, 2.5-4 mm broad. Staminodes 0.5-1 mm long, insertion similar to stamens in male flowers. Ovary triquetrous, 2-2.5 mm long, 2-2.5 mm in diameter. Stigmas sessile on ovary.

Additional specimens examined. Type locality, T. S. Choo 6695 (female) and 6696 (male) (K); Type locality, T. S. Choo 6697 (female), (PERTH); 1 mi [1.6 km] S of Jurien Bay township along track to lighthouse, T. S. Choo 68123 (UWA); Guilderton Beach, T. S. Choo 68125 (UWA); Yanchep Beach, 8 Aug. 1960, G. G. Smith s.n. (UWA); Kings Park, Perth, Oct. 1953, A. M. Baird s.n. (UWA); Pinjarra to Mandurah road, near Serpentine River, C. L. Wilson 828 (UWA).

Distribution and ecology. Restricted to the coastal region of south-west Western Australia, extending from Jurien Bay in the north (c. 200 km N of Perth) to Mandurah in the south (c. 70 km S of Perth)—Figure 3. It is found only in sandy soil.

Flowering period. Late August-October.

The new species is most closely related to *L. hermaphrodita* from which it differs in the following ways.

(a) *Lomandra maritima*, as the specific epithet implies, is a coastal species, whereas *L. hermaphrodita* is found only in inland localities.

(b) The flowering period of *L. maritima* is late August to October, whereas *L. hermaphrodita* flowers in April and May.

(c) The inflorescence branching in *L. maritima* is alternate, rarely opposite, whereas in *L. hermaphrodita* it is opposite or verticillate.

(d) The dry leaves of *L. maritima* are yellow or light brown, those of *L. hermaphrodita* are brick red or copper-coloured.

Acknowledgements

The author gratefully acknowledges the award of a University of Western Australia Studentship held in 1967 and 1968. He also wishes to thank Dr Brittan for supervision and guidance in the course of the work and for writing the Latin diagnoses, and Dr T. D. Macfarlane of the Western Australian Herbarium for information on the Oldfield specimen of *L. brittanii*.

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Dryandra mimica, a new species of Proteaceae from south-west Western Australia

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Abstract

George, A. S. *Dryandra mimica*, a new species of Proteaceae from south-west Western Australia. Nuytsia 5(1): 49-51 (1984). *Dryandra mimica* is described and discussed. Superficially resembling *D. nivea* (Labill.) R. Br., it is most closely related to *D. vestita* Kippist ex Meissner.

The genus *Dryandra* R. Br. (Proteaceae) has not been revised since its treatment by George Bentham in Volume 5 of the Flora Australiensis, published in 1870. Several new species have been described since then, but at least fifteen more await names. These will be published before the genus is prepared for Volume 17 of the "Flora of Australia", due to appear in 1988. One species is described here, however, in order to be available for the forthcoming "Flora of the Perth Region."

Dryandra mimica A. S. George, sp. nov. (Figure 1)

Species facie *Dryandrae niveae* (Labill.) R. Br., sed recte *D. vestitae* Kippist ex Meissner affinis, a qua habitu prostrato, foliis multi-dentatis, et tepalis penicillatis, praecipue differt.

Typus: Corner of Brentwood Rd and Crystal Brook Rd, Wattle Grove, Western Australia (32°04'S, 116°00'E), 17 Dec. 1972, A. S. George 11648 (holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH).

Shrub with small lignotuber and short underground stems, the latter with many linear tomentose bract-like prophylls. *Leaves* crowded near stem apices, linear, attenuate towards base, pungent, mostly 13-35 cm long including petiole, 5-15 mm wide just below apex, tomentose above becoming glabrous, reticulate and closely tomentose below, dentate with many rigid, obtuse to acute lobes 1-2 mm long at 90° to midrib; sinuses U-shaped, mostly 3-8 mm wide; margins revolute; petiole 4-6 cm long, tomentose and loosely hirsute, the lamina decurrent as a narrow rib each side. *Inflorescences* terminal, becoming crowded over successive years; involucre bracts narrowly linear, attenuate, 17-22 mm long, rufous-villous in lower 2/3, distally hirsute and closely tomentose. *Flowers* c. 20 per head, evenly spaced over receptacle; bracts and bracteoles narrowly linear, c. 1 cm long, rufous-villous. *Perianth* straight or outer ones gently curved, 25-30 mm long, yellow, glabrous at base, then villous with curled hairs, then glabrous in distal half except a tuft of long white hairs at apex; glabrous inside; limb narrow, 7-8 mm long, its base not clearly marked. *Pistil* straight or gently curved, 24-27 mm long, stout at base, attenuate to apex, glabrous; pollen-presenter not thickened. *Hypogynous scales* linear, acute, 2 mm long. *Follicles* few, ± oblong but upper margin obliquely curved to styler side, swollen at base, 2 cm long, 1 cm wide, covered with matted appressed hairs, the base and styler side also with long, straight rufous hairs.



Figure 1. *Dryandra mimica*. Holotype (A. S. George 11648).

Other collections examined. Type locality, 6 Aug. 1964, A. S. George 6360 (with old flowers) (PERTH); W of Mogumber Siding, 3 Sept. 1975, A. S. George 14165 (with old flowers) (PERTH); Acton Park Road, Whicher (Range), 13 Sept. 1976, G. S. McCutcheon 823 (sterile) (PERTH).

Distribution. Western Australia, known from the three localities cited.

Habitat. At the type locality on a sandy flat among low shrubland with scattered emergent *Eucalyptus marginata* and *Kingia australis*; at Mogumber on a deep sandy slope in *Banksia* low open woodland with heath understorey.

Flowering period. December-January.

Affinities. The species has very much the aspect of *Dryandra nivea* (Labill.) R. Br., with which it grows at the type locality. This resemblance is superficial, arising from the prostrate habit and dentate leaves. In fact, the leaves have rounded sinuses, not V-shaped as in *D. nivea*. The floral arrangement is different, *D. nivea* having the flowers (pale brown) arising around the margin of the receptacle leaving a broad central cavity at anthesis, whereas in *D. mimica* the flowers (yellow) arise evenly and evenly spaced from the receptacle. This arrangement is the same as that of *D. vestita* Kippist ex Meissner which is the closest relative of the new species. The floral structure and indumentum are like those of *D. vestita*, except that *D. mimica* has an apical tuft of long straight hairs which is lacking in *D. vestita*. The involucre bracts are similar in these two species and the close covering of prophylls on the underground stems of *D. mimica* has a parallel in the prophylls on the aerial stems of *D. vestita*. Both flower in summer, an unusual flowering period in the genus. At anthesis the tepals separate but do not relax, the limb loosely enclosing the pollen-presenter. In most species of *Dryandra*, including *D. nivea*, the tepals relax and curl back, leaving the pollen-presenter free.

Conservation status. Endangered, coded 3E (Leigh, Briggs & Hartley 1981). The type locality is freehold land and the Mogumber locality has been partly cleared.

Etymology. The Latin *mimicus*, imitative, refers to the superficial resemblance of the new species to *Dryandra nivea*.

Reference

- Leigh, J. H., Briggs, J. D. & Hartley, W. (1981). "Rare or Threatened Australian Plants". (Austral. Natl. Parks & Wildl. Serv., Special Publication 7: Canberra).

Seven new orchids from Western Australia

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Abstract

George, A. S. Seven new orchids from Western Australia. *Nuytsia* 5(1): 53-62 (1984). The following new taxa are described: *Caladenia amplexans*, *C. infundibularis*, *C. uliginosa*, *C. wanosa*, *Drakaea thymniphila*, *Pterostylis dilatata* and *Thelymitra variegata* var. *apiculata*.

Introduction

Description of these orchids arises from new collections and research carried out following my Check list of the Orchidaceae of Western Australia in *Nuytsia* 1: 166-196 (1970). Most have been known for some years but it has only recently been possible to decide the rank at which they should be named. The *Drakaea* provides a name for a species to which, until 1970, the name *D. elastica* Lindley was misapplied.

Caladenia amplexans A. S. George, sp. nov. (Figure 1A-D)

Species *Caladeniae caeruleae* R. Br. affinis, a qua lobis lateralibus labelli purpureis columnam amplectentibus praecipue differt, etiam folio latiore undique viridi, flore caeruleo pallidiore, et labello sine vittis transversalibus prominentibus.

Typus: 53 miles (c. 85 km) NE of Wubin, Western Australia (c. 29°53'S, 117°00'E) 20 Aug. 1960, A. S. George 900 (holo: PERTH).

Tuber ovoid, 1.5-2.5 cm long, the outer layers densely matted. *Flowering plant* to 25 cm tall. *Leaf* broadly linear, obtuse to acute, 2.5-12.5 cm long, 2-7 mm wide, sparsely hirsute above, almost glabrous below, green both sides. *Stem* hirsute with non-glandular hairs; bract 1, at middle; floral bract obtuse, 5-9 mm long. *Flower* 1, sometimes 2, pale blue inside and outside, scentless. *Lateral sepals* broadly falcate, directed forwards, obtuse, 7-16 mm long, 2-6 mm wide, closely glandular outside. *Dorsal sepal* linear, erect, 8-18 mm long, 2-4 mm wide, glandular outside. *Petals* linear, slightly falcate, 9-16 mm long, 2-4 mm wide, sparsely glandular outside. *Labellum* erect, 5-7 mm high, the apex recurved; lateral lobes broadly obtuse, entire, 1.5-2 mm high, clasping column apex, purple-maroon, sometimes faintly and irregularly banded; apical lobe c. 1 mm long, yellow, the margins with small calli; calli of lamina in 2 rows of 10-14 to the bend, then irregularly crowded on the apical lobe, cream, the basal ones almost 1 mm long, becoming smaller distally, the heads globular, papillose; sometimes small calli lateral to 2 main rows. *Column* 5-7 mm high, broadly winged from base to anther; anther apiculate.

Selected collections examined. Between Wurarga and Pindar, Aug. 1963, Y. Chadwick 2037; NW of Eurardy Stn homestead, 27°19'S, 114°27'E, 25 Aug. 1969, A. S. George 9541; Morawa, 27 Aug. 1959, M. C. George; near Koorda, 17 Sept. 1972, B. & M. Smith; 11 km N of Bullfinch, P. G. Wilson 6173; 24 km W of Paynes Find, 7 Aug. 1969, P. G. Wilson 8647. All collections at PERTH.

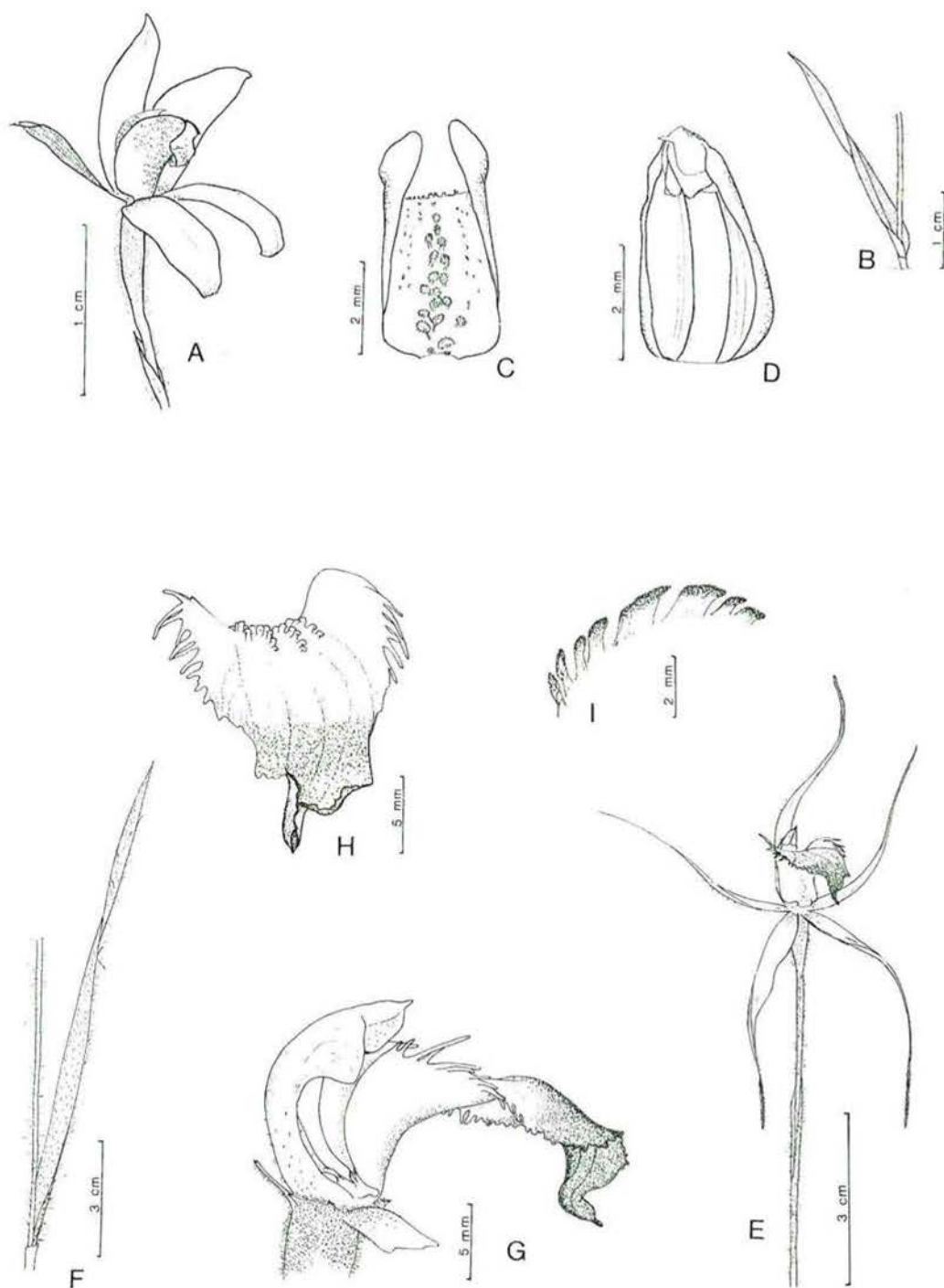


Figure 1. A-D—*Caladenia amplexans*. A—Flower. B—Leaf. C—Labellum from rear. D—Column from front. Locality not recorded. E-I—*Caladenia infundibularis*. E—Flower. F—Leaf. G—Labellum and column from side. H—Labellum from front and above. I—One row of calli. From A. S. George 11727.

Distribution. Western Australia, from the lower Murchison River to Merredin and east to Mt Churchman and Bullabulling.

Habitat. In loam and clay in *Acacia* shrubland, in granitic soil, and on greenstone ridges.

Flowering period. August—September.

Affinities. *Caladenia amplexans* has a strong affinity with *C. caerulea* R. Br. of the section *Caladenia*. It is readily distinguished from this species by the labellum which clasps the column with its lateral lobes. In *C. caerulea* these lobes are erect and well-spaced from the column. *Caladenia amplexans* usually has a broader leaf that is green (not red) beneath, the perianth segments are more obtuse, and the flowers are paler blue. The labellum lacks the prominent transverse red bands of *C. caerulea*. The distributions of the two species overlap slightly near the line of the Great Eastern Highway, but *C. caerulea* in Western Australia otherwise occurs south of *C. amplexans*. The two species have not been recorded growing together.

The column-clasping labellum is also found in the related *Caladenia saccharata* H. G. Reichb., but this species has a glistening white, sweetly scented flower and a narrow red-green leaf. There is also an affinity with the much larger species *C. sericea* Lindley.

Conservation status. Not considered rare or endangered.

Etymology. The Latin epithet *amplexans* (clasping) refers to the labellum.

Caladenia infundibularis A. S. George, sp. nov. (Figure 1E-I)

Species *Caladeniae huegelii* H. G. Reichb. affinis, a qua floribus pallide viridibus et atro-rubris; lamina labelli pro parte maxima horizontali apice deorsum curvato marginibus incurvis; et callis 4(-6) seriatis non ad dimidium laminae attingentibus, differt.

Typus: Near Scenic Drive turnoff, Augusta-Cape Leeuwin road, Western Australia (34°20'S, 115°09'E), 16 October 1973, A. S. George 11727 (holo: PERTH; iso: CANB).

A moderately robust spider orchid to 70 cm tall. *Leaf* linear to narrow-lanceolate, erect, 13-26 cm long, 8-14 mm wide, acute, hirsute both sides. *Stem* hirsute; stem bract 1. *Ovary* densely glandular-hirsute. *Flowers* 1 or 2; perianth pale green with maroon markings; sepals and petals finely nerved; scent absent. *Lateral sepals* spreading, broadly linear for 10-15 mm, then narrowed to filiform points, the whole 30-55 mm long, with slender clubs 7-15 mm long; dorsal sepal erect, linear, tapering to filiform point, 30-58 mm long, with club 6-15 mm long; sepals glabrous inside except some short glandular hairs near base, sparsely glandular-pubescent outside but glabrous below clubs; clubs very shortly glandular. *Petals* spreading, linear, tapering to filiform points, without clubs, 30-40 mm long. *Labellum* on a claw of 1-2 mm, the lamina obovate-obtrullate, horizontal for most of its length, towards the apex downturned with incurved margins almost forming a funnel, the apex itself turned under or outwards; margins entire at base for 7-10 mm, then fringed with fine smooth segments 3-7 mm long becoming shorter and thicker anteriorly, near the apex irregularly dentate to entire; apex almost acute; whole lamina 17-24 mm long, 9-15 mm wide excluding fringe, the lower 1/2 to 2/3 pale green, remainder dark red;

calli in 4 (sometimes 6) rows extending for 7-10 mm from base, slender, linear but with curved apices, the basal ones straight, c. 1.5 mm long, anterior ones less than 1 mm. *Column* ± erect, 13-15 mm high, narrowly winged with triangular, obtuse lobes c. 3 mm wide just below anther; anther 3-4 mm long, apiculate; 2 yellow glands at base of column.

Collections examined. Karridale, Oct. 1905, C. Andrews; "Cape Augusta" (probably Cape Leeuwin), 18 Oct. 1962, A. R. Fairall 789; Margaret River, Oct. 1959, K. Fletcher; S of Yallingup, 8 Oct. 1967, A. S. George 9209; Margaret River district, Oct. 1914, L. Glauert; Karridale, 12 Oct. 1977, R. Heberle; 5.5 km E of Karridale, 23 Oct. 1974, S. D. Hopper; Augusta, 17 Oct. 1967, G. Sumner; Yallingup, Oct. 1958, T. Smith. All collections at PERTH.

Distribution. Western Australia, between Cape Leeuwin and Cape Naturaliste.

Habitat. In loam in Jarrah-Karri forest, and in granitic sandy loam in low shrubland near coast.

Flowering period. October.

Affinities. This species belongs to the complex within section *Calonema* that includes *C. huegelii* H. G. Reichb. and *C. dilatata* R. Br. It is distinguished by the broad, horizontal lamina of the labellum, by the apex which is funnel-shaped with incurved margins, and by the 4-6 short rows of slender calli.

Conservation status. Rare, coded 2RC (Leigh, Briggs & Hartley 1981).

Etymology. The Latin *infundibularis* (funnel-shaped) refers to the apex of the labellum.

***Caladenia uliginosa* A. S. George, sp. nov. (Figure 2)**

Species *Caladeniae patersonii* R. Br. affinis, a qua praecipue floribus minoribus, labello minore pallide viridi et purpureo breviter fimbriato, differt. Sepala 4.5-8 cm longa; labellum 15-19 mm longum, 6-9 mm latum.

Typus: 31 km N of Frankland, Western Australia (34°11'S, 116°59'E), 3 Oct. 1978, A. S. George 15250 (holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH).

A slender spider orchid to 35 cm tall. *Leaf* linear, often broadly, acute or obtuse, 5-20 cm long, hirsute both sides, the hairs more sparse towards apex. *Stem* hirsute; stem bract 2-3 cm long. *Ovary* glandular-hirsute. *Flowers* 1-4; perianth pale green or greenish-cream with maroon markings; scent absent. *Sepals* broadly linear for 12-20 mm, then narrowed rather abruptly to filiform points, the whole 45-80 mm long, sparsely glandular near base, densely so on apices; lateral sepals pendulous. *Petals* similar but 35-55 mm long. *Labellum* erect on a claw 1 mm long, 7-9 mm high, 8-10 mm long, 15-19 mm long flattened, 6-9 mm wide; lamina narrowly ovate-oblong when flattened, curved forwards with the apex recurved; lateral lobes small, with a fringe of smooth segments up to 2.5 mm long; apex dentate, maroon; *calli* in 4 rows, often 6 near base, reducing to 2 near apex, narrow, slipper-like, white at base of labellum, smaller and maroon towards apex, not reaching apex. *Column* tilted slightly back, then forwards, 11-14 mm high; wings expanded to 4 mm wide below anther; 2 yellow glands inside at base; *anther* apiculate.

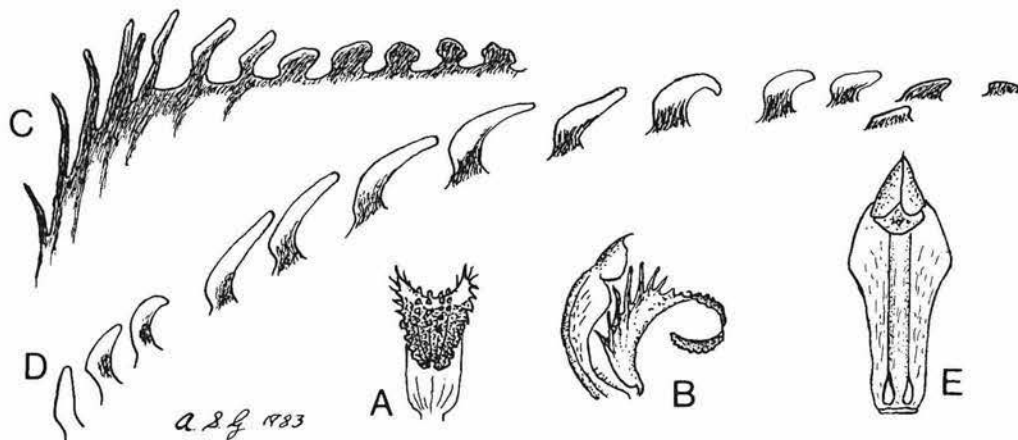


Figure 2. *Caladenia uliginosa*. A—Labellum from front x2. B—Labellum and column from side x2. C—Fringe of labellum margin. D—One row of calli from labellum. E—Column from front x3. Locality not recorded.

Selected collections examined. Near Dryandra, 29 Sept. 1971, A. S. George 11053 (PERTH); 12.5 km W of Frankland R., Muir Hwy, 2 Nov. 1977, A. S. George 15023 (AD, CANB, K, NSW, PERTH); Woodanilling turnoff, Albany Hwy, 3 Oct. 1978, A. S. George 15263 (PERTH); Kojonup, Oct. 1924, B. T. Goadby (PERTH); Rocky Gully, 9 Nov. 1977, R. Heberle (PERTH); Bridgetown, 15 Oct. 1919, O. H. Sargent (PERTH).

Distribution. Western Australia, between Dryandra, Pindalup, Bridgetown, Rocky Gully and Kojonup.

Habitat. Low-lying clay flats, wet in winter, in Eucalypt low open woodland and open shrubland.

Flowering period. October–November.

Affinities. *Caladenia uliginosa* belongs to the section *Calonema* in which it is related to *C. patersonii* R. Br. It is distinguished from this species by the pale green and red flowers, the smaller labellum with shortly fringed lateral lobes and maroon apex, and the lack of scent. Usually it is a short plant less than 20 cm tall.

Conservation status. Not considered rare or endangered.

Etymology. The Latin *uliginosus*, swampy, refers to the preferred habitat of the species.

***Caladenia wanosa* A. S. George, sp. nov. (Figure 3A–E)**

Species *Caladeniae radiali* R. Rogers affinis, a qua foliis minus hirsutis, sepalibus non nisi per 3–6 mm ab apicibus glandulosis, petalis glabris, sepalo dorsali erecto, et callis labelli vinosis in seriebus duabus, differt.

Typus: W of Eurardy Station homestead, N of Murchison River, Western Australia (27°34'S, 114°40'E), 24 Aug. 1969, A. S. George 9530 (holo: PERTH; iso: CANB).

A small slender spider orchid 10-20 cm tall. *Leaf* linear, erect or ascending, 3-9 cm long, 2-3 mm wide, acute, hirsute on lower surface, glabrous or very sparsely hirsute on upper surface, the hairs mostly non-glandular. *Stem* loosely hirsute with both short and long glandular and non-glandular hairs; stem bract 1; a similar bract subtending flower. *Flower* 1, rarely 2; perianth cream with deep maroon markings, almost glabrous except the glandular apices to the sepals; all segments 3-5-nerved, the central nerve the most prominent. *Sepals* broadly linear in lower half, tapering to filiform apices, the distal 3-6 mm glandular with short, thick glands, the whole sepal 21-32 mm long; lateral sepals curved down, dorsal sepal erect. *Petals* almost horizontal, linear, tapering to acuminate apices, 12-24 mm long. *Labellum* on a claw of 1-1.5 mm, erect at base, then curved forward with the apex recurved; lamina transversely elliptic, 8-10 mm wide, when flattened \pm obovate and 12-13 mm long, prominently nerved, the nerves fanned outwards from base; lateral lobes \pm horizontal; apex obtuse, maroon; margins entire, smooth, slightly thickened towards recurved apex; *calli* in 2 rows extending about half-way along lamina from base, 7-12 calli per row, the basal 1-3 \pm slender with narrow-ovoid heads, the others stout with heads becoming spherical on the short anterior calli, the heads divergent from the mid-line of the lamina; calli deep maroon. *Column* erect, 8-10 mm high, with scattered glands inside; no yellow glands at base; wings narrow above broad base and expanded below anther into lobes 2 mm broad with lower angle pronounced but obtuse; *anther* ascending to horizontal, 1.5-2 mm long, very shortly apiculate.

Other collections examined. Z Bend, Murchison River, Kalbarri National Park, early Sept. 1972, N. Hoffman (PERTH, K, MEL, NSW).

Distribution. Western Australia, in the lower Murchison River area.

Habitat. On a sandy flat in the shelter of shrubs (George) and in sand over sandstone among shrubs at the edge of the Murchison River gorge (Hoffman).

Flowering period. August-September.

Affinities. *Caladenia wanosa* is closely related to *C. radialis* R. Rogers, differing from it especially in the leaf, perianth and calli. The leaf is less hirsute than in *C. radialis*; only the sepals are glandular and then for only 3-6 mm (in *radialis* all segments are glandular for up to half their length); the dorsal sepal is erect (curved backwards and horizontal or pendulous in *radialis*); the calli are in 2 distinct rows, thick and maroon (in a \pm crowded band, slender and white to cream in *radialis*). *Caladenia wanosa* occurs well north of the known range of *C. radialis*, which occurs between Mingenew, Highbury and Ravensthorpe. These two species are probably best placed in section *Phlebochilus* Benth. A review of the infrageneric classification of *Caladenia* is needed, since many species have been described since Bentham divided the genus into five sections (Fl. Austral. 6: 376-389, 1873).

Conservation status. Rare, coded 2RC (Leigh, Briggs & Hartley 1981).

Etymology. The specific epithet is derived from the initials of the W.A. Native Orchid Study and Conservation Group. The Group has been very active in extending our knowledge of the orchids in Western Australia and has contributed many specimens to the Western Australian Herbarium.

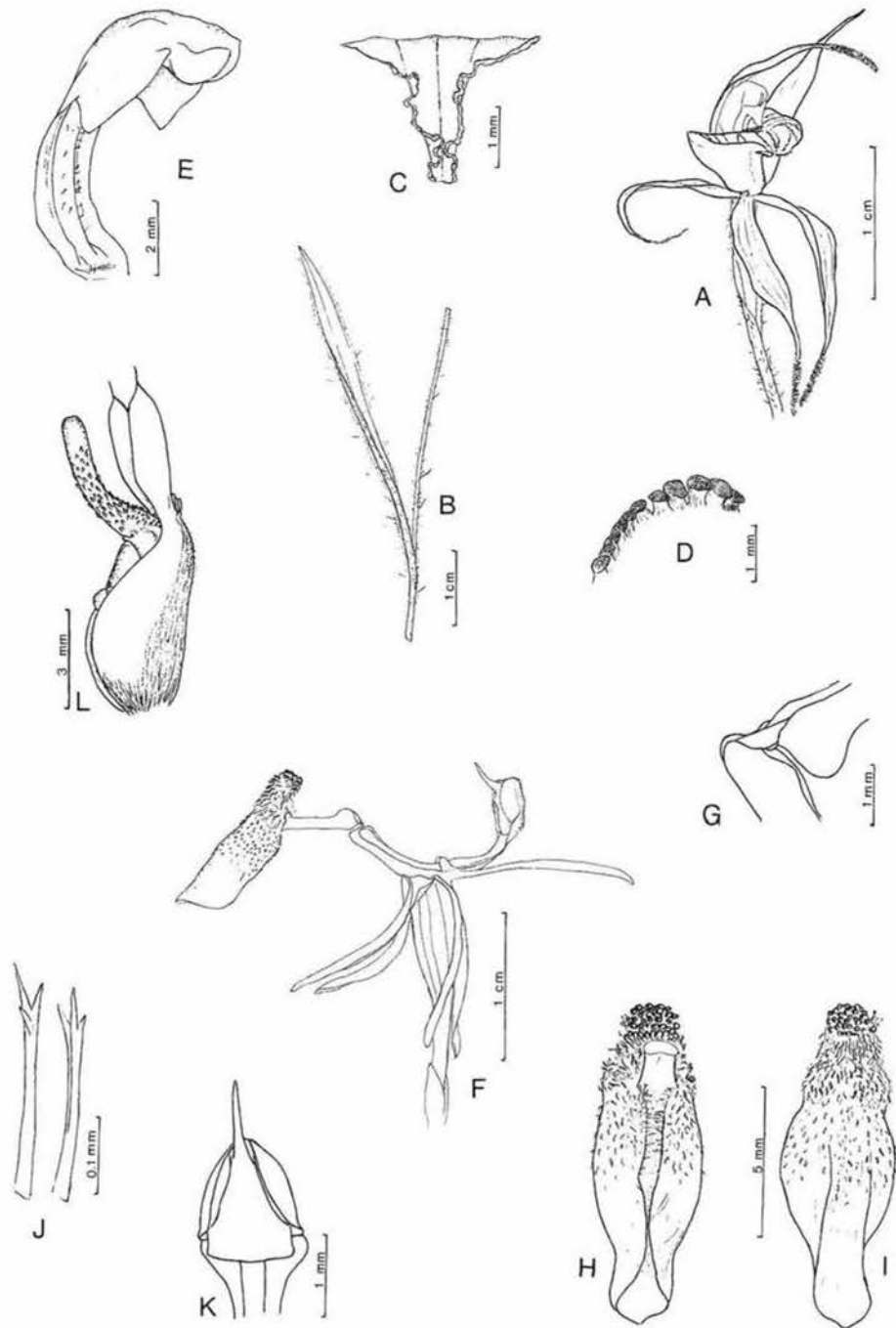


Figure 3. A-E—*Caladenia wanosa*. A—Flower. B—Leaf. C—Apex of labellum from front. D—One row of calli. E—Column. From A. S. George 9530. F-K—*Drakaea thynniphila*. F—Flower. G—Hinge of labellum. H—Lamina of labellum from front. I—Lamina of labellum from rear. J—Hairs from lamina of labellum. K—Anther and stigma. Between Nannup and Pemberton, collector unknown. L—*Thelymitra variegata* var. *apiculata*. Column from side. From A. S. George 2598.

Drakaea thynniphila A. S. George, sp. nov. (Figure 3F-K)

Species *Drakaea elasticae* Lindley affinis, a qua lamina labelli parviore (6-10 mm longa) non verrucosa praeter basim, apice non vel parum sursum flexo, differt.

Typus: Gull Rock Road, E of Oyster Harbour, Western Australia (34°59'S, 118°00'E), 1 Oct. 1971, A. S. George 11099 (holo: PERTH; iso: CANB).

A slender plant 13-35 cm tall, glabrous except labellum and rarely leaf. *Leaf* cordate, sessile at base of stem, ± amplexicaul, obtuse, 6-13 mm long, the centre thick and spongy below becoming thinner when dried, grey-green above with reticulate venation, rarely pubescent above. *Stem bract* 1, sessile, closely appressed, 4-6 mm long. *Floral bract* similar. *Pedicel* slender, 1-2 cm long. *Perianth segments* (except dorsal sepal) reflexed against ovary or curved forwards, narrow-linear, acute, 8-12 mm long, the margins inrolled; dorsal sepal extended horizontally behind column, similar to other segments, 9-13 mm long. *Labellum* on a claw with a median hinge, the lower part 5-6 mm long with a small swelling around a depression on upper side towards hinge; upper part of claw 5-6 mm long with a small swelling just above hinge; lamina dark red-black, smooth except base, 6-10 mm long, ± oblong, slightly swollen below point of attachment, then narrowed, the apex not or slightly flared, straight or a little upturned; callus below point of attachment consisting of variable rounded sessile glands, usually with a neck; both callus and adjacent half of lamina hirsute with simple or slightly divided hairs. *Column* reclined backwards, 7-9 mm long; basal auricles oblong-triangular, rounded, 2 mm long; stigma with apical mucro projecting beyond anther.

Collections examined. ?Yarloop, 4 Oct. 1977, A. Brown; Napier, near Albany, 14 Sept. 1971, L. Byrne; Gull Rock Road, E of Albany, 14 Sept. 1971, L. Byrne; Gull Rock Road, E of Albany, 1 Oct. 1971, A. S. George 11097; Rowley Road, SW of Forrestdale, 2 Oct. 1977, A. S. George s.n.; Donnelly River, 4 miles S of Nannup-Pemberton Road, 25 Oct. 1959, M. C. George; East Porongurups, Sept. 1930, B. T. Goadby; Denmark, 23 Sept. 1973, G. Rogerson; 1.5 miles W of Walpole, 21 Sept. 1974, T. G. Wilson; between Albany & Denmark, late Sept. 1975, C. Woolcock. All collections at PERTH.

Distribution. Western Australia, in near-coastal districts between Perth and Albany.

Habitat. In white sand on flats adjacent to swamps, in low open-woodland of *Eucalyptus marginata*, *Banksia* spp. and *Casuarina fraseriana*.

Flowering period. September-October.

Affinities. *Drakaea thynniphila* differs from *D. elastica* Lindley, its closest relative, in having the lamina of the labellum somewhat smaller, without an upturned apex, smooth and evenly dark red-black without spots. The two species have similar geographical ranges and flowering times, but the new species is usually much less frequent in number of plants.

Etymology. The specific epithet is derived from Thynninae, the subfamily to which belong the wasps which pollinate *Drakaea* (Stoutamire 1981), and the Greek suffix *phila* (loving).

Conservation status. Rare, coded 3R (Leigh, Briggs & Hartley 1981).

***Pterostylis dilatata* A. S. George, sp. nov.**

Species *Pterostylis nanae* R. Br. affinis, a qua foliis plantae florentis omnibus caulinis nullis rosulatis vel basalibus, etiam apicibus petalorum dilatatis, differt.

Typus: Below N side of Bluff Knoll, Stirling Range, Western Australia (34°22'S, 118°15'E), 6 July 1969, A. S. George 9390 (holo: PERTH; iso: CANB).

Flowering plant slender, 5-15 cm tall, without basal leaves. *Stem* leafy, finely scabrid; basal bract sheathing, 3-6 mm long. *Leaves* 3-6, narrowly lanceolate, acute, 6-23 mm long, 1.5-5.5 mm wide. *Flower* 1, erect, translucent white banded with bright to pale green. *Galea* 15-24 mm tall, the hood curved forward and slightly downward. *Dorsal sepal* gibbous near base, broadly linear above, rather abruptly narrowed to obtuse apex. *Petals* slightly exceeding dorsal sepal, the apices obtuse, dilated and concave forming a prominent hood 9-10 mm wide; outer margins slightly irregular. *Lateral sepals* erect, 22-30 mm long, united and narrowly cuneate for 10-14 mm, the apices filiform, terete, slightly clavate in distal 2-3 mm; sinus horizontal, the margin inrolled with a prominent central, obtuse, emarginate lobe. *Labellum* lamina oblong, obtuse, 5-6.5 mm long, with basal hair tuft. *Column* 7-8 mm high.

Selected collections examined. 19 miles (c. 30 km) N of Regans Ford, 19 July 1978, R. Cranfield 225 (PERTH); 8 km N of Kukerin, 1 July 1970, A. S. George 9898 (PERTH); Boyatup Hill, 33°44'S, 123°02'E, 13 Aug. 1980, A. S. George 15980 (PERTH); Manmanning, 10 Aug. 1974, B. & M. Smith (PERTH); 1 km N of Gibson, 5 Aug. 1980, D. R. Voigt s.n. (PERTH).

Distribution. Western Australia, at scattered localities in the south west between Perth and Israelite Bay, with an isolated occurrence at Point Culver on the edge of the Great Australian Bight.

Habitat. In sand in Eucalypt low woodland and open shrubland, usually in shelter of shrubs; also in granitic soil in closed scrub; at Gngangara persists in plantation of *Pinus radiata*.

Flowering period. June-August.

Affinity. *Pterostylis dilatata* is clearly related very closely to *P. nana* R. Br. and I have deliberated for some years as to the rank it should be given. It may easily be distinguished from *P. nana* by the lack of any basal leaves in flowering plants, and by the broad apices of the petals which give the galea a more hooded aspect. In *Pterostylis*, the presence or absence of a basal rosette in flowering plants has been considered important in the infrageneric classification and usually is linked to significant floral characters. *Pterostylis nana* and *P. dilatata* are exceptions, for their flowers are very similar morphologically.

The plant described by Lindley as *Pterostylis pyramidalis* is a variant of *P. nana* in which the basal leaves form a loose, not compact, rosette.

Conservation status. Rare, coded 3RC (Leigh, Briggs & Hartley 1981).

Etymology. The Latin *dilatatus*, widened, refers to the apices of the petals.

Thelymitra variegata (Lindley) F. Muell. var. ***apiculata*** A. S. George, var. nov. (Figure 3L)

A *Thelymitra variegata* (Lindley) F. Muell. typica lobis lateralibus columnae apiculatis differt; apiculi filiformi, 0.5-1 mm longi. Folium non spirale. Segmenta perianthii 10-17 mm longa, purpurea maculis atro-purpureis, marginibus aureis.

Typus: 7 miles (11 km) SE of Badgingarra homestead, Western Australia (30°29'S, 115°36'E), 19 June 1961, A. S. George 2598 (holo: PERTH).

Differs from typical *Thelymitra variegata* (Lindley) F. Muell. in the apiculate lateral lobes of the column: apiculi filiform, 0.5-1 mm long. *Leaf* not spiral. *Perianth segments* 10-17 mm long, bright purple with deep purple spots, the margins golden.

Collections examined. 3 miles (5 km) SW of Mt Lesueur, 24 July 1969, K. M. Allan 65; Stockyard Gully, July 1963, W. H. Butler; 2 miles (3 km) E along McNamarra Road from Brand Hwy, near Badgingarra, 19 July 1978, R. Cranfield 246; c. 5 miles (8 km) NE of Hill River Spring on Watheroo road, 19 June 1961, A. S. George 2608; Mogumber Mission, June 1965, M. C. George; near Jurien turnoff from Brand Hwy, 1981, P. Nikulinsky; Watheroo, 2 Aug. 1971, Mrs Scott (fls almost over). All collections at PERTH.

Distribution. Western Australia, between Eneabba and Mogumber.

Habitat. In lateritic sand in low shrubland.

Flowering period. June-July.

Discussion. *Thelymitra variegata* is variable in size and in the representation of gold and pale and deep purple in the perianth, but in general the floral morphology remains uniform. An exception is found in northern populations where the lateral lobes of the column each bear a fine apiculum. In addition the plants usually flower very early, in June and July; the typical variety flowers in August and September, although it may appear in July on the heaths east of the Stirling Range. The geographical range of var. *apiculata* is mostly to the north of that of var. *variegata*, but there are collections of the latter from Watheroo and Mt Lesueur.

Conservation status. Endangered, coded 2E (Leigh, Briggs & Hartley 1981).

Etymology. The varietal epithet refers to the fine points on the column lobes.

Acknowledgements

I am pleased to acknowledge discussions with a number of people about these orchids, in particular Andrew Brown, Laurie Byrne, Mark Clements, Ron Heberle, Noel Hoffman, Stephen Hopper and Warren Stoutamire.

I am also very grateful to Annette Wilson for preparing most of the Figures.

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A new species of *Darwinia* (Myrtaceae) from the Perth Region, Western Australia

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Abstract

Marchant, N. G. A new species of *Darwinia* (Myrtaceae) from the Perth Region, Western Australia. Nuytsia 5(1): 63-66 (1984). A new species, *Darwinia apiculata*, from near Kalamunda, suburban Perth, Western Australia, is described and illustrated. It belongs to sect. *Genetyllis* (DC.) Benth. and is similar to *D. helichrysoides* (Meisn.) Benth. and *D. oederoides* (Turcz.) Benth., differing in its habit, bracts, bracteoles, calyx lobes and corolla lobes. *Darwinia apiculata* is known only from the type locality.

The genus *Darwinia* Rudge (Myrtaceae) is currently being revised by the author. This new species is described in order to validate its inclusion in the projected handbook on the "Flora of the Perth Region" the boundaries of which are defined by Marchant & Perry (1981).

Darwinia apiculata N. G. Marchant, sp. nov. (Figure 1)

Frutex rotundatus 40-50 cm altus. *Rami* juveniles foliis manifeste decurrentibus. *Folia* dispersa; *petiolus* 0.2-0.3 mm longus; *lamina* lineari-triquetra, apicem versus irregulariter ciliolata, apiculata. *Involucri bractee exteriores* anguste ovatae, longe acuminatae, 8-10 mm longae, superficie abaxiali basi gibbosae. *Involucri bractee interiores* anguste ovatae, longe acuminatae, triquetrae, 10-15 mm longae, superficie adaxiali profunde concava. *Flores* 4-8. *Bracteolae* 2, cymbiformes. *Tubeus floralis* prominenter 5-costatus. *Calycis lobi* late ovati usque obovati. *Corollae lobi* trullato-ovati. *Stamina* 10. *Staminodia* 10, anguste triangulares. *Ovula* 2.

Typus: Uncleared area west of Alpine Rd, west of Kalamunda, 31°58'S, 116°02'E, Western Australia, 17 Oct. 1982, N. G. Marchant 82/111 (holo: PERTH; iso: CANB, K).

Densely branched, rounded *shrubs* 40-50 cm tall. Young *branches* slender, red, with prominent, decurrent leaf bases. *Leaves* scattered; *petioles* erect, 0.2-0.3 mm long; *laminae* horizontally spreading, linear-triquetrous, adaxial surface convex with a raised keel, 3-5 mm long on young stems, 5-6.5 mm long on mature stems, irregularly ciliate towards apices, acute, apiculate. *Inflorescences* fusiform in bud, becoming ovoid or broadly ovoid, cernuous. *Floral leaves* patent, pale green, petiole 0.5-1 mm long, lamina narrowly ovate, acuminate, 6.5-8 mm long, abaxial surface gibbous at the base. *Outer involucral bracts* narrowly ovate, long acuminate, 8-10 mm long, abaxial surface gibbous at the base, adaxial surface with narrow, lateral wings near the base, upper part triquetrous and sparsely ciliate. *Inner involucral bracts* narrowly ovate, long acuminate, triquetrous, 10-15 mm long, green, yellow-green or yellow and red, ciliate, abaxial surface gibbous at the base, adaxial surface deeply

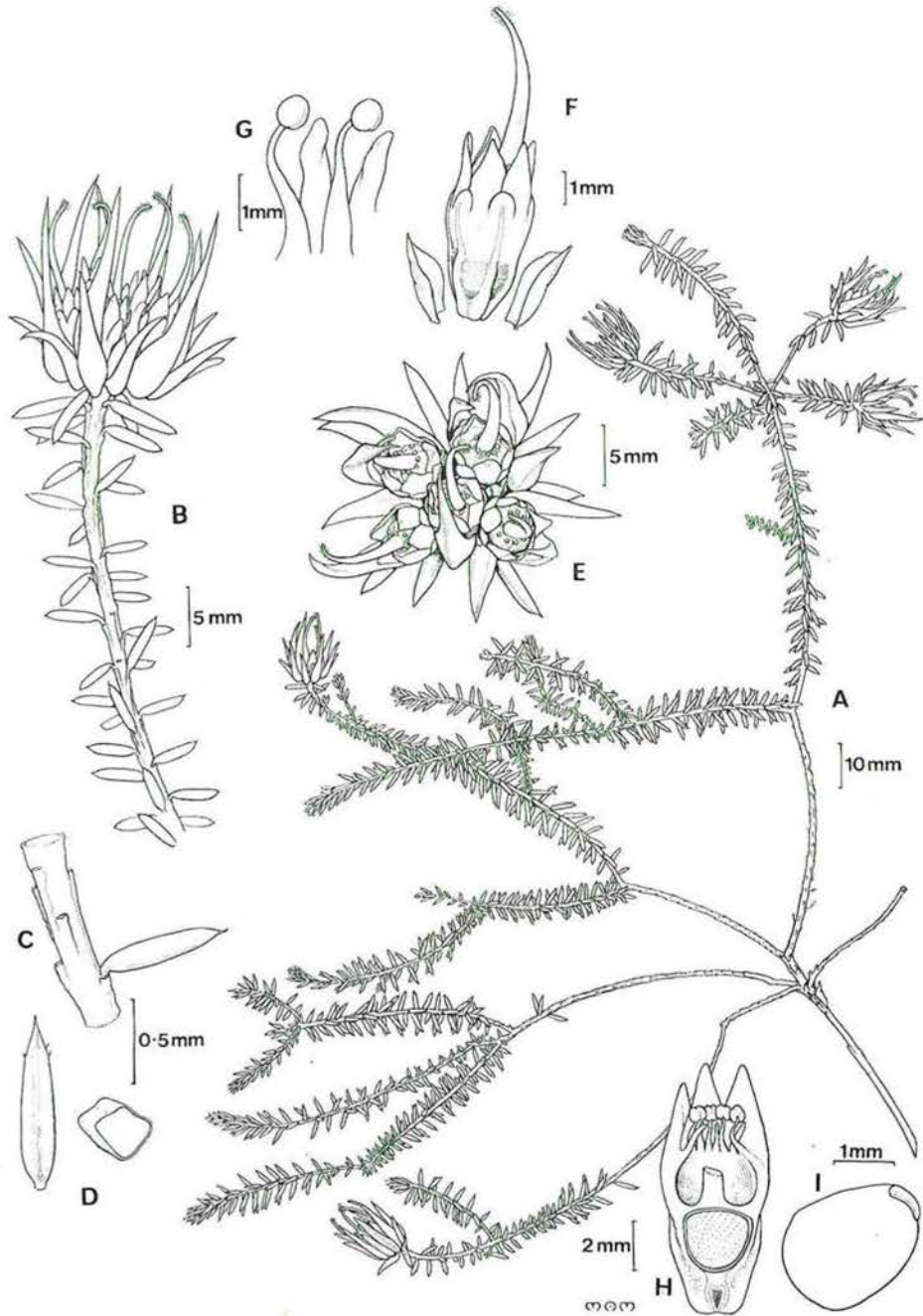


Figure 1. *Darwinia apiculata*. A—Habit. B—Portion of branch showing inflorescence. C—Enlarged portion of branch showing decurrent leaf bases. D—Single leaf and transverse section. E—Inflorescence (viewed from below) showing floral leaves, involucral bracts and five flowers. F—Single flower and two bracteoles. G—Two stamens and two staminodes. H—Fruit in longitudinal section showing single seed. I—Embryo showing turgid radicle and appressed plumule.

All drawn from living material.

concave. *Flowers* 4-8. *Bracteoles* 2, cymbiform, ovate when opened out, 3-4 mm long, 1.5-2.5 mm wide, acuminate. *Floral tubes* obconical, 2.5-3 mm long, with 5 prominent costae which continue into the calyx lobes; intercostal regions with 1 or more minute horizontal ridges and wrinkles; lower part brown; upper part yellow-green. *Calyx lobes* broadly ovate to broadly obovate, 1 mm long, 1 mm wide, entire, obtuse. *Corolla lobes* trullate-ovate, 2.5-3 mm long, 1.5-2.5 mm wide, acute, entire; *margins* slightly involute. *Stamens* 10; *filaments* slightly dilated at base, fused to staminodes in lower part, free part less than 1 mm long; anthers ovoid. *Staminodes* 10, alternating with the stamens, narrowly triangular, as long as the staminal filaments. *Style* falcate, introrse, slightly dilated at the middle, 6-9 mm long, red. *Style end* tapering to a truncate apex which is subtended by a 1 mm wide band of diffuse hairs. *Ovules* 2. *Fruits* apparently rarely developed, indehiscent, with all dried floral parts attached; *floral tube* slightly enlarged, hardened, pale-coloured. *Seeds* 1, rarely 2, exalbuminous; testa thin. *Embryo* consisting almost entirely of the turgid radicle 0.6-0.8 mm diameter; *plumule* sub-apical, appressed to radicle, consisting of a pair of minute, terminal cotyledons c. 0.1 mm long and a slightly flattened hypocotyl c. 0.3 mm long.

Distribution. Known only from a single locality west of Kalamunda, suburban Perth, where it occurs sporadically over 5-6 ha.

Habitat. Under dry sclerophyll woodland of Jarrah (*Eucalyptus marginata*) and thickets of *Dryandra sessilis* on a level, lateritic soil c. 250 m above sea level.

Affinities. *Darwinia apiculata* belongs to sect. *Genetyllis* which is characterised by short calyx lobes and flowers in simple, terminal heads. It superficially resembles *D. helichrysoides* (Meisn.) Benth. and *D. oederoides* (Turcz.) Benth. The three species are easily distinguished by the characters given in Table 1.

Table 1. Distinguishing features of *D. apiculata* and two allied South-western Australian species of *Darwinia*.

	<i>D. apiculata</i>	<i>D. helichrysoides</i>	<i>D. oederoides</i>
Habit	densely branched, 40-50 cm tall	sparsely branched, 20-45 cm tall	sparsely branched, prostrate
Inner involucre bracts			
length	10-15 mm	20-26 mm	13-16 mm
apex	acuminate	acute	acute
Bracteoles	3-4 mm x 1.5-2.5 mm	6-7 mm x 6-7 mm	12-15 mm x 2-2.5 mm
Calyx lobes			
shape	broadly ovate-broadly obovate	ovate	triangular
length	1 mm	2.5-3.5 mm	1 mm
Corolla lobes			
shape	trullate-ovate	trullate-ovate	triangular
apex	acute	obtuse	obtuse

Conservation status. (Leigh, Briggs & Hartley 1981). Endangered. *Darwinia apiculata* is known only from 5-6 ha. of uncleared, partly disturbed Crown Land with a total estimated population of 150-200 individual plants.

Etymology. The specific epithet refers to the distinctly apiculate leaves.

Acknowledgements

I am grateful to Mr & Mrs R. Hamilton, Kalamunda for drawing my attention to the new species. The illustration was kindly prepared by Margaret A. Menadue, while Paul Wilson made valuable suggestions for improving the manuscript. Professor K. H. Rechinger expertly provided the Latin diagnosis.

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Reinstatement of *Spinifex sericeus* R.Br. and hybrid status of *S. alterniflorus* Nees (Poaceae)

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Abstract

Craig, G. F. Reinstatement of *Spinifex sericeus* R.Br. and hybrid status of *S. alterniflorus* Nees (Poaceae). Nuytsia 5(1): 67-74 (1984). *Spinifex sericeus* R.Br., previously included under *S. hirsutus* Labill., is reinstated. *S. alterniflorus* Nees, a hybrid of *S. hirsutus* Labill. and *S. longifolius* R.Br., is described. Distinguishing features and a key to the Australian species of the genus are presented; distribution maps are provided.

Introduction

There are four species of *Spinifex* growing in Australia, one of which is a naturally occurring hybrid between *Spinifex hirsutus* Labill. and *S. longifolius* R.Br., called *S. alterniflorus* Nees. A fifth species, *S. littoreus* (Burm. f.) Merr. is absent from Australia.

Robert Brown (1810) recognised *Spinifex sericeus*, which he described from collections in the area of Port Jackson, New South Wales and on the coast of Queensland, as being distinct from *S. hirsutus* Labill. (1806-7), the lectotype of which was collected by Labillardière from the south coast of Western Australia. *S. sericeus* R.Br. was later made a synonym of *S. hirsutus* Labill. by Bentham (1878). Recent studies (Craig 1982) suggest that *S. sericeus* R.Br. should be reinstated.

Discussion

Morphology. The major vegetative features which distinguish *Spinifex hirsutus* and *S. sericeus* are leaf blade width and internode diameter. The more robust *Spinifex hirsutus* has often very short stem internodes, 9 to 18 mm diameter, and broad leaf blades (9 to 17 mm width). This compares with *S. sericeus* which has relatively narrow stem internodes, 4 to 8 mm diameter, and narrower leaves (5 to 10 mm leaf blade width).

Spinifex alterniflorus is morphologically intermediate to *S. hirsutus* and *S. longifolius*. It can be distinguished from both species by having a narrow leaf blade (3 to 7 mm broad) which is sparsely pubescent below and glabrous above.

Biochemistry. Starch gel electrophoresis of enzymes show clear distinctions between the varieties. Variations in allelic patterns were observed for ADH, IDH, GOT, LAP and PGM enzymes (Craig 1982) which highlight the phenotypic variation between the *Spinifex* species.

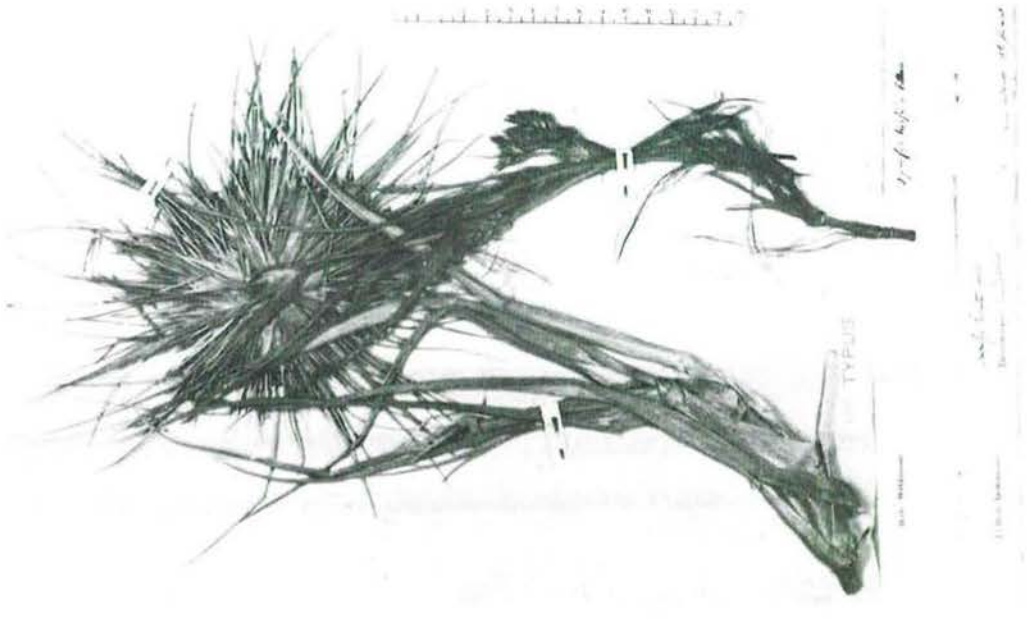


Figure 1. Type specimens of *Spinifex hirsutus* Labill. (1806). The bisexual inflorescence (L.H.S.) is typical of Western Australian populations, and the male inflorescence (R.H.S.) from eastern Australian populations.

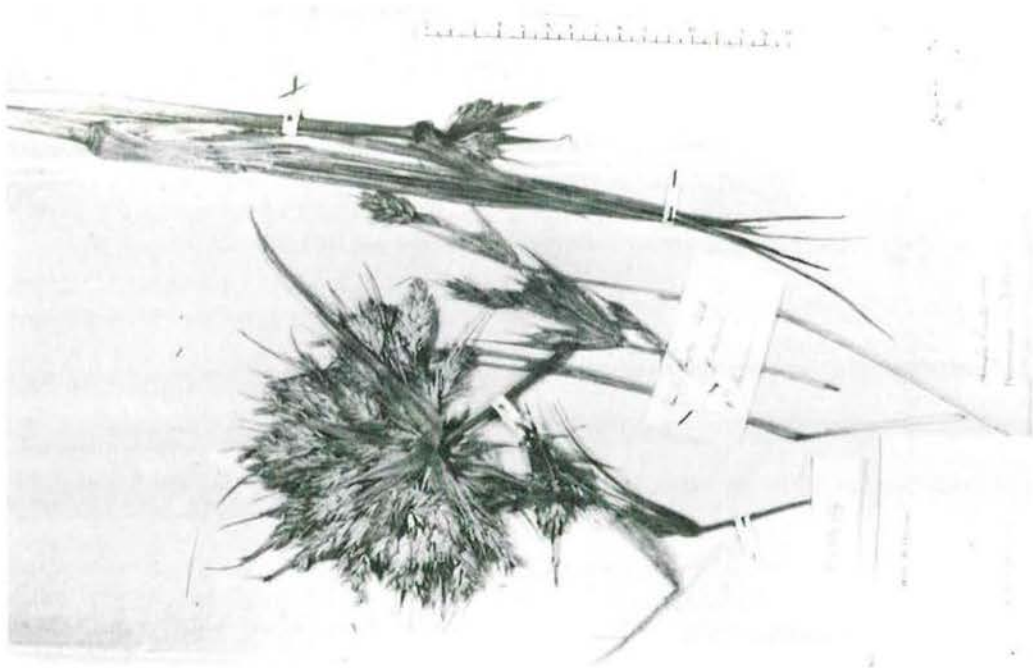


Figure 2. Lectotype sheet of *Spinifex hirsutus* Labill. (1807), probably collected from Esperance Bay in Western Australia.

Pollen fertility. Estimates show 83% pollen viability for *S. hirsutus*, 93% viability for *S. sericeus*, and from 0 to 10% viability for *S. alterniflorus* (Craig 1982).

Distribution. The two species are geographically distinct. *Spinifex hirsutus* is restricted to the south-west of Western Australia, and *S. sericeus* occurs in the eastern states of Australia, including Tasmania. It is also found in New Zealand. *Spinifex alterniflorus* occurs where the distributions of *S. hirsutus* and *S. longifolius* overlap, that is, in the south-west of Western Australia between Bunbury and Perth.

Photographs of the type specimens of *Spinifex hirsutus* Labill. (1806-7) held at the Herbarium Universitatis Florentinae (FI) and *S. sericeus* R.Br. (1810) held at the British Museum (BM) were examined. The type material of *S. hirsutus* is likely to have come from Esperance Bay in Western Australia or "capite van-Dieman" (Tasmania) where Labillardière visited during 1791-94 while on d'Entrecasteaux's voyage. Both the broad-leaved and narrow-leaved variants are included as types (Figure 1). A specimen labelled "cotypus" (Figure 2) closely resembles the male inflorescence illustration published by Labillardière (1807, tab. 231) and one labelled "isotypus" (Figure 1) resembles the bisexual inflorescence illustration (tab. 230) in the same publication. Stem width and leaf width measurements show that these specimens correspond to the broad-leaved *Spinifex* which grows in Western Australia. Thus the name *S. hirsutus* Labill. is restricted to the broad-leaved robust form, and the name *S. sericeus* R.Br. is reinstated for the narrow-leaved plant of eastern Australia.

Taxonomy

The following key distinguishes the three commonly occurring species of *Spinifex* in Australia, as well as a fourth, rarely mentioned species, *S. alterniflorus* Nees. This is a naturally occurring hybrid between *S. hirsutus* and *S. longifolius* which occurs between Bunbury and Perth in Western Australia (Craig 1982). A fifth species, *S. littoreus* (Burm. f.) Merr. grows on the sandy shores of India, Burma, Java and China (Trimen 1974); it is absent from Australia.

- 1a. Leaves glabrous on both lower and upper side, rigid, narrow *S. longifolius* R.Br.
- b. Leaves silky-pubescent or villous on one or both sides, flexuose.....2
- 2a. Leaf blades villous below and glabrous above, 3-7 mm broad, green3. *S. xalterniflorus* Nees
- b. Leaf blades densely hairy on both sides, 5-17 mm broad, grey-green.....3
- 3a. Stem internode diameter 9-18 mm; leaf blade 9-17 mm broad, densely silky pubescent; base of female or bisexual spikelet hairy; male spikelet 11.5 to 13.5 mm long.....1. *S. hirsutus* Labill.
- b. Stem internode diameter 4-8 mm; leaf blade 5-10 mm broad; base of female or bisexual spikelet glabrous; male spikelet 9.5 to 10.5 mm long.....2. *S. sericeus* R.Br.

Spinifex longifolius has been taxonomically described by Gardner (1952). It is a native coastal species of Australia, extending from Geographe Bay in Western Australia northwards through Northern Territory, New Guinea and the lesser Sunda Islands to Java (Sauer 1965). There are a few scattered occurrences in northern Queensland (McDonald 1979).

In Western Australia north of Geraldton it is the principal binding agent of the seawardmost foredunes. In the South-West, *Spinifex longifolius* more commonly grows on foredunes in sheltered areas where there is little sand inundation, rather than sites where sand is rapidly accreting.

Spinifex longifolius flowers between May and September in the north, and between August and November in the south-west of Western Australia.

1. *Spinifex hirsutus* Labill., Nov. Holl. Pl. 2: 81, tab. 230, 231 (1806-7). *Lectotype* (here selected): Esperance Bay, *Labillardière* (FI, photo seen, Figure 2) specimen labelled "Cotypus."

Culms creeping, stout, much branched, with usually very short terete internodes, 9 to 18 mm diameter, and imbricate leaf-sheaths which are persistent and mostly crowded on the older parts. *Leaf-sheaths* broad, open, scarcely keeled, truncate, striate, silky-pubescent on the outside and densely ciliate on the margins; *ligule* a densely ciliate rim. *Leaf blades* flat, linear, 9 to 17 mm broad and up to 35 cm long, densely silky-hairy on both sides. *Male inflorescence* pedunculate, consisting of clustered racemes, several together forming a terminal pseudo-head with usually a few fasciculate racemes some distance below, and subtended by lanceolate silky-villous spathioles. *Racemes* with sessile spikelets not distichously arranged. *Spikelets* on very short stout pedicels, solitary, silky-hairy, 11.5 to 13.5 mm long; *glumes* equal, 10.0 to 13.0 mm long and 5 to 9 veined; *lemmas* equal, 10.0 to 14.0 mm long, lower lemma 6 to 8 veined and upper lemma 5 veined. *Female inflorescence* a pseudo-head of racemes (each of which is reduced to one or rarely two spikelets), 1 to 3 on a single flowering stem, surrounded by bracts which vary from lanceolate to linear-subulate; rachis up to 15 cm long ending in a long subulate point or stout bristle. *Spikelets* sessile or subsessile, lanceolate in outline, 12.5 to 18.0 mm long, silky at base; *glumes* as long as the spikelet, *lower glume* 10 to 12 veined, *upper glume* 7 to 11 veined; *lemmas* subequal, 11.0 to 15.0 mm long, lower lemma 5 to 9 veined. Lower lemma without *palea*. *Stamens* rudimentary.

Specimens examined (all PERTH). WESTERN AUSTRALIA: Middle Is., Recherche Archipelago, A. S. Weston 10777; Emu Point, Albany, K. Newbey 3511; Albany, Oct. 1945, C. Gardner; Oldfield River, A. E. Orchard 1482; East Mt Barren, J. R. Cannon 361; Eyre, July 1901, Anketell; Israelite Bay, R. A. Saffrey 1332; Mullaloo Beach, T. E. H. Aplin 954; Middleton Beach, Albany, Dec. 1902, C. Andrews.

Distribution. South-west coast of Western Australia, from near Jurien in the north to Eyre on the south coast (Figure 3).

Habitat. Seawardmost foredunes where sand is actively accreting.

Flowering period. November to January.

2. *Spinifex sericeus* R.Br., Prod. 198 (1810). *Type*: Broad Sound, 10 Sept. 1802, R. Brown (holo: BM, photo seen (PERTH)).

[*S. hirsutus* Labill., Nov. Holl. Pl. 2:81, tab. 230, 231 (1806-7) pro parte, not as to lectotype.]

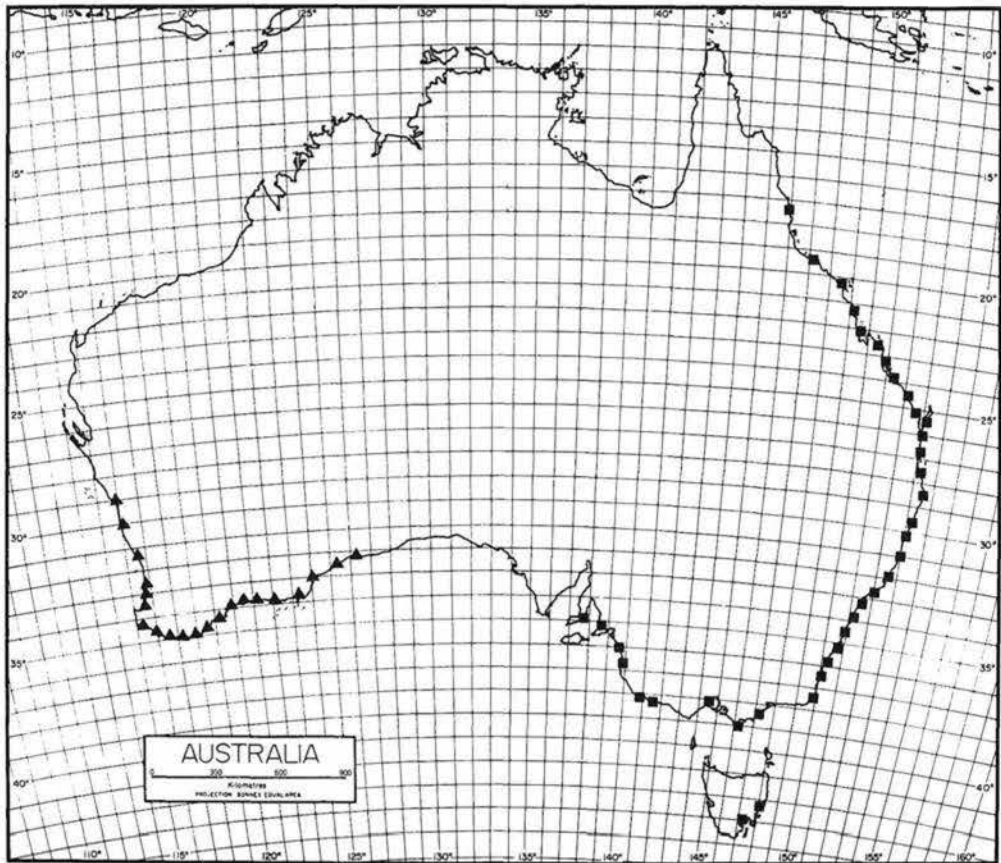


Figure 3. Distribution of *Spinifex hirsutus* Labill. (▲) and *S. sericeus* R.Br. (■) in Australia.

Culms creeping, stem internode diameter 4 to 8 mm. *Leaf blades* flat, linear, 5 to 10 mm broad and up to 38 cm long, silky-hairy on both sides. *Male inflorescence* as in *S. hirsutus*. *Male spikelets* 9.5 to 10.5 mm long. *Glumes* slightly shorter than lemmas, *lower glume* 7.0 to 9.0 mm long and 7 to 9 veined, *upper glume* 8.0 to 10.0 mm long and 6 to 10 veined, *lower lemma* 9.0 to 10.0 mm long and 5 to 7 veined, *upper lemma* 9.5 to 10.5 mm long and 5 veined. *Female inflorescence* similar to *S. hirsutus* but with spikelets glabrous at base. *Spikelet* length 13 to 18 mm long; glumes same length as spikelet; lemmas unequal, lower lemma 9 to 15 mm long and 5 to 9 veined, upper lemma 7 to 13 mm long. *Palea* present in lower lemma, 1/3 to 1/2 as long as palea in upper lemma; upper palea subtending a female floret. *Stamens* rudimentary.

Specimens examined (all PERTH). SOUTH AUSTRALIA: Brighton, *M. Koch* 936.

VICTORIA: Wilson's Promontory *Meebold* 2327; Portland Bay, Nov. 1887, *C. Walter*; Port Phillip, *G. Luehmann*.

NEW SOUTH WALES: Byron Bay, *J. L. Boorman* 9826.

Distribution. *Spinifex sericeus* extends southwards from north Queensland, through New South Wales, Victoria, Tasmania, to near Adelaide in South Australia. It is also found in New Zealand. The distribution map (Figure 3) is derived from Western

Australian Herbarium specimens, McDonald (1979), Hesp (1982) and personal observations. In Western Australia, *S. sericeus* is naturalized at City Beach, Perth, at Bunbury and at Peaceful Bay on the south coast.

Habitat. Coastal foredunes where wind blown sand is being deposited.

Flowering period. November to January in south-east Australia, and June to August in Queensland.

As discussed above, type material of *Spinifex hirsutus* Labill. (1806-7) included the broad-leaved variant of *Spinifex* collected from Esperance Bay, Western Australia, and a narrow-leaved variant presumably collected from Tasmania (Figure 1). The lectotype of *S. hirsutus* Labill. was chosen to be the broad-leaved variant and the narrow-leaved type was later described by Brown (1810) from material collected at Broad Sound, near Mackay in Queensland.

3. ***Spinifex xalterniflorus*** Nees in Lehm., Pl. Preiss. 2: 96 (1846) (pro sp.). *Type:* Swan River, Preiss, n. 1883 (iso: MEL, n.v. (see below)).

Tussock forming *perennial* with creeping stems, dioecious. *Stems* stout, internode diameter 6 to 9 mm. *Leaf blade* with a thick, rigid midrib, margins flattened, narrow (3 to 7 mm broad), villous below and glabrous above. *Male inflorescence* with characters intermediate to *S. hirsutus* and *S. longifolius*. *Female inflorescence* with up to six pseudo-heads of clustered racemes on a flowering stem, each raceme reduced to one or two spikelets; *rachis* up to 17 cm long ending in a subulate point. *Spikelets* sessile or subsessile, lanceolate in outline, 14.5 to 23.5 mm long, silky at base. *Seeds* very rarely reach maturity.

Specimens examined (all PERTH). WESTERN AUSTRALIA: City Beach, Perth, Craig 430 and 440; Floreat Beach, Perth, Craig 441; South Cottesloe, Perth, Craig 442 and 443.

This taxon is a naturally occurring hybrid between *S. hirsutus* and *S. longifolius* with morphological characters intermediate to both species. It has the appearance of *S. longifolius* but can be recognised by being sparsely pubescent below and glabrous above on the leaf blade.

Distribution. Populations of this hybrid occur in Western Australia at City Beach and Floreat Beach, near Perth; Kwinana, Woodman Point, Warnbro, Preston Beach and Leschenault Peninsula, Figure 4.

Habitat. Coastal foredunes in areas where there is light sand deposition.

Flowering period. August to January.

The type held in Melbourne was examined by N. G. Marchant, of the Western Australian Herbarium, and compared with a specimen and table of characters supplied by me. The type bears a note by S. T. Blake saying it is "perhaps a hybrid".

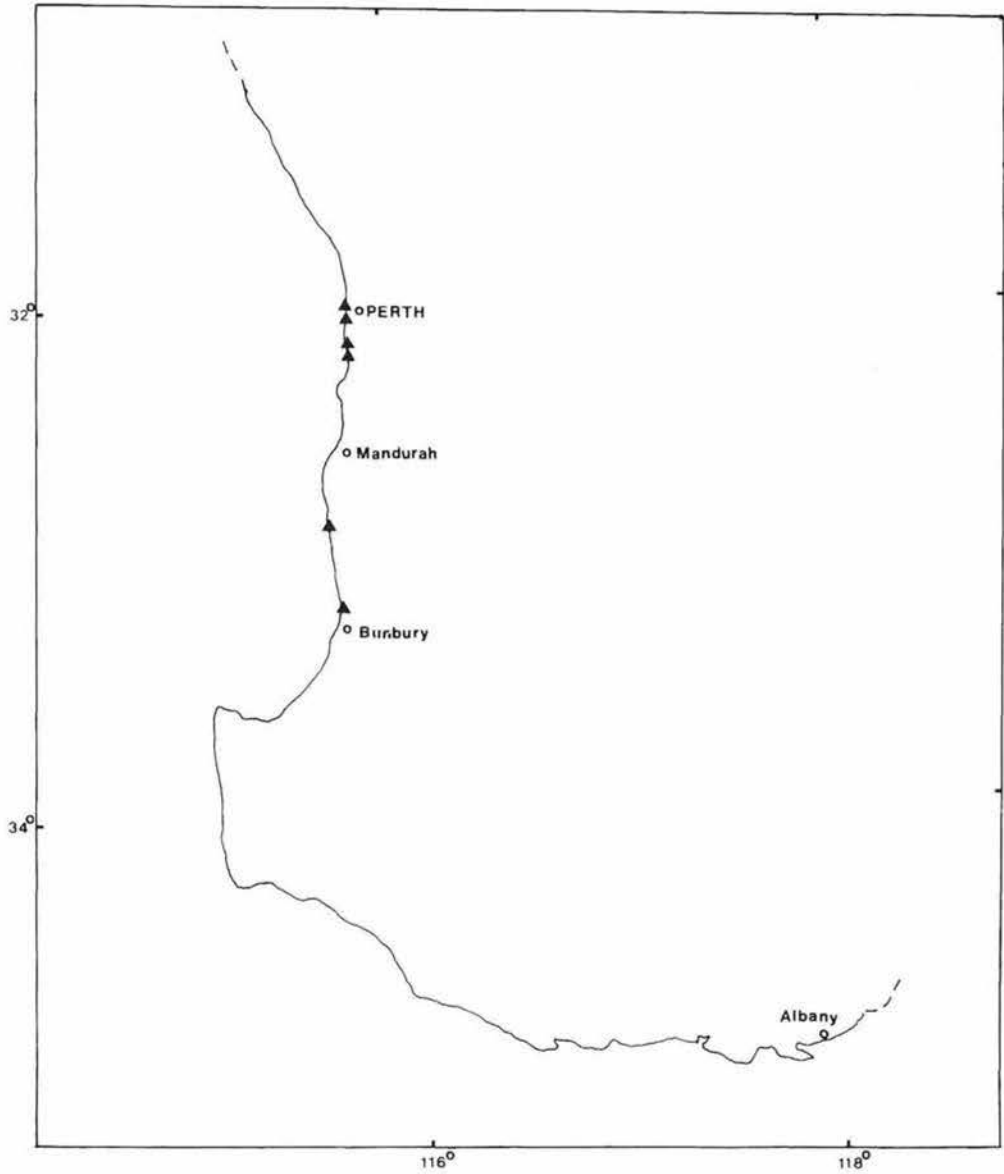


Figure 4. Distribution of *S. xalterniflorus* Nees in the south-west of Western Australia.

Acknowledgements

I am grateful to Mr P. G. Wilson for commenting on the manuscript. Dr J. W. Green kindly made available facilities at the Western Australian Herbarium. Thanks are also due to Miss B. Wilson who took measurements and photographs of type material held in Florence.

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Rumex (Polygonaceae) in Australia: a reconsideration¹

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Abstract

Rechinger, K. H. *Rumex* (Polygonaceae) in Australia: a reconsideration. Nuytsia 5(1): 75-122 (1984). Descriptions and a key are provided for the 8 indigenous and 9 alien species of *Rumex* within Australia. Of the indigenous taxa *R. alcockii*, *R. stenoglottis*, *R. x comaumensis* (*R. bidens* x *R. brownii*) and *R. x johannis-moorei* (*R. brownii* x *R. crispus*) are described as new. *Rumex dumosiformis* is reduced to a variety of *R. dumosus* and *R. flexuosiformis* is relegated to synonymy under *R. drummondii*. Notes on 4 hybrids between alien species are included. A classification for subgen. *Rumex* is proposed in which three new subsections within section *Simplices* are described: subsect. *Amphibii*, subsect. *Australienses* and subsect. *Acrancistrum*. The following taxa are included in this account. Indigenous species: *Rumex alcockii* Rech. f., *R. bidens* R. Br., *R. brownii* Campderá, *R. crystallinus* Lange, *R. drummondii* Meisn., *R. dumosus* A. Cunn. ex Meisn., *R. stenoglottis* Rech. f. and *R. tenax* Rech. f. Alien species: *Rumex acetosella* L., *R. bucephalophorus* L., *R. conglomeratus* Murr., *R. crispus* L., *R. frutescens* Thouars, *R. obtusifolius* L., *R. pulcher* L., *R. sagittatus* Thunb. and *R. vesicarius* L. Hybrids: *R. x comaumensis* Rech. f. (*R. bidens* R.Br. x *R. brownii* Campderá), *R. x johannis-moorei* Rech.f. (*R. brownii* Campderá x *R. crispus* L.), *R. x schulzei* Hausskn. (*R. conglomeratus* Murr. x *R. crispus* L.), *R. x muretii* Hausskn. (*R. conglomeratus* Murr. x *R. pulcher* L.), *R. x pratensis* Mertens & Koch (*R. crispus* L. x *R. obtusifolius* L.) and *R. xpseudopulcher* Hausskn. (*R. crispus* L. x *R. pulcher* L.).

Introduction

Rumex is a world-wide genus of about 160 species, a considerable number of which comprise geographical races which could be interpreted as subspecies. The genus as a whole has been monographed twice, once by Campderá (1819) and once by Meisner (1856). Both these treatments are now outdated. In a series of contributions towards a new generic monograph I have either revised the genus on a regional basis (South America 1933b, Australia and New Zealand 1935a, North America 1937, Asia 1949, Africa 1954) or have dealt with individual species-complexes (1932, 1933a and 1939). These papers, together with my treatments of *Rumex* for Flora Europaea (1964) and for the second edition of Hegi's Flora von Mitteleuropa (1958) include all known species except for a small endemic Hawaiian group which is still in need of revision.

My account of the Australian (and New Zealand) species (1935a) was based on the limited herbarium material available at the time. It was felt that the Australian species should be reappraised before summarizing the results of my studies in this genus. The current study was conducted during a visit to Western Australia from October to December 1982.

In this account the eight indigenous and nine alien species of *Rumex* currently known from Australia are described. These are the same species as in my 1935a revision except for the following: two new indigenous species, *R. alcockii* and *R. stenoglottis*, are described; two new hybrids, *R. x comaumensis* (*R. bidens* x *R.*

¹The present paper is to be regarded as "Vorarbeiten zu einer Monographie der Gattung *Rumex* IX". See references for previous publications.

brownii) and *R. xjohannis-moorei* (*R. brownii* x *R. crispus*) are described; *R. dumosiformis* has been reduced to a variety of *R. dumosus*; three alien species, *R. frutescens*, *R. sagittatus* and *R. vesicarius*, not previously recorded are included; notes on four hybrids between alien species are included viz. *R. xschulzei* (*R. conglomeratus* x *R. crispus*), *R. xmuretii* (*R. conglomeratus* x *R. pulcher*), *R. xpratensis* (*R. crispus* x *R. obtusifolius*) and *R. xpseudopulcher* (*R. crispus* x *R. pulcher*).

Species are arranged within the text according to the infrageneric classification which is outlined below. In most cases only a selection of specimens seen has been listed. Those herbaria from which material was examined are given in the Acknowledgements. The study was conducted at herb. PERTH and it is believed that the specimens examined there included the majority of those currently housed in Australia.

I here take the opportunity of correcting some misprints in my 1937 publication.

- p. 7, description of subsect. *Densiflori*, first line: read valvae ecallosae instead of callosae.
- p. 8, description of subsect. *Hydrolapatha*, second line: read latitudine instead of longitudine.
- p. 8, description of subsect. *Obtusifolii*, first line: read latitudine instead of longitudine.
- p. 8, description of subsect. *Dentati*, second line: read latitudine instead of longitudine.
- p. 8, description of subsect. *Maritimi*, second line: read latitudine instead of longitudine.
- p. 18 line nine (key): pedicels short, thick, about as long as the fruit instead of: long, slender, nearly twice as long as the fruit.

Geographical distribution and ecology of indigenous species

For the first time the distributions of indigenous Australian *Rumex* species have been mapped. I am of the impression that except for some areas of south eastern Australia, these distributions are incomplete. This may reflect a certain lack of interest in the genus by collectors within certain areas. I hasten to add, however, that following three months in Western Australia where field work was conducted between Kalbarri and Albany, I was successful in locating only two indigenous species of *Rumex* (*R. brownii* and *R. dumosus*). Indigenous species are evidently either rare or geographically very restricted, at least in this part of Australia. This experience raises the question as to whether or not *R. drummondii* has become extinct.

Most of the indigenous Australian species are centred in the south-east of the continent. One of the most geographically restricted species is *R. bidens*, a semi-aquatic plant which is found in freshwater swamps (Figure 11A). Its thick, hollow, creeping rhizome is at least temporarily submerged and from this arise short, usually unbranched inflorescences. It is known from New South Wales near the Murray River, Victoria, Tasmania and parts of South Australia. *Rumex brownii* is widespread in both coastal and inland areas of south eastern Australia but there are scattered, disjunct occurrences in Queensland, Central Australia and south-west Western Australia (Figure 13A). This species is also recorded for New Zealand, New Guinea, Timor and Java and it is not known what comprised its original area of occurrence.

Rumex alcockii, here segregated from *R. brownii*, is mainly confined to the Eyre and Yorke Peninsulas and the Flinders and Gawler Ranges in South Australia. This species occurs near the western limit of distribution of *R. brownii* in S.A. (compare Figures 13A and B). *Rumex tenax* has a fairly wide south-east Australian distribution but in contrast to (the unrelated) *R. brownii* it is evidently confined to the interior parts of the country west of the Great Dividing Range (Figure 11B). *Rumex crystallinus*, the only annual among the indigenous Australian species, inhabits the borders of temporarily submerged depressions and watercourses in arid/semi-arid inland areas. It is certainly not a weedy species and its few scattered records in the central and more northern parts of the continent and the one single very disjunct locality in Western Australia may well reflect undercollecting in the intervening areas (Figure 14).

Rumex dumosus and *R. stenoglottis* are also south-east Australian species. As I am unable to distinguish these two species when in flower, many herbarium specimens could not be named. Therefore the distributions shown in Figures 12A and 12B are rather incomplete. From available information *R. dumosus* (including var. *dumosiformis*) predominates in the south-east of Australia; the more northerly Queensland localities shown on Figure 12B look to represent a true disjunction.

In contrast to *R. dumosus*, *R. stenoglottis*, with few exceptions, has a more northerly, inland distribution occurring from 27° to 37°S and diagonally from 146° to 151°E (Figure 12A). *Rumex drummondii*, the third representative of the *dumosus*-group, is a little-known south-west Western Australian endemic.

Aliens

The European and Mediterranean species *R. acetosella* s.l., *R. crispus*, *R. pulcher*, *R. conglomeratus* and *R. obtusifolius* seem to have accompanied the early settlers in the first half of the last century. These species occasionally grow together and except for *R. acetosella*, hybrids occur between them (see below).

Rumex vesicarius (subgen. *Acetosa*), a saharo-sindian species which is widespread throughout desert and semidesert areas of North-Africa and Southwest Asia, seems to be the most recent immigrant to Australia. In 1921 Domin described this as a new species, *R. clementii*; later it was partly misnamed as *R. roseus* L., a closely allied but clearly distinct species. Today *R. vesicarius* is spread over vast areas of Australia and it attracts public attention by its large, often purplish tinged valves and its pale green, somewhat succulent leaves. One may speculate that this species was introduced to Australia by Afghan camel drivers during the latter half of last century. The South American *R. frutescens* is reported here as new to Australia. It was first recorded from Coode Island, Melbourne, a locality no longer existing owing to harbour works at the mouth of the Yarra River. It was rediscovered in 1981 at William Bay, 70 km west of Albany, W.A., by John Moore. Its main distributional area is South America but it is also known from two small islands in the South Atlantic: Gough Island and Tristan da Cunha. *Rumex sagittatus* (subgen. *Acetosa*) is a climber with tuberous roots and sagittate leaves. This South African species represents a garden escape within Australia. *Rumex bucephalophorus*, an extremely polymorphic, predominantly annual Mediterranean species, is a rare and evidently casual alien in Australia.

The most frequent alien of the genus is definitely *R. acetosella* (subgen. *Acetosella*). Its frequency can be judged from its representation in the major Australian herbaria as well as from my own field observations. When making excursions

in various directions from Perth, I have seen it practically everywhere along roadsides and on other disturbed sites. It covers huge areas of neglected fields south-west of Capel.

The most frequent species of the subgenus *Rumex* is beyond doubt *R. crispus*. Its strict habit is very characteristic and is unlike all other *Rumex* species occurring within Australia. *Rumex crispus* fruits somewhat earlier than the other species of subgen. *Rumex* but there is sufficient overlap of flowering times to permit hybridization to occur. Probably *R. pulcher* with its two subspecies is the third most common alien species of *Rumex* in Australia where its spread seems to have been favourably influenced by its high drought-tolerance. In the past this alien species was confused with the indigenous *R. dumosus* and *R. drummondii*, an error dating back to Bentham's (1870) treatment of *R. pulcher* (see sp. no. 9 below for further details). *Rumex conglomeratus* and *R. obtusifolius* are of only minor importance as aliens within Australia.

Rumex hymenosepalus Torrey, Botany Mexican Boundary 177 (1858), from the Southwestern United States and Mexico, is recorded in the NSW census (Jacobs and Pickard 1981) as naturalized (sporadically) in N.S.W. and Victoria. It is characterized by tuberous roots, somewhat succulent stems without axillary branches, fleshy, lanceolate, acuminate leaves with cuneate base and large, delicate, entire valves lacking callosities. Its taxonomic position within subgen. *Rumex* is isolated. The large valves lacking callosities are somewhat similar to those of *R. vesicarius*, but the latter species is an annual and belongs to subgen. *Acetosa*. *Rumex hymenosepalus* inhabits the most arid parts of SW North America and is there locally frequent on sandy and sometimes saline soil. For details see Rechinger (1937: 89-92).

Hybridization

Hybridization occurs frequently between most of the species of subgen. *Rumex*. These hybrids are usually highly sterile therefore back-crossing seems rare and hybrid introgression is absent. Pollen sterility is easily recognized by the grains either being of more or less unequal size or sometimes clumped together and forming an amorphous mass which is not released from the anthers.

In nature, hybrids of *Rumex* may be recognized by their appearance. The primary panicle sheds most of the sterile flowers but the plants continue to grow and tend to form secondary flowering panicles. Thus the hybrids are often taller than the parents and assume an untidy habit. Additionally most hybrids fail to set fruit because the flowers dry and fall off before full development of the valves (i.e. the three inner perianth segments) occurs. The few fruits which do reach full size combine the characters of the parents in various ways. Often these hybrid nuts, even if reaching full size, are not viable and can be compressed between the fingers.

From the large amount of Australian herbarium material examined, all the hybrids detected, with two exceptions, had European species as both parents. The most frequent hybrid is *R. crispus* x *R. obtusifolius* and this has been recognized by collectors in several cases. In Europe it is found wherever the parents grow together and it is evidently the most frequent hybrid in the genus and perhaps the most frequent of any genus within Europe. *Rumex crispus* x *R. pulcher* has only recently been found in south-west Western Australia by John Moore and by myself. Occurring also at the same locality were *R. conglomeratus* x *R. crispus* and *R. conglomeratus* x *R. pulcher*.

Rumex bidens × *R. brownii* is described below as the first recorded hybrid between indigenous Australian species. Also for the first time, a hybrid between an indigenous Australian species (*R. brownii*) and an alien (*R. crispus*) is here described viz. *R. xjohannis-moorei*.

Two hybrids in which *R. dumosus* or one of its relatives is one of the parents originated among plants cultivated by Danser in the 1920's, viz. *R. xascendens* Danser (*R. dumosus* × *R. salicifolius*) and *R. xupsaliensis* Danser (*R. dumosus* × *R. sp.*). These hybrids were included in my 1935a treatment of Australian *Rumex* but are not dealt with in the present paper.

The taxonomy of subgenus *Rumex*

As all the indigenous Australian species of *Rumex* occur in subgen. *Rumex* it is appropriate here to fit these into the classification which I first proposed in 1937 (for North American species) and extended in 1949 (to include Asiatic species) and 1953 (to include African species). The framework of this classification is presented below where it will be seen that three new subsections (*Acrancistrum*, *Amphibii* and *Australienses*) within sect. *Simplices* have been described in order to accommodate the Australian taxa. The basis of this classification is the combination of fruiting and growth characteristics, hopefully resulting in a more natural arrangement of species than has hitherto been proposed for this subgenus.

Meisner (1857) divided subgen. *Rumex* (his section *Lapathum*) into two groups, one containing species with entire fruiting valves and the other containing species with dentate valves. This arrangement is considered to be highly artificial.

In an earlier paper (Rechinger 1949b) I outlined certain evolutionary trends within subgen. *Rumex* (syn. subgen. *Lapathum*). The taxonomy of this subgenus is based on the transformation characteristics of the three inner perianth segments (valves) during the ripening process. The three main types of valve modification are:

1. The valves become more or less membranous and a network of nerves develop.
2. The midrib of one or all three valves more or less thickens and is transformed into a basal callosity.
3. The margins of the valves develop teeth of various number, shape, direction and length.

These modifications may occur separately or combined in various ways. They may be limited to a single species or to a group of species. In some cases all possible combinations occur within a single very polymorphic species, resulting in parallelism and convergence. These facts, together with the ability of many species to hybridize, cause some of the main problems for the taxonomist within this subgenus.

Growth characters are of primary importance in dividing subgen. *Rumex* into its component sections:

1. Section *Axillares*. Plants not developing basal leaves; producing regular, leafy, axillary shoots that tend to develop secondary inflorescences which often overtop the primary ones; the flowering and fruiting process is practically indeterminate.
2. Section *Simplices*. Plants developing basal leaves; stem solitary, unbranched and producing a terminal panicle with a limited flowering and fruiting period.

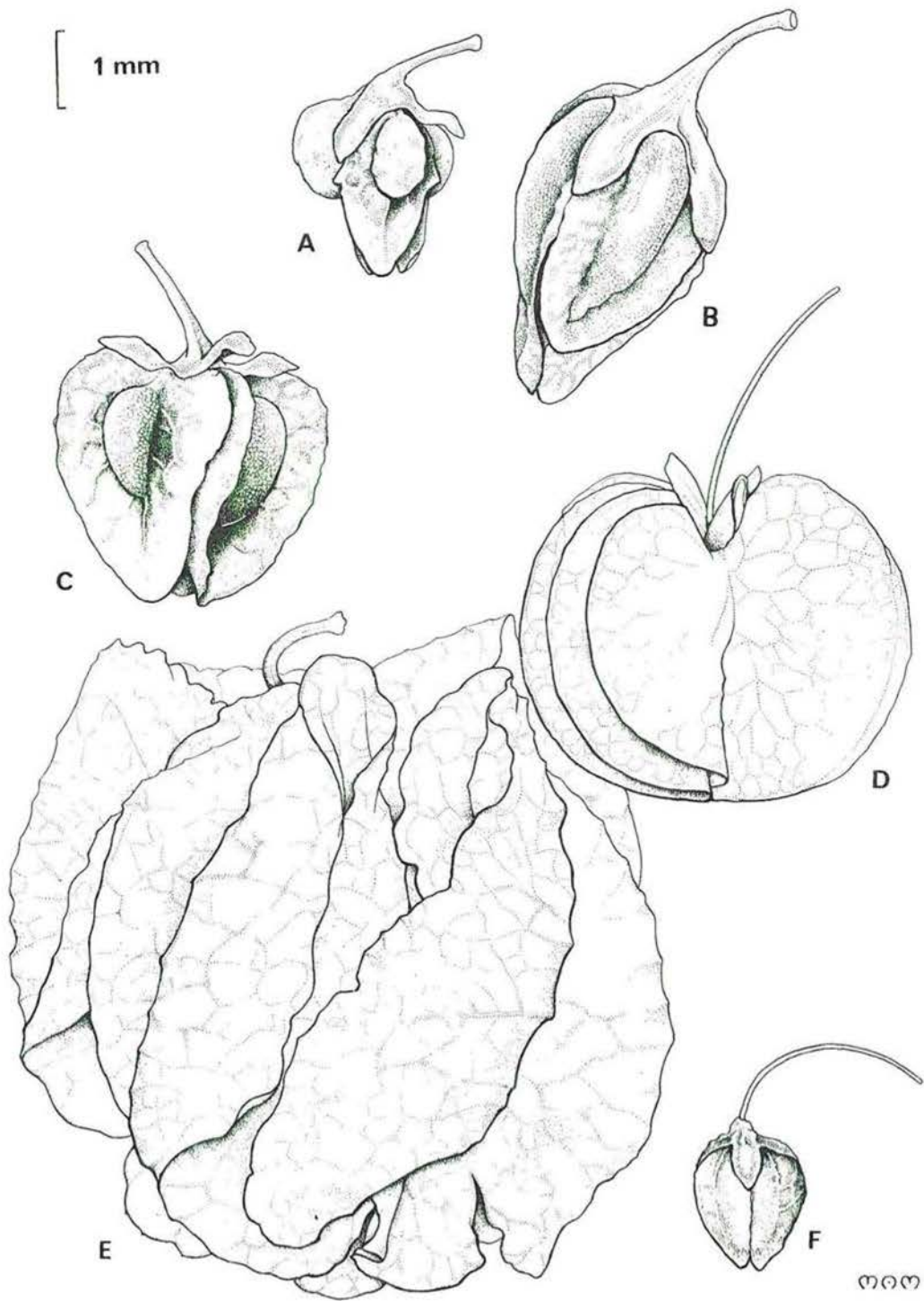


Figure 1. Fruits of *Rumex* species. A—*R. conglomeratus*. B—*R. frutescens*. C—*R. crispus*. D—*R. sagittatus*. E—*R. vesicarius*. F—*R. acetosella*.

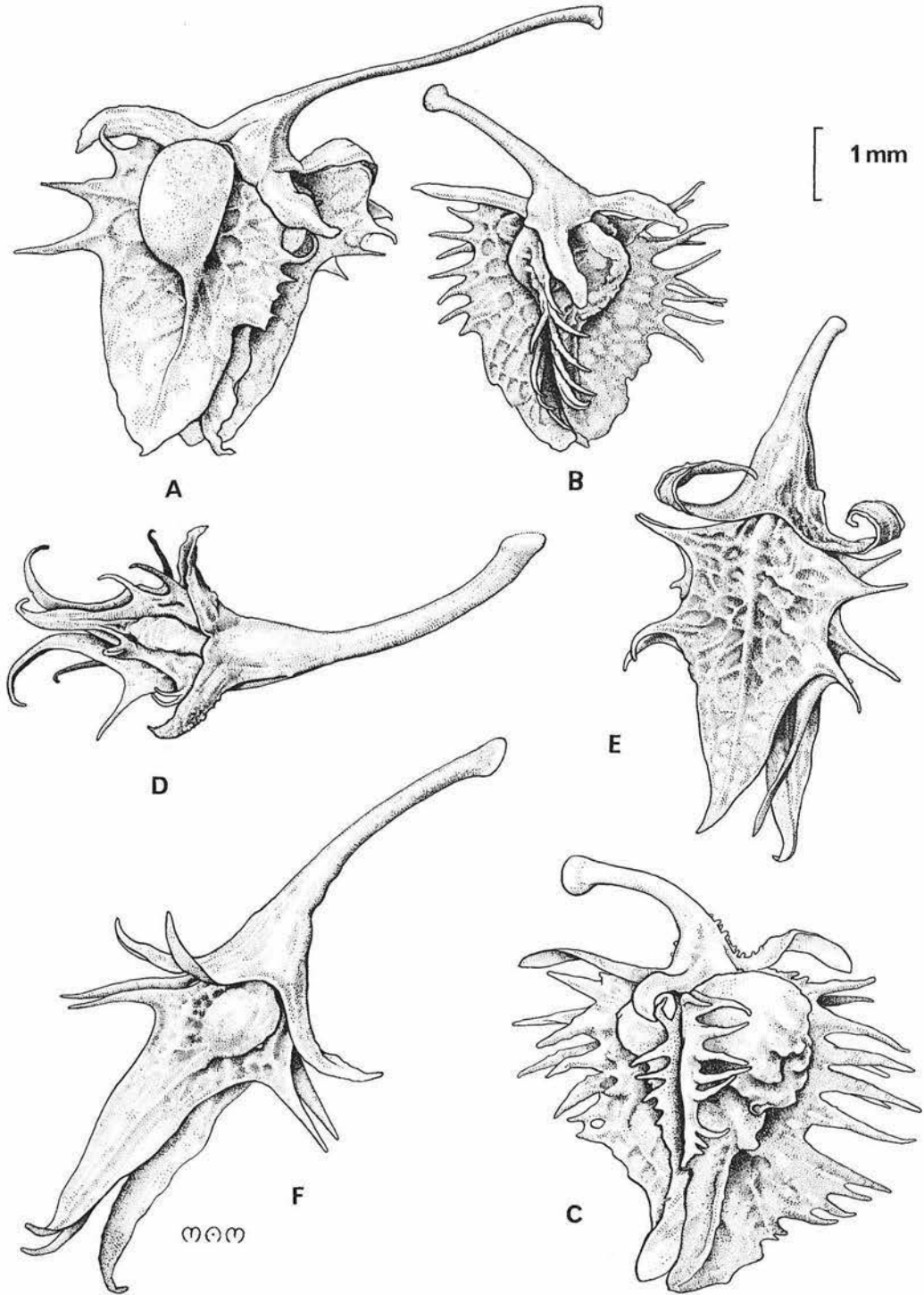


Figure 2. Fruits of *Rumex* species. A—*R. obtusifolius*. B—*R. pulcher* subsp. *pulcher*. C—*R. pulcher* subsp. *divaricatus*. D—*R. drummondii*. E—*R. dumosus*. F—*R. stenoglottis*.

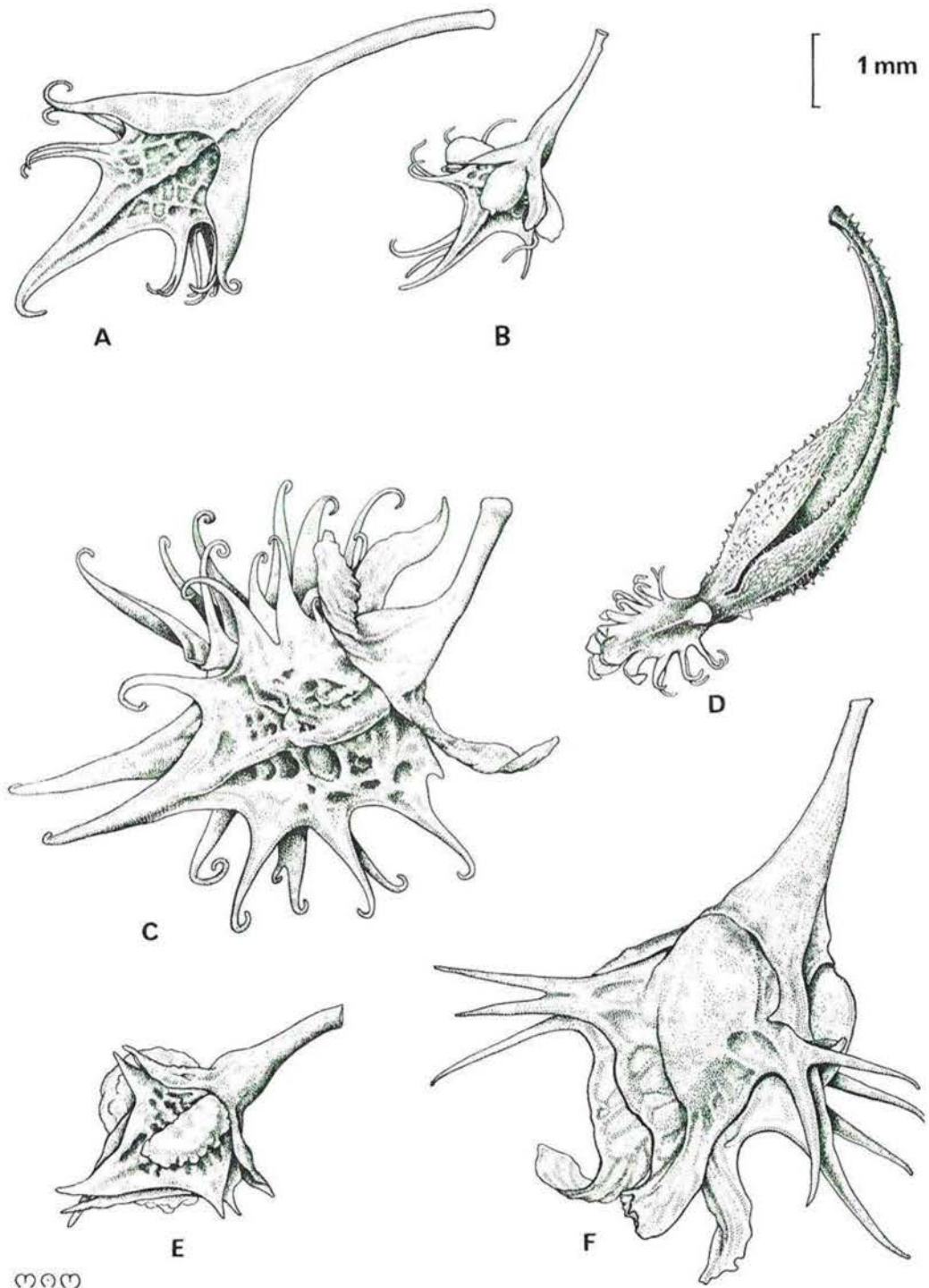


Figure 3. Fruits of *Rumex* species. A—*R. brownii*. B—*R. crystallinus*. C—*R. alcockii*. D—*R. bucephalophorus*. E—*R. tenax*. F—*R. bidens*.

Hybrids between species from these two sections are extremely rare.

Section *Axillares* has its centre of diversity in North America but there are several species in South America, four in Africa and two in East Asia. The section is represented in Australia by only the rare alien, *R. frutescens* (syn. *R. cuneifolius*). Hybrids between species of this section are known to occur.

Section *Simplices* has its centre of diversity in Europe and Asia and all the endemic and alien Australian species of subgen *Rumex*, except *R. frutescens*, belong to it. Hybrids are common between species of this section.

Despite a tendency for *R. alcockii* and *R. brownii* to occasionally develop axillary shoots these species have been included in sect. *Simplices*. These two species regularly develop basal leaves, which is a characteristic of this section.

Taxonomic arrangement of the Australian species of *Rumex*

(Numerals refer to species numbers in the text, asterisks indicate alien species.)

Subgen. *Acetosella*

1. **R. acetosella* L.

Subgen. *Acetosa*

Sect. *Sagittati*

2. **R. sagittatus* Thunb.

Sect. *Vesicarii*

3. **R. vesicarius* L.

Subgen. *Rumex*

Sect. *Axillares*

4. **R. frutescens* Thouars

Sect. *Simplices*

Subsect. *Crispi*

5. **R. crispus* L.

Subsect. *Conglomerati*

6. **R. conglomeratus* Murr.

Subsect. *Amphibii*

7. *R. bidens* R.Br.

Subsect. *Obtusifolii*

8. **R. obtusifolius* L.

9. **R. pulcher* L.

Subsect. *Australienses*

10. *R. dumosus* A. Cunn. ex Meisn.

11. *R. drummondii* Meisn.

12. *R. stenoglottis* Rech.f.

13. *R. tenax* Rech.f.

Subsect. *Acrancistrum*

14. *R. brownii* Campderá

15. *R. alcockii* Rech.f.

Subsect. *Maritimi*

16. *R. crystallinus* Lange

Subgen. *Platypodium*

17. **R. bucephalophorus* L.

Hybrids

18. *R. xcomaumensis* Rech.f. (*R. bidens* R.Br. x *R. brownii* Campdera)
 19. *R. xjohannis-moorei* Rech.f. (*R. brownii* Campdera x *R. crispus* L.)
 20. *R. xschulzei* Hausskn. (*R. conglomeratus* Murr. x *R. crispus* L.)
 21. *R. xmuretii* Hausskn. (*R. conglomeratus* Murr. x *R. pulcher* L.)
 22. *R. xpratensis* Mertens & Koch (*R. crispus* L. x *R. obtusifolius* L.)
 23. *R. xpseudopulcher* Hausskn. (*R. crispus* L. x *R. pulcher* L.)

Key to *Rumex* species in Australia

(Including indigenous and alien species; excluding hybrids—see spp. nos. 18-23.)

- 1a. Leaves usually hastate or sagittate with acute lobes. Flowers dioecious, polygamous or hermaphrodite.....2
 b. Leaves never hastate with acute lobes. Flowers hermaphrodite or polygamous.....4
 2a. Valves very small, not longer than the nut, without a callosity, often adnate to the nut—subgen. *Acetosella*.....1. *R. acetosella* L.
 b. Valves distinctly overtopping the nut—subgen. *Acetosa*.....3
 3a. Vigorous erect annual. Valves 12-18(23) mm, often tinged purplish or pinkish.....3. *R. vesicarius* L.
 b. Perennial climber with thick tuberous roots. Valves much smaller2. *R. sagittatus* Thunb.
 4a. Valves entire.....5
 b. Valves toothed.....7
 5a. Panicle open with divaricate branches, flower whorls distant and nearly all subtended by a leaf. Valves small and with a thick callosity covering most of their surface6. *R. conglomeratus* Murr.
 b. Panicle condensed, closed, whorls condensed, only the lowermost whorls or none subtended by a leaf. Callosity not covering most of valve surface6
 6a. Stem procumbent, rhizome long and indurate and bearing a few short, erect or ascendent inflorescences. Leaves thick, leathery when dry, obovate, obtuse, flat.....4. *R. frutescens* Thouars
 b. Stem strictly erect with appressed or rarely slightly patent inflorescence branches. Leaves lanceolate, tapering at both ends, acute, crispate (curled)5. *R. crispus* L.
 7a. Annuals. Fruiting perigone very small, up to 2 mm long.....8
 b. Perennials. Fruiting perigone above 2 mm long9
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Subgen. *Acetosella*

1. **Rumex acetosella* L., Spec. Plant. 338 (1753). *Typus*: Herb. LINN sheet 464.38 (locality unknown).

Perennial, dioecious, extremely polymorphic. *Stems* 10-50 cm high, erect or ascending, flowering on upper half. *Leaves* very variable; *basal leaves* long-petiolate, *laminae* usually hastate with acute, simple or rarely dissected basal lobes, the upper leaf segment broadly or narrowly lanceolate, rarely linear; *stem leaves* similar but smaller and short-petiolate. *Inflorescences* repeatedly branched, leafless. *Flower whorls* usually 5-8-flowered. *Pedicels* about equalling the flowers. *Valves* neither broader nor longer than the nut, either free or more frequently adnate to the nut. *Nuts* 1-1.5 mm long. (Figure 1F).

Distribution. Probably originating from Europe and southwestern Asia; well established in North and South America, South Africa, Australia and New Zealand.

The species comprises several subspecies, these being indistinguishable when no fruiting material is available. Most of the fruiting specimens from Australia belong to the supsp. *angiocarpus* (Murbeck) Murbeck, a southwest Europe taxon in which the valves are adnate to the nut. Until recently it was assumed that chromosome numbers were correlated with morphological characters (Löve 1941). However, according to more recent studies by Den Nijs (1974, 1976) and Johnson and Briggs (1962) this is not true, the situation being much more complicated. As the taxonomic studies of Den Nijs have not yet been published, I must refrain from going into more detail and no material is cited here.

Subgen. *Acetosa* sect. *Sagittati*

2. **Rumex sagittatus* Thunb., Prodr. Fl. Capens. 67 (1794). *Typus* not indicated.

Acetosa sagittata (Thunb.) L. Johnson & B. Briggs, Contrib. New South Wales Nat. Herb. 3: 166 (1962).

R. luxurians L.f., Suppl. 212 (1781) non L., Mantissa 64 (1767). *R. burchellii* Campderá, Monogr. Rumex 135 (1819).

Perennial. Roots developing thick tubers. *Stems* usually very long, exceeding 1 m, climbing, flexuose. All leaves bright green, long-petiolate; *laminae* (4)8-10 x 3-5 cm, hastate, with very acute divergent basal lobes up to 2.5 cm long, apices acute. *Inflor-escences* wide, open, primary branches at right angles to the axis, repeatedly branched. *Flower whorls* few-flowered. *Flowers* dioecious. *Fruiting pedicels* thin, fili-form, articulate at about the lower third. *Outer perianth segments* reflexed. *Valves* in fruiting stage orbicular, 4-7 x 6-9 mm, with narrowly cordate bases, thin, mem-branous, finely reticulate, pale coloured and sometimes tinged purple. *Nuts* 3 x 1.3 mm, pale brown. $2n = 18$ (Johnson & Briggs, loc. cit.). (Figure 1D).

Distribution. South Africa. Cultivated in places in tropical and subtropical regions. Established (?) in Australia.

Selected specimens examined. QUEENSLAND: Maleny, 18 January 1951, *R. Cole* s.n. (BRI).

NEW SOUTH WALES: La Perouse 33°59'S, 151°14'E, *R. Coveny* 6429 and *J. Powell* (NSW); 1 mile [1.6 km] S of Eurobodalla, NW of Narooma, *H. Salasoo* 5163 (NSW); North Sydney, *C. T. White* 10333 (BRI); c. 2 km S of Williamtown on Newcastle road, *K. L. Wilson* 2414 (NSW).

VICTORIA: Port Phillip Bay, Ricketts Point between Black Rock and Beaumaris, *Helen I. Aston* 932 (MEL).

TASMANIA: Sandy Bay, Long Beach 42°54'S, 147°18'E, 1 October 1968, *D. I. Morris* s.n. (HO); "Boobyalla" near Currie, King Island, Bass Strait, July 1972, *B. D. Smith* s.n. (MEL).

WESTERN AUSTRALIA: South Perth, *R. D. Royce* 6801 (PERTH); Claremont, February 1962, *J. Williams* s.n. (PERTH).

Rumex sagittatus is quite unlike any other Australian species in its tuberous roots—which are however, rarely collected or even observed—and its climbing habit. The valves are second in size only to *R. vesicarius*.

Subgen. *Acetosa* sect. *Vesicarii*

3. **Rumex vesicarius* L., Spec. Plant. ed 1: 336 (1753). *Type citation*: "Hab. in Africa."

Acetosa vesicaria (L.) A. Löve, Rit. Landbun. Atvinn. Hask. Reykyavik Ser. B, No. 3: 108 (1948).

Rumex clementii Domin, Bibl. Bot. 89: 614 (1921).

Rumex roseus auct. austral. nec aliorum.

Stout, succulent, pale green annuals. Basal and lower stem leaves with petioles longer than the laminae; laminae 5-10 x 4-8 cm, triangular with cordate or subtruncate bases (basal lobes \pm acute, acuminate or rarely \pm obtuse), flat, apices \pm broadly acuminate to \pm acute; upper stem leaves similar but smaller. Pedicels single per ocrea. Flowers at the apex of pedicels twin or triplet. Valves 12-18(23) x 15 mm, thin, finely reticulate, often tinged purplish or pinkish, inflated, those of the 2-3 flowers folded together, suborbicular or broadly elliptic, profoundly emarginate on both ends. Nuts 3.5-4.5 mm long, greyish brown. $2n = 18$ (A. Löve loc. cit.). (Figure 1E).

Selected specimens examined. QUEENSLAND: 66 km from Bedourie on road to Boulia, R. W. Purdie 1402 (BRI).

NEW SOUTH WALES: Fowlers Gap, N of Broken Hill, S. Jacobs 1940 (NSW); 11 km E of Warratta Bore, 32 km E of Milparinka, K. L. Wilson 1642 and J. Pickard (NSW).

SOUTH AUSTRALIA: c. 3 km from Wirrealpa on road to Blinman, W. R. Barker 293 (MEL, dupl. ex AD); Aroona Valley, c. 25 km NW of Oraparinna Hst., E. N. S. Jackson 1733 (CANB, dupl. ex AD); Ediacara, c. 50 km W of Leigh Creek, T. R. N. Lothian 2400 (AD); Sacred Canyon, c. 19 km SE of Wilpena, 27 September 1981, Naomi Norris s.n. (MEL); Gawler Cemetery, D. E. Symon 12901 (ADW); Musgrave Park 26°09'S, 131°12'E, S. H. Yengoyan, V. G. Harper and A. A. Yengoyan 150 (NT).

NORTHERN TERRITORY: Mulga Park 25°51'S, 131°39'E, S. H. Yengoyan, V. G. Harper and A. A. Yengoyan 31 (NT); Billygoat Hill, Alice Springs, G. Chippendale 90 (NT).

WESTERN AUSTRALIA: 1 mile [1.6 km] W of Mileura Hst., NW of Meekatharra, R. A. Saffrey 1113 (PERTH); 3 miles [4.8 km] from Menzies towards Kalgoorlie, 7 September 1968, M. E. Phillips s.n. (MEL, dupl. ex CBG); 2.5 km SE of Yaloo 28°22'S, 115°43'E, K. Paijmans 3903 (CANB).

Distribution. North Africa to Pakistan; north Arabia, southern Persia, Afghanistan, Pakistan, one locality in central Greece. This desert/semidesert species was introduced into Australia during the past 50-60 years and is now widespread and well established. In Western Australia I have observed the species to be well established at both Kalgoorlie (around the goldmines) and Kalbarri.

Rumex vesicarius cannot be mistaken for any other species on account of its annual growth, its juicy stem and leaves and the size of its valves. The fact that one pedicel usually bears two to three flowers, the valves of which are folded together, can easily escape observation.

4. **Rumex frutescens* Thouars, Esquisse Fl. Tristan d'Acougne in Mèl. Bot. et Voy. 4: 38 (1811). *Typus*: Tristan da Cunha, Moseley, Challenger Exped. s.n. (E, BM).

R. cuneifolius Campderá, Monogr. Rumex 95 (1819).

Icon.: Rechinger f., Ark. Bot. 26A (3): 20, fig. 8, tab. 5 (1933).

Perennial by a long, indurate, creeping rhizome with thick nodes; flowering stems solitary or few, short, rarely elongating. Basal leaves not developed; stem leaves thick, fleshy when alive but leathery when dry; lower leaves of flowering stems with thick petioles less than half as long as the laminae, laminae up to 12 x 5 cm, obovate



Figure 4. *Rumex frutescens*. John Moore, 10 Dec. 1981 (PERTH).

with cuneate bases, flat but with finely crispate margin, apices obtuse; *upper stem leaves* few, shorter petiolate, \pm acute. *Inflorescences* nearly leafless or with very few small leaves in the lower part, compact in the fruiting stage. *Whorls* many-flowered. *Fruiting pedicels* usually shorter than or as long as the perigone, stout, articulate about the middle. *Fruiting valves* 4-5 (6) x 3 mm, leathery, entire, ovate-triangular in outline, all bearing a strong thick fusiform callosity. *Nuts* about 2.5 x 2 mm. (Figures 1B and 4).

Distribution. South America, Argentine, Chile, Peru, Bolivia, Uruguay, Tristan da Cunha, Gough Island. Rarely as an alien in Europe (well established on dunes in southern England) and in North America. Known from two localities in Australia.

Specimens examined. WESTERN AUSTRALIA: William Bay, 70 km West of Albany, growing in summer moist winter waterlogged swamps with *Juncus* sp. in sand over gravel, 12 Dec. 1981 John Moore s.n. (PERTH). (On a visit by John Moore and myself to this locality in December 1982, *R. frutescens* could not be found.)

VICTORIA: Coode Island, Oct. 1908, Dec. 1908 and 28 Mar. 1912, J. A. Tovey and C. French jnr. (all MEL). This locality is no longer in existence, it having been destroyed by harbour works at the mouth of the Yarra River, Melbourne; there is, however, still a Coode Road (N. G. Marchant pers. comm.).

The discovery of this species at two localities on the south coast of Australia is of major phytogeographic interest. Its main area is South America. It was described from Tristan da Cunha as *R. frutescens* Thouars (1811). In my monograph of *Rumex* in Africa (1954: 62) I erroneously stated that *R. frutescens* is a synonym of *R. cuneifolius* (1819). The area of this species seems to be a truly south Atlantic one: Tristan da Cunha, 37°06'S, 12°20'W; Gough Island 40°12'S, 4°45'W. The question is still open whether it has been spread with or without human intervention. On its occurrence in Britain see Lousley, Report. Bot. Exch. Club 1941-42: 579 (1942).

Subgen. *Rumex* sect. *Simplices* subsect. *Crispi*

5. **Rumex crispus* L., Spec. Plant. 335 (1753). *Type citation*: "Hab. in Europae succulentis."

Perennial. *Stems* (30)50-100(150) cm high, strictly erect. *Basal and lower stem leaves* petiolate, petioles shorter than the laminae; *laminae* lanceolate, undulate, up to 30 cm x 60 mm, attenuate on both ends with cuneate rarely narrowly truncate bases, apices acute; *upper stem leaves* similar, but gradually becoming smaller and narrower. *Inflorescences* with erect rarely slightly patent branches, more or less compact in the fruiting stage, rarely the lower whorls separated by a few subtending leaves in the lower part of the inflorescence. *Whorls* many-flowered. *Fruiting pedicels* variable in length, thin, always longer than the valves. *Fruiting valves* varying in size (3.5)4-5(6) mm long and broad, orbicular-cordate, rarely subcordate-triangular, entire, usually all valves bearing a callosity, callosities equal or sometimes unequal; rarely only the anterior valve with a callosity and the others ecallose. *Nuts* (2)2.5-3(3.5) mm long, normally broadest below the middle. (Figure 1C).

Selected specimens examined. QUEENSLAND: Mary River c. 20 km S of Gympie 26°02'S, 152°04'E, 25 October 1974, S. L. Everist s.n. (BRI); Clifton, C. T. White 12670 (BRI).

NEW SOUTH WALES: 40 km NNW of Warren, K. Pajmans 1770 (CANB); Between Lyneham and Gungahlin, J. Pulley 1174 (CBG); Cave Creek, c. 0.5 mile [0.8 km] below Blue Waterhole, A. Rodd 68 (NSW).

VICTORIA: Wangaratta 36°22'S, 146°17'E, *Helen I. Aston* 2167 (BRI, dupl. ex MEL); Studley Park, Kew, *R. V. Smith* 77/28 (MEL).

TASMANIA: 13 miles [21 km] from Queenstown towards Hobart, *M. E. Phillips* 477 (CBG); Flinders Island near Whitemark, *John Whinray* 3 (MEL).

SOUTH AUSTRALIA: Southern Lofty Region 35°11'S, 138°37'E, *A. W. Bell* 106 (MEL dupl. ex AD); Bute Railway yard, c. 130 km NNW of Adelaide, *B. Copley* 812 (MEL dupl. ex AD)

NORTHERN TERRITORY: Todd River, Alice Springs 23°42'S, 133°52'E, 14 November 1979, *A. Thomas* s.n. (NT).

WESTERN AUSTRALIA: Woody Island, Recherche Archipelago, *Ian Abbott* 17 (MEL); Denmark 34°57'S, 117°21'E, *K. H. Rechinger* 60137 (PERTH, W).

Distribution. Probably originally spontaneous in Europe and southwestern Asia. Now well established in most extratropical parts of the world. *Rumex crispus* is the most common of the European species of subgen. *Rumex* in Australia.

Rumex crispus, in spite of a moderate range of morphological variability, can easily be distinguished from other species in Australia by its ± strict and rather dense panicles, its crispate leaves which are attenuate at both ends and by its broad, cordate-rounded, entire fruiting valves of which usually all, but rarely only the anterior one, bear a callosity.

Subgen. *Rumex* sect. *Simplices* subsect. *Conglomerati*

6. **Rumex conglomeratus* Murr., Prodr. Stirp. Goetting. 52 (1770). *Typus*: Germania: Göttingen.

For Synonymy see Rechinger f. 1949a: 96.

Perennial. Stems usually 30-80 cm high, ± erect, often branching from below the middle; branches arcuate-divaricate and forming open panicles. *Basal* and *lowermost stem leaves* petiolate; *petioles* usually as long as the laminae; *laminae* flat, narrowly oblong-ovate with slightly cordate or truncate bases, up to 6 cm x 3 mm, small in comparison with the size of the plant, apices rotundate-obtuse; *upper stem leaves* becoming gradually smaller and with shorter petioles and more acute apices. *Flower whorls* many-flowered, all distant, all (except sometimes the uppermost) subtended by a small short petiolate leaf. *Fruiting pedicels* about the same length as the valves or only slightly longer, articulate at the middle or slightly below. *Fruiting valves* 2.5-3.2 x 1-1.7 mm, oblong ovate, entire, all bearing a large callosity which sometimes occupies nearly the whole surface of the valve. *Nuts* 1.3-1.7 mm long, dark brown. (Figure 1A).

Selected specimens examined. QUEENSLAND: Upper Peachester 26°51'S, 151°54'E, *L. S. Smith* s.n. (BRI).

NEW SOUTH WALES: Moseley Park, Lord Howe Is., *A. C. Beauglehole* 5514 (CANB); Graveyard Ck, Kunghur, c. 12 miles [19.3 km] SW of Murwillumbah, *E. F. Constable* 6583A (NSW); At edge of Lake Burley Griffin, *R. Pullen* 8762 (CANB); c. 1.5 km S of Wyong Ck and 0.5 km W of Pacific Coast Highway, *K. L. Wilson* 1991 (NSW); 6.5 km N of Bendemeer on Macdonald River road to Kingstown, *K. L. Wilson* 4357 (NSW).

VICTORIA: Junction of Emerald and Cockatoo roads 37°58'S, 145°27'E, *S. J. Forbes* 244 (MEL); Studley Park, Kew, *R. V. Smith* 77/29 (MEL); Brodribb River bridge on Princes Highway 37°42'S, 148°34'E, *K. L. Wilson* 2173 (NSW).

TASMANIA: Near George Town 41°10'S, 146°50'E, December 1955, W. M. Curtis s.n. (HO); Ross 42°02'S, 147°32'E, 7 July 1966, W. M. Curtis s.n. (HO).

SOUTH AUSTRALIA: Torrens Gorge, c. 17 km ENE of Adelaide, Hj. Eichler 14620 (AD); E of Callendale, c. 40 km SW of Naracoorte, D. Hunt 2324 (MEL, dupl. ex AD).

WESTERN AUSTRALIA: Robinson Estate, SW of Albany, K. H. Rechinger 60016 (PERTH, W); Ocean Beach, S of Denmark 35°03'S, 117°20'E, K. H. Rechinger 60142 (PERTH, W).

Distribution. Central and southern Europe, Mediterranean, southwest and central Asia. Introduced into most extratropical parts of the world where it has become well established.

Rumex conglomeratus is easily recognized by its divaricately branched panicles, its flower whorls each subtended by a leaf and by its small, narrow, entire fruiting valves which bear a prominent callosity covering a large part of the valve surface.

Subgen. *Rumex* sect. *Simplices* subsect. *Amphibii*

Subsect. *Amphibii* Rech. f., subsect. nov.

Perennis, amphibius. Rhizomate procumbente elongato et inflato ad nodos radicante perennis. Caulis fructifer brevis, erectus, subsimplex. Folia basalia non evoluta; folia caulina lanceolato-linearia, acuta. Pedicelli fructiferi perigonio 1.5-2-plo longiores, basin perigonii versus valde incrassati, in tertia vel quarta parte inferiore articulati. Valvae ovato-rhombicae, acutae, omnes calliferae, utrinque dentes 2 antrorsos ferentes.

Typus: *R. bidens* R.Br.—Sectio monotypica.

Amphibious. *Perennial* by an often elongated and inflated procumbent rhizome rooting at its nodes and ending in a short ascendent or erect flowering stem. *Basal leaves* not developed; *lower stem leaves* narrowly lanceolate-linear with truncate or cuneate bases and acute tips; *stem leaves* lanceolate-linear, acute. *Fruiting pedicels* one and a half times to twice as long as the valves, much thickened at the base of perigone, articulate at the lower third or quarter. *Valves* ovate-rhombic, acute, all with a callosity, with two marginal teeth on each side pointing forward.

7. *Rumex bidens* R. Br., Prodr. Fl. Nov. Holl. 116 (1810). *Typus:* "R. Brown, Iter Australiense 2308, 1802-05" (BM).

R. muelleri Meisn. in DC., Prodr. 14: 61 (1856).

Amphibious perennials. *Rhizomes* often elongate, creeping in the mud, often floating or partly submerged, rooting at the nodes, internodes often inflated, rhizomes ending in an ascendent or more or less erect, usually unbranched flowering stem which is 20-60 cm high. *Basal leaves* not developed; *lower stem leaves* 10-20 x 1.5-2.5 cm, narrowly linear-lanceolate with truncate or broadly cuneate bases, margins flat or very slightly crisped, apices acute; *upper stem leaves* similar. *Flower whorls* many-flowered, distant, all with subtending leaves, lower whorls predominantly female, upper ones male (according to Black in sched.). *Fruiting pedicels* one and a half to twice as long as the fruiting perigone, much thickened towards the base of the perigone, articulate at 1/3-1/4 of the lower part. *Outer perigone segments* 3-4 mm

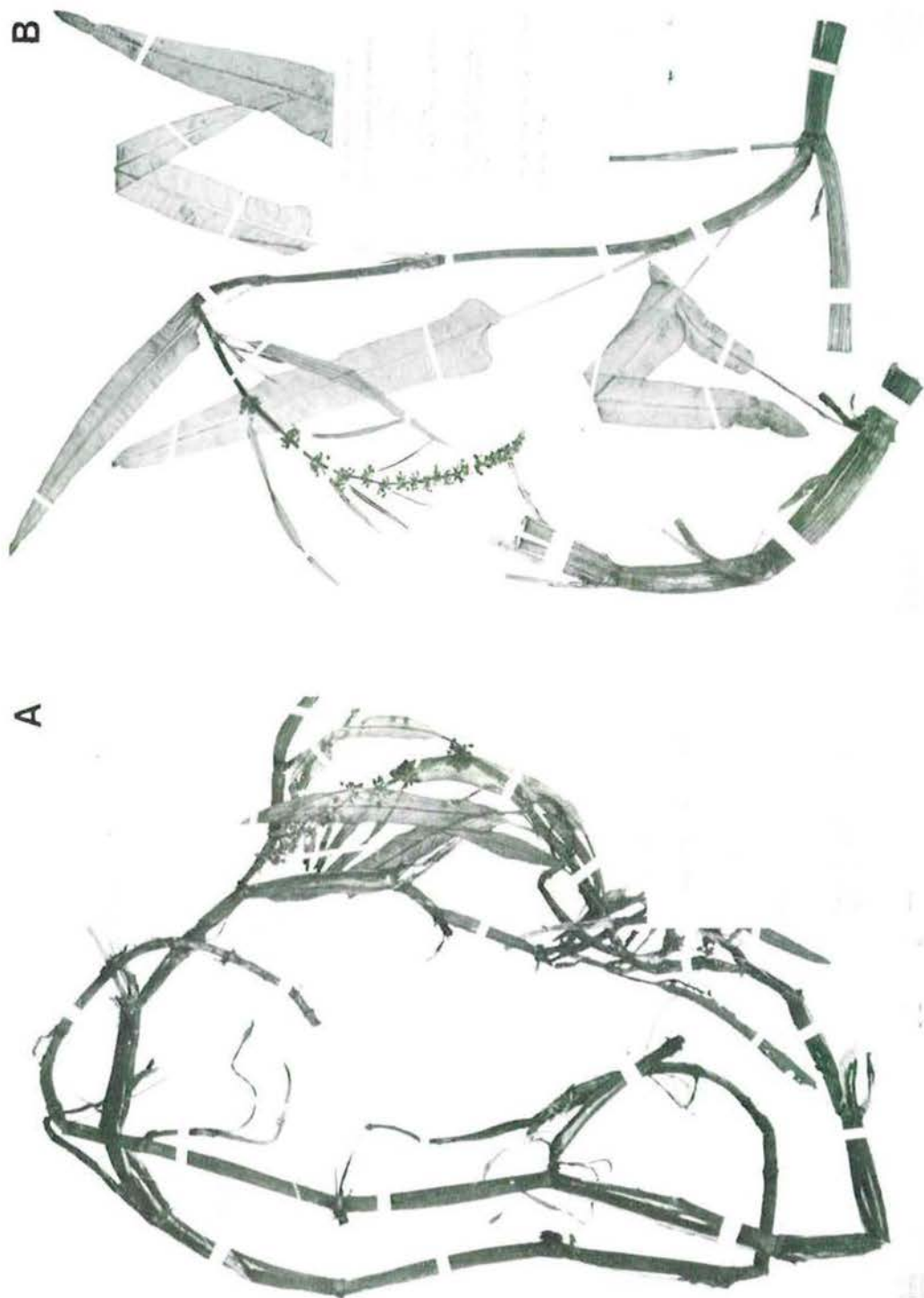


Figure 5. *Rumex bidens*. A—A. C. Beaglehole 30475 & A. E. Orchard (MEL). B—Helen I. Aston 1307 (MEL).

long, appressed to the margin of the interior ones and often hiding their lowest pair of teeth. *Fruiting valves* c. 5 x 3.5 mm, ovate-rhombic with a narrow tip bearing 2 antrorse teeth on either side; each valve with a callosity. *Nut* 3 mm long, dark brown. (Figures 3F and 5).

Selected specimens examined. NEW SOUTH WALES: Lake Whymoul near Barham, 28 November 1956, *R. A. Williamson* s.n. (NSW).

VICTORIA: Boggy Ck 0.5 miles [0.8 km] NW of Kyneton, *Helen I. Aston* 1240 (AD, MEL); Darlots Ck, Tyrendarra, Portland, *A. C. Beauglehole* 370 (MEL); c. 2 miles [3.2 km] W of Mt Abrupt Cairn, Grampians, 11 February 1969, *A. C. Beauglehole* and *A. E. Orchard* s.n. (MEL); Near Yarra River, October 1952, *F. Mueller* s.n. (MEL); Keilor Park, Maribyrnong Bridge near Calder Highway Bridge, *R. V. Smith* 69/54 (MEL); Geelong, December 1909, *H. B. Williamson* s.n. (CANB).

TASMANIA: Jordan River 42°44'S, 147°14'E, *L. Rodway* (HO); In drains about Launceston, *Ch. Stuart* 70 (MEL).

SOUTH AUSTRALIA: Mt Barker Ck, Mt Lofty Range, 4 December 1943, *J. B. Cleland* s.n. (AD); Mannum, River Murray, *C. M. Eardley* 2871 (ADW); SE Comaun, 20 km E of Penola, *D. Hunt* 1520 (AD); South Killanoola Swamp, c. 25 km SSW of Naracoorte, *D. Hunt* 2331 (AD, BRI, MEL); Wood's Point, c. 12 km downstream from Murray Bridge, 8 June 1962, *J. V. Mertin* s.n. (AD); SE of Marsh's Swamp, W of Lake Leake, 19 February 1966, *I. B. Wilson* s.n. (AD).

Distribution (Figure 11A). South-east mainland Australia and Tasmania.

Rumex bidens, an amphibious plant restricted to the south-east of Australia and to Tasmania, probably having no close relatives with the possible exception of *R. neglectus* T. Kirk, an endemic of New Zealand and the Auckland Islands.

Subgen. *Rumex* sect. *Simplices* subsect. *Obtusifolii*

8. **Rumex obtusifolius* L., Spec. Plant. 335 (1753). *Type citation*: "Hab. in Germania, Helvetia, Gallia, Anglia."

Perennial. *Stems* 60-80(120) cm high, erect, branching from about the middle; *branches* arcuate patent and forming an open panicle. *Basal leaves* with petioles usually longer than the laminae; *laminae* oblong-ovate from a cordate base, up to about 20 x 10 cm, flat, apices obtuse or broadly acuminate; *stem leaves* shorter petiole, narrower and longer, usually tapering from a rather broad, non-cordate base. *Flower whorls* all (except the uppermost) distant, the lower ones only subtended by a small leaf. *Fruiting pedicels* slender, articulate at about 1/3 or 1/4 of their length, about 2.5 times as long as the valve. *Fruiting valves* of varying shape and size (according to subspecies, see discussion), usually linguiform towards the apex, usually with 2-3 teeth in their lower half. *Nuts* 2.5-3.2 mm, broadest above the base, brown. (Figure 2A).

Selected specimens examined. NEW SOUTH WALES: Near Robertson, *M. Gray* 5883 (CANB); Near Thredbo Village, Kosciusko State Park, *M. Gray* 6410 (CANB); Near Cabramurra, *C. W. E. Moore* and *M. Gray* 5413 (CANB); Balmain, *K. L. Wilson* 891 (NSW).

VICTORIA: Trentham, on roadside, *R. V. Smith* 66/49 (MEL); Terang, in railway yard, *R. V. Smith* 66/75 (MEL); North Brighton railway station, 16 February 1956, *J. H. Willis* s.n. (MEL).

TASMANIA: Near Linda 42°04'S, 145°36'E, January 1953, *W. M. Curtis* (HO).

SOUTH AUSTRALIA: Mt Lofty Range National Park, 11 December 1943, *J. B. Cleland* s.n. (AD); Banks of River Torrens, Adelaide, *T. J. Smith* 2073 (AD).

WESTERN AUSTRALIA: Robinson Estate, SW of Albany 35°02'S, 117°53'E, *K. H. Rechinger* 60015 (PERTH, W).

Distribution. Europe except the Arctic (in the Mediterranean the species is restricted to the mountains); South-west Asia eastwards into the central Elburz Range. Introduced into many extratropical parts of the world and more or less established in some places. In Australia much rarer than *R. crispus*, *R. pulcher* and *R. conglomeratus*.

Rumex obtusifolius is a polymorphic species which can be divided into four subspecies (see Rechinger 1932: 41-61). The most common one in Australia and elsewhere outside its natural area of occurrence, is subsp. *obtusifolius* (syn. subsp. *agrestis* (Fries) Danser); it has valves up to 6 mm long, all usually possessing three teeth which in length about equal the width of the valve, the anterior valve only bearing a callosity. Some Australian specimens tend towards subsp. *transiens* with slightly smaller valves, shorter teeth and usually all valves bearing a callosity of unequal size.

9. **Rumex pulcher* L., Spec. Plant. 336 (1753). *Type citation*: "Hab. in Gallia, Italia, Veronae."

Perennial, variable in habit. *Stems* 20-60 cm high, ± stiff or angular-flexuose, variously branching often from below the middle (see subspecies). *Leaves* thickish, comparatively small, often papillose below, petiolate, petioles usually shorter but sometimes about as long as the laminae; *laminae* of basal leaves ovate-oblong from a cordate base, sometimes constricted below the middle (fiddle-shaped)—see subspecies; *stem leaves* few, shorter petiolate and more acute than the basal ones. *Flower whorls* many-flowered, all distant, all subtended by a small leaf which is not prominent in the uppermost whorls. *Fruiting pedicels* thickish, articulate near the middle or slightly below but not dehiscent, shorter than or sometimes equalling the valves. *Valves* thick, leathery, variable in shape (see subspecies), 4.5-6 × 2.5-4.5 mm, with a thick reticulate-foveolate reticulation, usually all bearing a callosity, of unequal sizes, margins variously and grossly dentate. *Nuts* 3-4 mm long, broadest below the middle. (Figures 2B and 2C).

Distribution. Mediterranean region and south-west Asia. Introduced into, and in places well established in, warmer places of the world. Common and locally well established in America and Australia.

Bentham (1870: 264) did not have a clear concept of *R. pulcher* as evidenced by the following passage from his description: "... radical and lower leaves oblong-lanceolate or almost linear. Pedicels shorter or longer than the perianth ... Inner segments of the fruiting perianth lanceolate or triangular, 2-3 lines long with a rigid point ... " These characters do not apply to *R. pulcher* but instead to *R. dumosus* or *R. drummondii*. Bentham confounded specimens of the Australian indigenous species, *R. dumosus* or *R. drummondii*, with the alien *R. pulcher*. This is apparent not only from his description but also from his listing as synonyms *R. oxyspalus* and *R. drummondii*. This error has persisted in some publications and herbaria up to the present.

Rumex pulcher is a polymorphic species (Rechinger 1932: 25-39) with five subspecies being recognized, two of which occur in Australia.

9a. subsp. **pulcher**

Fruiting branches horizontal or angularly reflexed and intricate. *Basal leaves* usually constricted below the middle. *Valves* narrowly ovate or oblong-triangular, with slightly ligulate apices and several well developed teeth near the base. (Figure 2B).

Selected specimens examined. NEW SOUTH WALES: Batemans Bay, L. A. S. Johnson and B. G. Briggs B3077 (NSW); Albury, 2 December 1975, H. J. Milvain s.n. (NSW).

VICTORIA: 4.7 miles [7.6 km] S of Terang, J. Anderson 331 (MEL); Yarra bank near Botanic Gardens, 13 December 1910, W. R. A. Baker s.n. (MEL).

TASMANIA: George Town 41°10'S, 146°50'E, December 1955, W. M. Curtis s.n. (HO); Hobart, April 1924, A. H. S. Lucas s.n. (NSW); Garland Grove, Cape Barren Is., J. S. Whinray 1455 (MEL).

SOUTH AUSTRALIA: Mt Drummond, C. R. Alcock 2591 (AD); Near Kalangadoo on Millicent road, D. Hunt 1966 (AD).

WESTERN AUSTRALIA: Denmark 34°57'S, 117°21'E, K. H. Rechinger 60138 (PERTH, W); 10 km W of Redmond 34°53'S, 117°42'E, K. H. Rechinger 60234 (PERTH, W); Narrikup 34°46'S, 117°42'E, K. H. Rechinger 60240 (PERTH, W); 5 km NE of Narrikup, K. H. Rechinger 60241 (PERTH, W); Red Gum Pass road near Kendenup 34°29'S, 117°38'E, K. H. Rechinger 60398 (PERTH, W).

Distribution. Mediterranean Basin and western Europe. Introduced and partly well established in warmer parts of most continents.

9b. subsp. **divaricatus** (L.) Murb., Beitr. z. Fl. Südbosniens und der Herzegovina in Fysiogr. Sällskap. Handl. 2: 45 (1891). *Typus*: "Hab. in Italia."

R. divaricatus L., Spec. Plant. ed. 2: 478 (1762).

Fruiting branches arcuate-divaricate. *Basal leaves* usually not constricted below the middle. *Fruiting valves* more or less broadly ovate or orbicular-triangular with broadly acuminate apices, with several short more or less irregular teeth on the margin. (Figure 2C).

Selected specimens examined. VICTORIA: Yarra bank, 13 December 1910, W. R. A. Baker s.n. (MEL).

TASMANIA: Sandy Bay, 15 July 1910, R. A. Black s.n. (MEL); Hogan Is., Eastern Bass Strait, January 1968, N. Scarlett s.n. (MEL).

SOUTH AUSTRALIA: Near Coomunga, Eyre Peninsula, C. R. Alcock 2586.

WESTERN AUSTRALIA: St. Fergus road, between Toodyay and Avon River, N. T. Burbidge 8013 (CANB); Northam, C. Dziekanowski 3971 and J. Roethke (PERTH); Capel, January 1925, H. G. Elliott s.n. (PERTH); South Perth, October 1944, R. D. Royce s.n. (PERTH); Moora, December 1968, E. B. J. Smith s.n. (PERTH).

Distribution. Mediterranean region, especially the southern part; south-west Asia. Introduced and in parts well established in warmer parts of America, Africa and Australia. The distinction between the two subspecies appears to be less clear in some cases in Australia than in the Mediterranean.

Subgen. *Rumex* sect. *Simplicis* subsect. *Australienses*

Subsect. *Australienses* Rech. f., subsect. nov.

Perennes. Folia basalia elongata, latitudine (3)5-30(!)-plo longiora. Pedicelli fructiferi perigonium aequantes ad eo triplo longiores, in medio vel infra medium articulati. Valvae ecallosae, unica vel omnes calliferae, semper dentatae.

Typus: Rumex dumosus A. Cunn. ex Meisn.

The new subsection is closest to subsect. *Obtusifolii* which includes *R. obtusifolius* L. and *R. pulcher* L., both of European or Mediterranean origin and occurring as aliens in Australia (see spp. 8 and 9 above). The main distinctive characters of the new subsection are the extremely narrow leaves, the far greater reduction of valve surface and the usually longer teeth in proportion to the valve surface. As a matter of fact *R. tenax* Rech. f. has the longest and finest leaves in the whole genus, they look nearly grasslike. The only extra-Australian species belonging to subsect. *Australienses* is *R. flexuosus* Solander ex Sprengel from New Zealand.

10. ***Rumex dumosus*** A. Cunn. ex Meisn. in DC., Prodr. 14: 62 (1856). *Typus:* Liverpool plains, forms large, round bushes, A. Cunningham (holo: K; iso: MEL, NSW, NY).

R. flexuosus F. Muell., Syst. Cens. Austral. Plts. 31 (1882), p.p. quidem.

Perennial with vertical rootstock. *Stems* several, 20-50 cm high, flexuose, repeatedly dividing from near the base with numerous thin, flexuose branches forming an entangled mass breaking off near the base and dispersing as a tumbleweed. *Basal leaves* long-petiolate; *laminae* 10-20 x 0.8-2 cm, linear-lanceolate from a broadened truncate or broadly cuneate rarely subcordate base, sometimes constricted above the base, panduriform and/or obtusely lobed at the base, with coarsely erose crispate margins, apices acute; *stem leaves* numerous, similar to the basal ones, gradually becoming shorter petiolate and narrower and more acute. *Panicles* (see above). *Flower whorls* (2)3-4(5)-flowered, distant, loose, nearly all subtended by a narrow leaf. *Fruiting pedicels* of varying length within one whorl, rather thin, articulate below the middle. *Fruiting valves* c. 5 x 3 mm long (excluding teeth), triangular, attenuate, strongly reticulate; medium nerve not or only slightly thickened, (more or less incrassate), sometimes forming an elongate callosity (var. *dumosiformis*); usually two strong teeth present on the lower part of each side of the valve, the lower one more or less patent, the upper one antrorse, sometimes a shorter third one occurs near the middle. *Nuts* 2.5-3 mm long. (Figures 2E and 6).

Rumex dumosus is interpreted here in a broad sense as comprising a set of variants badly in need of further investigation. Both comparative morphology and cytological studies as well as cultivation experiments are required to elucidate the complex variation patterns observed on the basis of limited fruiting material.

The relationship of *R. dumosus* to the New Zealand endemic, *R. flexuosus* Solander ex Sprengel should be reconsidered. At present I have no N.Z. material at hand for comparison. However, according to my earlier treatment (Rechinger 1935a: 45) the two species are related by their characteristic panicles whose fine, repeatedly divided branches form an entangled mass which breaks-off at ground level and is dispersed as a tumbleweed. *Rumex flexuosus*, however, presumably has more flowers



Figure 6. *Rumex dumosus*. A—T. Smith 813 (AD). B—John Moore, 3 Sept. 1981 (PERTH).

per whorl, its articulation on the fruiting pedicel is closer to the base and the valves are smaller on average. There is much variation in these characters within the Australian material of *R. dumosus* examined.

Rumex drummondii is accepted here as a species (see sp. 11 below) but it is noted that very little material of this taxon has been seen. The status of *R. drummondii* and its relationship to *R. dumosus* is therefore in need of critical reappraisal.

In my earlier treatment of *Rumex* (Rechinger 1935a: 43) I distinguished *R. dumosiformis* from *R. dumosus* on the basis of three characters of the fruiting valves: the valves were smaller, possessed longer teeth and their central nerve was thickened into a callosity. It is now apparent that these characters are not correlated and that there is variation from specimens with valves lacking a callosity to ones where it is quite pronounced. *Rumex dumosiformis* should therefore be regarded as only a variety (see 10b below).

10a. var. *dumosus*

Valves all ecallose.

Selected specimens examined. NEW SOUTH WALES: Jerrabomberra Avenue, Canberra, *E. M. Canning* 5033 (CBG); 15 miles [24 km] N of Deniliquin, *J. H. Leigh* S86 (NSW); Near Jerilderie, *E. McBarron* 20974 (NSW).

VICTORIA: c. 0.5 miles [0.8 km] N of Victoria Valley Hall on Grampians Road, *A. C. Beaglehole* ACB 30805 (MEL); Devils Pools, N of Wonga Hut, Wyperfeld National Park, *John Landy* and *A. C. Beaglehole* ACB 9594 (MEL); 8 km NNE of Strathmerton near site of Myee railway station 35°51'S, 145°30'E, *T. B. Muir* 6060 (MEL); Whipstick, near Neilborough, 10 November 1963, *W. Perry* s.n. (MEL).

TASMANIA: Conara to Ross, December 1955, *W. M. Curtis* s.n. (HO); Rokeby 42°53'S, 147°26'E, December 1899, *L. Rodway* s.n. (HO).

SOUTH AUSTRALIA: Hundred of Yaranyacka, c. 45 km NNE of Port Lincoln, *C. R. Alcock* C122 (AD); Wolseley, c. 80 km N of Naracoorte, *K. M. Alcock* 197 (AD); Iron Knob, c. 55 km NW of Whyalla, 7 November 1936, *J. B. Cleland* s.n. (AD); Beaumont hills, c. 6 km SE of Adelaide, 14 November 1943, *J. B. Cleland* s.n. (AD); Bool Lagoon, c. 25 km S of Naracoorte, *D. Hunt* 2203 (AD); Wilmington, c. 40 km SE of Port Augusta, 22 October 1928, *E. H. Ising* s.n. (AD).

WESTERN AUSTRALIA: (all PERTH). Swamp Road, Gairdner River, property of R. Hurst, *J. Moore* 5, 12 and 26; Devil Creek Road, Gairdner River, property of T. Parker, *J. Moore* 31.

Distribution (Figure 12B). South-east and south-west Australia. It is not known whether the Western Australian occurrences are natural or whether they are the result of human intervention. Rarely found in Europe as an alien on imported wool.

10b. var. *dumosiformis* (Rech. f.) Rech. f., stat. nov.

Rumex dumosiformis Rech. f., Oesterr. Bot. Z. 84: 43 (1935). *Lectotypus* (here selected): Murray River, Victoria, *Wawra* (W).

At least *anterior* valves bearing a callosity.

Other specimens examined. QUEENSLAND: Darling Downs, Macalister, April 1916, *E. W. Bick* s.n. (BRI); Jimbour, 9 May 1956, *M. Conway* s.n. (BRI); 6 miles [9.7 km] S of Muckadilla on "Lorne" Station, 12 June 1968, *C. J. Paull* s.n. (ADW, BRI); Everton, Jimbour, 8 June 1937, *A. Tuppack* s.n. (BRI).

NEW SOUTH WALES: Wonganella 35°13'S, 144°49'E, December 1918, *E. Officer* s.n. (NSW).

VICTORIA: Boorhaman, 29 November 1939, *Raleigh A. Black* s.n. (MEL); 4 miles [6.4 km] by road S of Echuca, *E. F. Constable* 5218 (NSW).

TASMANIA: Township Lagoon, Tunbridge 42°08'S, 147°25'E, *D. I. Morris* 7855 (HO).

SOUTH AUSTRALIA: Spalding 33°30'S, 138°37'E, 8 November 1920, *J. M. Black* s.n. (AD); Kilkenny, (5 km NW Adelaide), 9 September 1948, *J. B. Cleland* s.n. (AD); Brighton, (c. 15 km SSW Adelaide), 21 December 1949, *J. B. Cleland* s.n. (AD); Jamestown, 23 November 1960, *D. E. Symon* s.n. (ADW).

Distribution (Figure 12B). Eastern Australia, of scattered occurrence.

11. *Rumex drummondii* Meisn. in DC., Prodr. 14: 61 (1856). *Typus*: Swan River, Drummond 207 (iso: MEL).

R. pulcher sens. Benth., Fl. Austral. 5: 264 (1870), p.p. quoad syn. *R. drummondii*.

R. flexuosus F. Muell., Syst. Census of Austral. Plts. 31 (1882); Second Census of Austral. Plts. 53 (1889), p.p., non Sol. ex Sprengel.

R. flexuosiformis Rech. f. Oesterr. Bot. Z. 84: 46 (1935), syn. nov.

Perennial. Stems erect, 60-90 cm high, usually branched in the upper half; branches divaricate, flexuose, forming an open panicle. *Basal leaves* petiolate, petioles about equalling the length of laminae; laminae oblong-lanceolate from a truncate or subcordate base, nearly flat, up to 10 x 2 cm, apices acute; upper stem leaves evidently shorter petiolate, narrower and more acute. *Flower whorls* usually 8-12-flowered, all distant, only the lowermost subtended by a small leaf. *Fruiting pedicels* about twice or sometimes even 3 times as long as the valve, articulate around the lower third, more or less thickened towards the base of the perianth. *Fruiting valves* (3.5)4-5 mm long, 1.5-2 mm broad (excluding teeth), prolonged into a long and narrow acute apex which as a whole is somewhat slightly recurved but not hooked as in *R. brownii*, central nerve of the valve bearing a callosity near the base and 2(3) acute, more or less divergent, sometimes slightly curved teeth. *Nuts* 2.5-3.5 mm long, broadest slightly below the middle. (Figures 2D and 7A).

Other specimens examined. WESTERN AUSTRALIA: Gingin, October 1938, *P. R. Gorrie* s.n. (PERTH); Kalgan River, 5 miles [8 km] E of Albany, *A. Oldfield* s.n. (MEL).

Distribution (Figure 12B). Western Australia. The only precise localities known for this species are those given above.

Having now examined further material of Drummond 207 and 703 (syntypes of *R. drummondii*) from herb. MEL I am of the opinion that *R. flexuosiformis* Rech. f. should be considered conspecific with *R. drummondii*. Previously (Rechinger 1935a: 46) I had subdivided Meisner's taxon into *R. flexuosiformis* (based on Drummond 703) and *R. drummondii* (lectotypified by Drummond 207).



Figure 7. A—*Rumex drummondii*. Isotype, *J. Drummond* 207 (MEL). B—*R. stenoglottis*. *J. de Nardi & L. A. S. Johnson* 376 (NSW).

Rumex oxysepalus Meisn. (1857), evidently based on an immature specimen (Herb. Preiss 1357), probably should be considered conspecific with *R. drummondii* as suggested by Meisner in the protologue.

The characters separating *R. drummondii* from *R. dumosus*, seem to hold true, viz. long pedicels articulate near the base and many-flowered whorls. Furthermore the valves of *R. drummondii* are longer and narrower with a more prolonged narrow tip having the tendency to be slightly reflexed when dry (but not hooked as in *R. brownii*).

Bentham (1870) regarded *R. drummondii* as a synonym of *R. pulcher* and this error has persisted in several herbaria and publications up to the present. *Rumex pulcher* can always be easily recognized by its short thick pedicels which are articulate at about their middle and by its much broader valves which never have a prolonged tip.

12. *Rumex stenoglottis* Rech. f., sp. nov. (Figures 2F and 7B).

Perennis. Caulis erectus, \pm angulato-flexuosus, (30)40(50) cm altus, plerumque fere a basi iteratim tenuiter ramosus; panícula ampla intricate ramosa. Folia basalia et caulina inferiora mox marcescentia petiolo 3-8 cm longo vel interdum longiore suffulta, linearia, margine crispata, prope basin \pm indistincte rotundato-dilatata, basi ipsa contracta vel \pm oblique sinuato-cuneata, supra basin interdum \pm indistincte contracta, apice acuta; folia caulina pauca, brevius petiolata, valde diminuta; folia verticillastra inferiora fulcrantia brevissime petiolata, lanceolata, e basi dilatata longe attenuata. Florum verticillastra (3)4-5-flori, omnes remoti. Pedicelli fructiferi prope basin articulati, validiusculi, perigonium versus sensim incrassati, perigonio plerumque paulo longiores. Perigonii fructiferi folia exteriora basi valvarum appressa, dentem plerumque subaequantem eumque interdum \pm occultantes. Valvae fructiferae \pm 5 mm longae, dente excluso vix 1.5 mm latae, anguste lingulatae, in apicem acutum subulatum interdum subrecurvo-patulum excurrentes, utrinque basi dentem singulum rectangulariter patentem latitudine valvae longiorem ferentes, prope basin callo ovoideo-hemisphaerico in costam validam attenuato provisum, nervatura ad foveolas crasse marginatas paucissimas reducta. Nux \pm 3 mm long. Differt a *R. dumoso* A. Cunn. ex Meisn. valvis longioribus angustissimis lingulatis acutissimis, basi utrinque dentem unicum rectangulariter patentem ferentibus.

Typus: 500 m W of road 12 km N of Rankins Springs towards Naradhan, 36°46'S, 146°20'E, 290 m alt., New South Wales, Western Plains. 19 Nov. 1975. *M. D. Crisp* 1630 (holo: CBG).

Perennial. Stems erect, more or less angular-flexuose, 30-50 cm high, usually divided nearly from the base into a broad panicle composed of repeatedly divided fine branches which finally form a more or less entangled mass. *Basal* and *lower stem leaves* soon withering, slightly broadening at the base, often somewhat constricted above the base with wavy margin and acute apex; *stem leaves* few, smaller, with shorter petioles; *leaves subtending lower flower whorls* long, tapering from a slightly broader base. *Whorls* with (3)4(5) flowers, all distant. *Fruiting pedicels* articulate near the base, slightly thickened towards the perigone, usually slightly longer than the fruiting perigone. *Fruiting valves* c. 5 mm long (excluding the teeth), hardly 1.5 mm broad, narrowly tongue-shaped, gradually tapering into the sharp tip which is sometimes slightly patent-recurved (but never hooked), with a single, patent marginal tooth at the base; central nerve expanded into a callosity near its base. *Nuts* \pm 3 mm long.

Related to *R. dumosus* A. Cunn. ex Meisn. from which it is distinguished by its very narrow valves tapering to a sharp apex and bearing a single, patent tooth near the valve base.

Other specimens examined. QUEENSLAND: Darling Downs, Dalby, April 1916, C. T. White s.n. (BRI).

NEW SOUTH WALES: Ingleburn, J. Bacon & J. McBarron 16204 (NSW); Aberdeen, 19 December 1912, E. Breakwell s.n. (NSW); Yanco Experimental Farm, November 1913, E. Breakwell s.n. (NSW); 1 km W Wee Waa in floodplain of Namoi River 30°13'S, 149°25'E, B. G. Briggs 4318 (NSW); Mitchell Highway, 6 miles [9.7 km] SSE of Dubbo towards Wellington, R. Coveny 2508 (NSW); 20 km S of Nevertire on Tottenham Rd, G. M. Cunningham 3978 & P. L. Milthorpe (NSW); Backyamma State Forest, 15 miles [24 km] ENE Forbes, F. K. Curtin 317 (NSW); Garah, July 1963, F. W. Cutting s.n. (NSW); 25 km W Rankin Springs 33°53'S, 146°04'E, J. C. De Nardi 943 (NSW); The Meglo, Coonamble Experimental Station, J. C. De Nardi & L. A. S. Johnson 376 (NSW); Sydney Botanic Gardens, 2 January 1941, C. Fry s.n. (NSW); Gundy, January 1954, R. E. Herrington s.n. (NSW); Aberdeen, 3 December 1954, L. A. S. Johnson s.n. (NSW); Weemelah, E. McBarron 15768 (NSW); Boggabilla, October 1952, H. K. Paterson s.n. (NSW); Rice Research Station, Leeton 254/38, October 1938, s. coll. (NSW); Paradise Experimental Area, B. Semple 606 (NSW); "Iolanthe" 26 km W Garah 29°08'S, 149°28'E, K. L. Solling 552 (NSW); Parkes 33°08'S, 148°11'E, 1965, B. Stuckey s.n. (NSW); "Burrigillo" N of Merrywinebone edge of watercourse, 12 November 1956, J. T. Waterhouse s.n. (NSW); Yanco, February 1913, H. Wenzholz s.n. (NSW); Grong Grong, G. H. Wright 12 (NSW).

VICTORIA: Wyperfeld National Park, 7 miles [11.3 km] S of NE corner of the Hump, N boundary of park, A. C. Beauglehole and E. W. Finck ACB 29469 (MEL); St. Albans, R. H. Groves 524 (MEL); Pyrenees (central-west region), February 1840, George A. Robinson s.n. (MEL).

Distribution (Figure 12A). South eastern Australia.

In *Rumex stenoglottis* the valves are about 5 mm long (excluding the teeth), rarely 1.5 mm broad near their base and prolonged into a long thin very acute reflexed tip; there is only a single tooth at the base of the valve on each side. The collector of the type specimen has named his plant *R. crystallinus* Lange; E. M. Canning has tentatively renamed it as *R. tenax*. By the few fruits per whorl as well as by the pedicels longer than the valve, the plant, however, is definitely different from both these species; from *R. crystallinus* it is furthermore distinguished by its perennial growth habit. Several other sheets of *R. stenoglottis* which I have examined had been named *R. dumosus*. The latter is evidently the closest relative of the new species. Both have in common the repeatedly divided panicle with the branches forming an entangled mass. *Rumex stenoglottis*, however, differs from *R. dumosus* by the very narrow, lingulate valves bearing a single tooth at the base on each side.

Etymology. The specific epithet is derived from the Greek words *stenos* (narrow) and *glossa* (tongue), referring to the shape of the tip of the valves.

13. *Rumex tenax* Rech. f., Oesterr. Bot. Z. 84: 40 (1935). *Lectotype* (here selected): Narrabri, J. H. Maiden, November 1899, ex herb. Sydney (W).

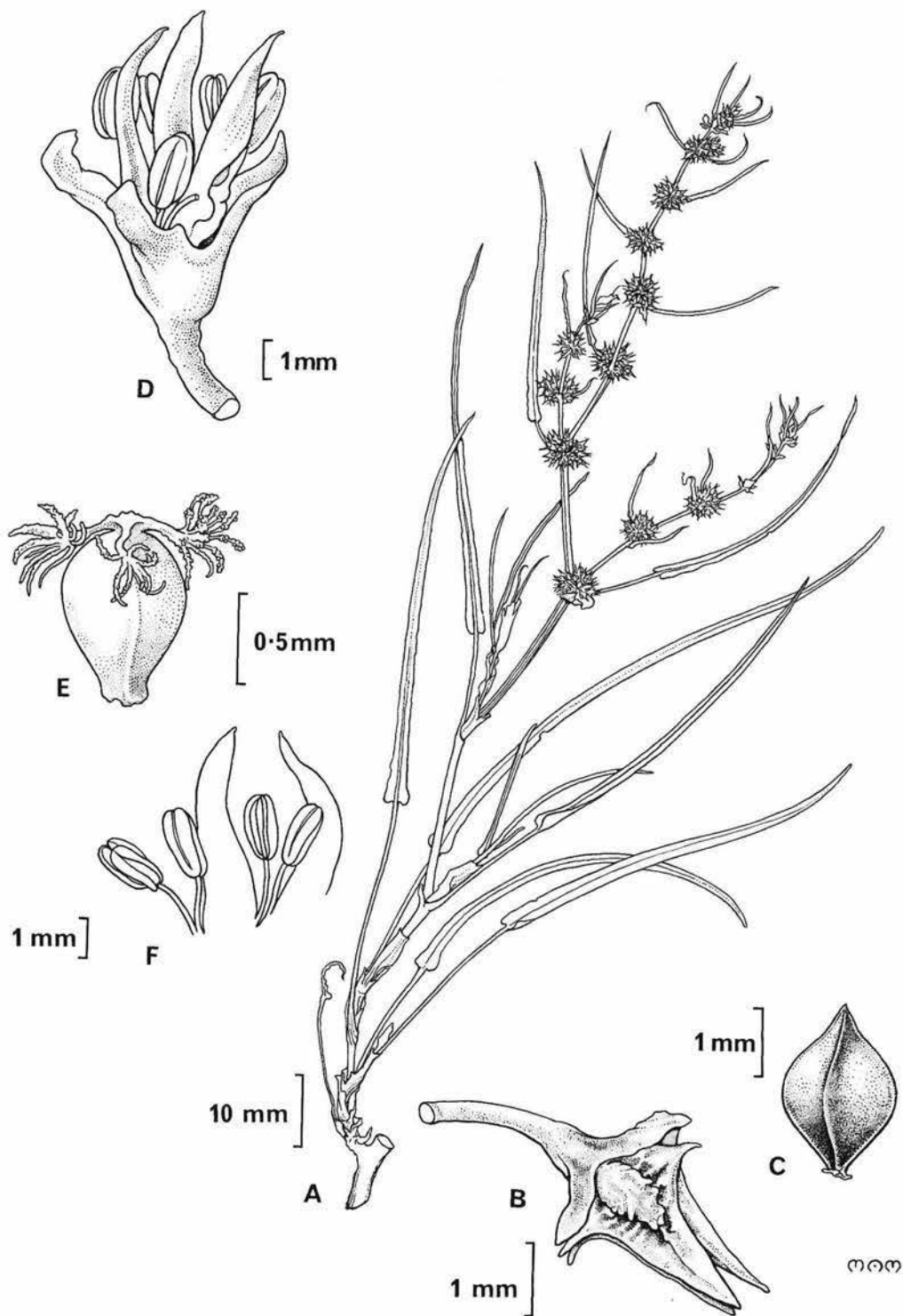


Figure 8. *Rumex tenax*. A—Habit. B—Fruit. C—Nut. D—Flower. E—Gynoeceium. F—Detail of anthers. Helen I. Aston 2184 (MEL).

Deep rooted *perennial*. Plants glabrous, smooth. *Stems* erect, wiry, 15-50 cm high, divaricately branched. *Basal leaves* with long and rigid petioles, narrowly linear, 90-160 x c. 5 mm, more or less indistinctly broadened at the base which is slightly obliquely truncate or more often broadly cuneate, apices very acute; *petioles* long, rigid; *stem leaves* up to 10 x 0.3-0.4 cm, very narrowly linear, 20-30 times as long as broad, flat or minutely crisped at the margin, base as on the basal leaves, *petiole* short; *upper stem leaves* diminishing in size, becoming still narrower. *Flower whorls* many flowered, dense, all distant, all with a narrow subtending leaf many times longer than the whorl. *Fruiting pedicels* articulate near the base, somewhat or up to 1.5 times longer than the fruiting perigone. Outer perigone segments c. 1.5 mm long. *Fruiting valves* 2.5-3 mm long, c. 1.5 mm broad near the base (excluding the teeth) apices straight and mucronate, surface of valve minutely pitted and with a single strong tooth on each side, all valves with a callosity. *Nuts* c. 2 x 2.25 mm. (Figures 3E and 8).

Selected specimens examined. QUEENSLAND: About 3 miles [4.8 km] SW Taroom (25°39'S, 149°48'E), R. W. Johnson 773 (BRI); Woodlands, about 40 miles [64 km] N Bungunya (28°26'S, 149°39'E), R. W. Johnson 1241 (BRI); 1 mile [1.6 km] W of Yelarbon 28°34'S, 150°45'E, L. A. S. Johnson & E. F. Constable s.n. (BRI); Roma, Maranoa district 26°35'S, 148°47'E, C. T. White 9545, (BRI, CANB); Cunnamulla, Warrego District, C. T. White 12020 (BRI).

NEW SOUTH WALES: Forbes 33°23'S, 148°01'E, September 1933, A. B. Cashmore s.n. (ADW); Lyneham Oval, Canberra, M. Gray 6280 (BRI); SW Tapio dam, Henshall 887 (NT); 29 miles [46.7 km] N of Stelman's Tank between Cobar and Bourke, C. W. E. Moore 4335 (CANB); 40 miles from Hay towards Balranald, 15 September 1965, M. E. Phillips s.n. (CBG); Kennedys Tank, 20 km N Broken Hill 31°34'S, 141°35'E, D. Symon 6735 (ADW, CANB).

VICTORIA: Northam Yarrowonga, in the railway yards 36°01'S, 146°00'E, Helen I. Aston 2184 (MEL); Wyperfeld Nat. Park within 3 miles [4.6 km] of Wonga Hut, A. C. Beaglehole 9537 (MEL); Johnson's Bend, Murray River near Mildura (20°29'S, 147°53'E), L. A. Craven 1582 (CANB, MEL); Charlton (158 miles NW Melbourne), 24 May 1964, R. V. Smith s.n. (MEL); c. 19 km SE Horsham 36°43'S, 142°12'E, D. E. Symon 9793 (ADW, CANB).

SOUTH AUSTRALIA: Lyrup, Southern Murray Region 34°16'S, 140°39'E, August 1922, H. W. Andrew s.n. (AD); Paringa near Renmark, 12 January 1884, M. Murray s.n. (AD); Mutooroo, just west of S.A. and N.S.W. border, c. 60 km WSW of Broken Hill, 1 May 1930, T. B. Paltridge s.n. (AD, CANB); Upper Murray River near 379 mile peg opposite Little Hunchee Island, D. E. Symon 11582 (ADW, CANB).

WESTERN AUSTRALIA: Merredin Research Station, March 1944, E. Langfield s.n. (PERTH).

Distribution (Figure 11B). *Rumex tenax* has an eastern Australian distribution roughly between 25°30' and 37°45'S and 139°30' and 152°30'E. Most localities are situated west of the Great Dividing Range.

As there appears to be considerable confusion between *R. tenax* and *R. crystallinus* the distinguishing features between these two species are given in the table below. Although the name *R. tenax* was correctly applied by both Beadle, Evans and Carolin (1972) and Burbidge and Gray (1970), Willis (1973) confused it with *R. crystallinus*. Many Australian herbarium specimens referable to these taxa have until now been wrongly named.

<i>R. crystallinus</i>	<i>R. tenax</i>
Annual	Perennial
Stem short, flexuose, ascendent, branching from the base or nearly so	Stem rather tall, somewhat wiry, erect, branches stiff, forming an open panicle
Colour of dry plant tending towards orange	Colour of dry plant never orange
Leaves broadly linear, all roughly crispate and long petiolate	Leaves very narrow, the narrowest of the whole genus, nearly grasslike, lower 3-4 (5) mm broad, upper 1-2 mm broad, flat, utmost border finely crispate
At least the upper whorls confluent	All whorls distant
Fruiting valves c. 2 mm long, barely 1 mm wide (excluding teeth) measured near the base, usually with 1(2) teeth of varying length on each side	Fruiting valves 2.5-3 mm long, c. 1.5 mm wide (excluding teeth) measured near the base, with a single strong tooth on each side

Rumex tenax evidently has no close relative but it can be regarded as a most remote representative of sect. *Australienses*. When describing *Rumex tenax* (1935a) I was in doubt about its duration. Judging from numerous sheets showing the basal, and in some cases even subterranean parts, it is now evident that it is a long lived perennial.

Subgen. *Rumex* sect. *Simplices* subsect. *Acrancistron*

Subsect. *Acrancistron* Rech.f., subsect. nov.

Perennis. Folia inferiora longitudine 2.5-4-plo longiora, basi cordata vel sinuato-truncata vel late cuneata, supra basin saepe \pm constricta. Pedicelli fructiferi valvis aequilongi vel eis ad duplo longiores, infra medium vel in tertia parte interiore articulati. Valvae nervo mediano incrassato provisae rarius subindistincte calliferae, utrinque hamato-pluridentatae, apice valvae quoque in dentem hamatum excurrente.—Typus subsectionis: *R. brownii* Campd.

Perennials. Lower leaves 2.5-4 times longer than broad, often slightly constricted above the base. *Fruiting pedicels* equalling the valves in length or up to twice as long, articulate below the middle or on the lower third; *central nerve of the valves* more or less thickened and sometimes with a more or less indistinct callosity, with several hooked marginal teeth and the apex ending equally in a hooked tooth.

14. ***Rumex brownii*** Campd., Monogr. *Rumex* 64, 81 (1819). *Typus*: "Ad portum Jackson", *R. Brown* (BM).

R. fimbriatus R. Brown, Prodr. Fl. Nov. Holl. 116 (1810) nec Poir.

R. brownianus Schult.f., Syst. Veg. VII, 2: 1395 (1830).

Perennial. Stems slender, 50-80(100) cm, ascendent, usually with few, elongate, leafless branches. *Basal leaves* variable in shape and size, oblong or lanceolate, base more or less cordate or sometimes truncate or broadly cuneate, usually panduriform, constricted above the base, up to 10(17) x 3(5) cm, slightly crispate at the margin, rarely flat, apices acute or subobtuse; *stem leaves* few and confined to the lower 1/3 of the plant, gradually becoming smaller and narrower and more acute. *Panicles* loose with very few, usually simple, elongate branches. *Whorls* few-flowered, with (5) 6(8) flowers, distant, without subtending leaves. *Fruiting pedicels* thin, as long as the valves or somewhat longer, rarely up to twice as long, articulate about 1/3 of their length. *Fruiting valves* (2.5)3(4) x c. 2 mm, triangular, strongly reticulate-nervose, dentate, teeth 3-5 on each side, all teeth as well as the apex hooked. *Nuts* c. 2 x 1.25 mm, broadest somewhat below the middle. $2n = 20$ (tetraploid)—B. Briggs in sched., NSW 60878. (Figures 3A and 9A).

Selected specimens examined. QUEENSLAND: Outside Tennyson Powerhouse, Brisbane, 23 September 1968, A. A. Dowling s.n. (BRI); Indooroopilly 27°30'S, 152°00'E, L. Durrington 00149 (BRI); Between Holland Park and Mt Gravatt, near Brisbane, C. E. Hubbard 2730 (BRI); 28 miles [44.8 km] S of Roma on road to Surat, L. A. S. Johnson and D. F. Blaxell 1001 (NSW); Warrego River crossing, 1 km E of "Nombardie" 27°27'S, 145°53'E, R. W. Purdie 664D (BRI); Kingaroy, L. S. Smith 3091 (CANB); Mackay 21°10'S, 149°10'E, T. Stanley 78253 and E. Ross (BRI); Wallumbilla, May 1916, C. T. White s.n. (NSW).

NEW SOUTH WALES: 1 km W of Wee Waa in floodplain of Namoi River 30°13'S, 149°25'E, B. G. Briggs 4318a (NSW); 8 miles [12.9 km] NE of Dubbo on road to Mendooran, R. Coveny 2471 (NSW); Near Cobbitty trig, 5.5 km N of Cobbitty 33°59'S, 150°42'E, R. Coveny 7447, D. Benson and H. Bryant (NSW); Eremeran turn-off on Gilgunnia road, G. M. Cunningham and P. L. Milthorpe 1466 (NSW); 37 miles [59.5 km] N of Cobar on Louth road 31°07'S, 145°27'E, S. Jacobs 205 (NSW); Cookardina, E. J. McBarron 465 (NSW); 62 miles [99.7 km] E of Cobar on Barrier Highway, C. W. E. Moore 3919 (CANB); Floodplain of Darling River c. 15 km SW of Wilcannia 31°45'S, 143°15'E, K. Pajmans 3222 (CANB); Lake Eucumbene, 27 January 1965, M. E. Phillips s.n. (CBG); N end of Little Slope, Lord Howe Island, J. Pickard 2752 (NSW); CSIRO grounds, lower E slope of Black Mountain, R. Pullen 8646 (CANB); Tuross River Catchment area 36°11'S, 149°40'E A. and C. Tyrrel 48 (CBG); 10.5 km SE of Mungindi on Moree road 29°02'S, 149°05'E, K. L. Wilson 1882 (NSW); Royal Botanic Gardens, Sydney, K. L. Wilson 657 and J. Seur (NSW).

VICTORIA: Brisbane Ranges, 2-3 miles [3.2-4.8 km] NE of Durdidwarrah, J. Anderson 315 (AD); Valencia Creek, c. 18 km N of Maffra, H. I. Aston 2016 (MEL); Wyperfeld National Park, 3.5 miles [5.6 km] SW of Wonga Hut, A. C. Beaglehole ACB 28446 (MEL); 4 miles [6.4 km] NE of Hattah Lake, Kulkyne Forest, A. C. Beaglehole ACB 39221 and J. H. Willis (MEL); Between Halls Gap and Stawell, 12 November 1959, D. E. Symon s.n. (ADW); Hawkesdale, December 1901, H. B. Williamson s.n. (NSW); Geelong, January 1910, H. B. Williamson s.n. (CANB); Port Phillip Bay, McCrae foreshore, 24 February 1963, J. H. Willis s.n. (MEL).

TASMANIA: Devonport 41°09'S, 146°23'E, October 1943, W. M. Curtis s.n. (HO); Brown's River near Hobart 42°58'S, 147°20'E, 23 December 1944, W. M. Curtis s.n. (HO); George Town 41°10'S, 146°50'E, December 1955, W. M. Curtis s.n. (HO); Gordon Point, Channel Highway, R. Melville 2434, J. Willis and W. Curtis (MEL); Buckland 42°37'S, 147°43'E, 14 December 1978, B. Robinson s.n. (HO); River Jordan 42°44'S, 147°14'E, January 1893, L. Rodway s.n. (HO); Roden Island, Furneaux Group, J. S. Whinray 1320 (MEL); Deal Island, Kents Group, J. S. Whinray 1927 (MEL).

SOUTH AUSTRALIA: Big Heath National Park, c. 25 km SW of Naracoorte, *C. R. Alcock* 3062, 3083 (AD); SE slope to Boat Harbour Creek, between Cape Jervis and Victor Harbour, *Hj. Eichler* 14441 (AD); Kangaroo Island at mouth of Western River, *Hj. Eichler* 15361 (AD); c. 5 km SSE of Bascombe Well Homestead (c. 25 km WSW of Lock), *Hj. Eichler* 19285 (AD, MEL); Torrens Gorge, Mt Lofty Range, *A. G. Spooner* 262 (AD); River front at Overland Corner, *D. E. Symon* 3874 (ADW); S of Pitlockry, Lower Coorong 36°25'S, 139°46'E, *D. E. Symon* 10551 (ADW); NE of Kondoolka Homestead, Gawler Range, *J. Z. Weber* 3086 (AD); Mambray Creek, c. 40 km SSE of Port Augusta 32°50'S, 138°04'E, *D. J. E. Whibley* 4380 (AD); c. 35 km SSE of Yunta near Manunda, *P. G. Wilson* 2228 (AD).

NORTHERN TERRITORY: CSIRO paddock 23°48'S, 133°54'E, 19 July 1977, *D. J. Nelson* s.n. (NT)

WESTERN AUSTRALIA: Helena Bridge, June 1902, *C. Andrews* s.n. (PERTH); *C. Milton's* property, 3 km S of Mt Barker 34°38'S, 117°40'E, *K. F. Kenneally* 6494 (PERTH); *R. & D. Hurst's* property, Swamp Road, 60 km S of Jerramungup, *K. H. Rechinger* 60059 (PERTH, W); *M. Buxton's* property, 10 km W of Redmond (34°53'S, 117°42'E), *K. H. Rechinger* 60235 (PERTH, W); Margaret River, 13 January 1945, *R. D. Royce* s.n. (PERTH); *Buxton's Farm*, Hay River District 34°53'S, 117°34'E, 29 April 1981, *J. K. Scott* s.n. (PERTH).

Distribution. Australia (Figure 13A), New Zealand, Timor, New Guinea and Java. It is not known whether the Western Australia occurrences are natural or whether they are the result of human intervention. Rarely found as an alien in Europe.

The most outstanding character of *R. brownii* and the closely related *R. alcockii* are the hooked teeth on their valves. There is a group of African and Asiatic species, namely *R. nepalensis* Spreng. (see map 4, Rechinger 1932), *R. bequaertii* De Wildeman (Central and South Africa and Madagascar) and *R. steudelii* Hochst. (Central and South Africa) which share this character. However, these species differ from *R. alcockii* and *R. brownii* in having the tips of the valves pointed and straight, not pointed and hooked. It is open to question whether the character of hooked teeth is an expression of close relationship or whether it might have evolved convergently in Australia and in Africa and Asia.

There is a considerable range of morphological variation in *R. brownii* even after the removal of *R. alcockii* (see sp. 15 below). This variation involves the width and shape of the leaves and the size of the fruiting perigones.

A peculiar ecotype or geographical race occurs on the Yorke Peninsula and Kangaroo Island in South Australia and extends east to the Furneaux Group in Bass Strait. The plants are of low habit, 5-20 cm high, the flowering stems are unbranched and possess few stem leaves, the basal leaves are thickish, small, linear-oblongate or obovate, often constructed below the middle, and have a cordate base. The fruit on most specimens seen are not quite ripe but they seemingly hardly differ from typical *R. brownii*. Future visitors to this area should try to establish whether it is an ecotype or a geographical race. Pending further observations I refrain from assigning a formal rank to this interesting variant. The following specimens referable to this variant have been seen.

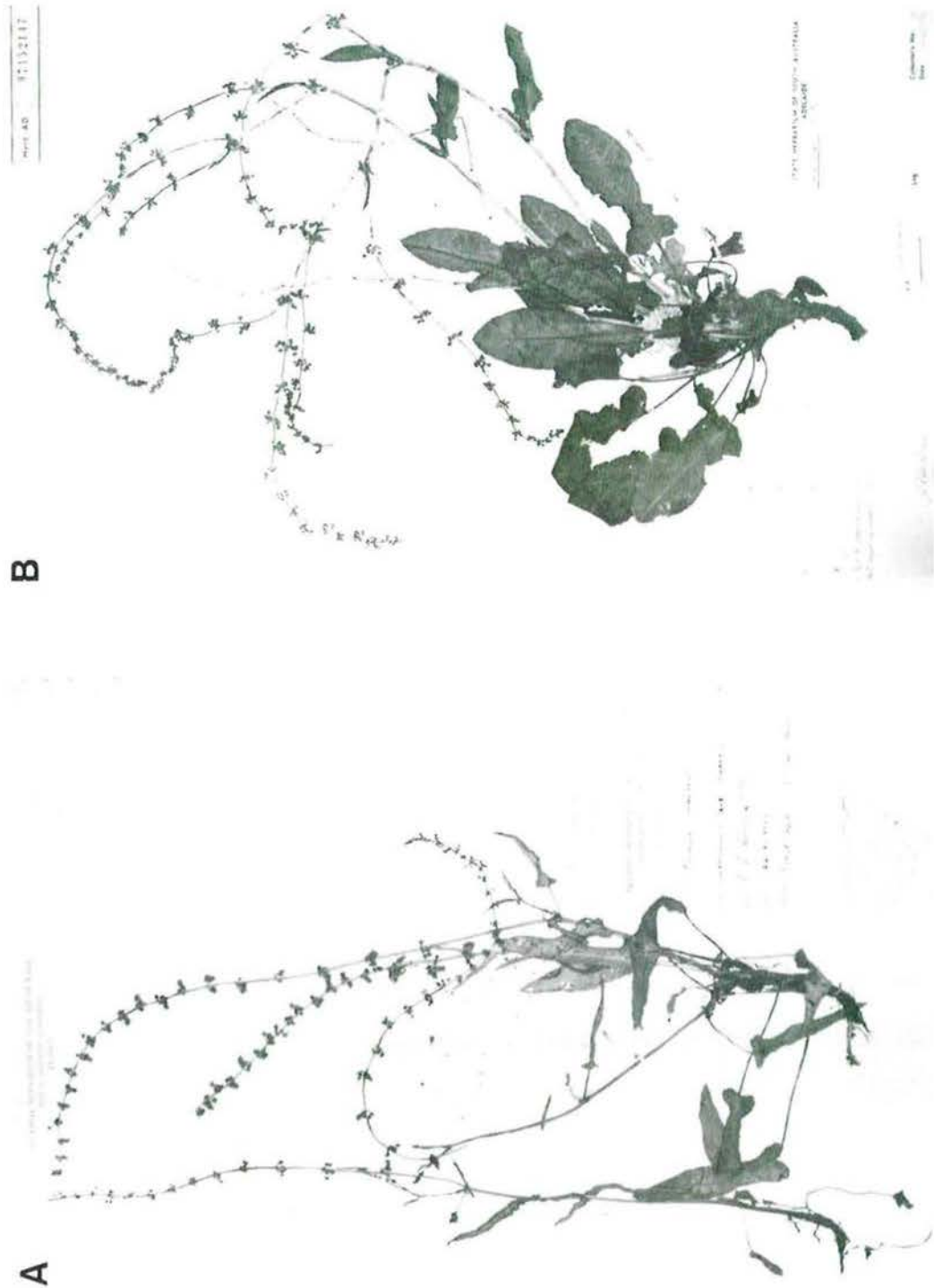


Figure 9. A—*Rumex brownii*. K. L. Solling 580 (NSW). B—*R. alcockii*. C. R. Alcock 3583 (AD).

VICTORIA: Lady Julia Percy Island, A. C. *Beaglehole* ACB 6650 (MEL)

TASMANIA: East Sister Island, Furneaux Group 39°40'S, 148°00'E, J. S. *Whinray* 9 (HO); Mount Chappell Island, Furneaux Group, J. S. *Whinray* 586 (HO).

SOUTH AUSTRALIA: Ardrossan, c. 90 km NW of Adelaide 34°26'S, 137°55'E, *Anon.* 341 (AD 97923135); Rocky River, Kangaroo Island, 19 November 1924, J. B. *Cleland* s.n. (AD); Stokes Bay, Kangaroo Island, A. B. G. *Trainee* 91 (AD); Rocky River, Kangaroo Island, J. R. *Wheeler* 1183 (AD).

15. *Rumex alcockii* Rech. f., sp. nov. (Figures 3C and 9B).

Perennis, 30-60 cm altus, ascendens vel \pm erectus, robustus, pauciramosus; rami elongati, subflexuosi, simplices. Planta exiccando bruneo-rufescens. Folia crassiuscula, in vivo evidenter subcarnosa, in sicco subcoriacea, oblonga vel oblongo-lanceolata; folia basalia petiolo quam lamina plerumque subaequante vel paulo tantum brevior suffulta, oblonga vel late oblongo-lanceolata, latitudine plerumque (2.5)3(3.5)-plo longiora, basi cordata vel sinuato-truncata, supra basin panduriformi-contracta, plana sed extremo margine leviter crenata vel subcrispata, apice obtusiuscula vel subacuta; folia caulina non numerosa, saepe in dimidia vel in tertia parte inferiore caulis sita, sensim brevius petiolata, minora, proportione angustiora et acutiora. Verticillastri multiflori, inferiores floribus 8-15, infimis folio diminuto exceptis omnia foliis fulcrantibus carentes. Pedicelli crassiusculi, perigonium \pm aequantes vel paulo longiorus. Perigonii folia exteriora marginibus interiorum appressa, \pm 2 mm longa. Valvae 4-4.5 mm longae crasse coriaceae, grosse reticulato-foveolatae; nervus medianus ceteris multo validior, in parte inferiore saepe in callum \pm distinctum fusiformem incrassatus; nervus in apicem valvae longe sensim attenuatum apice manifeste hamato-incurvum excurrens; dentes utrinque 3-4, apice manifeste hamati. Nux 2.8-3 mm longa.

Typus: S.A. Eyre Peninsula-Gawler Ranges, c. 32 km N Minnipa, P. G. *Wilson* 526 16.10.1958 (holo: AD).

Perennial. Plant turning reddish brown upon drying. *Stems* 30-60 cm high, ascendent or erect, robust, with few branches. *Leaves* thickish, *petioles* \pm equalling laminae in length; *laminae* of basal leaves oblong or broadly oblong-lanceolate, (2.5)3(3.5) times longer than broad, base cordate or sinuate-truncate, usually with a slight contraction above the base, mainly flat but minutely or slightly crenate or crispate at the extreme margin; *stem leaves* not numerous, usually situated in the lower half or third of the stem, smaller and proportionally narrower and more acute than the basal leaves. *Lower whorls* with 8-15 flowers, only the lowermost subtended by a leaf, the majority completely leafless. *Valves* 4.5-5 mm long, somewhat leathery, grooved, the central nerve thicker than the remainder and often with a distinct callosity near its base, prolonged at the apex into a distinct hook, 3-4 marginal teeth present and all equally hooked at the tip. *Nuts* 2.8-3 mm long.

Selected specimens examined. SOUTH AUSTRALIA: South of Bascombe Well, c. 115 km NNW of Port Lincoln, C. R. *Alcock* 1540 (AD); Coultla, South Eyre Peninsula, C. R. *Alcock* 2309 (ADW); Little Swamp, c. 10 km NW of Port Lincoln, Eyre Peninsula, C. R. *Alcock* 2524 (AD, ADW); Near Coomunga, c. 15 km NW of Port Lincoln, C. R. *Alcock* 2585, 2588 (AD, ADW); Hundred of Wangary, c. 30 km NW of Port Lincoln, C. R. *Alcock* 2748 (AD, ADW); Hundred of Warrow, c. 45 km NW of Port Lincoln, C. R. *Alcock* 2776 (AD); South Artaming Dam, Yardea Homestead, c. 210 km W of Port Augusta, C. R. *Alcock* 4179 (AD); Pondalowie, Innes National Park, 33°15'S, 136°55'E, C. R. *Alcock* 4921 (AD); c. 2 km W of Hiltaba Homestead,

c. 105 km NE of Streaky Bay Township, *B. J. Blaylock* 1976 (AD); Blinman, c. 80 km SE of Leigh Creek, 24 September 1956, *J. B. Cleland* s.n. (AD); Corunna, c. 5 km N of Iron Knob, c. 55 km NW of Whyalla, *W. L. Cleland* s.n. (AD); Yararoo Station, Kulpara, c. 110 km NW Adelaide, *B. Copley* 1627 (AD); Siccus River, Johnson's Pdk, Koonamore Station, c. 400 km NNE Adelaide, *M. Crisp* 696 (AD); Mt Remarkable Nat. Park, Mambray Creek 32°50'S, 138°04'E, *N. N. Donner* 4921 (AD); Mambray Creek, c. 45 km SE of Port Augusta, *Hj. Eichler* 17643 (AD); Southern face of Mt Yardea, c. 65 km NE Minnipa, *L. Haegi* 826 (AD, ADW); Oraparinna Nat. Park, c. 160 km NNE of Port Augusta, *E. N. S. Jackson* 1712, 1756 (AD); W of Arkarool Sanctuary Headquarters, c. 95 km ENE of Leigh Creek, *R. H. Kuchel* 2948 (AD); South side of Mt Serle which is c. 45 km E of Leigh Creek, *T. R. N. Lothian* 3117 (AD); Oratunga Station near Blinman, Flinders Range, *J. Ogden* ANU 18127 (CANB); c. 8 km WNW Mount Remarkable, *A. E. Orchard* 3265 (AD); Thurlga Station, c. 25 km W of Lake Gairdner south, *K. D. Rohrlach* 903 (AD); Hiltaba homestead, c. 105 km NE of Streaky Bay Township, *A. G. Spooner* 2327 (AD); Mambray Creek, *D. E. Symon* 755 (ADW); Balcanoona Station, *D. E. Symon* 3017 (ADW); Oraparinna National Park, *D. E. Symon* 7447 (ADW); ± 40 km SW of Yardea H. S. on road to Minnipa, *D. E. Symon* 8118 (CANB); Gourambulla Cave, Hawker, c. 90 km north east of Pt Augusta, *G. J. Telfer* 59 (AD); Oraparinna Nat. Park, c. 160 km NNE of Port Augusta, *J. Z. Weber* 2484 (AD); Melrose, on lower slopes of Mt Remarkable 32°49'S, 138°11'E, *P. G. Wilson* 2779 (AD).

Distribution (Figure 13B). The new species is restricted to the Eyre Peninsula-Flinders Range area of South Australia. It occurs at the western end of the range of *R. brownii* in that State.

Rumex alcockii is closely related to *R. brownii* Campd. in that the teeth on the margin as well as at the tip of the fruiting valves all end in a hook and by the lowermost floral whorls only being subtended by a leaf. *Rumex alcockii* is distinguished from *R. brownii* by a number of correlated characters, viz. its vigorous growth, its thick, short leaves, the lower ones on average being only 2.5-3 times as long as broad, its more numerous flowers per whorl (8-15 in *R. alcockii*, (5)6(8) in *R. brownii*) and its larger fruiting valves (4.5-5 mm long in *R. alcockii*, (2.5)3(4) mm in *R. brownii*).

Etymology. The species is named in honour of C. R. Alcock, Pest Plants Commission, South Australian Department of Agriculture. The segregation of this new species from *R. brownii* was made possible through an instructive set of specimens gathered by Alcock, viz. nos. 1540, 2309, 2524, 2585, 2588, 2748 and 4179 (all AD).

Subgen. *Rumex* sect. *Simplices* subsect. *Maritimi*

16. *Rumex crystallinus* Lange, Index Sem. Hort. Haun. 28(1861). *Typus*: A specimen cultivated in Copenhagen Bot. Garden (holo: C).

R. halophilus F. Muell., *Fragm. Phytogeogr. Austral.* 4: 48(1863).

Annual, 6-40 cm high, becoming orange-reddish when dry. *Stems* usually low, flexuose, ascendent, often bearing flowers from the base; habit variable according to humidity, rarely luxuriant. *Basal and lower stem leaves* up to 6 x 0.8 cm, ± papillose below, all long petiolate, linear with obtuse basal lobe, margins strongly crisped, apices acute. *Flower whorls* many flowered, all distant and subtended by linear, erose leaves, sometimes the upper ones close together. *Fruiting pedicels* equalling the fruiting perianth or up to 1.5(2) times longer, filiform, articulate near the base.

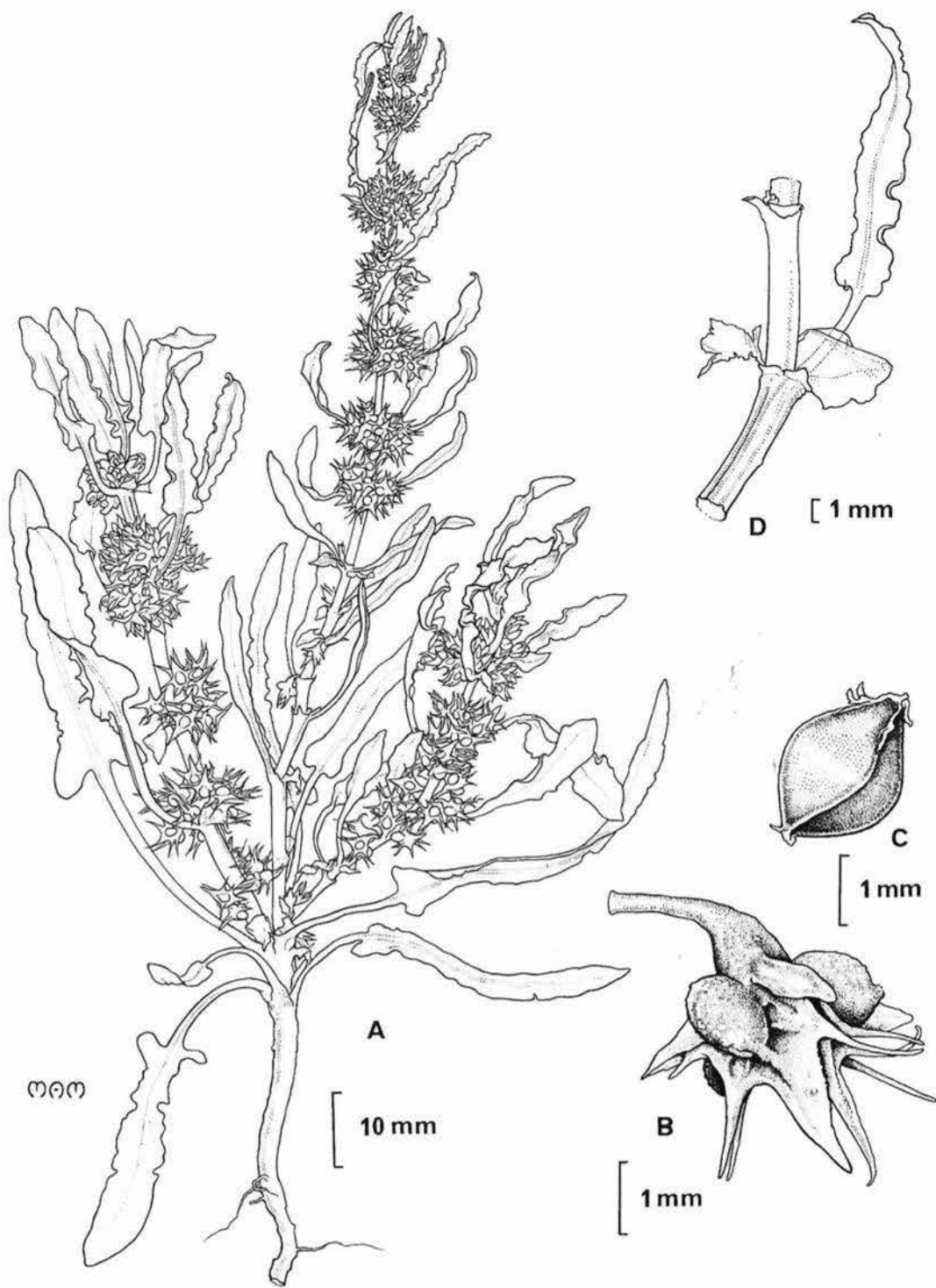


Figure 10. *Rumex crystallinus*. A—Habit. B—Fruit. C—Nut. D—Stem segment and leaf. T. R. N. Lothian & D. E. Francis 480 (AD).

Fruiting valves c. 2 mm long, barely 1 mm broad (excluding the teeth) at the base, each valve with a callosity and with 1(2) teeth of varying length on either side, apices narrow and acute. *Nuts* c. 1 x 0.5 mm. (Figures 3B and 10).

Selected specimens. QUEENSLAND: Nive Tank about 30 miles N of Augathella, May 1939, *S. L. Everist* s.n. (BRI); Diamantina River, 1.5 miles [2.4 km] west of Roseberth Homestead c. 20 km N South Australian border, *R. Filson* 3348 (AD); Campsite at Diamantina River north bank, just north of Queensland/South Australian border, *T. R. N. Lothian* and *D. E. Francis* 516 (AD).

NEW SOUTH WALES: Willow Point Station, Darling River 33°20'S, 141°46'E, 18 March 1959, *L. A. S. Johnson* and *E. F. Constable* s.n. (NT); Mount Mulyah, about 60 miles NW of Louth, *C. W. E. Moore* 6348, 6352 (CANB); NE side of Fort Grey Basin, Sturt National Park 29°06'S, 141°14'E, *K. L. Wilson* 652 (BRI).

VICTORIA: Hattah Lakes National Park, Hattah Lake, *A. C. Beauglehole* 968 (MEL).

SOUTH AUSTRALIA: Yardea Station c. 210 km W of Port Augusta, 6 October 1972, *C. R. Alcock* s.n. (AD); Murbko Flat, 15 km S Morgan 34°08'S, 139°39'E, 21 February 1973, *R. J. Chinnock* s.n. (AD); Dolabarinna crossing on Warburton River 27°45'S, 138°13'E, *E. N. S. Jackson* 2661 (AD); 2 miles [3.2 km] S of Queensland/South Australian border, *T. R. N. Lothian* and *D. E. Francis* 479, 480 (AD); Bookaloo Dam c. 75 km NW Port Augusta, 6 April 1930, *B. J. Murray* s.n. (AD); Lake Paddock, Koonamore c. 60 km north of Yunta, 1 March 1930, *T. B. Paltridge* s.n. (AD); Near Tinga Tingana on the Strezelecki Creek, *D. E. Symon* 5671 (ADW, CANB); The Diamantina c. 40 km S of Birdsville 26°21'S, 139°31'E, 25 August 1975, *J. Z. Weber* s.n. (AD); c. 50 km NW Andamooka 30°05'S, 136°55'E, *J. Z. Weber* 5870 (AD).

NORTHERN TERRITORY: Curlew Waterhole, Lander R., 70 km NW Willowra H.S. 20°33'S, 132°07'E, *G. Chippendale* 4803 (AD, MEL, NT); Mayfield Swamp, Andado Station 25°48'S, 135°16'E, *T. S. Henshall* 1483 (AD, CANB).

WESTERN AUSTRALIA: Lyndon River about 16 miles inland 23°32'S, 114°50'E, 1885, *H. S. Carey* s.n. (MEL).

Distribution (Figure 14). All mainland States in arid/semiarid areas.

Rumex crystallinus, the only annual Australian *Rumex*, undoubtedly belongs to subsect. *Maritimi* Rech. f. (1937). This subsection is characterized by annual growth, small valves usually with long teeth and all bearing a callosity. The distribution of the subsection is world wide. Each continent has one or several endemic species. Ecologically all *Maritimi* grow on temporarily flooded depressions or along riversides. None are weeds.

Rumex crystallinus has up till recently been confused with *R. tenax* which from my standpoint is neither similar nor related. The distinctive characters have been pointed out in detail under *R. tenax* (sp. 13 above).

Subgen. *Platypodium*

17. **Rumex bucephalophorus* L., Spec. Plant. 336 (1753). *Typus*: "Hab. in Italia".

For Synonymy see Rechinger 1939.

Annual (ours). *Stems* 5-20 cm high, single or several, thin, ± branching. *Basal leaves* small, up to 2 cm long, petiolate, ovate or spatulate, flat. *Flower whorls* few flowered, (1)2-3(4). *Flowers* mostly dimorphic or at least in part supported by

normal thin pedicels, in part by elongate broadened and flattened pedicels broader than the fruit. *Valves* minute, dentate, bearing a small reflexed callosity. *Nuts* 1.3-2.3 mm long. (Figure 3D).

Selected specimens examined. WESTERN AUSTRALIA: Yallingup, 5 November 1963, *R. Bettenay* s.n. (PERTH).

Distribution. Mediterranean area (see Rechinger 1939). Rarely as an alien elsewhere.

Rumex bucephalophorus is a highly polymorphic species which has been divided into seven subspecies (Rechinger 1939) which are confined to various parts of the Mediterranean and Macaronesia. The Australian specimen(s) are not complete enough to be assigned to a certain subspecies but they probably belong to subsp. *hispanicus* (Steinh.) Rech.f.

Hybrids

18. *Rumex xcomaumensis* Rech.f., hybr. nov. (= *R. bidens* R.Br. x *R. brownii* Campderá).

Perennis. Caulis decumbens vel ascendens, irregulariter pauciramosus, nodis inferioribus radicanibus, internodiis inferioribus fistulosis; rami elongati, flexuosi. Folia longe petiolata, inferiora 8-10 x 2-3 cm, oblongo-linearata, basi late oblique cuneata, interdum subdilatata, margine plana, apice acuta; folia superiora brevius petiolata, anguste lineari-lanceolata, 8-15 x 0.8-1 cm, apicem versus longissime sensim attenuata. Florum verticillastri infimi et medii foliis angustissime linearibus suffulti, 6-10-flori. Pedicelli fructiferi tenues, irregulares, perigonium aequantes usque eo sesqui, vel exceptione usque duplo, longiores. Valvae fructiferae irregulariter evolutae, ad summum 5 x 3 mm (dentibus lateralibus exclusis) coriaceae irregulariter crasse calliferae, paucifoveolato-reticulatae, ambitu subrhombico-triangularae, utrinque dentes plerumque 2-3, validos divergentes latitudinem valvae subaequant proferentes; dentes et apex valvae apice pro parte quidem subhamati. Nux plerumque non vel incomplete evoluta.

Typus: Comaum area, c. 20 km N Penola, South Australia, comm. *Miss Hunt* No. 4 (holo: AD).

Other specimens examined. SOUTH AUSTRALIA: On way from Wolseley to Comaum (Wolseley is c. 95 km N Comaum which is 65 km N of Mount Gambier), *K. M. Alcock* 196 (AD); South Australia, South East, *K. M. Alcock* 37 "grows near swamps and looks like a hybrid between *R. bidens* and *R. brownii*" (AD).

Rumex xcomaumensis seems to be a hybrid, its parents are probably *R. bidens* R. Brown and *R. brownii* Campd. Fertility is evidently much reduced. The habit, a creeping radican stem with erect rather short inflorescences and also to a certain extent the leaves, are reminiscent of *R. bidens*. The slender pedicels and the more numerous, often slightly hooked teeth suggest *R. brownii* as the other probable parent.

The two Alcock specimens listed above are similar in most respects but they differ slightly from the type in that their lowermost whorls are subtended by a leaf and the tubercles on their valves are somewhat less pronounced.

This is the first recorded hybrid between two indigenous Australian species of *Rumex*.

19. *Rumex xjohannis-moorei* Rech. f., hybr. nov. (= *R. brownii* Campderá x *R. crispus* L.)

Perennis. Caulis erectus, in parte superiore pauciramosus. Folia emarcida. Florum verticillastri multiflori. Pedicelli fructiferi tenuiter filiformes, inaequilongi, in quarta circiter parte inferiore articulati, quam valvae duplo usque fere quadruplo longiores. Valvae ambitu et magnitudine variables, cordato-triangulares, valde inaequaliter calliferae, apice partim quidem \pm productae, longitudine interdum latiores, margine irregulariter denticulatae. Nux saepe saepius incomplete evoluta.

Typus: 60 km S of Jerramungup, Swamp Road, property of R. D. Hurst, on field borders, 8.12.1982, *Rechinger f.* 60063 (holo: PERTH; iso: W).

Rumex xjohannis-moorei was recognized by John Moore as a hybrid. It was found in association with *Rumex crispus* while *R. brownii* grew nearby. It is intermediate in habit, is of more vigorous growth and is more profusely branched than *R. brownii*, but the branches are more patent, more elongate and more flexuose than in *R. crispus*. The pedicels are of very unequal length but in proportion to the valves on average are longer than in *R. crispus*. The valves are in general appearance more similar to *R. crispus* but smaller and of very unequal size and shape and \pm irregularly denticulate near the base; the callosities are very irregularly developed. The degree of sterility seems to be rather high, a considerable number of flowers have set no fruits at all, in some of them the nuts have reached their full size but usually they can be compressed and seem to be not viable.

R. brownii x *R. crispus* is the first recorded spontaneous hybrid between an indigenous and an alien species. It is named after its discoverer, Mr John Moore of the W.A. Department of Agriculture (Albany branch), who has undertaken a special study of *Rumex* in the Albany region. John guided my wife and myself on several excursions in the Albany region in December 1982.

20. *Rumex xschulzei* Hausskn. (= *R. conglomeratus* Murr. x *R. crispus* L.) Mitt. Geogr. Ges. (Thüringen) Jena 3: 68 (1885). *Typus*: Several syntypes from Germany: Thüringen, *Haussknecht* (JE).

In habit closer to *R. crispus* but panicle less strict, flower whorls more distant and at least in the lower half of branches subtended by a leaf. Valves entire, much smaller and especially narrower than in *R. crispus*.

Known from only one locality, viz. Western Australia, 5 km N of Brennan's Ford along Scott River Road NE of Augusta, *K. H. Rechinger* 59864 (PERTH, W).

21. *Rumex xmuretii* Hausskn. (= *R. conglomeratus* Murr. x *R. pulcher* L.), Mitt. Geogr. Ges. (Thüringen) Jena 3: 73 (1885). *Typus*: Switzerland, Lausanne, *Haussknecht* (JE).

Not easily recognized because both parents have divaricate branching panicles and distant floral whorls which are mostly subtended by a leaf. Valves smaller than *R. pulcher* with less pronounced teeth.

Recorded from the following Western Australian localities: 5 km N of Brennan's Ford along Scott River Road, NE Augusta 34°13'S, 115°16'E, *K. H. Rechinger* 59864, 59866 (PERTH, W); 5 km NE of Narrikup on Yellanup Road to Porongurup Range, *K. H. Rechinger* 60242 (PERTH, W).

22. ***Rumex xpratensis*** Mertens & Koch, (= *R. crispus* L. x *R. obtusifolius* L.), *Deutschl. Flora* 2: 609 (1826). *Syntypi*: Thüringen, Wallroth; Heidelberg, Dierbach; Darmstadt, Borkhausen; Westfalen, Bönninghausen (location of specimens unknown).

Intermediate in habit between the parents or sometimes more similar to *R. crispus*. Compared with *R. crispus* the leaves are less crispate or only slightly undulate, they are broader and truncate or the lower ones slightly cordate. The valves are more or less intermediate in shape between the parents, they are always much broader than in *R. obtusifolius* and with shorter teeth; the tips of valves are slightly triangular to tongue-shaped.

Specimens examined. QUEENSLAND: Outside Tennyson Powerhouse, Brisbane, 23 September 1968, *A. A. Dowling* s.n. (BRI)

NEW SOUTH WALES: Orange, 15 January 1951, *R. C. Madsen* s.n. (NSW); Bulga Service Station on the Windsor-Singleton Road, *R. Coveny* 6531 and *J. Powell* (NSW)

VICTORIA: Orbost, in garden, c. 1937, *F. Robbins* s.n. (MEL).

SOUTH AUSTRALIA: Shores of Brown Lake, Mt Gambier, *D. E. Symon* 1188 (ADW); Mt Lofty Botanic Garden, *J. R. Wheeler* 328 (AD).

WESTERN AUSTRALIA: Robinson Estate, SW of Albany, *K. H. Rechinger* 60017 (PERTH, W).

This is the most frequent hybrid of *Rumex* and it can be found nearly everywhere where the parents grow together.

23. ***Rumex xpseudopulcher*** Hausskn. (*R. crispus* x *R. pulcher* L.), *Mitt. Bot. Ver. (Thüringen)* Jena 11: 60 (1897). *Typus*: Greece, Thessalia: Orman Magula, *Haussknecht* (JE).

Usually more similar to *R. crispus* in habit, but pedicels shorter, nervation of valves more pronounced and the margin dentate. Leaves truncate or subcordate at the base, less crispate than in *R. crispus*.

Valves similar to those of *R. crispus* x *R. obtusifolius* but with shorter pedicels, stronger reticulation and the valve tip usually less, or not at all, protracted.

Specimens examined. WESTERN AUSTRALIA: 5 km N of Brennan's Ford along Scott River Road, NE Augusta 34°13'S, 115°16'E, *K. H. Rechinger* 59865 (PERTH, W); Denmark, along road to Agricultural Experimental Station 34°57'S, 117°21'E, *K. H. Rechinger* 60139 (PERTH, W); Narrikup, 30 km N of Albany to Mt Barker 34°46'S, 117°42'E, *K. H. Rechinger* 60239 (PERTH, W).

Acknowledgements

I wish to thank Dr J. W. Green, Curator of the Western Australian Herbarium, Perth (PERTH) for kindly arranging to have herbarium specimens of *Rumex* from the following Australian herbaria sent to PERTH for examination: Alice Springs

(NT), Adelaide (AD and ADW), Brisbane (BRI), Canberra (CANB and CBG), Hobart (HO), Melbourne (MEL) and Sydney (NSW). I wish to sincerely thank the staff at herb. PERTH for facilitating my work and for creating a friendly and stimulating atmosphere. Special thanks are extended to Iona D'Souza and Peter Poli (for mapping the indigenous species), Vicki Hamley (for typing the manuscript) and Bruce Maslin (for suggesting improvements to the text). The drawings were prepared by Margaret Menadue.

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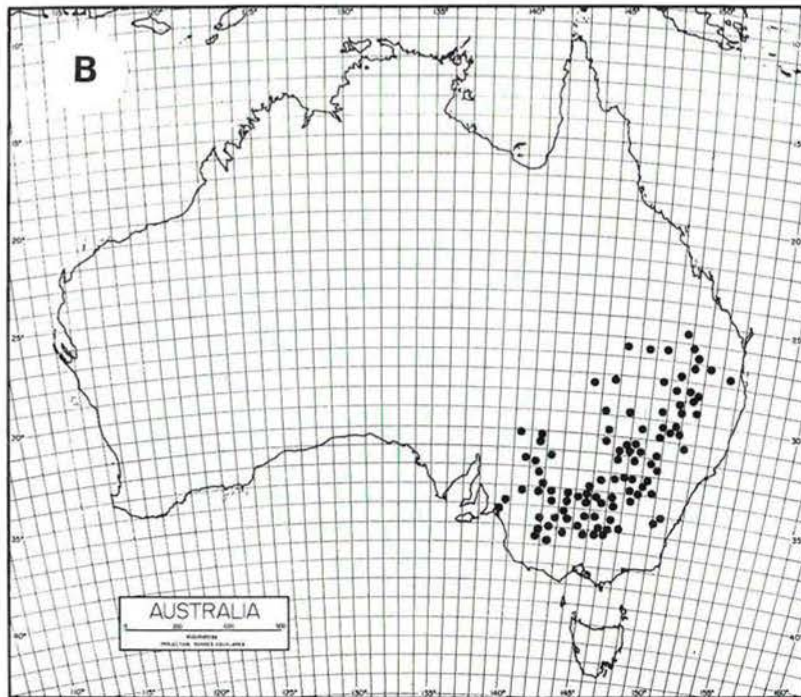
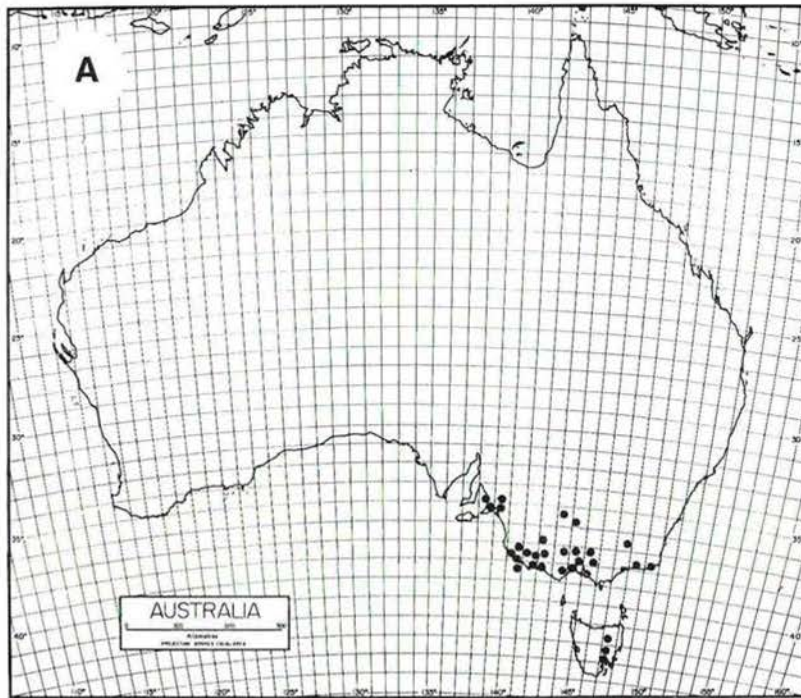


Figure 11. A—Distribution of *Rumex bidens*. B—Distribution of *R. tenax*.

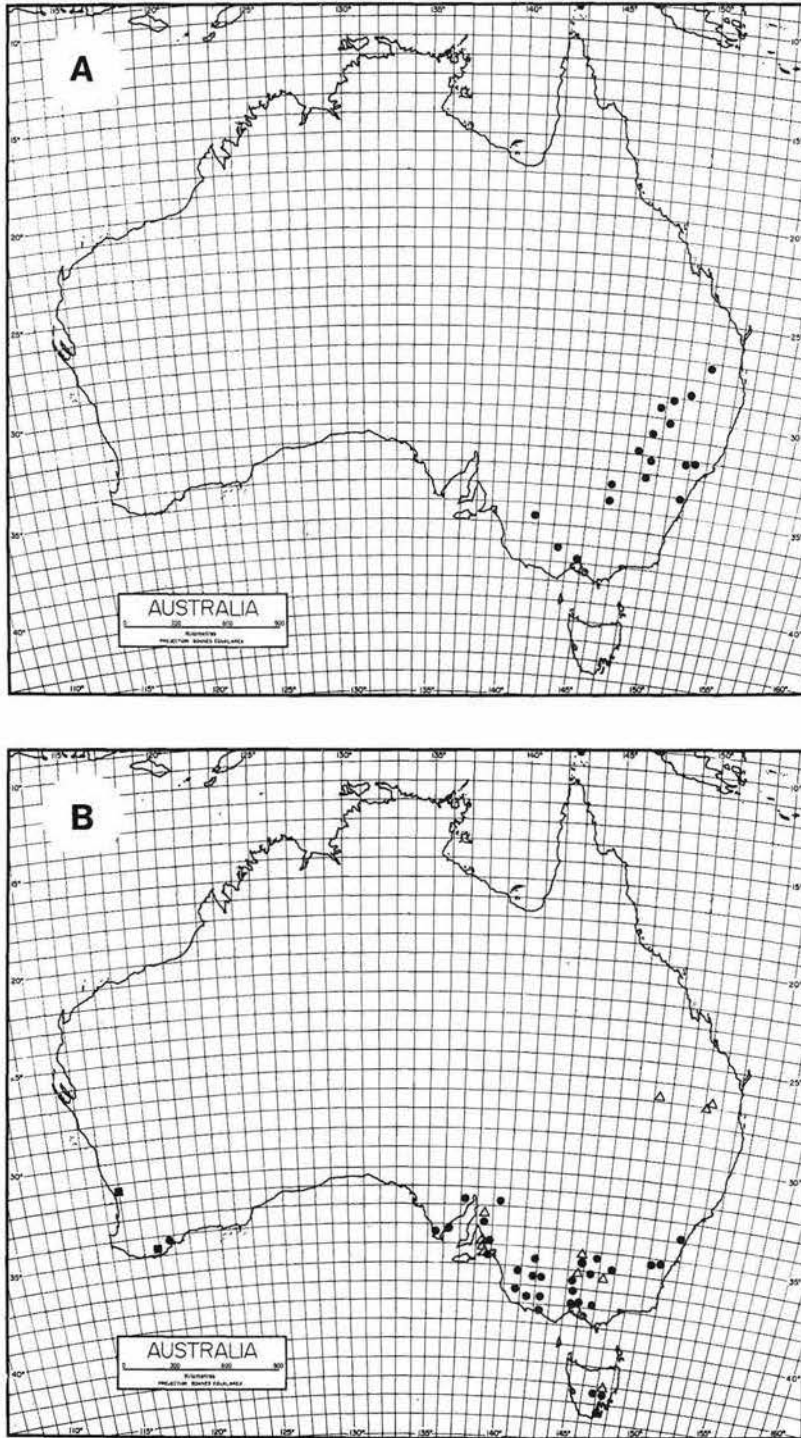


Figure 12. A—Distribution of *Rumex stenoglottis*. B—Distribution of *R. dumosus* var. *dumosus* (●), *R. dumosus* var. *dumosiformis* (△) and *R. drummondii* (■).

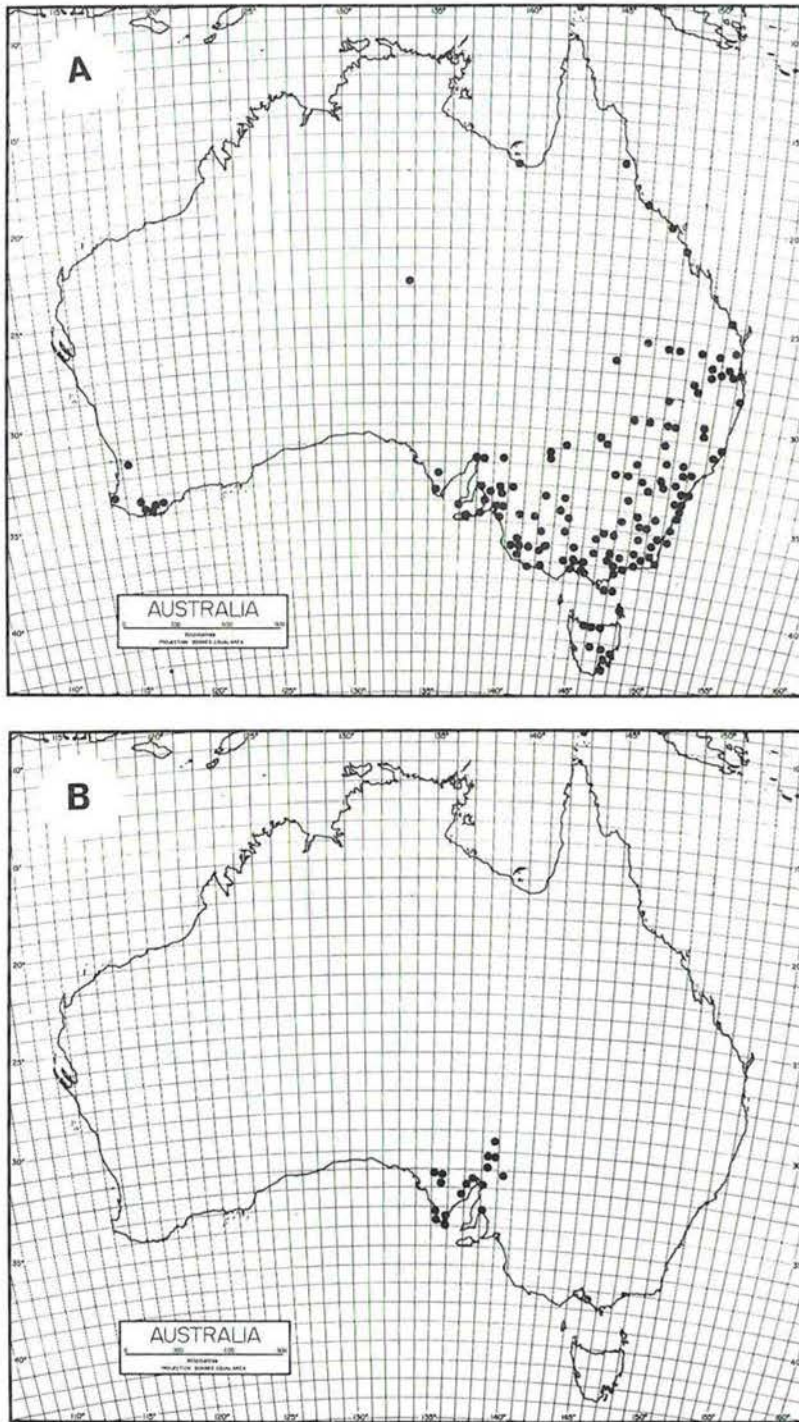
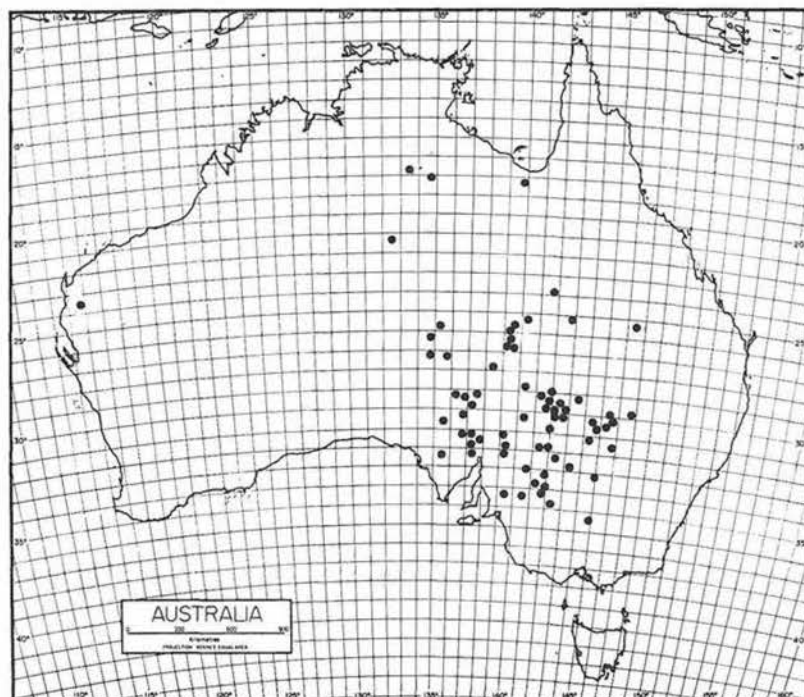


Figure 13. A—Distribution in Australia of *Rumex brownii*. B—Distribution of *R. alcockii*.

Figure 14. Distribution of *Rumex crystallinus*.

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Nine new species of *Calothamnus* Labill. (Myrtaceae: Leptospermoideae) from Western Australia

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Abstract

Hawkeswood, T. J. Nine new species of *Calothamnus* Labill. (Myrtaceae: Leptospermoideae) from Western Australia. Nuytsia 5(1): 123-153 (1984). Nine new species and one new subspecies of *Calothamnus* from Western Australia are described, namely *C. graniticus*, *C. tuberosus*, *C. formosus*, *C. formosus* subsp. *rigidus*, *C. hirsutus*, *C. brevifolius*, *C. aridus*, *C. macrocarpus*, *C. kalbarriensis* and *C. borealis*. A new combination, *C. graniticus* subsp. *leptophyllus*, is also provided, based on *C. torulosus* Schau. var. *leptophylla* Benth. The affinities of the new species are considered. In addition, a key is provided to all species of *Calothamnus* presently recognized.

Introduction

The author is presently revising the genus *Calothamnus* Labill., a group of myrtaceous plants endemic to Western Australia. Since it will be some time before the revision is complete, this paper provides descriptions of the new species and a key to the presently recognized specific and subspecific taxa. Existing keys and other taxonomic data on the genus have proved to be inadequate, and this has resulted in many misidentifications in survey work publications.

Calothamnus is currently classified with *Beaufortia*, *Regelia*, *Phymatocarpus* and *Eremaea* in a subtribe named Beaufortiinae (Bentham 1867) or Calothamninae (Niedenzu 1898), or in a group informally named "*Calothamnus* infra-alliance" (Briggs and Johnson 1979). Among these genera *Calothamnus* is closest in floral morphology to *Beaufortia*, and it also resembles *Lamarchea* (of the neighbouring "*Melaleuca* infra-alliance" in the classification of Briggs and Johnson 1979) in leaf anatomy (Hawkeswood 1978 and in prep.) and floral features. From *Lamarchea* it differs most strikingly in having erect, basifixed anthers and from *Beaufortia* in having more than one ovule per locule and anthers dehiscing by longitudinal slits.

The generic characteristics include the following morphological features. Mostly medium-sized to tall woody shrubs, occasionally low-growing. Leaves usually crowded, linear or sometimes oblanceolate, usually glabrous when mature, oil glands prominent. Flowers sessile, in small clusters or dense (often unilateral) spikes on older stems from which the leaves have fallen, or amongst leaves (but not necessarily axillary); calyx-tube somewhat campanulate, glabrous or pubescent, often immersed in the stems; calyx-lobes deltoid, usually thick with scarious margins, sometimes all or few persistent; petals 4 or 5, obovate to elliptical, usually deciduous; staminal claws 4 or 5, equal or unequal (sometimes upper two fused and lower ones reduced as in *C. sanguineus* Labill.), crimson to deep purple-red (yellow-brown in *C. pachystachyus* Benth.), usually with numerous filaments; ovary inferior, 3-celled; ovules numerous. Fruit a sessile capsule, depressed globular to ovoid; calyx-lobes absent or present; seeds linear to narrow-obovoid, 1-4 mm long, usually darker in colour than the numerous ovulodes.

The group is popularly known as "one-sided bottlebrushes", but this is a misnomer since most of the species have cylindrical spikes or scattered flowers on all sides of the stem.

The genus is clearly divided into two groups, 4-merous and 5-merous species. Within each group the species are here arranged systematically.

In addition to the usual herbarium acronyms (Holmgren, Keuken and Schofield 1981), KP has been used for herb. Kings Park Botanic Garden, Perth. Where a herbarium holds more than one sheet of a collection, this has been indicated by the relevant number in brackets after the specimen's citation.

For some of the species described herein, not every specimen seen by the author has been cited. In these cases, specimens with no collection data have not been cited but have been included in the figure for total number of specimens seen.

The term "calyx-tube" has been adopted in this paper and follows the terminology of Bentham (1867) since there appears to be little agreement amongst modern authors on the correct use of terms to describe this floral structure and its associated appendages.

Key to the species of *Calothamnus*

- | | | |
|-----|---|------------------------------|
| 1. | Flowers 4-merous | 2 |
| 1.* | Flowers 5-merous | 22 |
| 2. | Two upper staminal claws broad, flat; two lower ones narrow | 3 |
| 2.* | Staminal claws all narrow | 6 |
| 3. | Calyx-tube (at time of flowering) entirely immersed in the thick, swollen rhachis | 4 |
| 3.* | Calyx-tube (at time of flowering) not immersed in the rhachis (rhachis not prominently swollen) | 5 |
| 4. | Leaves flat, 8-15 cm long (Mogumber, Moora area)..... <i>C. pachystachyus</i> Benth. | |
| 4.* | Leaves terete, 15-30 cm long (Eneabba area)..... <i>C. longissimus</i> F. Muell. | |
| 5. | Two upper staminal claws fused; anthers glabrous; leaves mostly 1-2 cm long, terete or biconvex in transection, usually with numerous spreading hairs; shrub 30-80 cm high (Cape Naturaliste to Kalbarri) | <i>C. sanguineus</i> Labill. |
| 5.* | Two upper staminal claws free; anthers covered in long, cobweb-like hairs; leaves mostly 2-4 cm long, terete, with few spreading hairs (or glabrous), somewhat scabrous; shrub 20-45 cm high (Perth to Eneabba) | <i>C. torulosus</i> Schau. |
| 6. | Calyx-tube (at time of flowering) \pm immersed in the swollen rhachis or rhachis somewhat dilated at base of calyx-tube..... | 7 |
| 6.* | Calyx-tube (at time of flowering) not immersed in the rhachis | 13 |
| 7. | Rhachis swollen (leaves terete, (3)7-10(30) cm long; flowers in unilateral spikes 4-10 cm long—Perth, along south-west coast to Albany and Stirling Range) | <i>C. lateralis</i> Lindl. |
| 7.* | Rhachis not swollen | 8 |

8. Leaves flat9
- 8.* Leaves terete10
9. Leaves with two longitudinal grooves both adaxially and abaxially
(Stirling Range)*C. microcarpus* F. Muell.
- 9.* Leaves without grooves (Pingelly to Albany)*C. planifolius* Lehm.
10. Staminal claws more than 1.5 cm long11
- 10.* Staminal claws less than 1 cm long12
11. Staminal claws \pm equal with 5 filaments; shrub to 2 m high
(Stirling Range)*C. affinis* Turcz.
- 11.* Staminal claws not equal, the two upper ones with 3-5 filaments,
the lower ones with 1 or 2 filaments; shrub to 40 cm high
(Tutanning Reserve, Cranbrook, Frankland)*C. preissii* Schau.
12. Leaves 10-20 cm long; staminal claws \pm equal, each with 2-4
filaments (Stirling Range, Mt Barker)*C. schaueri* Lehm.
- 12.* Leaves 1-2.5 cm long; staminal claws not equal, the two upper ones
with 4 or 5 filaments, the lower ones reduced to a single stamen
(Bowelling to the Stirling Range)*C. lehmannii* Schau.
13. Fruit retaining all 4 lobes (two of which are reflexed and promi-
nently thickened, the other ones less thickened, deflexed)14
- 13.* Fruit retaining 2 lobes which are prominently thickened and
reflexed (or fruit very shortly 4-lobed)15
14. Leaves short, mostly 2-2.5 cm long, stiff, pungent; calyx-tube
densely pubescent; fruit mostly 15-20 mm long, 13-18 mm wide
(Red Hill, Gosnells, Boyagin Rock)*C. rupestris* Schau.
- 14.* Leaves long, (4)5-7(8) cm long, shortly mucronate; calyx-tube
usually glabrous; fruit mostly 16-18 mm long, 12-15 mm wide (Cape
Naturaliste, Dwellingup, Collie)1. *C. graniticus* T. J. Hawkeswood
15. Fruit shortly 4-lobed (leaves 8-12 cm long, glaucous; fruit depressed
globular, 5-7 mm wide—Peak Charles, Knapp Rock, Barbalin Rock,
Spinifex Rock)2. *C. tuberosus* T. J. Hawkeswood
- 15.* Fruit with two prominently thickened lobes16
16. Leaves pungent, rigid, densely crowded (flowers hidden by the
dense foliage—Mt Barren Range)*C. pinifolius* F. Muell.
- 16.* Leaves not pungent17
17. Flowers usually 2-5(8) together in a small cluster amongst leaves18
- 17.* Flowers usually arranged in a dense spike21
18. Leaves flat19
- 18.* Leaves terete20
19. Leaves mostly 1.5-2 cm long, 1.4-2 mm wide, narrowly oblanceo-
late (Wongan Hills)*C. asper* Turcz.
- 19.* Leaves mostly 2-4 cm long, 3-8 mm wide, usually oblanceolate
.....*C. homalophyllus* F. Muell.
20. Calyx-tube densely hirsute; flowers 3-5 in a cluster (Cape Riche)
.....*C. robustus* Schau.
- 20.* Calyx-tube usually glabrous, (sometimes finely pubescent); flowers
mostly 3 together in a cluster (Mt Barren Range)*C. validus* S. Moore
21. Leaves mostly oblanceolate (sometimes narrowly oblanceolate),
glabrous (Geraldton to the Kalbarri National Park)
.....*C. homalophyllus* F. Muell.
- 21.* Leaves linear, usually with spreading hairs (occasionally glabrous)
(Shark Bay to Cape Arid)*C. quadrifidus* R. Br.
22. Calyx-tube (at time of flowering) immersed or half immersed in the
rhachis23

- 22.* Calyx-tube not immersed in the rhachis (although rhachis may be slightly dilated at the base of the calyx-tube)24
23. Calyx-tube (at time of flowering) entirely immersed in the swollen, corky rhachis; fruit smooth, embedded in the rhachis (Fitzgerald River area)*C. gibbosus* Benth.
- 23.* Calyx-tube (at time of flowering) half immersed in the rhachis; fruit usually ribbed, not embedded in the rhachis (Albany to Cape Arid)*C. gracilis* R.Br.
24. Leaves flat; calyx-tube and lobes densely pubescent (lobes thickened and persistent on fruit; leaves usually scabrous—Kalbarri National Park)*C. blepharospemus* F. Muell.
- 24.* Leaves terete25
25. Fruit with short rounded protuberances (Shark Bay to Yuna)3. *C. formosus* T. J. Hawkeswood
- 25* Fruit without such protuberances, usually smooth26
26. Fruit \pm depressed globular, smooth, usually truncate (or occasionally very shortly 5-lobed)27
- 26.* Fruit not depressed globular, longer than wide32
27. Fruit usually with corky excrescences, sometimes smooth or warty28
- 27.* Fruit without corky excrescences, usually smooth or with wide, smooth ribs29
28. Leaves mostly 4-6 cm long, terete (Geraldton to Kalbarri National Park)*C. oldfieldii* F. Muell.
- 28.* Leaves mostly 1.5-2.5 cm long, terete or slightly flattened (Kalbarri to Tamala Homestead)8. *C. kalbarriensis* T. J. Hawkeswood
29. Calyx-tube glabrous (leaves mostly 2-2.5 cm long, sparsely pilose; fruit large, smooth, cylindrical to almost globular, 13-17 mm long, 13-18 mm wide—East Mt Barren)7. *C. macrocarpus* T. J. Hawkeswood
- 29.* Calyx-tube densely pubescent30
30. Leaves hirsute (mostly 2-2.5 cm long; fruit densely pubescent but becoming glabrous with age, then smooth, 5-6 mm long, 5-6 mm wide—Perth to Eneabba)4. *C. hirsutus* T. J. Hawkeswood
- 30.* Leaves glabrous31
31. Leaves mostly 8-12 mm long, fruit initially pubescent, but becoming glabrous with age, 4-5 mm long, c. 5 mm wide (Cunderdin, Tammin, Piawaning)5. *C. brevifolius* T. J. Hawkeswood
- 31.* Leaves mostly 7-10 cm long, fruit glabrous or ribbed, 4-8 mm long, 5-8 mm wide (Paynes Find, Wiluna, Sandstone) .6. *C. aridus* T. J. Hawkeswood
32. Calyx-tube glabrous (leaves 6-10 cm long, fruit 8-12 mm long—East of Geraldton through arid regions of south-west Western Australia)*C. gilesii* F. Muell.
- 32.* Calyx-tube densely pubescent33
33. Fruit truncate or very shortly 5-lobed (leaves erect, with short, appressed hairs giving them a blue-grey appearance—Learmonth, Cape Range, Coral Bay)9. *C. borealis* T. J. Hawkeswood
- 33.* Fruit not truncate, prominently 2 or 5 lobed34
34. Fruit widest at the middle, with 2 lobes prominently thickened at top of fruit (Albany to Esperance)*C. villosus* R.Br.
- 34.* Fruit widest at the base, with 5 lobes prominently thickened at top of fruit (Geraldton to the Kalbarri National Park)*C. chrysantherus* F. Muell.

Four-merous species

1. *Calothamnus graniticus* T. J. Hawkeswood, sp. nov. (Figures 1, 2, 3, 4, 11)

Frutex usque ad 2 m altus. Folia linearia, teretia, erecta, (2.5)4-8(10) cm longa, (0.4)1-1.5(2) mm lata, mucronata, glabra vel appresso pilosa. Flores 2-25, in fasciculis parvis vel spicis brevibus. Calycis tubus (5)7-8(10) mm longus, glaber, verrucosus; calycis lobi 6-8 mm longi. Petala 11-15 mm longa. Unguis staminalis 32-40 mm longus, atroseus; filamentis marginalibus (17)20-22(25). Fructus sessilis, 15-22 mm longus. Semina 2-2.5 mm longa, atrobrunnea.

Typus: Little Meelup Beach, Cape Naturaliste area (33°32'S, 115°01'E); erect, usually compact, wide shrub to 1.5 m high; locally common; heath with *Hakea*, *Leucopogon*, *Beaufortia* species; 24 June 1979, T. J. Hawkeswood 110 (holo: PERTH; iso: CANB, MEL, NSW, PERTH).

Erect, wide, compact or sometimes spreading, single or multi-stemmed, much-branched, glabrous or slightly pubescent *shrub* to 2 m high. *Young plants* with smooth bark, *older plants* with thick stems and hard grey bark often splitting near the base of the trunk. *Young branches* glabrous or shortly pubescent. *Older stems* often with prominent leaf scars. *Leaves* sessile, linear, terete, erect, rigid or flaccid, (2.5)4-8(10) cm long, (0.4)1-1.5(2) mm wide, shortly mucronate, pungent, glabrous or clothed with closely appressed, short, white hairs; leaves scattered or densely crowded at ends of branches. *Oil glands* on leaves randomly distributed and conspicuous (especially in glabrous-leaved specimens). *Flowers* 2-25 in clusters or irregular spikes usually on portions of stems from which the leaves have fallen. *Calyx-tube* large, extended globular to broadly campanulate, (5)7-8(10) mm long, glabrous, green, somewhat verrucose; *rhachis* slightly dilated at base; *calyx-lobes* erect, glabrous outside, shortly pubescent within; two opposite lobes wider than remaining two (smaller lobes overlapped by larger ones in bud); largest lobes broadly deltoid, obtuse, slightly concave, 6-8 mm long, 5-7 mm wide, thick but with thin, scarious margins; remaining two lobes narrowly deltoid, concave, 6-8 mm long, c. 4 mm wide, thinner but with thin, fimbriate margins. *Petals* broadly ovate, obtuse, concave, glabrous, 6-7(8) mm long with a claw 5-7 mm long. *Staminal claws* ± equal, 32-40 mm long, 3-4.5(5) mm wide, glabrous, dark pink to crimson; *marginal filaments* (17)20-22(25); *anthers* linear, 2.5-3(3.5) mm long. *Style* thick, tapering towards the tip, glabrous, (20)25-40 mm long; *stigma* small. Summit of *ovary* densely pubescent. *Fruit* sessile, almost ovoid, 15-22 mm long (including thickened calyx-lobes), 10-18 mm wide, smooth (or slightly wrinkled); larger *calyx-lobes* thickened and reflexed, smaller lobes slightly thickened and deflexed; style often persistent in fruit. Fertile *seeds* few to many per capsule, 2-2.5 mm long, linear-cuneate, truncate, angular, glabrous; *testa* dark brown. *Ovulodes* numerous, 1.5-2.5 mm long, linear to linear-cuneate, truncate, angular, glabrous, light brown.

Key to subspecies

- A. Flowers up to 15 in clusters or irregular spikes. Leaves (1)1.5(2) mm wide, glabrous or shortly pubescent (Cape Naturaliste area) 1a. subsp. *graniticus*
 A*. Flowers up to 25 in clusters or irregular spikes. Leaves 0.5-0.8(1) mm wide, glabrous (or if pubescent, only sparsely so at base) (Dwellingup-Collie area).....1b. subsp. *leptophyllus*



Figure 1.—*Calothamnus graniticus* T. J. Hawkeswood subsp. *graniticus*—Holotype (Hawkeswood 110).



Figure 2.—*Calothamnus graniticus* T. J. Hawkeswood subsp. *leptophyllus* (Benth.) T. J. Hawkeswood—Lectotype (Drummond No. 39, K).

1a. subsp. graniticus (Figures 1, 3, 4)

Erect, multi-stemmed, much-branched *shrub* to 1.5 m high with thin stems, smooth bark and prominent leaf scars. *Leaves* densely crowded at ends of branches, (2.5)4-7(8) cm long, (1)1.5(2) mm wide, pungent, glabrous or shortly pubescent. *Flowers* 3-15 in clusters or irregular spikes usually on portions of stems from which the leaves have fallen. *Fruit* 15-20 mm long (including thickened calyx-lobes), 13-18 mm wide; *style* often persistent in fruit.

Derivation of name. *Graniticus*, Latin, meaning "living on granite soil", refers to its habit of growing exclusively on granulite based soils.

Habitat. Appears to be restricted to granulite (granite-gneiss) outcrops where it is clearly the dominant species (Figure 3). For further information on this taxon and its ecology and distribution on the Cape Naturaliste Peninsula, see Hawkeswood (in prep.). Flowers May to June.

Distribution. Confined to the Cape Naturaliste Peninsula (33°32'S, 115°01'E) at Meelup Beach, Eagle Bay and the coastline immediately west of the Cape Naturaliste lighthouse to Yallingup (33°38'S, 115°02'E) (Figure 11).

Selected specimens examined. WESTERN AUSTRALIA: Sugar Loaf or Busselton (?), April 1943, *B. Peters* s.n. (PERTH); near Cape Naturaliste, 12 April 1927, *H. G. Elliot* s.n. (PERTH); Cape Naturaliste, opp. Sugar Loaf Rock, (33°32'S, 115°00'E), "heath with *Beaufortia*, *Templetonia*, *Leucopogon* and *Melaleuca* species", 24 June 1979, *T. J. Hawkeswood* 70, 71, 74, 74a, 92, 106, 107, 108 (PERTH); Eagle Bay, Cape Naturaliste (c. 33°31'S, 115°01'E), 23 June 1979, *T. J. Hawkeswood* and *P. Johnson* 1, 2, 3, 4 (PERTH); Eagle Bay, Cape Naturaliste, 24 June 1979, *T. J. Hawkeswood* 75, 76 (PERTH); Little Meelup Beach (33°32'S, 115°01'E), 24 June 1979, *T. J. Hawkeswood*, 72, 72a, 73, 77, 77a, (PERTH); Little Meelup Beach, 24 June 1979, *M. Peterson* and *T. J. Hawkeswood* 1 (PERTH); Opposite Sugar Loaf Rock, 24 June 1979, *S. Wilson* 1 [2] (PERTH).

Total number of specimens examined: 35.

1b. subsp. leptophyllus (Benth.) T. J. Hawkeswood, comb. et. stat. nov. (Figure 2)
Basionym: *C. torulosus* Schau. var. *leptophylla* Benth. Fl. Austr. 3: 175 (1867).
Lectotype: Swan River *Drummond*, no. 39 (K, photograph seen, Figure 2) *lecto. nov.*

Erect, multi-stemmed, few-branched *shrub* to 1.5 m high with thin stems, smooth bark, and prominent leaf scars. *Leaves* crowded at ends of branches, (3)4-8(10) cm long, 0.5-0.8(1) mm wide, glabrous or sparsely pilose, especially at base; *oil glands* prominent. *Flowers* 2-25 scattered or arranged in dense spike-like clusters on older stems from which leaves have fallen. Calyx-tube, calyx-lobes, petals, staminal claws, anthers, style and seeds similar to subsp. *graniticus*. *Fruit* wrinkled, often with smooth, irregular bumps, 16-22 mm long (including thickened calyx-lobes), 10-15 mm wide; *style* often persistent in fruit.

Derivation of name. *Leptophyllus*, from Greek, meaning "thin or thread-like" referring to the thin, terete leaves of this subspecies in comparison to the thicker, shorter leaves of subspecies *graniticus*.

Habitat. In *Eucalyptus* woodland on lateritic soils near creeks with *Xanthorrhoea preissii*, *Calothamnus quadrifidus*, and species of *Grevillea*, *Hibbertia* and *Hakea*. Flowers June to August.



Figure 3. Habitat of *Calothamnus graniticus* T. J. Hawkeswood subsp. *graniticus* in Reserve 21629, adjacent to the coastal road at Meelup, Cape Naturaliste. The heath is dominated by *C. graniticus* subsp. *graniticus*, inland plants of which are shorter than those growing nearer the shore. Photo M. Peterson.



Figure 4. Close-up of flowers of *Calothamnus graniticus* T. J. Hawkeswood subsp. *graniticus* at Eagle Bay, Cape Naturaliste. Photo M. Peterson.

Distribution. Only two localities are known at present, namely the Dwellingup area (c. 32°42'S, 116°02'E) and Collie Weir (33°20'S, 116°00'E), (now known as Wellington Dam) (Figure 11).

Other specimens examined. WESTERN AUSTRALIA: Oakley Dam, Dwellingup, 31 May 1972, R. J. Edmiston 5 (PERTH); Oakley Brook, due E of Pinjarra (32°40'S, 115°57'E), 30 April 1979, J. Dodd s.n. (PERTH); near Oakley Dam, Dwellingup, 24 June 1979, M. Peterson 10 [2] (PERTH); Between Dwellingup and Oakley Dam, 24 June 1979, T. J. Hawkeswood and M. Peterson 15 [5] (PERTH); Oakley Dam, Dwellingup (near Dam), 28 Sept. 1979, T. J. Hawkeswood 235 [3], 236 [1] (PERTH); Collie Weir, (33°20'S, 116°00'E), August 1946, F. M. Bennett s.n. (PERTH, CANB, NSW).

Total number of specimens examined: 16.

Comments. *Calothamnus graniticus* is related to *C. rupestris* Schau. (which is found on the western side of the Darling Range east of Perth), the only other species which has petals possessing prominent claws and fruiting capsules with two opposite lobes reflexed while the remaining two are deflexed. *Calothamnus graniticus* differs from *C. rupestris* in having flowers with glabrous, verrucose, calyx-tubes (densely pubescent in *C. rupestris*), longer, less pungent leaves, and flowers with dark pink to crimson staminal claws (pink in *C. rupestris*). Plants of *C. graniticus* tend to have more flowers per cluster than those of *C. rupestris*. *Calothamnus graniticus* subsp. *graniticus* is only found on granulite (granite-gneiss) outcrops on the Cape Naturaliste Peninsula where it has a disjunct distribution and is only locally common. In response to the climatic conditions experienced on the Cape, plants possess thick leaves with a large amount of storage leucoparenchyma tissue. All plants on the western side of Cape Naturaliste possess leaves with close, appressed hairs, while on the eastern side, both glabrous- and hairy-leaved variants grow sympatrically (Hawkeswood in prep.).

Calothamnus graniticus subsp. *leptophyllus* appears to be restricted to the western side of the Darling Range. It seems to favour a rocky habitat on slopes near water-courses and appears to be only locally abundant. It differs from the typical subspecies in having thinner, usually slightly longer leaves which are sometimes glabrous but usually sparsely pubescent (hairs \pm patent). Extensive anatomical investigations (Hawkeswood in prep.) have shown that the leaves have palisade tissue 1 cell deep whereas in subspecies *graniticus*, the palisade is 2 cells thick. Plants of subspecies *leptophyllus* tend to be straggly and multi-stemmed, but few-branched with larger clusters of flowers encircling the stem.

Bentham (1867) regarded subspecies *leptophyllus* as merely a variety of *C. torulosus* Schau. to which it is not closely related. However, in accordance with nomenclature to be adopted in the revision, this taxon has been elevated to a subspecies of *C. graniticus*. The typical subspecies contains larger populations than those of subspecies *leptophyllus*, justifying the name *graniticus* as the species name. In any case, the name *leptophyllus* has no priority outside its rank.

Bentham cited two syntypes for *C. torulosus* var. *leptophylla*, these being Drummond nos. 32 and 39, both in herb. K; the specimen Drummond no. 39 has been chosen as the lectotype for the subspecies since it possesses more fruiting capsules and flower buds. Bentham's confusion with *C. torulosus* may have arisen through neither specimen possessing open flowers.

2. *Calothamnus tuberosus* T. J. Hawkeswood, sp. nov. (Figures 5, 7, 11)

Frutex ad 2.5 m altus. Folia linearia, teretia, (3)5-8(12) cm longa, 1.2-2 mm lata, glabra. Flores in dense spicati, (1.5)2-3 cm longi. Calycis tubus (2)2.5-3 mm longus, glaber; calycis lobi 1-1.5 mm longi, glabri. Petala (2.5)3-4 mm longa, ferruginea. Unguis staminalis 22-28 mm longus, 1-1.2 mm latus, glaber; filamentis marginalibus 12-16. Fructus depresso-globularis vel globularis, 4-5 mm longus, (4)5-6(7) mm latus. Semina 0.6-1 mm longa, atro brunnea.

Typus: Peak Charles, (32°53'S, 121°10'E); shrub 4 m; bark papery, flowers red, on granite slope; 10 April 1971, A. S. George 10626 (holo: PERTH).

Erect, compact, much-branched, glabrous, gnarled *shrub* mostly to 2.5 m high. *Young shoots* glabrous. *Leaves* sessile, linear, terete, stiff, erect, (3)5-8(12) cm long, 1.2-2 mm wide, glaucous, mucronate, pungent, glabrous, crowded at ends of branches; oil glands prominent. *Flowers* in dense spikes (1.5)2-3 cm long near the ends of branches amongst leaves or on portions of branches from which leaves have fallen. *Calyx-tube* narrow-campanulate to campanulate, (2)2.5-3 mm long, glabrous or finely pubescent at base only, rhachis dilated at base; calyx-lobes equal, 1-1.5 mm long, erect, acute to slightly obtuse, glabrous outside and within; margins thin, scarious, ciliate. *Petals* broadly elliptic, (2.5)3-4 mm long, obtuse, concave, glabrous, deciduous, orange-brown, papery with thin, scarious, partially ciliate margins. *Staminal claws* equal, 22-28 mm long, 1-1.2 mm wide, glabrous, deep orange-red; marginal filaments 12-16, anthers linear-oblong, c. 1 mm long, dark yellow-brown. *Style* 10-25 mm long, slender, glabrous, stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, depressed globular to globular, 4-5 mm long, (4)5-6(7) mm wide, smooth, shortly 4-lobed often becoming almost truncate. *Fertile seeds* few per capsule, 0.6-0.8(1) mm long, linear-oblong, truncate (often obliquely), glabrous; *testa* dark brown. *Ovulodes* numerous, linear-oblong to oblong, 0.6-1 mm long, truncate, glabrous, dark yellow-brown.

Derivation of name. *Tuber*, Latin meaning "a swelling" or "tumour", and *-osus*, Latin for "abounding in". Refers to the long, tuberous roots possessed by this species.

Habitat. On granite outcrops or in granitic loam at base of outcrops in open shrubland. Locally common. Flowers September to February depending on climatic conditions of previous season.

Distribution. Barbalin Rock (30°58'S, 118°06'E), Knapp Rock (32°06'S, 120°45'E), Spinifex Rock (31°53'S, 120°39'E), Dog Rock (33°00'S, 121°04'E) and Peak Charles (32°53'S, 121°10'E) (Figure 11).

Other specimens examined. WESTERN AUSTRALIA: Barbalin Rock, 2 Sept. 1969, K. Newbey 2872 (PERTH); Knapp Rock, near Johnston Lake on Hyden-Norseman track, 13 June 1967, A. Kessell 614 (PERTH); Spinifex Rock, Hyden-Norseman track, 8 Feb. 1967, A. Kessell 550 [2] (PERTH); Spinifex Rock, at 330 mile peg on Hyden track, NW of Norseman, May 1966, A. Kessell 263 (PERTH); Dog Rock, 14 June 1972, H. Demarz D3648 (PERTH, KP); Peak Charles, 17 May 1956, A. R. Main s.n. (PERTH); Peak Charles, 18 May 1956, A. R. Main 23715 (PERTH); Peak Charles, July 1964, B. T. Clay and A. R. Main s.n. (PERTH); Peak Charles, 24 Oct. 1964, J. S. Beard 3822 (PERTH, KP); Peak Charles, 18 Sept. 1976, R. J. Hnatiuk 760910 (PERTH); Seedling grown at W.A. Herbarium, 15 Aug. 1978, R. Hnatiuk 780096 (PERTH).

Total number of specimens examined: 15.

Comments. *Calothamnus tuberosus* has no close affinity to any of the other 4-merous species and when the complete revision is published, it will probably be placed in a section on its own. This species has been confused with *C. gilesii* F. Muell. in herbarium collections. *Calothamnus gilesii* has 5-merous flowers, dark green slender leaves mostly 1-1.2 mm wide, hairs at the base of the calyx-tube and almost cylindrical fruit 8-12 mm long and c. 10 mm wide, with two of the lobes prominently thickened and persistent. *Calothamnus tuberosus* has 4-merous flowers, glaucous, succulent leaves 1.2-2 mm wide, usually a glabrous calyx-tube and depressed globular, shortly 4-lobed fruit measuring 4-5 mm long, 5-7 mm wide.

The most characteristic feature of this species is the presence of fleshy, tuberous roots, first recorded by Hnatiuk (1979) who stated that such root structures had not been previously recorded in Australian Myrtaceae. Hnatiuk found during transplantation of seedlings grown in the glasshouse, that they had developed tubers. It appeared from anatomical examination of the tubers (Hnatiuk 1979) that they were well-adapted to store water. In addition, Hnatiuk found that a dried seedling lost water rapidly from the roots whereas the leaves dried out slowly. I have shown (Hawkeswood 1978, in prep.) that terete-leaved species of some genera in the Myrtaceae (e.g. *Melaleuca*, *Eremaea*, *Beaufortia*, *Callistemon* and *Calothamnus*) have leaves with thick cuticles varying from 5 μ m to 15 μ m, epidermal cells with thick upper walls encrusted with cutin and often sunken stomates. All these features restrict water loss from leaves.



Figure 7. Habitat of *Calothamnus tuberosus* T. J. Hawkeswood at Peak Charles, with a large plant in the foreground. Photo A. S. George.

Thus it is interesting to ask why *Calothamnus tuberosus* has developed a tuberous habit when the leaves themselves have the capacity to hold water. Specimens of *C. quadrifidus* R. Br. growing sympatrically with the populations of *C. tuberosus* at Peak Charles (32°53'S, 121°10'E) have been examined for tubers by Dr K. W. Dixon (Department of Botany, University of Western Australia, pers. comm.) and none possessed tubers.

Calothamnus tuberosus is locally common on the large granite outcrops of Peak Charles, Dog Rock, Knapp Rock and Spinifex Rock (Figure 7). Another record is from Barbalin Rock (K. Newbey 2872, PERTH), some 350 km NW of Spinifex Rock, which suggests that *C. tuberosus* has a disjunct distribution.

Five-merous species

3. *Calothamnus formosus* T. J. Hawkeswood, sp. nov. (Figures 6, 8, 9, 18)

Frutex usque ad 2.5(4) m altus. Folia linearia, teretia, pilosa, pleraque glabrescenti, vel glabra, (3)4-6(7) cm longa, 0.8-1.2 mm lata, acuminata vel breviter mucronata. Flores 3-15, fasciculati vel dense spicati. Calycis tubus pleraque 4-5 mm longus, glaber vel interum hirsutus; calycis lobi circa 1 mm longi, glabri vel subtiliter pubescentis. Petala 3.5-6 mm longa, oblonga, rosea. Unguis staminalis 22-30 mm longus, 1-1.5 mm latus, glaber; filamentis marginalibus 26-32. Fructus cylindraceus, 6.5-8 mm longus, 5-6 mm latus, pleraque truncatus. Semina circa 2 mm longa, pallido brunnea, ciliata.

Typus: 530 mile peg on road to Denham, (c. 26°20'S, 113°58'E); shrub to 3 feet in tall open shrubland, with *Banksia*, *Grevillea*, *Hakea*, *Plectrachne* and *Eucalyptus*; 11 July 1970, T. E. H. Aplin 3357 (holo: PERTH; iso: CANB).

Erect, large, wide, compact, mostly glabrous shrub to mostly 2.5 m high (sometimes 4 m high), with thick bark often splitting on old trunks. Young stems and leaves densely pilose, becoming almost glabrous with age or initially glabrous. Leaves sessile, linear, terete (sometimes biconvex in transection), (3)4-6(7) cm long, 0.8-1.2 mm wide, glabrous or with occasional, scattered, spreading hairs, scabrous or smooth, acuminate-acute or shortly mucronate, sometimes obtuse, not pungent, usually crowded on younger stems at ends of branches or occasionally sparsely scattered on older stems; often conspicuously spotted with large oil glands and irregularly furrowed. Flowers 3-15, arranged in irregular, ± unilateral clusters or dense, short spikes on older stems usually on portions of stems from which the leaves have fallen. Calyx-tube narrowly to broadly campanulate, 4-5 mm long, glabrous or sometimes pubescent; rhachis slightly dilated at the base; calyx-lobes c. 1 mm long, deltoid, acute, slightly concave, erect or slightly spreading, ± glabrous or very shortly pubescent outside, ± glabrous within, thick but with thin, scarious or ciliate margins. Petals 3.5-6 mm long, oblong, obtuse, concave, glabrous, pink, papery with thin, pale, scarious, partially ciliate margins. Staminal claws ± equal, free, glabrous, 22-30 mm long, 1-1.5 mm wide, crimson, pale yellow-green at base near ovary; marginal filaments 26-32; anthers linear, 0.5-0.7 mm long, yellow. Style slender, glabrous, 15-30 mm long; stigma small. Summit of ovary densely pubescent. Fruit sessile, cylindrical, 6.5-8 mm long, 5-6 mm wide, glabrous, truncate or very shortly 5-lobed, covered in short, rounded bullate protuberances, grey-brown; orifice c. 2 mm diameter. Fertile seeds few to many, linear-cuneate, truncate, angled, c. 2 mm long, with transparent cilia on the angles, sometimes curved on one surface; testa light brown. Ovulodes numerous, linear, glabrous, 1.5-2 mm long, smooth, curved, dark brown.



Figure 8. Habit of *Calothamnus formosus* T. J. Hawkeswood subsp. *formosus* west of Hamelin Homestead (Shark Bay area). It occurs sporadically in mallee-heath on red sand. Photo M. Peterson.

Key to subspecies

- A. Leaves mostly 4-6 cm long, usually shortly pilose3a. subsp. *formosus*
 A.* Leaves mostly 7-9 cm long, glabrous3b. subsp. *rigidus*

3a. subsp. *formosus* (Figures 6, 8, 18)

Erect, large *shrub* mostly to 2.5 m high (sometimes 4 m high). *Leaves* terete, (3)4-6(7) cm long, 0.8-1.2 mm wide, scabrous, shortly pilose, older leaves often glabrous. *Calyx-tube* narrowly campanulate, mostly glabrous; *rhachis* dilated at base. *Fruit* 6.5-8 mm long, 5-6 mm wide.

Derivation of name. *Formosus*, Latin, meaning "beautiful on account of form" referring to the large shrub- to tree-like habit of this species.

Habitat. Grows on red sandplains in mallee-heaths with associated species of *Grevillea*, *Hakea*, *Banksia* etc. (Figure 8). Flowers mostly between August and December.

Distribution. Shark Bay area between 26°20'S and 27°10'S, 113°35'E and 114°35'E (Figure 18).

Other specimens examined. WESTERN AUSTRALIA: Tamala Station, May 1960, R. W. Vollprecht s.n. (PERTH); Coburn Station, 15 October 1974, J. S. Beard 7061 (PERTH); 22 miles [35.2 km] W of Hamelin Homestead (26°38'S, 113°55'E), 17

April 1979, T. J. Hawkeswood, 20, 48, 49a, 49b, 50, 55 (PERTH); 8 miles E of Tamala Homestead, 20 August 1979, M. Peterson 28 (PERTH); 15 km NW of Cooloomia Homestead, (26°50'S, 114°12'E), 18 September 1979, S. D. Hopper 1341 [2] (PERTH).

Total number of specimens examined: 13.

3b. subsp. **rigidus** T. J. Hawkeswood, subsp. nov. (Figures 9, 18)

Differt a *C. formosus* subsp. *formosus* foliis glabris laevibus plus rigidis, (6.5)7-9(11) cm longis, fructu leviter latiore et brevior 6-8 mm longo, 5-7 mm lato.

Typus: Murchison River septentrionalem versus ad 424 m.p., (26°33'S, 114°30'E); frutex vel arbor 3.3 m alt.; phalangibus scarletinus; 30 October 1963, F. Lullfitz 2842 (holo: PERTH).

Differs from the typical subspecies in having glabrous, smooth, more rigid leaves (6.5)7-9(11) cm long, 0.8-1.2 mm wide, often with conspicuous *oil glands*; the *calyx-tube* slightly more broadly campanulate, with the base covered in white hairs and the *rhachis* not so prominently dilated at the base; *fruit* slightly wider and shorter, 6-8 mm long, 5-7 mm wide.

Derivation of name. *Rigidus*, Latin, meaning "hard" or "stiff", refers to the somewhat more rigid leaves possessed by this subspecies in comparison with subspecies *formosus*.

Habitat. Grows on sandplains in mallee-heaths with associated species of *Grevillea*, *Hakea*, *Eucalyptus* etc. Flowers October to December.

Distribution. From near Overlander Roadhouse (26°15'S, 114°20'E) to Yuna (28°20'S, 115°00'E) (Figure 18).

Other specimens examined. WESTERN AUSTRALIA: Near Yuna, 6 December 1958, C. A. Gardner 12047 (PERTH); No. 8 tank (via Carnarvon), 5 January 1960, C. A. Gardner 12300 (PERTH); 424 mile peg on Carnarvon Highway, 30 October 1963, F. Lullfitz L2842 (KP); 425 mile peg on Carnarvon Highway, 3 December 1965, F. Lullfitz L4314 (KP); 435 mile peg on Carnarvon Highway, 7 December 1963, F. Lullfitz L4550 (KP); S from Carnarvon near 436 mile peg, 29 October 1968, J. V. Blockley 1022 (KP); 34 mi S of Wannoo, 17 Sept. 1968, M. E. Phillips CBG 035669 (BRI, NSW).

Total number of specimens examined: 10.

Comments. *Calothamnus formosus* is related to *C. blepharospermus* F. Muell. which has more or less cylindrical, truncate fruits covered with short, rounded (bullate) protuberances, and flat, narrow-oblongate leaves. However, *C. formosus* is distinctive in having smaller cylindrical fruits and terete leaves. Another prominent feature is the pink petals. Most specimens examined have had ± glabrous calyx-tubes, but one specimen, lodged at UWA (K. Baird s.n., Carnarvon-Geraldton Road, September 1968) had flowers with densely pubescent calyx-tubes. This specimen may represent another subspecies, but the absence of further material prevents the recognition of such.

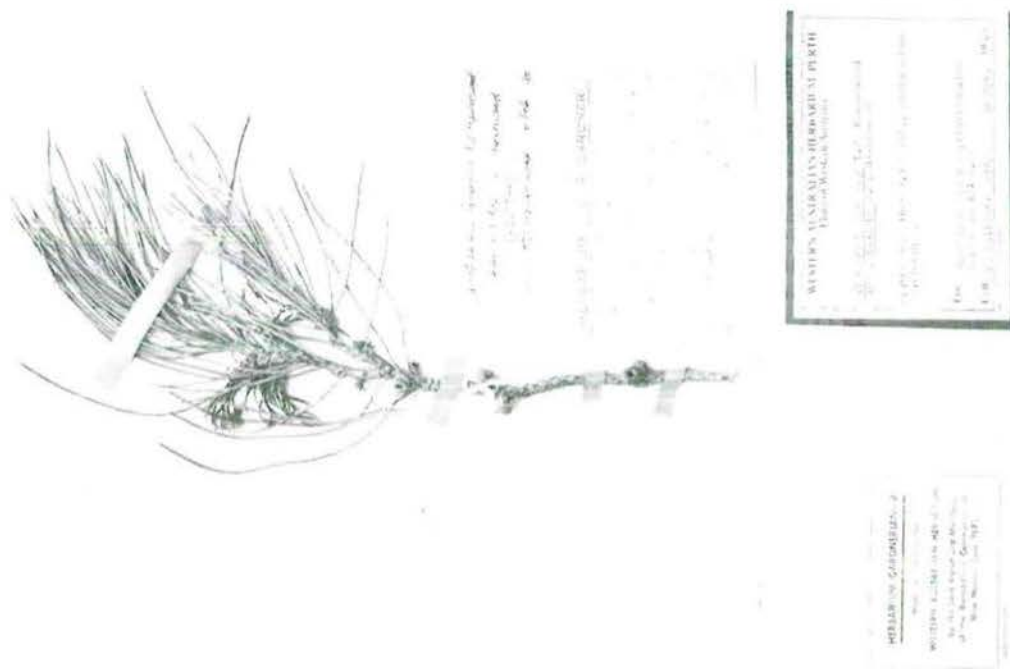


Figure 9.—*Calothamnus formosus* T. J. Hawkeswood subsp. *rigidus* T. J. Hawkeswood—Holotype (Lullfitz 2842).



Figure 10.—*Calothamnus hirsutus* T. J. Hawkeswood—Holotype (George 9759).

Both subspecies of *Calothamnus formosus* appear to have a limited distribution in the central western coastal region of Western Australia where they are locally common. No National Parks or Reserves have been set up at present in the areas where they occur. The Shark Bay region contains many endemic plant and animal species, some of which are at present undescribed, and the setting up of a National Park here should ensure the preservation of these rare endemic species.

4. *Calothamnus hirsutus* T. J. Hawkeswood, sp. nov. (Figures 10, 11)

Frutex ad 1 m altus. Folia linearia, teretia, (1.5)2-2.5(3) cm longa, 0.5-0.8 mm lata, longe albo hirsuta. Flores 4-8, fasciculati. Calycis tubus 3-4 mm longus, dense pubescens, calycis lobi 2.5-4 mm longi. Petala 5-6 mm longa, ferruginea. Unguis staminalis (20)25-30 mm longus, circa 1 mm latus, glaber; filamentis marginalibus 20-25. Fructus depresso globularis, 5-6 mm longus, 5-6 mm latus. Semina 0.7-1 mm longa, atrogrisea.

Typus: N of Arrowsmith Lake ($\pm 29^{\circ}30'S$, $115^{\circ}04'E$); spreading shrub 80 cm, flowers red; in sandy loam near swamp; 16 October 1969, A. S. George 9759 (holo: PERTH; iso: CANB, NSW, PERTH).

Low, compact, usually erect, multi-branched, often spreading *shrub* to 1 m high, more or less hirsute; *older stems* glabrous, usually thick and often corky. *Young shoots* densely pilose. *Leaves* sessile, linear, terete, or slightly flattened, crowded, (1.5)2-2.5(3) cm long, 0.5-0.8 mm wide, shortly mucronate but not pungent, sparsely hirsute (hairs \pm perpendicular to leaf, spreading, slender) or sometimes \pm glabrous; *oil glands* randomly distributed and conspicuous. *Flowers* 4-8 in dense, sessile clusters (sometimes unilateral) amongst leaves on older stems. *Calyx-tube* broadly campanulate, 3-4 mm long, densely pubescent; *rhachis* slightly dilated at base; *calyx-lobes* equal, 2.5-4 mm long, erect, acute to slightly obtuse, pubescent outside, shortly pubescent within, margins thin, scarious, ciliate. *Petals* obovate-elliptical, obtuse, concave, 5-6 mm long, glabrous, orange-brown, papery with thin, scarious, ciliate margins. *Staminal claws* \pm equal, (20)25-30 mm long, c. 1 mm wide, glabrous, deep red; *marginal filaments* 20-25; anthers narrow-oblong to oblong, 0.7-1 mm long, dark brown. *Style* 20-28(32) mm long, slender, glabrous; *stigma* small. Summit of *ovary* densely pubescent. *Fruit* sessile, globular, 5-6 mm long, 5-6 mm wide, initially pubescent but becoming glabrous with age, truncate or with one lobe thickened, (often lobes persistent on young fruiting capsules), reflexed; *orifice* c. 2 mm diameter. *Fertile seeds* few to numerous per capsule, 0.7-1 mm long, oblong to narrow-oblong, angles smooth; *testa* dark grey with shallow grooves, outer seeds curved. *Ovulodes* numerous, 0.7-1 mm long, cuneate to narrow-oblong, variously angular, cream.

Derivation of name. Latin *hirsutus*, meaning "shaggy, bristly, prickly" or in botanical Latin, having long hairs. Refers to the long, spreading simple hairs on the leaves.

Habitat. Grows in heath communities on sandplains with species of *Hakea*, *Banksia*, *Eremaea*, *Grevillea* etc. Flowers October to February.

Distribution. From north of Arrowsmith Lake ($29^{\circ}30'S$, $115^{\circ}04'E$) to the Perth suburb of Cannington and to the Helena Valley (Figure 11). At present, there have been no collections made between Perth and the Moore River ($31^{\circ}02'S$, $115^{\circ}50'E$). This may be due either to a disjunct distribution pattern or the result of land clearing for agricultural purposes.

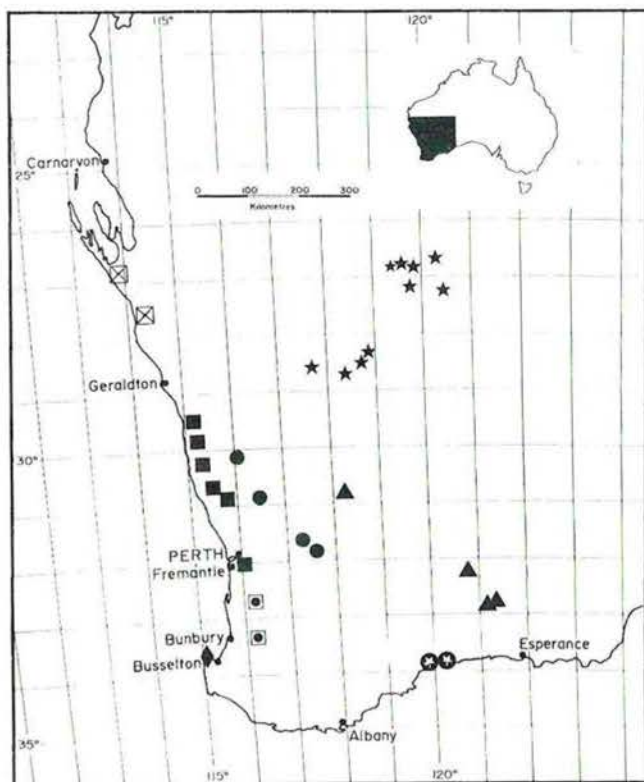


Figure 11. Distribution of the *Calothamnus* taxa—*C. aridus* (★), *C. brevifolius* (●), *C. graniticus* subsp. *graniticus* (◆), *C. graniticus* subsp. *leptophyllus* (◼), *C. hirsutus* (◼), *C. kalbarriensis* (⊠), *C. macrocarpus* (◐), and *C. tuberosus* (▲).

Selected specimens examined. WESTERN AUSTRALIA: 13.3 miles [21 km] N of Cockleshell Gully turn-off to Three Springs, 8 October 1967, W. A. Loneragan 67091 (UWA); Hill River, 22 September 1957, N. H. Speck s.n. (UWA); 1 km E of Lake Indoon, (29°52'S, 115°10'E), 16 December 1976, R. Hnatiuk 761419 (PERTH); Mt Lesueur, 1 November 1973, D. Kitchener 104 (PERTH); Strathmore Road Reserve (no. 26248), S of Badgingarra, (30°34'S, 115°21'E), 5 November 1975, A. S. George 14202 (PERTH); Eneminga Reserve, near Regan's Ford, close to Colin Wedge's property, March 1966, S. W. Bowdler s.n. (PERTH); Moore River National Park, 2 October 1971, R. D. Royce 9503 (PERTH); Darling Range, Perth, April 1901, E. Pritzel NSW 144000 (NSW); Boundary Road, Cannington opposite UWA Botany Dept. Block, 16 November 1977, R. Tinetti s.n. (UWA); Cannington, 21 November 1910, A. Morrison 730 (NSW); Cannington, October 1927, H. Steedman s.n. (PERTH); Cannington, 25 May 1901, A. Morrison s.n. (PERTH); Canning Plains, October 1903, W. V. Fitzgerald NSW 143999 (NSW); Canning Range, 25 February 1903, A. Morrison s.n. (PERTH); Cannington, 2 November 1927, C. T. White 5267 (BRI); Serpentine Dam, 28 September 1979, T. J. Hawkeswood 125 (PERTH); Helena Valley, near Ridge Hill Road, 28 November 1978, J. Seabrook 632 (PERTH); 2.6 miles W of Byford, along Abernethy Road, 20 September 1979, M. Peterson s.n. (PERTH).

Total number of specimens examined: 25

Comments. This species has been confused with *C. villosus* R. Br. in all herbarium collections examined. This error has arisen because knowledge of the true identity of *C. villosus* R. Br. has been previously lacking. The type specimen of *C. villosus* was collected from Lucky Bay (34°00'S, 122°12'E) by Robert Brown who published the name in 1812. Robert Brown also collected and named two other *Calothamnus* species from south-west Western Australia, namely *C. quadrifidus* R. Br. and *C. gracilis* R. Br. These two species were more or less glabrous and since his third species possessed a pubescent calyx-tube, Brown named it *C. villosus*. Thus this name has also been applied to *C. hirsutus* because of its villous characters.

However, *C. hirsutus* is clearly distinguishable from *C. villosus* in having thin, spreading leaves (mostly 2-2.5 cm long) with long, simple, white hairs and depressed globular fruits (often initially truncate but sometimes with one lobe thickened and deflexed across the orifice). This lobe often wears or breaks away on fruits more than one year old resulting in the capsules being truncate. *C. villosus* possesses rigid, smooth or scabrous leaves, mostly 2.5-3.5 cm long, usually glabrous but sometimes sparsely pilose. The fruit is almost ovoid to ellipsoid with two opposite lobes thickened and persistent. *C. hirsutus* has affinities with *C. brevifolius* T. J. Hawkeswood (see under comments on that species).

Calothamnus villosus has a fairly wide distribution from Red Gum Springs in the Stirling Ranges (34°25'S, 119°50'E), Cape Riche (34°36'S, 118°47'E) to the Gairdner and Fitzgerald Rivers, East Mt Barren (33°46'S, 122°01'E) and also occurs to the east of Mt Ragged (33°27'S, 122°28'E). On the other hand, *C. hirsutus* is found from Perth to Arrowsmith Lake (29°30'S, 115°04'E) (Figure 11).

5. ***Calothamnus brevifolius*** T. J. Hawkeswood, sp. nov. (Figures 11, 12, 13, 14)

(?) Synonym: *C. villosus* R. Br. var. *ericifolius* Benth. Fl. Austr. 3:178 (1867). Type: Swan River, James Drummond. 1st Coll. (holo: K, photograph seen).

Frutex ad 0.5 m altus. Folia linearia, teretia, vel leviter applanata (7)8-12(15) mm longa, 0.5-0.8 mm lata. Flores 1-5, dispersi vel breviter et dense fasciculati. Calycis tubus 3.5 mm longus, dense pubescens; calycis lobi circa 2 mm longi. Petala 5-6 mm longa, anguste oblonga, acuta. Unguis staminalis pleraque 20-25(28) mm longus, 0.8-1 mm latus, atroroseus; filamentis marginalibus 15-20. Fructus depresso globularis vel fere cylindraceus, 4-5 mm longus, circa 5 mm latus. Semina 0.7-1 mm longa.

Typus: 11 km E of Piawaning (30°50'S, 116°30'E); in sandy soil on road verge with *Xylomelum angustifolium* and *Banksia prionotes*; 15 February 1980, P. G. Wilson 11711 (holo: PERTH; iso: BRI, CANB, MEL, NSW, PERTH).

Small, erect, spreading, much-branched glabrous *shrub* to about 0.5 m high; the *older stems* with thick bark often splitting. *Young stems* and shoots glabrous. *Leaves* sessile, short, linear, terete (or biconvex in transection), somewhat scabrous, (7)8-12 (15) mm long, 0.5-0.8 mm wide, attenuate at base near rhachis, shortly mucronate but not pungent, crowded on younger branches, sometimes loosely scattered; *oil glands* few, scattered (prominent in dried specimens). *Flowers* 1-5, in short, dense clusters encircling stems amongst leaves, or scattered in groups of 1-3, usually on younger branches. *Calyx-tube* narrowly campanulate, 3-5 mm long, densely pubescent, rhachis slightly dilated at base; *calyx-lobes* narrow deltoid, acute, slightly concave, not spreading, c. 2 mm long, hirsute outside, closely and shortly pubescent within, thick but with thin, ciliate margins. *Petals* narrow-oblong, 5-6 mm long,



Figure 12. Habit of *Calothamnus brevifolius* T. J. Hawkeswood, on a roadside verge near Piawaning. Photo K. F. Kenneally.



Figure 13. Close-up of branch with flowers and fruit of *Calothamnus brevifolius* T. J. Hawkeswood. Photo K. F. Kenneally.

mostly acute, glabrous, slightly concave, papery with thin, scarious margins. *Staminal claws* \pm equal, 20-25(28) mm long, 0.8-1 mm wide, glabrous, dark pink; *marginal filaments* 15-20; *anthers* narrow-oblong, 0.5-0.7 mm long. *Style* 10-27 mm long, glabrous, slender; *stigma* small. Summit of *ovary* densely pubescent. *Fruit* sessile, depressed globular to almost cylindrical, 4-5 mm long, c. 5 mm wide, truncate or occasionally one of the lobes thickened, persistent and curved into the orifice; pubescence often persistent in mature fruits; *orifice* 1.5-2 mm diameter. *Fertile seeds* small, 0.7-1 mm long, oblong-cuneate with smooth angles, glabrous, truncate; *testa* dull dark brown. *Ovulodes* 0.7-1 mm long, linear-oblong, cuneate, truncate, glabrous, shining yellow-brown.

Derivation of name. *Brevi*, Latin, meaning "short"; *folius*, Latin, meaning "leaved"; refers to the short leaves which are a characteristic feature of this species.

Habitat. In sandy soil with *Xylomelum angustifolium* and *Banksia prionotes* on road verge between Wongan Hills and Piawaning (Figure 12). At Marchagee, the species is a compact shrub to 30 cm tall growing with *Melaleuca acuminata* and *Thryptomene prolifera* heaths as a mosaic in yellow, well drained, sandy loam (B. G. Muir, pers. comm., June 1979). Flowers January to February.

Distribution. Presently only known from a few localities in the southern portion of the Western Australian wheatbelt, namely Piawaning (30°55'S, 116°23'E), Charles Gardner Flora Reserve (31°49'S, 117°32'E), Cunderdin (31°40'S, 117°15'E), near Corrigin (32°20'S, 117°50'E) and in the Marchagee Reserve 23601, (30°00'S, 116°05'E) (Figure 11).

Other specimens examined. WESTERN AUSTRALIA: 0.5 miles [0.8 km] S of Piawaning, January 1968, K. Newbey 3157 (PERTH); S of Tammin, 4 February 1960, T. E. H. Aplin 634 (PERTH); Cunderdin, 3 January 1955, G. M. Storr s.n. (UWA); 19 miles W of Corrigin, 1 January 1964, A. S. George 6052 (PERTH); Marchagee Reserve 23601, c. 10 km N of Marchagee (30°00'S, 116°05'E), 1 June 1977, B. G. Muir 482 (4.7) (PERTH); Charles Gardner Flora Reserve, S of Tammin, 6 April 1966, R. D. Royce 8324 (PERTH).

Total number of specimens examined: 12.

Comments. This species is related to *C. hirsutus* T. J. Hawkeswood, from which it differs in having smaller fruits 4-5 mm long and wide, shorter leaves mostly 8-12 mm long, fertile seeds with dull dark brown testas and ovulodes which are shining yellow-brown. *C. hirsutus* has fruits 5-6 mm long and wide, leaves mostly 2-2.5 cm long, fertile seeds with dark grey testas and cream-coloured ovulodes. Both species have narrow-oblong, \pm acute petals, acute calyx-lobes, pubescent calyx-tubes and occasionally one of the lobes thickened, persistent and deflexed into or across the orifice of the fruit. However, the fruit of both species is usually found to be truncate since the lobe wears or breaks away with age.

Calothamnus brevifolius appears to have a limited distribution, probably as a result of the extensive clearing of land for agricultural purposes in the areas from which it has been collected in the past. A visit was made by the author on 16 February 1980, to Piawaning, (30°55'S, 116°23'E) to check K. Newbey's record of 15 years ago (Newbey 3157, PERTH), but no plants were located after an extensive search by the author and Mr S. Wilson. However, on 15 February, one plant was discovered by Mr P. G. Wilson 11 km E of Piawaning towards Wongan Hills (Figures

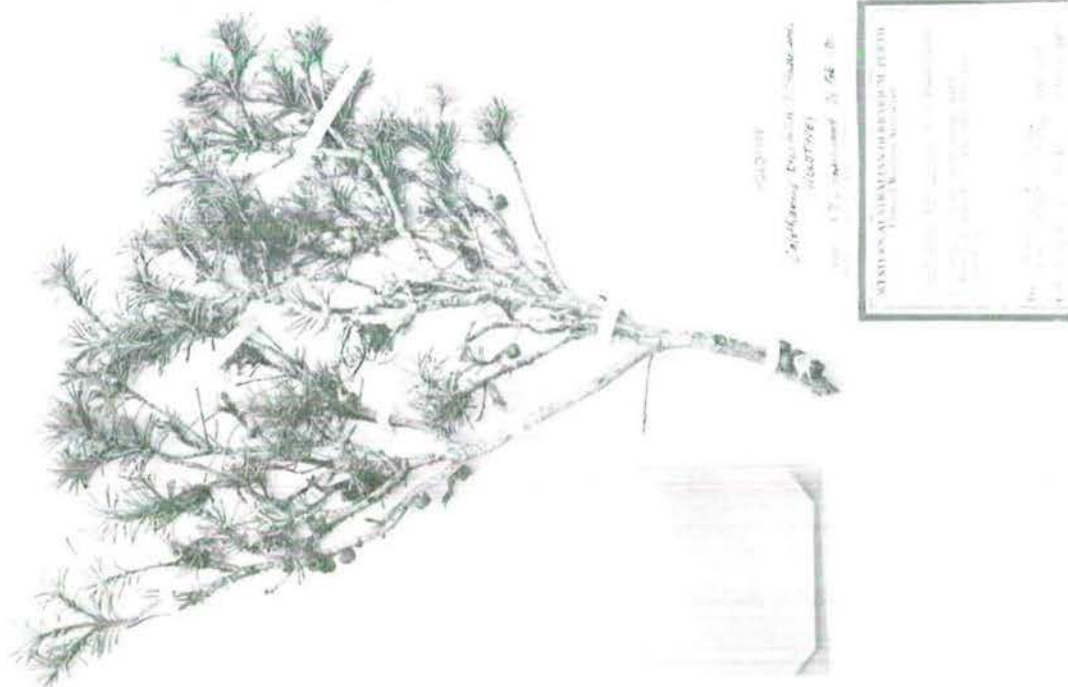


Figure 14.—*Calothamnus brevifolius* T. J. Hawkeswood—Holotype (Wilson 11711).



Figure 15.—*Calothamnus aridus* T. J. Hawkeswood—Holotype (Gardner 14434).

12, 13). Mr Wilson also explored the Charles Gardner Flora Reserve South of Tammin on 15 February but due to the dry season most plants in the area were withered and were non-flowering and no *C. brevifolius* plants were located. It is possible that this is a rare species and its continued existence can only be assured in reserves such as Marchagee Reserve 23601, which are set aside for purposes of conservation.

Bentham (1867) described *C. villosus* R. Br. var. *ericifolius*. I have been able to examine a photograph of the type. Although the specimen resembles *C. brevifolius*, it has hirsute leaves, large immature fruits and only a few flowers and buds. Since there is no definite locality on the label, I am hesitant to assign a name to the specimen. In any case, the name *ericifolius* Benth. has no priority outside the rank of variety.

6. *Calothamnus aridus* T. J. Hawkeswood, sp. nov. (Figures 11, 15)

Frutex usque ad 2.5 m altus. Folia linearia, teretia, erecta, (5)7-10(12) cm longa, 0.6-1.2 mm lata, acuminata, glabra, glandibus oleaceis prominentibus ornata. Flores pleraque 2-8(10) conferti super caulibus inter folia positi. Calycis tubus (2)2.5-3 mm longus, glaucus, albo pilosus; calycis lobi 1-1.5 mm longi breviter albo pilosi. Petala auranticae-brunnea, 3-5 mm longa, breviter albo pilosa. Unguis staminalis 20-25 mm longus, circa 1 mm latus, glaber, auranticus vel roseus; filamentis marginalibus 10-12. Fructus depressus globularis, 4-8 mm longus, 5-8 mm latus, glaber. Semina 1.5-2 mm longa, brunnea.

Typus: Between Montague Range and 75 mls N of Sandstone on Wiluna Road, (c. 26°50'S, 119°57'E); bushy, erectly branched shrub 6-8 feet tall; stamens red, anthers yellow; red *Triodia* sand; 22 August 1963, C. A. Gardner 14434 (holo: PERTH; iso: PERTH).

Erect, much-branched, multi-stemmed, straggly to compact *shrub* to 2.5 m high. *Young shoots* glabrous or sometimes finely pilose. *Leaves* sessile, linear, terete, erect, (5)7-10(12) cm long, 0.6-1.2 mm wide, glabrous, narrowed into a thin apex 2-3 mm long (straight or curved), dark to olive green; *oil glands* prominent and randomly distributed. *Flowers* 2-4 (mostly 3) in a cluster or 5-8(10) in a loose spike amongst leaves on younger stems. *Calyx-tube* narrow campanulate to almost cylindrical, (2) 2.5 mm long, glaucous and covered in white hairs; *rhachis* slightly dilated at base; *calyx-lobes* deltoid-obtuse to almost semi-circular, concave, 1-1.5 mm long, with scattered, short, white hairs; *margins* thin, scarious, ciliate. *Petals* obovate, concave, obtuse, 3-5 mm long, thin, covered in short, appressed hairs, orange-brown, persistent; *margins* thin, ciliate. *Staminal claws* ± equal, free, 20-25 mm long, c. 1 mm wide, glabrous, orange-red in lower half to two-thirds, pink-red in upper portion; *marginal filaments* 10-12, pink-red, *anthers* linear, 1-1.3 mm long, yellow or yellow-brown. *Style* slender, 15-26 mm long, glabrous, pink-red, stigma small. *Fruit* depressed globular, 4-8 mm long, 5-8 mm wide, smooth or with irregular bulges or ribs, truncate or shortly five-lobed (lobes usually persistent in young fruit and absent in old, worn fruit). *Fertile seeds* linear-oblong, 1.5-2 mm long, variously angular, often obliquely truncate, glabrous; *testa* dark red-brown. *Ovulodes* similar to fertile seeds, mostly c. 1.5 mm long, slightly paler in colour, usually often obliquely truncate, glabrous.

Derivation of name. *Aridus*, Latin, referring to the arid habitat in which this species grows.

Habitat. Grows in red sand in *Triodia-Eucalyptus* woodland and *Triodia* sandplain associations. Flowers August to October.

Distribution. From Wiluna (26°35'S, 120°14'E), Albion Downs (27°14'S, 120°20'E) and sandplains between the Montague Range and Wiluna, to areas between Sandstone (27°59'S, 119°28'E) and Paynes Find (29°15'S, 117°40'E) (Figure 11).

Other specimens examined. WESTERN AUSTRALIA: W of Sandstone Road, S of Wiluna, sandplain above breakaway, 20 September 1957, *N. H. Speck* 861 [2] (PERTH); 55 miles N of Sandstone, towards Wiluna, 14 October 1972, *R. D. Royce* 10383 (PERTH); 34 miles SW of Wiluna, 29 July 1963, *A. S. George* 5638 (PERTH); rabbit-proof fence, 23 miles S of Meekatharra-Wiluna railway, 28 August 1958, *N. H. Speck* 1318 (PERTH); 10 miles NW of Albion Downs woolshed, 17 September 1958, *N. H. Speck* 1466 (PERTH); 75 miles NE of Paynes Find, 20 August 1974, *H. Demarz* 5106 (PERTH); Youanmi Downs, 26 August 1963, *C. A. Gardner* 14380 (PERTH); No. 1 rabbit proof fence, 340 mile peg, July 1937, *G. F. Melville* 29 [2] (PERTH); Kirkalocka Station on sandplain, 7 miles E of homestead, 24 September 1973, *J. S. Beard* 6655 (PERTH, NSW); 24 miles from Sandstone turnoff, 8 September 1963, *F. Lullfitz* L2400 (PERTH, KP).

Total number of specimens examined: 16.

Comments. *Calothamnus aridus* is not closely related to any other known species in the genus. It is the only species which has petals covered in short, appressed, simple hairs (the remaining species have the petal margins ciliate only). The hairy calyx-tube and petals, and the very narrow, erectly held leaves are probably adaptations to the arid environment which this species inhabits.

There is some variation in the size and shape of the fruits on the specimens lodged at PERTH and KP. Fruits vary from 5-6 mm diameter, depressed globular, smooth capsules, to 8 mm diameter depressed globular capsules, slightly wider at the apex than at the base with smooth, rounded ribs.

Many specimens in the W.A. Herbarium (PERTH) have been confused with *C. chrysantherus* F. Muell. The latter species has larger floral parts, more densely pubescent calyx-tube, scabrous leaves, and larger fruits (widest at the base) with prominently thickened calyx-lobes at the apex.

7. *Calothamnus macrocarpus* T. J. Hawkeswood, sp. nov. (Figures 11, 16)

Frutex erectus usque ad 2(-3) m altus. Folia linearia, teretia, erecta vel patentia, (1.2)2-2.5(3) cm longa, (1)1.5-2 mm lata, breviter mucronata, glandibus oleaceis prominentibus ornata. Flores 1 vel 2(8) confertis in ramulis supernis inter folia positi. Calycis tubus (3)4-6 mm longus, glaber; calycis lobi 2-2.5 mm longi, glabri. Petala 6-8 mm longa, pallido brunnea. Unguis staminalis 28-35 mm longus, 2-2.5(3) mm latus, glaber, puniceus; filamentis marginalibus (22)26-28(32). Fructus cylindraceus ad fere globularis, 13-17 mm longus, 13-18 mm latus, glaber. Semina circa 4 mm longa.

Typus: West side of East Mt Barren (33°56'S, 120°02'E); shrub 50-80 cm; flowers bright red; in rocky quartzite soil, near summit; 21 April 1962, *A. S. George* 3675 (holo: PERTH; iso: CANB).

Erect, much-branched *shrub* usually to 2 m high but sometimes to 3 m high. *Young shoots* pilose; *older stems* usually glabrous; *younger stems* becoming glabrous with age or sometimes remaining sparsely pilose. *Leaves* sessile, crowded, erect or spreading, linear (sometimes curved), terete, somewhat succulent, (1.2)2-2.5(3) cm

long, (1)1.5-2 mm wide, glabrous or sparsely pubescent, shortly mucronate but not pungent; *oil glands* prominent. *Flowers* usually 1 or 2 together (or occasionally 3 to 8) on stems amongst leaves (but not necessarily axillary). *Calyx-tube* broadly campanulate, (3)4-6 mm long, glabrous; *oil glands* large, conspicuous; *rhachis* slightly dilated at base of calyx-tube; *calyx-lobes* deltoid, obtuse or slightly acute, concave, 2-2.5 mm long, glabrous, centre thickened; *margins* scarious, partially ciliate. *Petals* obovate, 6-8 mm long, obtuse, concave, glabrous, pink to light brown, papery with thin, scarious, partially ciliate margins; *oil glands* prominent in centre. *Staminal claws* \pm equal, free, 28-35 mm long, 2-2.5(3) mm wide, glabrous, crimson; marginal filaments (22)26-28(32); anthers linear, c. 1.5 mm long, yellow. *Style* slender, glabrous, 15-25(30) mm long; *stigma* small. *Ovary* densely pubescent at summit. *Fruit* sessile, large, sometimes almost hidden by dense foliage, cylindrical to almost globular (sometimes slightly wider at base than at apex), 13-17 mm long, 13-18 mm wide, glabrous, smooth, dark brown; *orifice* 3-4 mm diameter; *calyx-lobes* persistent, short, thick, often almost enclosing the orifice. *Fertile seeds* few per capsule, c. 4 mm long, linear, straight or curved, glabrous, shiny, often obliquely truncate at one end, angular (angles sharp); *testa* papery, dark yellow-brown. *Ovulodes* numerous, c. 4 mm long, linear, slightly narrower than the fertile seeds, glabrous, shiny, angular, slightly paler in colour than fertile seeds.

Derivation of name. Greek, *macros* meaning "large" or "long"; Greek *carpos* meaning "fruit"; *macrocarpus* refers to the prominently large, almost globular fruit of this species.

Habitat. Restricted to rocky, quartzite soil in shrubby heath. Flowers August to December, and probably to April (as indicated by data on type specimens).

Distribution. Appears to be restricted to East Mt Barren (33°56'S, 120°02'E) and nearby Culham Inlet (Figure 11).

Other specimens examined. WESTERN AUSTRALIA: NW of East Mt Barren, no date, C. A. Gardner 12096 (PERTH); East Mt Barren, 29 August 1962, C. A. Gardner 14034 [2] (PERTH); East Mt Barren, 25 August 1964, F. Lullfitz L3609 [2] (PERTH); East Mt Barren, 11 October 1967, D. Young Y283 [2] (KP); foot of East Mt Barren, 31 October 1967, J. S. Beard 2195 (KP); East Mt Barren Range, 10 January 1969, H. Demarz D1060 (KP); Culham Inlet, 25 October 1964, K. Newbey 1613 (PERTH).

Total number of specimens examined: 13.

Comments. *Calothamnus macrocarpus* is not closely allied to any other species. The large, cylindrical to almost globular, smooth fruits, which measure 13-17 mm long and 13-18 mm wide, are a distinctive feature. The leaves hold relatively large amounts of water (as clearly evidenced by crushing them) and are conspicuously dotted with large oil glands. This is probably one of the most beautiful species of the genus and has been in cultivation at Kings Park and in Perth residential gardens for a number of years. Although it appears restricted to the East Mt Barren area, its conservation is assured as this lies within the Fitzgerald River National Park.

8. *Calothamnus kalbarriensis* T. J. Hawkeswood, sp. nov. (Figures 11, 17)

Frutex usque ad 1 m altus. Folia linearia, teretia vel breviter applanata, (0.8)1.5-2.5(3.5) cm longa, pleraque 0.8-1(1.5) mm lata, breviter mucronata, glabra. Flores 1-3, fasciculati. Calycis tubus pleraque 4-6 mm longus, pleraque glaber. Petala 6-7 mm

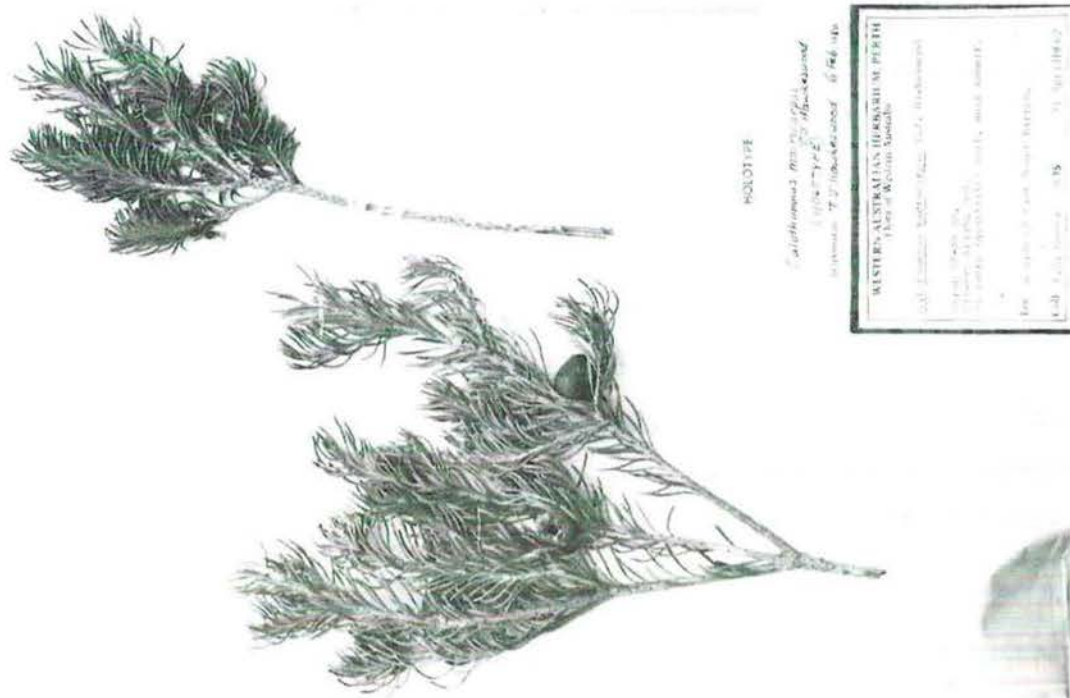


Figure 16.—*Calothamnus macroscarpus* T. J. Hawkeswood—Holotype (George 3675).

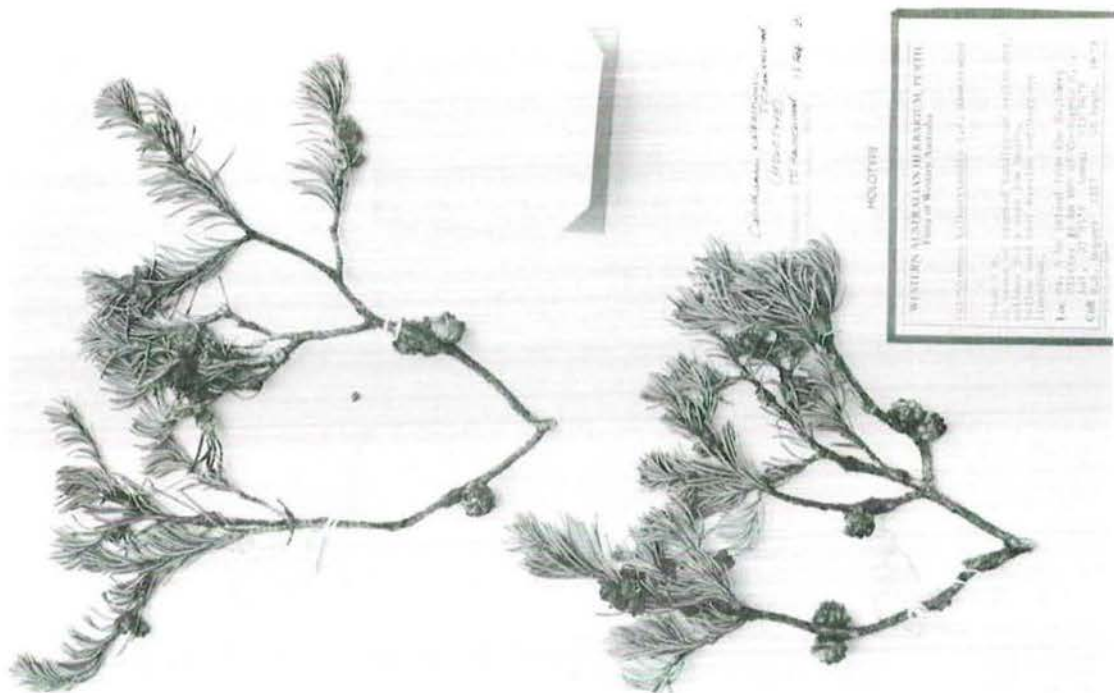


Figure 17.—*Calothamnus kalbarriensis* T. J. Hawkeswood—Holotype (Hopper 1327).

longa, ferruginea. Unguis staminalis (20)25-30 mm longus, 1.5-2 mm latus; filamentis marginalibus (20)25-30. Fructus \pm cylindraceus vel globularis, (8)10-12 mm longus, 10-12 mm latus. Semina 2.5-3 mm longa, brunnea.

Typus: Circa 5 km inland from the Zuytdorf Cliffs, 40 km WSW of Cooloomia Homestead, (27°05'S, 113°56'E); shrub 1 m; in grove of stunted *Eucalyptus erythrocorys* mallees 2-3 m over low heath; yellow sand over massive outcropping of limestone; 15 September 1979, S. D. Hopper 1327 (holo: PERTH; iso: CANB).

Erect, straggly, mostly glabrous *shrub* to 1 m high; branches often with prominent leaf scars. *Young shoots* glabrous or pilose (hairs short, appressed). *Leaves* sessile, linear, terete or slightly flattened, erect or slightly spreading and curved, (0.8)1.5-2.5 (3.5) cm long, 0.8-1(1.5) mm wide, pale green, shortly mucronate, but not pungent, glabrous or with short, appressed, sparse hairs. *Flowers* 1-3 together in small clusters, amongst leaves or on portions of stems from which leaves have fallen; *buds* arising from short, swollen, corky excrescences on the stems. *Calyx-tube* broadly campanulate to almost cylindrical, 4-6 mm long, glabrous or very shortly pubescent; *rhachis* prominently dilated at base; calyx-lobes (2.5)3-4 mm long, almost equal, broadly deltoid, obtuse to slightly acute, glabrous or shortly pubescent outside and inside, thick but with thin, brown, scarios, (often ciliate) margins. *Petals* obovate-elliptical to broadly obovate-elliptical, 6-7 mm long, slightly concave, obtuse, papery, orange-brown, glabrous; *margins* thin, scarios, sometimes partially ciliate; *lamina* dotted with oil glands. *Staminal claws* \pm equal, (20)25-30 mm long, 1.5-2 mm wide, glabrous, dark orange-red; *marginal filaments* (20)25-30; *anthers* linear, c. 1.5 mm long, glabrous, dark brown. *Style* slender, 20-25 mm long, glabrous; *stigma* small. *Fruit* almost cylindrical (often almost globular, slightly wider at base), (8)10-12 mm long (including lobes when present), 10-12 mm wide, sometimes smooth (epidermis peeling with age) but usually rough and corky, often truncate; *lobes* (when present) somewhat corky, erect or incurved. *Fertile seeds* few per capsule, linear-oblong, truncate, 2.5-3 mm long, angular; *testa* brown with a row of transparent cilia on each angle. *Ovulodes* numerous, 2.5-3 mm long, linear, cuneate, truncate, brown, the outer ones curved.

Derivation of name. Named after the township of Kalbarri from where the first collections were made.

Habitat. Grows on sand dunes or shallow sand over limestone in low open mallee heath with species of *Eucalyptus*, *Eremaea*, *Beaufortia*, *Hakea*, *Persoonia* etc. Flowers mostly from August to October.

Distribution. Along the coast from near Tamala Station Homestead (26°42'S, 113°43'E), to the township of Kalbarri (27°42'S, 114°12'E) in the Kalbarri National Park (Figure 11).

Other specimens examined. WESTERN AUSTRALIA: Kalbarri, 20 June 1977, D. R. Bellairs 1666 (PERTH); Sand dunes S of Kalbarri (near Red Bluff) in Kalbarri National Park, 4 August 1979, M. Peterson s.n. (PERTH); 4 miles SE of Tamala Station Homestead (26°44'S, 113°45'E), 27 August 1969, A. S. George 9571 (PERTH).

Total number of specimens examined: 5.

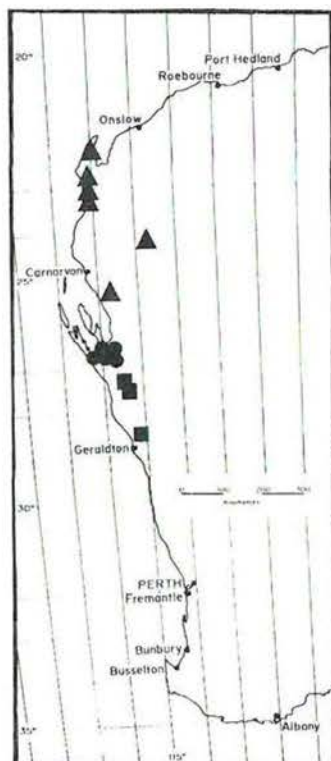


Figure 18. Distribution of the *Calothamnus* taxa—*C. borealis* (▲), *C. formosus* subsp. *formosus* (●), and *C. formosus* subsp. *rigidus* (■).

Comments. The flowers and fruits of *Calothamnus kalbarriensis* resemble those of *C. oldfieldii* F. Muell., however it can be readily distinguished by the shorter, erectly held leaves mostly 1.5-2.5 cm long (4-6 cm long and spreading in *C. oldfieldii*). Both species have fertile seeds with a single row of cilia on each ridge of the testa. The distributions of the two species do not overlap since *C. oldfieldii* is distributed from the Murchison River (27°45'S, 114°15'E) to about 80 km east of Geraldton (28°50'S, 115°30'E) while *C. kalbarriensis* is presently known from Kalbarri (27°42'S, 114°12'E) north along the coast to Tamala Homestead (26°42'S, 113°43'E).

9. *Calothamnus borealis* T. J. Hawkeswood, sp. nov. (Figures 18, 19)

Frutex erectus ad 1 m altus. Folia linearia, teretia, pleraque erecta, (5)7-10(13) cm longa, 1-1.5 mm lata, breviter mucronata, pilosa. Flores fasciculati vel breviter spicati. Calycis tubus pleraque 4-5 mm longus, pubescens; calycis-lobi 2-3 mm longi. Petala circa 5 mm longa, rosea ad ferruginea. Unguis staminalis 20-25 mm longus, 1-2 mm latus, glaber; filamentis marginalibus 20-25. Fructus cylindraceus, 6.5-10 mm longus, 7-10 mm latus, glaber. Semina 2-3 mm longa, pallido brunnea.

Typus: Exmouth Road; spreading shrub 60 cm high, sandy loam; 8 August 1976, Wittwer W1769 (holo: PERTH).

Short, erect, multi-stemmed, spreading *shrub* to about 1 m high, with thick, corky stems; *bark* often decorticating into thin layers at base of plants. *Young shoots* pilose. *Leaves* sessile, crowded, usually erect, terete to biconvex in transection, (5)7-10 (13) cm long, 1-1.5 mm wide, shortly mucronate but not pungent, covered in short, appressed simple hairs, giving a dull grey-green appearance. *Flowers* 1-12, arranged in small clusters or short spikes 1.5-3 cm long, usually on leafy branches. *Calyx-tube* almost campanulate, 4-5 mm long, densely pubescent; *rhachis* slightly dilated at the base of calyx-tube; *calyx-lobes* \pm equal, 2-3 mm long, deltoid, acute to slightly obtuse, thick, pubescent outside, very shortly pubescent inside, margins thin, ciliate. *Petals* obovate, obtuse, concave c. 5 mm long, pink to orange-brown, papery, with thin scarious margins. *Staminal claws* \pm equal, 20-25 mm long, 1-2 mm wide, glabrous; *marginal filaments* 20-25; anthers linear, 0.6-0.8 mm long, yellow. *Style* 10-25 mm long, slender, glabrous; *stigma* small. Summit of *ovary* densely pubescent. *Fruit* sessile, almost cylindrical, slightly wider at base than apex, 6.5-10 mm long, 7-10 mm wide, truncate or very shortly 5-lobed; *orifice* c. 3 mm wide. *Fertile seeds* narrow-oblong, 2-3 mm long, ciliate, angled, often truncate; *testa* chocolate brown. *Ovulodes* linear to narrow-oblong, 2-3 mm long, smooth, truncate, light brown.

Derivation of name. *Borealis*, Latin, meaning "north" or "northern". This is the most northerly distributed species of *Calothamnus* hence the specific epithet.

Habitat. Grows on red sand dunes amongst spinifex or low heath. Flowers July to September.

Distribution. Presently known from the Exmouth region (c. 22°00'S, 114°05'E) to Coral Bay (23°05'S, 113°49'E) with an isolated distribution inland at the Kennedy Ranges (Beard 4375, 24°20'S, 115°10'E) (Figure 18).

Other specimens examined. WESTERN AUSTRALIA: Learmonth Road, 15 miles N of Waroona turnoff, 20 July 1964, *J. S. Beard* 3529 (PERTH, KP); Coral Bay turnoff, 8 August 1976, *H. Demarz* D6107 (PERTH); 56 miles [89.2 km] S of Learmonth, 2 June 1961, *A. S. George* (PERTH); 79 miles [126.4 km] S of Learmonth, 2 June 1961, *A. S. George* 2400 (PERTH); Minilya River, 28 August 1932, *C. A. Gardner* 3208 (PERTH); 6 miles [9.6 km] N of Cardabia Station Homestead, 4 September 1970, *A. S. George* 10212 (PERTH); 80 miles [128 km] NE of Carnarvon, Kennedy Range, near old Merlinleigh Homestead, 23 August 1965, *J. S. Beard* 4375 (PERTH).

Total number of specimens examined: 9.

Comments. *Calothamnus borealis* is not closely related to any other *Calothamnus* species, but has been confused with *C. chrysantherus* F. Muell. in all herbarium collections examined and in vegetation survey publications. This is possibly because of the hairy leaves and flowers with densely pubescent calyx-tubes, two characters which are shared with *C. chrysantherus*. *Calothamnus borealis* differs in having dull grey-green, erectly held leaves with short, appressed hairs, staminal claws 20-25 mm long and smaller fruits 6.5-10 mm long by 7-10 mm wide. *Calothamnus chrysantherus* has mature leaves with scattered, spreading hairs, staminal claws 25-30 mm long and fruits 12-15 mm long by 8-10 mm wide. In addition, the testa of the fertile seed of *C. borealis* is chocolate brown in colour, while it is grey-brown in *C. chrysantherus*.

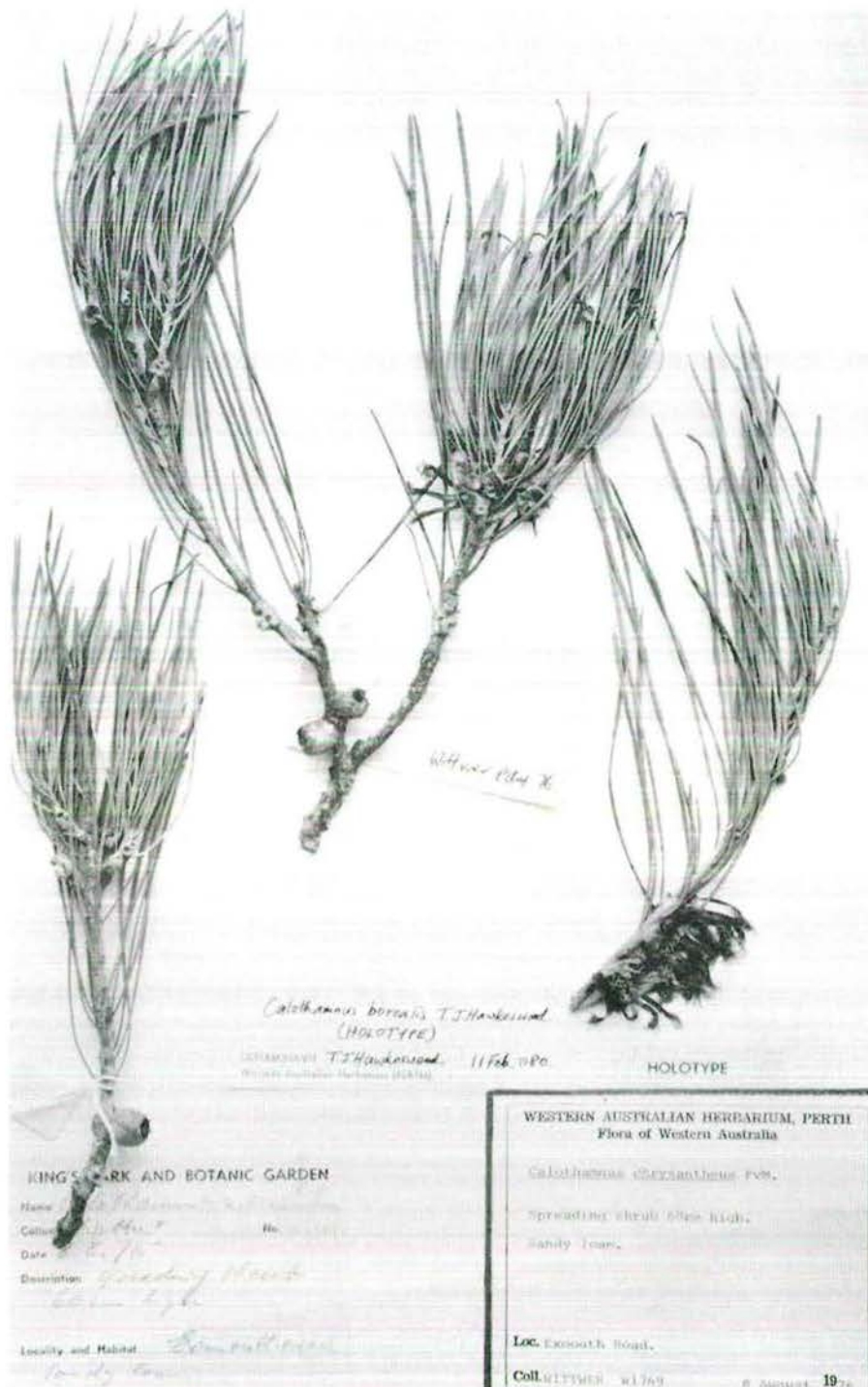


Figure 19. *Calothamnus borealis* T. J. Hawkeswood—Holotype (Wittwer W1769).

While the distribution of *C. chrysantherus* is clearly defined (Murchison River in the Kalbarri National Park to Northampton), records on the distribution of *C. borealis* are not complete and further collections are required. However, it appears certain that the two species do not overlap and that *C. borealis* has a disjunct distribution in the Kennedy Range.

Acknowledgements

I would like to thank Dr N. G. Marchant (W.A. Herbarium, (PERTH) and Dr N. H. Brittan (Department of Botany, University of Western Australia) for assistance during this work and for commenting on the manuscript. Thanks are also expressed to Mr P. G. Wilson (W.A. Herbarium) for encouragement during the course of this study and, in particular, for assistance with the Latin diagnoses. Mr A. S. George is acknowledged for taking the photographs of the type specimens and helpful discussions. Invaluable help has been provided also by Messrs K. F. Kenneally, and R. J. Cranfield, Mrs J. W. Lee-Frampton and Miss V. Hamley. I would like to thank the Curator of the W.A. Herbarium, Dr J. W. Green, for providing facilities in order that this research could be undertaken and completed. Much assistance in field work has been provided by Messrs M. Peterson and S. Wilson and Miss A. Kreger. The Curator of herb. NSW is acknowledged for the loan of material. This research was commenced while I was a student in receipt of a Commonwealth Postgraduate Research Award at the Botany Department, University of Western Australia during April to October 1979 and February to June 1980. Typing of an earlier draft was completed by Mrs D. McNamara, James Cook University of North Queensland, Townsville, Queensland. The majority of this research has been undertaken on private funds and I would like to express my thanks to my mother, Mrs D. E. Hawkeswood for much valuable support during my research.

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Patersonia argyrea, a new species of Iridaceae from the Gairdner Range, Western Australia

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Abstract

Cooke, D. A. *Patersonia argyrea*, a new species of Iridaceae from the Gairdner Range, Western Australia. Nuytsia 5(1): 155-158 (1984). *Patersonia argyrea* D. A. Cooke is described and illustrated; a hybrid origin of this species is suggested.

Introduction

Specimens of a *Patersonia* from heaths in the Gairdner Range have been referred formerly to *P. rudis*, a species occurring in jarrah forests of the Darling Range. A review of the genus for the "Flora of Australia" has shown that this material represents a distinct species, which is described formally here.

Patersonia argyrea D. A. Cooke, sp. nov. (Figure 1)

Herba perennis indumento candido. Folia linearia sublaxa 3.5-5 mm lata, in sectione biconvexa, sulcis profundis papillois vel villosis, marginibus villosis. Scapus foliis paulo brevior omnino villosus. Spathae ellipticae cymbiformes c. 5 cm longae leviter striatae atrocastaneae sparsim sericeae, marginibus scarioso-hyalinis ad 3 mm latis. Hypanthium glabrum. Ovarium pubescens. (Descriptio typi).

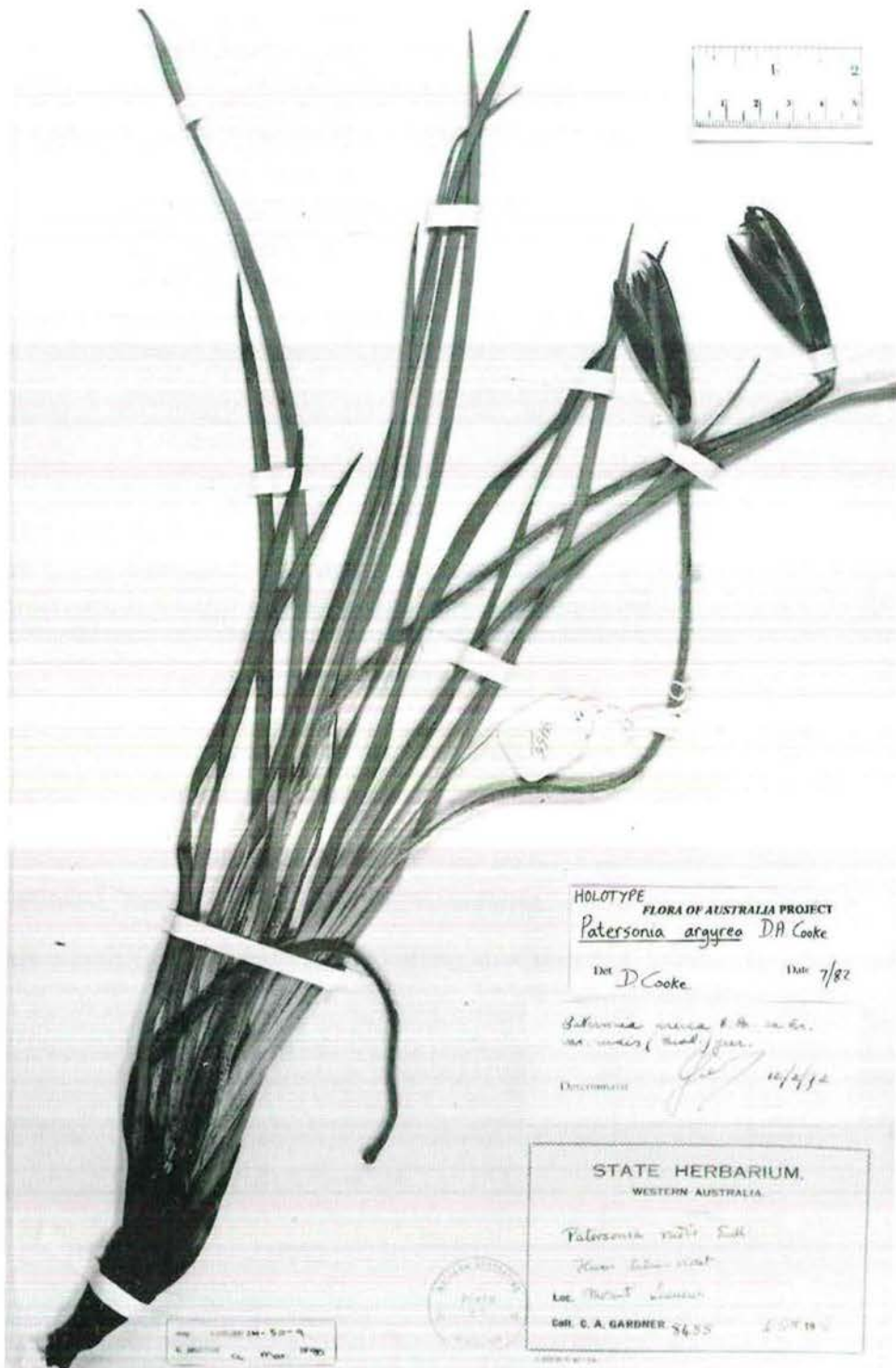
Typus: Mt Lesueur, 16 October 1946, C. A. Gardner 8455 (holo: PERTH).

Tufted evergreen perennial herb with white indumentum. Rhizome short, woody, subterranean. Leaves basal, 6-10 per shoot, equitant, linear-ensiform, rather lax, 20-42 cm long, 2-5.2 mm wide, biconvex, striate with deep grooves containing papillae or hairs; margins and bases villous to pubescent. Scape erect, shorter than leaves, 21-35 cm long, terete, completely villous. Spathe bracts elliptic, cymbiform, 3.5-5.2 cm long, prominently veined, dark chestnut-brown, sparsely sericeous, with scarioso-hyaline margins 2-3 mm wide. Inner bracts of inflorescence slightly exserted, brown with hyaline margins. Flowers several, violet. Hypanthial tube 2-3.5 cm long, glabrous. Ovary pubescent. Capsule and seeds not seen.

Other specimens examined. WESTERN AUSTRALIA: Hill N of Mt Benia, E of Jurien, 23 September 1979, E. A. Griffin 2343 (PERTH); slope of Mt Lesueur, 4 November 1962, R. D. Royce 7731 (PERTH).

Habitat and distribution. Apparently restricted to heath on sandy soils in the Mt Lesueur—Mt Benia area.

Etymology. The epithet (Lat. *argyreus*, silvery) refers to the shining white vestiture of the foliage, which gives the plant a silvery-grey appearance.

Figure 1. Holotype of *Patersonia argyrea*.

Character compatibility analysis (Cooke unpublished) suggests that *Patersonia argyrea* exhibits an anomalous combination of characters from two distinct clades within the genus. The habit and the well developed indumentum resemble those of *P. rudis* Endl.; the thickened, papillose-grooved leaves and brown spathes with broad hyaline margins suggest an affinity with *P. juncea* Lindley. Comparison of the three species (Table 1) shows that *P. argyrea* lies between *P. rudis* and *P. juncea*.

Table 1. Comparison of *Patersonia argyrea* with *P. rudis* and *P. juncea*. Quantitative characters are expressed as the mean of 5 measurements from each of 5 collections (*P. rudis* and *P. juncea*) or, for each of 3 collections (*P. argyrea*), the mean of 5 measurements for leaf and spathe characters and 2 measurements for scape length, \pm sample standard deviation (S).

	<i>P. rudis</i>	<i>P. argyrea</i>	<i>P. juncea</i>
Leaf length (cm)	45.8 \pm 11.6	29.8 \pm 6.5	11.3 \pm 3.5
Leaf width (mm)	6.0 \pm 1.4	3.5 \pm 1.0	1.0 \pm 0.1
Leaf section	flat	biconvex	terete to biconvex
Leaf grooves	absent	present	present
Leaf papillae	absent	present	present
Leaf margin vestiture	villous	villous	glabrous to pilose
Scape length (cm)	30.0 \pm 5.1	25.9 \pm 5.6	10.0 \pm 3.7
Scape vestiture	pubescent to villous	villous	glabrous
Spathe length (cm)	5.4 \pm 0.7	4.3 \pm 0.8	3.6 \pm 0.3
Hyaline margin of spathe	absent or vestigial	2-3 mm wide	2-3 mm wide
Spathe colour	black	brown	brown
Spathe vestiture	sparsely sericeous	sparsely sericeous	glabrous
Ovary vestiture	pubescent	pubescent	glabrous

One hypothesis to explain this combination of characters would be a past hybridization between *P. rudis* and *P. juncea*. This could have occurred by introgression (Anderson 1949) or by hybrid speciation (Grant 1971) with the hybrid occupying a habitat unavailable to either parent species. *P. argyrea* is an established species rather than a recent casual hybrid, occurring within the range of *P. juncea* but 120 km from the present northern limit of the range of *P. rudis*.

Specimens of P. juncea examined. WESTERN AUSTRALIA: Palm Terrace, Forrestfield, 5 Oct. 1978, R. J. Cranfield R156 (PERTH); Wooroloo, Oct. 1907, M. Koch 1737 (NSW, MEL); 2.4 km along Hardie road from Williams-Narrogin road, 3 Jan. 1982, T. D. Macfarlane 745 (PERTH); Watheroo National Park, 5 Oct. 1971, R. D. Royce 9607 (PERTH); between Badgingarra and Jurien Bay, 8 Oct. 1969, D. J. Whibley 3160 (AD, MEL).

Specimens of P. rudis examined. WESTERN AUSTRALIA: Wannamal turnoff, Great Northern Highway, 8 Jan. 1975, H. Demarz 5552 (Kings Park, PERTH); Pickering Brook, 19 Dec. 1978, H. Demarz 7298 (Kings Park, PERTH); Red Hill, Toodyay road, 19 Oct. 1960, A. S. George 1676 (PERTH); Darling Range, 16 Jan. 1840, L. Preiss 2347 (MEL); 70 km S of Moora, 3 Nov. 1974, D. J. Whibley 5001 (AD, PERTH).

Acknowledgements

I would like to thank the staff of the National Herbarium of Victoria (MEL), where this paper was prepared, and the Directors/Curators of AD, Kings Park and Botanic Garden (Perth), NSW and PERTH herbaria for the loan of specimens.

This work was funded by an Australian Biological Resources Study grant from the Department of Home Affairs and Environment.

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Notes on *Daviesia* and *Jacksonia* (Leguminosae: Papilionoideae) for the Flora of the Perth Region

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Abstract

Crisp, M. D. Notes on *Daviesia* and *Jacksonia* (Leguminosae: Papilionoideae) for the Flora of the Perth Region. Nuytsia 5(1): 159-170 (1984). Six groups of confused species are resolved. As a result, three new species of *Daviesia* are described, namely *D. triflora*, *D. podophylla* and *D. inflata*. *Daviesia gracilis* is proposed as a new name for *D. juncea* sensu Sm., non (Schrad.) Pers. *Daviesia hakeoides* Meissn. var. *subnuda* Benth. is raised to subspecies level. Lectotypes are chosen for *D. physodes* Cunn. ex Don and *D. quadrilata* Benth. *D. physodes*, which has been confused with *D. incrassata* Sm., is reinstated. *Jacksonia condensata* Crisp et J. Wheeler sp. nov. is based upon the misapplied name *J. capitata* sensu Meissn., non Benth. *J. densiflora* Benth., which has been confused with *J. floribunda* Endl., is reinstated.

The *Daviesia juncea* problem

Six taxa have been confused under the name *D. juncea* Sm. They have in common a rush-like, apparently leafless habit, and they belong to the group of species with lighish imbricate bracts discussed by Crisp (1982, p. 13).

Only three of these taxa are totally leafless, namely *D. triflora*, *D. gracilis* and *D. debilior* Crisp subsp. *sinuans* Crisp. Two taxa, *D. debilior* subsp. *debilior* and an unnamed species, are partly clothed with phyllodes, but the phyllodes resemble the branchlets. In the sixth taxon, *D. hakeoides* subsp. *subnuda*, the phyllodes are often few, very reduced and inconspicuous.

Key to species confused under *D. juncea*

1. Phyllodes 0; leaves all reduced to scales
 2. Inflorescences all 3-flowered; calyx base (receptacle) truncate, 2 x diam. of pedicel*D. triflora*
 2. Inflorescences with a variable no. of flowers (2-4 or 3-5); receptacle tapered to pedicel
 3. Upper 2 calyx lobes united in a truncate, emarginate lip; standard 6-6.5 mm broad*D. debilior* subsp. *sinuans*
 3. Upper 2 calyx lobes free, triangular, separated by a 0.75 mm deep sinus; standard 9-10 mm broad*D. gracilis*

1. Some phyllodes present, either branchlet-like and absent from upper parts of branchlets, or short (1-5 mm), pungent, and scattered over branchlets
 4. Phyllodes short (1-5 mm), pungent and scattered over branchlets, sometimes very few.....*D. hakeoides* subsp. *subnuda*
 4. Phyllodes > 10 mm long, not pungent, absent from upper parts of branchlets
 5. Standard dorsally deep pink with no central streak, 6-6.5 mm broad*D. debilior* subsp. *debilior*
 5. Standard dorsally purple-black with a central yellow streak, c. 10 mm broad*D. sp.*

Daviesia gracilis, *D. triflora* and *D. hakeoides* subsp. *subnuda* are dealt with below. *D. debilior* (including both subspecies) was described by Crisp (1982). The unnamed species, which is endemic in the Stirling Range, will be described in the future.

The name *D. juncea* Sm. is a later homonym of *D. juncea* (Schrad.) Pers., which is itself a synonym of *Viminaria juncea* (Schrad.) Hoffmanns. It is fortunate that this name must now lapse in view of its wide misapplication. A new name is proposed for it below.

***Daviesia gracilis* Crisp, nom. nov. (Figure 1A)**

D. juncea Sm. in Rees, Cyclopaedia 11: sub *Daviesia* no. 10 (Sep. 1808); Trans. Linn. Soc. London 9:260 (1808); Meissn. in Lehm., Pl. Preiss. 1:47 (1844), quoad specimen Preiss 1160; Benth., Fl. Austral. 2:88 (1864), pro parte; non (Schrad.) Pers. Type: King George's Sound, west coast of New Holland, lat. 35, [1791], A. Menzies (holo: LINN, photo CBG; iso: BM, photo CBG).

D. gracilis occurs on heathy sandplains in the Albany-Stirling Range region. Characters to distinguish it from *D. triflora*, probably its closest relative, are given under the latter (below).

***Daviesia triflora* Crisp, sp. nov. (Figure 1B)**

D. juncea sensu Meissn. in Lehm., Pl. Preiss. 1:47 (1844), quoad specimen Preiss 1159; Benth., Fl. Austral. 2:89 (1864), pro parte; nec (Schrad.) Pers. nec Sm.

Frutices junciformes caulibus multis ad 0.6 m adscendentibus, ramulis teretibus striatis, foliis ad squamas parvas redactis, racemis in fasciculos condensatis, accurate 3-floris, pedicello quoque 2-3 bracteis expansis exacte seriatim imbricatis cuneatis vel oblongis subtento, calyce lobis 2 superis in labium truncatum vel obtusum connatis, base calycis (receptaculum) truncata. Species *D. debiliori* Crisp subsp. *sinuanti* Crisp et *D. gracili* Crisp simillima.

Typus: 0.6 km W of intersection of Coorow-Green Head road with Brand Hwy, 30°05'S, 115°19'E, 4 July 1976, C. Chapman (16)76, fl. (holo: CBG; iso: AD, K, MEL, PERTH).

Rush-like *shrubs* with many stems ascending to 0.6 m, apparently spreading by rhizomes. *Branchlets* erect, not sinuous, terete, smooth, finely striate. *Phyllodes* 0; *leaves* reduced to small scales, never pungent. *Racemes* 1 per scale leaf axil, conspicuously obovoid in bud, condensed to clusters, strictly 3-flowered; *bracts* conspicuous, imbricate; lowermost bracts spirally arranged, shell-shaped; upper bracts

spreading in a neat row of 2 or 3 beneath each pedicel, hooded, cuneate or oblong, truncate, each row 5-6 mm long; *rachis* produced into an erect, slender, sterile bristle c. 4 mm long, ending in a cluster of reflexed bracts. *Pedicels* 3-6 mm long. *Calyx* campanulate, 2.5-3.5 mm long, with a truncate base (receptacle) which is 2x diam. of pedicel; upper 2 lobes united in a truncate or obtuse, emarginate lip; lower 3 lobes shorter, apiculate. *Corolla: standard* very broad-ovate, emarginate, cordate, 8-9 x 7.5-9 mm including c. 1.5 mm claw, yellow or orange-yellow with a dark red centre; *wings* obliquely obovate, auriculate, 6-6.5 mm long including c. 2 mm claw, dark red; *keel* semicircular, falcate, slightly auriculate, saccate, acute, 5-5.5 mm long including c. 2 mm claws, dark red. *Stamens* strongly dimorphic; inner whorl of 5 with very broad-ovoid anthers; vexillary anther with cells confluent at apex. *Pod* compressed, obliquely depressed-obtriangular, scarcely acute, 10-20 x 6-9 mm. *Seed* (Chapman (88)77) obloid, c. 4 mm long, c. 2.25 mm broad, c. 1.25 mm thick, tan with black markings; aril thickly lobed, oblong in outline.

Chromosome number. $2n = 18$; voucher V. E. Sands 637.5.6 (Sands 1975).

Etymology. The epithet is from the Latin prefix *tri-* (three) and *florus* (flowered) and refers to the strictly three-flowered inflorescence.

Selected collections (66+ seen). WESTERN AUSTRALIA: N of Perth on Geraldton Hwy, vicinity of 36 mile peg, c. 31°30'S, 115°59'E, C. Chapman (88)77 (CBG, PERTH); c. 3.5 miles [5.5 km] N of Marchagee, 30°01'S, 116°06'E, C. Chapman (96)77 (AD, CBG); 148 km NNW of Gingin by road, R. Coveny 3185 & T. E. H. Aplin (K, L, NSW, PERTH); Kewdale, 31°58'S, 115°58'E, R. Coveny 8219 (CBG, NSW); 38 km N of Muchea along Brand Hwy, 31°15'S, 115°49'E, M. D. Crisp 6455 (CBG, MEL); 7 km S of Marchagee, 30°07'S, 116°03'E, M. D. Crisp 6494 (CBG, PERTH); 7 km S of Eneabba, 29°52'S, 115°16'E, E. A. Griffin 893 (PERTH); in arenosis sylvae prope oppidum Perth, L. Preiss 1159 (K, LD, MEL); East Bullsbrook road, voucher $2n = 18$, V. E. Sands 637.5.6 (SYD).

Distribution. Western Australia, Irwin and Darling districts, coastal plain from Serpentine north to Eneabba. Common around Perth.

Habitat. Usually on sand or occasionally in gravelly lateritic soil. Associated vegetation is usually heath dominated by *Banksia* spp., *Casuarina campestris*, *Adenanthos cygnorum*, *Actinostrobos* sp. or *Eucalyptus todtiana*, but may be open forest dominated by *Eucalyptus marginata*, *E. gomphocephala*, or *E. wandoo*.

Flowering period. May to September. Fruiting period. September and October.

Affinity. *Daviesia triflora* resembles *D. gracilis* (q.v.) and *D. debilior* subsp. *sinuans* in being totally leafless. *D. debilior* differs from *D. triflora* in having a variable number of flowers (2-4) in the inflorescence, bracts which are all spirally arranged, a receptacle which is more or less tapered to the pedicel, weak, more or less sinuous branchlets and smaller flowers (e.g. standard 6-6.5 mm broad, calyx 1.5-2 mm long).

Daviesia gracilis, which occurs in the Stirling Range-Albany area, may be distinguished by its variable number of flowers (3-5) in the inflorescence, its bracts which are all spirally arranged, its calyx with two triangular upper lobes separated by a distinct (0.75 mm deep) sinus and by its receptacle which tapers to the pedicel.

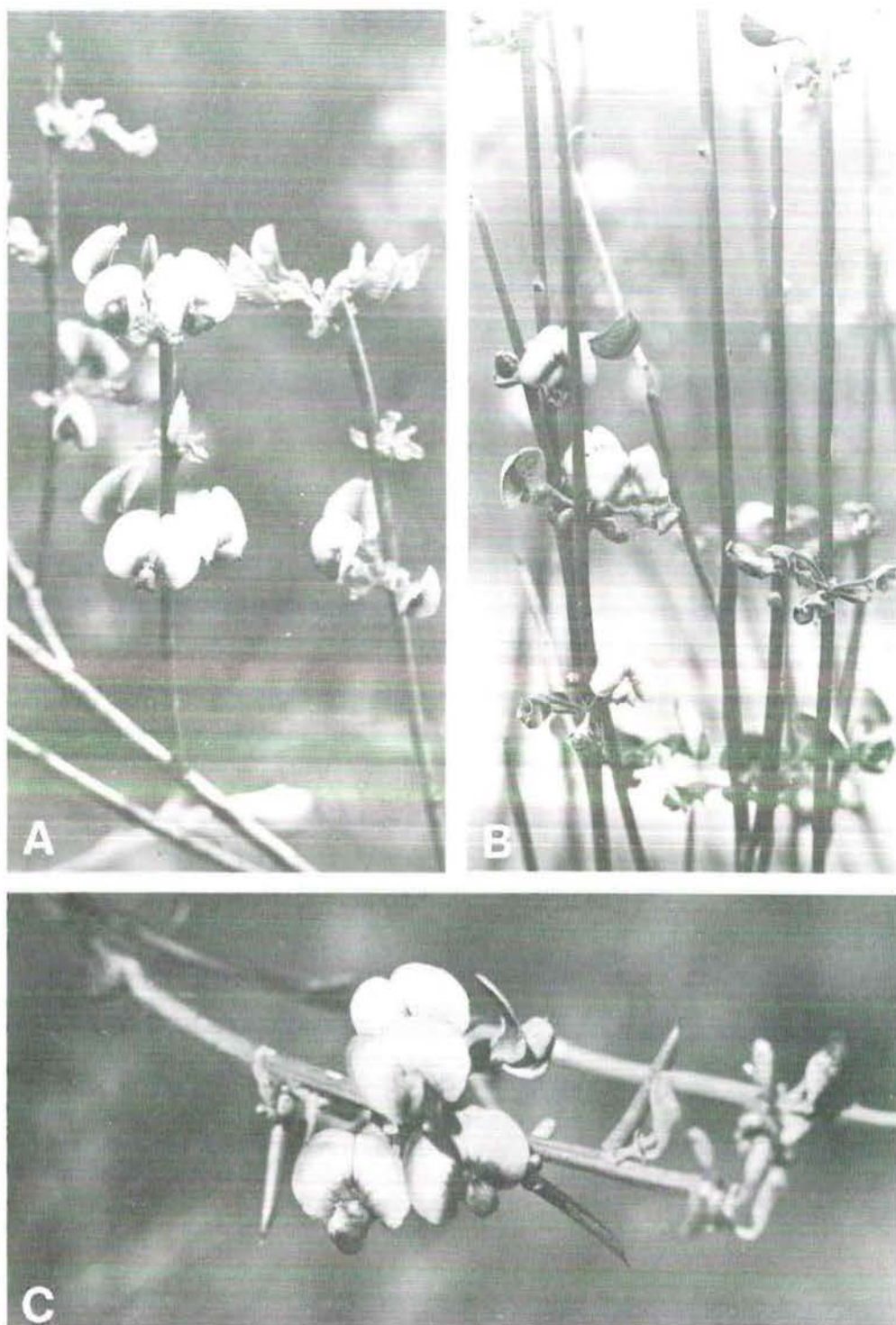


Figure 1. A. *Daviesia gracilis*, from Crisp 6076. B. *D. triflora*, from Crisp 6456. C. *D. inflata*, from Crisp 6092.

Daviesia hakeoides Meissn. subsp. ***subnuda*** (Benth.) Crisp, stat. nov. Basionym: *D. hakeoides* Meissn. var. *subnuda* Benth., Fl. Austral. 2:83 (1864). Holotype: Swan River, *Drummond* 42 (K, photo CBG).

D. juncea sensu Meissn. in Lehm., Pl. Preiss. 1:47 (1844), quoad specimen *Drummond* 237 & *Preiss* 1181; Benth., Fl. Austral. 2:89 (1864), pro parte; nec (Schrad.) Pers. nec Sm.

D. juncea Sm. var. *spinescens* S. Moore, J. Linn. Soc., Bot. 45:169 (1920), syn. nov. Types: Wickpin, 1915, *F. Stoward* 108 (lectotype, here designated: BM, photo CBG); Wundowie, 1916, *F. Stoward* 261 (BM, photo CBG); Kauring, near Greenhills, 1916, *G. W. Brown* s.n., herb. *F. Stoward* no. 572 (BM, photo CBG).

Daviesia hakeoides subsp. *subnuda* combines a slight morphological difference (phyllodes less than 10 mm long) with a distribution which is adjacent to but farther inland than *D. hakeoides* sensu stricto.

There has been a great deal of confusion between the more depauperate forms of *D. hakeoides* subsp. *subnuda*, *D. triflora* and *D. gracilis*. The differences between the latter two species are given under *D. triflora* (q.v.). Both species differ from *D. hakeoides* subsp. *subnuda* in being totally leafless, whereas *D. hakeoides* subsp. *subnuda* always has some spinescent phyllodes which may be only a few mm long and scarcely visible, but which always can be felt.

The *Daviesia quadrilatera* problem

To date, two species with remarkably similar quadrilateral phyllodes have been confused under the name *Daviesia quadrilatera*. Even the original description of *D. quadrilatera* was based on mixed material, representing both species. The type is a single sheet in Kew (K), ex Bentham's Herbarium, with three twigs, respectively labelled 1a, 1b and 2 by myself. Twigs 1a and 1b bear flowers and belong to one species; twig 2 bears an old pod and belongs to the other species.

Bentham's original description includes some characters diagnostic of both species. Thus, "racemulis plurifloris folio sublongioribus" (racemes several-flowered, slightly longer than the leaves) is diagnostic for the species represented by twigs 1a and 1b, whereas "ramis teretibus" (branches terete) is diagnostic for the species represented by twig 2. Further characters given by Bentham distinguish the twigs, although not the species. Thus, "glaucous" (glaucous) may be found in either species, but is only seen on twig 2 of the type, whereas "folia . . . bis longiora quam lata" (leaves twice as long as broad) is within the range of variation of both species, but in the type is more characteristic of the phyllodes of twigs 1a and 1b than of the phyllodes on twig 2, which are generally nearer 3 times longer than broad. The remaining characters given by Bentham apply equally to all twigs and to both species. To sum up, Bentham's description is about equally correct (or equally wrong) for all elements of his type.

Thus the choice of a lectotype of *D. quadrilatera* cannot be based on how well the description matches different parts of the type material. All later authors have consistently confused the two species, so usage of the name cannot be used as a criterion in choosing a lectotype. Other things being equal, I have chosen a flowering twig, namely twig 1a, as the lectotype. Twig 1b also belongs to *D. quadrilatera* in the new, narrow sense. Twig 2 thus belongs to a new species, *D. podophylla*, which is described in this paper.

Daviesia quadrilatera Benth. in Lindl., Sketch Veg. Swan River Colony xiv (1839); Meissn. in Lehm., Pl. Preiss. 1:52 (1844), quoad specimen *Drummond* 228; Benth., Fl. Austral. 2:85 (1864), pro parte; Reinke, Jahrb. Wiss. Bot. 30:30, fig. 16 (2) (1897). Type: Swan River, 1839, *J. Drummond* 1st Coll. s.n. (K, photo CBG—lectotype, here designated: twig marked 1a; isolectotype: twig marked 1b; the twig marked 2 = *D. podophylla* (q.v.)).

D. quadrilatera is restricted to heaths on sand or laterite between Jurien Bay and Three Springs. Characters to distinguish it from *D. podophylla* are given under the latter (q.v.). Before 30 April 1982, I determined specimens of this species mostly with the unpublished name "*D. auriculata*". These should be corrected.

Daviesia podophylla Crisp., sp. nov.

D. quadrilatera Benth. in Lindl., Sketch Veg. Swan River Colony xiv (1839), pro parte, non sensu stricto; Meissn. in Lehm., Pl. Preiss. 1:52 (1844), quoad specimen *Preiss* 1139; Benth., Fl. Austral. 2:85 (1864), pro parte.

Frutices glauci ad 1 m alti et 2 m lati, ramis divaricatis, ramulis teretibus saepe apice spinescenti, phyllodiis verticaliter complanatis oblique quadrilateralis vel triangularibus, apicibus exterioribus pungentibus, ad basim in pedem petiolum simultantem c. 1 mm latum contractis, racemis 1-2(raro-3)-floris brevissimis (c. 1 mm longis), pedicellis 2-4 mm longis, quam pedunculis longioribus. Species *D. quadrilaterae* proxima, quae ramulis angulatis apice haud spinescenti, phyllodiis sessilibus, ad caulem base 1.5-4 mm lata adnatis, racemis umbelliformibus 3-6-floris, pedunculis 5-12 mm longis, quam pedicellis longioribus dignoscenda.

Typus: 47 miles [75 km] W of Coorow on Coorow-Green Head Rd, 21 July 1978, *R. J. Cranfield* 273, fl. (holo: CBG; iso: A, CANB, MEL, MO, NFLD, NSW, PERTH, UWA).

Divaricately branched, glaucous shrubs to 1 m tall and 2 m broad. Branchlets short, 50-200 mm long, often spine-tipped, terete. Phyllodes erect, articulate, vertically flattened, obliquely quadrilateral or triangular, pungent at outer apex and base, rarely with 1 or 2 extra pungent points on the upper edge, contracted at the base to a short (1-2 mm) foot resembling a petiole, to 25 x 8 mm, with raised anastomosing veins. Racemes 1 per axil, 1-2(rarely 3)-flowered; rachis very short, c. 1 mm long; pedicels much longer, 2-4 mm long. Calyx broad-campanulate, 2.5-3 mm long; teeth minute. Corolla: standard broad-obovate, emarginate, cordate, 7.5-8 x 6-7 mm including c. 1 mm claw, orange-yellow with a dark red centre fading greenish; wings obliquely obovate, auriculate, 6-7 mm long including c. 1 mm claw, dark pinkish red; keel obliquely narrow-ovate, inflexed at centre, upper half constricted to an obtuse beak, auriculate, c. 7 mm long including 2.5-3 mm claws. Stamens moderately dimorphic; anthers all 2-celled, subdorsifixed, alternately long and short, otherwise uniform. Pod swollen, very broad-obtriangular in outline, acuminate, 11-16 mm long, 8-10 mm broad, 6-8 mm thick. Seed (C. Chapman (118) 77, M. E. Phillips 2651 and F. Muell. s.n., MEL 81274 & 81278) more or less globular, 3 mm diam., red-brown. Hilum not sunken. Aril 0; funicle separating cleanly from hilum when seed is shed. Seedling (Crisp 5442) with obliquely very broad-obtriangular phyllodes, pungent at both apices, c. 15 x c. 12 mm.

Chromosome number. $n = 9$; voucher G. J. Keighery 2432.

Etymology. The name is derived from the Greek *podion* (foot e.g. of a vase) and *phyllon* (leaf) and refers to the petiole-like foot of the phyllode, which is absent in the closely related *D. quadrilatera*.

Selected collections (47+ seen). WESTERN AUSTRALIA: Greenough's and Irwin's River, Nov. 1877, Anon. s.n. (MEL 81274 & 81278); Burma Road, SE of Walkaway, 25+ km SE of Geraldton, A. M. Ashby 2894 (AD, PERTH); between location 9849 and NE corner of Winchester Grazing Co., c. 29°46'S, c. 115°55'E, C. Chapman (118) 77 (CBG, PERTH); just W of Brand Hwy, on Green Head Road, 30°04'S, 115°20'E, 8 July 1979, C. Chapman s.n., spirit material (CBG 8302561); 104.6 km NNW of Gingin, R. Coveny 3164 and T. E. H. Aplin (K, L, NSW, PERTH, RSA); 24 km N of Green Head Road along Eneabba South Road, 5 km ENE of Lake Indoon, 29°52'S, 115°12'E, M. D. Crisp 5442, seedling (CBG); Jurien Bay turn-off, 23 km N of Badgingarra along Brand Hwy, 30°14'S, 115°23'E, M. D. Crisp 6469 (AD, CBG); Hill River Crossing, Brand Hwy, 30°21'S, 115°28'E, G. J. Keighery 2342, voucher n = 9 (PERTH); Gooseberry Hill, Darling Range, 16 Aug 1906, A. Morrison s.n. (AD, PERTH); Maida Vale, near Perth, M. E. Phillips 2651 (CBG).

Distribution. Western Australia, Irwin and Darling districts, from near Perth north to Kalbarri; rare around Perth; common from Jurien Bay to Three Springs.

Habitat. On sand with lateritic subsoil. Associated vegetation is heath dominated by *Banksia*, *Hakea*, mallee *Eucalyptus* etc.

Flowering period. Mainly June to August. Fruiting period. September to November.

Affinity. *Daviesia podophylla* can be confused with no species other than *D. quadrilatera*, which has remarkably similar quadrilateral phyllodes. However, the latter may be distinguished readily by its branchlets which are angular and never spinescent, its sessile phyllodes which are adnate to the branchlet by a 1.5-4 mm broad base and especially by its racemes which are umbelliform with a robust, 5-12 mm long rachis, and which have 3-6 flowers on pedicels much shorter than the rachis. The flowers of *D. quadrilatera* are rather larger than those of *D. podophylla* e.g. the calyx is c. 5 mm long and the standard is c. 9 mm broad.

Daviesia podophylla seems to be unique in the genus in having seeds without an aril and a non sunken hilum. However, I have not seen seeds of *D. quadrilatera*, which is so closely related to *D. podophylla* that it may well have the same unusual seed characters.

Daviesia podophylla is a host to *Pilostyles hamiltonii* C. A. Gardner (Rafflesiaceae). Voucher: 27.4 km W along Strathmore Rd from Brand Hwy, 14 May 1976, B. Dell s.n. (PERTH).

Specimens of this species were determined incorrectly by me as *D. quadrilatera* before 30 April 1982. These should be corrected.

The *Daviesia colletioides* problem

Daviesia inflata Crisp, sp. nov. (Figure 1C)

D. colletioides sensu Meissn. in Lehm., Pl. Preiss. 1:48 (1844), pro parte; Benth., Fl. Austral. 2:83 (1864); E. Pritzel in Diels et E. Pritzel, Bot. Jahrb. Syst. 35:248 (1904); non Cunn. ex Benth.

D. incrassata Sm. var. *cylindrica* Domin, Vestn. Kral. Ceske Spolec. Nauk., Tr. Mat.-Prir., Prague 1921-2, 2:34 (1923), verisim. Type: non cit. (n.v.).

Frutices multicaules ad 1 m alti, ramulis teretibus, phyllodiis teretibus pungentibus articulatis apice recurvato, lobis calycis ad marginem clare pallidioribus, lamina vexilli latiore quam longiore crocea, legumine inflato fragili 15-18 x 13-15 mm. *D. incrassata* Sm. ab hac specie phyllodiis in ramulis non articulatis differt, et *D. incrassata* et *D. physodes* Cunn. ex Don calyce colore uniformi, lamina vexilli haud latiore quam longiore flava vel subrosea, legumine turgido subcartilagineo c. 12 x c. 10 mm distinguendae.

Typus: c. 0.5 km S of Brennan Ford crossing of Scott River, c. 11 km ENE of Augusta, 34°16'S, 115°16'E, 12 Sep. 1977, W. R. Barker 2329, fl. (holo: CBG; iso: AD, K, PERTH).

Shrubs with many ascending or spreading stems to 1 m tall. *Branchlets* longish, ascending, terete, longitudinally wrinkled when dry, frequently galled. *Phyllodes* ascending, articulate, terete, with apex acicular and more or less recurved, 5-80 mm long, 0.5-1.5 mm diam. *Racemes* 1 per axil, 2-5-flowered; *bracts* spatulate, 1-1.5 mm long; *rachis* 2-8 mm long. *Pedicels* longish (3-9 mm). *Calyx* c. 4 mm long, green with a variable infusion of lead grey at least around bases of lobes or sometimes all over; margins of lobes distinctly paler; lobes broad- or very broad-triangular, c. 1 mm long. *Corolla*: *standard* very broad-obovate, emarginate, cordate, 10-11 x 9-10 mm including c. 2 mm claw, orange-red with a slight pink infusion towards margins, dark red towards centre, with a vertical yellow guide mark at centre; *wings* obliquely obovate, auriculate, c. 7.5 mm long including c. 2 mm claw, dark red; *keel* ovate, falcate, obtuse, auriculate, c. 7.5 mm long including 4 mm claws, dark red. *Stamens* strongly dimorphic; filaments flattened and overlapping; anthers all 2-celled, alternately basifixed and narrow-ovoid versus sub-dorsifixed, ovoid and half as long. *Pod* inflated, beaked, bladderly when immature, brittle when mature, 15-18 x 11-15 mm. *Seed* (Webb s.n.) ellipsoid, c. 5 mm long, c. 2.5 mm broad, c. 2.25 mm thick; aril thickly lobed, obovate in outline.

Etymology. The epithet is from the Latin *inflatus* (bladdery) and refers to the state of the immature fruit.

Selected collections (60+ seen). WESTERN AUSTRALIA: 11 miles [18 km] along Steward Road from Pemberton-Nannup road, E. M. Bennett 1613 (PERTH); 23 km from Pemberton along road to Nannup, Tobruk Road turn-off, 34°25'S, 115°49'E, M. D. Crisp 5349 (CBG, K, MEL, PERTH); c. 40 km W of Albany, Hay River Bridge, 34°58'S, 117°28'E, M. D. Crisp 6092, J. Taylor & R. Jackson (CBG, L, MO, MEL, NSW, PERTH); Bow River, Oct. 1912, S. W. Jackson s.n. (NSW 34877); Yallingup Nature Reserve, 33°42'S, 115°06'E, R. Pullen 9852 (CANB, CBG); Donnybrook, R. D. Royce 4851 (PERTH); 15.5 km from Denmark along South Coast Hwy to Albany, A. Strid 20429 (C, CBG, K, PERTH); King Georges Sound, Dec. 1882, W. Webb s.n. (MEL 81385).

Distribution. Western Australia, Darling district, near the coast from Harvey south to Augusta, thence east to Mt Melville.

Habitat. Grows on sand, frequently on swampy flats which are inundated in winter, or on higher ground. Associated vegetation is heath dominated by sedges and *Melaleuca* (swampy flats) or jarrah forest (higher ground).

Flowering period. September and October. *Fruiting period.* December and January.

The name *D. colletioides* was misapplied to this species, first by Meissner and consistently thereafter by all authors until now. The original *D. colletioides* Cunn. ex Benth. is a taxonomic synonym of *D. genistifolia* Cunn. ex Benth.

One of the collections (Preiss 1180) seen and cited by Meissner under this name is mixed material, consisting partly of *D. inflata* (the sheet in NY) and partly of *D. incrassata* (the sheet in LD). Bentham (1864) was the first to recognise this. Some sheets of Preiss 1180 in other herbaria are *D. inflata* (G, K, MEL 81314), some are *D. incrassata* (G, MEL 77813) and one bears twigs of both species (MO). The other collection cited by Meissner (Preiss 1163) is uniformly *D. inflata*.

Affinity. *Daviesia inflata* belongs to a large group of Western Australian species characterised by swollen pods. In *D. inflata*, the pods are larger, more bladderly when immature and more brittle when ripe than in the other species.

The species most likely to be confused with *D. inflata* are *D. incrassata* and *D. physodes*. The former is easily distinguished by its phyllode bases being continuous with the branchlets. Both species may be distinguished from *D. inflata* by their uniformly coloured calyces without paler margins, and by the lamina of the standard being circular or slightly narrower than long (c. 7-8 mm broad) and yellow, infused with pink towards the margins, with a dark red centre, but with no central guide mark. In *D. incrassata* and *D. physodes*, the phyllodes are frequently compressed or flattened in the vertical plane, becoming dilated or lobed at the apex.

The *Daviesia incrassata* problem

From the time of Bentham (1864), a common species in the Perth region has been confused with *D. incrassata*, which only occurs outside the region. The name *D. physodes* is reinstated here for this species.

Daviesia physodes Cunn. ex Don, Gen. Hist. Dichlamydeous Pl. 2:125 (1832); Meissn. in Lehm., Pl. Preiss. 1:49 (1844); Hook., Bot. Mag. 72:t.4244 (1846). *Types:* Swan River, A. *Cunningham* (lecto, here designated: G, photo CBG; isolecto: E, FI-W, ?K, OXF, photos CBG); Oyster Harbour, King Georges Sound, 25 December 1821, A. *Cunningham* 209 (? syn: BM, E, K, photos CBG) = *D. incrassata* Sm.

Daviesia incrassata sensu Benth., Fl. Austral. 2:83 (1864), pro parte; E. Pritzel in Diels et E. Pritzel, Bot. Jahrb. 35:248 (1904), pro parte; non Sm. sensu stricto.

Daviesia incrassata Sm. var. *typica* Domin, Vestn. Kral. Ceske Spolec. Nauk., Tr. Mat.-Prir., Prague 1921-2, 2:33 (1923), pro parte, nom. inval.

Daviesia physodes occurs on the coastal plain and in the Darling Range, extending from Geraldton south to Augusta and east to Narrogin. Although closely similar to *D. incrassata*, it differs in the phyllodes being articulate with the branchlets. In the typical form, the phyllodes are dilated upwards and often lobed at the apex but in some plants the phyllodes become terete, and may be confused with those of *D. inflata*. Characters to distinguish *D. physodes* from *D. inflata* are given under the latter (q.v.).

The author of *D. physodes*, George Don junior, attributes the name, in manuscript, to Alan Cunningham. He does not cite any specimens, but merely states "Native of New Holland". Two Cunningham collections labelled "*D. physodes* A. Cunn." are extant, one from Swan River and the other from King Georges Sound. They represent different species. The Swan River collection is *D. physodes*, as recognised here, whereas the King Georges Sound collection is *D. incrassata*.

A search of Cunningham's manuscripts (microfiche, BM) yielded only one description under the name *D. physodes*. This description closely matches the collection from King Georges Sound (= *D. incrassata*), and in fact Cunningham cites this collection. On the other hand, Cunningham's manuscript description conflicts with Don's published description. Thus it seems most unlikely that Don used Cunningham's manuscript.

The Cunningham collection from Swan River is fully consistent with Don's published description, and therefore it seems likely that Don used a specimen from this collection. Four sheets were located in the herbaria E, FI, G and OXF, plus a sheet in K with a rather doubtful fragment. The sheet in K bears a second fragment which may belong to the collection of *D. incrassata* from King Georges Sound.

The specimen in Geneva was chosen as the lectotype because it probably came from the Lambert Herbarium which, according to Miller (1970), was used extensively by Don when he wrote his "General History". After Lambert's death, his herbarium was divided into lots, sold, and widely dispersed. Miller (1970) states that lot 292, consisting of specimens from Capt. P. P. King's expedition to Australia (c. 1818-22) was bought by Rich, probably on behalf of Delessert, whose herbarium is now in Geneva (G). Specimens from the King voyage were collected by Cunningham.

Before seeing the type material of *D. physodes* in mid 1982, I determined specimens of this species erroneously as *D. brachyphylla* Meissn. or *D. brachyphylla* subsp. *puerilis* Crisp ined.

The *Jacksonia capitata* problem

Jacksonia condensata Crisp et J. Wheeler, sp. nov. Based upon: *J. capitata* sensu Meissn. in Lehm., Pl. Preiss. 1:45 (1844); Benth., Fl. Austral. 2:61 (1864); non Benth. (1837). *Types*: In solo sublimoso glareoso districtus Peel, Oct. 1840, Herb. L. Preiss 1078 (holo: LD, photo CBG; iso: G (2 sheets), P, W (2 sheets), photos CBG).

Jacksonia capitata var. *rigida* E. Pritzel in L. Diels et E. Pritzel, Bot. Jahrb. Syst. 35:241-242 (1904). *Type*: Hab. in distr. Avon pr. Tammin in fruticetis arenosis flor. m. Oct. *Syntypes*: E. Pritzel 759 (isosyntype: PERTH) and Diels 5077 (n.v.).

Etymology. The epithet is from the Latin *condensatus* (condensed) and refers to the head-like inflorescence.

Additional collections. WESTERN AUSTRALIA: Stirling Range National Park, S Boundary, 8 km E of Chester Pass Road, 34°29'S, 118°08'E, M. D. Crisp 6129, J. Taylor & R. Jackson (CBG, NSW, PERTH); 17 km NW of Quairading, 5.5 km W of Tongerung Well, 31°55'S, 117°17'E, M. D. Crisp 6189, J. Taylor & R. Jackson (CBG, K, PERTH); Stirling Ranges, just out of park, towards Borden, M. E. Phillips s.n. (CBG 035636); 14.5 miles [23 km] from Arthur River towards Darkan, M. E. Phillips s.n. (CBG 038662); Stirling Range National Park, 10 miles [16 km] from Red Gum Pass-Kendenup road, along Stirling Range Drive, J. W. Wrigley WA/68-4385 (CBG, PERTH).

The two authors of the new species realised independently, as a result of revisionary work (M.D.C.) and work on the Flora of the Perth Region (J.W.), that the name *J. capitata* sensu Meissn. non Benth. had been misapplied to this species, which was in fact unnamed.

This is a well known species, albeit under the misapplied name *J. capitata* sensu Meissn.; so well known in fact, that it seems sufficient to propose a new name for it here according to the procedure laid down in the I.C.B.N. Art. 33.3, note 1. Meissner originally described it in Latin, and he cites only a single collection, Preiss 1078. His specimen, here designated as the holotype, is in Lund (LD), and there are isotypes in Geneva (G) and Vienna (W). There is no specimen from Meissner's herbarium in New York (NY).

Jacksonia condensata differs from *J. capitata* Benth., with which it was originally confused, in having subsessile flowers, ovoid buds, yellow petals, keel slightly shorter than wings and much shorter than standard, and a sessile ovary. In *J. capitata* Benth., the flowers are distinctly pedicellate, the buds are obovoid, the petals are yellow and dark red, the keel is longer than the wings and standard, and the ovary is stipitate. Until now, *Jacksonia capitata* Benth. has been known by its synonym, *J. umbellata* Turcz.

Specimens of *J. condensata* from Hill River to Tammin and Quairading (e.g. M. D. Crisp 6189) have thicker, more rigid sterile stems and belong to Pritzel's var. *rigida* of *J. capitata* sensu Meissn. but are probably not specifically distinct.

The *Jacksonia floribunda* problem

There has been a great deal of confusion between Western Australian species of *Jacksonia* which have their ultimate branchlets modified into flattened, lobed, toothed phylloclades. A quick survey of herbarium material indicates that there are many more taxa than names available for them. However the identities of some of the older names can be clarified here.

Jacksonia floribunda Endl., *Stirpium Australasicarum* Decades III, 9 (1838). *Type*: In *Novae Hollandiae austro-occidentalis interioribus*, inter King Georges Sound et Swan-River, *J. S. Roe* (holo: W, photo CBG).

This name has been misapplied to other species from the very beginning. It was confused mainly with *J. densiflora* Benth. (q.v.), and also with *J. grevilleoides* Turcz. (q.v.). *Jacksonia floribunda* is very close to *J. decumbens* E. Pritzel, with which it has in common rather open, few-flowered inflorescences, persistent bracts, villous calyces and a procumbent habit. It differs in having larger flowers and fewer, deeper, less regular lobes on the phylloclades. However, *J. decumbens* may not be specifically distinct from *J. floribunda*, in which case the latter name would take precedence. More work on these taxa is required. Both *J. floribunda* and *J. decumbens* occur outside the Perth Region as defined for the forthcoming Flora.

Jacksonia decumbens E. Pritzel in Diels et E. Pritzel, *Bot. Jahrb. Syst.* 35:238, fig. 30h (1904). *Type*: Hab. in distr. Darling septentrionali prope Mooliabeenee in silvis arenosis apertis flor. et fruct., m. Jan. ?*Syntypes*: L. Diels 2425 (n.v.) and E. Pritzel 260 (B(2 sheets), E, G (2 sheets), MO, P (2 sheets), W, photos CBG).

J. densiflora Benth. var. *laxiflora* Benth., Fl. Austral. 2:55 (1864), syn. nov. Type: *J. Drummond* 4th Coll. no. 24 (K(2 sheets), photos CBG). Isotypes: BM, G, K, MEL, P (2 sheets), photos CBG.

This may not be specifically distinct from *J. floribunda* (q.v.).

Jacksonia densiflora Benth. in Lindl., Sketch Veg. Swan River Colony xiii (1839); Fl. Austral. 2:54 (1864), excl. var. *laxiflora*. Type: Swan River, 1839, *J. Drummond* 1st Coll. s.n. (holo: K, photo CBG; iso: CGE, photo CBG).

J. floribunda sensu Meissn. in Lehm., Pl. Preiss. 1:43 (1844); Reinke, Jahrb. Wiss. Bot. 30:24, fig. 10 (5, 6) (1897); E. Pritzel in Diels et E. Pritzel, Bot. Jahrb. Syst. 35:238 (1904); non Benth.

Jacksonia densiflora is characterised by long, dense terminal racemes with very villous, almost woolly hairs on the rachis bracts and calyces, caducous bracts and an erect habit. *Jacksonia floribunda* and *J. decumbens* differ in having persistent bracts, less densely hairy inflorescences, and perhaps also in their procumbent habit and more open inflorescences, depending upon how broad a circumscription is given to these taxa. The typical form of *J. densiflora* occurs on the coastal plain in the vicinity of Perth. Specimens from north and east of the Perth Region differ in inflorescence, habit and fruit, and probably belong to undescribed taxa, but need further investigation.

Jacksonia grevilleoides Turcz., Bull. Soc. Imp. Naturalistes Moscou 26:259 (1853); Reinke, Jahrb. Wiss. Bot. 30:24, fig. 11 (3) (1897); E. Pritzel in Diels et E. Pritzel, Bot. Jahrb. Syst. 35:240, fig. 30, F, G (1904). Type: *Drummond* Coll. 4 no. 32 (iso: BM, G (2 sheets), K (4 sheets), P (2 sheets), W, photos CBG).

J. floribunda sensu Benth., Fl. Austral. 2:55 (1864); non Endl.

This species is readily distinguished from all the preceding by the long tapered lobes of the phylloclades, most being longer than the width of the phylloclades, and by the insertion of the flowers at the tips of these lobes. Bentham did not see Endlicher's type of *J. floribunda*, which presumably explains his error in placing *J. grevilleoides* under it. *Jacksonia grevilleoides* occurs in the vicinity of the Stirling Range and the adjacent South Coast.

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Lomandra nutans (Xanthorrhoeaceae or Dasypogonaceae), a new species from the Stirling Range area, Western Australia

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Abstract

Macfarlane, T. D. *Lomandra nutans* (Xanthorrhoeaceae or Dasypogonaceae), a new species from the Stirling Range area, Western Australia. Nuytsia 5(1): 171-175 (1984). *Lomandra nutans* is described and illustrated. A map of its distribution on the plain south and south-east of the Stirling Range is provided. The species is unique in the genus in possessing a nutant panicle but is assigned to Section *Lomandra*, Group A of Stevens.

Introduction

The species described here has been known for some years only from male plants. The recent acquisition of good material of both sexes and of field observations now allow it to be fully described.

Lomandra nutans T. D. Macfarlane, sp. nov. (Figures 1, 3-4)

Folia 9-30 cm x 0.5-1 mm, semi-teretia vel superne parum V-formia; supra papillosa ad puberula, subtus laevia, papillosa vel puberula. Folia basi margine lacerata, pallida. Paniculae masculae et femineae parum vel omnino nutantes; rami pro parte maxima verticillati, simplices. Pedicelli alterni crassi recto-patentes, omnes bractea et bracteola minore laterali suffult; bractea cum bracteola pedicellum semicingentes. Flores masculi globosi, 2-3 mm longi. Perianthium segmentis exterioribus minoribus membranaceis rubris, segmentis exterioribus carnosis cremeis. Stamina plus minusve aequalia; filamenta pro parte maxima libera, prope basin segmenti inserta. Flores feminei ellipsoidei, 3.2-4 mm longi. Perianthium segmentis exterioribus minoribus tenacibus, viridi- vel rubri-cremeis, segmentis intimis carnosis mollibus cremeis rubro suffusis. Stylus brevissimus.

Typus: 22 km E of Ellen Peak, Stirling Range (Bremer Bay 1:250 000 sheet), 8 October 1982, K. Newbey 9672 (holo: PERTH (male); iso: CANB (male, female), K (male, female), NSW (male, female), NY (male, female), PERTH (female). [This locality is c. 300 m along Boundary Road from Chillinup Road (see Figure 5), Newbey pers. comm.]

Perennial tussock-forming plants growing from a small irregular rhizome. *Stems* several, ascending, up to 10 cm long, 3-6 mm diameter, branching several times to form compact tufts of several leaf fascicles. *Leaves* 9-30 cm x 0.5-1 mm, lamina



Figure 1. Habit of *Lomandra nutans*. Type locality. Figure 2. Habitat of *Lomandra nutans* at type locality. Open mallee of *Eucalyptus decipiens* and *E. tetragona*. *Lomandra* plants occur in the low shrub areas between the mallees. Figure 3. Male inflorescence of *Lomandra nutans*. Type collection. Figure 4. Part of female inflorescence of *Lomandra nutans*. Type collection. Photographs by K. R. Newbey.

bright green beneath, somewhat glaucous above, semi-terete or upper surface shallowly V-shaped, upper surface minutely papillose to puberulent, lower surface smooth, minutely papillose or puberulent; leaf base-margins shredding early into pale, usually fine, fibres; leaf apex blunt to acute, rather thin and often eroding irregularly. Male inflorescence a panicle 1/3-1/2 as long as leaves, peduncle slightly bent to completely recurved so that panicle is slightly inclined from the vertical to completely pendent, the bend sharp or smoothly curved, usually occurring in upper part of peduncle but sometimes within the panicle and involving the main axis, branches and some pedicels. Peduncle smooth to papillose, slightly to markedly flattened, with up to 10 cm exposed above leaf bases. Panicle up to 3 cm long, compact; branches usually whorled, 2-4 per node, sometimes solitary (especially at proximal

node) or several nodes crowded so that several branches superficially appear to be whorled at one node; each branch subtended by a conspicuous triangular to narrowly triangular bract, 2.5-6 mm long at proximal nodes; branches bearing alternately arranged pedicels, the branches themselves straight or rather zig-zag and then superficially appearing to be dichotomously branched, pedicels in distal part of panicle inserted directly on main axis. *Pedicels* stout, stiff, erect, 0.5-3.9 mm long, each subtended by a bract and bracteole, *bract* triangular to narrowly triangular, 0.6-1.5 mm long, shorter than to about as long as pedicel, *bracteole* shorter and narrower, lateral to the bract and partly overlapping it, bract and bracteole together only half encircling the pedicel at its base. *Female inflorescence* similarly a panicle with partly or fully recurved peduncle, shorter and with fewer flowers than the male, often inconspicuous among the leaf bases. *Flowers* conspicuously articulated at base, not scented. *Male flowers* globular, 2-3 mm long; *perianth segments* free, incurved at anthesis; *outer segments* dull purplish red, elliptical to oblong with acute to rounded apex, 1/2-2/3 as long as inner segments, narrower, membranous; *inner segments* cream sometimes with a central band of mottled red on exterior, cream with purple at base on interior, broadly ovate to orbicular, fleshy; *stamens* all nearly equal in length, with each filament free from perianth for most of its length. *Female flowers* ellipsoidal, 3.2-4 mm long; *perianth segments* free, their apices slightly parted at anthesis; *outer segments* green below, dark reddish-green above, ovate with obtuse apex, c. 3/4 as long as inner segments and of similar thickness but tougher; exterior of *inner segments* pale greenish cream tinged with red especially in middle and toward apex, interior cream with purple at base, rather fleshy but soft; *ovary* 3-locular with 1 ovule per locule; *stigmas* borne on a very short style. Only immature capsules seen, flattened-spherical, smooth, purplish green with pale yellow vertical stripe along middle of valves.

Other specimens examined. WESTERN AUSTRALIA: 1.7 km along Kuch Rd from Gnowellen Rd (9 km direct NE of Ellen Peak, Stirling Range), 34°19'S, 118°25'E, T. D. Macfarlane 1080 (NSW, PERTH); 2 km inside southern boundary of Stirling Range National Park along Red Gum Pass Road, 34°25'S, 117°44'E, T. D. Macfarlane 1160 (PERTH); 1 km N of southern boundary of Stirling Range National Park along Chester Pass Road, 34°28'S, 118°04'E, T. D. Macfarlane 1162 (PERTH); Type locality, T. D. Macfarlane 1167 (CANB, MEL NSW, PERTH); South Stirling Nature Reserve, 34°35'S, 118°8'30"E, Nov. 1982, A. V. Milewski (PERTH, 2 specimens); 9 km ESE of Ellen Peak, K. Newbey 4337 (PERTH); near type locality, K. Newbey 9673 (PERTH); E of Ellen Peak near Chililup [actually just outside E boundary of Stirling Range National Park E of Ellen Peak—Wittwer, pers. comm.], E. Wittwer 2094 (PERTH).

Flowering period. September to mid-December.

Habitat. (Figure 2) *Lomandra nutans* grows on pale grey to white loamy sand, sometimes containing gravel, and on reddish clayey sand, in well-drained sites on almost flat to undulating terrain in mallee of *Eucalyptus falcata* or open mallee of *E. decipiens* and *E. tetragona*. The new *Lomandra* has been found almost exclusively at sites where the tall shrubs (taller than 1 metre) have a canopy cover (sensu Muir 1977) of less than 20% or where low shrubs (shorter than 1 metre) have a canopy cover of less than 35%. It usually grows in the open intermixed with sedges, rarely actually under shrubs or mallees. Plants of *L. nutans* recover well after fire and their density of flowering seems to be improved subsequently. The foregoing observations are based mainly on information provided by K. R. Newbey (pers. comm.) and Newbey (1979).

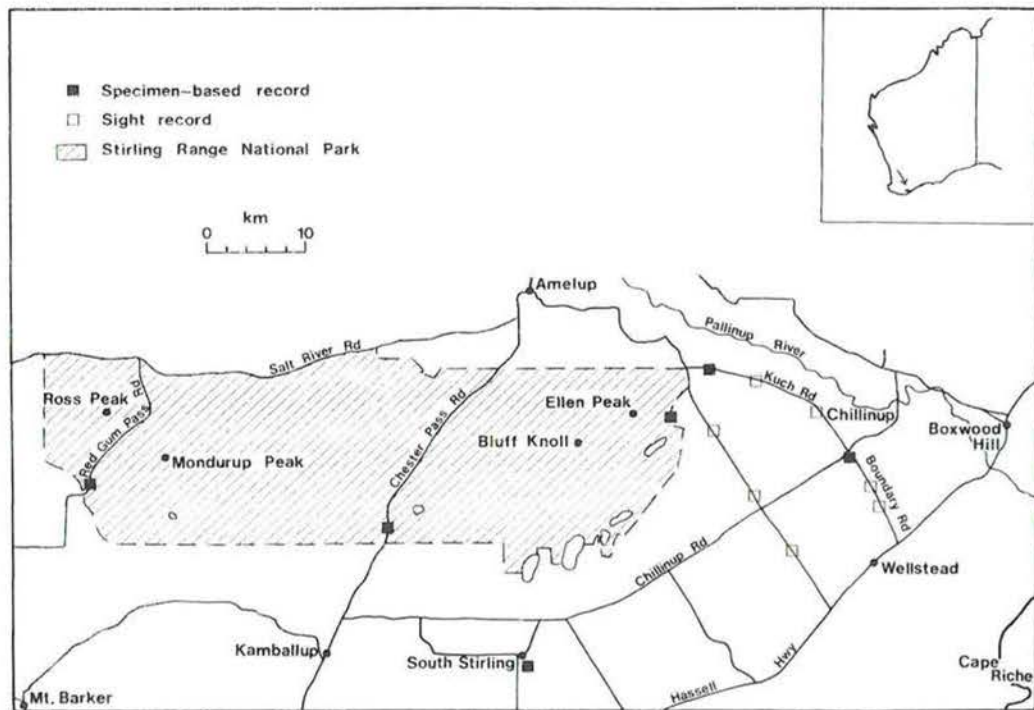


Figure 5. Distribution of *Lomandra nutans*. Sight records supplied by K. R. Newbey (pers. comm.).

Distribution. (Figure 5) The plain south and east of the Stirling Range, north-west of Hassell Highway (Albany-Jerramungup road) and south of the Pallinup River.

Conservation status. *Lomandra nutans* is a species of very restricted distribution, coded 2RC (according to the criteria of Leigh, Briggs & Hartley 1981) with a geographic range of only 80 km. Two collections have been made in the Stirling Range National Park, another from close to the eastern boundary of the Park, and two from the South Stirling Nature Reserve. Thus, although the species is not highly endangered, its long-term survival in the agricultural area outside of the reserves mentioned is doubtful owing to its dependence there on the maintenance of road-verge habitats.

Discussion. *Lomandra nutans* is unique in the genus in having nutant panicles. It belongs to Section *Lomandra*, Group A of Stevens (1978) in that the inflorescence is paniculate and each flower is subtended by a bract and a much narrower, laterally placed bracteole which together do not encircle or ensheath the flower or pedicel.

Although no species can be confused with *Lomandra nutans*, the following seem to be its closest relatives: *L. pauciflora* (R. Br.) Ewart and *L. brittanii* Choo in Western Australia and the *L. filiformis* complex (Lee 1961) in eastern Australia. The three western species share globular male flowers with fleshy inner perianth segments. In addition, *L. nutans* shares papillose leaf surfaces with *L. brittanii* and elongated stems with *L. pauciflora*. However, *L. brittanii* is a much smaller plant with a usually

spicate inflorescence and *L. pauciflora* has much longer, decumbent stems, very different leaves (softer and usually shorter), a racemose inflorescence and yellow flowers.

Members of the *Lomandra filiformis* complex resemble *L. nutans* in flower form and arrangement but their inflorescences appear different because the branches are stout compared to the slender, usually recurved pedicels. In contrast, *L. nutans* has short erect pedicels similar to the branches in thickness and somewhat divergent, which lend the panicle the superficial appearance of being dichotomously branched. Taxa in the *L. filiformis* complex have short stems and elongated subterranean rhizomes whereas in *L. nutans* the rhizome is compact and the stems are elongated.

Acknowledgements

I thank Ken Newbey, Ongerup, W.A., for making a special search for and collection of the new species, for the use of photographs and for his detailed ecological and distributional notes. Mrs Alma Lee, Sydney, kindly commented on the systematic relationships of the new species. Prof. K. H. Rechinger, Vienna, checked the Latin description. Cheryl Lynch prepared the figures.

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New combinations in *Tribulopsis* (Zygophyllaceae) of the Western Australian flora

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Abstract

Eichler, Hansjoerg. New combinations in *Tribulopsis* (Zygophyllaceae) of the Western Australian flora. *Nuytsia* 5(1): 177 (1984). Transfers are made from *Tribulus* to *Tribulopsis* for two species and one variety which is simultaneously raised to the rank of species.

The checking of entries for Zygophyllaceae in the "Census of vascular plants of Western Australia" by J. W. Green (Feb. 1981) in assisting the preparation of a revised edition revealed the need for three new combinations which are here validated as follows:

Tribulopsis affinis (W. Fitzg.) H. Eichler, comb. nov. *Tribulus affinis* W. V. Fitzgerald, *J. Roy. Soc. W. Austral.* 3: 157 (8 Oct.-10 Dec. 1918) [Repr.: 56 (Nov. 1918)].

Tribulopsis curvicarpa (W. Fitzg.) H. Eichler, comb. nov. *Tribulus curvicarpus* W. V. Fitzgerald, *J. Roy. Soc. W. Austral.* 3: 158 (8 Oct.-10 Dec. 1918) [Repr.: 57 (Nov. 1918)].

Tribulopsis sessilis (Domin) H. Eichler, stat. et comb. nov. *Tribulus solandri* var. *sessilis* Domin, *Biblioth. Bot.* 89: 281, 835 (Oct. 1926).

Publication date of *Nuytsia* Volume 4 Number 3: 11 October 1983
